DRV 300
Three-phase voltage regulator

WARNING !

HIGH LEAKAGE CURRENT: first connect to earth !

The DRV300 is a voltage regulator for three phase motors which operates connected to the three phase mains voltage.
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 so ensure the instructions in this manual and all required security measures are read and followed carefully.

- **When receiving the goods, check that the packing is intact; in the event of any damage due to transportation, notify the forwarding agent according to legal requirements.**
- **The DRV series of products shown in this manual has been manufactured to the highest standards.**
- **The manufacturer declines all responsibility for accident, loss or damage caused by the use of these appliances. These must be correctly installed by qualified personnel in conformity with their destined use and, whenever needed, must undergo correct maintenance which should be carried out while ensuring the safety of people, domestic animals and goods.**
- **The purchaser must previously ascertain the suitability of the product for the use it is intended for and assume all consequent risks and responsibility.**
- **The DRV300 is a mains voltage regulator which uses the phase-cut principle completely controlled over the three phases. It has been designed to vary the effective voltage on three phase asynchronous motors for fans following a control signal (either Ma or VDC). The appliance is manufactured for industrial use and therefore meets the EMC standards that relate to industrial environments.**
- **Using the appliance for purposes other than the ones described above will be considered incorrect. In particular, the appliance may NOT be used to supply machine tools or any other machines where the motor torque-speed characteristic is not quadratic.**
- **If the equipment is intended for civil, commercial and/or light industrial use, supplementary components and other types of equipment are required which can be supplied on specific request from the purchaser. In this case, the purchaser must provide a suitable design of the plant in which the appliance is to be installed (compliant with EN 60555 - 2/3 standards regarding disturbance produced by electrical household appliances and the like.**

- **We decline all responsibility for any errors in the catalogues, publications or other written documents. The information in this manual is not binding and we reserve the right to make changes to the products without prior notice, at any time and in any way that we deem convenient for production purposes or useful for increasing functionality and performance.**

SAFETY RULES !

This appliance has been designed to give excellent performance provided it is installed and used carefully in a suitable electric environment by qualified personnel.
The following rules **must be obeyed** when installing the regulator :

- **Follow the instructions in this manual exactly and observe all safety measures in force.**
- **Do NOT tamper with or disassemble the regulator's 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; earthing 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 exnternal protection panel.
- **DO NOT** touch the electrical parts of the circuit when the power supply is connected under any circumstances.
- Before supplying power to the unit, check carefully that the power and earth are correctly connected.
- 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 **S2 = ON/OFF**.
- The **S2 = ON/OFF** contact on the signal terminal board does not cut the mains supply and therefore cannot be used as a safety switch.
- Install the regulator out of direct sunlight so that the container cannot get overheated and cause a reduction in the maximum load current.
- The appliance may operate at environmental temperatures up to **50°C**. Do not install it where this temperature may be exceeded or the integrity of the regulator will be compromised and the appliance may make the user appliance operate at full load (100%) with all consequent effects.
- The appliance must be stood vertically to encourage heat dissipation and to ensure there is a sufficient air circulation and free space measuring **150 mm** above and below the regulator. If several regulators are to be grouped together on a single electric board, provide forced air circulation with a fan or cooling unit of sufficient power.
- 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.**
- **Under no circumstances alter the trimmers marked with the spot of red paint.**

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CONTENTS

1.0 PRESENTATION

THANK YOU for choosing an **DRV300** series three phase voltage regulator designed specifically to give the maximum yield and greatest ease of use.
Like all our products, it has been built to the very highest quality standards using electronic components of the utmost reliability which have undergone functional tests that guarantee use of the product for at least **30,000 hours** of continuous operation without problem.

The **DRV300** regulator is a power unit designed to meet requirements of quality and flexibility of use in plants and machines in which proportional variation of the speed of rotation of the fans is essential.

The regulator is housed in two different case :

- **IP 55** : the **DRV300** is in a **GEWISS GW Plast® 120°C** case, which guarantees high heat resistance during ordinary use (**120°C**), increased mechanical impact resistance (**IK = 08**) and a protection level (**IP55**) that allows the regulator to be installed out of doors;
- **IP 22** : the **DRV300** is in a protected aluminium case; the **12A** & **20A** are housed to have the same mechanical attachment hole

The **DRV300** (**IP22 & IP5** case), is shown in **fig.1**.

fig. 1

Before installing the **DRV300**, you are invited to read this manual which describes the necessary procedures for correct installation and commissioning of the machine

DRV300

Like all our products, the **DRV300** series bears **CE** marking as required by directive **89/336/ECC** and its subsequent modification **EEC/92/31** on electromagnetic compatibility.
The essential requirements of the directive are satisfied by conformity to "**generic standards**" for heavy industry.

EN 50081-2 emission standard, **EN 50082-2** immunity standard, and in particular:

EN 55011	class B, for radiated disturbances
EN 55011	class A, for conducted disturbances
ENV 50140 (IEC 801-3)	for susceptibility (on the power supply)
ENV 50141	for conducted susceptibility on power lines
IEC 801-4	for fast transistors (bursts / high frequency disturbances)
IEC 801-2	for electrostatic discharge (**ESD**)

The tests and checks for conformity have been carried out according to the procedures described in the product's technical documentation.
Since all these products are not used as "**stand alone**" appliances but incorporated into other plants or machines, the standards' compatibility test was carried out under typical operating conditions.
The system used was formed by an **DRV300** voltage regulator, a control cable and relative controls, a power supply cable, a motor cable and a fan.

Responsibility for the final characteristics of the system or plant regarding the EMC directive rests with the installer. The equipment must be installed in observance of the regulations in force using the information presented in this manual.

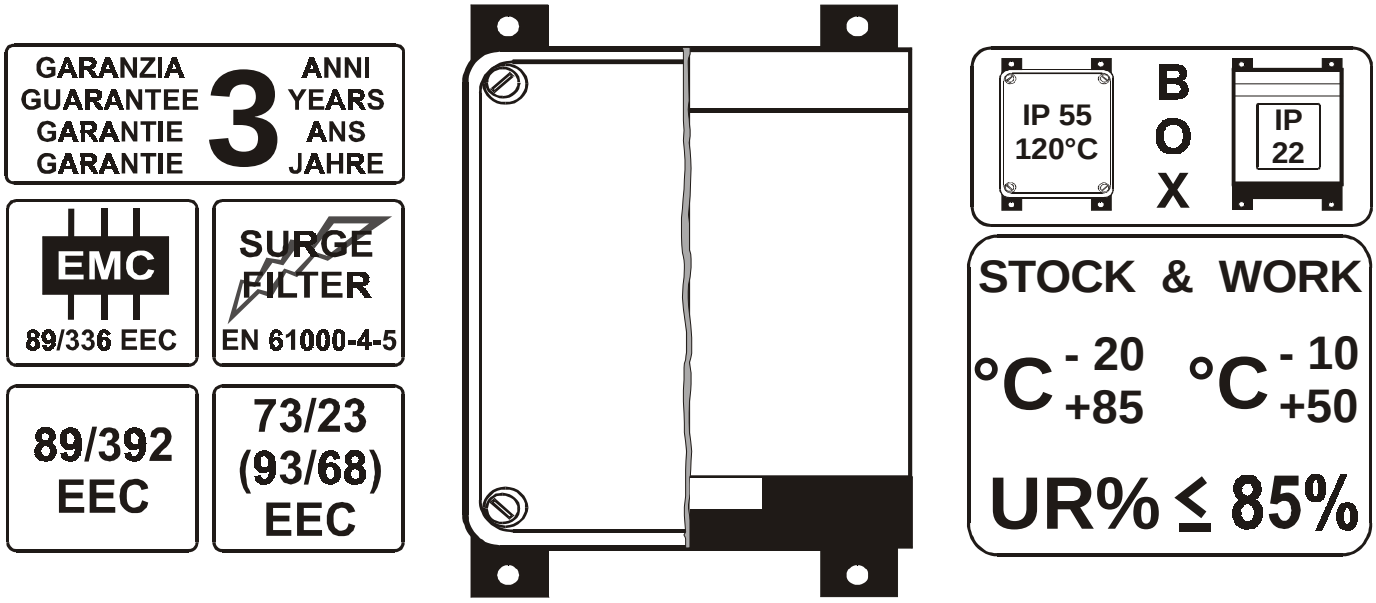


fig. 2

Fig. 3 & **fig. 4** represent the **DRV300** (**IP 55 & IP 22**) regulator, with the general contents

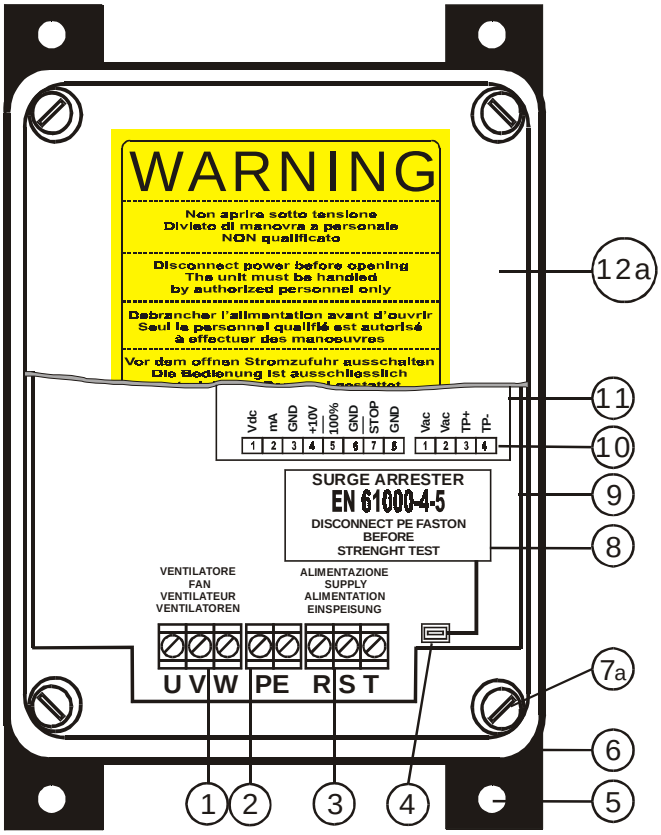


fig. 3

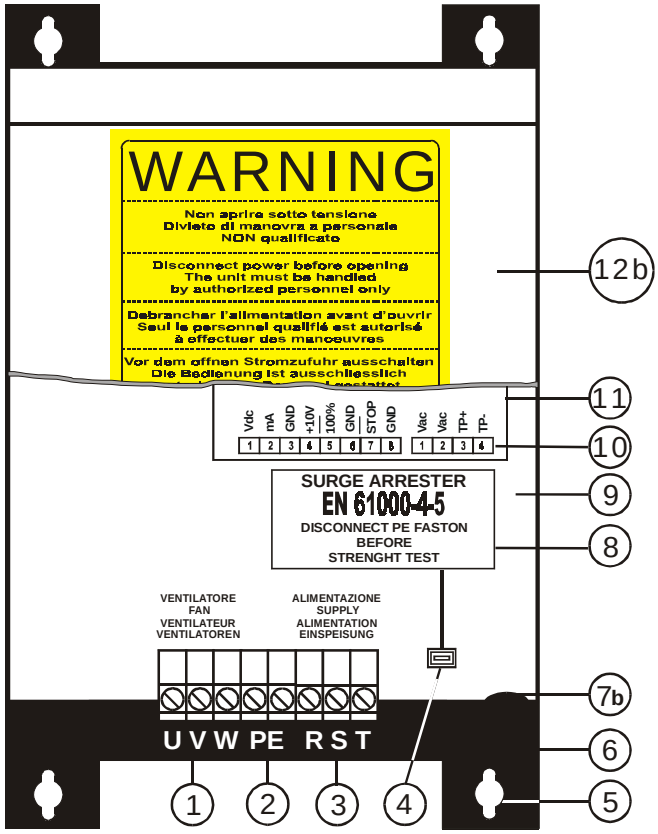


fig. 4

CONTENTS of DRV300 regulator

1	Terminal block for load connection (**U-V-W**)
2	Terminal block for **PE** connection
3	SURGE ARRESTER circuit / **PE** faston connection
4	Terminal block for threephase power supply (**R-S-T**)
5	Screws hole for wall installation
6	Black anodized heat sink

7_a	Cover screws **TPN** (**CEI 23-58**) max. **2,5** Nm
7_b	Hole for input signals cable
8	SURGE ARRESTER circuit like **EN 61000-4-5**
9	Power card (lower)
10	Terminal block for analog inputs/output signals
11	Control card (upper)
12a	GEWISS **GW Plast ® 120°C** case
12b	Alluminium IP 22 case's cover

1.1 DESCRIPTION

The **DRV300** series three-phase cutting regulators comprises two electronic cards on a vetronite support mounted inside the case.
The two cards represent the **control** section (upper) and **power** section (lower).

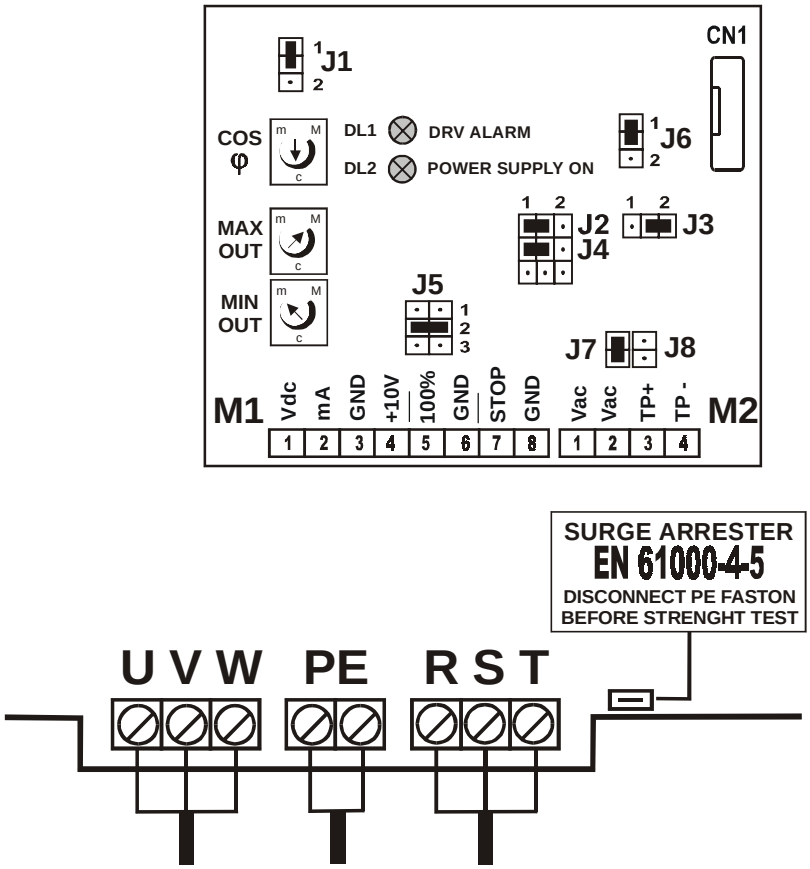


fig. 5

The **control card** contains the following regulation, connection, calibration and signalling components:

• **Leds :** **ALARM (DL1)** **SUPPLY O.K. (DL2)**	Marked "**DL1 & DL2**" **RED Led DL1** to signal "regulator fault / Alarm " **GREEN Led DL2** to signal "DRV supply O.K."
• **jumpers**	Marked '**Jn**'; used to change preset operational modes
• **COS φ**	Calibration trimmer for COS **φ**
• **flat cable**	Marked '**CN1**' The flat allows connection to the control and power cards. Check the flat is securely fixed during maintenance or commissioning.
• **Inputs/output signals terminal boards**	**Terminal block M1,** for Analogue and ON/OFF IN-put
	Terminal block M2, for PWM (TP+ / TP-) IN-put and for '0 cross' VAC reference of the remote control supply

The **power card** contains the following connection components:

• **power supply terminal boards**	**R, S, T** for three-phase input supply **U, V, W** for three-phase output **PE** for the **Earth** connection

1.2 INSTALLATION AND MECHANICAL DIMENSIONS

The **DRV300** regulator must always be securely assembled and fixed using the four (**4**) attachment screws on the side fins before connecting to the power supply.
The regulator is cooled by natural convection and so air must be able to pass freely below and above the appliance.
Therefore ensure there is at least **150 mm** of free space above and below the regulator.
The **DRV300** series are avaible in **IP55 & IP20** case :

IP55 VERSION (S version)

The appliances are housed in sturdy **GEWISS** cases having different sizes, which are all manufactured in **GW-Plast 120°C** with black anodised aluminium supports; these provide high resistance to heat (**120°C**) and impact resistance (**IK = 08**), and have an **IP55** degree of protection, therefore can be directly installed outdoor.
The holes provided on the lower part of the regulator are for entry of the electric connection cables:

- four pole line (**three phase + Earth**) to power the regulator,
- four pole line (**three phase + Earth**) to power the load,
- signal cable lines for the analogue inputs and digital outputs.

To make installation simpler, all regulators are also fitted with stuffing boxes in **PA6** polyamide, class **V2**, **IP68**, for use with the power and signal cables.

IP22 VERSION (G version)

The appliances are housed in aluminium case with the same sizes for **12A** and **20A** (only the '**C**' size is different).
The hole provided on the lower part of the regulator is for entry of the electric connection cable:

- signals cable line for the analogue input and digital outputs.

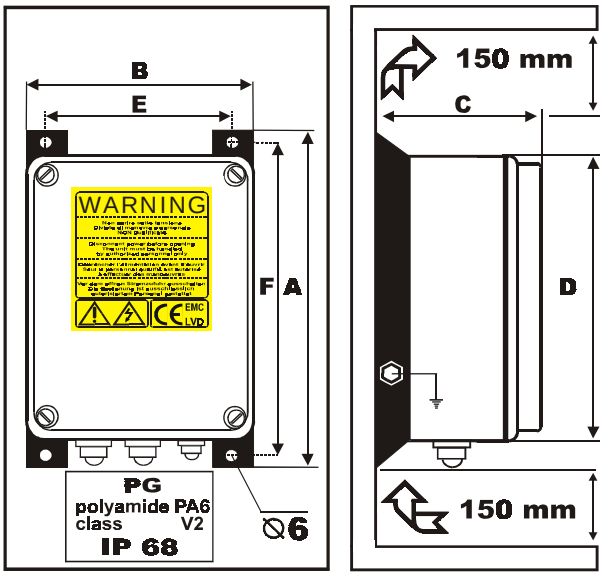


fig. 6

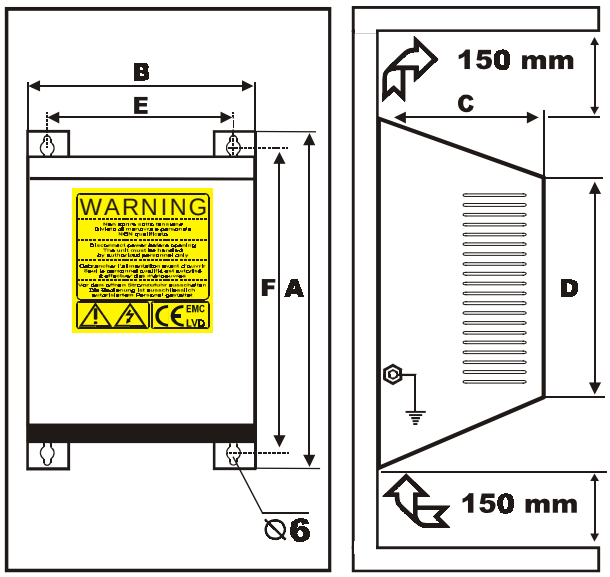


fig. 7

Mechanical Dimensions

MODELS	*A*	*B*	*C*	*D*	*E*	*F*	*Kg.*	*⌀ Fixing screw holes*
DRV 312 S	**286**	**201**	**130**	**255**	**181**	**255**	**3.2**	**⌀ 6**
DRV 316 S	**295**	**201**	**160**	**195**	**172**	**260**	**4.5**	**⌀ 6**
DRV 320 S	**351**	**237**	**181**	**317**	**185**	**320**	**5.0**	**⌀ 6**
DRV 325 S	**351**	**237**	**201**	**317**	**185**	**320**	**7.5**	**⌀ 6**
DRV 312 G	**295**	**201**	**105**	**195**	**172**	**260**	**3.2**	**⌀ 6**
DRV 320 G	**295**	**195**	**133**	**195**	**164**	**260**	**4.3**	**⌀ 6**

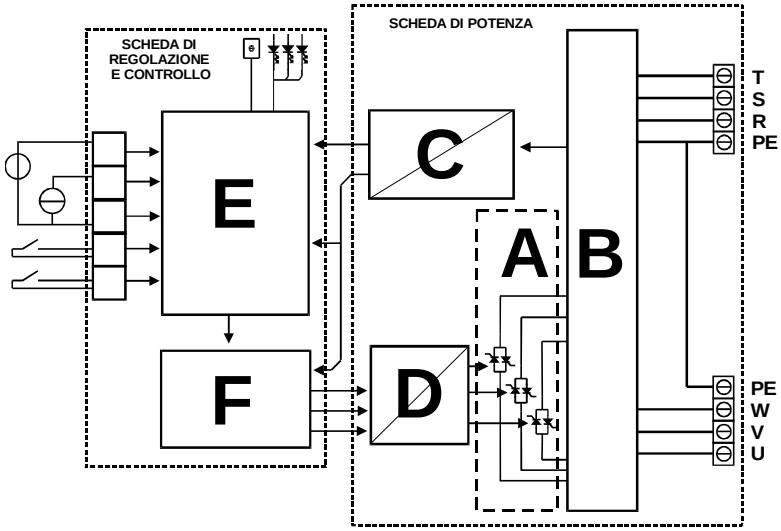
Table 1

1.3 PRINCIPLE OF OPERATION

The **DRV300** series appliances are voltage regulators that use the phase cutting principle totally controlled over three phases.
The regulators, also referred to as speed controls, have been designed to change the average voltage on the following types of equipment, according to a control signal:

- asynchronous three phase motors connected to **fans, pumps, agitators, mixers**;
- electrical resistor devices with sectioned **single / three phase**.

Regulation occurs as a result of cutting of the input sinusoid. Regulation does not generate any torque knock or pulsation and is particularly quiet. Any voltage loss is contained within a maximum limit of **1%**.
Fig. 8 shows a block diagram of regulator **DRV300**.



A - Power circuit
B - Mains filter and EMC protective devices
C - Power supply and synchronism signals
D - Insulators for the control signals of the power devices
E - Regulation and control circuit
F – Modulator for control of the power devices

fig. 8

The speed regulators are sized to withstand a starting current equal to more than 3 the rated current; therefore, when choosing a regulator, it is essential to take into consideration both the motor starting current and the type of motor.
It is actually well-known that, while the starting current in axial fans is equal to 2 or 3 times the rated current, the same current in centrifugal fans can have values around 7 or 8 times the rated current.
As far as the choice of motor is concerned, it is advisable to choose motors suited to the type of regulation.
As a general rule, the best suited are:

- **motors with high slipping resistive motors**
- **defluxed motors**
- **tropicalised motors**
- **CLASS H motors**

as these allow better performance to be obtained with speed changes, they are quieter and start with lower current.

When choosing a motor, it is always advisable to contact your own supplier and order a motor which is suitable for speed control by voltage change. Subsequently, practical trials should be carried out on the motors or prototype machines in order to check their correct operation.

After choosing the motor, the speed regulator must be ordered according to

- the **rated voltage**,
- **maximum power** required (load-Amperes) bearing in mind the **starting current**.

After the motor characteristics have been checked, the following should be defined in order to identify the type of operating mode and application.

1.3.1 Operating mode

The **DRV** controls allow three different types of operation depending on which type of input is available:

- **DRV 'M' with 0-20 mA input signal**
- **DRV 'V' with 0-10 Vdc input signal**
- **DRV 'T' with PWM input signal (PWM modulation for Triac : TG / Trigger)**

DRV 'M' ▪ **with 0-20 mA input signal**
DRV 'V' ▪ **with 0-10 Vdc input signal**
DRV 'T' ▪ **with PWM input signal (PWM modulation for Triac : TG / Trigger)**

In this case, the **DRV300** is controlled by an external **MASTER** regulator which decides the phase cutting of the voltage by sending the **mA/Vdc/PWM** control signal to the **DRV300**.

ATTENTION : The (**mA/Vdc/PWM**) factory selection can be changed by the operator

ATTENTION : For **Vdc** input, do not place power cables with signal cables in the same raceway; if the cables cross one another, ensure it is at 90°.

1.3.2 Application

It is generally possible to connect one control signal (**0-20 mA / 0-10 Vdc / PWM**) to **'DRV300'** regulator. The principal applications are with remote control unit for measuring pressure (**bar**), temperature (**°C**), humidity (**%RH**), delivery (**cu.m/h**), superpressure (**mm.**), static pressure (**Pa**), supertemperature (**destratification**) etc. in plants and machines for Air-Conditioning, Refrigeration and Clean-Room.

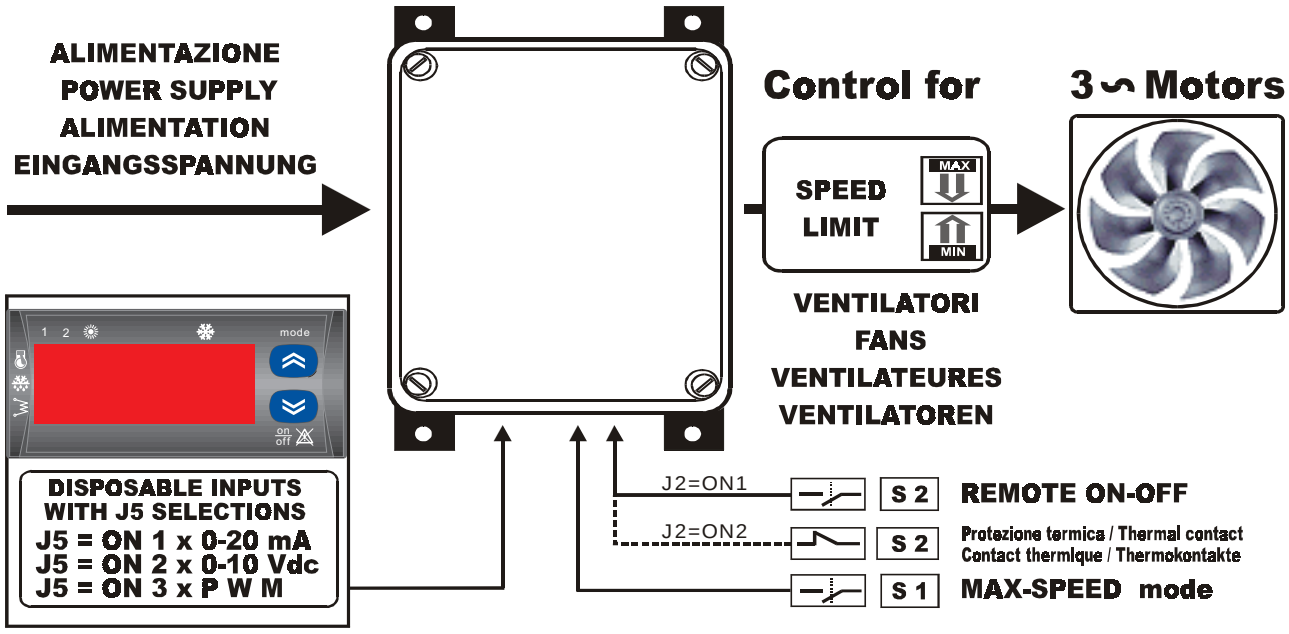


fig. 9

1.4 ELECTRIC MOTORS

Three phase asynchronous motors can be connected to the **DRV300** regulator in applications where the torque-motor speed characteristic is quadratic.
This mainly allows phase cutting application with axial and centrifugal fans used for control purposes (max. **4 kw** for fan's motor).
The correct electrical connection and the supply voltage are given on the motor's specifications plate.
The sense of rotation of the motor can be altered by swapping the connections of two of the three supply cables.
It is important to keep the motor power supply cable as short as possible to reduce the level of interference and leakage currents to a minimum **(10 / 15 mt)**; if the cable has to be long, an auxiliary three-phase filter of exactly the same power as the regulator must be installed on the regulator output.
The figure below shows the star and delta connection configurations.

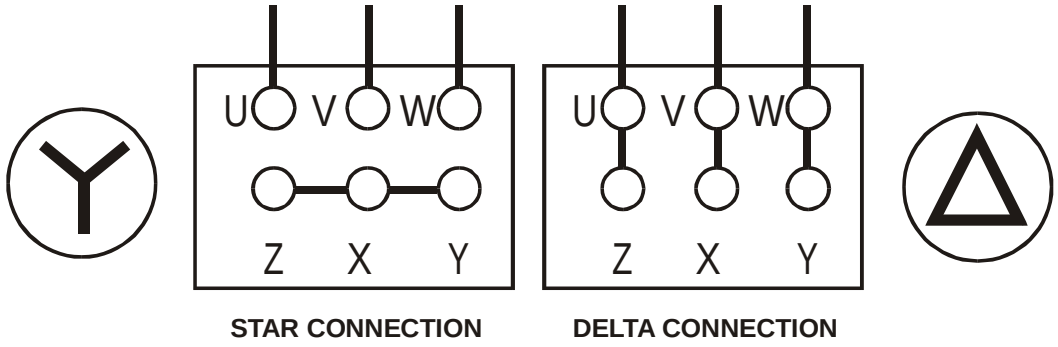


fig. 10

The **DRV300** regulator can control several motors connected in parallel but the absorption of the motors' total current must never exceed the rated current as given on the **DRV300**'s specification plate.
The speeds of the motors vary at the same time though any differences 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 speeds of the motors are different, motors must be used with different rated speeds. Bear in mind though that motors with very different characteristics create different electrical situations and these may cause problems on start up and at low speeds caused by different resistances of the stators which require different voltages on start up and at low speeds.

1.4.1 Magnetothermal protection

DRV300 devices must be protected by a magnetothermal switch fitted upstream of the cutting regulators. **Installation of magnetothermal protections is the responsibility of the installer**.
It is advisable to fit an automatic magnetothermal protection with a '**C**' intervention curve having the following capacity:

DRV models	magnetothermal carrying capacity
DRV 312	**20 A**
DRV 316	**25 A**
DRV 320	**30 A**
DRV 325	**36 A**

Table 2

1.5 DRV300 TECHNICAL CHARACTERISTICS

SUPPLY	Voltage		**400VAC +/- 10 %** three-phase (**230VAC** on request)	
	Frequency		**50 Hz** (60 Hz)	
	Overvoltage protection		for installation Category **II** (**4 KV**)	
CURRENT	Rated		**DRV 312**	**12 A** up to **50°C** environment, over decrease by **0.6 A/°C**
			DRV 316	**16 A** up to **50°C** environment, over decrease by **0.6 A/°C**
			DRV 320	**20 A** up to **50°C** environment, over decrease by **1.0 A/°C**
			DRV 325	**25 A** up to **50°C** environment, over decrease by **1.0 A/°C**
	Overload		**200%** of the rated current (max. **10"** every **3'**)	
POWER	Control circuits		**5 VA**	
	Thermally dissipated		**DRV 312**	**42 W @ 12A**
			DRV 316	**56 W @ 16A**
			DRV 320	**70 W @ 20A**
			DRV 325	**88 W @ 25A**
OPERATING PRINCIPLE	Totally controlled three-phase cutting, with compensation for inductive loads and motors, without need for connection to NEUTRAL ; the Automatic Phase monitoring switch-off in case of missing line Phase			
OPERATING CHARACTERISTIC	Standard UNIT (Vers. **M , V , T**)		The output voltage increase as the input increase, in according to the specific appliance regulating curve (**fig. 11**). With the '**COMPENSATORY**' version, the **DRV300** control & integrate the **VAC** input (from **350 VAC** to **450 VAC**) and the load change (**fig. 12**). **Standard Config.** : output increasing as the controlled variable increases	
	STARTER UNIT (Vers. **O**)		The **DRV300** start and go to **MIN OUT** with **T1** (from **0" to 1200"**) setting; then increase **VAC** output to **MAX OUT** with soft-start **T2** (from **8" to 150"**) With the '**COMPENSATORY**' version, the **DRV300** control & integrate the **VAC** input (from **350 VAC** to **450 VAC**) and the load change (**fig. 12**).	
INPUT SIGNALS	Control	Vers. **M**	**0-20 mA, Ri = 100 hom** analog input	
		Vers. **M**	**0-10 Vdc, Ri = 10 khom** analog inputs, priority to the greater	
		Vers. **T**	**Two** opto-isolated input for **PWM** '**0-cross**' modulation : **TG** (Trigger) and **AC line** reference	
	Auxilary **S1**	Vers. **M,V,T**	**ON/OFF** input: with **S2** = **ON** > **DRV** go to **100% OUTPUT**	
		Vers. **O**	**ON/OFF** input: with **S2** = **ON** > **DRV** go to T1 & T2 timer soft-start	
	Auxilary **S2** all versions	**J2 = ON 1**	**ON/OFF** input : remote **ON-OFF / NO** contact (stop-start)	
		J2 = ON 2	**ON/OFF** input : motor protection / **NC** thermal contact (**TK**)	
OUTPUT SUPPLY	Potentiometer supply		**+10Vdc / 5 mA** stabilized output for **10 kohm ½ W** lin. potentiometer	
OPTIONAL FUNCTIONS	Starting at 100% (Speed-Up)		If connected, when the machine is switched on, it causes full mains voltage (100%) to be supplied to the load for a few seconds	
	COMPENSATORY mode		With the '**COMPENSATORY**'mode (opt. '**C**'), the **DRV300** control & integrate the **VAC** input (from **350 VAC** to **450 VAC**) and the load change (**fig. 12**).	
ADJUSTMENTS AND PRESETTINGS	**Version & Input**		**M:** 0-20 mA **V:** 0-10Vdc **T:** Triac	**O: Soft-Starter**
	Minimum Output limit		Adjustable from **0%** to **100%**	
	Cut-Off		Factory calibration at 10% VAC power supply	
	Maximum Output limit		Adjustable from **100%** to **0%**	
	Acceleration Ramp **T1**		Factory Standard **0"**	**T1** Adjustable from **0** to **1200"**
	Soft-Start **T2**		Factory Standard **5"**	**T2** Adjustable from **8"** to **150"**
LED SIGNALLING	Supply stopped		**DL1** (red) : Signals supply stoppage due to : ▪ **DRV 300** out of order ▪ absence of one supply phase (monitoring phase), ▪ **S2=OFF / TK** motor thermal opening (**NC** contact, with J2 = ON2 selection), ▪ **S2=ON / Start-Stop** contact closing (**NO** contact, with J2 = ON1 sel.)	
	Supply present		**DL2** (green) : Signals the presence of supply voltage	
	Soft-Start Timer (**T1 > ON**)		**DL3** (yellow) : Signals the **T1** timer time work	

PROTECTIONS	**EMC integrated** mains filter		According to **EN 55011** (**CEI 110-6**) Class **B** : **ISM** appliances directly connected to low voltage power mains			
	SURGE arrester protection		According to **EN 61000-4-5** : overvoltage Category **II** (**4 KV**)			
ALARM SIGNALS	Mains phase monitoring		Checks contemporary presence of the three supply voltage phases, it locks the unit if one of the three phases is absent when the **DL1 LED** is switched **ON**			
CASE	**Standard solutions**		**IP 55 GEWISS (GW) case**		**IP 22 case**	
	Dimensions and Weight	**DRV 312**	**286 x 201 x 130 mm**	**3.5 kg.**	**295 x 201 x 105 mm**	**3.2 kg.**
		DRV 316	**286 x 201 x 160 mm**	**4.0 kg.**		
		DRV 320	**351 x 237 x 181 mm**	**4.5 kg.**	**295 x 192 x 135 mm**	**4.3 kg.**
		DRV 325	**351 x 237 x 201 mm**	**7.5 kg.**		
	Materials		**GW-Plast® 120°C** and aluminium		Aluminium	
	Cover screws		Cover screws **TPN** (**CEI 23-58**) max. 2,5 Nm			
	Degree of protection		**IP 55**		**IP 22**	
	Environmental pollution		Strong pollution			
	Fire resistance		Category **D**			
INSULATION	Case		Class **I** (use of earthed protection cable)			
	Control circuits		4000V between control input and mains voltage components			
TEMPERATURE	Working		**-10 T 50** (from –10°C to + 50°C)			
	Storing		**-20 T 85** (from –20°C to + 85°C)			
HUMIDITY	**RH < 85%**					
INSTALLATION	Vertical wall-mounting only, with **No 4** ∅ 6 mm holes					
ELECTRICAL CONNECTIONS	Signal		Trailing cable with rated cross section max. **1.5 sq mm / 22-14 AWG Cu**			
	Power		Trailing cable with rated cross section min. **2.5 sq mm / 20-12 AWG Cu**			
TECHNICAL STANDARDS REFERENCE	**89/392/EEC** Directive **73/23/EEC** (**93/68/EEC**) Directive		**CEI-EN 60204-1** : "Safety of machinery"			
	89/336/EEC Directive		**EN 50081-2** Generic standard for industrial environment emission			
			EN 50082-2 Generic standard for industrial environment immunity			
			EN 55011 class **B**, for radiated disturbance			
			EN 55011 class **B**, for conducted disturbance			
			ENV 50140 (**IEC 801-3**) for susceptibility (on the supply)			
			ENV 50141 for conducted susceptibility on the signal lines			
			IEC 801-4 for fast transients (burst / high-frequency disturbance)			
			IEC 801-2 for electrostatic discharge (**ESD**)			

Table 3

This new **DRV300** is the fan speed cutting regulator with the specialized **output-VAC curve**, that with the '**COMPENSATORY**'mode (opt. '**C**'), controls and integrates the **VAC** supply input (from **350 VAC** to **450 VAC**) and the load change (**fig. 12**).

So the ratio between the **DRV300** Vac output and the remote control signal input, is the same even if :

- The power supply (**VAC** input) change from **350 VAC** to **450 VAC**
- The rated current is at **2%** or **100%**
- There are axial or centrifugal fans connected to load

In this case it is possible, with a specific remote control sooftware, to reach the fans speed at the **m^3/h** really required from the system controlled (ex.: **FREE-COOLING**).

DRV 300 STANDARD CONFIGURATION (*) With N.**3** axial fans **ZIEHL-EBM FE 800-6**

INPUT (VDC)	V-OUT WITH RATED VAC -10% (360VAC)	V-OUT WITH RATED VAC -5% (380VAC)	V-OUT WITH RATED VAC 0% (400VAC)	V-OUT WITH RATED VAC +5% (420VAC)	V-OUT WITH RATED VAC +10% (440VAC)
1	**50**	**54**	**57**	**60**	**63**
2	**68**	**74**	**80**	**84**	**90**
3	**102**	**111**	**120**	**128**	**131**
4	**158**	**170**	**181**	**194**	**200**
5	**204**	**220**	**234**	**248**	**258**
6	**249**	**266**	**283**	**300**	**315**
7	**292**	**312**	**332**	**354**	**380**
8	**336**	**350**	**372**	**396**	**420**
9	**348**	**373**	**393**	**415**	**435**
9,5	**356**	**376**	**397**	**417**	**437**

N.B. : The loss voltage is contained within a maximum limit of **1%** (Vac-supply / Vac-loss on SCR).

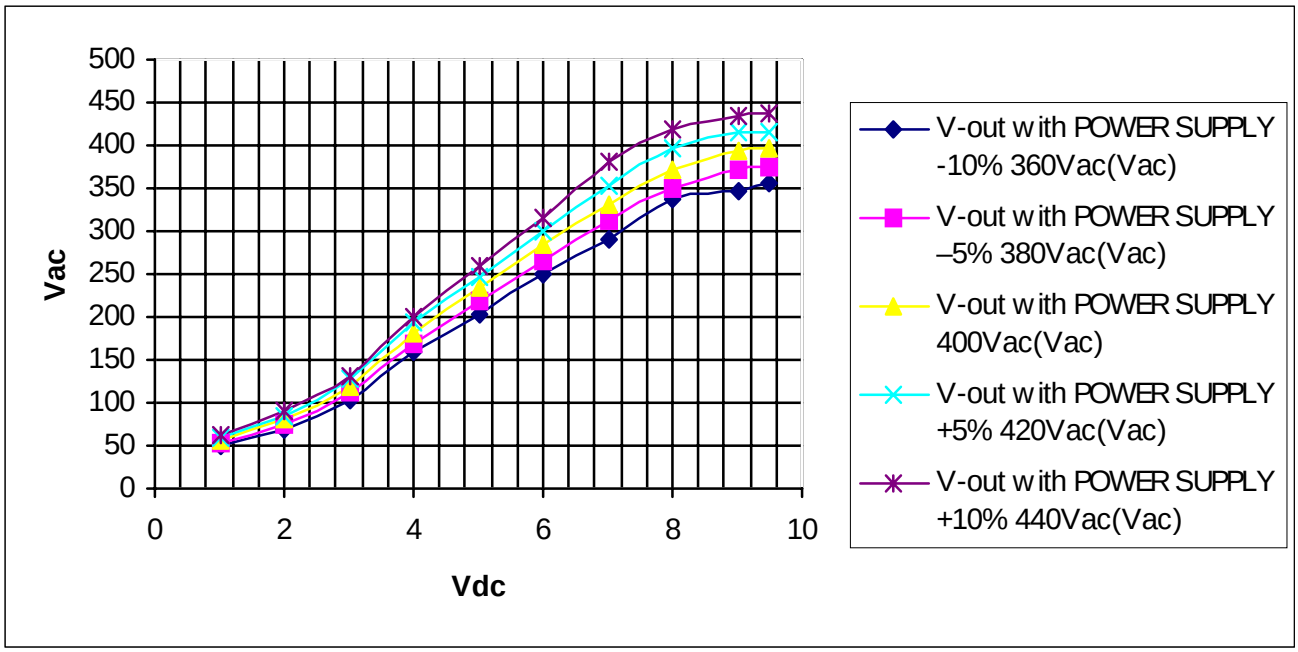


fig. 11

DRV300 Vac RMS COMPENSATORY (*) With N.**3** axial fans **ZIEHL-EBM FE 800-6**					
INPUT (VDC)	**V-OUT WITH RATED VAC -10% (360VAC)**	**V-OUT WITH RATED VAC -5% (380VAC)**	**V-OUT WITH RATED VAC 0% (400VAC)**	**V-OUT WITH RATED VAC +5% (420VAC)**	**V-OUT WITH RATED VAC +10% (440VAC)**
1	**52**	**53**	**54**	**54**	**54**
2	**90**	**90**	**91**	**91**	**92**
3	**129**	**130**	**130**	**131**	**131**
4	**169**	**170**	**171**	**172**	**172**
5	**209**	**210**	**211**	**212**	**213**
6	**250**	**252**	**253**	**254**	**255**
7	**291**	**293**	**295**	**296**	**297**
8	**332**	**335**	**337**	**338**	**340**
9	**356**	**373**	**378**	**381**	**383**
9,5	**356**	**376**	**396**	**404**	**407**
10	**356**	**376**	**396**	**404**	**407**

N.B. : The loss voltage is contained within a maximum limit of **1%** (Vac-supply / Vac-loss on SCR).

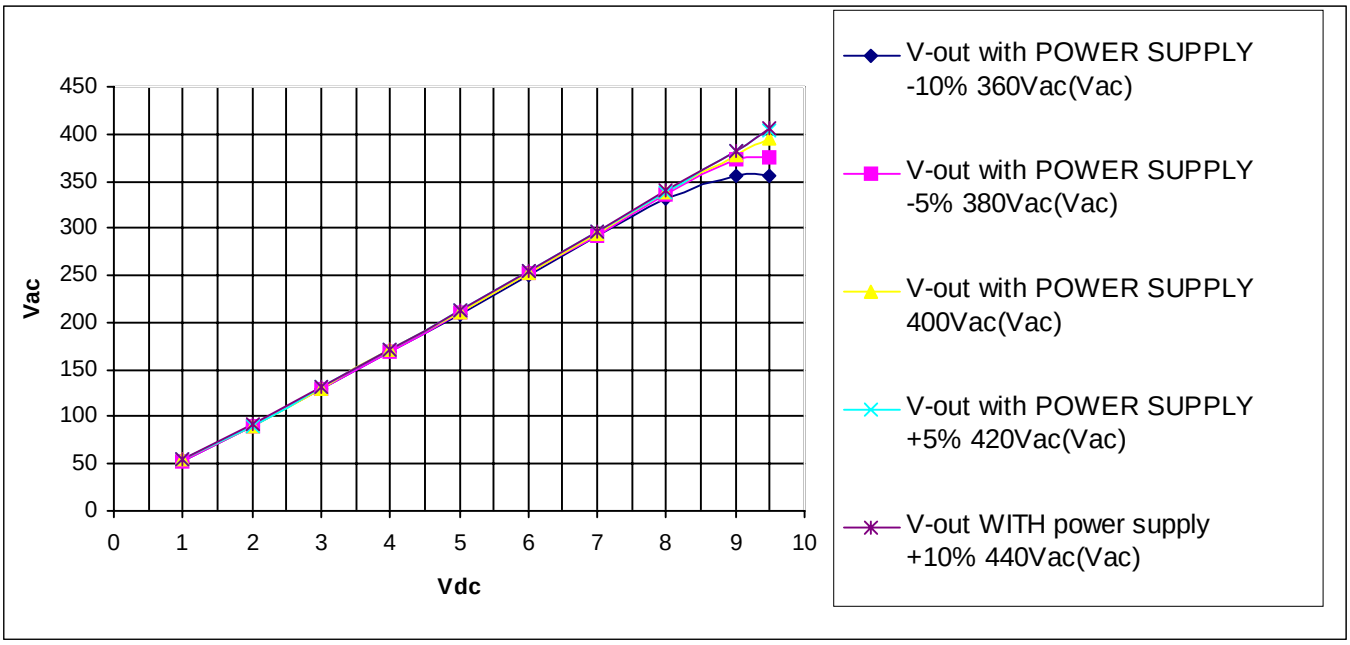


fig. 12

2.0 ELECTRICAL CONNECTIONS

2.1 POWER CARD

For supply and load connection, reference should be made to the diagrams shown in **fig. 13,** making sure the section of the cables is adequate to the connected load.
The power cables (supply and load) must be installed separately from the control cables (analogue inputs and **ON-OFF** inputs/outputs) keeping the maximum distance possible between the conductors.
Do not place power cables with signal cables in the same raceway. If the cables cross one another, ensure it is at 90°.

ATTENTION : connect the earth conductor to the screw placed purposely beside the dissipator. Use heat resistant cables able to withstand temperatures greater than 90°C.

SURGE ARRESTER : electric protection placed between the regulator supply and the earth to protect the device from transitory mains excess voltage.
ATTENTION : disconnect the faston contact from the earth reference in the 'electric strength test'.

The **DRV300** regulators allows connection of three-phase loads *without requiring Neutral connection.*
This simplifies installation and facilitates the **STAR** or **DELTA** load configuration.
It is advisable to provide a by-pass switch to allow load activation even when the cutting regulators is faulty (**emergency by-pass**).

When connecting the by-pass, the following precautions should be taken into consideration:
i) connection made through the by-pass switch must keep phase correspondence unaltered so as to avoid destructive shortcircuits and maintain the motor's sense of rotation.
ii) before supplying the load with maximum voltage, supply to the regulator should be disconnected, therefore:
• it is advisable to use a three-position manual switch as a commutation device
• if automatic commutation is carried out by means of contactors, make sure there is some delay (at least 2 seconds) between regulator disconnection and load activation operations.

Electrical connection of the supply and load for **12A DRV300** regulators is shown in **fig. 13**

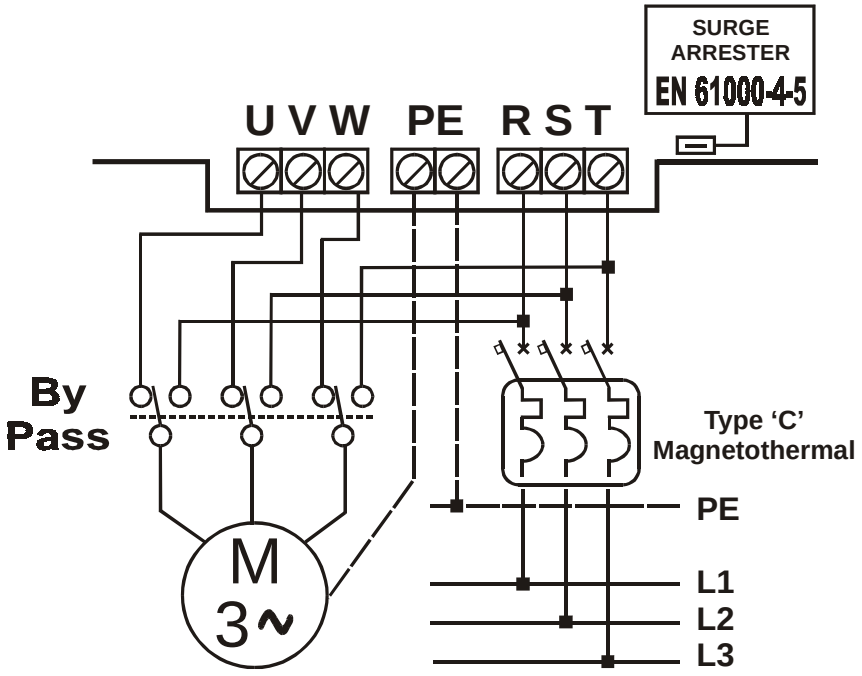


fig. 13

2.2 ANALOGUE INPUT SIGNALS

The connections for the control analogue input is described below, and in particular :

0-10 Vdc	Voltage control signal (**Vdc**)
0-20 mA	Current control signal (**mA**)
TP + / TP –	Modulating control signal (**PWM**)
(* Vac)	(*) Vac : supply remote control reference for '0-cross' cutting regulation

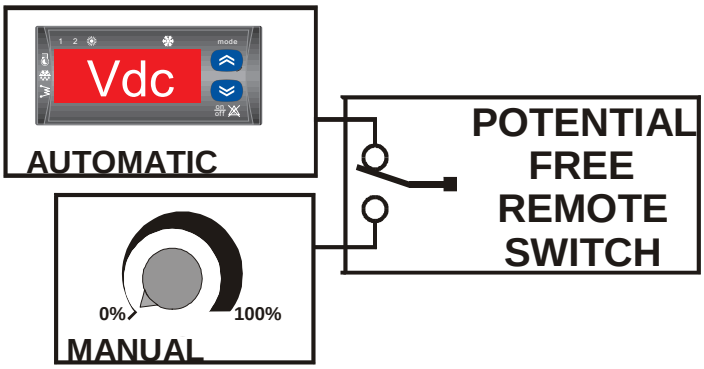
CONNECTIONS	Trailing cable with rated cross section max. **1.5 sq mm / 22-14 AWG Cu**

If regulator control from an external unit is required, choose one of the following versions:

- **DRV M** when the external control unit uses a current control signal (**0-20 mA**), or
- **DRV V** when the external control unit uses a voltage control signal (**0-10 Vdc**), or
- **DRV T** when the external control unit uses a **MODULATING** control signal (**PWM**)

(*) The "COMPENSATORY" option 'C' is disposible for all versions (J1 = ON1)

(*) The 'V' configuration allows a grid of several regulators to be controlled via a single regulation control signal in Vdc, even if the regulators are a mixture of single phase and three phase.
It is therefore possible to control totally and automatically several ventilation units and, if necessary, to release one or more regulators from automatic regulation that, using a local, manual control signal, are regulated to the requested voltage.



In standard condition the **DRV300** is at **MAX. OUT** when the **INPUT** control signal is at max. value.

Fig. 14 shows the auxiliary **M1 & M2** connections and the operating regulation controls.

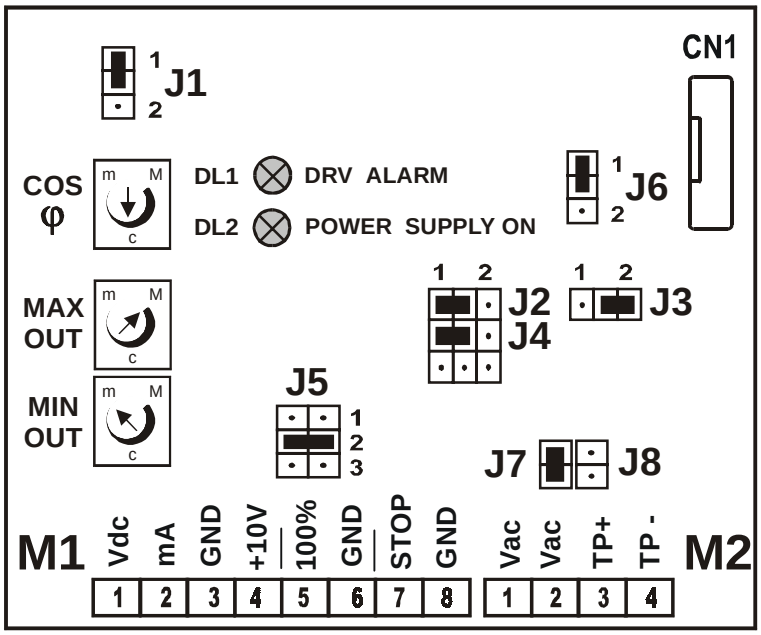


fig. 14

2.2.1 Remote 0-10 Vdc INPUT

The **AUTOMATIC / MANUAL Vdc** control signal can be connected to terminal block **M1**, with **DRV 'V'** version.
In this case the configuration jumper **J5 = ON 2** (fig. **15**)

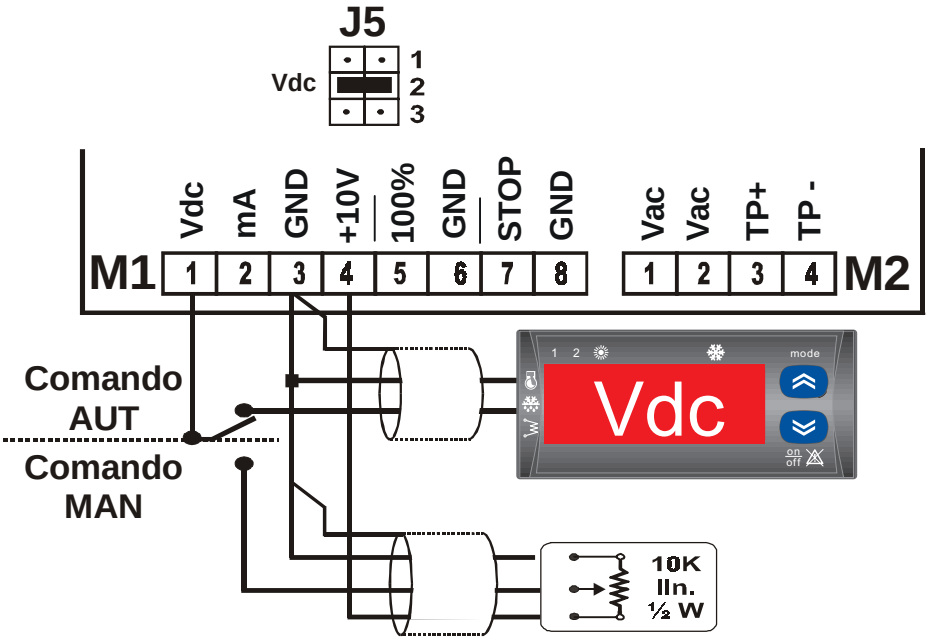


fig. 15

2.2.2 Remote 0-20 mA INPUT

The **AUTOMATIC / MANUAL mA** control signal can be connected to terminal block **M1**, with **DRV 'M'** version.
In this case the configuration jumper **J5 = ON 1** (fig. **16**)

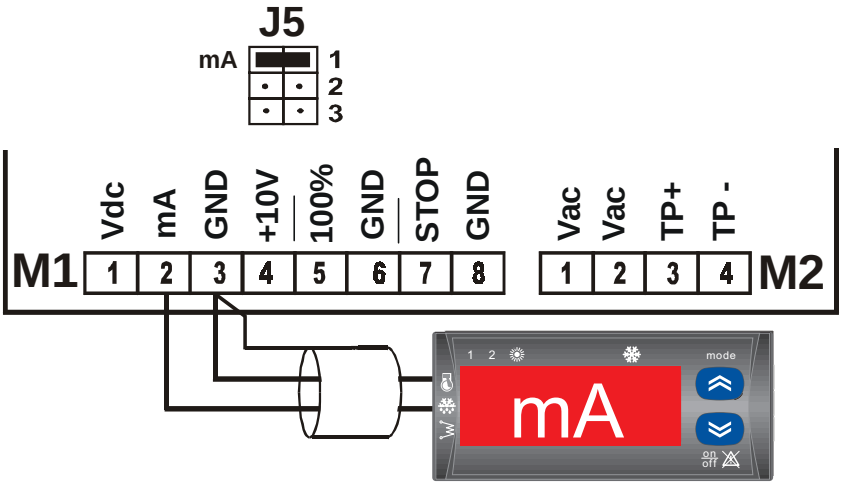


fig. 16

2.2.3 Remote PWM modulating INPUT (for TRIAC)

The **AUTOMATIC PWM** control signal can be connected to terminal block **M2**, with **DRV 'T'** version.
In this case the configuration jumper **J5 = ON 3** (fig. **17**).

It is possible to connect, for the correct phase-cutting (**ZERO-CROSS FUNCTION**), the **Vac** (**12–24 Vac**) supply reference of the remote control, for synchronize with power supply the DRV300 phase-cutting.
In this case the configuration jumper **J6 = ON 1** (fig. **17**).
The regulator is specialized for **PWM** remote control for **ELIWELL** (**J7 = ON**)

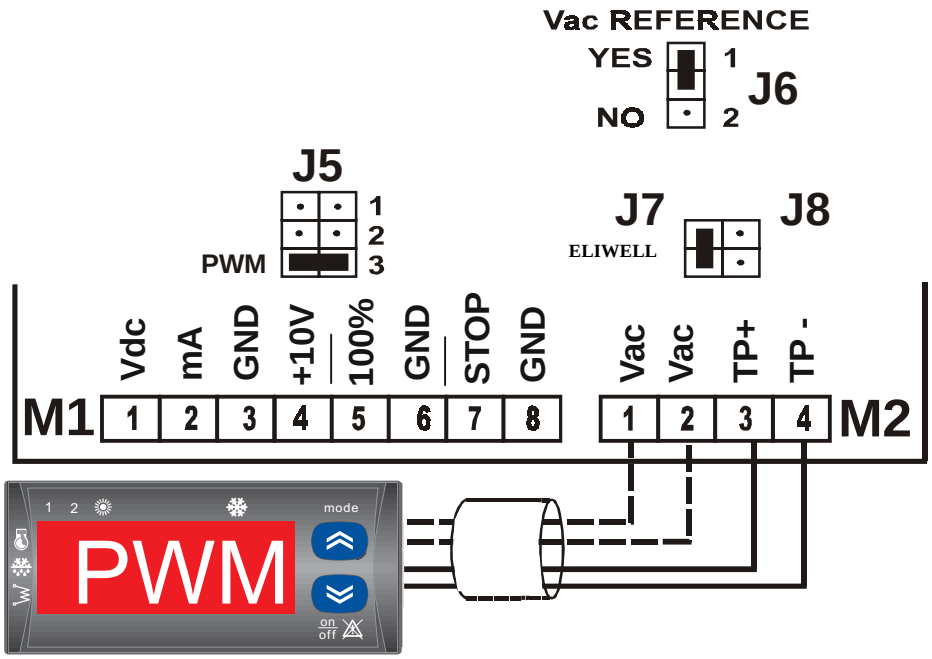


fig. 17

2.3 ELECTRICAL CONNECTIONS ON-OFF INPUTS / OUTPUTS

This paragraph describes the connections to the auxiliary **ON-OFF** inputs **(S1 - S2),** available on the **'M1'** terminal board for which the electrical connection is **POTENTIAL-FREE** signal contact.

CONNECTIONS	Trailing cable with rated cross section **1.5 sq mm / 22-14 AWG Cu**

2.3.1 Operating selection

The operating selection is obtained by activating the **5/6** and **7/8** terminals on the '**M1**' terminal board.
Fig. 19 shows an example of connection using switches and safety devices.

S1		indicates a **normally open** (**NO)** switch for commutation from **AUTOMATIC** (**NO**) to **100%** (**NC**) operation.
S2 for	**J2 = ON 1**	indicates a **NO** contact for activation/inhibition of operation (**remote ON-OFF**)
	J2 = ON 2	indicates a **NC** contact for safety device, e.g. a **HEAT PROTECTION** positioned on the motor, which would halt operation if were open

S1: AUT / MAN (M1 - 5/6)

S1 = OPEN	**operation with variable speed regulation**
S1 = CLOSED	**MAX SPEED operation at MAX OUTPUT VAC value**

The **S1** contact allows the regulation to be commutated from "AUTOMATIC OPERATION" (power supplied according to the control signal) to "MANUAL 100%" with **MAX. OUTPUT** reference limit.

APPLICATION EXAMPLE : WINTER / SUMMER operation for HEAT PUMPS mode.
The fans, connected to the regulator, can be activated depending on the temperature or pressure detected; or, by switching **S1 (CLOSED) :** voltage to the fans can be kept constant, equal to the value set with **MAX.OUT**, for the required time.
The operation described here can be achieved by means of electromechanical devices.
However it is extremely simple if the cutting regulators is controlled by an external regulator (e.g. **Eliwell** type : Energy-ECH series), which can automatically control the **S1** contact.

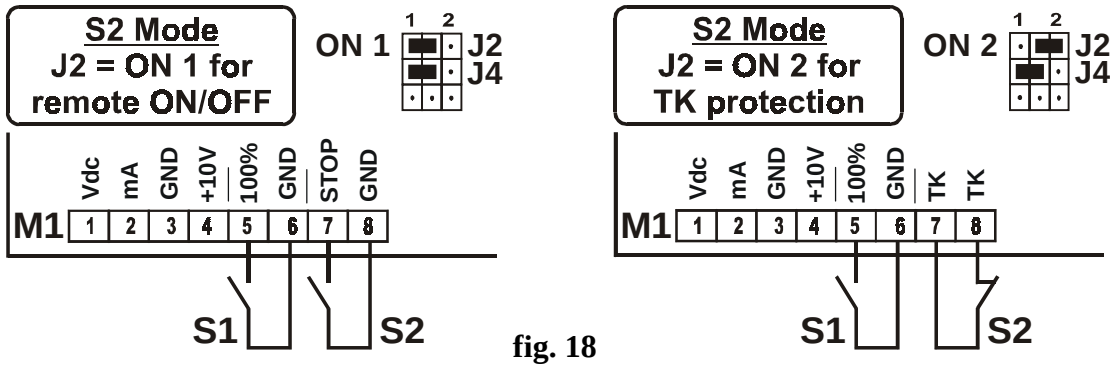


fig. 18

S2: remote ON-OFF for J2 = ON 1 (7/8 - M1)

S2 = OPEN	**Regulator operational**
S2 = CLOSED	**Operation Stop**

With **S2 = CLOSED**, operation of the cutting regulators is stopped via a remote free contact.
This is useful, for example, to stop fans during defrosting or to link fan operation to activation of a central unit (e.g. compressor) or an alarm (e.g. max./min. temperature).

S2: thermal contact TK for J2 = ON 2 (7/8 - M1)

S2 = CLOSED	**Regular operation (Led ALARM = OFF)**
S2 = OPEN	**STOP operation (Led ALARM = ON)**

Intervention of an external safety device opens a FREE POTENTIAL contact and halts operation of the regulator.
In plants with fans in parallel, individual protection devices must be used for each motor connected so as to reduce the risk of a total stop.

3.0 COMMISSIONING PROCEDURE

Having carried out the electrical connections to the regulator, it is time to perform the configuration, regulation and commissioning operations for the **DRV300** regulator by following the procedure below.
It is important to remember that the settings of the **jumpers** (**Jn**) are only to be modified to change the configuration or the operating mode of the regulator set in the factory (check the label on the right side of the casing).

3.1 Jumpers

This paragraph describes the preset functions of the programming **jumpers**; the jumpers used on the card are of the following types - **3 contacts** (see **fig. 19**).
The term "**Jumper**" refers to the moveable element which connects two (2) contacts.

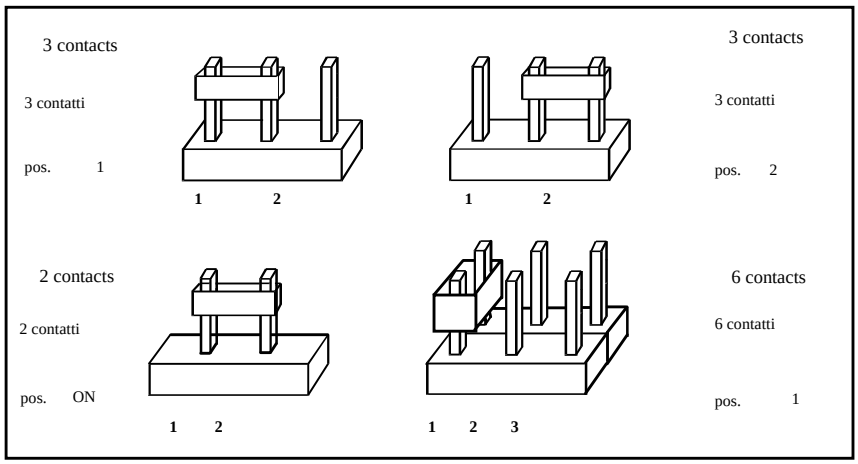


fig. 19

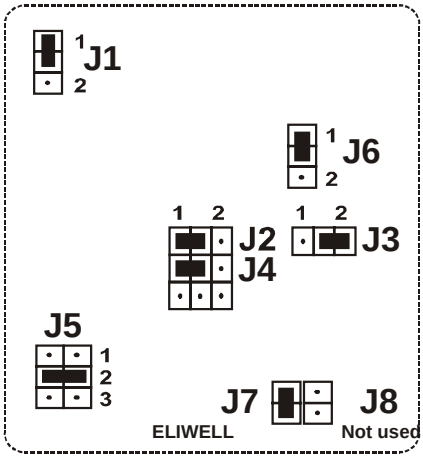


fig. 20

For **3** contact jumpers, there are two selection types:
- position '**1**' i.e. the middle jumper connected to jumper no. **1**
- position '**2**' i.e. the middle jumper connected to jumper no. **2**

The main jumpers on the **DRV300** cutting regulators **control card** are described below.

J1

J1 = ON1 Select the operating mode "**COMPENSATORY**" (only for **DRV300** in Option **'C'**):
when the "**COMPENSATORY**" mode is present (opt. '**C**'), switch **ON** the function

J1 = ON2 when the "**COMPENSATORY**" mode is **NOT** present
The standard position is J1 = ON2

J2

	for :	Select the **S2** operating mode : (**ON-OFF MODE**):	
J2 = ON1	**STOP/START**	with **S2 = NO** (open) **DVR300** is **O.K. (DL1 = OFF)** with **S2 = NC** (closed) **DVR300** is **OFF (DL1 = ON)**	**Factory condition**
J2 = ON2	**T.K.**	with **S2 = NC** (closed) **DVR300** is **O.K. (DL1 = OFF)** with **S2 = NO** (open) **DVR300** is **OFF (DL1 = ON)**	

J3

Selects the **SPEED-UP** mode, for **4"**, only when Power Supply switch **ON** :

J3 = ON1 **SPEE-UP** mode is **ABLE**.

J3 = ON2 **SPEE-UP** mode is **ANABLE**.
The standard position is J2 = ON2

J4 **Warning : factory calibration**

J5	Select the **INPUT** operating mode :
J5 = ON1	when selected, the input is activated for **0-20 mA** control signal
J5 = ON2	when selected, the input is activated for **0-10 Vdc** control signal
J5 = ON 3	when selected, the input is activated for **TRIAC** (**PWM**) control signal

J6	Select the **SYNCHRONISM** to Power Supply, with the **PWM** input:
J6 = ON1	- **with** signal of **VAC SYNCHRONISM** Note : with **Energy-ECH ELIWELL** / **F04** at **30** (default)
J6 = ON2	- **without** signal of **VAC SYNCHRONISM** Note : with **Energy-ECH ELIWELL** / **F04** at **255**

J7	Select the **PWM** control signal for **Energy-ECH ELIWELL**
J7 = ON >	For **ELIWELL** selection

J8	not used
J8 = ON >	

WARNING !

- **Check the position of jumpers 'Jn' during commissioning.**
- **The regulator is already set for the operations indicated on the label on the side of the casing; if modifications are required, describe and indicate the modifications made on the TECHNICAL ASSISTANCE MODULE.**

4.0 CONTROL TRIMMER

<u>WARNING</u>: Before starting the regulator calibration phase, check the position of the trimmers MIN-OUT = m & MAX. OUT = M (see fig. 14).
The position of the trimmers marked with a spot of red paint (factory calibrated trimmers) must not be altered.

4.1 MAX. OUTPUT regulation

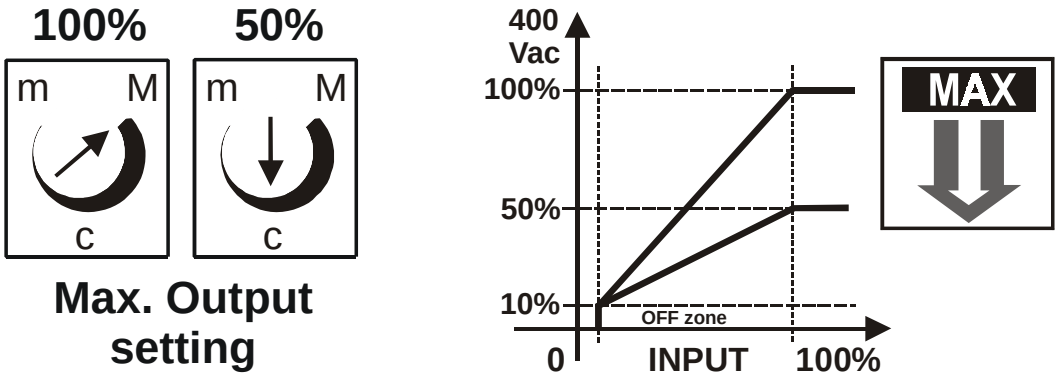


fig. 21

MAX. OUT
M = 100%
m = 0%

Limits the maximum operating voltage (from 100% to 0%).
It is useful for limiting the maximum capacity or noise of the fan when turning at max. speed.
It is set in the factory to the max. value '**M'** which corresponds to the max. voltage supplied to the fan and equal to 100% of the control value.

To regulate the **MAX. OUTPUT** voltage correctly, proceed as follows:

1) bring the **MIN-OUT** trimmer (manual control of minimum voltage) to position '**M';**
2) turn the **MAX-OUT** trimmer starting from position '**M**' as far as the desired **MAX**. voltage value;
3) bring the **MIN-OUT** trimmer to minimum value '**m'**: the MAX output voltage is regulated

4.2 MIN. OUTPUT regulation

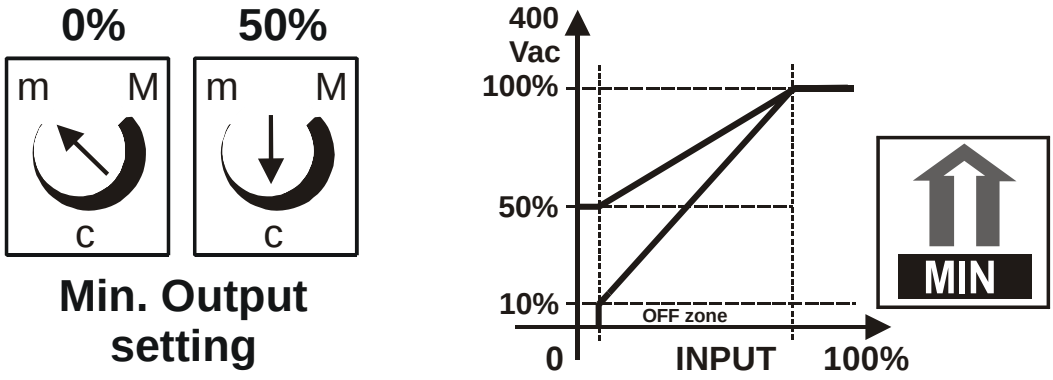


fig. 22

MIN. OUT
m = 0%
M = 100%

Allows manual regulation of the minimum output voltage from 0 to 100%.
During the calibration starting phase, it is used to check the regulator for correct cutting regulators and the fans for correct rotation.
It is also used as reference for calibration of the MAX. OUTPUT voltage.

Regulation of MIN-OUT trimmer, supplies the fan with a constant minimum voltage when the automatic control is not working or the control input is disconnected.
Rotate **MIN-OUT** anticlockwise starting from position '**m**' until the desired minimum voltage is reached.

In the diagram below, is shown the **DRV300** in standard configuration and **0-10 Vdc** input, with :

- **NO** limit **MIN & MAX** output
- Operation only with **MIN-OUT VAC** limit
- Operation beetween **MIN & MAX** output **VAC** limit

DRV300 STANDARD CONFIGURATION (*) With N.**3** axial fans **ZIEHL-EBM FE 800-6**

Input (0-10 Vdc)	**SUPPLY 405 VAC with MIN-OUT = 0 VAC MAX-OUT = 405 VAC**	**SUPPLY 405 VAC with MIN-OUT = 100 VAC MAX-OUT = 405 VAC**	**SUPPLY 405 VAC with MIN-OUT = 100 VAC MAX-OUT = 305 VAC**
0	**0**	**100**	**100**
0,5	**0**	**115**	**107**
1,0	**57**	**135**	**118**
1,5	**68**	**156**	**127**
2,0	**80**	**173**	**137**
2,5	**102**	**194**	**150**
3,0	**120**	**210**	**160**
3,5	**150**	**230**	**171**
4,0	**181**	**246**	**182**
4,5	**208**	**260**	**193**
5,0	**234**	**280**	**205**
5,5	**255**	**299**	**216**
6,0	**283**	**316**	**226**
6,5	**305**	**332**	**237**
7,0	**332**	**350**	**248**
7,5	**352**	**365**	**256**
8,0	**372**	**376**	**265**
8,5	**381**	**386**	**275**
9,0	**393**	**393**	**285**
9,5	**402**	**402**	**295**
10	**402**	**402**	**305**

N.B. : The loss voltage is contained within a maximum limit of **1%** (Vac-supply / Vac-loss on SCR).

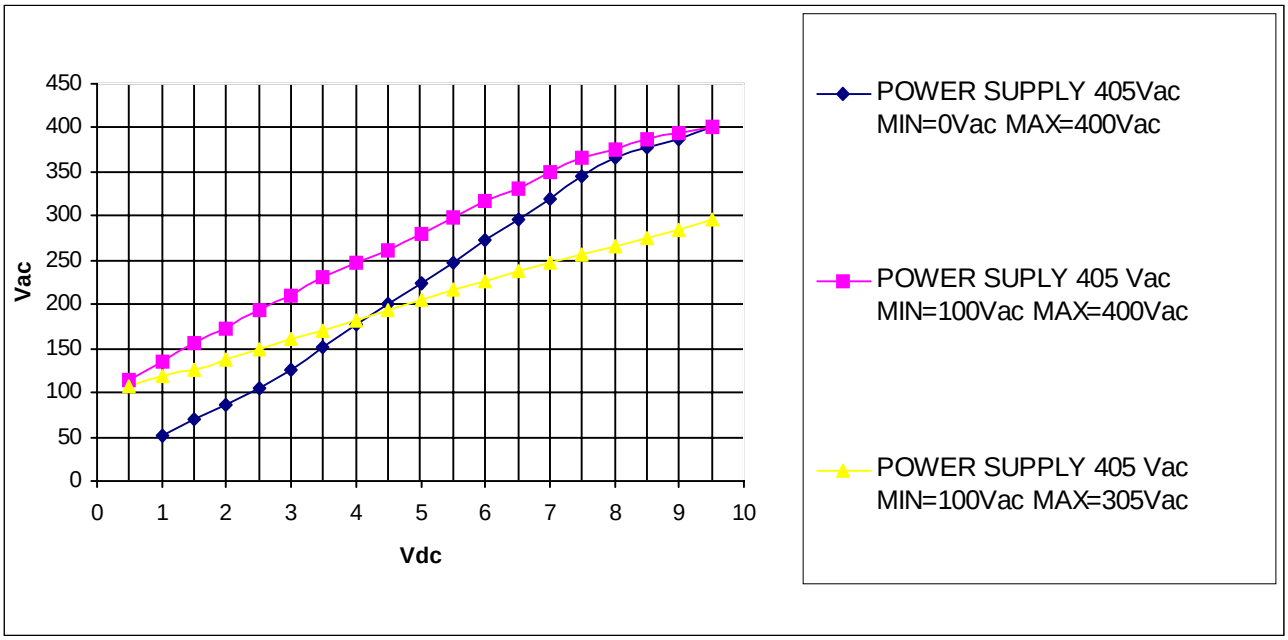


fig. 23

5.0 TROUBLE SHOOTING

Some of the problems which may occur during or after unit commissioning are listed below with their possible solutions.

Problem	Cause	Solution
Unit supplied but load does not activate.	**C1**. Absence of one phases (**Led DL1** on). **C2**. The load is not connected. **C3**. No control signal. **C6**. Remote **STOP** (**ON-OFF**) (**7/8** contacts closed).	**S1**. Check supply connections and input phases. **S2**. Check there are no electrical interruptions between regulator and load. **S3**. Check sensors for correct operation (return voltage) and connections to signal terminal board. **S6**. Check **STOP 7/8** control contact on signal terminal board.
Tension can be read on outlet terminal heads to load (circa **370 VAC**) but motor does not start.	**C1**. Load not connected to regulator terminals.	**S1**. Check electromagnetic switch or motor / regulator connection sectioner. **S2**. Check the motor heat protection TK.
Protection fuses burn out.	**C1**. Regulator undersized for load used. **C2**. Interference on supply lines. **C3**. **By-pass** configuration with short circuited phases.	**S1**. Check powers involved as well as starting and operating currents. **S2**. Check the supply line and if necessary install mains or 'surge' filters upstream of the cutting regulators. **S3**. Check input and output phase correspondence.
After correctly operating for a certain time, cutting regulators supplies the maximum voltage load regardless of control signal.	**C1**. Lack of ventilation and/or high working temperature in the unit. **C2**. Remote control signal faulty or short-circuited.	**S1**. Check the unit is mounted vertically; check the room temperature where the unit is installed. **S2**. Check input control voltage (**input** terminal board).
Unit has suspended regulation and Led **DL1** is on.	**C1**. External safety device has intervened (contact **MB 6,7**).	**S1**. Check unit reset type (see position of jumper **J13**). **S2** .Check activation of the safety device and the cause of the intervention.
Unit has suspended regulation and Led **AC LINE ALARM** is on.	**C1**. A fuse has burnt out or one of supply phases is absent.	**S1**. Replace supply line fuse and check beginning of line upstream.
Output voltage constant (100%) even with control signal activated.	**C1**. The contact **S1** is closed.	**S1**. Select correct operating mode (**NO** contact) by activating contacts **5/6** of terminal board.

Table 4

6.0 LIABILITY AND RESIDUAL RISKS

Eliwell & Controlli s.r.l. shall not be liable for any damages deriving from:
- installation/use other than that prescribed and, in particular, that which does not comply with safety standards anticipated by regulations and/or those given herein;
- use on boards which do not guarantee adequate protection against electric shock, water or dust under the conditions of assembly applied;
- use on boards which allow access to dangerous parts without the use of tools;
- tampering with and/or alteration of the products;
- installation/use on boards not complying with the standards and provisions of current legislation.

7.0 DISCLAIMER

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TECHNICAL ASSISTANCE SHEET

1. All **DRV300** equipment are guaranteed for **36** months from the date of testing.
2. The guarantee is rendered invalid under these circumstance:

- evidence of tampering with the mechanics or electrics
- incorrect installation
- improper use
- external electrical causes

Please keep this sheet near the 'DRV' regulator. To improve the assistance service and speed fault diagnosis, please fill this sheet in and send it to the Assistance centre together with the regulator in the event of a breakdown.

Customer:	**Regulator model:**	
Serial no.:	**Date of installation:**	**Date of breakdown:**

Description of the fault

☐ Noisy motor	☐ Burnt out motor	**Burnt fuse**						
☐ Unbalanced phases	☐ Protection interrupt	☐ phase **R**		☐ phase **S**		☐ phase **T**		
☐ Blocked motor	☐ Differential interrupt	VAC		VAC		VAC		
		AMP		AMP		AMP		

☐ **Description:**

Controls and contacts check card

☐ COS φ	☐ Supply 10Vdc / 5 mA	☐ INPUT mA
☐ MAX OUTPUT	☐ Supply reference VAC	☐ INPUT Vdc
☐ MIN OUTPUT	☐ Contact S1	☐ INPUT -T/+T (PWM)
☐	☐ Contact S2	☐

Details of the connected load

Manufacturer:	Type ☐ fans ☐ electric resistors
Electrical data ☐ VAC ☐ Amp ☐ Start amp. ☐ Code	

	Motor		**Electrical data**		
Electrical data	☐ star	☐ delta	Phase R S	V	Amp
Traction	☐ direct	☐ belt driven	Phase S T	V	Amp
Mechanics	☐ helical	☐ centrifugal	phase T R	V	Amp

Operator name:	Company stamp:

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DRV 300
rel. 10/06 eng
cod. 8MA10027