Voltage regulator

for ventilated heat exchangers, dry-cooler and remote condensers

RDM300

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sistemi elettronici professionali

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INTRODUCTION

This manual contains all the information necessary for the installation, operation, and maintenance of the RDM300 device. Its smooth operation and duration depend on proper maintenance and attention during use.

Do not proceed in any way to install or use of the product without first becoming familiar with the safety instructions contained in this manual.

This manual is an integral part of the device and must accompany it throughout its entire life cycle, until demolition. For ease of reference, the manual is divided into sections identified by a box containing the section title on the outer side of each sheet.

In order to provide an effective consultation, the notes of particular significance are highlighted as follows:

The notes marked with this symbol aim at ensuring maximum uptime for maximum machine performance.

The notes marked with this symbol are particularly significant for safety purposes, and must be strictly adhered to by anyone working on the machine.

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1. Presentation

The **RDM300** device is a voltage regulator that uses the principle of phase-cutting partialisation, totally controlled in all three phases, to partialise the root mean square (RMS) voltage applied to the load, without connection of the Neutral conductor.

The RDM300 device specializes in the regulation of three-phase asynchronous motors for applications on the ventilated heat exchangers used in air conditioning and refrigeration systems.

The device supports two types of inputs:

- signals from sensors (via transducers);
- control signals.

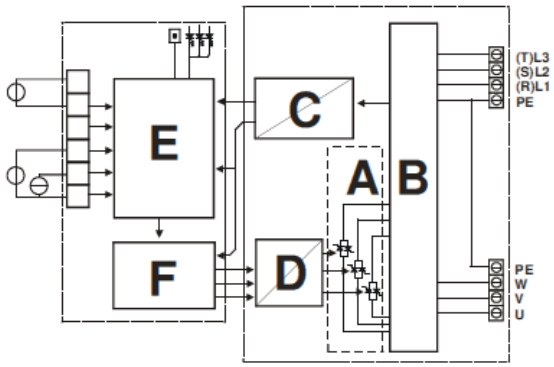
It can therefore operate in one of the following ways:

- **MASTER**: the output voltage varies as a function of one or more signals, maintaining the prevalent input within a given proportional band;
- **SLAVE**: the output voltage varies in proportion to the prevalent input.

The device is designed to manage 2 inputs. In case more inputs are needed, one or more input expansion modules of the **MEI-4** model (max 6) must be used (para. 7.4), each of which allows to connect up to four signals in mA/Vdc/NTC for each device.

If you connect multiple inputs, you can select whether to use the greater or lesser in value. The system compares all incoming signals, and the regulation is performed by using the prevalent signal.

The RDM300 device consists of a circuit board mounted inside a *GW Plast™* container resistant to 120°C, with IP55 protection, consisting of a power unit (in the lower part) and a control unit (in the upper part).



Power unit

A) Power circuit

B) Mains filter and EMC protection

C) Power supply and synchronization signals

D) Insulators for the control signals of the power devices

Regulation and control unit

E) Regulation and control circuit

F) Power device control modulator

The device is designed to withstand a breakaway starting current of approximately 2.5 times the rated current.

1.1 Features of the device

The RDM300 device can be connected to three-phase asynchronous motors, if the torque-speed characteristic of the load applied to the motor is quadratic.

This allows application mainly with axial fans, whereas for centrifugal fans the motor must be provided with control by phase-cutting partialisation (V ~ voltage variable).

The device can control several motors connected in parallel, the only limitation is the total absorption of current (both normal operating current and breakaway starting current), which must not exceed the rated values of the device, shown on the outer label.

The motor speed varies at the same time; any changes in behaviour during start-up phase and low speed operation are due to slight differences between the motors, even when the motors are the same type.

Conversely, if the speeds required must be different from each other, motors with different rated speeds must be used.

Motors different from each other can present heterogeneous electrical situations due to the differing resistive values of the stators, which can cause problems during start-up and low speed operation.

The device, used as **MASTER** or **SLAVE**, can act in 2 different ways:

- *Direct*: output increases as input increases;
- *Reverse*: output decreases as input increases.

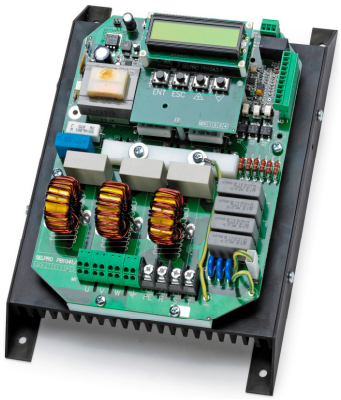
By default, the output increases as the controlled variable increases.

1.2 Model identification

The devices of the RDM300 series are available in different models; to identify the model of your device, refer to the following paragraphs.

IP 55

IP 20

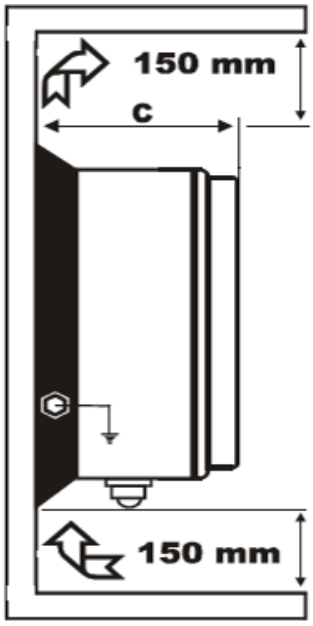


IP 00

1.2.1 Models with IP55 protection (for outdoor use)

These models are supplied in a plastic container with high mechanical resistance (IK = 08), mounted on an aluminium sink. The holes on the device underside are entries for the electrical connection cables:

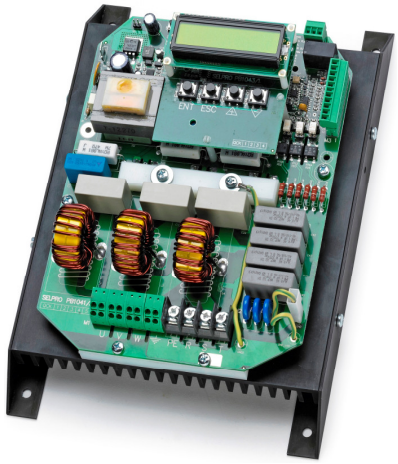
- Three-phase line cables (with earth connection) to power the network;
- Three-phase line cables (with earth connection) to power the load;
- Signal cables for analog inputs and digital outputs.

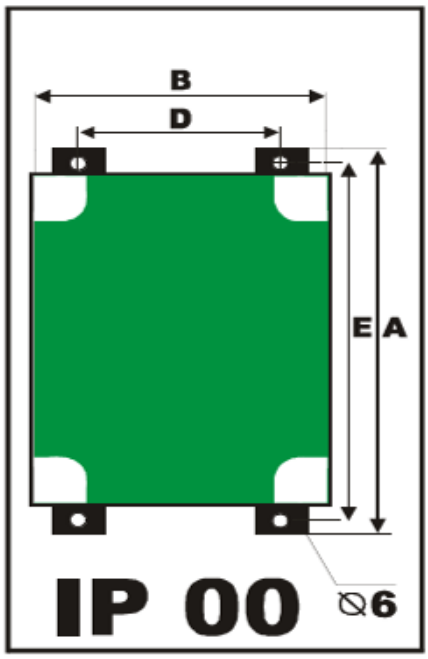


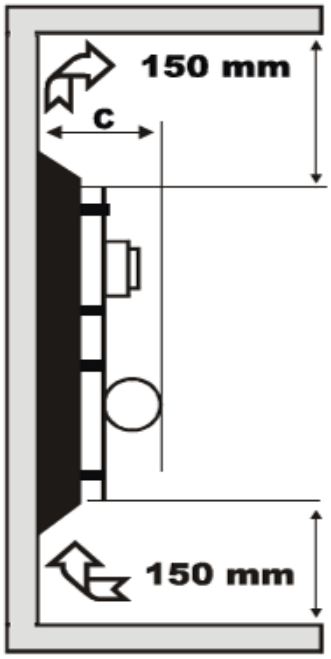
Model	Mechanical dimensions						
	A	B	C	E	F	Weight	Ø holes
RDM 308	253	234	116	210	200	2.5 kg	6.0 mm
RDM 312	285	201	130	153	255	3.8 kg	6.0 mm
RDM 318	285	201	162	173	255	4.5 kg	6.0 mm
RDM 320	350	235	181	185	320	6.5 kg	6.0 mm
RDM 328	350	235	204	173	320	7.5 kg	6.0 mm

1.2.2 Models with IP00 protection (from board)

These models are supplied on aluminium support without plastic container.



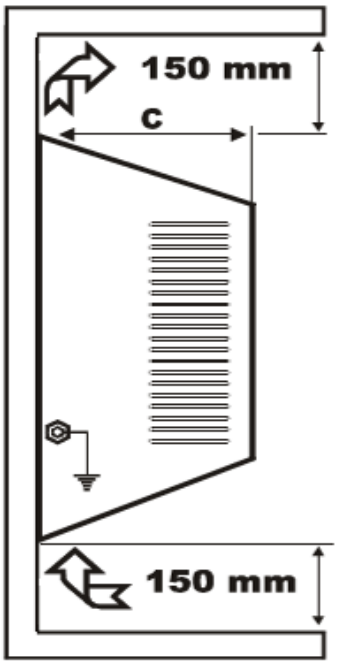




Model	Mechanical dimensions						
	A	B	C	D	E	Weight	Ø holes
RDM 308	253	234	116	210	200	2.5 kg	6.0 mm
RDM 312	285	201	130	153	255	3.8 kg	6.0 mm
RDM 318	285	201	162	173	255	4.5 kg	6.0 mm
RDM 320	350	235	181	185	320	6.5 kg	6.0 mm
RDM 328	350	235	204	173	320	7.5 kg	6.0 mm

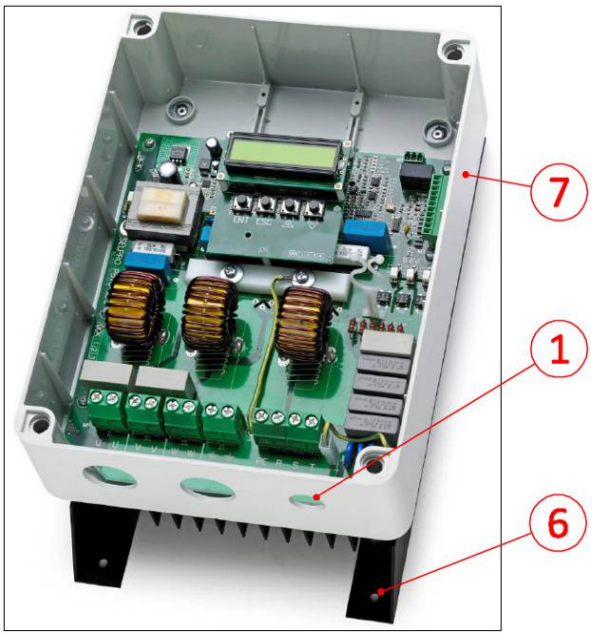
1.2.3 Models with IP20 protection (from board)

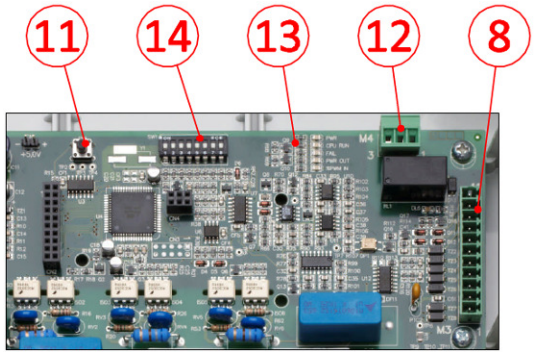
These models are supplied on aluminium support; they have protective shoulders and cover in both the two available versions (from 12A to 20A).

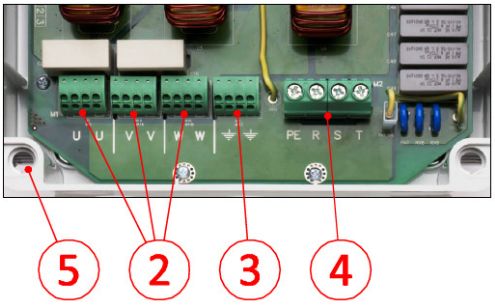


Model	Mechanical dimensions						
	A	B	C	D	E	Weight kg.	Ø holes
RDM 312	295	201	100	162	260	3.2.	6.0 mm
RDM 320	295	192	130	162	260	4.5	6.0 mm

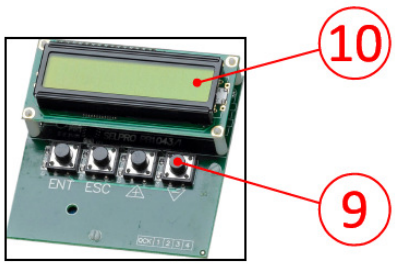
1.3 Description of components







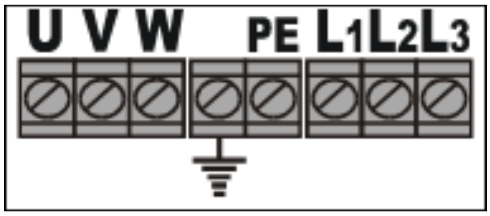
1) Cable glands;
2) Terminals for three-phase load connection (U-V-W) (para. 1.3.2);
3) Terminals for earth connection (para. 1.3.2);
4) Three-phase power supply connection L1-L2-L3 (R-S-T) + EARTH (PE);
5) NPT clamping screw (CEI 23-58);
6) Tab with holes for wall mounting the device;
7) GW Plast™ container;
8) Control inputs connection terminal block (para. 1.3.3);
9) Keyboard (para. 1.3.6)
10) Display (para. 1.3.5)
11) RESET pushbutton
12) Alarm relay terminal block
13) Indicator light (para. 1.3.1)
14) Dip-Switch (para. 1.3.4)



1.3.1 Indicator lights (LED)

Code	Figure	Code	Function	
DL1		PWR	Power supply is present	
DL2		CPU RUN	Microprocessor is operating (intermittent flashes) • Proper operation: flashing DC 50%, freq. 500 MHz • CosPhi setting active: Flashing DC 50%, freq 2 Hz	
DL3		FAIL - KO	1 Flashing	Board has reached maximum temperature (85°C)
			2 Flashings	Power supply phase lacking
			3 Flashings	Opening of motor thermal protection
			4 Flashings	Input outside allowed range
DL4		PWR OUT	Running: delivery of output voltage	
DL5		% PWM	PWM control percentage from control input	
DL6		RL1	RL1 relay state (illuminated if excited)	

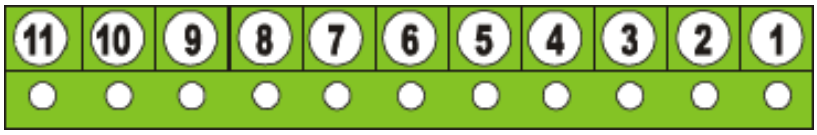
1.3.2 Power terminal



L1; L2; L3; PE: connection terminals for three-phase power supply

U; V; W; Gnd: terminals for three-phase load connection

1.3.3 M3 terminal block (control signals)



1) **(IN2) NTC / Ma / Vdc**: Input 2 for control signals 0-5V, 0-10V, 4-20mA, NTC (Master/Slave);
2) **(IN1) NTC / Ma / Vdc**: Input 1 for control signals 0-5V, 0-10V, 4-20mA, NTC (Master/Slave);
3) **Gnd**: Earth reference;
4) **+V (20Vdc)**: Power supply to transducer with 20Vdc - 20mA non-stabilized output, protected against short-circuit (to IN1 / IN2);
5) **VR (5Vdc / 10Vdc)**: Power supply with output +10.0 Vdc / +5.0 Vdc - 5 mA stabilized and protected against short circuit (to IN1 / IN2);
6) **OUT 0-10 V:** 0-10Vdc control output for auxiliary power unit
7) **(S2) START/STOP:** NO/NC contact (based on the position of DSw4, para.1.3.4) for the "STOP regulation" remote control;
8) **GND:** Earth reference;
9) **TK:** NC contact for connecting motor thermal protection;
10) **PWM:** 0-10Vdc control signal input, in PWM modulation, opto-isolated, from 3 to 30V - 10mA – non-polarized;
11) **PWM:** 0-10Vdc control signal input, in PWM modulation, opto-isolated, from 3 to 30V - 10mA – non-polarized.

1.3.4 Dip Switch

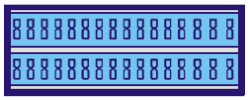
The standard features in place and the possible modifications that can be made by the user are as follows:

- **DSW 1 - Set-Point Location:**
  - *On* : *Set-Point* at the minimum regulation voltage value
  - *Off* : *Set-Point* to the maximum regulation voltage value .
- **DSW 2 - Regulation Mode:**
  - *On* : Reverse (inversely proportional to the control signal);
  - *Off* : Direct (directly proportional to the control signal).
- **DSw 3 - Transfer function** (available only in Slave mode):
  - *On* : Quadratic transfer function;
  - *Off* : Linear transfer function.
- **DSw 4: - Start/Stop Contact Operation :** DSw4 setting reverses the mode by which the Start/Stop contact pushbutton M3 (para. 1.3.3) defines the start/stop/*Heat Pump Mode* condition:
  - DSw4 On and Start/Stop contact closed and earthed (On): Start;
  - DSw4 On and Start/Stop contact open (Off): Stop (or *Heat Pump* if a value > 0 has been set for the HP parameter, para.5.6);
  - DSw4 Off and Start/Stop contact closed and earthed (On): Stop (or *Heat Pump* if you have set a value > 0 for the HP parameter, para. 5.6);
  - DSw4 Off and Start/Stop Contact (OFF): Start.
- **DSw 5 and 6 - Alarm Relay Operation:**

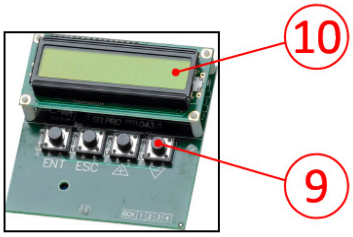
The settings of Dsw5 and Dsw6 determine the operation of alarm relay RL1. For more information, refer to Chapter 6

- **DSw 7 - CosPhi Parameter:**
  - *On* : Changes the CosPhi value (calibration with external 10Kohm potentiometer);
  - *Off* : Normal operation (CosPhi factory value).
- **DSw 8 – Custom Function:**
  - *On* : **Active**;
  - *Off* : **Inactive**.

1.3.5 Display



The display is LCD type, backlit, with 2 alphanumeric lines of 16 characters each.



9 Display (para. 1.3.5)

10 Keyboard (para. 1.3.6)

1.3.6 Keyboard

The keyboard consists of four keys (*ENTER*) , (*EXIT*), (Up) and (Down). The display and keys are used to view and change the device work parameters.
(Refer to sections 4.3 and 4.5)

1.4 Technical characteristics:

1.4.1 Power supply:

Standard voltages	**400 V~** three-phase (+20% / -15%)
Voltage limits	**Lower: 360 V~ (-10%)**
	Upper: 440 V~ (+10%)
Overvoltage protection	For installation category **II** (**4 KV**)

1.4.2 Power and current by model

The following table shows the power dissipated in the environment and the root mean square (RMS) value of input current at ambient temperature, depending on the model.

Model	Power	Current (temperature < 50°C)	Current (Temperature > 50°C)
RDM 308	32 W / 8A	**8 A**	downgrade **0.6 A/°C**
RDM 312	48 W / 12A	**12 A**	downgrade **0.6 A/°C**
RDM 318	72 W / 18A	**18 A**	downgrade **1.0 A/°C**
RDM 320	80 W / 20A	**20 A**	downgrade **1.0 A/°C**
RDM 328	112 W / 28A	**28 A**	downgrade **1.2 A/°C**

The device is capable of supporting an overload equal to 200% of rated current (max. 10" every 3').

1.4.3 Analog control signals

When operating in Master mode, signals can be connected to the device that come from sensors and measure different quantities, as shown in the table. Depending on the type of signal, you should set the appropriate configuration code (para. 5.5).

Configuration code	Input Signal	Resistance
rtE-01 (*)	NTC Temperature	10 kohm
rPr420 / rPr015 / rPr025 / rPr030 / rPr045	4 to 20 mA	100 ohm
rUu05 / rPu030 / rPu045	0 - 5 Vdc	10 kohm
rUu010	0 to 10 Vdc	10 kohm
rS-420	4 to 20 mA	100 ohm
rS-010	0 to 10 Vdc	10 kohm

(*) Factory configuration

1.4.4 Input logic contacts

- Control signal (Slave mode only): PWM digital signal, voltage from 3 to 30 Vdc insulated and non-polarized.
- ON /OFF signal: contact ON /OFF free of potential, programmable via DSw4 (NA or NC).
- Motor thermal protection: ON/OFF contact free of potential (NC).

1.4.5 Output signals and contacts

Control analog	Signal in Slave mode: **0-10 Vdc / 10-0 Vdc**, max **30mA**
Auxiliary power supplies	**+20Vdc +/- 20%,** max **40mA** non-stabilized, protected against short-circuit
	+5Vdc max **20mA** stabilized and protected from short circuit
Potentiometer power supply	**+10Vdc / 5mA** stabilized, with protection for manual control potentiometer
Alarm Relays	Contacts **COM**, **NC**, **NA** for alarm relay RL1

1.4.6 Alarms

Control input	Verify that the control signal is within the limits allowed
Power supply PRESENT	Verify that the power is within the limits allowed
Mains phase monitoring	Phase failure - Insufficient power supply **(-20% V~ input)**
Device Integrity	Reading the device work temperature by internal sensor

For more information about the alarms, refer to Chapter 6 .

1.4.7 Protections

Overvoltage	Compliant under **EN 61000-4-5**: overvoltage category **II** (**4 KV**)
Control input	With PTC to prevent breaks caused by short circuits
Device Integrity	Internal thermal protection

1.4.8 Container

Materials	**GW Plast** (max. temperature 120°C) and aluminium
Clamping screws	**NPT** series with max torque of **2.5Nm** (according to **CEI 23-58**).
Protection:	**IP 55** using cable gland KIT
Fire Resistance	Category **D**

1.4.9 Working ambient conditions

Storage temperature	from -30°C to +85°C
Humidity	< 85% non-condensing
Vibrations	< 1G (9.8 m/s^2)

1.4.10 Insulation

Container	Class I (use of protective conductor connected to earth)
Control circuits	**4000 Vdc** between control input and line voltage parts

For more information about the alarms, refer to Chapter 6.

2. Safety

2.1 General safety requirements

You must follow very carefully the safety prescription specified below, every time you interact with the device.

- Read carefully and follow the instructions in this manual; keep a copy with the device.
- Before starting the device, the user must determine it suitability for the use he/she intends to make of it, taking all risk and liabilities arising from improper use of the device.
- The installation, commissioning, and use of this device should only be performed by qualified personnel with knowledge of the product technical standards, in accordance with safety and personal protection standards.
- The device contains no user-serviceable parts: do not tamper with or disassemble the internal parts of the device. Doing so will void the warranty, and may cause serious injury to persons and property.
- The user must be protected from the power supply, and the motor must be equipped with protection against overvoltage, in accordance with the applicable standards.
- Do not power the device without the protective cover in place.
- Never touch any parts of the electrical circuit when power is on.
- Do not alter or damage the equipment identification tags.

2.2 Allowed Use

The device is aimed at regulating the rotation speed of high-slip three-phase asynchronous motors applied to axial and centrifugal fans used in air conditioning, refrigeration or air handling and treatment.

Any use other than that allowed ones is prohibited.

2.3 Compliance and harmonic distortions

The device has no internal filters to eliminate the harmonic distortions generated by regulation, and therefore generates disturbance to the power line, identified as "current harmonic distortions", during regulation at low speeds (THD value).
The necessity to apply a filter to eliminate harmonic distortion depends on the current drawn by the device.
Refer to **EN 61000-3-2** and **EN 61000-3-12**.

It is the responsibility of the device installer or user to ensure, according to the distribution network parameters, that both conditions are met. If not, to reduce harmonic currents you must install a filter appropriately sized (para. 3.6.1).

2.4 Compliance of the device

The device is compliant with to the following standards:

Standard	Code Standard	Description
2006/95 CE	EN60204-1	Machine safety and electrical system
	EN 50178	Electronic equipment for power installation
2004/108 CE	EN 61800-3	Variable speed electrical drives. Part 3: Product standard relating to electromagnetic compatibility and the specific test methods

The device carries the CE marking according to Directive 89/336/EEC on electromagnetic compatibility, as amended. The Directive essential requirements are met by compliance with the requirements specified in the *generic-standards* for industrial environment.

The testing and compliance audits were performed in the manner described in the product technical file.

The device is also compliant with PDS (Power Drive Systems), which guarantees the EMC compliance of the regulator + fan(s) system.

The final features of the system or plant in relation to the EMC Directive are the responsibility of the installer, who must carry out the system commissioning very carefully, in accordance with the applicable regulations, based on the information contained herein.

It is prohibited to carry out the device commissioning before the plant of which it is part has been declared to be compliant with the applicable regulations.

Reference compliance for marking			
CDM system	PDS system		
		CE	EMC LVD

3. Installation and Connections

3.1 General safety requirements

Before and during installation, you must follow very carefully the safety prescription specified below.

- For the control of delicate products, or high value products that need to be kept within specific limits, we recommend installing a separate monitoring device, equipped with alarm contacts.
- The installation must be done by a qualified technician who carefully connects the electrical system, fixes the cables in their definitive position, and turns it on. Incorrect installation can cause serious injury to persons and serious damage property.
- Do not install in an environment exposed to direct sunlight, or that can reach temperatures above the maximum expected ambient temperature (50°C). In this case, the device may be damaged and/or you must make the connected load work at full capacity (100%).
- As entries for the connection cables, you must use only the holes provided, which are always on the bottom, on the side of the power terminal blocks, in order to prevent infiltration of external agents (water, dust, etc.), and maintain the device **IP55** protection by using the supplied cable gland and the quality sheaths and cables that properly fit.
- Reassemble and make sure the outer protective cover closes perfectly.

3.2 Installation precautions

3.2.1 Cable diameter

Model	Flexible cable rated section	
	Signal	Power
RDM 308	1.5 mm² (13 AWG)	2.5 mm² (13 AWG)
RDM 312	1.5 mm² (13 AWG)	2.5 mm² (13 AWG)
RDM 318	1.5 mm² (13 AWG)	6.0 mm² (9 AWG)
RDM 320	1.5 mm² (13 AWG)	6.0 mm² (9 AWG)
RDM 328	1.5 mm² (13 AWG)	10.0 mm² (7 AWG)

For connection, use silicone (FG7) or PVC insulated cables, and remember that the silicone insulation, which does not allow the cable to cool optimally, tolerates higher temperatures.

The temperature of the PVC cables should not exceed 70°C, while the silicone insulated cables withstand temperatures of 90°C.

Problems may increase in the vicinity of the connection terminals, where the variations in the conductor temperatures can cause loosening of the clamping screws, thus leading the terminal to overheat due to increased electrical resistance.

3.2.2 Ambient temperature

The device is cooled by natural convection, and therefore air must be able to pass freely under and over the device. A free space of at least **150 mm** must be maintained both above and below the device.

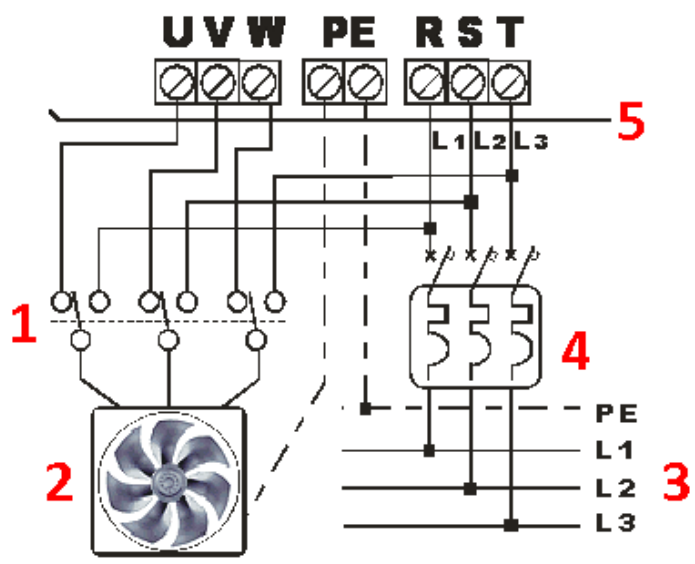
3.3 Mechanical installation

Before connecting it to the electrical system, secure the device by using the four fixing holes located on the side tabs.

If the device in use is the **IP55** version (para. 1.2.1), it can be mounted outdoors. Conversely, if the device is in the **IP00** (para. 0) or **IP20** version (para. 0), it must be installed inside an electrical cabinet.

3.4 Connecting the power and signal cables

To connect the power and load cables, refer to the following scheme. Make sure to use wires whose section is adequate for the connected load (para. 3.2.1).



1) By-pass (external);

2) Fans;

3) Power supply;

4) Magnetothermal protection type C / fuses;

5) PE
Faston conductor and EN 61000-4-5 overvoltage arrester EN 61000-4-5

The power cables (power and load) must be installed separately from control cables (analog inputs and ON-OFF input/outputs), maintaining the maximum possible distance between the conductors.

Do not mix power cables with signal cables in the same raceway, and in case of intersection, place them at a 90° angle.

In the presence of a residual current protection system, use industrial switches with leakage current to earth ≥ 100 mA.

3.5 Motor connections

The correct wiring and power supply voltage are shown on the motor nameplate.

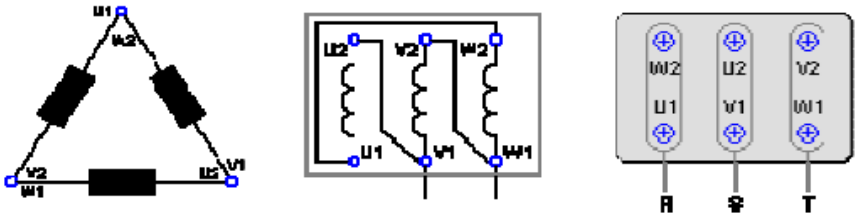
It is important that the motor power cable is as short as possible, to minimize the level of interference and the leakage currents (maximum 15 m).

- The motor can be connected in a star or a delta configuration (see paragraphs below), without a neutral conductor.

3.5.1 Delta connection (high speed)

The voltage on the windings is $\mathbf{V_{ph} = V_n}$

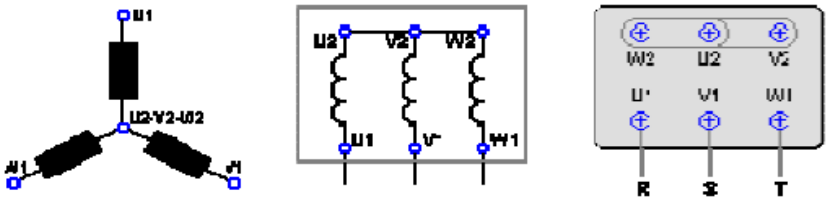
The current flowing in the windings is given by: $\mathbf{I_{ph} = I_n / 1{,}732}$



3.5.2 Star connection (low speed)

The voltage on the windings is $\mathbf{V_{ph} = V_n / 1{,}732}$

The current flowing in the windings is given by: $\mathbf{I_{ph} = I_n}$

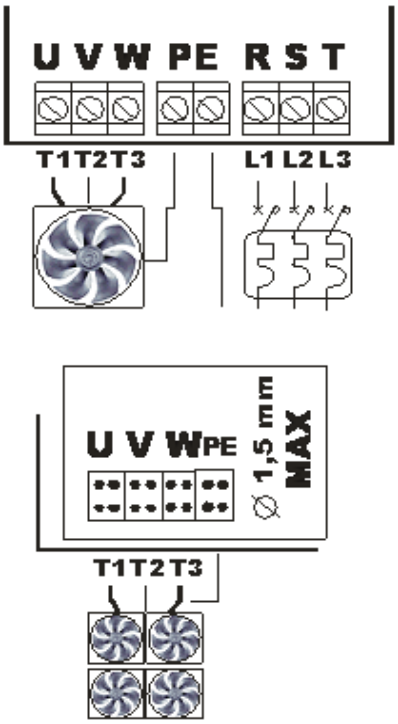
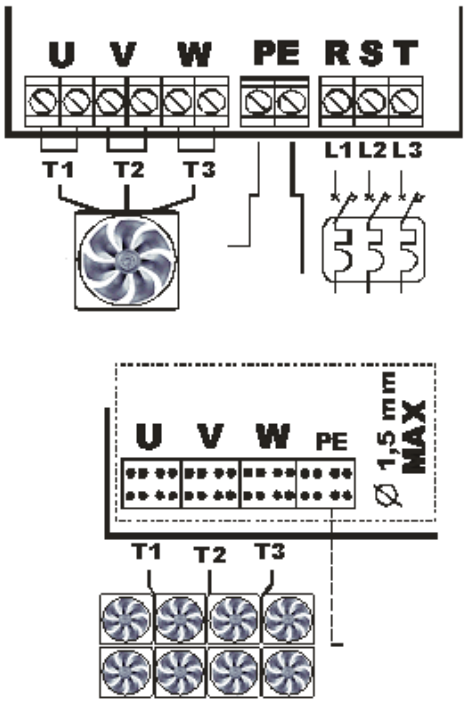


3.5.3 Reversing rotation

The rotation direction can be reversed by exchanging 2 of the 3 phases connected to the motor.

3.5.4 Control of multiple users

If you need to connect multiple users to the device, refer the following table for connection.

Current from 8 to 20A: standard single output or 4 connections of max 1.5 mm²	**Current 20 and 28A**: double standard output or 8 connections of maximum 1.5 mm²
	
Models RDM308; RDM312; RDM318; RDM320	Models: RDM320, RDM328

If the speeds required on the users must be different, you should use different speed controllers, with different control signals.

3.6 Protections

3.6.1 Installation of active filter

To apply the active filter (para. 7.5) take into account that the nominal value of THD in a condition of maximum disturbance must be 14%.
Place the active filter directly on the power line, with a parallel connection upstream of the electrical system to be brought to compliance.
The filter can then operate directly on several machines installed, and can be added to a pre-existing filter to increase the total power.

3.6.2 Fuses

To protect the device power modules (SCR) from the electrical disturbance in the system, it is recommended that you use fuses *Ferraz Shawmut (Elettroitalia)* or the like, as they are suitable for the protection of power devices (SCR - Triac).

Mod. RDM300	Breaker (MAX value recommended)	Protection fuses for SCR modules			
		Type	Amp	Type	V c.a.
RDM 308	16 A	FR10GB69V16	12	10 x 38	690 V
RDM 312	20 A	FR10GB69V16	16		
RDM 318	32 A	FR10GB69V25	25		
RDM 320	32 A	FR14GC69V25	25	14 x 51	
RDM 328	40 A	FR14GC69V32	32		

3.6.3 Magnetohermal protection

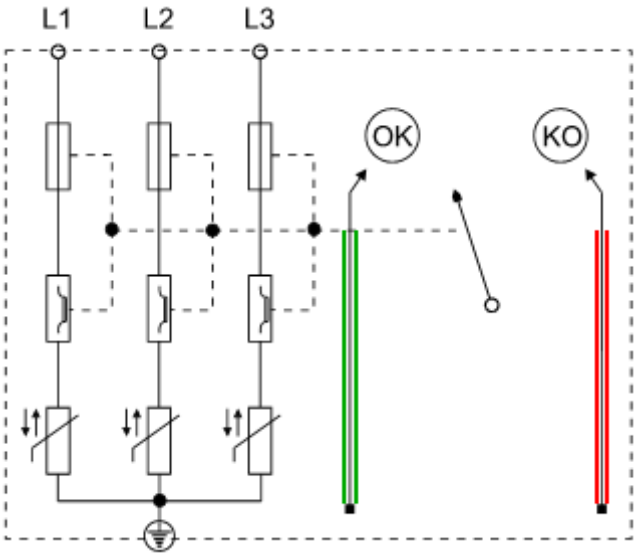
Upstream of the RDM300 device there must be a short-circuit and/or overvoltage protection system; the supply of such protection is the installer's responsibility, and may consist of:

- A set of three ultra-fast fuses (see table above), that protects the power components used in the device against a short-circuit /electrical discharge on the V ~ output line regulated.
- Three-phase 'C' trip curve breaker.

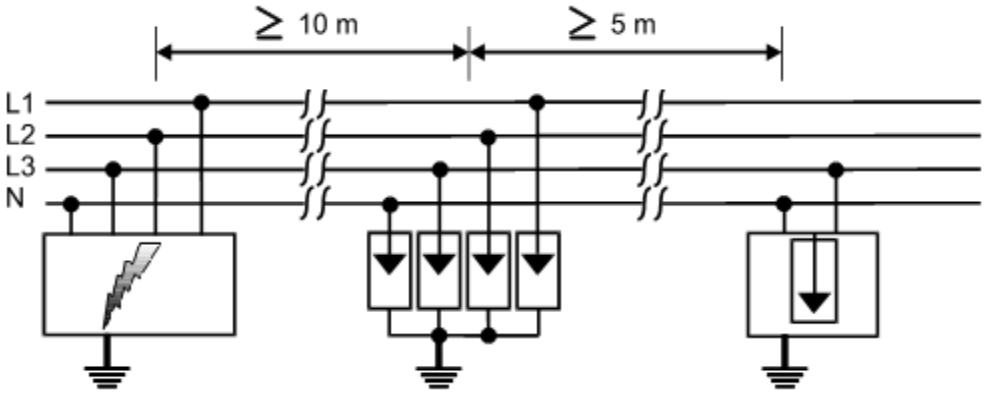
S.EL.PRO. recommends the combined use of both protections to safeguard the integrity of the electrical regulation device.

3.6.4 Overvoltage arrester

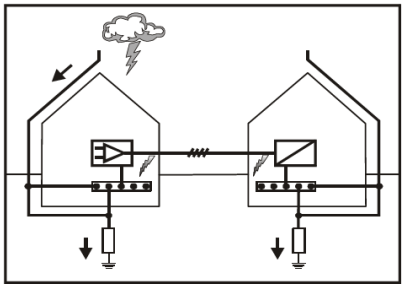
The overvoltage arrester is an electrical protection located between the device power supply unit and earth, and protects the device against mains transient overvoltage.
To connect to the network (L1, L2, L3, N) of the overvoltage arrester, a conductor must be used which has a section equal to that of the existing conductor.
If this is not possible, and therefore a conductor having a smaller section is used, this conductor must be provided with short-circuit protection by means of a 100 A fuse of the gl type.
For connection to the earth system, a conductor must be used which has a section equal to 50% of the section of the main equipotential bonding conductor, not less than 6 mm and not more than 25 mm.
The figure shows the wiring diagram of a three-phase filter for connection to the supply line of a RDM300 series device.
The filter has a window where the interchangeable cartridge is located; this window displays the arrester state: green = OK, red = failure.



The connection cable between the arrester and the earth system must be installed in such a way as to make the route as short as possible.

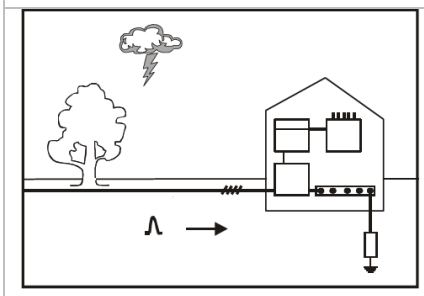


If the power mains supply is disturbed, it is recommended to install three-phase overvoltage arrester filters directly on the device power supply unit. Keep in mind that overvoltage can come from:



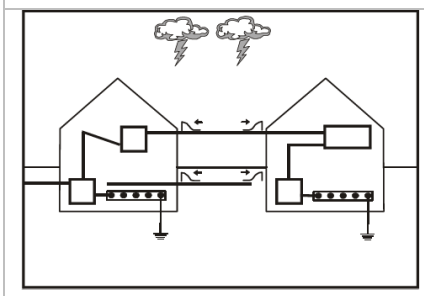
Direct atmospheric discharge

When lightning strikes directly a building having a basic protection system, the connected parts of the system (integrated system), reach a considerable potential: this will cause differences in the potential of the parts connected to earth and the potential of live parts, and this will make the insulation insufficient.
Therefore, perforations and discharges occur that cause irreparable damage to the equipment.



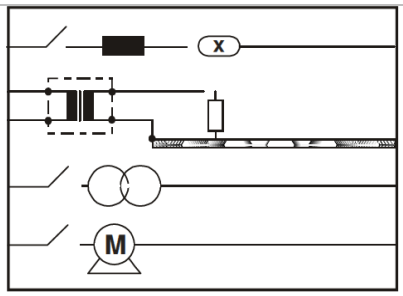
Indirect atmospheric discharge

If lightning strikes a electrical supply unit directly, even at a considerable distance from the building or through the roots of a tree, it goes directly into the supply cable or to the leakage system; the overvoltage that is generated, even in this case, can cause severe damage



Atmospheric discharge between cloud and cloud

If the discharge does not occur between a cloud and earth, but between clouds having a different potential, overvoltages are formed through these reflected discharges, which in this case can cause considerable damage, too.



Overvoltage by opening or closing operations

Overvoltage caused by operations in the electricity distribution and low voltage networks should not be underestimated.
Operations that cause overvoltage consist of, for example, the defusing of high-voltage cables with no-load operation, the triggering and defusing of transformers, capacitors, heavy inductive loads, etc.

It is advisable to prepare a bypass switch in order to drive the load even in the event of failure of the shutter switch (emergency by-pass).

3.7 Electrical tests

3.7.1 Electrical strength test (IEC EN 60204-1)

The electrical system must withstand a test voltage applied for a period of at least 1 second between the conductors of all the circuits, except those designed to operate at PELV or lower voltages, and the potential protection circuit.

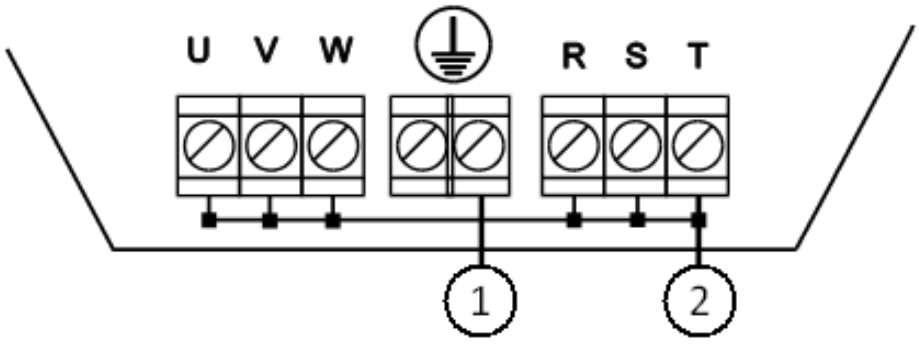
The test voltage must:

- have a value of twice the equipment rated supply voltage, or **1000Vdc**, whichever is higher;
- have a value of twice the equipment rated supply voltage, or **1000Vdc**, whichever is higher;
- be equipped with a transformer having a minimum rated power of 500VA..

Components not designed to pass this test must be disconnected during the test.

During the dielectric strength test, always disconnect the Faston connector from the PE earth reference.

The test voltage is applied between points **1** and **2** as shown in the **figure.**



3.7.2 Insulation resistance test (IEC EN 60204-1)

The insulation resistance measured at a voltage of **500 Vdc**, between the conductors of the power circuit and the equipotential bonding protection circuit, must not be less than **1 Mohm**.

The test must be performed between points **1** and **2** shown in the previous figure.

3.8 Connection to control sensors and signals

According to the type of control sensors (in Master mode) or control signals (in Slave mode) connected to the terminal block M3 of the RDM300 device, a configuration code is determined, indicated in the paragraphs of below; refer to para. 1.4.3 to set the correct configuration code by using the keyboard.

Control signals for MASTER mode:

- 4-20 mA
- 0.5 – 4.5 Vdc
- 0-10 Vdc
- Kohm (NTC sensor 10 kohm@25°C)

Control scale for MASTER mode:

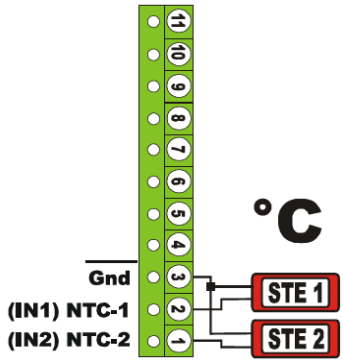
- 4-20 mA sensor
  - **0-15bar / 0-25bar / 0-30bar / 0-45bar**
- 0.5 – 4.5 Vdc sensor
  - **0-30bar**
- NTC sensor (10 kohm@25°C)
  - **-20/90°C**

Control signals for SLAVE mode:

- 4-20 mA
- 0-10 Vdc
- PWM

3.8.1 NTC transducer 10 kohm 25° (Master mode)

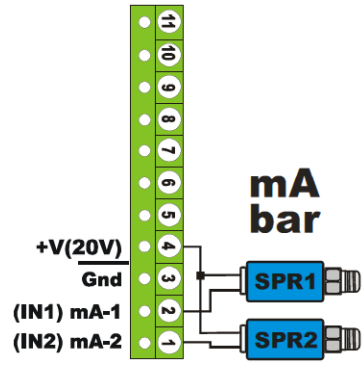
The diagram shows the connection of the NTC sensor (para. 7.3).



Code	Range
rtE-01	-20÷90°C

3.8.2 Transducer 4-20 mA (Master mode)

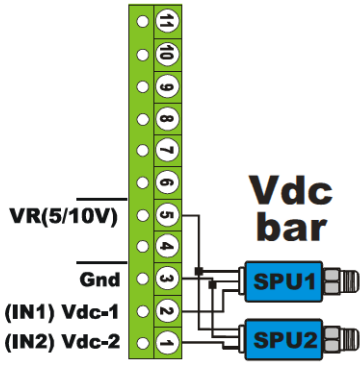
The diagram shows the connection of the 4-20 mA transducer (para. 7.2).



Code	Range
rPr420	4÷20 mA
rPr015	0÷15 bar
rPr025	0÷25 bar
rPr030	0÷30 bar
rPr045	0÷45 bar

3.8.3 Ratiometric transducer (Master mode)

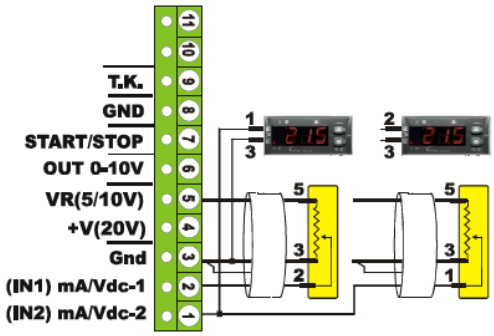
the diagram shows the connection of the ratiometric transducer (para. 7.2).



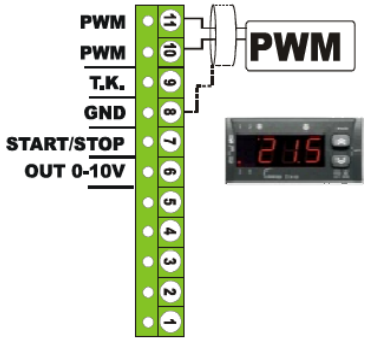
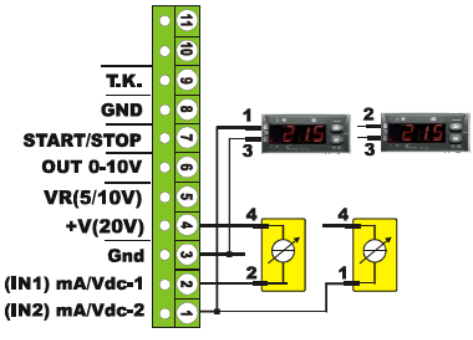
Code	Range
rUu-05	0÷5 V c.c.
rPu030	0÷30 bar
rPu045	0÷45 bar
rPu010	0÷10 V c.c.

3.8.4 Remote control signals (Slave mode)

The diagram shows the connection of the control signals (0-10 Vdc and 4-20 mA and PWM) from an external unit, for automatic regulation (control from thermoregulator) or manual unit (control from potentiometer) (para. 7.1).

<table>
<tr><td rowspan="2"> 

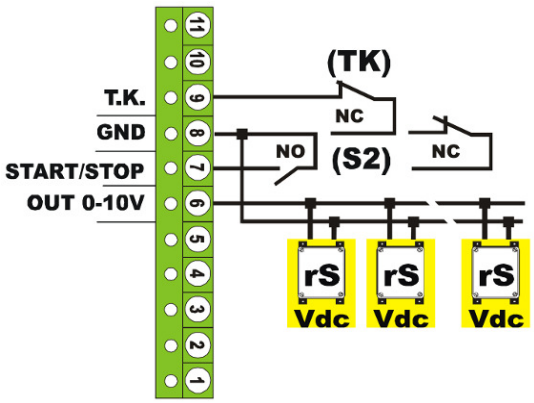
Control: 0-10 Vdc → 

Control: 10-0 Vdc → 
</td><td>Code</td><td>Range</td></tr>
<tr><td>rS-010</td><td>0-10 Vdc</td></tr>
<tr><td rowspan="2"> 
</td><td>Code</td><td>Range</td></tr>
<tr><td>rS-PWM</td><td>0-100 %</td></tr>
<tr><td rowspan="2"> 

Control: 4-20 mA → 

Control: 20-4 mA → 
</td><td>Code</td><td>Range</td></tr>
<tr><td>rS-420</td><td>4-20 mA</td></tr>
</table>

3.8.5 Connection of auxiliary signals and inputs



All the contacts of the auxiliary signals and inputs are located on the device M3 terminal block.

- Connect to the TK thermal protection to terminals 8 and 9: when TK is closed (On), consent for operation is given; when the TK contact is open (Off) the thermal protection alarm goes off.
- Connect the Start/Stop contact to terminals 7 and 8. The functioning of the contact depends on the settings of Dsw4:
  - *Dsw4 ON* : when S2 is closed (On), the operation consent is given; when S2 is open (Off), the stop command is given, and the HP value at output.
  - *DSw4 OFF* : when S2 is closed (On), to stop command is given and the HP value at output; when S2 is open (Off), the operation consent is given.

The S2 contact (terminals 7 and 8) does not disconnect the mains power supply: do not use it as a safety switch.

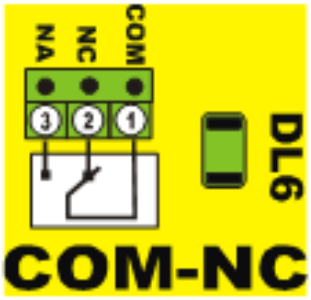
- By using the 0-10 Vdc outlet located on the terminal block (terminals 6 and 8) ,it is possible to control different regulators by means of the same signal.

The Vdc control auxiliary output follows the trend of the output voltage (U-V-W) according to the settings of DSw2.

3.8.6 Alarm relay contacts (M4)

An alarm relay is located on the board, and its operation is programmable for the various signaling levels.

In factory mode, when starting up the device, the relay switches from the rest position (NC, contacts 1 and 2) to the active position (NA, contacts 1 and 3).

Normally set open	Normally set closed
	

The various alarm levels can be activated by appropriately setting DSw5 and Dsw6 (para. 1.3.4).

4. Operation mode

This section of the manual illustrates the operating principle of the device, depending on the settings that will be selected on the Dip Switches and on the display.

Before proceeding with any settings, carefully read the following paragraphs to understand the behavior of the device depending on the configuration code, the pre-selected operating mode, and the setting of the parameters.

4.1 Operation in Heat Pump mode

When the Stop command is sent to the device (para. **Errore. L'origine riferimento non è stata trovata.**), if you set a value > 0 for the HP parameter (para. 4.6.11) the device delivers an output voltage equal to the set value (heat pump mode).

The regulation according to the set mode (Master or Slave, para. 4.2 and 4.3) starts up again when the Start command is given.

4.2 Master mode operation

4.2.1 Regulation principle

The output voltage varies to maintain the within the proportionate band the magnitude measured by the transducer connected to the input, in direct or reverse mode, depending on the configuration of **DSw2**.

The *Set-Point* (**SP**), set by the manufacturer, corresponds to the input value for which the output is brought to the maximum regulation value (**100%**). By changing the **DSw1** you can invert the operation, by setting the SP in correspondence of the minimum regulation value (**0%**).

The reference graphs (para. 4.3) show the trend of the output voltage, in response to the input signal, in direct and a reverse mode, with SP at the minimum and at the maximum values. The output voltage is expressed as a percentage of the input voltage.

The regulation and limits (factory settings **0%** and **100%**) can be set by means of:

- **hi**: parameter determining the maximum % of the output voltage;
- **Lo**: parameter determining the minimum % of the output voltage.

For both these parameters you can also determine the forcing values, which are:

- **Sh**: parameter determining the input value for which the output is forced to 100%;
- **So**: the parameter determining the input value for which the output is forced to 0%.

And the respective hysteresis:

- **ih**: parameter determining hysteresis at the **Sh** value;
- **io**: parameter determining hysteresis at the **So** value.

The forcing action depends on the preselected operating mode:

- in direct mode the output goes to 0% if **in < So** (*Cut-Off*) and to 100% if **in > Sh**;
- in reverse mode the output goes to 0% if **in > Sh** (*Cut-Off*) and to 100% if **in < So**.

If a regulation area is encountered that has a high noise level (extra dB), you can set a skip area that will not be regulated:

- **Jh**: upper limit of the skip area, expressed as a % of the supply voltage;
- **JL**: lower limit of the skip area, expressed as a % of the supply voltage.

4.2.2 Parameters set from the keyboard

Among the following parameters it is possible to view the current value and set the desired value .

Para.	Description	Set limits	Unit of measure
SP	*Set-Point* : desired value of the magnitude to be controlled	Para. 4.6.1	mA / Vdc / °C / bar
Pb	Proportional regulation band width	Para. 4.6.2	mA / Vdc / °C / bar
hi	Maximum output voltage limit	Para. 4.6.3	% (of supply voltage)
Lo	Minimum output voltage limit	Para. 4.6.4	% (of supply voltage)
dE	*Soft-Start* : acceleration/deceleration time	Para. 4.6.5	sec
Jh	Upper limit of the skip area (for extra dB)	Para. 4.6.6	% (of supply voltage)
JL	Lower limit of the skip area (for extra dB)	Para. 4.6.6	% (of supply voltage)
Sh	Value of input signal that forces the output at maximum (Overspeed)	Para. 4.6.7	mA / Vdc / °C / bar
ih	Hysteresis at Sh value	Para. 4.6.8	mA / Vdc / °C / bar
So	*Cut-Off* : value of input signal that forces the output to 0	Para. 4.6.9	mA / Vdc / °C / bar
io	Hysteresis at the So value	Para. 4.6.10	mA / Vdc / °C / bar
HP	*Heat Pump*: operation in heat pump mode	Para. 4.6.11	% (of output voltage)

4.2.3 Read-only parameters

Of the following parameters, only the current value can be viewed, but it is not possible to set the desired value.

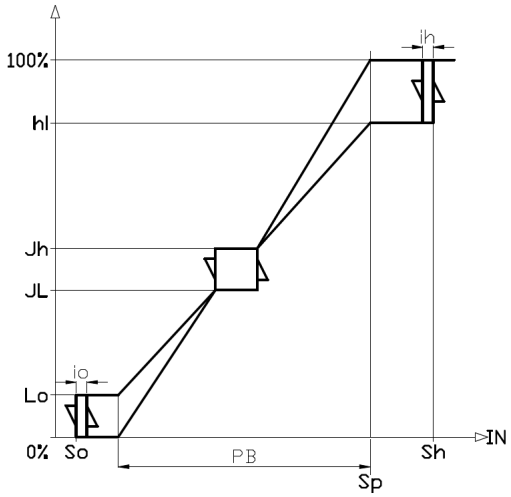
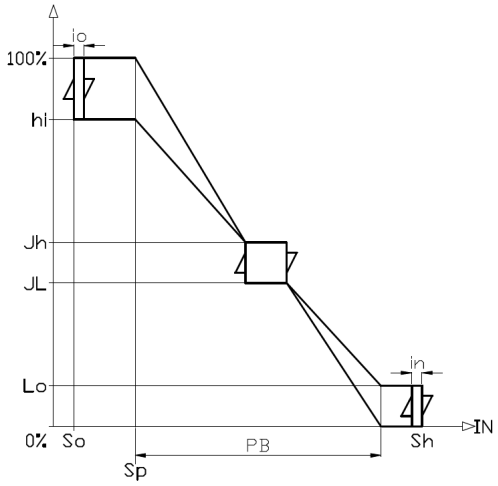
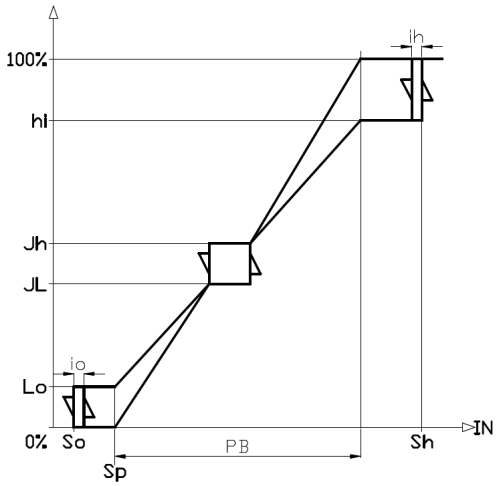
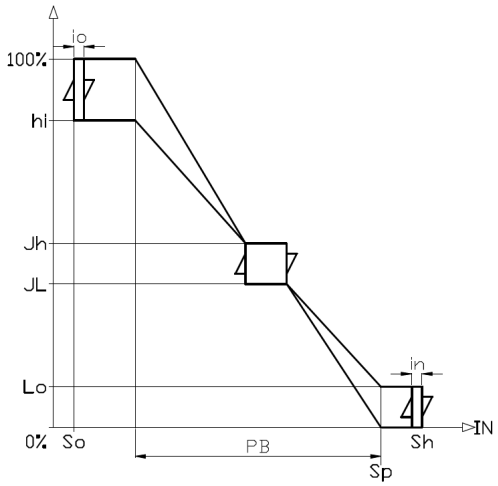
Para.	Description	Unit of measure
ti	Instant board temperature	°C
Co	Value of output regulation control	% (of supply voltage)
in	Value of prevalent input signal (I1 or I2)	mA / Vdc / °C / bar

4.3 Operational diagrams in Master mode

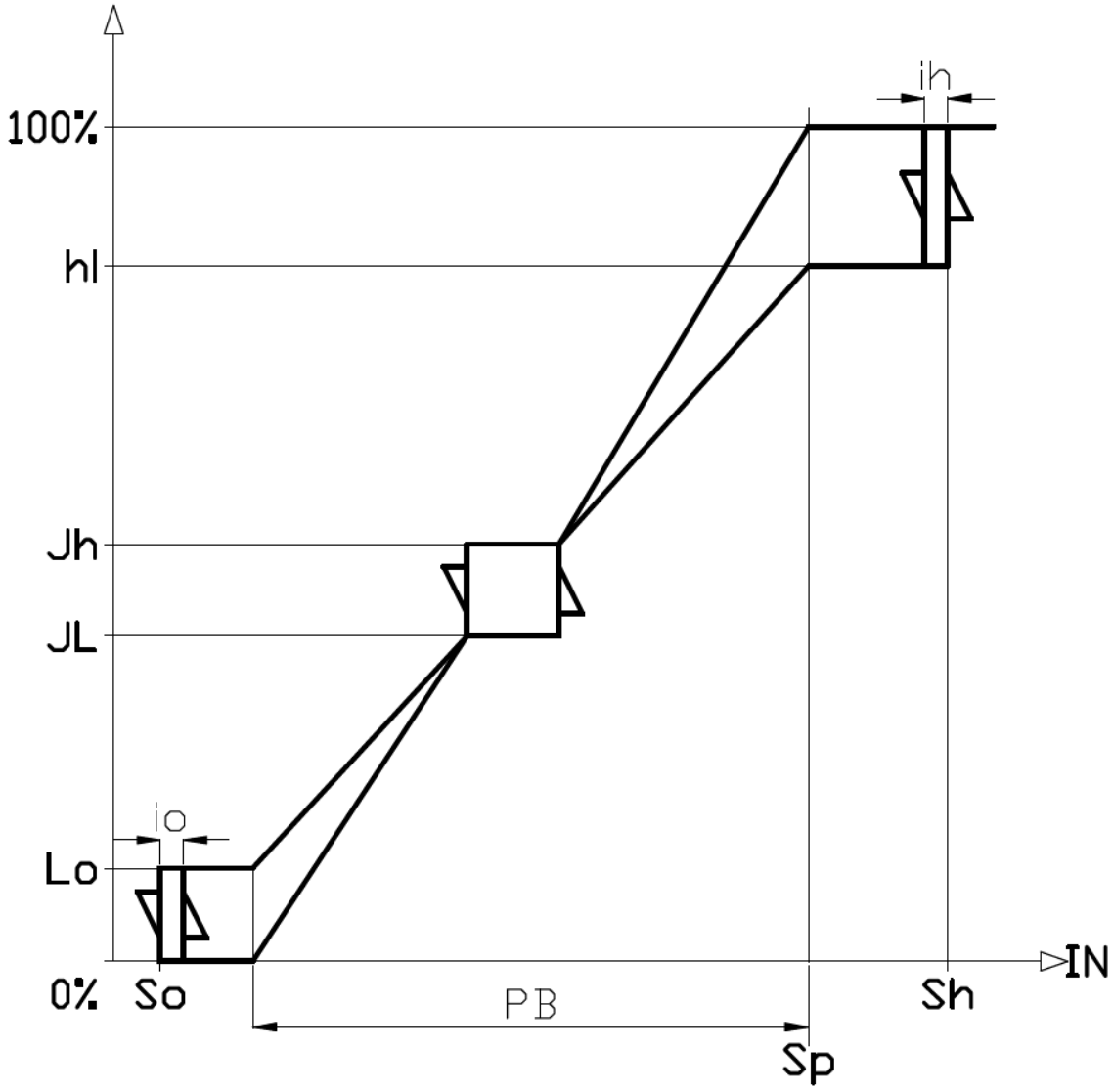
In Master mode regulation mode depends on the settings of Dsw1 and Dsw2:

Setting	Dsw1	Dsw2	Function	Ref.
	Off	Off	Direct regulation with *Set-Point* at maximum	4.3.1
	Off	On	Inverse regulation with *Set-Point* at maximum	4.3.2
	On	Off	Direct regulation with *Set-Point* at minimum	4.3.3
	On	On	Inverse regulation with *Set-Point* at minimum	4.3.4

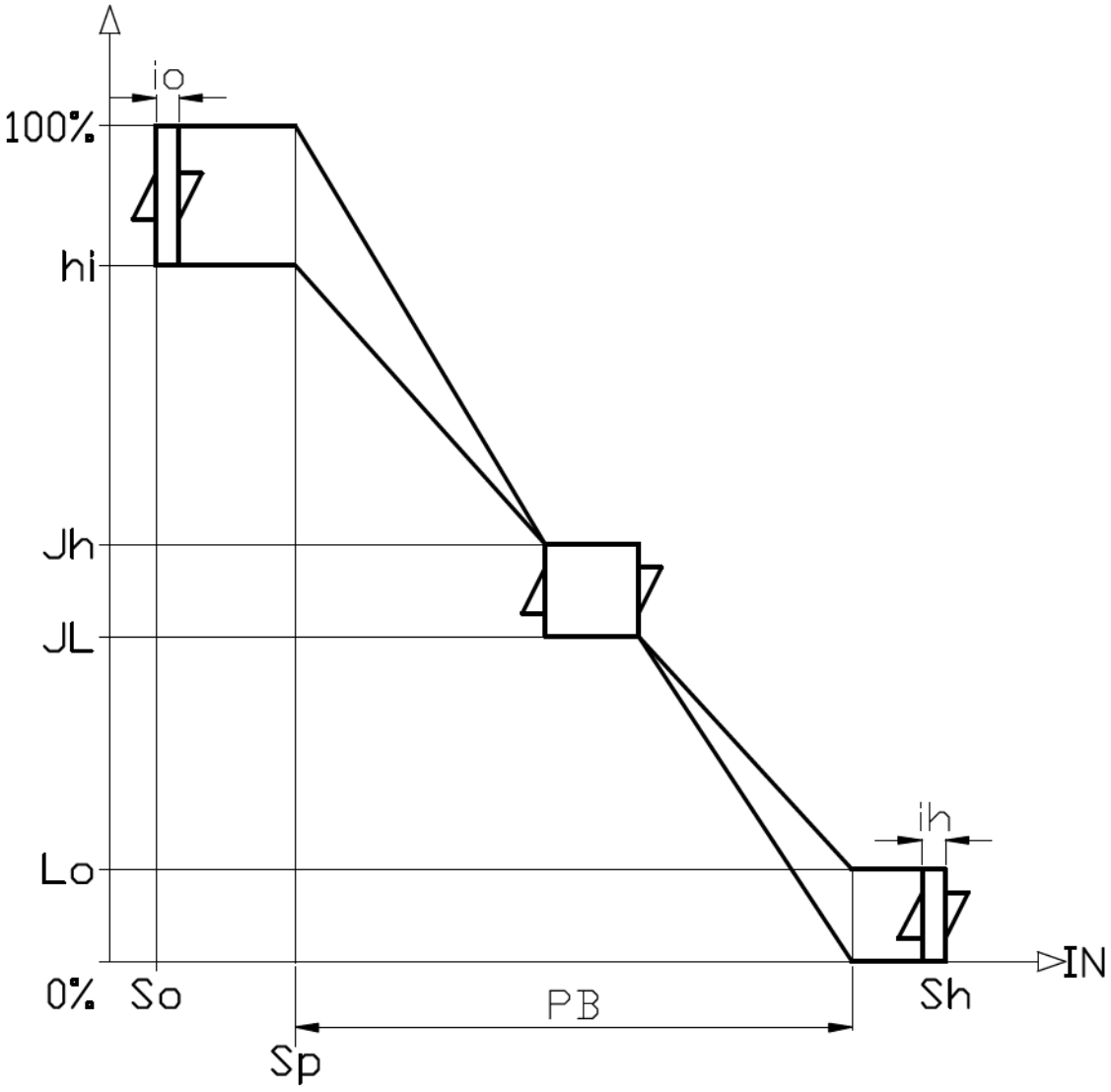
The 4 diagrams are compared in the following table.

	Direct regulation	Inverse regulation
Set-Point at maximum		
Set-Point at minimum		

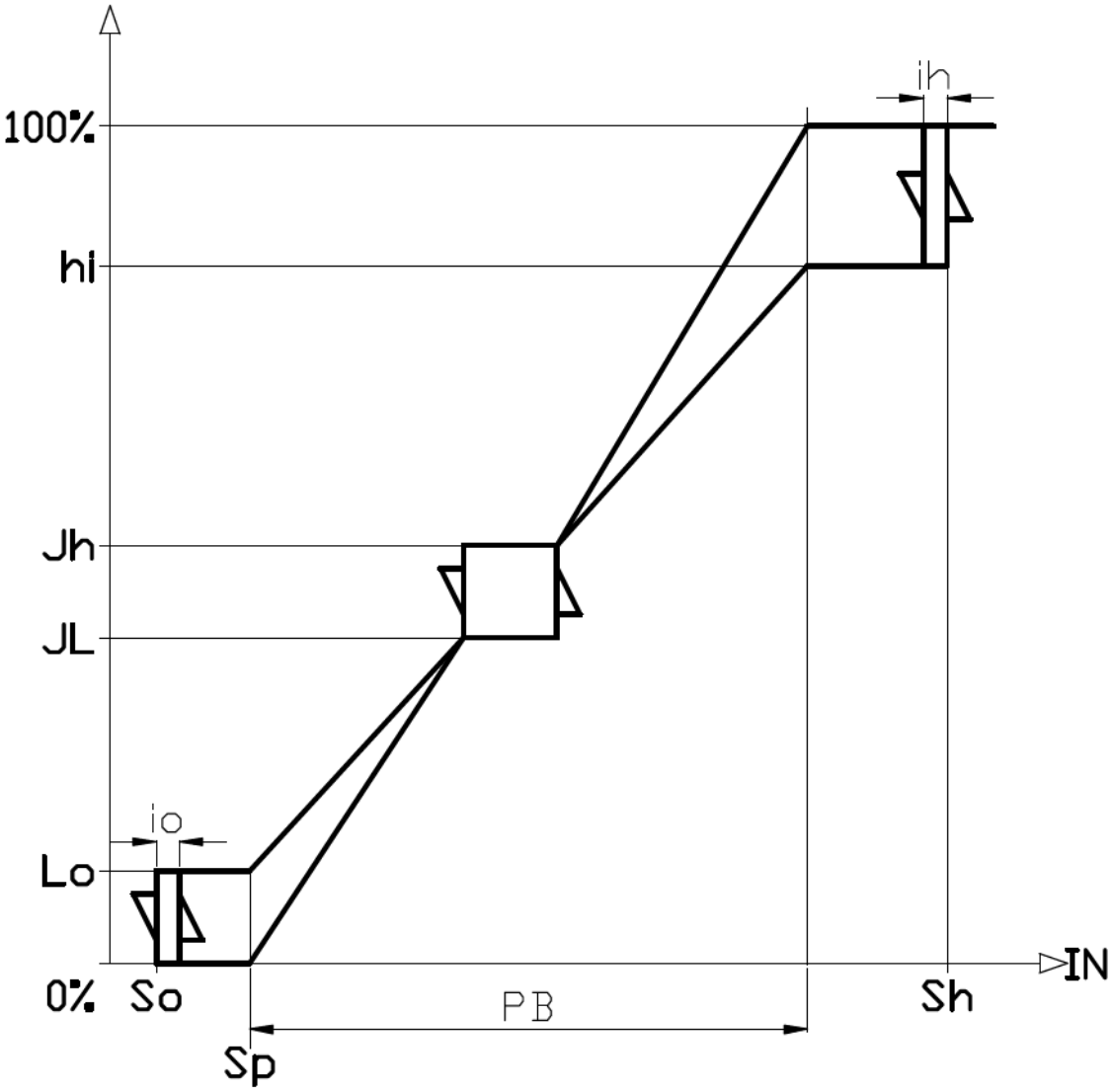
4.3.1 Direct regulation with Set-Point at maximum



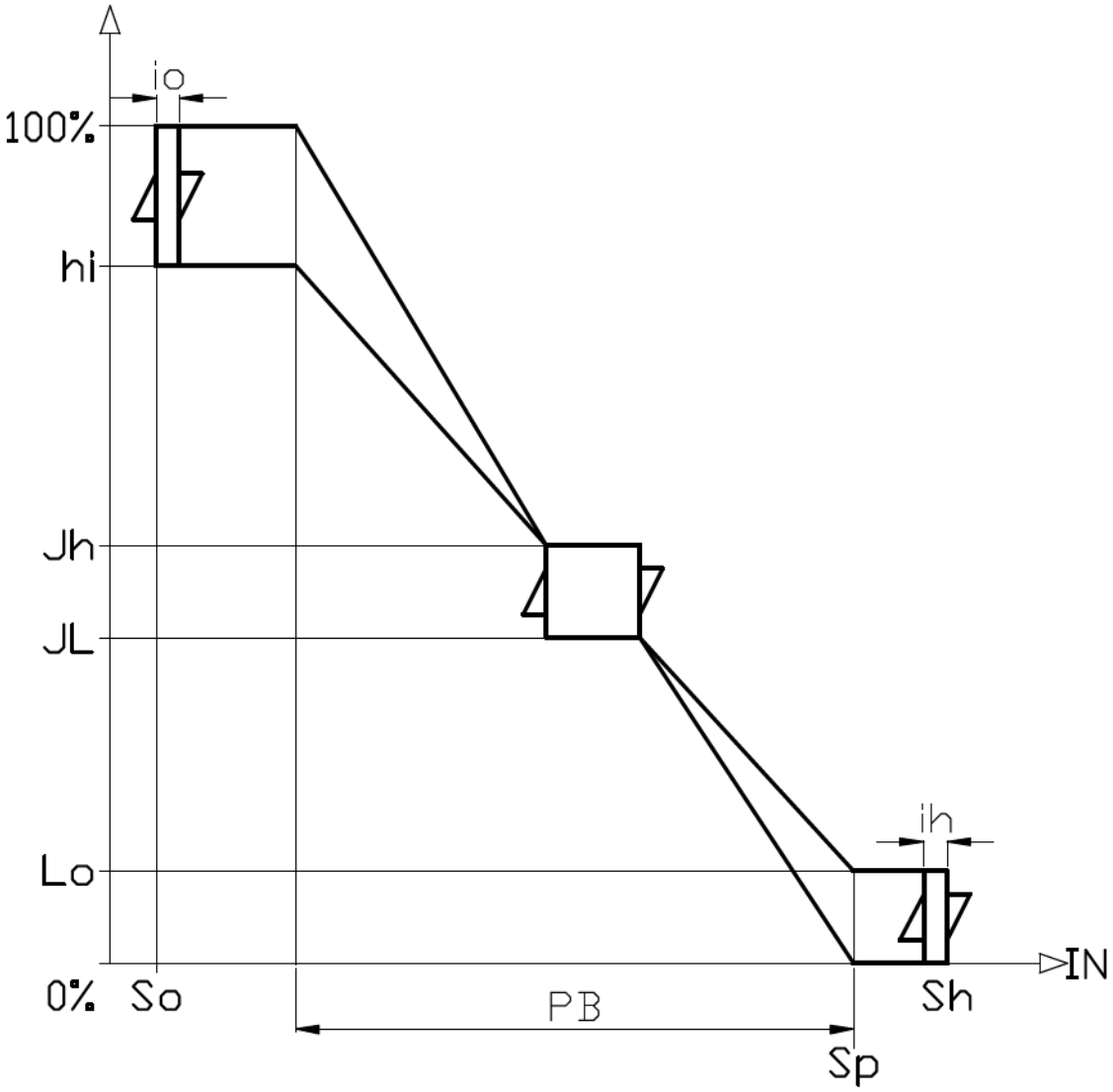
4.3.2 Inverse regulation with Set-Point at maximum



4.3.3 Direct regulation with Set-Point at minimum



4.3.4 Inverse regulation with Set-Point at minimum



4.4 Operation in Slave mode

4.4.1 Regulation principle

The output voltage varies in proportion to the input control signal, in direct or reverse mode depending on the configuration **of DSw2**.

The two reference graphs (para 4.5.1 and para 4.5.2) show the trend of the output voltage, in response to the control signal (**IN**) in direct and reverse mode. The output voltage is expressed as a percentage of the input voltage

The regulation limits (factory setting: **0%** and **100%**) can be set by means of:

- **hi**: parameter determining the maximum % of the output voltage;
- **Lo**: parameter determining the minimum % of the output voltage.

For both parameters it is also possible to determine a forcing value:

- **So**: parameter determining the input value for which the output is forced to 0%.

And the respective hysteresis:

- **io**: parameter determining hysteresis on the **So** value.

The forcing action depends on the preselected operating mode:

- in direct mode the output goes to 0% if **in < So**;
- in reverse mode the output goes to 0% if **in > So**.

If a high noise area is encountered (extra dB), it is possible to set a skip area in which there is no regulation:

- **Jh**: upper limit of the skip area, expressed in % of the supply voltage;
- **JL**: lower limits of the skip area, expressed in % of the supply voltage.

4.4.2 Parameters set from keyboard

Among the following parameters it is possible to view the current value and set the desired value .

Para.	Description	Set limits	Unit of measure
hi	Maximum output voltage limit	Para. 4.6.3	% (of supply voltage)
Lo	Minimum output voltage limit output	Para. 4.6.4	% (of supply voltage)
dE	Acceleration/deceleration time (*Soft-Start*)	Para. 4.6.5	sec
Jh	Upper limit of the skip area	Para. 4.6.6	% (of supply voltage)
JL	Lower limits of the skip area	Para. 4.6.6	% (of supply voltage)
So	*Cut-Off* : input signal value that forces the output to 0	Para. 4.6.9	mA / Vdc / °C / bar
io	Hysteresis at So value	Para. 4.6.10	mA / Vdc / °C / bar

4.4.3 Read-only parameters

Of the following parameters, it is possible to view the current value but not set the desired value.

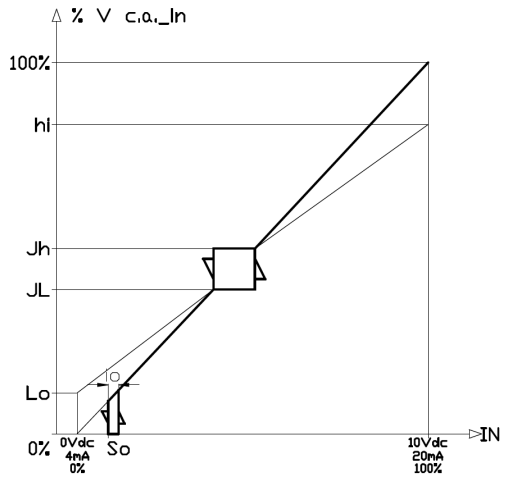
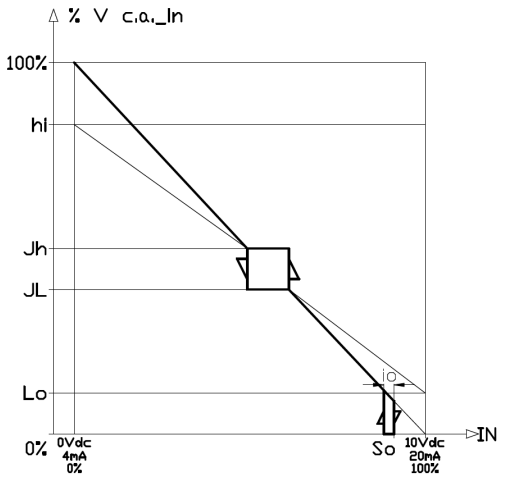
Para.	Description	Unit of measure
ti	Instant temperature of the board	°C
Co	Output voltage value	% (of supply voltage)
in	Prevalent input signal value (I1 or I2)	mA / Vdc / °C / bar

4.5 Functional diagrams in Slave mode

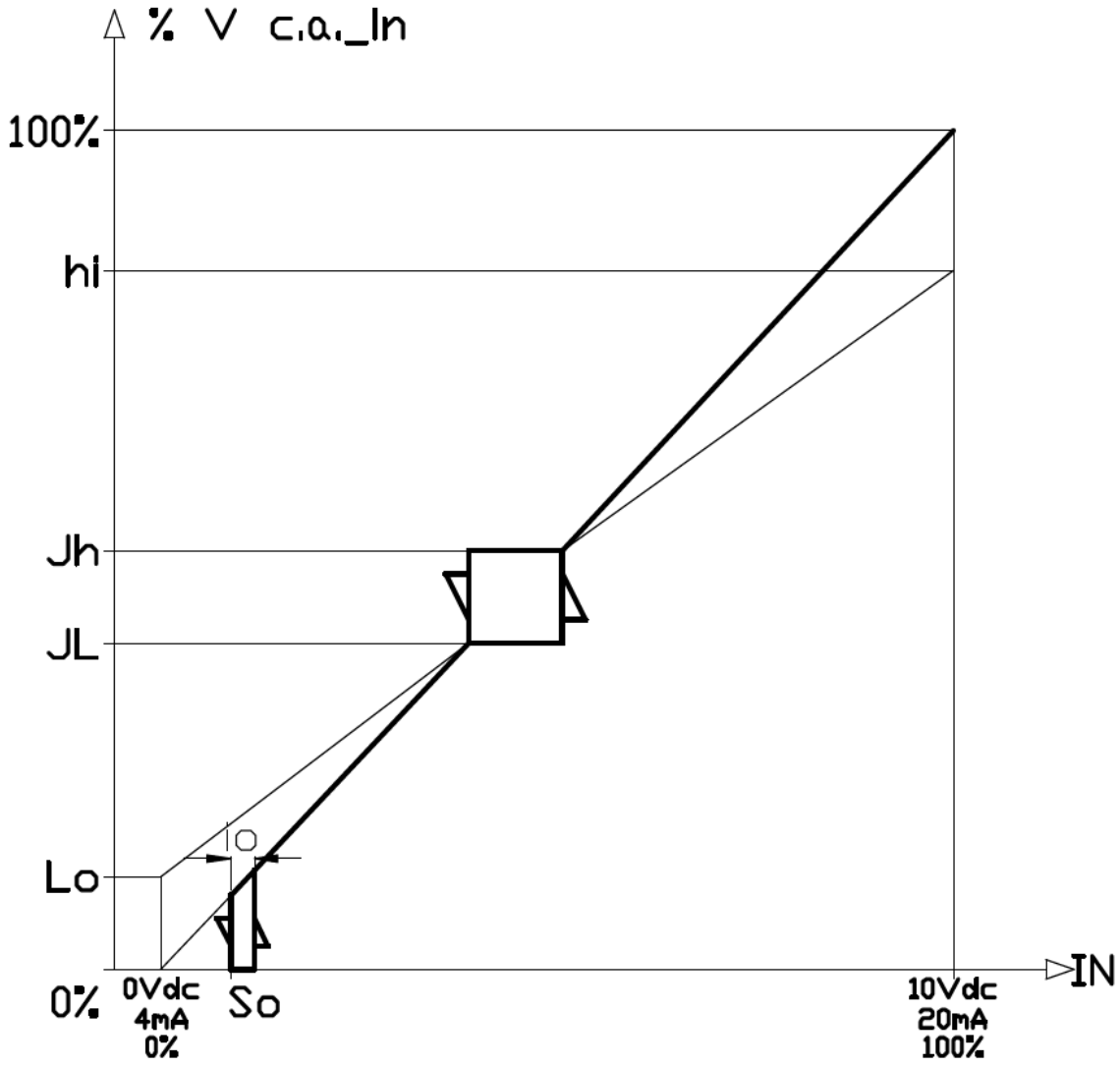
In Slave mode the regulation depends on the settings of Dsw2:

Dsw2	Function	Ref.
Off	Direct regulation	4.5.1
On	Inverse regulation	4.5.2

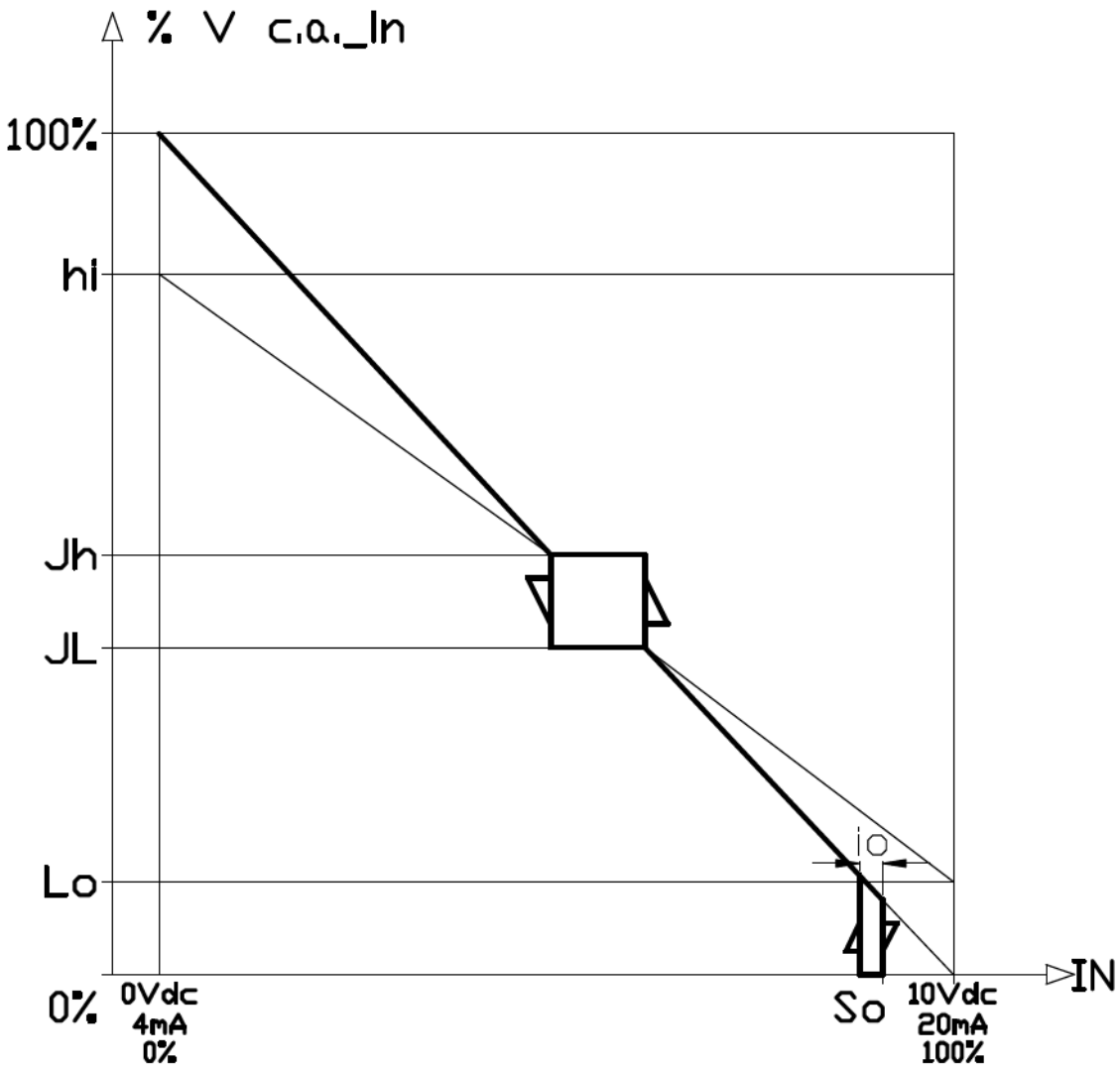
The two diagrams are compared in the following table.

Direct regulation	Inverse regulation
	

4.5.1 Direct regulation



4.5.2 Inverse regulation



In SLAVE configuration, in order to use the device in *Reverse* mode, set "**So**" at 95% of the chosen scale (9.5 Vdc / 19 mA). This way, the Cut-Off value is set properly for turning off the fans. The procedure of changing the parameters is described in Para. 5.6

4.6 Parameter setting range and predefined values

The following tables show the Setting Range allowed and the predefined default value of each parameter that can be set for each setting.

The configuration codes in Master mode are displayed on a gray background, while the configuration codes in Slave mode are displayed on a blue background.

4.6.1 Set-Point (SP)

Configuration		rtE-01	rPr420	rPr015	rPr025	rPr030	rPr045	rUu010	rUu-05	rPu030
Value	Min.	-10.0	4.0	0	0	0	0	0	0	0
	Max.	+90.0	20.1	15.0	25.0	30.0	45.0	10.0	5.0	30.0
UM		°C	mA	bar	Bar	bar	bar	Vdc	Vdc	bar
Default		45.0	14.0	10.6	17.0	17.0	25.0	6.0	2.9	18.9
Transducer or signal model		STE –10 /+90°C	4-20 mA	SPR 0-15 bar	SPR 0-25 bar	SPR 0-30 bar	SPR 0-45 bar	0-10 Vdc	0-5 Vdc	0-5 Vdc

4.6.2 Proportional regulation band width (Pb)

Configuration		rtE-01	rPr420	rPr015	rPr025	rPr030	rPr045	rUu010	rUu-05	rPu030
Value	Min.	2.0	0.2	0.5	1.0	1.0	1.0	0.2	0.1	1.0
	Max.	55.0	16.0	15.0	25.0	30.0	45.0	10.0	5.0	30.0
UM		°C	mA	bar	Bar	bar	bar	Vdc	Vdc	bar
Default		7.5	2.6	2.4	3.5	3.5	5.2	1.6	0.8	3.5
Transducer or signal model		STE –10 /+90°C	4-20 mA	SPR 0-15 bar	SPR 0-25 bar	SPR 0-30 bar	SPR 0-45 bar	0-10 Vdc	0-5 Vdc	0-5 Vdc

4.6.3 Maximum output voltage limit (hi)

Configuration		rtE-01	rPr420	rPr015	rPr025	rPr030	rPr045	rUu010	rUu-05	rPu030	rS-420	rS-010	rS-PWM
Value	Min.	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Max.	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
UM		% OUT	% OUT	% OUT	% OUT	% OUT	% OUT	% OUT	% OUT	% OUT	% OUT	% OUT	% OUT
Default		100	100	100	100	100	100	100	100	100	100	100	100
Transducer or signal model		All sensors											

4.6.4 Minimum output voltage limit (Lo)

Configuration		rtE-01	rPr420	rPr015	rPr025	rPr030	rPr045	rUu010	rUu-05	rPu030	rS-420	rS-010	rS-PWM
Value	Min.	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Max.	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
UM		% OUT	% OUT	% OUT	% OUT	% OUT	% OUT	% OUT	% OUT	% OUT	% OUT	% OUT	% OUT
Default		0	0	0	0	0	0	0	0	0	0	0	0
Transducer or signal model		All sensors											

4.6.5 Soft-Start (dE)

Configuration		rtE-01	rPr420	rPr015	rPr025	rPr030	rPr045	rUu010	rUu-05	rPu030	rS-420	rS-010	rS-PWM
Value	Min.	0.1”	0.1”	0.1”	0.1”	0.1”	0.1”	0.1”	0.1”	0.1”	0.1”	0.1”	0,1”
	Max.	60”	60”	60”	60”	60”	60”	60”	60”	60”	60”	60”	60”
UM		sec	sec	sec	sec	sec	sec	sec	sec	sec	sec	sec	sec
Default		2,0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Transducer or signal model		All sensors											

4.6.6 Upper limit (Jh) and lower limit (JL) of the skip area

Configuration		rtE-01	rPr420	rPr015	rPr025	rPr030	rPr045	rUu010	rUu-05	rPu030	rS-420	rS-010	rS-PWM
Value	Min.	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Max.	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
UM		% OUT	% OUT	% OUT	% OUT	% OUT	% OUT	% OUT	% OUT	% OUT	% OUT	% OUT	% OUT
Default		100	100	100	100	100	100	100	100	100	100	100	100
Transducer or signal model		All sensors											

4.6.7 Input value that forces output to the maximum (Sh)

Configuration		rtE-01	rPr420	rPr015	rPr025	rPr030	rPr045	rUu010	rUu-05	rPu030
Value	Min.	-20.0	4.0	0	0	0	0	0	0	0
	Max.	+90.0	20.0	15.0	25.0	30.0	45.0	10.1	5.0	30,0
UM		°C	mA	bar	bar	bar	bar	Vdc	Vdc	bar
Default		90.0	20.0	15.0	25.0	30.0	45.0	10.0	5.0	30.0
Transducer or signal model		STE –10 /+90°C	4-20 mA	SPR 0-15 bar	SPR 0-25 bar	SPR 0-30 bar	SPR 0-45 bar	0-10 Vdc	0-5 Vdc	0-5 Vdc

4.6.8 Hysteresis at Sh (ih) value

Configuration		rtE-01	rPr420	rPr015	rPr025	rPr030	rPr045	rUu010	rUu-05	rPu030
Value	Min.	1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0,1
	Max.	30	5.0	5.0	8.0	8.0	15.0	5.0	2.5	15,0
UM		°C	mA	bar	bar	bar	bar	Vdc	Vdc	bar
Default		1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Transducer or signal model		STE –10 /+90°C	4-20 mA	SPR 0-15 bar	SPR 0-25 bar	SPR 0-30 bar	SPR 0-45 bar	0-10 Vdc	0-5 Vdc	0-5 Vdc

4.6.9 Cut-Off (So)

Configuration		rtE-01	rPr420	rPr015	rPr025	rPr030	rPr045	rUu010	rUu-05	rPu030	rS-420	rS-010	rS-PWM
Value	Min.	-20.0	4	0	0	0	0	0	0	0	4.0	0	0
	Max.	+90.0	20	15	25	30	45	10.0	5.0	30.0	20.0	10.0	100
UM		°C	mA	bar	bar	bar	bar	Vdc	Vdc	bar	mA	Vdc	%
Default		-20.0	4	0	0	0	0	0	0	0	4.0	0	0
Transducer or signal model		STE –10 /+90°C	4-20 mA	SPR 0-15 bar	SPR 0-25 bar	SPR 0-30 bar	SPR 0-45 bar	0-10 Vdc	0-5 Vdc	0-5 Vdc	-	-	-

4.6.10 Hysteresis at So (io) value

Configuration		rtE-01	rPr420	rPr015	rPr025	rPr030	rPr045	rUu010	rUu-05	rPu030	rS-420	rS-010	rS-PWM
Value	Min.	1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Max.	30	5.0	5.0	8.0	8.0	15.0	5.0	2.5	15.0	5.0	5.0	50
UM		°C	mA	bar	bar	bar	bar	Vdc	Vdc	bar	mA	Vdc	%
Default		1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Transducer or signal model		STE –10 /+90°C	4-20 mA	SPR 0-15 bar	SPR 0-25 bar	SPR 0-30 bar	SPR 0-45 bar	0-10 Vdc	0-5 Vdc	0-5 Vdc	-	-	-

4.6.11 Heat Pump (HP)

Configuration		rtE-01	rPr420	rPr015	rPr025	rPr030	rPr045	rUu010	rUu-05	rPu030
Value	Min.	0	0	0	0	0	0	0	0	0
	Max.	100	100	100	100	100	100	100	100	100
UM		%	%	%	%	%	%	%	%	%
Default		0	0	0	0	0	0	0	0	0
Transducer or signal model		-								

5. Settings

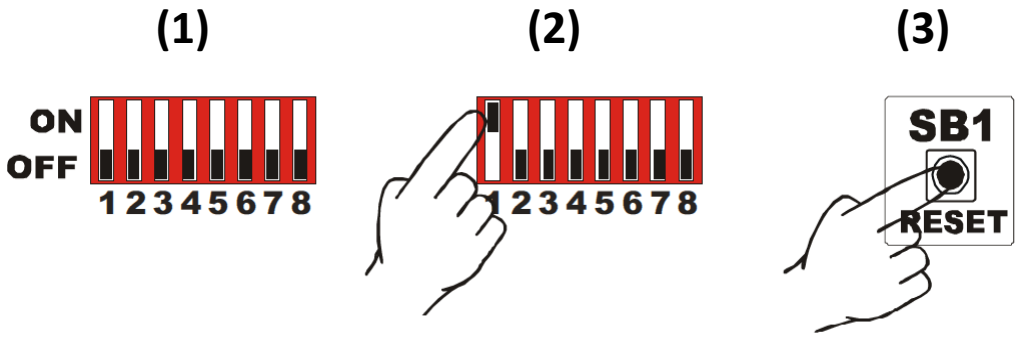
The device is designed in a way that the user can select the settings suitable for the configuration made during installation (para. 3.8).

The 8 *Dip Switches* serve to set the device operating mode, while the display and the keyboard are used to view and modify the device working parameters.

5.1 Setting the Dip-Switches

The *Dip Switches* (from DSw1 to DSw8) allow you to define and modify at any time the RDM300 device modes and regulation functions.

To make the changes made to the *Dip Switches* (DSw) operative, press the RESET pushbutton.



To properly set *Dip Switches*, refer to paragraph 1.3.4; the effects of regulating Dsw1 and Dsw2 are shown in the graphs in paragraphs 4.3 and 4.5.

5.2 Turning on

Before powering the device, make sure the earth connection has been properly made according to the technical standards and regulations in force. Moreover, make sure all the signal and power connections are correct.

Avoid continuous turning on and off the power supply to the device; a constant power supply maintains the device at working temperature and eliminates the problem of forming condensation inside the protection box. For frequent turning ON and OFF, use the Start/Stop contact on the M3 terminal block (para. 1.3.3).

When turning on the device or after pressing the RESET pushbutton, the display shows a rapid sequence of the following messages:

Hardware data	PB1041-42 | vr. 4.1	Software version initials
	www.selproweb.it	Name of manufacturer

After that, and after each RESET as well, the LCD display automatically shows the input signal value (parameter "**in**"):

Current configuration	rtE-01 | STANDBY	Operating state: ready
Parameter: input signal	in | 42,0 °C	Value and Unit of measure

In conditions of normal operation, the display is divided into three areas:

(a): Configuration	(b): Status message
(c): Parameter : Initials	Value - Unit of measure

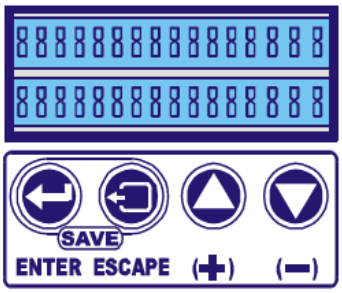
(a) For setting the configuration codes (para. 3.8) refer to paragraph 5.5.

(b) The state messages are as follows:

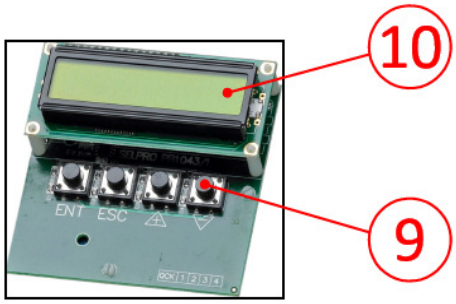
- **STAND-BY** : ready to operate, no power supply
- **PWR-OUT** : power supply in progress
- **HP OUT** : supply to load in *Heat Pump* mode
- **ALARM** : presence of one or more alarms
- **SET CosPhi** : manual regulation of CosPhi parameter enabled a

(c) For the setting of parameters (para. 4.2.2 and 4.4.2), refer to paragraphs 5.5 and 5.6.

5.3 Contrast regulation



9	Display
10	Keyboard



To change the LCD contrast , press the pushbutton and the keys simultaneously to increase, or press the pushbutton to decrease

On line 2 it is changed as follows:

Current configuration	rtE-01	PWR OUT	Operating status
LCD brightness	LCD	xxx dimm	Value and Unit of measure

The display brightness value varies from 0 to 100, and can be set at increments of 5.

5.4 Displaying parameters on the LCD

After finishing the preliminary phase, and turning on the device, the display shows the following items:

Current configuration	rtE-01	STANDBY	Operating status
Parameter	in	23,0 °C	Value and Unit of measure

By pressing the key and the key you can scroll the entire list of setting parameters in a loop.

For example, by pressing the key, the following information appears:

Current configuration	rtE-01	STANDBY	Operating status
Parameter	SP	45,0 °C	Value and Unit of measure

From here, when you press the ▲ key again, the following information appears:

Current configuration	rtE-01	STANDBY	Operating status
Parameter	PB	7.5 °C	Value and Unit of measure

From here, by pressing the ▼ key three times, to the following information appears:

Current configuration	rtE-01	STANDBY	Operating status
Parameter	C◊	00 % out	Value and Unit of measure

By pressing the RESET key, you are returned immediately to the conclusion of the preliminary phase.

Starting with the value of the "**in**" parameter, to which you can always return by pressing the RESET key, you can scroll all the values of the other parameters by using the ▲/▼ keys**.**

5.5 Selection of the configuration code

The device has 12 predefined configurations, already programmed by the manufacturer.
By setting one of these configuration codes, each previous change made to the regulation parameters is deleted automatically, and the predefined values of the set configuration code are set (para. 4.6).

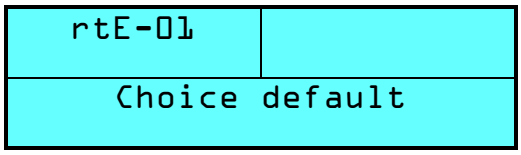
In the first installation phase the configuration code **rtE-01** is displayed (factory default setting).

To select a configuration different from the default, follow this procedure:

- Keep the ↵ and ▼ keys pressed down simultaneously
- connect the power supply to the device, or if already powered, press the RESET key.
- Wait until the display lights up.

- Simultaneously release the ↵ and ▼ keys; the device turns on and, after the initial message, the following information appears on the display:

Selected configuration

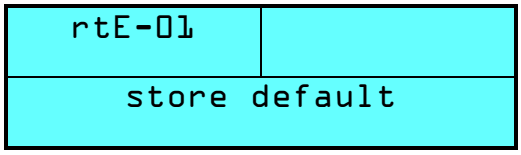


Select default code

- When you press the ▲ and ▼ keys , the 12 available configuration scroll in the first field.
- When the desired configuration years in the first field, press the ↵ pushbutton; the display shows the following information:

Selected configuration

(flashing words)

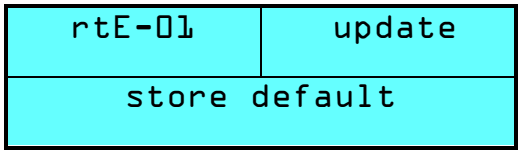


Store default code

- To exit, in order to avoid making the changes operative, and to return to the previous phase, press the ⏎ key.
- To confirm the selection, press the ↵ and ⏎ keys simultaneously. The display shows the following information:

Selected configuration

(flashing words



Update and progress

Store default code

The selected configuration is saved and becomes operative immediately.

This procedure can be carried out even in cases of anomaly in the displaying of parameters; this way, all the default values of the selected configuration code are reset.

5.6 Changing the work parameters

To change the work parameters, follow the steps below.

With the device in operation, the current work page appears on the display; for example, suppose the "**in**" parameter appears.

Configuration being used	rtE-01	PWR OUT	Operating status
Parameter	in	42,0 °C	Value and Unit of measure

To accelerate the scrolling of the parameter value to be set, simultaneously press also .

- Press for an instant and while releasing the and " " keys: the following information appears on the display :

Configuration being used	rtE-01	Program	Operating status
Parameter	SP	45,0 °C	Value and Unit of measure

- When you press the key or the , on the second line of the display that changeable parameters scroll in succession.
- After determining the parameter that you want to change, for example the Proportional band "**PB**", press the key; the following information appears on the display:

Configuration being used	rtE-01	Modify	Operating status
Proportional band	Pb	7.5 °C	Value and Unit of measure

- By pressing the ▲ and ▼ keys you can change the value of the parameter appearing on the second line, bringing it to 9.5 °C, for example.

Configuration being used	rtE-01	Modify	Operating status
Proportional band	Pb	9.5 °C	Value and Unit of measure

- When you press the ESC key, you cancel the new set value by leaving the original "**PB**" value unchanged.
- When you press the ↵ key, you confirm the new set value and proceed to select the next ones.
- To **exit** and a void making the changes operative, press the ESC key;
- To **confirm** the changes made, simultaneously press the ↵ + ESC keys.

The changed parameters are saved, and the display shows the following information:

Configuration being used	rtE-01	Update	Operating status
Proportional band	Pb	9.5 °C	Value and Unit of measure

Then it shows

Configuration being used	rtE-01	PWR OUT	Operating status
Parameter	in	42.0 °C	Value and Unit of measure

After changing the parameters, the device returns to operating mode, and on the display the value the "**in**" parameter of the active input is displayed.

5.7 Setting of JH and JL parameters

During the electronic regulation of the fans, the magnetic resonance (extra dB) generated by the controlled motor are highlighted. By means of the device you can circumscribe a noise area by following this procedure:

- With the device in normal operating mode, the display shows the current work page, for example the "**in**" parameter.

Configuration being used	rtE-01	PWR OUT	Operating status
Parameter	in	42,0 °C	Value and Unit of measure

- When you press it for an instant while simultaneously releasing the and keys; the following information appears on the display:

Configuration being used	rtE-01	Program	Operating status
Parameter	SP	45,0 °C	Value and Unit of measure

- When you press the or keys, on the second line of the display the changeable parameters scroll in succession.
- Press the pushbutton until a last second line on the display shows "**Jh**"; when you press the following information appears on the display:

Configuration being used	rtE-01	Modify	Operating status
Parameter	Jh	100 %	Value and Unit of measure

The output voltage of the device is brought to the current value of "**Jh**" (100% of the input voltage); this allows the user to scroll the entire scale of the output voltage regulation, and to identify and circumscribe the area of most severe noise emitted by the fans.

- By pressing the ▲ and ▼ keys, you can change the parameter value shown on the second line, by bringing it to 74%, for example.

Configuration being used	rtE-01	Modify	Operating status
Parameter	Jh	74 %	Value and Unit of measure

The variations made to do the "**Jh**" value are immediately reflected on the output voltage device.

- When you press ESC, you delete the newly set value by leaving the original "**Jh**" value unchanged
- When you press the ↵ key, you confirm the newly set value, then continue.

The device returns to normal operating mode and the output voltage returns to the initial value.

- Press the ▲ key once: on the second line of the display the item "**JL**" appears;
- When you press the ↵ key, the following information appears on the display:

Configuration being used	rtE-01	Modify	Operating status
Parameter	JL	100 %	Value and Unit of measure

The output voltage of the device is brought to the current value of "**JL**" (100% of the output voltage).

- By pressing the ▲ and ▼ keys you change the value of the parameter shown on the second line, by bringing it for example to 70%.

Configuration being used	rtE-01	Program	Operating status
Parameter	JL	70 %	Value and Unit of measure

- When you press the key, you cancel the newly set value, leaving the original value of "**JL**" unchanged.
- When you press the key, you confirm the newly set value, then continue.

The device returns to normal operation, and the output voltage returns to the initial value.

- To **exit** without making the changes operative, press the key;
- To **confirm** the changes you have made, simultaneously press the keys **+** .

The parameters changed are saved, and the display shows the following information:

Configuration being used	rtE-01	Update	Operating status
Parameter	JL	70 %	Value and Unit of measure

And then it shows:

Configuration being used	rtE-01	PWR OUT	Operating status
Parameter	in	42,0 °C	Value and Unit of measure

After the parameters are changed, the device returns to the operating mode, and the display shows again the value of the parameter "**in**" of the active input.

6. Alarms

6.1 Activation of the alarm relay

By configuring the alarm relay RL1 by setting DSw5 and DSw6, you can signal externally the regulator operating state, according to the user's needs (para. 1.3.4).

To properly set the *Dip Switches*, consult the following tables.

6.1.1 Activation according to the operating mode

The following table shows the activation of the alarm relay RL1 as a function of the operating mode of the device.

				
STOP				
STAND-BY				
ALARM				
PWR-OUT				
HP OUT				
SET CosPhi				

6.1.2 Activation in cases of failure

				
Power supply off				
Power supply insufficient				
Device failure				
Phase lacking				
Remote stop active and operation HP=0%				
Supply at 0%				

6.2 Alarm signal by means of LED

The alarm state is indicated by the DL3 warning light. The number of flashings indicates which alarm was detected.

DL3  **FAIL – KO**	**1** flashing	Board temperature> 85°C
	2 flashings	One phase is lacking
	3 flashings	Opening of motor thermal protection
	4 flashings	Signal at the “**in**” input out of scale

If several alarms are present, the one with the highest priority is indicated (corresponding to a lower number of flashings). In normal conditions -- absence of alarms -- the LED remains unlit.

6.3 Alarm signal by means of display

The alarm state is indicated on the first line of the display by a message combined with the word "**ALARM**" (except in the phases of setting the configuration code and the work parameters).

The alarms are displayed in the order of decreasing priority: the presence of an alarm with a higher priority prevents the appearance on the display of those with lower priority.

The possible alarm messages in order of decreasing priority, are the following

T board	ALARM
xxx	yy,y zz

Board temperature> 85°C

PH loss	ALARM
xxx	yy,y zz

A phase is lacking

Thermal	ALARM
xxx	yy,y zz

Opening of motor thermal protection

IN under	ALARM
xxx	yy,y zz

Input signal lower than minimum admissible value

IN over	ALARM
xxx	yy,y zz

Input signal higher than maximum admissible value

Automatic reset: the alarm is not memorized. When the cause of the alarm no longer exists, the corresponding alarm message also ceases to exist, and the device resumes normal operation.

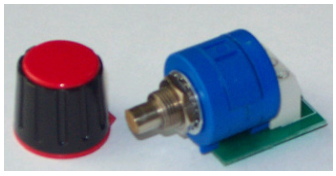
6.3.1 Alarm thresholds on inputs

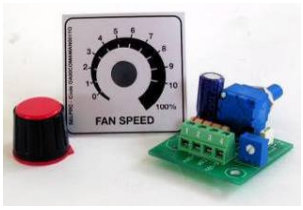
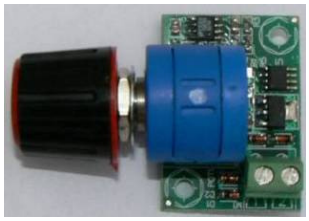
The alarm thresholds on the inputs depend on the configuration code adopted.

Configuration	Minimum alarm threshold		Maximum alarm threshold	
rS-420	-	mA	24	mA
rS-010	-	Vdc	11	Vdc
rtE-01	-24	°C	+94	°C
rPr420	2.0	mA	24	mA
rPr015(*)	2.0	mA	24	mA
rPr025(*)	2.0	mA	24	mA
rPr030(*)	2.0	mA	24	mA
rPr045(*)	2.0	mA	24	mA
rUu-05	-	Vdc	5.5	Vdc
rPu030(*)	-	Vdc	5.5	Vdc
rUu010	-	Vdc	11	Vdc

7. Accessories

7.1 Potentiometers for remote manual control

 **ZC RGF PB1034 00000**	Potentiometers for external remote control • Regulation control 0-10 Vdc • Available versions of 1 or 10 revolutions with knob ∅ 22 and adhesive serigraphed label • 10 revolutions version with knob ∅ 30 and 100 regulation points • Panel mount, with shaft 15 mm long . (∅ 6.3) • Complete with adhesive serigraphed label 50 x 50 mm.
 **ZC RGF PB1050 10000** With knob (∅ 22)	Linear potentiometer for remote regulation control: • 0-10 Vdc • 10 revolutions – 10kohm – 3 W – wire Complete with adhesive serigraphed label 50 x 50 mm.
 **ZC RGF PB1050 20000** With knob (∅30) having 100 points	

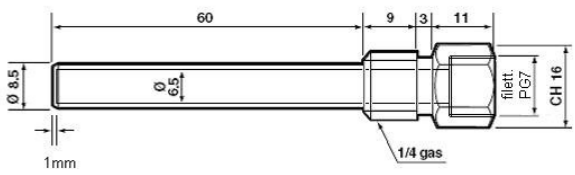
 **ZC RGF PB1034 00000**	Linear potentiometer for remote regulation control: • 0-10 Vdc • 1 revolution– 10kohm – 1 W – in Cermet Complete with adhesive serigraphed label 50 x 50 mm and knob (∅ 22).
 **ZC RGF PB1035 10000** With knob (∅ 22)  **ZC RGF PB1035 20000** With knob (∅30) with 100 points	Voltage converter for manual control: • Input 24Vdc • Output 0-10Vdc With maximum voltage settable limit, for regulating the following positions: • fan motors • shutter reduction gears • motorized valve reduction gears Complete with adhesive serigraphed label 50 x 50 mm.
 **ZC RGF PB1040 10000** with knob (∅ 22) **ZC RGF PB1040 20000** With knob (∅30) having100 points	Voltage converter for manual control: • Input 24Vdc • Output 4-20mA for regulating the following positions: • fan motors • shutter reduction gears • motorized valve reduction gears, Complete with adhesive serigraphed label 50 x 50 mm

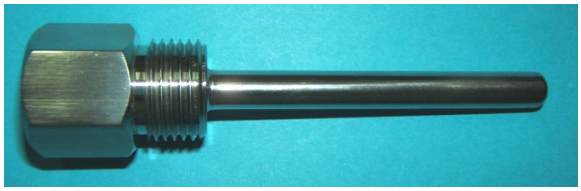
7.2 4-20 mA / 0-5 V pressure transducers

Signal given by sensor	**4 … 20 mA**	
Power supply	**7 … 30 Vdc**	**0.5 … 4.5 Vdc**
Working scales (bar)	**0 … 15/25/30/45**	**5 Vdc +/- 0,25Vdc**
Linearity	**< 0.5 % FS max**	**0 … 30/45**
Temperature	**-25° … 80°C**	
Electrical connection	**2 wires**	
Mechanical connection	**7/ 16" - 20 UNF**	**3 wires**
Protection	**IP 65**	

7.3 NTC temperature sensors

	Sensor	**NTC sensor(resin coated terminal)**
	Connection	**Silicone cable 3.0 m long**
	Terminal	**STAINLESS AISI 304 6 x 40 mm**
	Working field (°C)	**–50 T 110**
Sump: nickel plated brass	Sump	**Support for NTC sensor**
	Thread	**1 / 4” GAS**
	Terminal	**STAINLESS AISI 304 8.5 x 75 mm**





7.4 Universal expansion module of control inputs MEI-4

Electronic unit for the connection of 4 additional control and regulation inputs, for all the regulation applications, with:

- Control inputs: 4-20mA, NTC (10k), 0-5Vdc, 0-10Vdc, 0-20mA
- Regulation outputs: 0-10 Vdc / 0-20 mA

Selectable Master-Slave function:

- Temperature (with NTC sensor), pressure, remote control, etc.
- Automatic selection of the greater or lesser in value
- Output of interactive connection with other RGF-MEI units (maximum 3)
- Indicator lights to visualize the active inputs
- Protection of power supply line by fuse
- Protection against overvoltage on the power supply
- Total protection against short-circuits on the 4 inputs

The unit has protection filters against disturbance of the inputs signals.

7.5 NTF noise filter for phase-cutting regulators (for extra-dB)

Application of the NTF filter between the device and the fan motor reduces the noise due to the electronic regulation.
The NTF filter can be used only for regulating the SCR V~ voltage (phase-cutting).
It is made by an inductance and a condenser (1 per phase) to compensate the reactive current on the motor and it is directly connected to the device output.

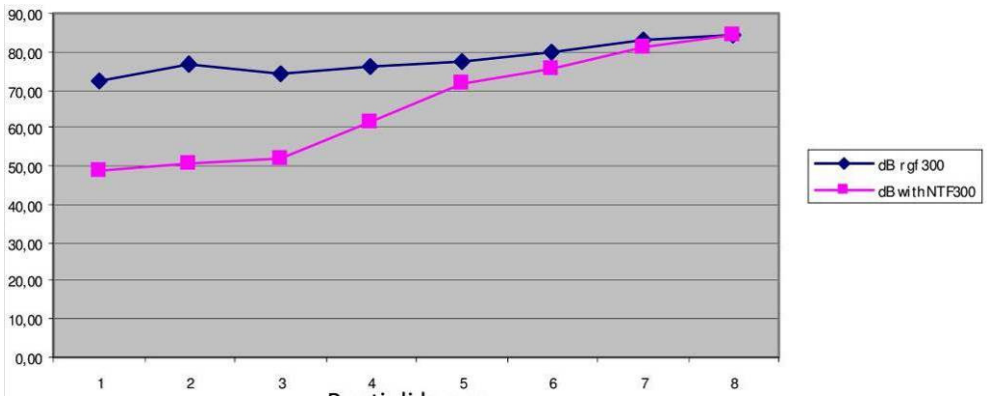
- The filter cannot function or be powered without the fan turned on. Protection degree: IP 55 Box
- Input : 3 ~ 230/420/500V~ +/-10% (standard)

The size of the condensers combined with the filter depends on the power of the connected fans (maximum 2 per filter).

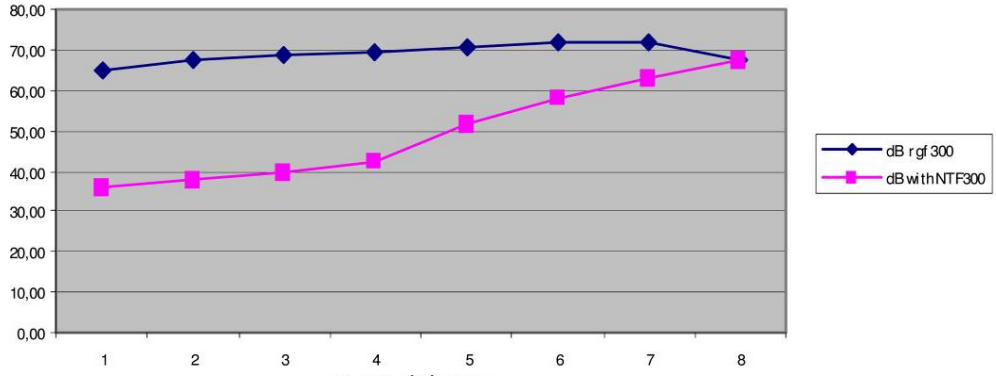
The following graphs show the noise levels of the device as a function of the output voltage (to the fan motor):

- without filter (blue line);
- with filter (magenta line).

FE080-SDA.6N.2NV 6/6P



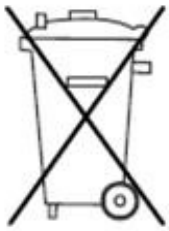
FE080-NDA.6K.2NV 12/12P



Do not use the NTF filter when the fan is not connected, in order to not damage the SCR of the RDM300 device.

8. Disposal

The device and its accessories must be collected separately from other waste products in compliance with the applicable law 2002/96/CE in on matters of disposal.



9. Selection of regulation CODES

The following table shows the rule for creating the ordering code and the admissible variants for each feature or function

ZA RDM	α	ββ	χχ	δ	ε	ϕ	γ	η	φ

α	**Three-phase Power supply**	**3**	**R-S-T + PE**
ββ	**Rated current (RMS at 50°C)**	**08**	**8** Amperes
		12	**12** Amperes
		18	**18** Amperes
		20	**20** Amperes
		28	**28** Ampere s
χχ	**Standard Power supply (other voltages upon request)**	**40**	**400Vac** (minimum limit: 380Vac /maximum limits: 440Vac @ **+/-10%**)
		23	**230Vac +/-10%**
		48	**480Vac** (minimum limit: 460Vac /maximum limit: 500Vac @ **+/-10%**)
δ	**Power supply frequency**	**0**	**50Hz / 60Hz with automatic frequency selection**
ε	**Operation**	**U**	**Universal : Master or Slave mode**
ϕ	**Type of control inputs** **Selection by manufacturer**	**P**	**Programmable : the user selects the type of regulation** **rtE -01** per NTC sensor**10kohm @ 25°C** (scale **-20/90 °C**) **rPr420** for transducer **4-20 mA** **rPr015** for pressure transducer with scale **0-15 bar (mA)** **rPr025** for pressure transducer with scale **0-25 bar (mA)** **rPr030** for pressure transducer with scale **0-30 bar (mA)** **rPr045** for pressure transducer with scale **0-45 bar (mA)** **rUu-05** for transducer **0-5 Vdc** **rPu030** for ratiometric pressure transducer with scale **0-30 bar** **rPu045** for ratiometric pressure transducer with scale **0-45 bar** **rUu010** for transducer **0-10 Vdc** **rS-010** for remote signal control **0-10 Vdc (SLAVE)** **rS-420** for remote signal control **4-20 mA (SLAVE)** **rS-PWM** for remote signal control **PWM (SLAVE)**
γ	**Container manufacture**	**S**	For outdoors, degree of protection **IP 55 / 120°C**
		G	For inside the cabinet, degree of protection **IP20**
		P	For inside the cabinet, degree of protection **IP00**
η	**Options**	**0**	Standard three-phase connection + earth
		4	Connection for four motors (models having 12A & 18/20A) three-phase + earth
		8	Connection for eight motors (models having 20A & 28A) three-phase + earth
φ	**Revision index**	**0**	Last coded revision or personalization for the customer
The currents (RMS) indicated are full load with ambient temperature at 50°C			

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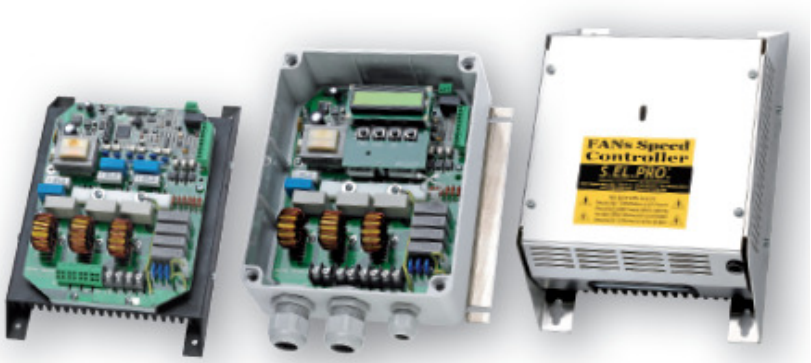

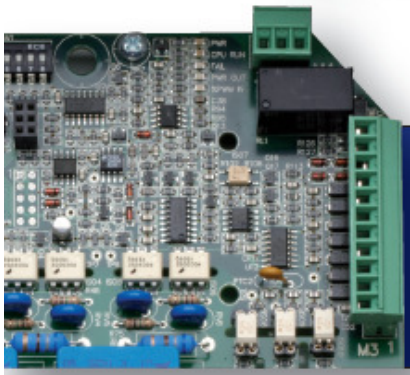

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