S.EL.PRO.®
sistemi elettronici professionali

rgf 100 300

DRV 100 300

DSV

CLEAN POWER SYSTEM

HELPI
DATA ACQUISITION SYSTEM

rgf 100-1

USER MANUAL

WARNING !

HIGH LEAKAGE CURRENT: first connect to earth !

The rgf100 is a voltage regulator for single-phase motors which operates connected to the single-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 rgf100 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 rgf 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 rgf100 is a mains voltage regulator which uses the phase-cut principle controll over the sihgle-phases. It has been designed to vary the effective voltage on single-phase asynchronous motors for fans following a control signal (either mA, VDC or Ohm). 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 internal protection panel made from lexan.
- **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 single-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.
- 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.**
- **DO NOT force the trimmers to rotate beyond their set mechanical travel.**
- **Only alter the trimmers intended for regulation.**
- **Under no circumstances alter the trimmers marked with the spot of red paint.**

WARNING !

HIGH LEAKAGE CURRENT: first connect to earth !

CONTENTS

1.0 PRESENTATION

THANK YOU for choosing an **rgf100-1** series single 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 **rgf100-1** 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 a **GEWISS GW PlastÒ 120°C** case (**fig. 1**) 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.
The **rgf100-1** control is shown in **fig.1**.

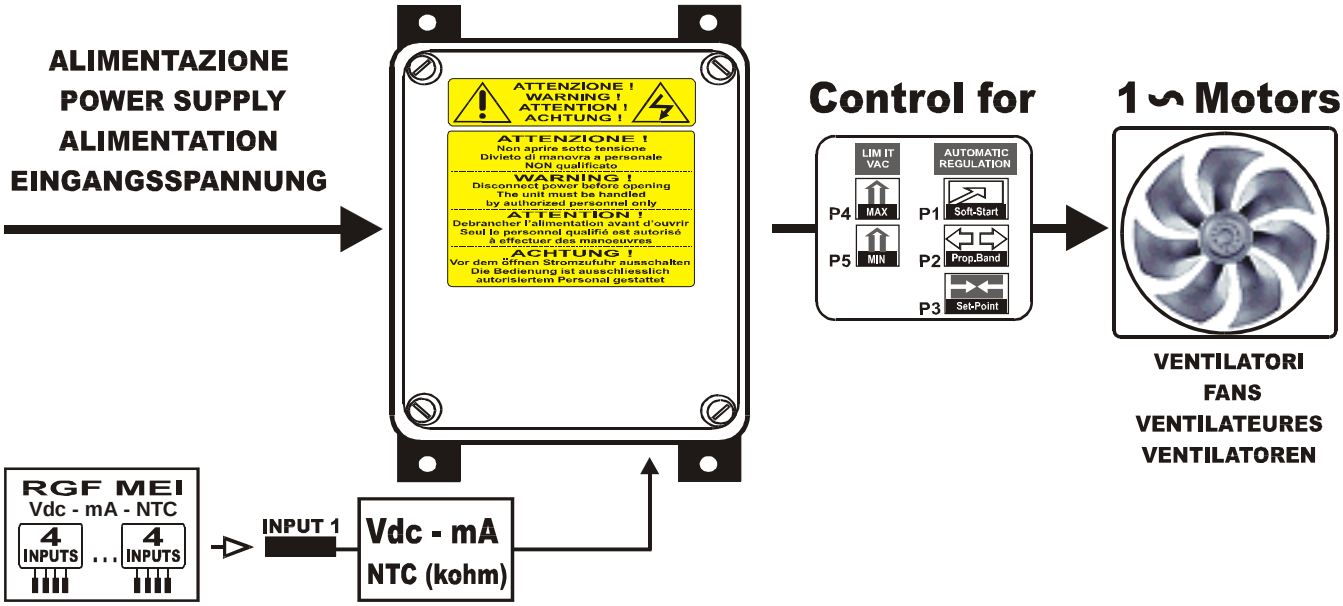


fig. 1

Before installing the **rgf100-1**, you are invited to read this manual which describes the necessary procedures for correct installation and commissioning of the machine.

Like all our products, the **rgf100-1** series bears **CE** marking as required by directive **89/336/ECC** and its subsequent modification **EEC/92/31** on electromagnetic compatibility.
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 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. The system used was formed by an **rgf100-1** 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.

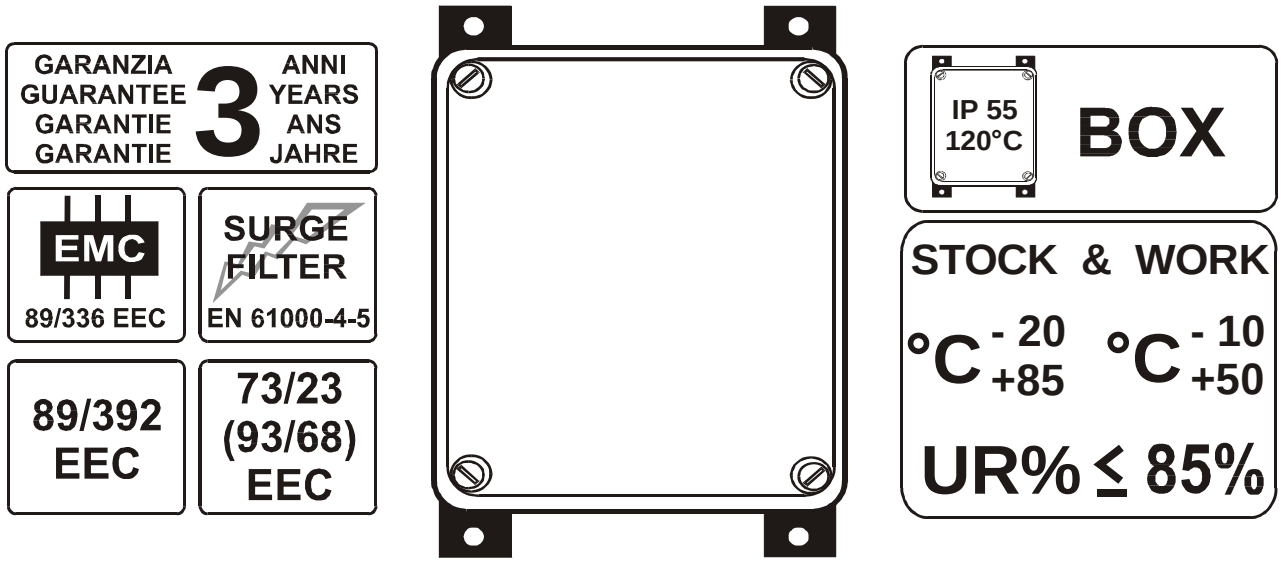


fig. 2

Fig. 3 represent the **rgf100-1** regulator with the general contents

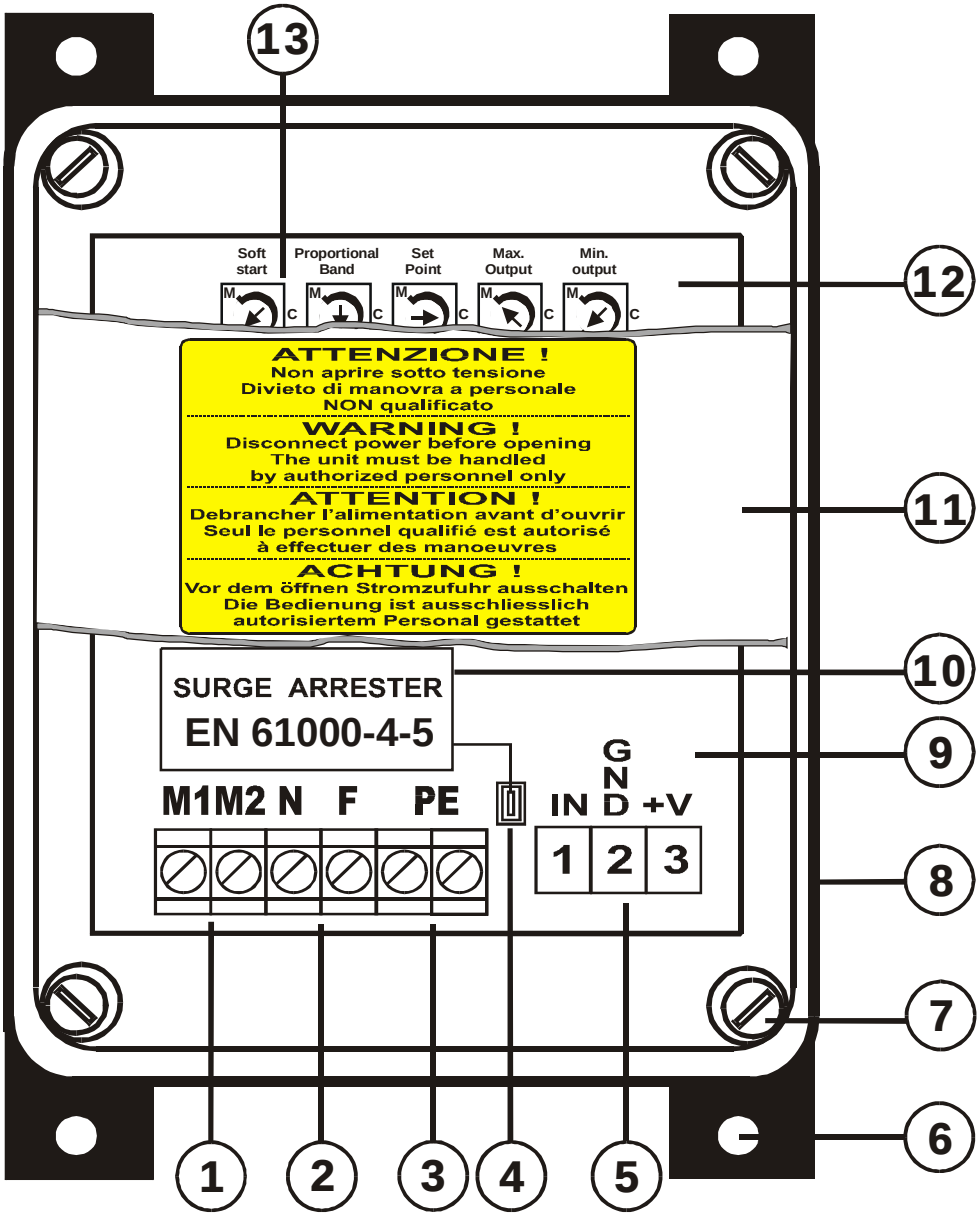


fig. 3

CONTENTS of rgf100-1 regulator

1.	Terminal block for single-phase power supply (F - N)
3.	Terminal block for PE connection
5.	Terminal block for analog input signal
7.	Cover screws
9.	Power card (lower)
11.	GEWISS GW Plast ® 120°C case
13.	Control Trimmer for work parameters regulation

2.	Terminal block for load connection (M1 – M2)
4.	SURGE ARRESTER circuit / PE faston connection
6.	Screws hole for wall installation
8.	Black anodized heat sink
10.	SURGE ARRESTER circuit like EN 61000-4-5
12.	Control card (upper)

1.1 DESCRIPTION

The **rgf100-1** series single-phase cutting regulators comprises one electronic cards on a vetronite support mounted inside the **GEWISS IP55 GW PlastÒ 120°C** case.
The cards represent the **control** section (upper) and **power** section (lower).

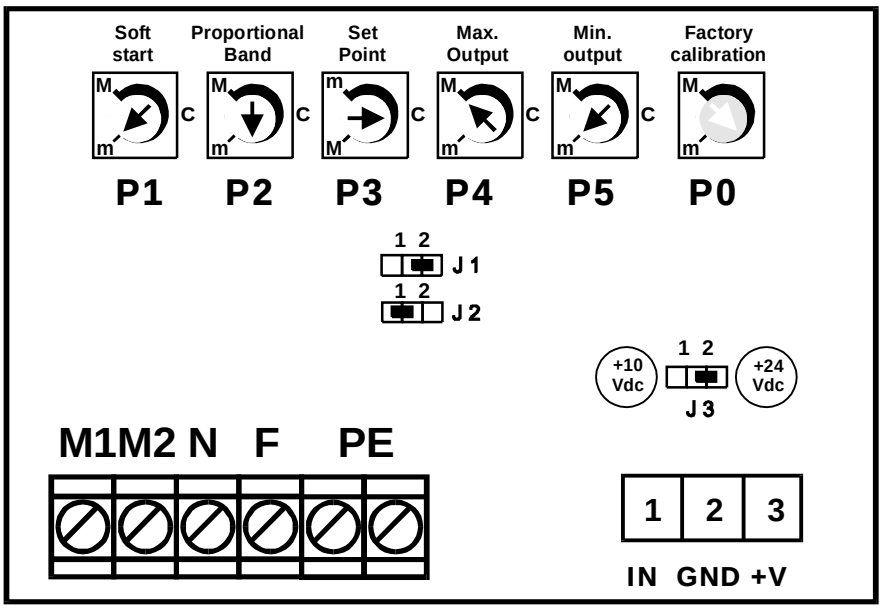


fig. 4

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

•	**trimmers**	Marked "**Pn**"; used to set working parameters
•	**jumpers**	Marked '**Jn**'; used to change preset operational modes
•	**Inputs signals terminal block**	**Terminal board (IN – GND - +V)** for connection of the control analogue input signal
•	**power supply terminal block**	'**F-N**' for **VAC** input supply '**M1-M2**' for output supply to load '**PE**' for the **Earth / PE** connection

1.2 INSTALLATION AND MECHANICAL DIMENSIONS

The **rgf100-1** 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 holes provided on the lower part of the regulator are for entry of the electric connection cables:

- three pole line (**F + N + Earth**) to power the regulator,
- three pole line (**M1 + M2 + 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.

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.

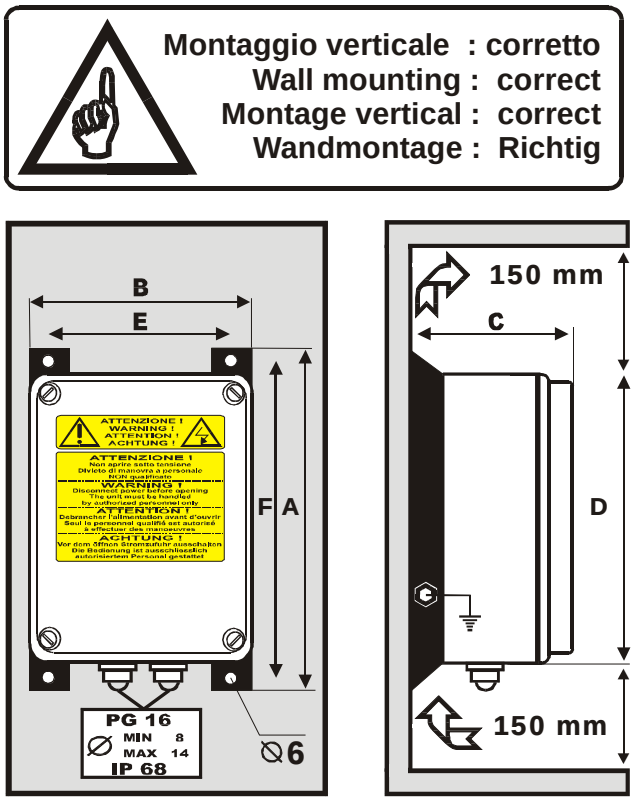


fig. 5

Mechanical Dimensions

MODELS	*A*	*B*	*C*	*D*	*E*	*F*	*Kg.*	*Æ Fixing screw holes*
rgf 110	**240**	**152**	**115**	**195**	**108**	**210**	**1,6**	**Æ 6**
rgf 116							**1,7**	

Table 1

1.3 PRINCIPLE OF OPERATION

The **rgf100-1** series appliances are voltage regulators that use the phase cutting principle.
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 single phase motors connected to **fans, pumps, agitators, mixers**;
- electrical resistor devices.

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. 6 shows a block diagram of regulator **rgf100-1**.

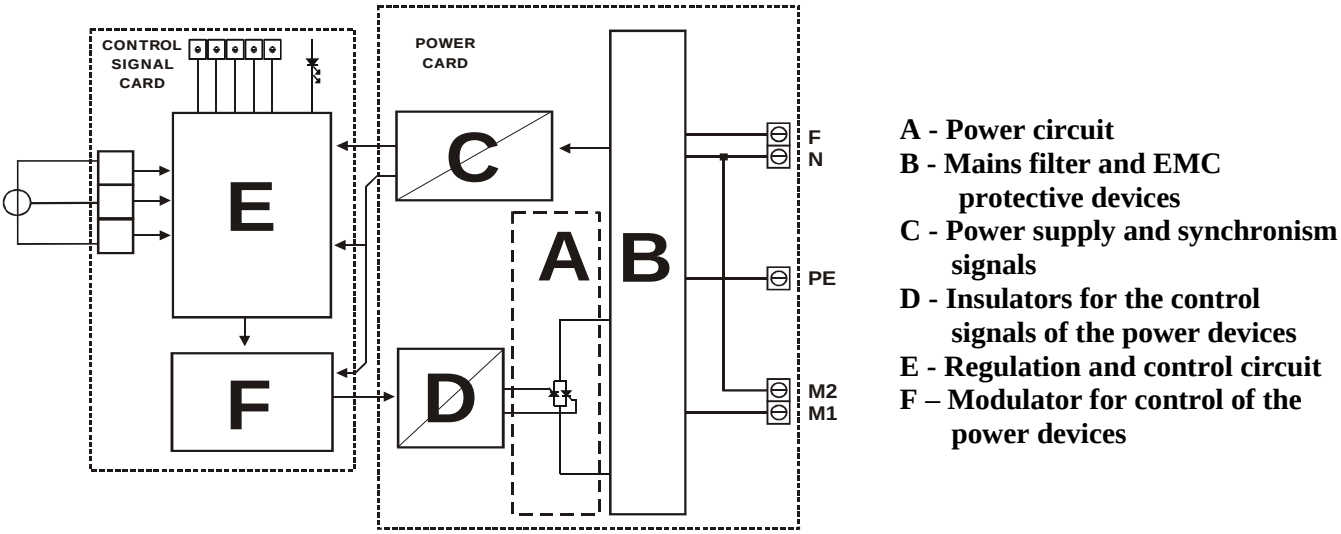


fig. 6

The speed regulators are sized to withstand a starting current equal to more than twice 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**
- **tropicalized 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 **rgf** controls allow two different types of operation depending on which type of input is available:

- **operation as REGULATOR (also called MASTER)**

the phase cutting regulators is directly connected to one or more sensors; the phase cutting is a function of the values selected for:

- **Set-point** (**SP** trimmer **P3**)
- **Proportional band** (**PB** trimmer **P2**)

- **operation as POWER UNIT (also called SLAVE)**

In this case, the **rgf** is set up to be controlled by an external Master regulator which decides the phase cutting of the voltage by sending the control signal to the slave.

The incoming control signal to the **rgf100-1** regulators can be:

For a **MASTER (mA – Vdc)**	Active sensors with control in current (**mA**) or voltage (**Vdc**)
For a **MASTER (ohm)**	**NTC** sensors with control in **°C/ohm (10kohm @ 25 °C)**
For a **SLAVE (mA – Vdc)**	Control signals in current (**mA**) or voltage (**Vdc**)

1.3.2 Applications

It is generally possible to connect one sensors / control signals to the '**MASTER'** and **'SLAVE'** models.
In the case of active sensors, this can be directly powered (**24Vdc / max. 40 mA**).
The principal applications are for measuring pressure (**bar**), temperature (**°C**), humidity (**%RH**), delivery (**cu.m/h**), superpressure (**mm.**), static pressure (**Pa**), supertemperature (**destratification**) etc. in plants and machines.

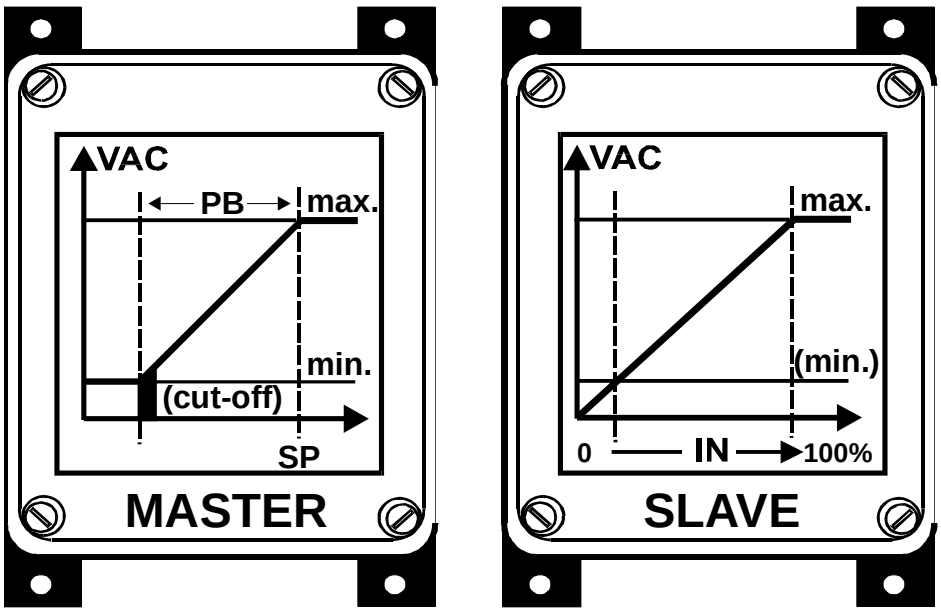


fig. 7

1.4 ELECTRIC MOTORS

Single phase asynchronous motors can be connected to the **rgf100-1** 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.
The correct electrical connection and the supply voltage are given on the motor's specifications plate.
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 filter of exactly the same power as the regulator must be installed on the regulator output.
The figure below shows the connection configurations.

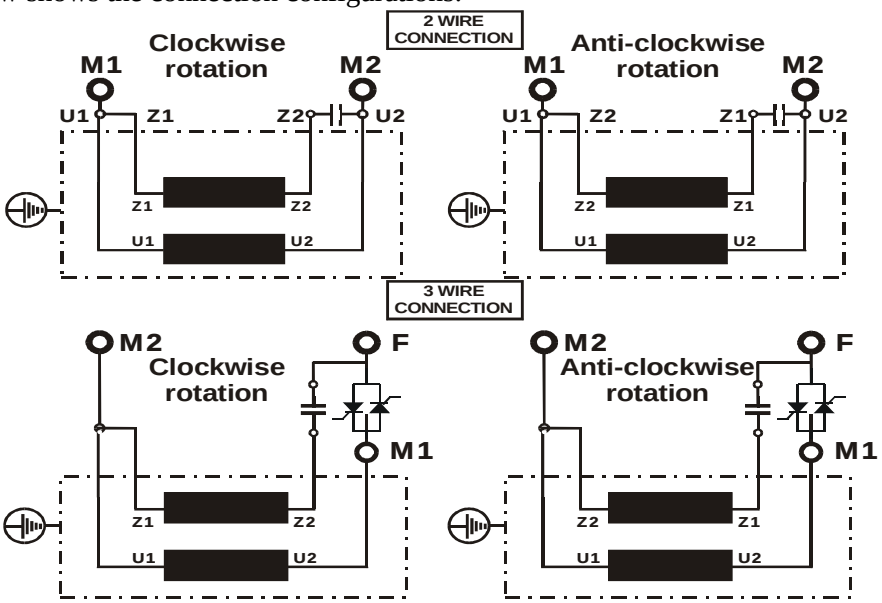


fig. 8

The **rgf100-1** 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 **rgf100-1**'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

rgf100-1 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:

rgf models	magnetothermal carrying capacity
rgf 110	16 A
rgf 116	25 A

Table 2

1.5 rgf 100-1 TECHNICAL DATA

SUPPLY	Voltage	**230VAC** +/- 10 % Single-phase				
	Frequency	**50 Hz** (60 Hz on request)				
	Overvoltage protection	for installation Category **II** (**4 KV**)				
CURRENT	Rated	**RGF 110**	**10 A** up to **50°C** environment , over decrease by **0.5 A/°C**			
		RGF 116	**16 A** up to **50°C** environment , over decrease by **0.8 A/°C**			
	Overload	**200 %** of the rated current (max. **10"** every **3'**)				
POWER	Control circuits	**3VA**				
	Dissipated in environment	**RGF 110**	**20 W @ 10A**			
		RGF 116	**32 W @ 16A**			
OPERATING PRINCIPLE	Cutting phase with compensation for inductive loads and motors					
OPERATING CHARACTERISTIC	POWER Unit (Vers.E , F)	The output voltage depends on the control signal applied to the input, according to the specific appliance regulating curve				
	Regulator (Vers.B , C , D , G , L)	The output voltage changes to keep the quantity measured by the transducer set to the target point, chosen by means of the Set-Point.				
INPUT SIGNALS	Control	Vers. **E**	One **0-20 mA , Ri = 100 Ohm** analog input			
		Vers. **B**	One **4-20 mA , Ri = 100 Ohm** analog input			
		Vers. **F**,**G**	One **0-10 Vdc** analog input with **Ri = 10 Kohm** input impedance			
		Vers. **C**,**D**,**L**	One analog input specific for the **NTC** sensor supplied (**10K@25°C**)			
OUTPUT SIGNAL	Versions **B, G, E**	**+20V** -10/+20%, **40 mA** non-stabilized rated voltage				
	Version **F**	**+10V/5mA** stabilised voltage				
ADJUSTMENTS AND PRESETTINGS	**Version & Input**	**B: 4-20 mA**	**G: 0-10 V**	**C:-10/+40°C**	**D:+20/+70°C**	**L:-30/+20°C**
	Target value	4...20 mA	0..10 V	-10..+40 °C	+20..+70 °C	-30 +20 °C
	Proportional range	0.7..7.0 mA	1..6 V	2…30 °C		
	Minimum Limit	Adjustable from **0%** to **100%**				
	Maximum Limit	Adjustable from **100%** to **0%**				
	Acceleration ramp	Adjustable **1"** to **10"**				
PROTECTIONS	**EMC** integrated mains filter	According to **EN 55011** (**CEI 110-6**) Class **B** : **ISM** appliances directly connected to low voltage power mains				
	Overvoltage protection	According to **EN 61000-4-5** : overvoltage Category **II** (**4 KV**)				
CASE	Dimensions and Weight	**240 x 150 x 115 mm** **1.6 kg / 1.7 kg.**				
	Materials	**GW-Plast 120°C** and black anodised aluminium				
	Degree of protection	**IP 55**				
	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	**89/392/EEC** Directive **73/23/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

2.0 ELECTRICAL CONNECTIONS

2.1 POWER CARD : ELECTRICAL CONNECTIONS

For supply and load connection, reference should be made to the diagrams shown in **fig. 9**, 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 input) 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 **rgf100-1** regulators allows connection of single-phase load.
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 **10A & 16A rgf100-1** regulators is shown in **fig. 9**

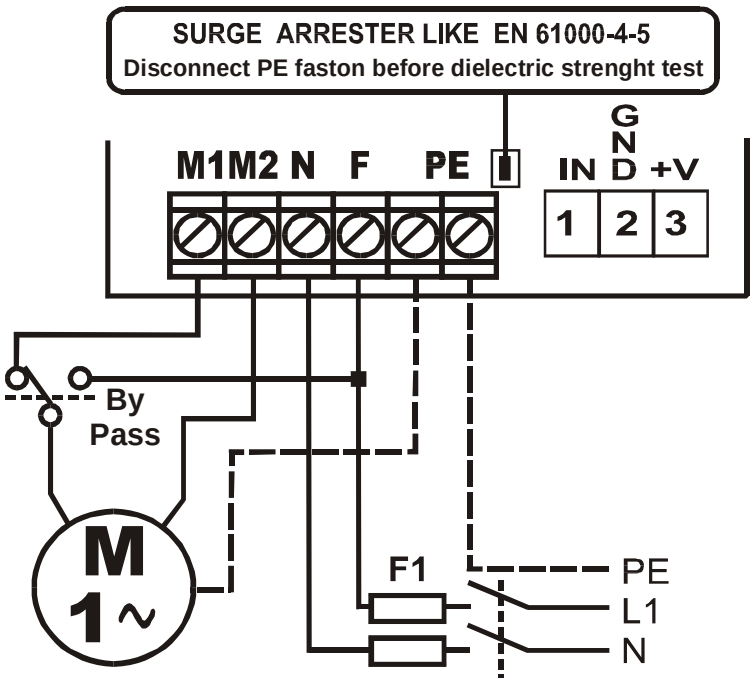


fig. 9

2.2 ANALOGUE INPUT SIGNALS : ELECTRICAL CONNECTIONS

The connections for the control analogue inputs are described below.
They can be connected to the **analogue input** terminal board, in particular:

MASTER version	Active sensors with control in current (**mA**) or voltage (**Vdc**)
MASTER version	**NTC** sensors with control in **°C (per 10kohm = 25 °C)**
SLAVE version	Control signals in current (**mA**) or voltage (**Vdc**)

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

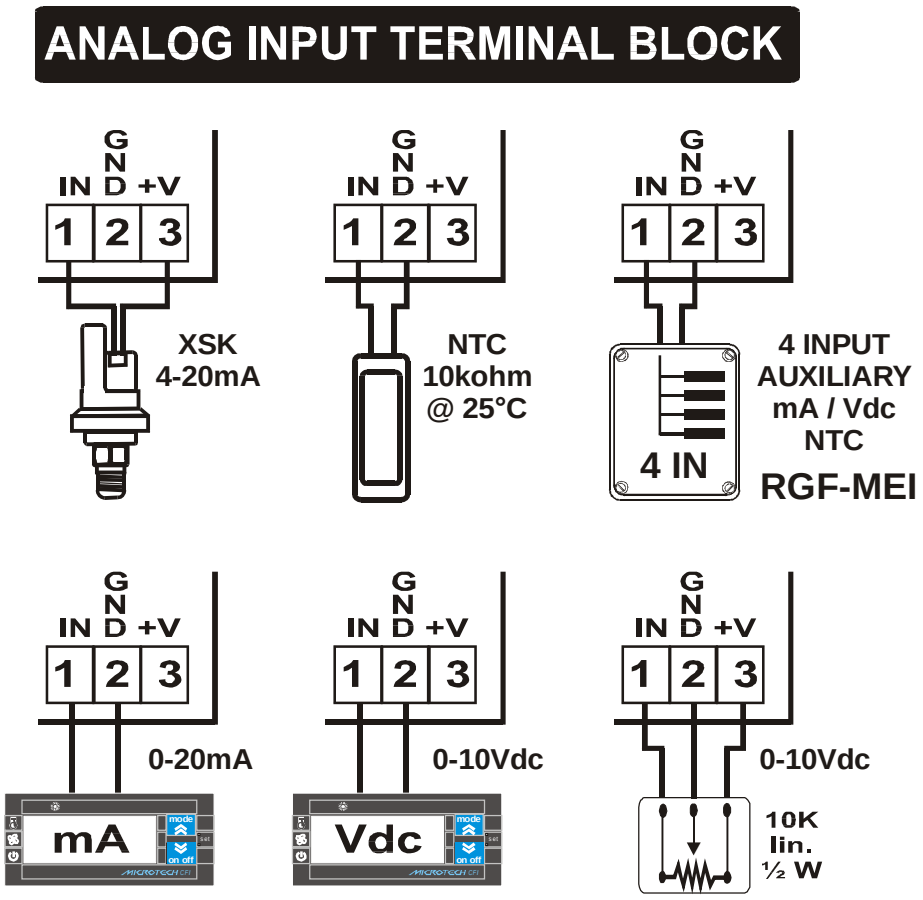


fig. 10

One of the main applications of the **rgf100-1** series regulators is the control of voltage and speed of rotation of fans.
This is modulated to keep temperature or pressure constant as a work point for one or more refrigerating circuits (condensator or evaporator mode).
In the **STANDARD** condition, the fan reaches maximum output voltage (or **P4**) coinciding with the work **Set-point**.
Directions are given below for connection or calibration of **rgf100-1** regulators with **active pressure sensors**, **NTC** temperature sensors and other possible applications for **direct or remote regulation**.

2.2.1 Connection of XSK pressure transducer 4-20 mA

The fig. 11 show the rgf100-1 with Trimmer and centesimal switch for Set-Point P3

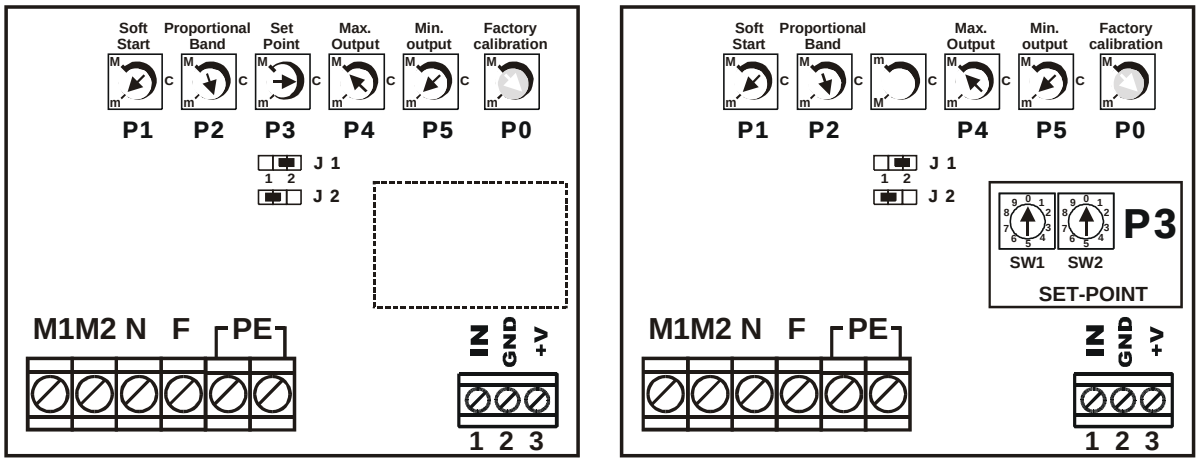


fig. 11

Fig. 12 shows the connection of pressure transducer plus the type of operation (standard) and the operating regulation controls

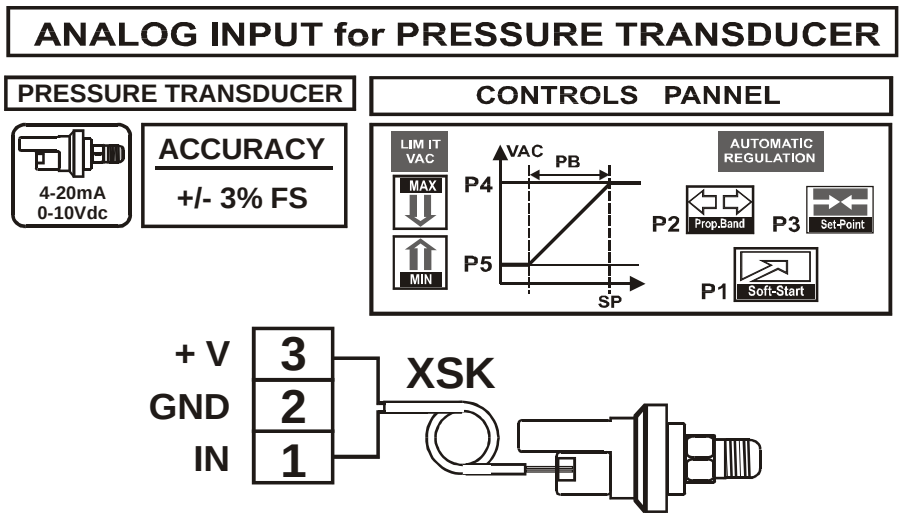


fig. 12

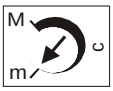
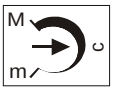
WARNING : ***do not invert the transducer cables (IN / +V) when connection is made to terminals 1/3 as the transducer may be damaged.***

The table below lists the information necessary for calibration of the **Set-point** with the position of **P3** referred to the Trimmer (**Trim**.), and for calibration of the **Proportional Band** with the position of **P2**.

Setting of work point SP / Set-point P3 with 4-20 mA pressure transducer

P3	Trimmer Set	mA	V(*)	XSK 30 bar
	**m**	**4**	**0.4**	**0.00**
		6	0.6	3.75
		8	0.8	7.50
		10	1.0	11.25
	c	**12**	**1.2**	**15.00**
		14	1.4	18.75
		16	1.6	22.50
		18	1.8	26.25
	M	**20**	**2.0**	**30.00**

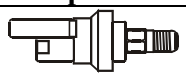
Proportional Band PB / P2 setting with 4-20 mA pressure transducers

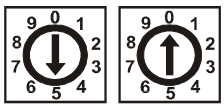
P2	Trimmer Set	mA	XSK 0-30
	**m**	**0.7**	**1.31**
			
	c	**3.5**	**6.56**
			
	M	**7**	**13.12**

Tab. 4

The table below lists the information necessary for calibration of the **Set-point** with the position of **P3** referred to the centesimal **switch** (**Com**.) and for calibration of the **Proportional Band** with the position of **P2**.

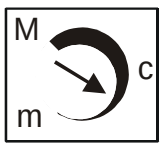
Setting of work point SP / Set-point P3 with XSK pressure transducer





mA	V(*)	XSK 30 bar	N°
04	**0.4**	**0.00**	**00**
06	0.6	3.75	13
08	0.8	7.50	25
10	1.0	11.25	37
12	**1.2**	**15.00**	**50**
14	1.4	18.75	63
16	1.6	22.50	76
18	1.8	26.25	87
20	**2.0**	**30.00**	**99**

Proportional Band PB / P2 setting with XSK pressure transducers

1 mA = 1,875 bar	mA	With XSK 0-30 bar
2.2 mA  **(factory calibration)**	**2,2**	**4,12 bar**

Tab. 5

(*) Column **V** gives the voltage values legible with a multimeter (**20Vdc** scale limit) on the **IN**/**Gnd** terminals of the analogue inputs, corresponding to the **mA** control signal generated by the **4-20mA** transducer in regulation.

2.2.2 Connection of NTC temperature sensor (10kohm @ 25 °C)

Three versions of **NTC** temperature sensors are available for **rgf100-1** models:

- **D** for scale **+20 °C to +70 °C**
- **C** for scale **- 10 °C to +40 °C**
- **L** for scale **- 30 °C to +20 °C**

Connection of **NTC** sensor is shown in **fig. 13** below.
Also shown is the type of operation (standard) and operating regulation controls.

D for scale 20T70 (C°)	**C for scale -10T40 (C°)**	**L for scale -30T20 (C°)**

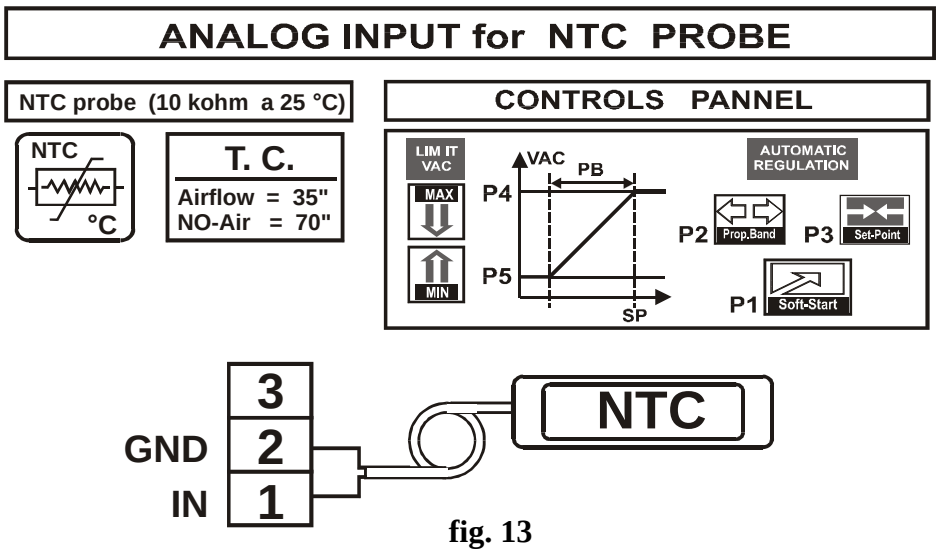


fig. 13

The table below lists the information necessary for calibration of the **Set-point** with the position of **P3** referred to the centesimal Commutators (**Com.**) or Trimmer (**Trim.**), and for calibration of the **Proportional Band** with the position of **P2**.

Setting of work point SP / Set-point P3 with NTC probe

SP / Trimmer For P3					SP / Centesimal switch for P3			
SP/P3		**D (°C) 20/70**	**C (°C) -10/40**	**L (°C) -30/20**	**SP/P3 Comm.**	**D (°C) 20/70**	**C (°C) -10/40**	**L -30/20**
M c m	**m**	**20°**	**-10°**	**-30°**	**00**	**20°**	**-10°**	**-30°**
					10	25°	-05°	-25°
					20	30°	00°	-20°
					30	35°	05°	-15°
					40	40°	10°	-10°
M c m	**c**	**45°**	**15°**	**-05°**	**50**	**45°**	**15°**	**-05°**
					60	50°	20°	00°
					70	55°	25°	05°
					80	60°	30°	10°
					90	65°	35°	15°
M c m	**M**	**70°**	**40°**	**20°**	**99**	**70°**	**40°**	**20°**

Proportional Band PB / Trimmer P2 with NTC probe

PB/P2		Skale D/C/L
M c m	**m**	**3 °C**
M c m	**c**	**18 °C**
M c m	**M**	**30 °C**

Tab. 6

2.2.3 Connection of other sensors and control signals

Active sensors with : **0-20 / 4-20 mA current output (E vers.), and 0-10 Vdc voltage output (F vers.)**

Connection can usually be made to the **rgf100-1** regulator with one active sensors, with current output control signal (**0-20 mA**) or voltage output (**0-10 Vdc**) with conductors having two or three wires.
If the sensors have an earth (**Gnd**) as well as a signal (**IN**) reference, and they accept a **+24Vdc** (max. **40 mA** supply), they can be directly connected to and supplied by the **rgf100-1** regulator (**fig. 14**).
The diagram below shows the connection of pressure transducer used to maintain constant pressure / air delivery from a fan in a controlled air flow plant (laminar flow); also shown is the type of operation (standard) and the operating regulation controls.

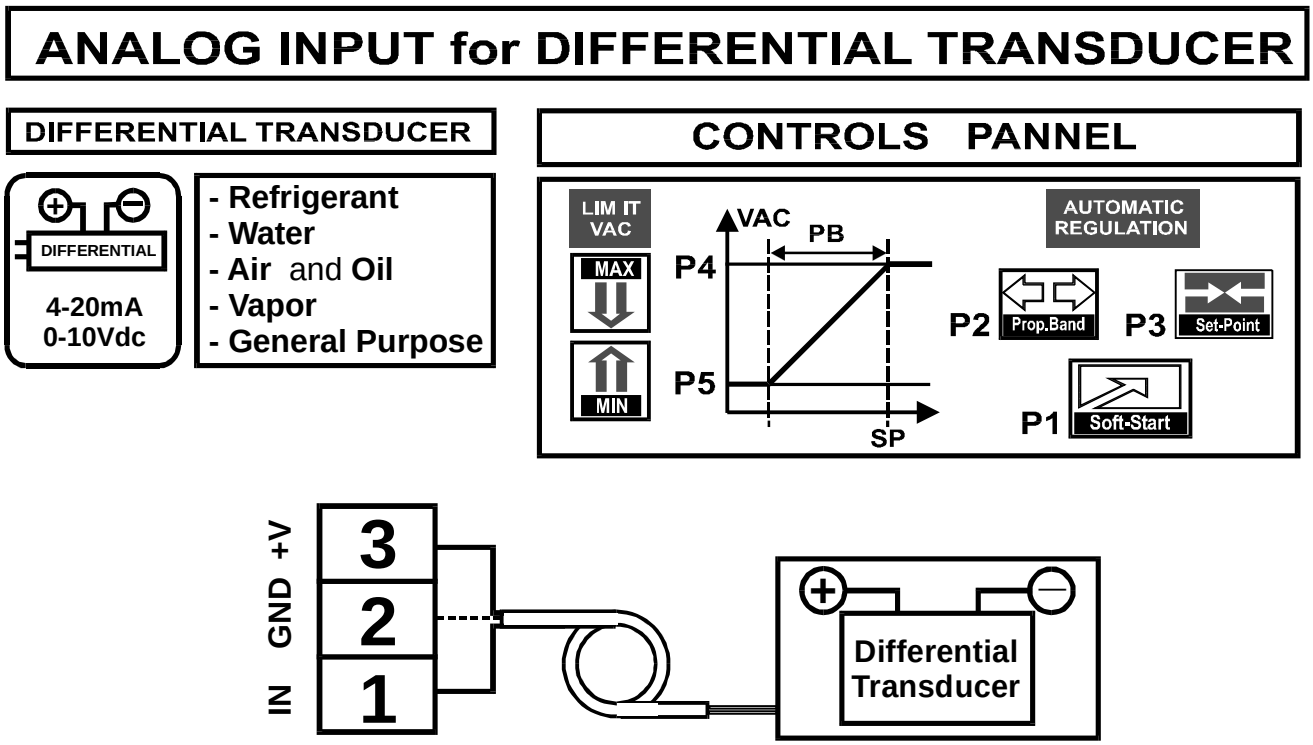


fig. 14

2.2.4 Remote connection for a current (mA) or voltage (Vdc) control signal

Connection of an external control unit (for SLAVE E, F)

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

SLAVE E when the external control unit uses a current control signal (**0-20 mA**), or
SLAVE F when the external control unit uses a voltage control signal (**0-10 Vdc**).

This configuration allows a grid of several regulators to be controlled via a single regulation control signal in either mA or 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.
See **fig. 15** for the layout of the connections.

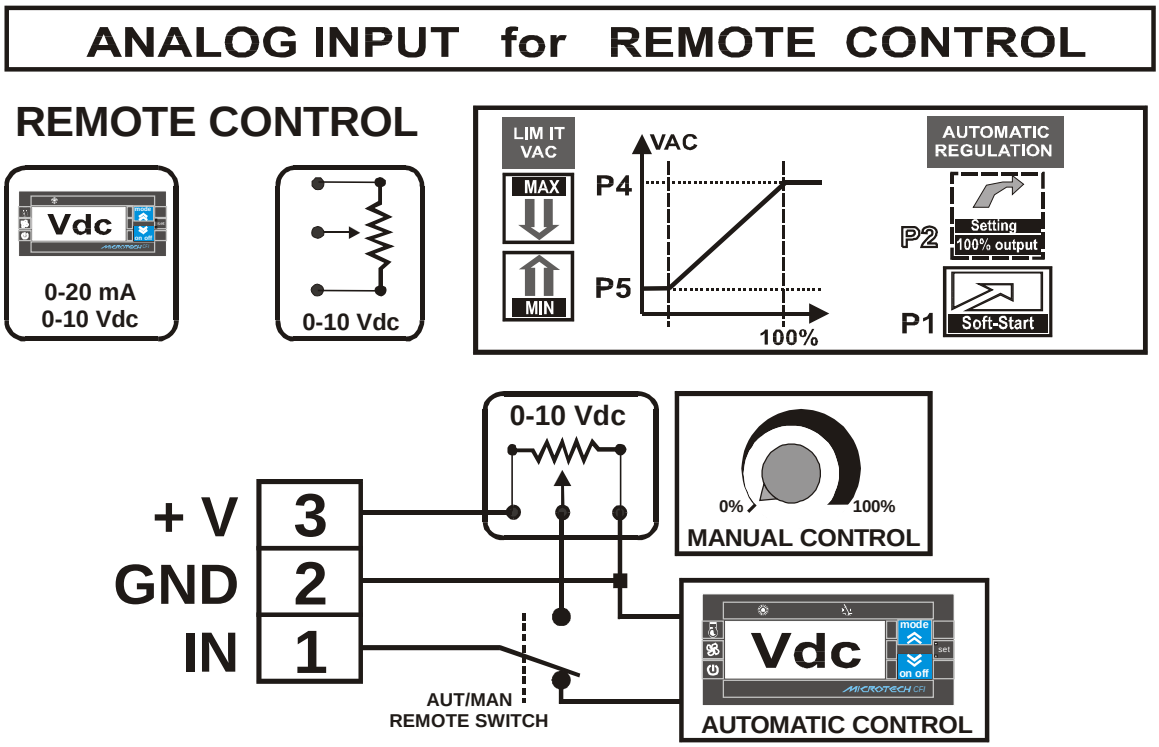


fig. 15

2.2.5 Connection of the rgf MULTI-TRANSDUCERS control

It is possible to increase the number of current (**mA**) or voltage (**Vdc**) inputs which can be connected to the regulator **rgf100-1**, by installing the **rgf-MEI** expansion module.
In this configuration, the rgf100-1 regulator receive control signal from **rgf MEI** regulator, through the **IN** and **GND** terminals**.**
With four (4) sensors-signals connected, the regulator automatically selects the greater (factory-standard) or lesser signal value.
The regulator is automatically controlled by a sensor which provides the signal with the greater value ; as the said module is supplied separately, theoretically there is no limit to the number expansion cards that can be added.
For more information see the rgf-MEI user manual.
The electrical connection available are shown in **fig. 16**.

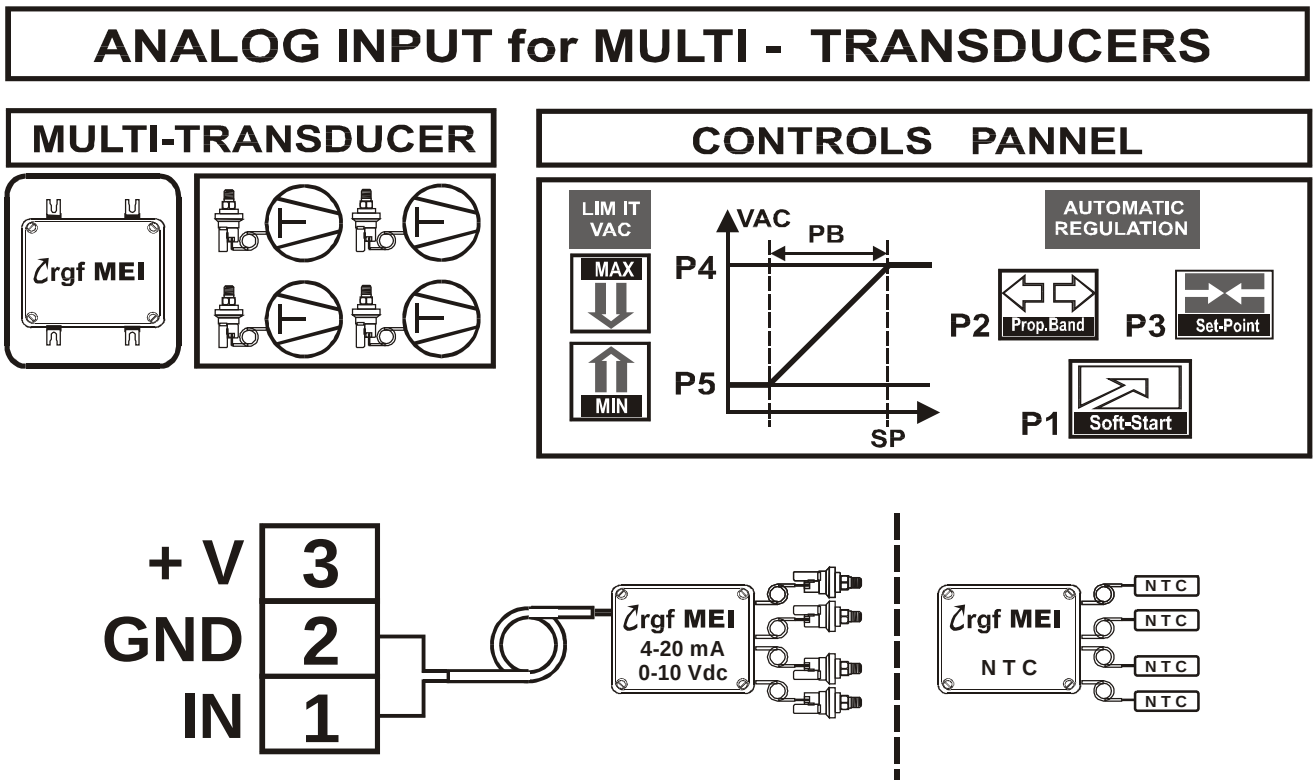


fig. 16

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 **rgf100-1** 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 **jumper**.
The jumper used on the card is of the following type – **3 contacts** (see **fig. 17**).
The term "**Jumper**" refers to the moveable element which connects two (2) contacts.

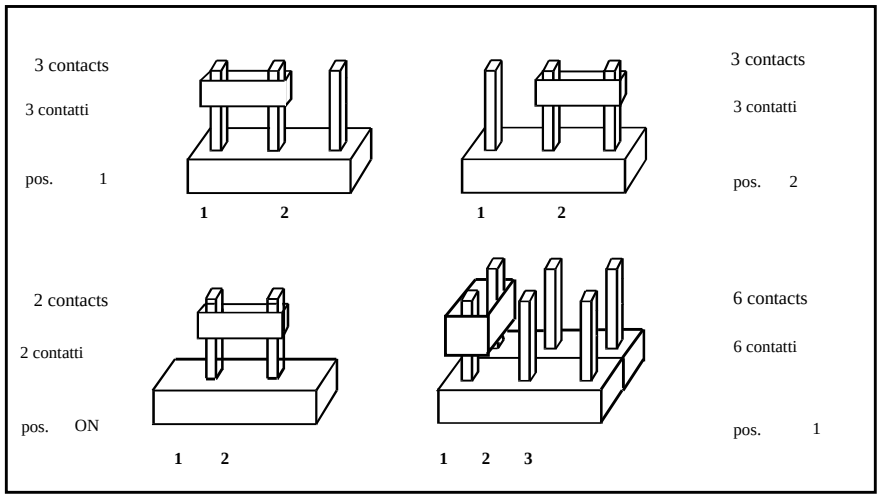


fig. 17

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 **rgf100-1** cutting regulators **control card** are described below.

J1 / J2

The **J1 / J2** are a factory's jumper calibration

To select a new operating mode (Master or Slave), see the fig. **18 / 19 / 20 / 21 / 22**.

J3

Selection for active sensor and remote manual control supply
In the case of **MASTER (B0 and G0)** configuration, the cutting regulators is able to supply the active sensors with **24 Vdc**, maximum current **40 mA** ;
in the case of **SLAVE (F0)** configuration, the cutting regulators is able to supply the remote manual control with 10 Vdc, maximum current 5 mA.
The supply voltage selection is obtained by activating the following bridges :

J3 = ON 2 - to have **24 Vdc / 40 mA** on outlet 3 of terminal board, to supply sensor
J3 = ON 1 - to have **10 Vdc / 5 mA** on outlet 3 of terminal board A, to supply potentiometer 10kohm
The standard position given is J3=ON2

WARNING ! : Check the position of jumpers '**J3**' during commissioning procedure.

WARNING ! : Make sure that the 'Jn' jumpers are correctly positioned during commissioning.
In the case where the **rgf100-1** regulator work function is modified (**MASTER / SLAVE**), refer to fig. **18**, **19**, **20**, **21** and **22**, showing the different positions of these bridges depending on the standard work configurations.

3.2 MASTER, version B (4-20 mA)

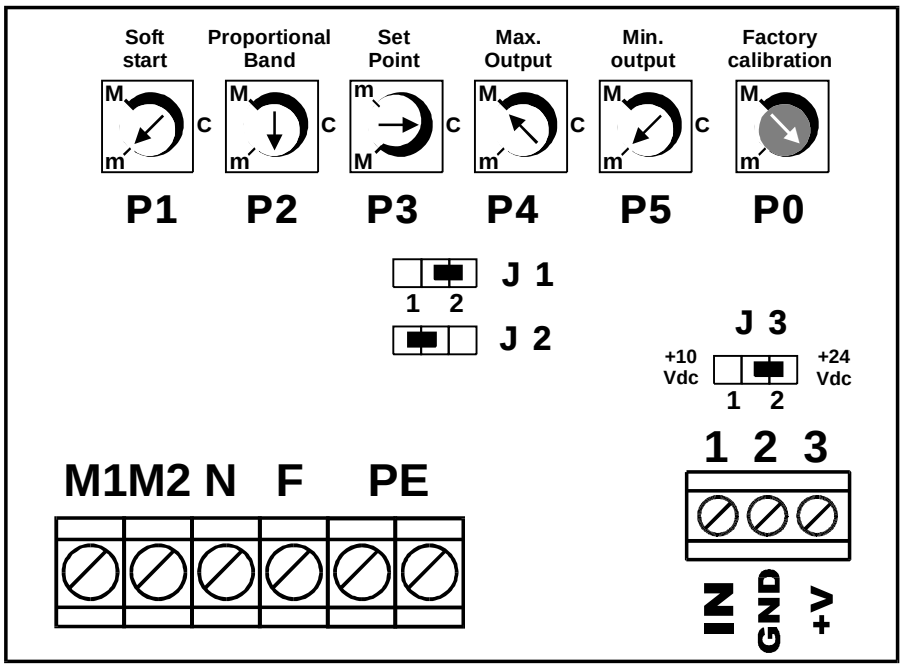


fig. 18

3.3 MASTER, version G (0-10 Vdc)

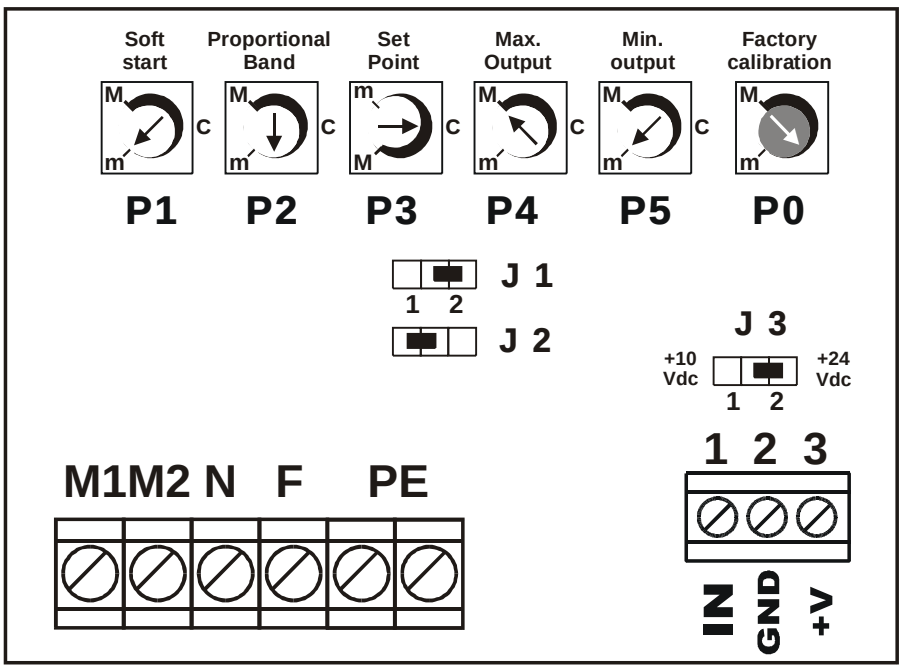


fig. 19

3.4 SLAVE, version E (0-20 mA)

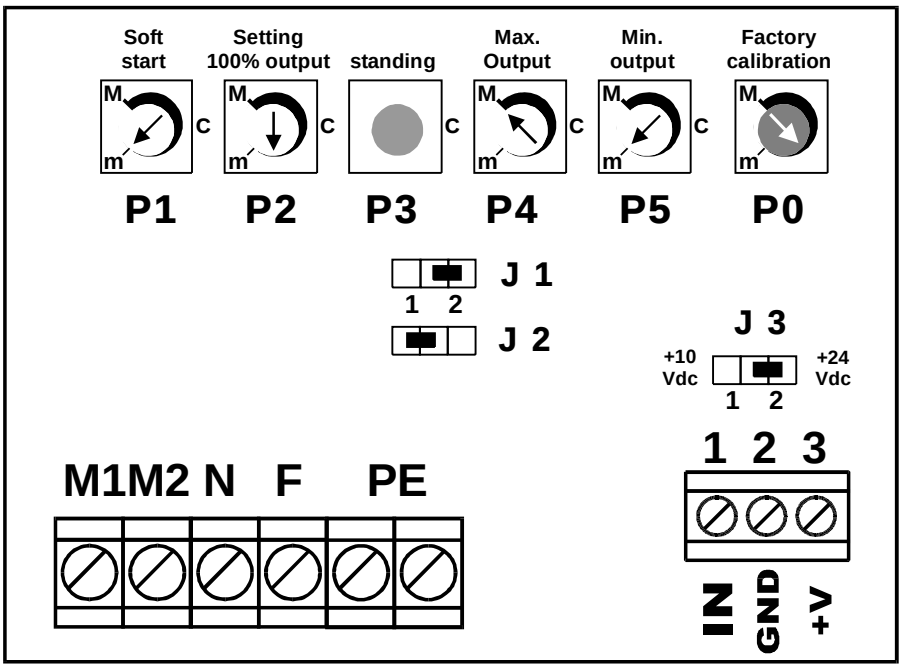


fig. 20

3.5 SLAVE, version F (0-10 Vdc)

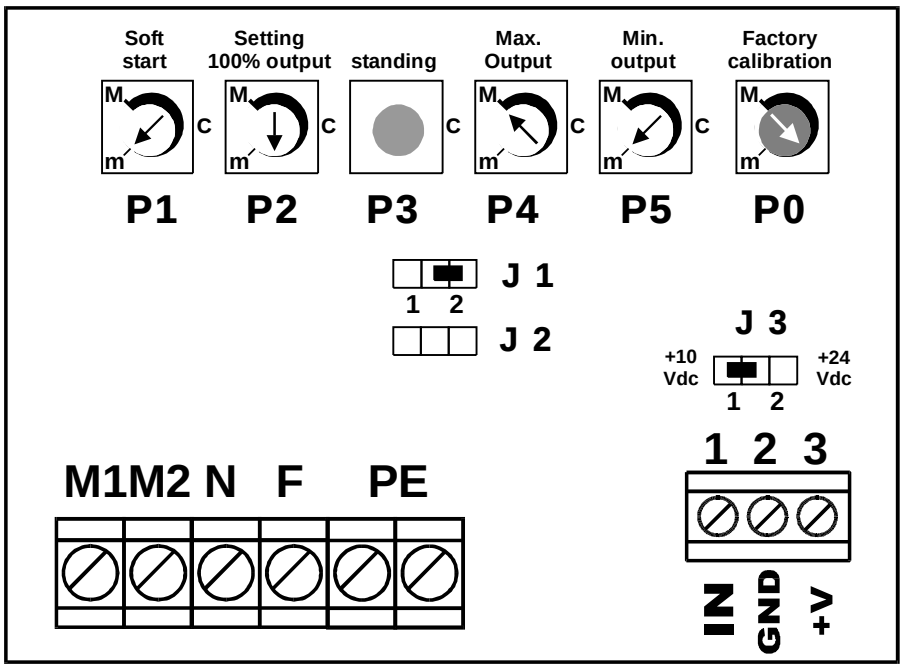


fig. 21

3.6 MASTER, version D, C or L (NTC °C)

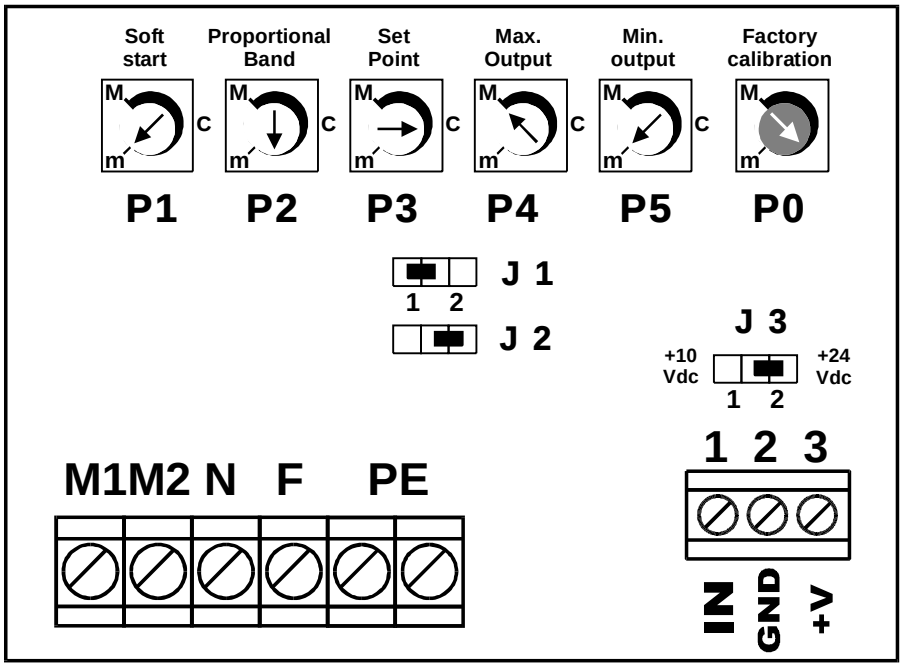


fig. 22

The **rgf100-1** version for temperature control inputs with **NTC** sensors is available in three **°C** scales:
MASTER D with temperature scale **+20 to +70 °C**
MASTER C with temperature scale **-10 to +40 °C**
MASTER L with temperature scale **-30 to +20 °C**

The scale limit values for the Trimmer with **P3** Set-point calibration are inverted compared to the current (**mA**) and voltage (**Vdc**) scales for the active sensors.

WARNING !

- **The configuration with NTC temperature sensors is not compatible with other configurations.**

It is not therefore possible to alter the position of the jumpers to pass from operation with NTC sensors to operation with active sensors or control signals in mA or Vdc, nor to change the °C work field/scale of the rgf regulator.

- **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.**

3.7 Optional module for centesimal Set-point

The **rgf100-1** regulator can be used in versions **MASTER B, G, D, C, L** with a **reference centesimal Set-point** by using the **optional** module card **RGFPB10641**.
With the optional module, Trimmer **P3** is disabled (**standing**) and substituted by one pairs **10** positions **digital commutators (centesimal switch)**.

In **fig. 23** are schown the table value for :
- **0-30 bar / 4-20 mA** transducer
- **0-70 °C NTC** sensor (*)

(*) the 0-70 °C skale is only with centesimal Set-Point option

With Centesimal Set-Point, the proportional Band is setting like schown in **fig. 24** table, for D **bar** & D**°C**

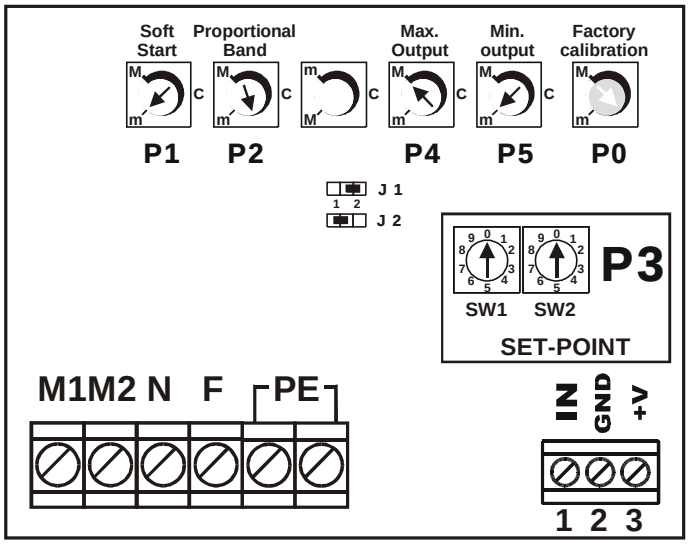


fig. 23

SP	SPK 0-30 bar TC	Δ	Check mA/Vdc IN GND 1 2 3	SP	SPK 0-30 bar TC	Δ	Check mA/Vdc IN GND 1 2 3
00	00.00	4	04 = 0.4	50	15.00	4	12 = 1.2
06	01.87	4	05 = 0.5	57	16.87	4	13 = 1.3
13	03.75	4	06 = 0.6	63	18.75	4	14 = 1.4
19	05.63	4	07 = 0.7	69	20.62	4	15 = 1.5
25	07.50	4	08 = 0.8	76	22.50	4	16 = 1.6
31	09.37	4	09 = 0.9	81	24.37	4	17 = 1.7
37	11.25	4	10 = 1.0	87	26.25	4	18 = 1.8
44	13.12	4	11 = 1.1	93	28.12	4	19 = 1.9
				99	30.00	4	20 = 2.0

SP	TC °C	Δ	Check kohm IN GND 1 2 3	SP	TC °C	Δ	Check kohm IN GND 1 2 3
00	0	7	27.28	50	35	5	6.94
07	5	6	22.05	58	40	5	5.82
13	10	6	17.96	66	45	5	4.91
20	15	6	14.68	73	50	5	4.16
27	20	5	12.09	80	55	6	3.53
35	25	5	10.00	87	60	6	3.02
42	30	5	8.31	93	65	7	2.58
				99	70	8	2.22

fig. 24

4.0 CONTROL TRIMMER

Having carried out the electrical connections to the regulator and checked the presetting functions, it is time to move onto the regulation and commissioning operations, by following the procedure below :

4.1 Operating mode selection

With the **'MASTER'** versions, it is possible to select the regulators **rgf100-1** for two operating modes :

DIRECT	The **"direct"** mode is selected when using the device designed to increase the fan speed of rotation as the controlled parameter value increases
REVERSE	the **"reverse"** mode is selected when deciding to use the device designed to increase the fan speed of rotation as the controlled parameter value decreases

Owing to the type of signal transmitted, the operating mode with NTC sensors becomes inverted.
(*) The Direcy & Reverse mode are a factory calibration.
With the **'SLAVE'** versions, the operating mode is decided by the external controller, therefore the only significant parameters for commissioning are the **Minimum** and **Maximum** voltage limits.

WARNING: Before starting the regulator calibration phase, check the position of the trimmers as shown in figs. 25 and 26;The position of the trimmers marked with a spot of red paint (factory calibrated trimmers) must not be altered.

4.2 Calibration trimmer

Before starting the regulator calibration phase, check the trimmer position as shown in the figure.

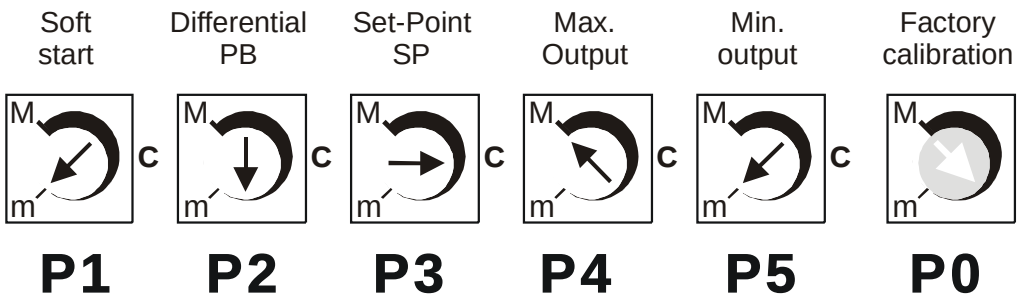


fig. 25 **Starting configuration for 'MASTER' regulator calibration trimmers**

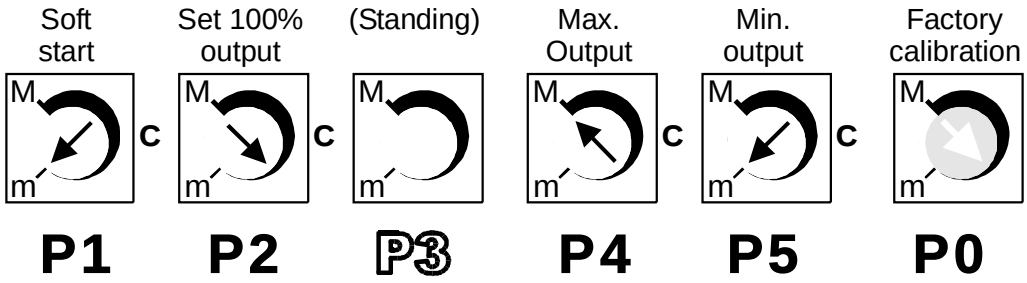


fig. 26 **Starting configuration for 'SLAVE' regulator calibration trimmers**

The work parameters regulation can be divided into **TWO PHASES:**

1. **definition of regulator work limits**: the values of **P4** and **P5** are defined in this phase.
2. **definition of regulator work field**: the values of **P2** and **P3** are defined in this phase.

With **SLAVE** type regulators, the regulator calibration is completed during **PHASE 1**.
With **MASTER** type regulators, **PHASE 1** is necessarily followed by **PHASE 2** which defines the **Work Range** and **Set-point**.

4.3 MAX. OUTPUT regulation (P4 trimmer)

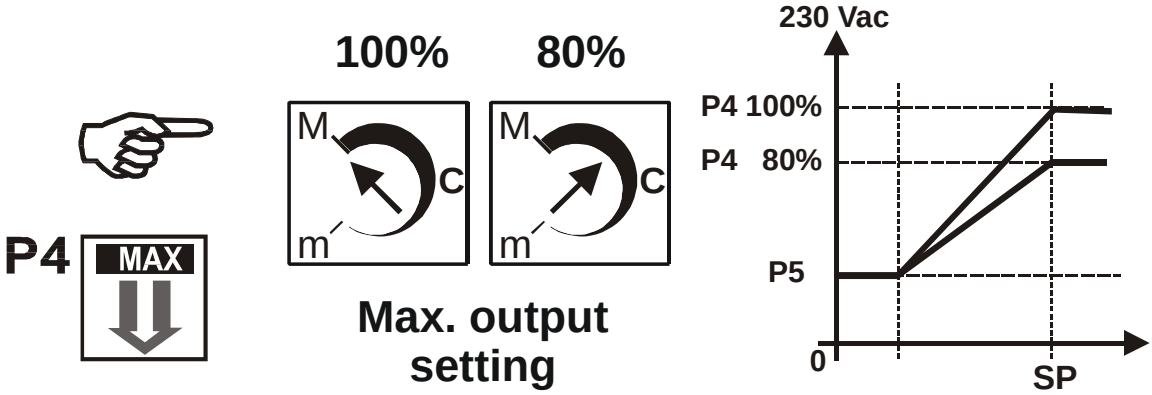


fig. 27

P4 MAX. OUTPUT **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:
When the control signal is set to the maximum operating value, it is possible to limit the maximum operation voltage by activating the **P4** trimmer.
To set the **P4** trimmer, the system must be set to generate the maximum value in automatic control (Vdc, mA or °C).
Starting from position **'M'**, turn **P4** clockwise until the value required as maximum output voltage limit is reached

4.4 MIN. OUTPUT regulation (P5 trimmer)

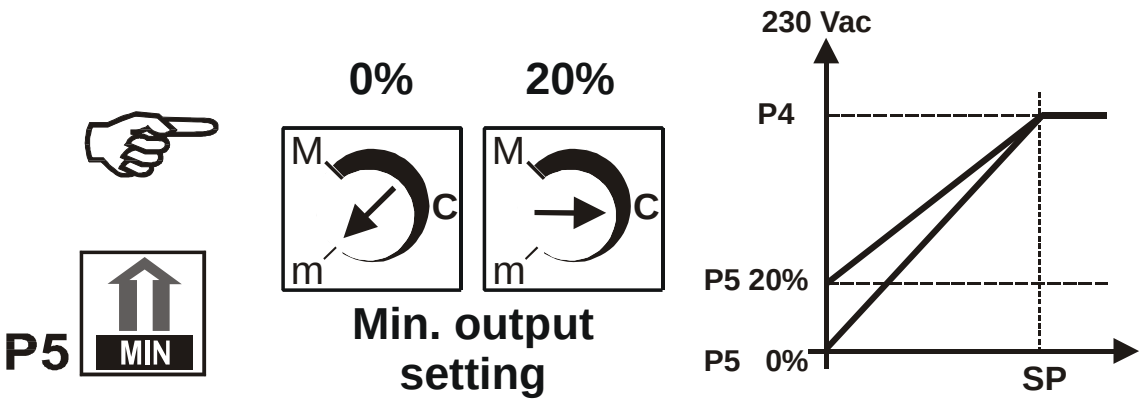


fig. 28

P5 MIN. OUTPUT **m = 0%** **M = 70%**

This adjusts the output voltage manually from 0% to 70%.
During the calibration starting phase, it is used to check the regulator for correct cutting regulators and the fans for correct rotation

When the automatic control is not operating or the control input is disconnected, it is possible to supply the fan with a minimum constant voltage by activating the **P5** trimmer.
Under these conditions, the fan always rotates at a fixed minimum speed once the automatic regulation control has reached the minimum value.
Rotate **P5** anticlockwise starting from position 'm', until the desired minimum voltage is reached.

4.5 PROPORTIONAL BAND regulation (P2 trimmer)

P2 PROPORTIONAL BAND **- mA** **- Vdc** **- °C**

Trimmer **P2** takes on different roles depending on the model of **rgf100-1** chosen:
- on '**Master**' operation models (**B,G,D,C,L**), **P2** adjusts the proportional band.
- on '**Slave**' operation models (**E** and **F**), trimmer **P2** is set at the factory to give maximum voltage to the load corresponding to the maximum control signal sent to the regulator.

4.5.1 Versions with MASTER regulator operation

In **MASTER** regulator versions the range determines the value in **mA / V / °C** of the input signal that, once set, passes the fan from the maximum voltage (**MAX. OUT P4**) to the minimum set (**MIN. OUT P5**).
The **P2** work field is different for different versions.

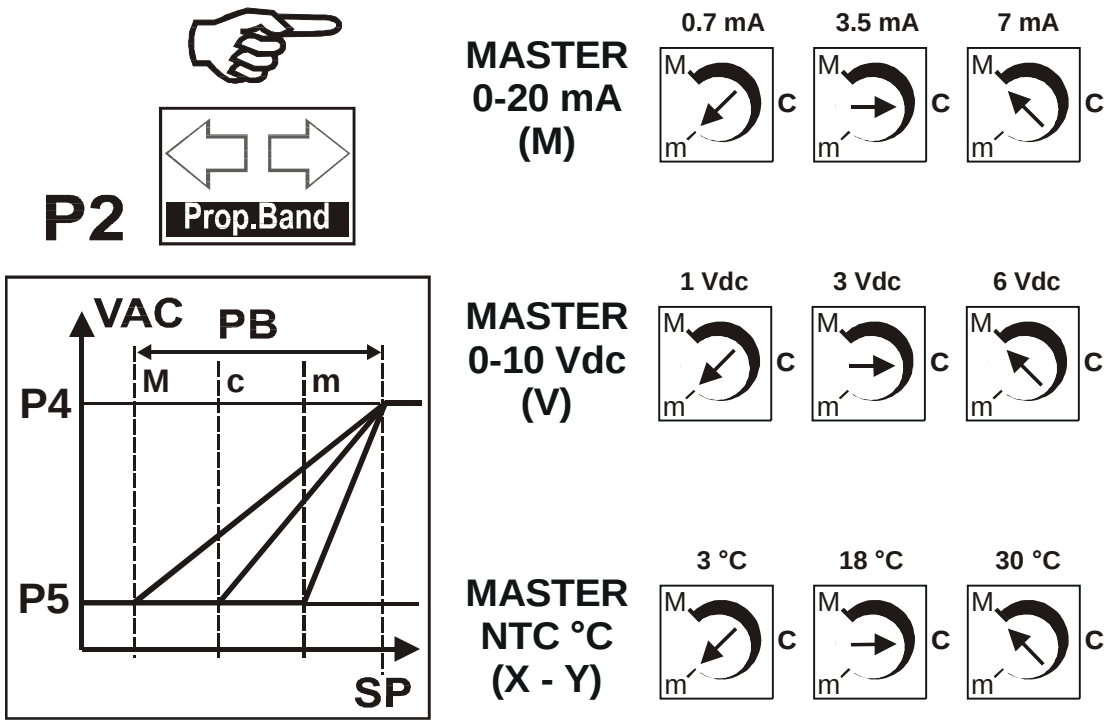


fig. 29

Version M for 4/20 mA active sensors:

ranges from:
- **0.7 mA** (trimmer in position '**m**')
- **3.5 mA** (trimmer in position '**c**')
- **7.0 mA** (trimmer in position '**M**').

The current signal is tied to the scale amplitude of the transducer used.
In the case of pressure control (which occurs most frequently), the value of the **mA/Bar** ratio changes depending on the pressure transmitter scale.

Version V for 0/10 Vdc active sensors:

ranges from:
- **0.30 Vdc** (trimmer in position '**m**')
- **1.75 Vdc** (trimmer in position '**c**')
- **3.50 Vdc** (trimmer in position '**M**').

For **Vdc / set physical quantity** correspondence, refer to the characteristics of the sensor used.

Versions X and Y for NTC sensors (°C) :

ranges from:
- **3.0 °C** (trimmer in position '**m**')
- **18.0 °C** (trimmer in position '**c**')
- **30.0 °C** (trimmer in position '**M**').

4.5.2 Versions with SLAVE regulator operation

In this case, the **rgf100-1** is subjected to a control signal (automatic or manual) generated by a remote controller.
Trimmer **P2** only determines the maximum voltage supplied to the fan corresponding to the maximum control signal received by the regulator from the remote controller :
20 mA for the **SLAVE M** version, and
10 Vdc for the **SLAVE V** version.
Starting with the trimmer in position '**m**' and remote control at maximum (**20 mA** or **10 Vdc**), check the value of the voltage supplied to the load.
It is at maximum (100%) when the trimmer is roughly in the position shown in **fig. 30** with the control signal in mA and Vdc.
In this configuration, the **DIRECT** or **REVERSE** mode is determined by the external controller.
N.B.: **in the SLAVE configuration the P2 trimmer is already calibrated and varnished to hold its position in the factory and must NOT be altered.**

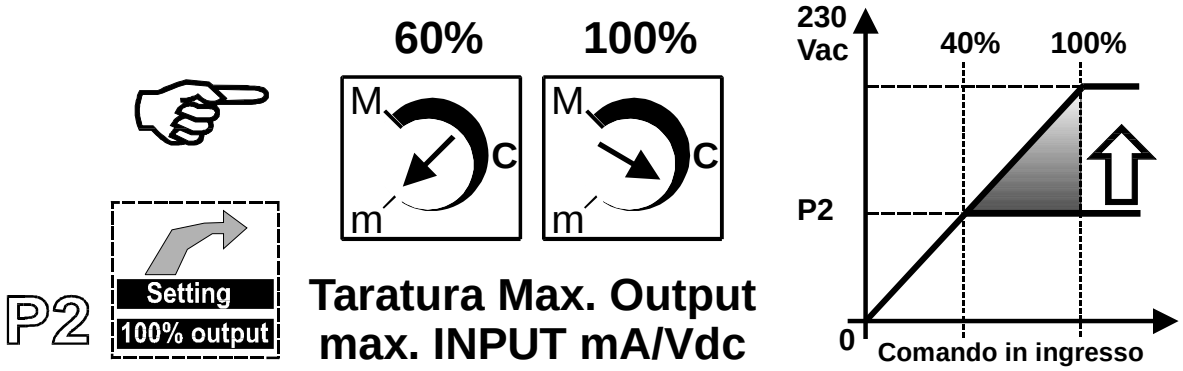


fig. 30

4.6 SET-POINT regulation (P3 Trimmer)

P3 **SET POINT** **- mA** **- Vdc** **- °C**	It is possible to activate the **SET-POINT** (the automatic regulation start point) by activating the **P3** trimmer. **In the standard configuration, the Set-Point coincides with the maximum value of supply (100% or value of P4 max. output).** The regulation scales are as follows in '**Master**' versions: • model **B** : from **0 mA** **to** **20 mA** • model **G** : from **0 Vdc** **to** **10 Vdc** • model **D** : from **20 °C** **to** **70 °C** • model **C** : from **-10 °C** **to** **40 °C** • model **L** : from **-30 °C** **to** **20 °C** The direction of regulation goes from '**m**' (low values) to '**M**' (high values). In **SLAVE** versions **(E** and **F) &** with **centesimal switch**, this trimmer **is not operative (STANDING)** even if present. **Note:** - for **B** versions, the regulation refers to the current control signal (**mA**) - for **G** versions, the regulation refers to the voltage control signal (**Vdc**). - for **D, C** and **L** versions, the trimmer regulation refers directly to the temperature in **ºC**. It is therefore necessary to change the "**range**" of the sensor being used to work out the corresponding measured quantity / control signal.

Fig. 31 shows the values and positions of the trimmers for the different '**MASTER**' configurations.

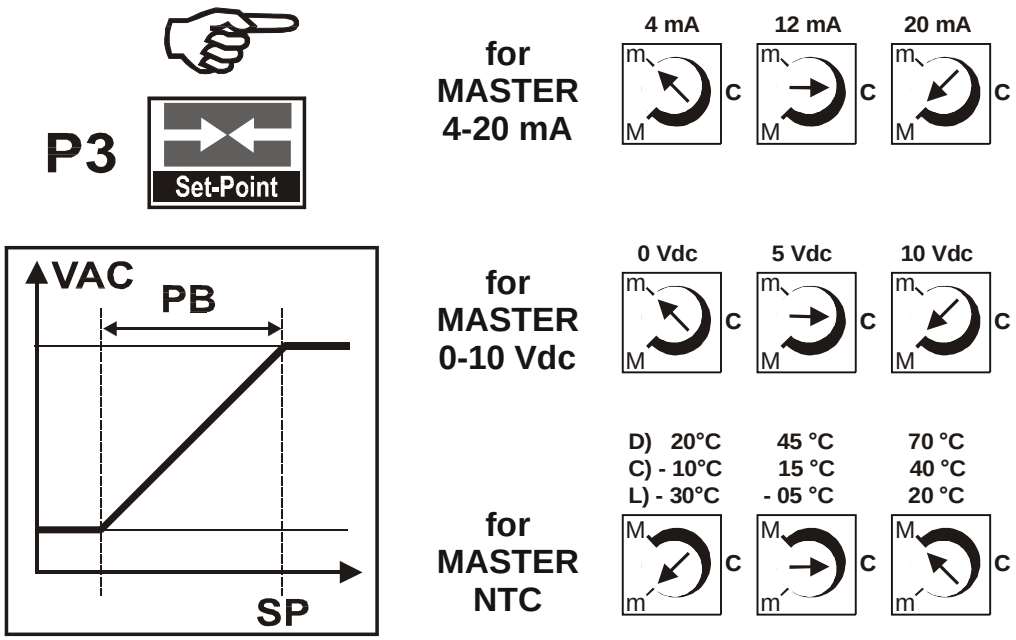


fig. 31

During the calibration procedure, it is advisable to start from position 'c' so as to be positioned halfway through the work field and the connected transducer or sensor scale.

4.7 SOFT-START regulation (P1 trimmer)

P1
Soft-Start

m = 2”
M = 10”

Adjusts the rapidity with which the fan speed varies ('**slow start**' and '**slow stop**'); in practice it makes the system 'slow' or 'fast' depending on the change in the automatic control signal.
In the '**M**' position (trimmer completely turned anticlockwise), the variation speed is slowed to the maximum (system slow to vary).
In the '**m**' position (minimum), speed variation is almost instantaneous ('fast' system).
The cutting regulators is provided with a minimum **Soft-Start** time equal to circa **2** seconds (**P1=m**) to avoid possible hunting that might be caused by an excessively slow system.

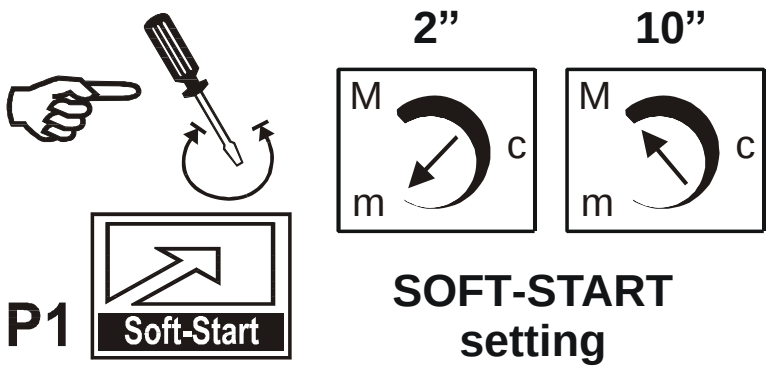


fig. 32

WARNING
The position of trimmers marked with a spot of red paint (factory calibration) must not be altered

5.0 rgf 100-1 EASY REFERENCE COMMISSIONING GUIDE

Having connected the supply and load to the regulator, the control system commissioning operation must be divided into two phases in order to separate the **definition** of the regulator **work voltage limits** (**P4-P5**) from the **surround control values (P3-P2** with mA - Vdc - °C) in automatic regulation:

QUESTION	ANSWER	HOW TO PROCEED
Should the fan reach **100**% speed in automatic regulation? **(P4)**	• **NO** (with IN = max. value) • **YES**	• With **P5** in position **M**, turn **P4** clockwise slowly, starting from '**M**' until the desired max. voltage (VAC) is reached • Turn **P4** to position '**M**'
Should the fan constantly rotate at a fixed speed regardless of the automatic regulation signal? **(P5)**	• **YES** (with IN = 0 value) • **NO**	• Starting from '**m**', turn **P5** slowly anticlockwise, until reaching the desired voltage (VAC) • Turn **P5** to position '**m**'

Once the **P4** and **P5** values have been defined and therefore become fixed reference parameters, define the work field values (**P2** Proportional Band) and work point value (**P3** Set-point) in the:

"MASTER" CONFIGURATION with control in mA / Vdc / °C

P3, point where the system go on in automatic regulation, starting from **MIN.OUT** or **0%**
P2, point where the system reaches the **MAX.OUT** control value for the fans (P4)

How can you determine the proportional band? **(P2)**	**Use the P2 trimmer.** First, check the trimmer's work parameters (**fig. 29**).	Starting from position '**m**', turn **P2** anticlockwise until the position considered as the optimum regulation is reached.
How can you determine the Set-Point? **(P3)**	**Use the P3 trimmer.** First, check the scale zone in which to operate (**fig. 31**).	Starting from position '**c**', turn **P3** clockwise or anticlockwise until the position considered as the optimum regulation is reached.

Once **P2** and **P3** have been positioned, check the modulation system and slowly correct by using:

P3 (+/-) if the Set-point is not working at the required pressure or temperature, and with
P2 (+/-) if the fan voltage variation is too fast or too slow.

"SLAVE" CONFIGURATION with control in mA / Vdc

With this configuration, once the **P4** and **P5** reference parameters have been defined, the regulator carries out speed changes on the basis of the control values which are transmitted by the external controller, **without** needing further calibration.

QUESTION	ANSWER	HOW TO PROCEED
What should you do to control the 100% output in slave configuration ?	First, check the **P2** calibration, with the control Input (mA-Vdc-°C) is at Max. value	Generate the maximum control value (**20mA - 10Vdc – max. °C**) and, looking at VAC output verify the 230VAC for fan-load (see 4.5.2 point)

6.0 TROUBLE SHOOTING INSTRUCTION . . .

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 single-phases. **C2.** Load not connected. **C3.** No control signal. **C4.** Incorrect operating mode (direct, reverse) and Set points not adequate for control signal. **C5.** Maximum voltage supplied to lower load at minimum starting voltage.	**S1.** Check supply connections and input VAC. **S2.** Check there are no electrical interruptions between regulator and load. **S3.** Check sensors for correct operation (return voltage tab.4/5 for mA) and connections to analogue input terminal board. **S4.** Check P3 trimmer calibration and J1 / J2 bridge positions. **S5.** Check P4 trimmer calibration.
Tension can be read on outlet terminal heads to load (about 200 VAC), but motor does not start.	**C1.** Load not connected to regulator terminals.	**S1.** Check electromagnetic switch or disconnecting switch between motor / regulator..
Protection fuses burn.	**C1.** Regulator undersized with respect to load used. **C2.** Interference on supply lines. **C3.** By-pass configuration with short circuit phases.	**S1.** Check powers involved, as well as starting and operating current. **S2.** Check supply line and, if needed, install mains or 'surge' filters before the cutting regulators. **S3.** Check input and output phase correspondence.
After correctly operating for a certain time, cutting regulators supplies maximum voltage load regardless of control signal.	**C1.** Lack of ventilation and / or high working temperature in the unit. **C2.** Detection transducer faulty or short-circuited.	**S1.** Check the unit is mounted vertically ; check temperature of room where the unit is placed. **S2.** Check input control voltage (tab. 4).
Unit regulates load in ON - OFF operation.	**C1.** Proportional range too "tight" with respect to system response.	**S1.** Increase proportional range value using TP2 trimmer.
Unit has suspended regulation	**C1.** External safety device has intervened **C2.** Fuse burnt or supply phases absent.	**S1.** Check safety device activation and cause of intervention. **S2.** Replace supply line fuse and check beginning of line.

Tab. 7

TECHNICAL ASSISTANCE SHEET

1. All **rgf** equipment is 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 'rgf' 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 **RN**	☐ phase **SN**	☐ phase **TN**
☐ Blocked motor	☐ Differential interrupt			

☐ **Description:**

Controls and contacts check card

☐ Soft-Start	P1	☐ Max. Out. Lim.	P4	☐ Transd. fd. 24 Vdc / 40 mA	
☐ Prop.Band	P2	☐ Min. Out. Lim.	P5		
☐ Set-point	P3			☐ Potent. fd. 10Vdc / 5mA	
		☐			
☐ INPUT 4/20 mA					
☐ INPUT 0/10 Vdc		☐ Input 1		☐	
☐ INPUT NTC				☐	

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 N	V	Amp
Traction	☐ direct	☐ belt driven	Phase S N	V	Amp
Mechanics	☐ helical	☐ centrifugal	phase T N	V	Amp

Operator name:	Company stamp:

rgf INSTALLATION FEATURES

rgf FEATURES	
Serial N°	
Model	

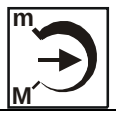
FAN FEATURES			
N°	Model	Load (Amp)	Power Supply

PROBE FEATURES

TYPE	N°	MODEL	RANGE	CONNECTION
Pressure Transducer				
NTC probe				
Transducer . . .				

WORKING PARAMETERS

TRIMMER		% OUTPUT	VAC OUTPUT	VAC SUPPLY	FACTORY SETTING	OPERATOR
P4	MAX. OUT					
P5	MIN. OUT					

TRIMMER		bar	°C	mA	Vdc	FACTORY SETTING	OPERATOR
P2	PROP. BAND						
P3	SET-POINT						
P3	SET-POINT					SP1 N° :	

Date :	Operator Name :	Company :