

**C83X**

***Gas burners***

**MANUAL OF INSTALLATION - USE - MAINTENANCE**

***CIB UNIGAS***

**BURNERS - BRUCIATORI - BRULERS - BRENNER - QUEMADORES - ГОРЕЛКИ**

## DANGERS, WARNINGS AND NOTES OF CAUTION

**THIS MANUAL IS SUPPLIED AS AN INTEGRAL AND ESSENTIAL PART OF THE PRODUCT AND MUST BE DELIVERED TO THE USER.**

**INFORMATION INCLUDED IN THIS SECTION ARE DEDICATED BOTH TO THE USER AND TO PERSONNEL FOLLOWING PRODUCT INSTALLATION AND MAINTENANCE.**

**THE USER WILL FIND FURTHER INFORMATION ABOUT OPERATING AND USE RESTRICTIONS, IN THE SECOND SECTION OF THIS MANUAL. WE HIGHLY RECOMMEND TO READ IT.**

**CAREFULLY KEEP THIS MANUAL FOR FUTURE REFERENCE.**

### 1) GENERAL INTRODUCTION

- The equipment must be installed in compliance with the regulations in force, following the manufacturer's instructions, by qualified personnel.
- Qualified personnel means those having technical knowledge in the field of components for civil or industrial heating systems, sanitary hot water generation and particularly service centres authorised by the manufacturer.
- Improper installation may cause injury to people and animals, or damage to property, for which the manufacturer cannot be held liable.
- Remove all packaging material and inspect the equipment for integrity. In case of any doubt, do not use the unit - contact the supplier.

The packaging materials (wooden crate, nails, fastening devices, plastic bags, foamed polystyrene, etc), should not be left within the reach of children, as they may prove harmful.

- Before any cleaning or servicing operation, disconnect the unit from the mains by turning the master switch OFF, and/or through the cut-out devices that are provided.
- Make sure that inlet or exhaust grilles are unobstructed.
- In case of breakdown and/or defective unit operation, disconnect the unit. Make no attempt to repair the unit or take any direct action.

Contact qualified personnel only.

Units shall be repaired exclusively by a servicing centre, duly authorised by the manufacturer, with original spare parts and accessories.

Failure to comply with the above instructions is likely to impair the unit's safety.

To ensure equipment efficiency and proper operation, it is essential that maintenance operations are performed by qualified personnel at regular intervals, following the manufacturer's instructions.

- When a decision is made to discontinue the use of the equipment, those parts likely to constitute sources of danger shall be made harmless.
- In case the equipment is to be sold or transferred to another user, or in case the original user should move and leave the unit behind, make sure that these instructions accompany the equipment at all times so that they can be consulted by the new owner and/or the installer.
- This unit shall be employed exclusively for the use for which it is meant. Any other use shall be considered as improper and, therefore, dangerous.

The manufacturer shall not be held liable, by agreement or otherwise, for damages resulting from improper installation, use and failure to comply with the instructions supplied by the manufacturer. The occurrence of any of the following circumstances may cause explosions, polluting unburnt gases (example: carbon monoxide CO), burns, serious harm to people, animals and things:

- Failure to comply with one of the WARNINGS in this chapter
- Incorrect handling, installation, adjustment or maintenance of the burner
- Incorrect use of the burner or incorrect use of its parts or optional supply

### 2) SPECIAL INSTRUCTIONS FOR BURNERS

- The burner should be installed in a suitable room, with ventilation openings complying with the requirements of the regulations in force, and sufficient for good combustion.
- Only burners designed according to the regulations in force should be used.
- This burner should be employed exclusively for the use for which it was designed.
- Before connecting the burner, make sure that the unit rating is the same as delivery mains (electricity, gas oil, or other fuel).
- Observe caution with hot burner components. These are, usually, near to the flame and the fuel pre-heating system, they become hot during the unit operation and will remain hot for some time after the burner has stopped.

When the decision is made to discontinue the use of the burner, the user shall have qualified personnel carry out the following operations:

- a Remove the power supply by disconnecting the power cord from the mains.
- b Disconnect the fuel supply by means of the hand-operated shut-off valve and remove the control handwheels from their spindles.

### Special warnings

- Make sure that the burner has, on installation, been firmly secured to the appliance, so that the flame is generated inside the appliance fire-box.
- Before the burner is started and, thereafter, at least once a year, have qualified personnel perform the following operations:
  - a set the burner fuel flow rate depending on the heat input of the appliance;
  - b set the flow rate of the combustion-supporting air to obtain a combustion efficiency level at least equal to the lower level required by the regulations in force;
  - c check the unit operation for proper combustion, to avoid any harmful or polluting unburnt gases in excess of the limits permitted by the regulations in force;
  - d make sure that control and safety devices are operating properly;
  - e make sure that exhaust ducts intended to discharge the products of combustion are operating properly;
  - f on completion of setting and adjustment operations, make sure that all mechanical locking devices of controls have been duly tightened;
  - g make sure that a copy of the burner use and maintenance instructions is available in the boiler room.
- In case of a burner shut-down, reset the control box by means of the RESET pushbutton. If a second shut-down takes place, call the Technical Service, **without trying to RESET further**.
- The unit shall be operated and serviced by qualified personnel only, in compliance with the regulations in force.

### 3) GENERAL INSTRUCTIONS DEPENDING ON FUEL USED

#### 3a) ELECTRICAL CONNECTION

- For safety reasons the unit must be efficiently earthed and installed as required by current safety regulations.
- It is vital that all safety requirements are met. In case of any doubt, ask for an accurate inspection of electrics by qualified personnel, since the manufacturer cannot be held liable for damages that may be caused by failure to correctly earth the equipment.
- Qualified personnel must inspect the system to make sure that it is adequate to take the maximum power used by the equipment shown on the equipment rating plate. In particular, make sure that the system cable cross section is adequate for the power absorbed by the unit.
- No adaptors, multiple outlet sockets and/or extension cables are permitted to connect the unit to the electric mains.
- An omnipolar switch shall be provided for connection to mains, as required by the current safety regulations.
- The use of any power-operated component implies observance of a few basic rules, for example:
  - do not touch the unit with wet or damp parts of the body and/or with bare feet;
  - do not pull electric cables;
  - do not leave the equipment exposed to weather (rain, sun, etc.) unless expressly required to do so;
  - do not allow children or inexperienced persons to use equipment;
- The unit input cable shall not be replaced by the user. In case of damage to the cable, switch off the unit and contact qualified personnel to replace. When the unit is out of use for some time the electric switch supplying all the power-driven components in the system (i.e. pumps, burner, etc.) should be switched off.

### 3b) FIRING WITH GAS, LIGHT OIL OR OTHER FUELS

#### GENERAL

- The burner shall be installed by qualified personnel and in compliance with regulations and provisions in force; wrong installation can cause injuries to people and animals, or damage to property, for which the manufacturer cannot be held liable.
- Before installation, it is recommended that all the fuel supply system pipes be carefully cleaned inside, to remove foreign matter that might impair the burner operation.
- Before the burner is commissioned, qualified personnel should inspect the following:
  - a the fuel supply system, for proper sealing;
  - b the fuel flow rate, to make sure that it has been set based on the firing rate required of the burner;
  - c the burner firing system, to make sure that it is supplied for the designed fuel type;
  - d the fuel supply pressure, to make sure that it is included in the range shown on the rating plate;
  - e the fuel supply system, to make sure that the system dimensions are adequate to the burner firing rate, and that the system is equipped with all the safety and control devices required by the regulations in force.
- When the burner is to remain idle for some time, the fuel supply tap or taps should be closed.

#### SPECIAL INSTRUCTIONS FOR USING GAS

Have qualified personnel inspect the installation to ensure that:

- a the gas delivery line and train are in compliance with the regulations and provisions in force;
- b all gas connections are tight;
- c the boiler room ventilation openings are such that they ensure the air supply flow required by the current regulations, and in any case are sufficient for proper combustion.
- Do not use gas pipes to earth electrical equipment.
- Never leave the burner connected when not in use. Always shut the gas valve off.
- In case of prolonged absence of the user, the main gas delivery valve to the burner should be shut off.

#### Precautions if you can smell gas

- a do not operate electric switches, the telephone, or any other item likely to generate sparks;
- b immediately open doors and windows to create an air flow to purge the room;
- c close the gas valves;
- d contact qualified personnel.
- Do not obstruct the ventilation openings of the room where gas appliances are installed, to avoid dangerous conditions such as the development of toxic or explosive mixtures.

### DIRECTIVES AND STANDARDS

#### *Gas burners*

##### European directives

- Regulation 2016/426/UE (appliances burning gaseous fuels)
- 2014/35/UE (Low Tension Directive)
- 2014/30/UE (Electromagnetic compatibility Directive)
- 2006/42/EC (Machinery Directive)

##### Harmonized standards

- UNI EN 676 (Automatic forced draught burners for gaseous fuels)
- EN 55014-1 (Electromagnetic compatibility- Requirements for household appliances, electric tools and similar apparatus)
- EN 60204-1:2006 (Safety of machinery – Electrical equipment of machines.)
- CEI EN 60335-1 (Specification for safety of household and similar electrical appliances);
- CEI EN 60335-2-102 (Household and similar electrical appliances. Safety. Particular requirements for gas, oil and solid-fuel burning appliances having electrical connections).
- UNI EN ISO 12100:2010 (Safety of machinery - General principles for design - Risk assessment and risk reduction);

#### *Light oil burners*

##### European directives

- 2014/35/UE (Low Tension Directive)
- 2014/30/UE (Electromagnetic compatibility Directive)
- 2006/42/EC (Machinery Directive)

##### Harmonized standards

- UNI EN 267-2011 (Automatic forced draught burners for liquid fuels)
- EN 55014-1 (Electromagnetic compatibility- Requirements for household appliances, electric tools and similar apparatus)
- EN 60204-1:2006 (Safety of machinery – Electrical equipment of machines.)
- CEI EN 60335-1 (Specification for safety of household and similar electrical appliances);
- CEI EN 60335-2-102 (Household and similar electrical appliances. Safety. Particular requirements for gas, oil and solid-fuel burning appliances having electrical connections).
- UNI EN ISO 12100:2010 (Safety of machinery - General principles for design - Risk assessment and risk reduction);

#### *Heavy oil burners*

##### European Directives

- 2014/35/UE (Low Tension Directive)
- 2014/30/UE (Electromagnetic compatibility Directive)
- 2006/42/EC (Machinery Directive)

##### Harmonized standards

- UNI EN 267 (Automatic forced draught burners for liquid fuels)
- EN 55014-1 (Electromagnetic compatibility- Requirements for household appliances, electric tools and similar apparatus)
- EN 60204-1:2006 (Safety of machinery – Electrical equipment of machines.)
- CEI EN 60335-1 (Specification for safety of household and similar electrical appliances);
- CEI EN 60335-2-102 (Household and similar electrical appliances. Safety. Particular requirements for gas, oil and solid-fuel burning appliances having electrical connections).
- UNI EN ISO 12100:2010 (Safety of machinery - General principles for design - Risk assessment and risk reduction);

### Gas - Light oil burners

#### European Directives

- Regulation 2016/426/UE (appliances burning gaseous fuels)
- 2014/35/UE (Low Tension Directive)
- 2014/30/UE (Electromagnetic compatibility Directive)
- 2006/42/EC (Machinery Directive)

#### Harmonized standards

- UNI EN 676 (Automatic forced draught burners for gaseous fuels)
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- CEI EN 60335-2-102 (Household and similar electrical appliances. Safety. Particular requirements for gas, oil and solid-fuel burning appliances having electrical connections).
- UNI EN ISO 12100:2010 (Safety of machinery - General principles for design - Risk assessment and risk reduction);

### Gas - Heavy oil burners

#### European directives:

- Regulation 2016/426/UE (appliances burning gaseous fuels)
- 2014/35/UE (Low Tension Directive)
- 2014/30/UE (Electromagnetic compatibility Directive)
- 2006/42/EC (Machinery Directive)

#### Harmonized standards

- UNI EN 676 (Automatic forced draught burners for gaseous fuels)
- EN 55014-1 (Electromagnetic compatibility- Requirements for household appliances, electric tools and similar apparatus)
- EN 60204-1:2006 (Safety of machinery – Electrical equipment of machines.)
- CEI EN 60335-1 (Specification for safety of household and similar electrical appliances);
- CEI EN 60335-2-102 (Household and similar electrical appliances. Safety. Particular requirements for gas, oil and solid-fuel burning appliances having electrical connections).
- UNI EN ISO 12100:2010 (Safety of machinery - General principles for design - Risk assessment and risk reduction);

### Industrial burners

#### European directives

- Regulation 2016/426/UE (appliances burning gaseous fuels)
- 2014/35/UE (Low Tension Directive)
- 2014/30/UE (Electromagnetic compatibility Directive)
- 2006/42/EC (Machinery Directive)

#### Harmonized standards

- EN 55014-1 (Electromagnetic compatibility- Requirements for household appliances, electric tools and similar apparatus)
- EN 746-2 (Industrial thermoprocessing equipment - Part 2: Safety requirements for combustion and fuel handling systems)
- UNI EN ISO 12100:2010 (Safety of machinery - General principles for design - Risk assessment and risk reduction);
- EN 60204-1:2006 (Safety of machinery – Electrical equipment of machines.)
- EN 60335-2 (Electrical equipment of non-electric appliances for household and similar purposes. Safety requirements)

### Burner data plate

For the following information, please refer to the data plate:

- burner type and burner model: must be reported in any communication with the supplier
- burner ID (serial number): must be reported in any communication with the supplier
- date of production (year and month)
- information about fuel type and network pressure

Type	--
Model	--
Year	--
S.Number	--
Output	--
Oil Flow	--
Fuel	--
Category	--
Gas Pressure	--
Viscosity	--
El. Supply	--
El. Consump.	--
Fan Motor	--
Protection	--
Drwaing n°	--
P.I.N.	--

### SYMBOLS USED



**WARNING!**

Failure to observe the warning may result in irreparable damage to the unit or damage to the environment



**DANGER!**

Failure to observe the warning may result in serious injuries or death.



**WARNING!**

Failure to observe the warning may result in electric shock with lethal consequences

Figures, illustrations and images used in this manual may differ in appearance from the actual product.

### BURNER SAFETY

The burners - and the configurations described below - comply with the regulations in force regarding health, safety and the environment. For more in-depth information, refer to the declarations of conformity that are an integral part of this Manual.



**DANGER! Incorrect motor rotation can seriously damage property and injure people.**

### Residual risks deriving from misuse and prohibitions

The burner has been built in order to make its operation safe; there are, however, residual risks.



Do not touch any mechanical moving parts with your hands or any other part of your body. Injury hazard  
Do not touch any parts containing fuel (i.e. tank and pipes). Scalding hazard  
Do not use the burner in situations other than the ones provided for in the data plate.  
Do not use fuels other than the ones stated.  
Do not use the burner in potentially explosive environments.  
Do not remove or by-pass any machine safety devices.  
Do not remove any protection devices or open the burner or any other component while the burner is running.  
Do not disconnect any part of the burner or its components while the burner is running.  
Untrained staff must not modify any linkages.



After any maintenance, it is important to restore the protection devices before restarting the machine.  
All safety devices must be kept in perfect working order.  
Personnel authorized to maintain the machine must always be provided with suitable protections.



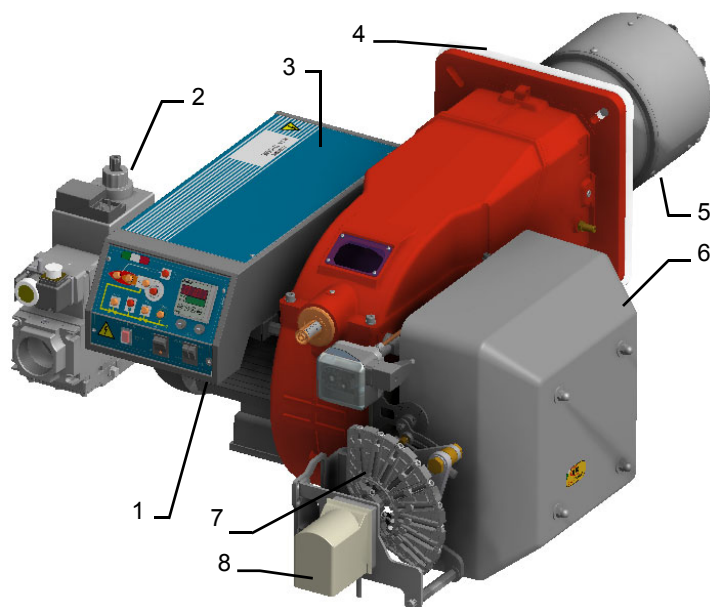
ATTENTION: while running, the parts of the burner near the generator (coupling flange) are subject to overheating. Where necessary, avoid any contact risks by wearing suitable PPE.



## PART I: SPECIFICATIONS

## BURNERS FEATURES

Note: the figure is indicative only.



- 1 Control panel with startup switch
- 2 Gas valves group
- 3 Electrical panel
- 4 Flange
- 5 Blast tube - Combustion head
- 6 Air pressure switch
- 7 Adjusting cam (progressive/fully modulating burners only)
- 8 Actuator

Fig. 1

**Gas operation:** the gas coming from the supply line passes through filter, gas valves and pressure regulator. This one forces the pressure in the utilisation limits. The electric actuator, that moves proportionally the air damper and the gas butterfly valve, uses an adjusting cam with variable shape. This one allows the optimisation of the gas flue values, as to get an efficient combustion. The combustion head positioning determines the burner's output. The combustion head determines the energetic quality and the geometry of the flame. Fuel and comburent are routed into separated ways as far as the zone of flame generation (combustion chamber).

The control panel, placed on the burner's front side, shows each operating stage.

## Burner model identification

Burners are identified by burner type and model. Burner model identification is described as follows.

Type	<b>C83X</b>	Model	<b>M-. MD. SR. *. A. 1. 80.</b>
	<b>(1)</b>		<b>(2) (3) (4) (5) (6) (7) (8)</b>

1	BURNER TYPE	<b>C83X</b>
2	FUEL	M - Natural gas B - Biogas L - LPG
3	OPERATION (Available versions)	AB - Double stage PR - Progressive MD - Fully modulating
4	BLAST TUBE AND AIR INLET CONFIGURATION	SR = Standard blast tube + ABS polymer (silenced) air intake LR = Extended blast tube + ABS polymer (silenced) air intake
5	DESTINATION COUNTRY	* - see data plate
6	BURNER VERSION	A - Standard Y - Special
7	EQUIPMENT	0 = 2 gas valves 1 = 2 gas valves + gas proving system 7 = 2 gas valves + maximum gas pressure switch 8 = 2 gas valves + gas proving system + maximum gas pressure switch
8	GAS CONNECTION see Specifications	32 = Rp1 <sub>1/4</sub> 40 = Rp1 <sub>1/2</sub> 50 = Rp2 65 = DN65

## Fuel



**WARNING! The burner must be used only with the fuel specified in the burner data plate.**

Type	--
Model	--
Year	--
S.Number	--
Output	--
Oil Flow	--
Fuel	--
Category	--
Gas Pressure	--
Viscosity	--
El.Supply	--
El.Consump.	--

The burner technical specifications, described in this manual, refer to natural gas (calorific net value  $H_i = 9.45 \text{ kWh/Stm}^3$ , density  $\rho = 0.717 \text{ Kg/Stm}^3$ ). For different fuel such as LPG, town gas and biogas, multiply the values of flow and pressure by the corrective factors shown in the table below.

Fuel	$H_i$ (KWh/Stm <sup>3</sup> )	$\rho$ (kg/Stm <sup>3</sup> )	$f_Q$	$f_p$
LPG	26,79	2,151	0,353	0,4
Town gas	4,88	0,6023	1,936	3,3
Biogas	6,395	1,1472	1,478	3,5

For example, to obtain the flow and pressure values for the biogas:

$$Q_{biogas} = Q_{naturalGas} \cdot 1,478$$

$$P_{biogas} = P_{naturalGas} \cdot 3,5$$



**ATTENTION! The combustion head type and the settings depend on the fuel. The burner must be used only for its intended purpose specified in the burner data plate.**



**ATTENTION! The corrective factors in the above table depend on the gas composition, so on the calorific value and the density of the gas. The above value can be taken only as reference.**

BURNER TYPE		C83X M-..	C83X L-..
Output	min. - max. kW	200 - 830	200 - 830
Fuel		Natural gas	L.P.G.
Category		see next paragraph	I <sub>3B/P</sub>
Gas flow rate	min.-max. Stm <sup>3</sup> /h	21 - 88	7.5 - 31
Gas pressure	min.-max. mbar	(see Note 2)	
Power supply triphase		220V/230V 3~ / 380V/400V 3N ~ 50Hz	
Auxiliary Power supply		220V/230V 2~ / 220V/230V 1N ~ 50Hz	
Total power consumption	kW	1,6	1,6
Fan motor	kW	1,1	1,1
Protection		IP40	
Operation		Two stages - Progressive - Fully modulating	
Valves size / Gas connection - 32		1" <sub>1/4</sub> / Rp 1 <sub>1/4</sub>	1" <sub>1/4</sub> / Rp 1 <sub>1/4</sub>
Valves size / Gas connection - 40		1" <sub>1/2</sub> / Rp 1 <sub>1/2</sub>	1" <sub>1/2</sub> / Rp 1 <sub>1/2</sub>
Valves size / Gas connection - 50		2" / Rp 2	2" / Rp 2
Valves size / Gas connection - 65		2" <sub>1/2</sub> / DN65	2" <sub>1/2</sub> / DN65
Operating temperature	°C	-10 ÷ +50	
Storage Temperature	°C	-20 ÷ +60	
Working service*		Intermittent	

<b>Note1:</b>	All gas flow rates are referred to Stm <sup>3</sup> / h (1.013 mbar absolute pressure, 15° C temperature) and are valid for G20 gas (net calorific value H <sub>i</sub> = 34,02 MJ / Stm <sup>3</sup> = 9,45 kWh / Stm <sup>3</sup> );
<b>Note2:</b>	Maximum gas pressure= 360 mbar (with Dungs MBDLE) Maximum gas pressure= 500 mbar (with Siemens VGD) Minimum gas pressure= see gas curves.
<b>Warning:</b>	Burners are suitable only for indoor operation with a maximum relative humidity of 80%

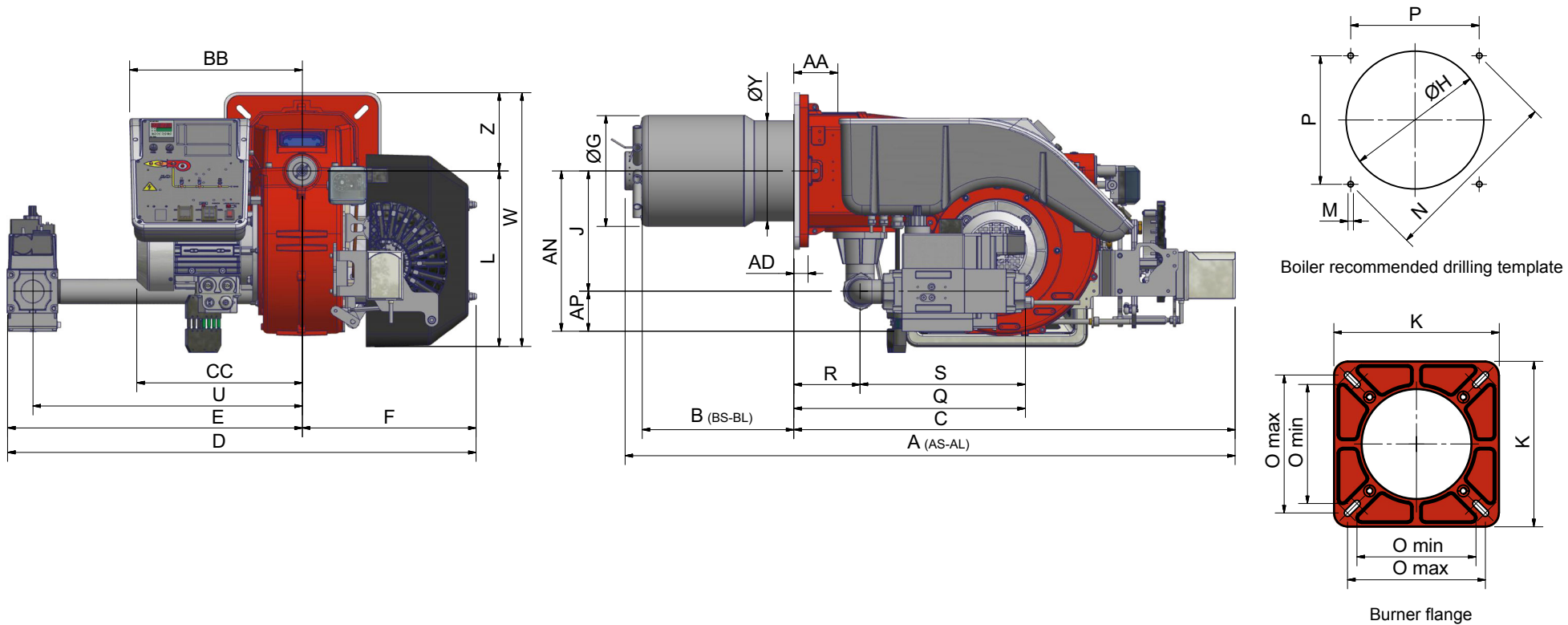
(\*) **NOTE ON THE WORKING SERVICE:** the control box automatically stops after 24h of continuous working. The control box immediately starts up, automatically.

### Country and usefulness gas categories

GAS CATEGORY	COUNTRY																								
	AT	ES	GR	SE	FI	IE	HU	IS	NO	CZ	DK	GB	IT	PT	CY	EE	LV	SI	MT	SK	BG	LT	RO	TR	CH
I <sub>2H</sub>																									
I <sub>2E</sub>	LU	PL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
I <sub>2E( R ) B</sub>	BE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(*) I <sub>2EK</sub>	NL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
I <sub>2ELL</sub>	DE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
I <sub>2Er</sub>	FR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(*) <b>Only for I<sub>2EK</sub></b> : the appliance was configured for the appliance category K (I <sub>2K</sub> ) and is suitable for the use of G and G+ distribution gases according to the specifications as included in the NTA 8837:2012 Annex D with a Wobbe index of 43.46 – 45.3 MJ/m3 (dry, 0 °C, upper value) or 41.23 – 42.98 (dry, 15 °C, upper value). This appliance can moreover be converted and/or be calibrated for the appliance category E (I <sub>2E</sub> ). This therefore implies that the appliance "is suitable for G+ gas and H gas or is demonstrably suitable for G+ gas and can demonstrably be made suitable for H gas" within the meaning of the "Dutch Decree of 10 May 2016 regarding amendment of the Dutch Gas Appliances Decree and the Dutch Commodities (Administrative Fines) Act in connection with the changing composition of gas in the Netherlands as well as technical amendment of some other decrees.																									

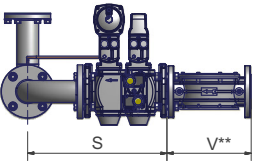
Overall dimensions (mm)

8



	*DN	AA	A (A <sub>S</sub> )	A (A <sub>L</sub> )	BB	B (B <sub>S</sub> )	B (B <sub>L</sub> )	C	CC	D	E	F	G	H	J	K	L	M	N	O <sub>MIN</sub>	O <sub>MAX</sub>	P	Q	R	S	U	V (**)	W	Y	Z
C83X	32	87	1207	1292	328	300	450	873	342	942	598	344	219	249	233	300	347	M10	330	216	250	233	387	131	256	540	-	502	198	155
	40	87	1207	1292	328	300	450	873	342	935	591	344	219	249	233	300	347	M10	330	216	250	233	458	131	327	540	-	502	198	155
	50	87	1207	1292	328	300	450	873	342	870	526	344	219	249	233	300	347	M10	330	216	250	233	473	131	342	526	-	502	198	155
	65	87	1207	1292	328	300	450	873	342	1062	718	344	219	249	233	300	347	M10	330	216	250	233	563	131	432	593	292	502	198	155

BS = standard blast tube    BL = long blast tube    DN = gas valves size



(\*\*) According to the gas train size and the burner type, MB-DLE or VGD valves are supplied. The "V" measure, refers to the gas filter, for burners provided with Siemens VGD valves. MB-DLE valves have a built-in filter.

B\*: SPECIAL blast tube lengths must be agreed with **Cib Unigas**

### How to read the burner “Performance curve”

To check if the burner is suitable for the boiler to which it must be installed, the following parameters are needed:

- furnace input, in kW or kcal/h ( $\text{kW} = \text{kcal/h}/860$ );
- backpressure (data are available on the boiler ID plate or in the user's manual).

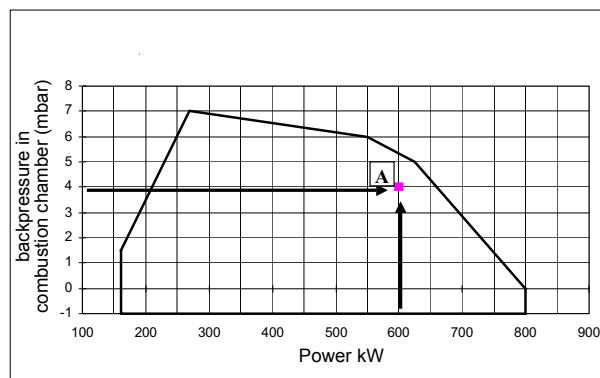
Example:

Furnace input: 600kW

Backpressure: 4 mbar

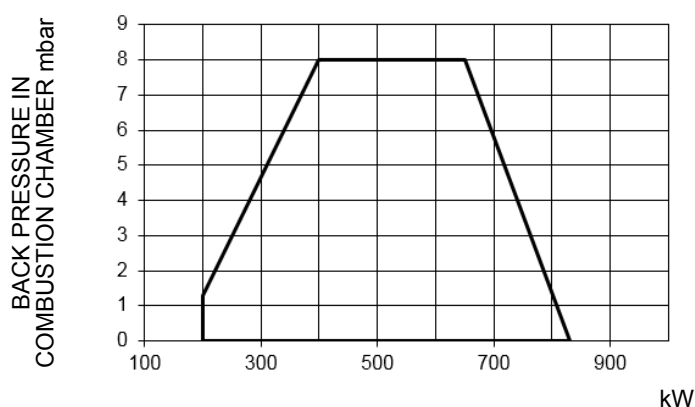
In the “Performance curve” diagram, draw a vertical line matching the furnace input value and an horizontal line matching the backpressure value. The burner is suitable if the intersection point A is inside the performance curve.

Data are referred to standard conditions: atmospheric pressure at 1013 mbar, ambient temperature at 15° C.



### Performance Curves

#### C83X



To get the input in kcal/h, multiply value in kW by 860.

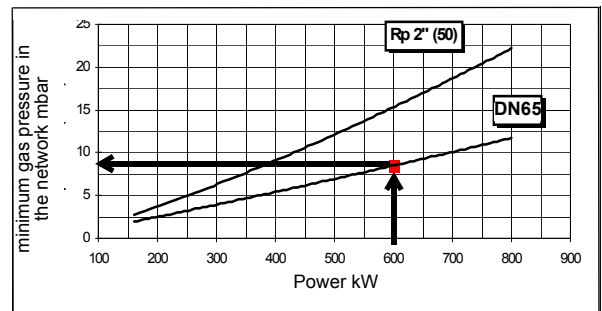
Data are referred to standard conditions: atmospheric pressure at 1013mbar, ambient temperature at 15° C

**NOTE:** The performance curve is a diagram that represents the burner performance in the type approval phase or in the laboratory tests, but does not represent the regulation range of the machine. On this diagram the maximum output point is usually reached by adjusting the combustion head to its “MAX” position (see paragraph “Adjusting the combustion head”); the minimum output point is reached setting the combustion head to its “MIN” position. During the first ignition, the combustion head is set in order to find a compromise between the burner output and the generator specifications, that is why the minimum output may be different from the Performance curve minimum



## Checking the proper gas train size

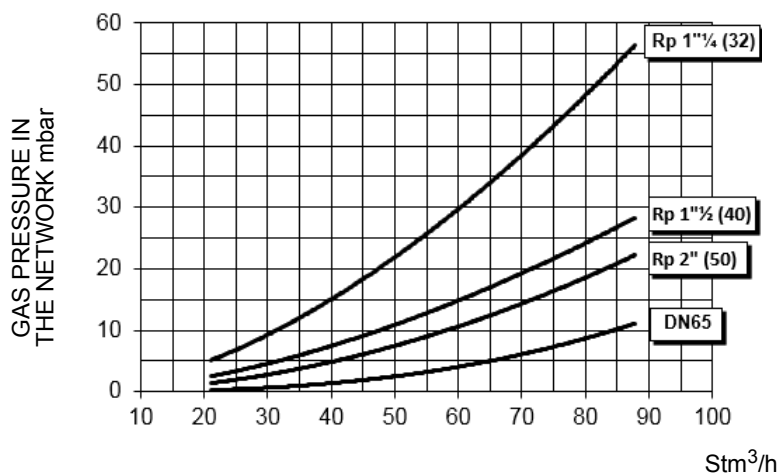
To check the proper gas train size, it is necessary to the available gas pressure value upstream the burner's gas valve. Then subtract the backpressure. The result is called **pgas**. Draw a vertical line matching the furnace input value (600kW, in the example), quoted on the x-axis, as far as intercepting the network pressure curve, according to the installed gas train (DN65, in the example). From the interception point, draw an horizontal line as far as matching, on the y-axis, the value of pressure necessary to get the requested furnace input. This value must be lower or equal to the **pgas** value, calculated before.



## Pressure in the Network / gas flow rate curves

### ● Natural Gas burners

C83X M-..



**ATTENTION:** the gas rate value is quoted on the x-axis, the related network pressure is quoted on the y-axis (pressure value in the combustion chamber is not included). To know the minimum pressure at the gas train inlet, necessary to get the requested gas rate, add the pressure value in the combustion chamber to the value read on the y-axis.



The values in the diagrams refer to **natural gas** with a calorific value of 8125 kcal/Stm<sup>3</sup> (15°C, 1013 mbar) and a density of 0.714 kg/Stm<sup>3</sup>.



The values in the diagrams refer to **GPL** with a calorific value of 22300 kcal/Stm<sup>3</sup> (15°C, 1013 mbar) and a density of 2.14 kg/Stm<sup>3</sup>. When the calorific value and the density change, the pressure values should be adjusted accordingly.

Where:

$$\Delta p_2 = \Delta p_1 * \left( \frac{Q_2}{Q_1} \right)^2 * \left( \frac{\rho_2}{\rho_1} \right)$$

$p_1$	Natural gas pressure shown in diagram
$p_2$	Real gas pressure
$Q_1$	Natural gas flow rate shown in diagram
$Q_2$	Real gas flow rate
$\rho_1$	Natural gas density shown in diagram
$\rho_2$	Real gas density

## Combustion head gas pressure curves

Combustion head gas pressure depends on gas flow and combustion chamber backpressure. When backpressure is subtracted, it depends only on gas flow, provided combustion is properly adjusted, flue gases residual O<sub>2</sub> percentage complies with "Recommended combustion values" table and CO in the standard limits). During this stage, the combustion head, the gas butterfly valve and the actuator are at the maximum opening. Refer to , showing the correct way to measure the gas pressure, considering the values of pressure in combustion chamber, surveyed by means of the pressure gauge or taken from the boiler's Technical specifications.

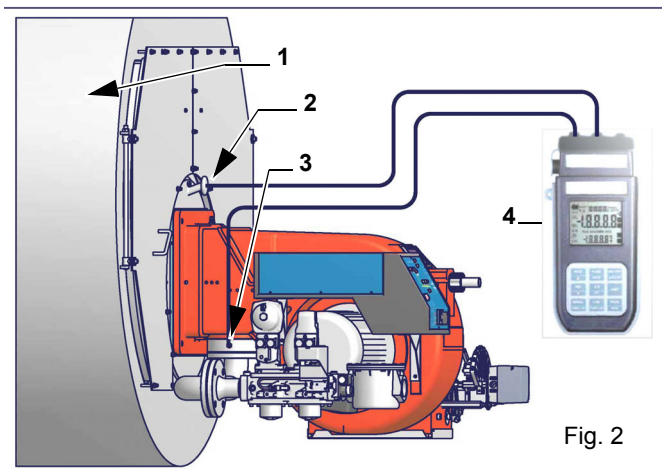


Fig. 2

Note: the figure is indicative only. Key

- 1 Generator
- 2 Pressure outlet on the combustion chamber
- 3 Gas pressure outlet on the butterfly valve
- 4 Differential pressure gauge



**ATTENTION: THE BURNED GAS RATE MUST BE READ AT THE GAS FLOW METER. WHEN IT IS NOT POSSIBLE, THE USER CAN REFERS TO THE PRESSURE-RATE CURVES AS GENERAL INFORMATION ONLY.**

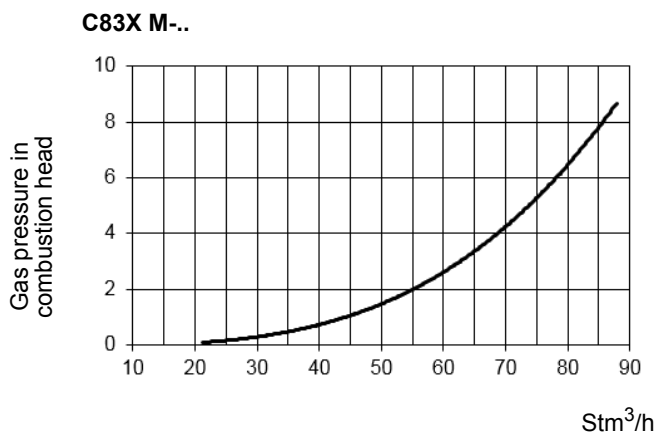
## Measuring gas pressure in the combustion head

In order to measure the pressure in the combustion head, insert the pressure gauge probes: one into the combustion chamber's pressure outlet to get the pressure in the combustion chamber and the other one into the butterfly valve's pressure outlet of the burner. On the basis of the measured differential pressure, it is possible to get the maximum flow rate: in the pressure - rate curves (showed on the next paragraph), it is easy to find out the burner's output in Stm<sup>3</sup>/h (quoted on the x axis) from the pressure measured in the combustion head (quoted on the y axis). The data obtained must be considered when adjusting the gas flow rate.

## Pressure - rate in combustion head curves



**Curves are referred to pressure = 0mbar in the combustion chamber!**



The values in the diagrams refer to **natural gas** with a calorific value of 8125 kcal/Stm<sup>3</sup> (15°C, 1013 mbar) and a density of 0.714 kg/Stm<sup>3</sup>.



The values in the diagrams refer to **GPL** with a calorific value of 22300 kcal/Stm<sup>3</sup> (15°C, 1013 mbar) and a density of 2.14 kg/Stm<sup>3</sup>. When the calorific value and the density change, the pressure values should be adjusted accordingly.

Where:

$$\Delta p_2 = \Delta p_1 * \left( \frac{Q_2^2}{Q_1^2} \right) * \left( \frac{\rho_2}{\rho_1} \right)$$

- $p_1$  Natural gas pressure shown in diagram
- $p_2$  Real gas pressure
- $Q_1$  Natural gas flow rate shown in diagram
- $Q_2$  Real gas flow rate
- $\rho_1$  Natural gas density shown in diagram
- $\rho_2$  Real gas density

## PART II: INSTALLATION

## MOUNTING AND CONNECTING THE BURNER

## Transport and storage



**ATTENTION!** The equipment must be installed in compliance with the regulations in force, following the manufacturer's instructions, by qualified personnel. All handling operations must be carried out with appropriate resources and qualified personnel



**ATTENTION:** Use intact and correctly dimensioned hoisting equipment, conforms to the local regulations and health and safety regulations. Do not stand under lifted loads.

If the product must be stored, avoid humid and corrosive places. Observe the temperatures stated in the burner data table at the beginning of this manual. The packages containing the burners must be locked inside the means of transport in such a way as to guarantee the absence of dangerous movements and avoid any possible damage.

In case of storage, the burners must be stored inside their packaging, in storerooms protected from the weather. Avoid humid or corrosive places and respect the temperatures indicated in the burner data table at the beginning of this manual.

## Packing

The burners are despatched in wooden crates whose dimensions are:

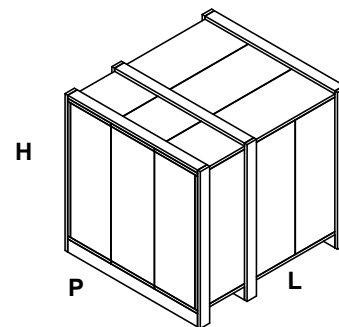
- 1636mm x 1036mm x 1016mm (L x P x H).

Packing cases of this type are affected by humidity and are not suitable for stacking.

The following are placed in each packing case:

- burner with detached gas train;
- gasket or ceramic fibre plait (according to burner type) to be inserted between the burner and the boiler;
- envelope containing this manual and other documents.

To get rid of the burner's packing, follow the procedures laid down by current laws on disposal of materials.

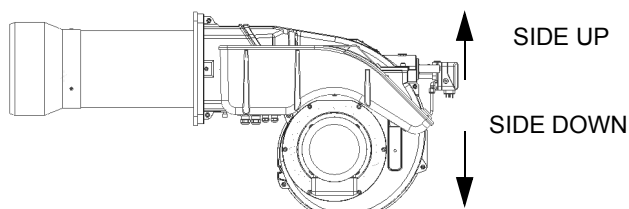


## Handling the burner



**WARNING!** The handling operations must be carried out by specialised and trained personnel. If these operations are not carried out correctly, the residual risk for the burner to overturn and fall down still persists. To move the burner, use means suitable to support its weight (see paragraph "Technical specifications").

The burner is designed to work positioned according to the picture below. For different installations, please contact the Technical Department.

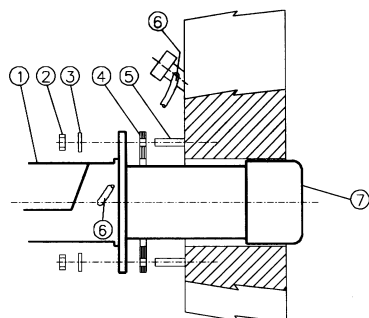


Note: the figure is indicative only.

## Fitting the burner to the boiler

To install the burner into the boiler, proceed as follows:

- 1 make a hole on the closing door of the combustion chamber as described on paragraph "Overall dimensions")
- 2 place the burner to the boiler: lift it up and handle it according to the procedure described on paragraph "Handling the burner";
- 3 place the 4 stud bolts (5) on boiler's door, according to the burner drilling template described on paragraph "Overall dimensions";
- 4 fasten the 4 stud bolts;
- 5 place the gasket on the burner flange;
- 6 install the burner into the boiler;
- 7 fix the burner to the stud bolts, by means of the fixing nuts, according to the next picture.
- 8 After fitting the burner to the boiler, ensure that the gap between the blast tube and the refractory lining is sealed with appropriate insulating material (ceramic fibre cord or refractory cement).



### Keys

- 1 Burner
- 2 Fixing nut
- 3 Washer
- 4 Sealing gasket
- 5 Stud bolt
- 7 Blast tube

## Matching the burner to the boiler (low NOx burners)

The burners described in this manual have been tested with combustion chambers that comply with EN676 regulation and whose dimensions are described in the diagram. In case the burner must be coupled with boilers with a combustion chamber smaller in diameter or shorter than those described in the diagram, please contact the supplier, to verify that a correct matching is possible, with respect of the application involved. To correctly match the burner to the boiler verify the type of the blast tube. Verify the necessary input and the pressure in combustion chamber are included in the burner performance curve; otherwise the choice of the burner must be revised consulting the burner manufacturer. To choose the blast tube length consider the following rule, even if it differs from the instructions of the boiler manufacturer: Cast-iron boilers, three pass flue boilers (with the first pass in the rear part): the blast tube must protrude about 150÷200 mm into the combustion chamber. The length of the blast tubes does not always allow this requirement to be met, and thus it may be necessary to use a suitably-sized spacer to move the burner backwards.

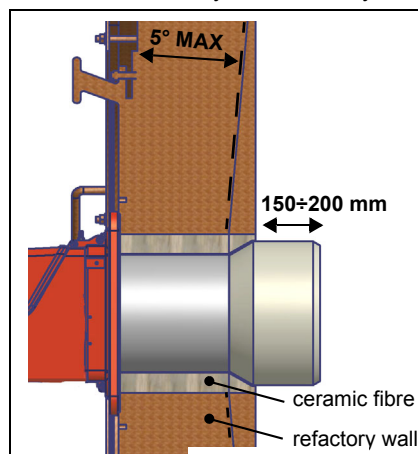


Fig. 2

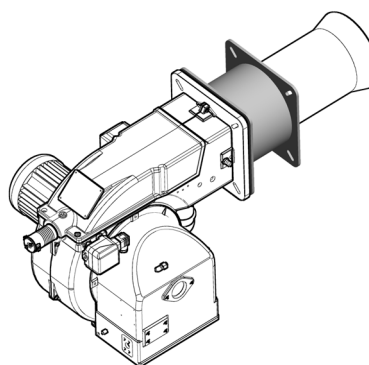


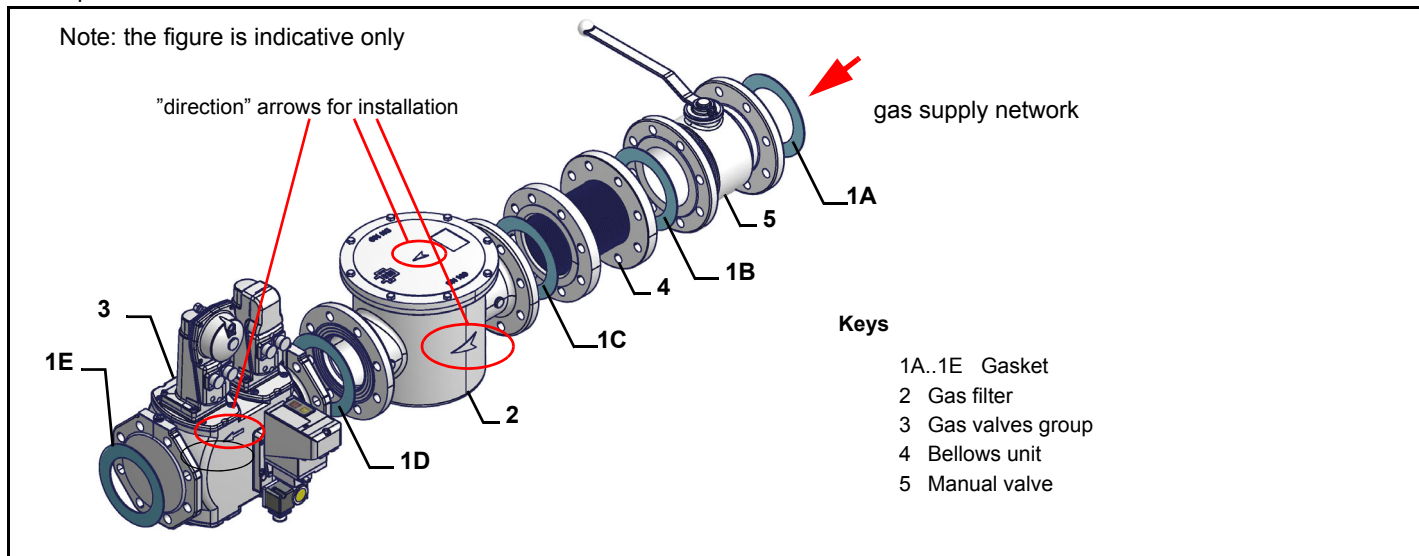
Fig. 3



**WARNING! Carefully seal the free space between blast tube and the refractory lining with ceramic fibre rope or other suitable means.**

## GAS TRAIN CONNECTIONS

The diagrams show the components of the gas train included in the delivery and which must be fitted by the installer. The diagrams are in compliance with the current laws.



Procedure to install the double gas valve unit:

- two (2) gas flanges are required; they may be threaded or flanged depending on size
- first step: install the flanges to prevent entry of foreign bodies in the gas line
- on the gas pipe, clean the already assembled parts and then install the valve unit
- check gas flow direction: it must follow the arrow on the valve body
- VGD20: make sure the O-rings are correctly positioned between the flanges and the valve
- VGD40 and MBE: make sure the gaskets are correctly positioned between the flange
- fasten all the components with screws, according to the following diagrams
- make sure bolts on the flanges are properly tightened



**WARNING:** before executing the connections to the gas pipe network, be sure that the manual cutoff valves are closed.



**ATTENTION:** it is recommended to mount filter and gas valves to avoid that extraneous material drops inside the valves, during maintenance and cleaning operation of the filters (both the filters outside the valves group and the ones built-in the gas valves).



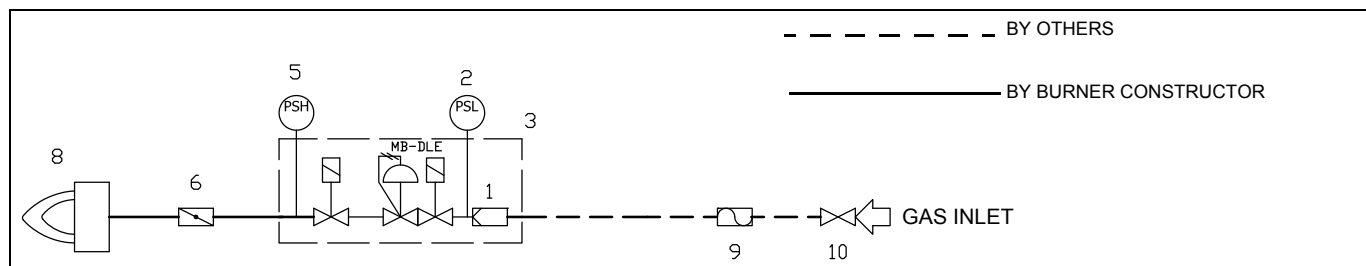
**ATTENTION:** once the gas train is mounted, the gas proving test must be performed, according to the procedure set by laws in force.

To mount the gas train, proceed as follows:

- 1 In case of threaded joints: use proper seals according to the gas used- in case of flanged joints: place a gasket between the elements
- 2 Fasten all the items by means of screws, according to the diagrams showed, observing the mounting direction for each item

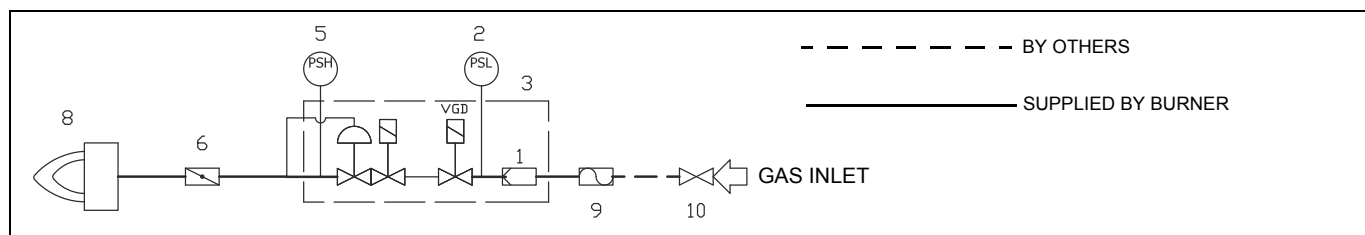
**NOTE:** the bellows unit, the manual cutoff valve and the gaskets are not part of the standard supply

Gas train with valves group MB-DLE (2 valves + gas filter + pressure governor)





## Gas train with valves group VGD with built-in gas pressure governor

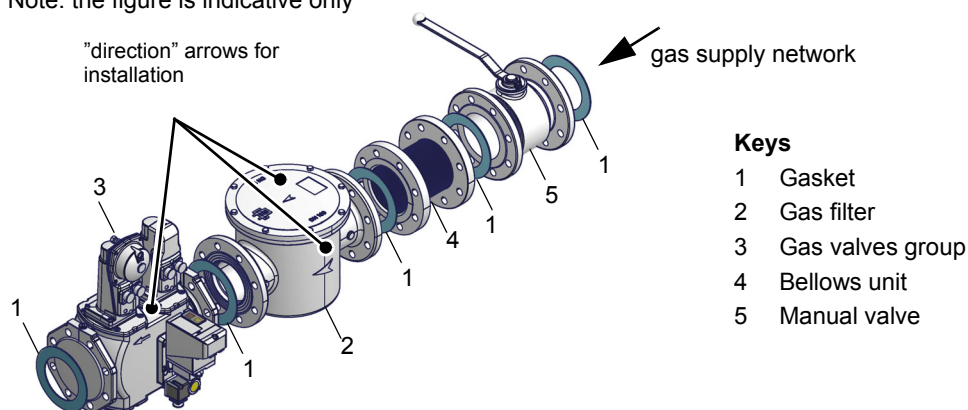


## Key

1	Filter	6	Butterfly valve
2	Pressure switch - PGMIN	8	Main burner
3	Safety valve with built in gas governor	9	Bellows unit(*optional)
		10	Manual valve(*optional)
5	Pressure switch PGMAX:included MBE, for VGD e MB-DLE Optional		

**MultiBloc MB-DLE - Assembling the gas train**

Note: the figure is indicative only



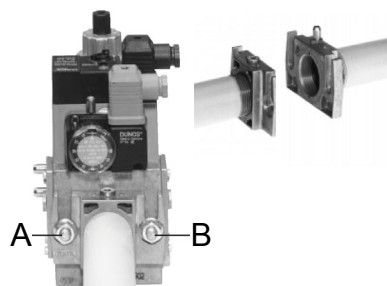
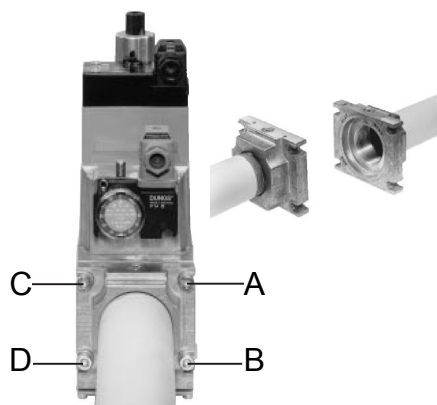
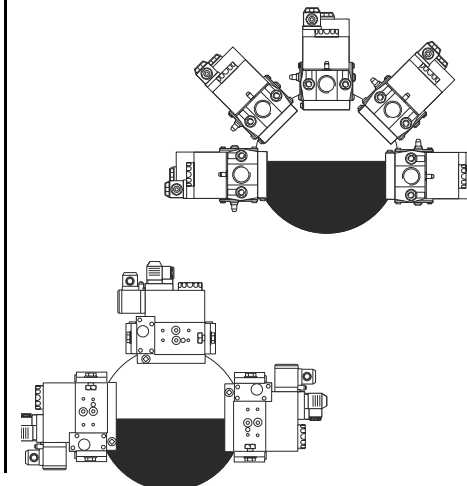
## Keys

- 1 Gasket
- 2 Gas filter
- 3 Gas valves group
- 4 Bellows unit
- 5 Manual valve

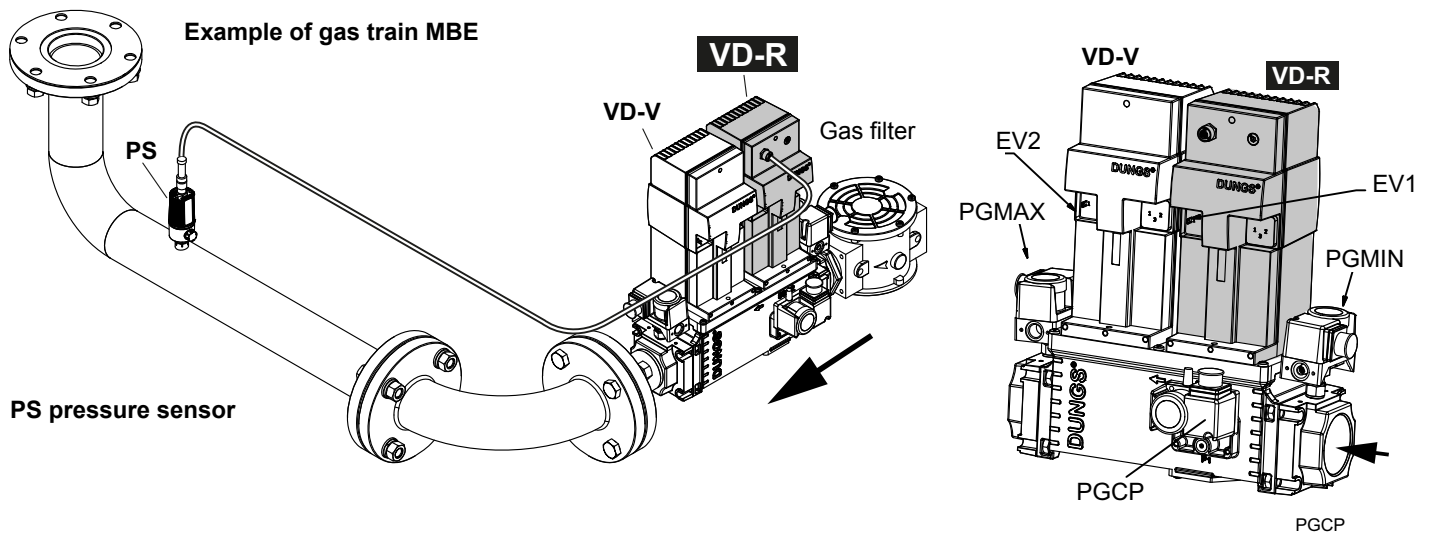
**MULTIBLOC DUNGS Mounting**

**MB-DLE 405..412**  
**MB-DLE 415..420**

- 1 Mount flange onto tube lines: use appropriate sealing agent
- 2 Insert MB-DLE: note position of O rings
- 3 Remove MultiBloc between the threaded flanges
- 4 After installation, perform leakage and functional test
- 5 Disassembly in reverse order

**MB-DLE 405..412****MB-DLE 415..420****MOUNTING POSITIONS**

## MultiBloc MBE



**ATTENTION:** once the gas train is mounted according, the gas proving test must be performed, according to the procedure set by the laws in force.

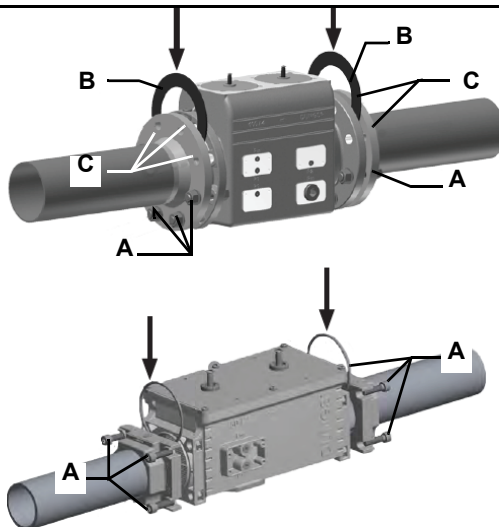


**ATTENTION:** it is recommended to mount filter and gas valves to avoid that extraneous material drops inside the valves, during maintenance and cleaning operation of the filters (both the filters outside the valves group and the ones built-in the gas valves).



**WARNING:** Slowly open the fuel cock to avoid breaking the pressure regulator.

## Threaded train with MultiBloc MBE - Mounting



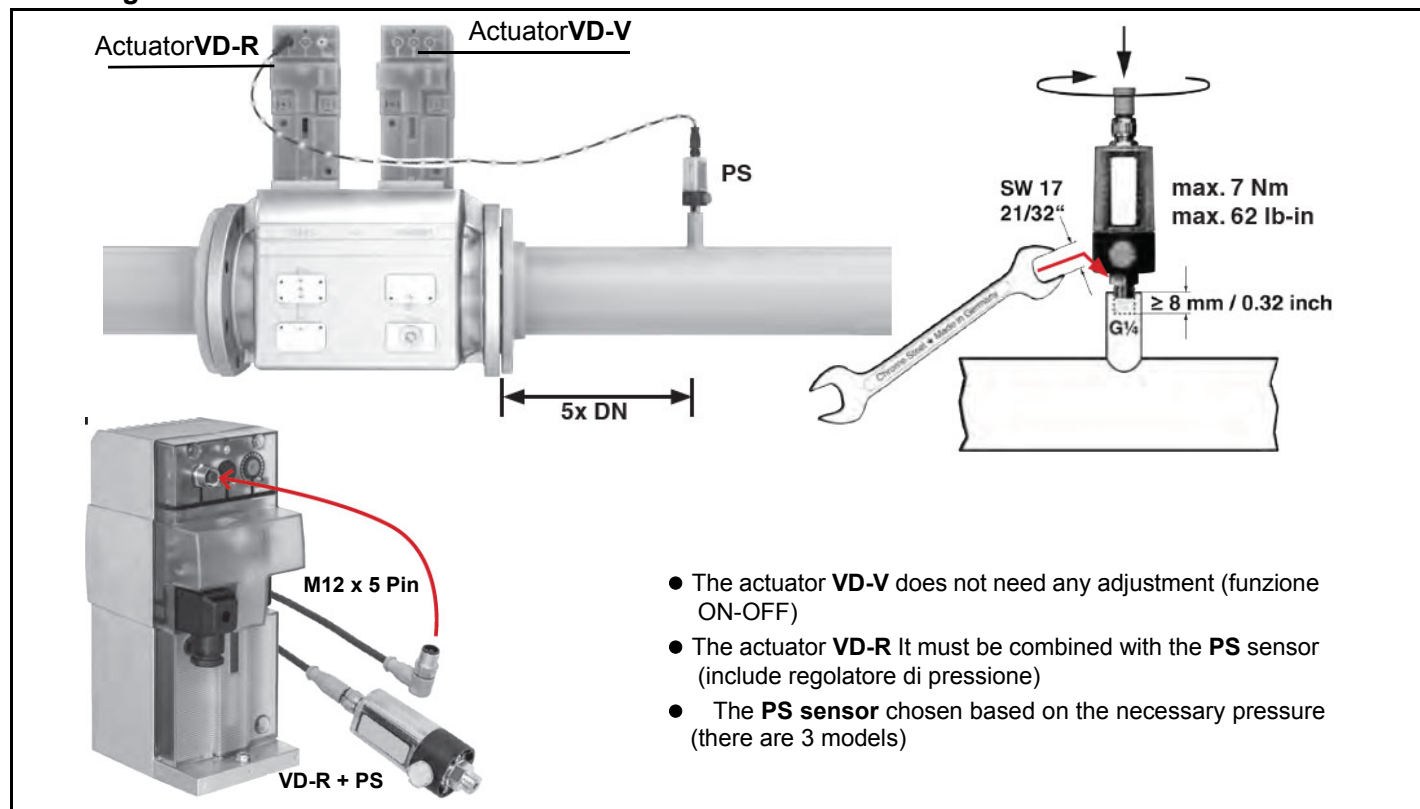
1. Insert studs A.
  2. Insert seals B.
  3. Insert studs C.
  4. Tighten studs in accordance with section 8.
- Ensure correct position of the seal!**
5. Perform leak and functional tests after mounting.
  6. Screws (4xM5x20) for VD assembly are supplied.

1. Mount flange into pipe systems. Use appropriate sealing agent.
2. Insert VB together with supplied O-rings.  
Check current position of O-rings.
3. Tighten supplied screws (8xM8x30) in accordance with section 8.
4. Screws (4xM5x25) for VD assembly are supplied.
5. After installation, perform leakage and functional test.
6. Disassembly in reverse order.

## Mounting position MBE / VB / VD



## Mounting VD-R & PS-...



1. Gas pressure regulation is possible with VD-R and PS pressure sensor only.

**WARNING! For US/CN installation, the output pressure must be monitored by min. and max. pressure switches set to +/- 20% of the setpoint.**

2. Mounting on pipe. Sensor position: 5x DN according to MBE. Pipe fitting with female thread size 1/4, mount sensor with seal, observe torque.
3. The pressure sensor includes a vent limiter according to UL 353 and ANSI Z21.18/CSA 6.3. No venting required in locations where vent limiters are accepted by the jurisdiction.
4. Only PS pressure sensors specified by DUNGS are authorised to be connected to the VD-R's M12 interface.
5. Only PS cables specified by DUNGS are authorised to be used to connect the PS to the VD-R. Max. cable length 3 m.

## Siemens VGD20.. e VGD40..

Siemens VGD20.. and VGD40.. gas valves - with SKP2.. (pressure governor)

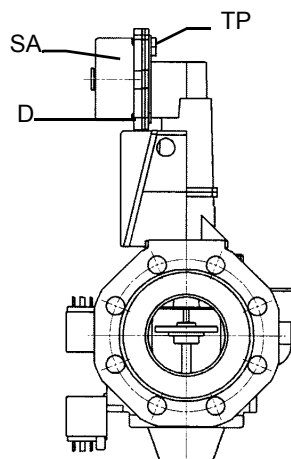
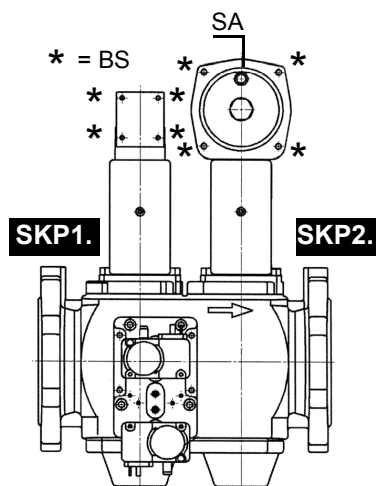
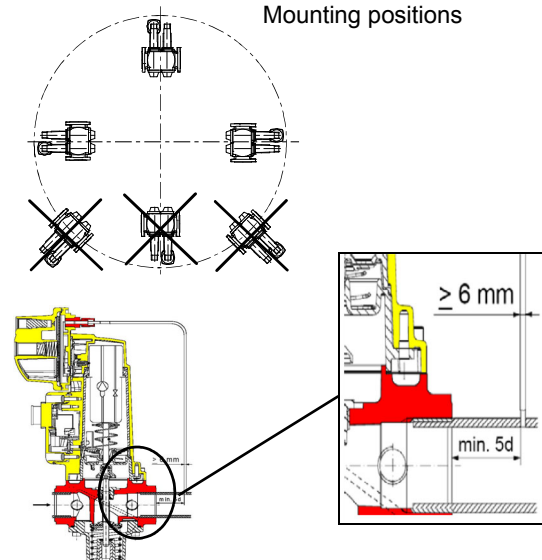
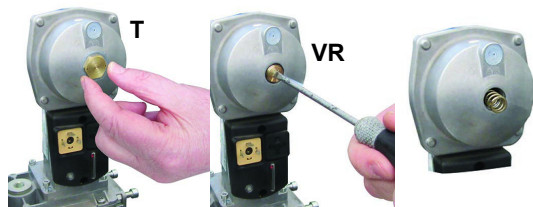
- Connect the reference gas pipe (**TP** in figure; 8mm-external size pipe supplied loose), to the gas pressure nipples placed on the gas pipe, downstream the gas valves: gas pressure must be measured at a distance that must be at least 5 times the pipe size.
- Leave the blowhole free (**SA** in figure). Should the spring fitted not permit satisfactory regulation, ask one of our service centres for a suitable replacement.



**Caution: the SKP2 diaphragm D must be vertical**



**WARNING: removing the four screws BS causes the device to be unserviceable!**

SIEMENS VGD..  
Mounting positions**version with SKP2 (built-in pressure stabilizer)****Siemens VGD valves with SKP actuator:**

The pressure adjusting range, upstream the gas valves group, changes according to the spring provided with the valve group.

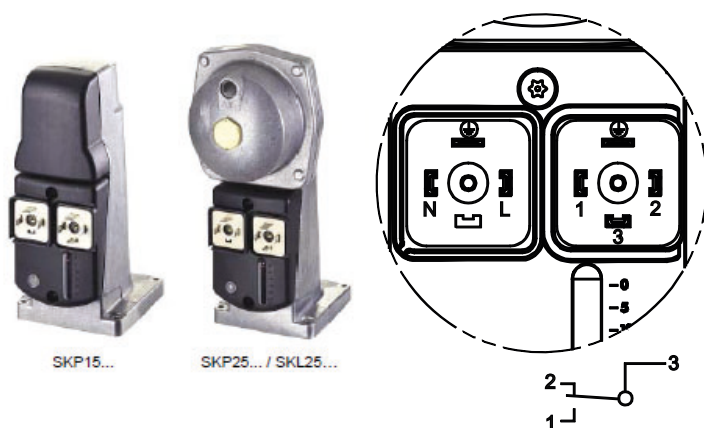
To replace the spring supplied with the valve group, proceed as follows:

- Remove the cap (T)
  - Unscrew the adjusting screw (VR) with a screwdriver
  - Replace the spring
- Stick the adhesive label for spring identification on the type plate.

Performance range (mbar)			
	neutral	yellow	red
Spring colour SKP 25.0	0 ÷ 22	15 ÷ 120	100 ÷ 250
Spring colour SKP 25.4		7 ÷ 700	150 ÷ 1500

**Siemens VGD SKPx5 (Auxiliary-optional micro switch)**

Actuator connection

Valve drive  
Plug connectionEnd of stroke  
Plug connection

(solo con SKPxx.xx1xx)

**Gas valveGas Filter (if provided)**

The gas filters remove the dust particles that are present in the gas, and prevent the elements at risk (e.g.: burner valves, counters and regulators) from becoming rapidly blocked. The filter is normally installed upstream from all the control and on-off devices.



**ATTENTION:** it is recommended to install the filter with gas flow parallel to the floor in order to prevent dust fall on the safety valve during maintenance operation.

Once the train is installed, connect the gas valves group and pressure switches plugs.

## ELECTRICAL CONNECTIONS



**WARNING:** (only for double stage and progressive burners) The burner is provided with an electrical bridge between terminals 6 and 7; when connecting the high/low flame thermostat, remove this bridge before connecting the thermostat.



**Any cable connection or hook-up to the grid must be carried out by qualified, informed and trained personnel, directly coordinated and authorized by Technical Service. Always check in advance that the system electrical interlock is fitted with a safety circuit breaker.**



**WARNING! It is forbidden to use the fuel pipes for the execution and/or completion of the grounding**



- The system must comply with the current regulations.
- Earth the system; always check in advance the connection, functionality and compliance with the health and safety principles of the earth cable. If in doubt, ask for an accurate inspection by qualified technical engineers.
- Check the connection to the grounding system.
- Do not use any extraneous conductive parts (i.e. fuel feeding pipes, metal structures ...) to connect the burner to ground.
- In connecting the supply wires to the burner MA terminal strip, ensure that the earth wire is longer than the phase and neutral wires.
- Careful not to invert the phase and neutral connections
- Fit the burner power line with an omnipolar disconnecter and differential switch, a thermo-magnetic circuit breaker or fuses.
- Supply the burner with a flame retardant cable with a section suitable to the installed power (see electrical diagram enclosed), paying attention to the voltage values printed on the burner plate.
- Always check in advance the protection from overcurrents and electromagnetic interference of the power supply. If these and other values do not match the threshold data stated by the manufacturer, isolate the burner from all power sources and contact the Authorized Technical Service urgently.
- Check that the voltage of the system and burner motors match the voltage of the power grid (+/- 10%).
- Ensure the IP protection rating is consistent with the installation place and environment characteristics
- Before carrying out any operation on the machine electrical panel, open the system omnipolar disconnecter and move the switch on the burner panel to OFF.

In any case:

- use suitably protected and safe burner/boiler supply and tracking cables;
- avoid using extensions, adaptors or multiple sockets.

For further information, refer to the electrical diagram.

Follow the electrical diagrams attached to the manual for the connections to the terminal strip.

The electrical panel is supplied complete with a terminal strip for the connection to the system electrical line and, in case of on board control panel, a plug for the connection to the modulation probe (if any).

### Rotation of electric motor

Once the electrical connection of the burner is executed, remember to check the rotation of the electrical motor (pump motor if any, and fan motor) . The motor should rotate according to the "arrow" symbol on the body. In the event of wrong rotation, reverse the three-phase supply and check again the rotation of the motor.



**ATTENTION:** check the calibration of the thermal relay sensor (+5% ÷ +10% rated value).



**DANGER! Incorrect motor rotation can seriously damage property and injure people.**

**NOTE:** the burners are supplied for three-phase 380 V or 400 V supply, and in the case of three-phase 220 V or 230 V supply it is necessary to modify the electrical connections into the terminal box of the electric motor and replace the overload tripped relay.



### Note on electrical supply

If the power supply to the burner is 230V three-phase or 230V phase-phase (without a neutral), with the Siemens control box, between the terminal 2 (terminal X3-04-4 in case of LMV2x, LMV3x, LMV5x, LME7x) on the board and the earth terminal, an RC Siemens RC466890660 filter must be inserted.

#### Key

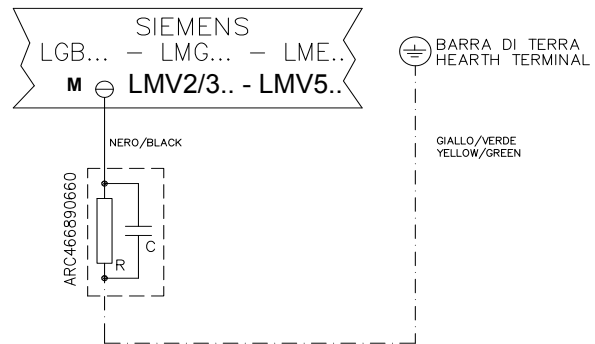
C - Capacitor (22nF/250V)

LME / LMV - Siemens control box

R - Resistor (1MΩ)

M - Terminal 2 (LGB,LMC,LME), terminal X3-04-4 ( LMV2x, LMV3x, LMV5, LME7x)

RC466890660 - RC Siemens filter



For LMV5 control box, please refer to the labeling recommendations available on the Siemens CD attached to the burner

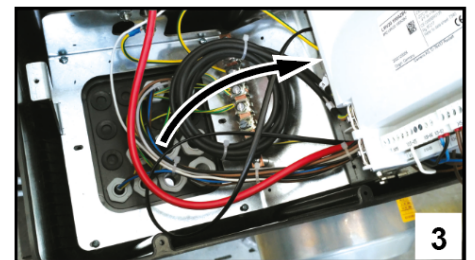
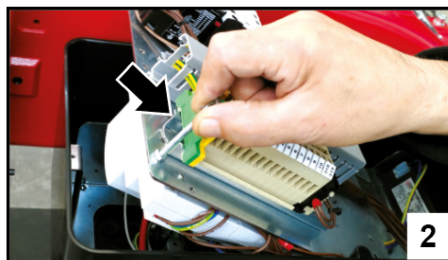
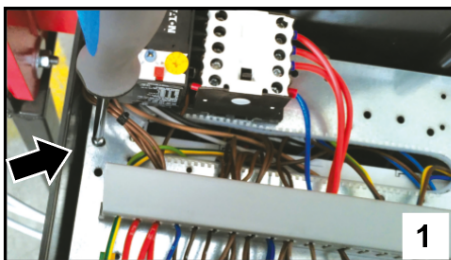
### Configuration with separate electrical panel (optional)

The length of the electrical cables must comply with the provisions in the technical sheets of the equipment or the advice the company gives at the time of the offer/contract.

Provide sufficient protections for cables and connectors, taking into consideration positioning spaces and the panel-burner tracing surfaces. Always consult beforehand the electrical drawings supplied in relationship to the topography of the feeding systems.

### Procedure for accessing the equipment and making electrical connections

- 1 Unscrew the screw as shown in Fig. 1
- 2 Lift the plate using the screws as shown in Fig. 2
- 3 Make the electrical connections



## PART III: OPERATION



**DANGER!** Incorrect motor rotation can seriously damage property and injure people. **WARNING:** before starting the burner up, be sure that the manual cutoff valves are open and check that the pressure upstream the gas train complies the value quoted on paragraph "Technical specifications". Be sure that the mains switch is closed.

**DANGER:** During commissioning operations, do not let the burner operate with insufficient air flow (danger of formation of carbon monoxide); if this should happen, make the gas decrease slowly until the normal combustion values are achieved. **WARNING:** never loose the sealed screws! otherwise, the device warranty will be immediately invalidate!

## LIMITATIONS OF USE

THE BURNER IS AN APPLIANCE DESIGNED AND CONSTRUCTED TO OPERATE ONLY AFTER BEING CORRECTLY CONNECTED TO A HEAT GENERATOR (E.G. BOILER, HOT AIR GENERATOR, FURNACE, ETC.), ANY OTHER USE IS TO BE CONSIDERED IMPROPER AND THEREFORE DANGEROUS.

THE USER MUST GUARANTEE THE CORRECT FITTING OF THE APPLIANCE, ENTRUSTING THE INSTALLATION OF IT TO QUALIFIED PERSONNEL AND HAVING THE FIRST COMMISSIONING OF IT CARRIED OUT BY A SERVICE CENTRE AUTHORIZED BY THE COMPANY MANUFACTURING THE BURNER.

A FUNDAMENTAL FACTOR IN THIS RESPECT IS THE ELECTRICAL CONNECTION TO THE GENERATOR'S CONTROL AND SAFETY UNITS (CONTROL THERMOSTAT, SAFETY, ETC.) WHICH GUARANTEES CORRECT AND SAFE FUNCTIONING OF THE BURNER.

THEREFORE, ANY OPERATION OF THE APPLIANCE MUST BE PREVENTED WHICH DEPARTS FROM THE INSTALLATION OPERATIONS OR WHICH HAPPENS AFTER TOTAL OR PARTIAL TAMPERING WITH THESE (E.G. DISCONNECTION, EVEN PARTIAL, OF THE ELECTRICAL LEADS, OPENING THE GENERATOR DOOR, DISMANTLING OF PART OF THE BURNER).

NEVER OPEN OR DISMANTLE ANY COMPONENT OF THE MACHINE EXCEPT FOR ITS MAINTENANCE.

TO SECURE THE MACHINE, ACT ON THE ISOLATOR SWITCH. IN CASE OF ANOMALIES THAT REQUIRED A SHUT DOWN OF THE BURNER, IT'S POSSIBLE TO ACT ON THE AUXILIARY LINE SWITCH, LOCATED ON THE BURNER FRONT PANEL.

IN CASE OF A BURNER SHUT-DOWN, RESET THE CONTROL BOX BY MEANS OF THE RESET PUSHBUTTON. IF A SECOND SHUT-DOWN TAKES PLACE, CALL THE TECHNICAL SERVICE, WITHOUT TRYING TO RESET FURTHER.

**WARNING:** DURING NORMAL OPERATION THE PARTS OF THE BURNER NEAREST TO THE GENERATOR (COUPLING FLANGE) CAN BECOME VERY HOT, AVOID TOUCHING THEM SO AS NOT TO GET BURNT.

## Gas operation

- Turn to the ON position the mains switch S1 on the burner front panel.
- Check the flame control box is not in the lockout position (light B1 on), if necessary reset it by means of the pushbutton S2 (reset);
- Check that the control thermostats or pressure switches enable the burner to operate.
- Check the gas supply pressure is sufficient (light G3 on), if necessary, adjust the pressure switches.

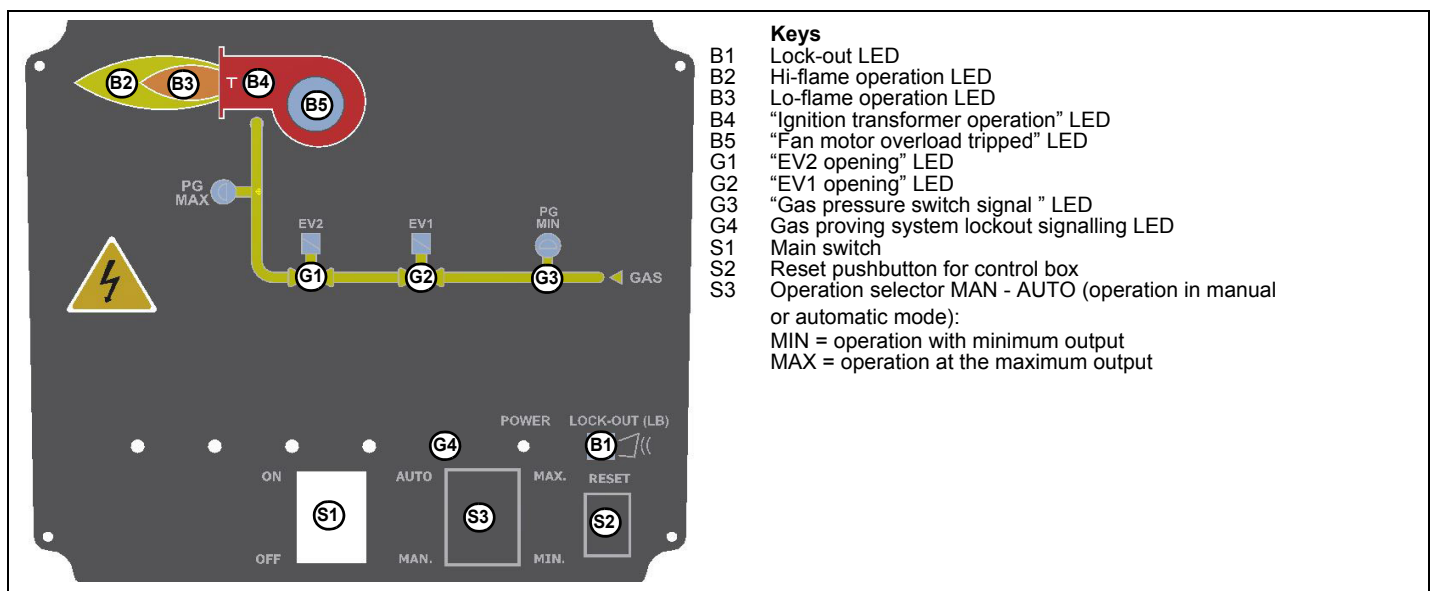
**Only burners provided with the gas proving system:** the check cycle of the gas proving system starts; the end of this check is signalled by the light of the lamp on the device. When the valves check is finished, the startup cycle of the burner begins. In the case of a leak in a valve, the gas proving system locks and the lamp G4 lights. To reset the device press the device pushbutton.

- The startup cycle begins, the actuator drives the air damper to the maximum opening position, the fan motor starts and the pre-purge phase begins. During the pre-purge phase, the complete opening of the air damper is signalled by the lamp B2 on the frontal panel of the electrical board.
- At the end of the pre-purge phase, the air damper goes to the ignition position, the ignition transformer turns on (signalled by the lamp B4) and few seconds later the solenoid valves EV1 and EV2 are energized (lights G1 and G2 on the front panel).
- Few seconds after the opening of the valves, the ignition transformer turns off and the lamp B4 turns off subsequently:

**Double-stage burners:** the burner is on in low flame stage (light G is on); some seconds later, the high flame operation begins and the burner switches automatically to high flame (light B2 is on) or remains in low flame operation, according to the plant requests.

**Progressive and fully modulating burners** - few seconds after the gas valve opening, the ignition transformer is de-energized. The burner is in low flame operation and some seconds later, the two-stages operation begins; the burner increases or decreases its output, directly driven by the external thermostat (progressive version) or by the modulator (fully modulating burners only).

Fig. 4 - Burner front panel



## ADJUSTING AIR AND GAS FLOW RATES



**WARNING!** During commissioning operations, do not let the burner operate with insufficient air flow (danger of formation of carbon monoxide); if this should happen, make the fuel decrease slowly until the normal combustion values are achieved.

**WARNING!** the combustion air excess must be adjusted according to the values in the following chart.

Recommended combustion parameters		
Fuel	Recommended (%) CO <sub>2</sub>	Recommended (%) O <sub>2</sub>
Natural gas	9 ÷ 10	3 ÷ 4,8
LPG	11 ÷ 12	2,8 ÷ 4,3

### Adjustments - brief description

Adjust the air and gas flow rates at the maximum output ("high flame") first, by means of the air damper and the adjusting cam respectively.

- Check that the combustion parameters are in the suggested limits.
- Check the flow rate measuring it on the counter or, if it was not possible, verifying the combustion head pressure by means of a differential pressure gauge.
- Then, adjust the combustion values corresponding to the points between maximum and minimum: set the shape of the adjusting cam foil. The adjusting cam sets the air/gas ratio in those points, regulating the opening-closing of the throttle gas valve.
- Set, now, the low flame output, acting on the low flame microswitch of the actuator in order to avoid the low flame output increasing too much or that the flues temperature gets too low to cause condensation in the chimney.

### (First) Start-up preliminary operations - gas supply

Recommended actions to be carried out in sequence:

- 1 Check the burner and all its components are installed correctly
- 2 Check that all electrical and mechanical parts are connected correctly
- 3 Check that there is water or other vector fluids in the generator
- 4 Check that the ventilation gates/dampers in the plant are open and the stack is free
- 5 Connect the gauges used to adjust and check pressures on the incoming line and on the head, air and fuel side.
- 6 Open the thermostatic series and the safety chain
- 7 Turn the main switch on the panel front with the "MAN/AUTO" selector to position "0".
- 8 Select the GAS mode with the fuel selector on the front of the panel (if any)
- 9 Check the phase and neutral position is correct
- 10 Open the manual shut-off valves slowly, in order to prevent any water hammers that might seriously damage valves and pressure regulator
- 11 Check the sense of rotation of the electrical motors
- 12 Bleed the line, getting rid of all the air in the pipe as far as the main gas valve
- 13 Ensure the pressure entering the main valves is not excessive due to damage to or wrong adjustment of the line pressure regulator
- 14 Ensure the gas supply minimum pressure is at least equal to the pressure required by the pressure curves - burnt gas flow



**DANGER!** Venting the air from the piping must take place in safe conditions, avoiding dangerous concentrations of fuel in the rooms. You must therefore ventilate the rooms and wait long enough for the gases to dissipate outside before switching on.



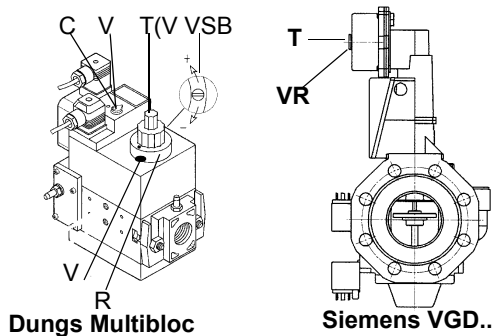
To ensure the proper operation of the flow sensors, the fuel/air pipes must be free of liquid residues such as oil or water. Also, make sure that the silencer is installed on the air intake.



To ensure the proper operation of the flow sensors, the fuel/air pipes must be free of liquid residues such as oil or water. Also, make sure that the silencer is installed on the air intake.

## Adjusting procedure

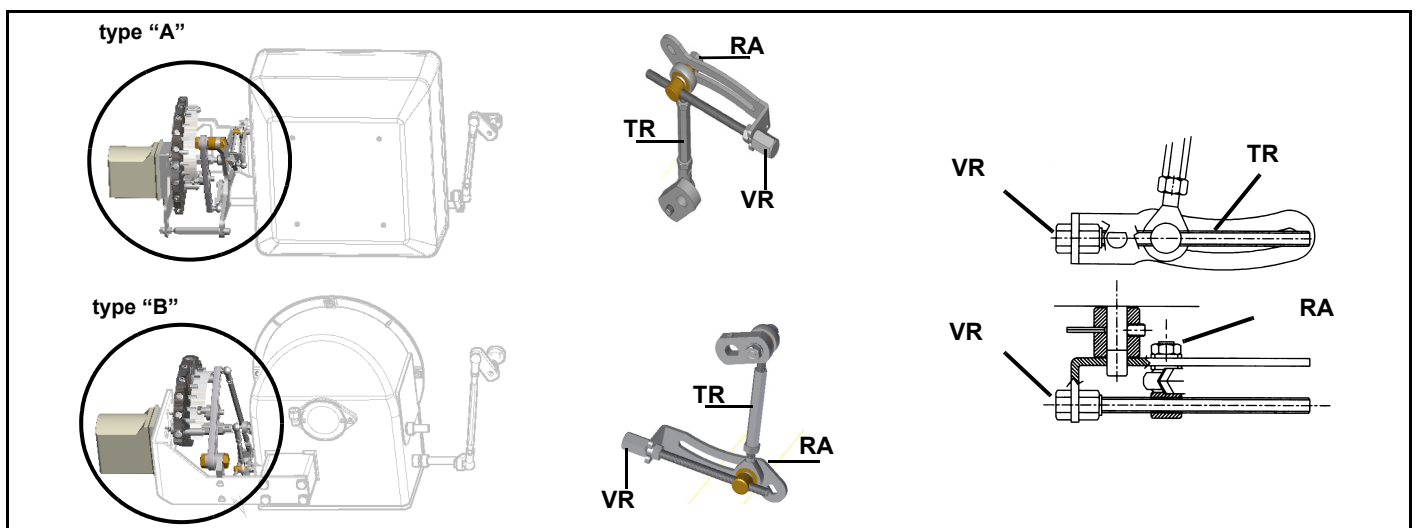
- 1 Turn the burner on by means of its main switch **A**: if the burner locks (LED **B** on in the control panel) press the RESET button (**C**) on the control panel. See chapter "Operation" for further details.
- 2 check the fan motor rotation;
- 3 Start the burner up by means of the thermostat series and wait until the pre-purge phase comes to end and that burner starts up;
- 4 the burner starts up in the low flame stage: drive the burner to high flame stage, by means of the "high/low flame" thermostat **TAB**.
- 5 adjust the burner combustion values in the high flame stage as described in the following steps.
- 6 go on adjusting air and gas flow rates: check, continuously, the flue gas analysis, as to avoid combustion with little air; dose the air according to the gas flow rate change following the steps quoted below;
- 7 acting on the pressure governor of the valves group, adjust the **gas flow rate in the high flame stage** as to meet the values requested by the boiler/utilisation:
  - **Multibloc MB-DLE**: the valve is adjusted by means of the **RP** regulator after slackening the locking screw **VB** by a number of turns. By unscrewing the regulator **RP** the valve opens, screwing the valve closes. The pressure stabilizer is adjusted by operating the screw **VS** located under the cover **C**. By screwing down the pressure is increased and by unscrewing it is reduced. **Note**: the screw **VSB** must be removed only in case of replacement of the coil.
  - **Siemens VGD valves group**: remove cap **T** and act on the **VR** adjusting screw to increase or decrease the pressure and consequently the gas rate; screwing **VR** the rate increases, unscrewing it decreases (see next figure).



**!** Pressure governor is factory-set. The setting values must be locally adapted to machine conditions. Important! Follow the instructions carefully!

- 8 To adjust the **air flow rate in the high flame stage**, loose the **RA** nut and screw **VRA** as to get the desired air flow rate: moving the rod **T** towards the air damper shaft, the air damper opens and consequently the air flow rate increases, moving it far from the shaft the air damper closes and the air flow rate decreases.

**Note**: once the procedure is performed, be sure that the blocking nut **RA** is fasten.



Go on adjusting the burner according to the model (double-stage, progressive, fully-modulating).

## Double-stage burners

- drive the burner to the low flame stage by means of the **TAB** thermostat;
- To change the gas flow rate in order to get an efficient combustion, slacken the nut **DB** and adjust the opening angle of the gas butterfly valve by rotating the screw **TG** (clockwise rotation increases gas flow, anticlockwise rotation decreases it). The slot on the butterfly valve shaft shows the opening degree of the valve regarding the horizontal axis. **Don't act on DE nuts.**

**NOTE**: At the end of settings, make sure the locking screws **RA** and **DB** are fully tightened.



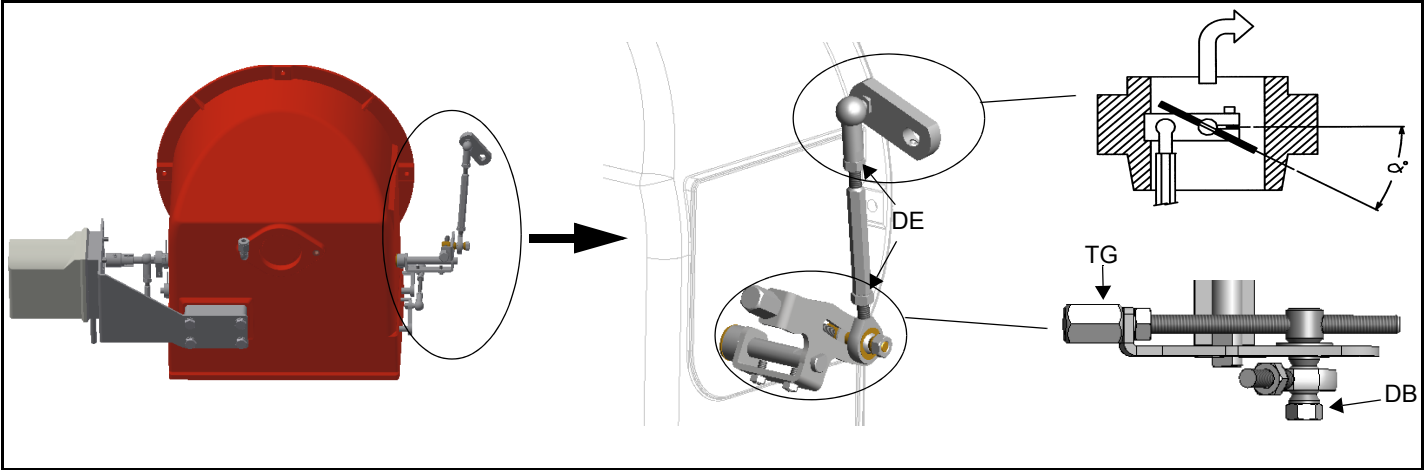
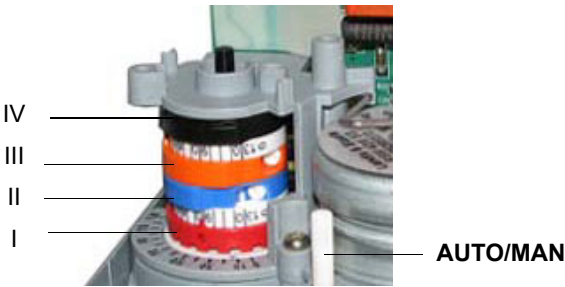
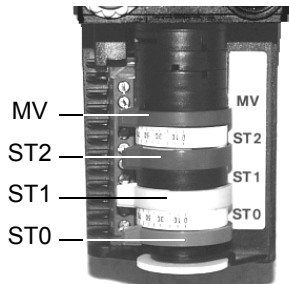


Fig. 5

- Now adjust the pressure switches.
- If it is necessary to change the burner output in the low flame stage, move the low flame cam: the low flame position matches the ignition position. As far as burners fitted with Dungs MBC gas valves, the low flame cam does not match the ignition cam position, that is why it must be set at about 30° more than the ignition cam.
- Turn the burner off and then start it up again. If the adjustment is not correct, repeat the previous steps.

Berger STA6 B 3.41 (high-low flame burners)

Siemens SQN72.2A4Axx (high-low flame burners)



For DUNGS MB-DLE / Siemens VGD gas valves	Actuator camsBerger STA	Siemens SQN72
High flame position (set to 90°)	ST2	I (red)
Low flame and ignition position	ST1	III (orange)
Stand-by position (set to 0°)	ST0	II (blue)
Not used	MV	IV (black)

Berger STA12: a key is provided to move the cams.

Siemens SQN72: a key is provided to move cams I and IV, the other cams can be moved by means of screws.

On the BERGER STA12B3.41 actuator, the manual air damper control is not provided. On the Siemens actuator the AUTO/MAN mode is provided (see picture).

## Progressive burners

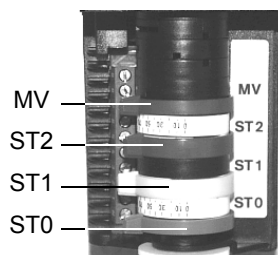
Once the procedure till step 8 described is accomplished, go on as follows:

9 set the low flame cam matching the high flame cam;

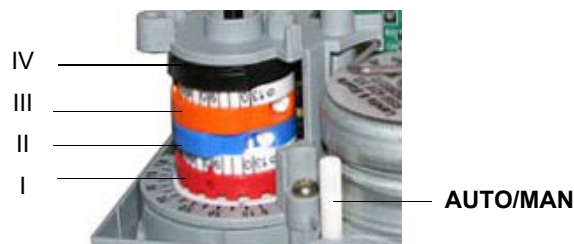
10 set the **TAB** thermostat to the minimum in order that the actuator moves progressively towards the low flame position;

The manual air damper control is not provided on these actuators. The adjustments must be carried out acting manually on the cams.

Berger STA12B3.41 (progressive and fully modulating burners)



Siemens SQN72.4A4Axx (progressive and fully modulating burners)

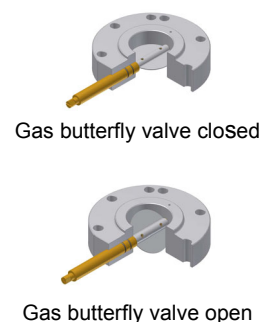
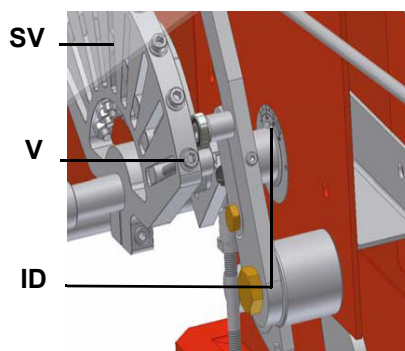
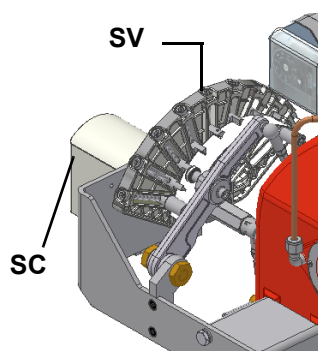


For DUNGS MB-DLE / Siemens VGD gas valves	Actuator camsBerger STA	Siemens SQN72
High flame position (set to 90°)	ST2	I (red)
Low flame and ignition position	ST1	III (orange)
Stand-by position (set to 0°)	ST0	II (blue)
Not used	MV	IV (black)

11 move the low flame cam to the minimum to move the actuator towards the low flame until the two bearings find the adjusting screw that refers to the lower position: screw **V** to increase the rate, unscrew to decrease.

12 Move again the low flame cam towards the minimum to meet the next screw on the adjusting cam and repeat the previous step; go on this way as to reach the desired low flame point.

13 Now adjust the pressure switches.



14 If it is necessary to change the burner output in the low flame stage, move the low flame cam: the low flame position matches the ignition position. As far as burners fitted with Dungs MBC gas valves, the low flame cam does not match the ignition cam position, that is why it must be set at about 30° more than the ignition cam.

15 Turn the burner off and then start it up again. If the adjustment is not correct, repeat the previous steps.

## Fully-modulating burners

To adjust the fully-modulating burners, use the **CMF** switch on the burner control panel (see next picture), instead of the **TAB** thermostat as described on the previous paragraphs about the progressive burners. Go on adjusting the burner as described before, paying attention to use the CMF switch instead of **TAB**.

The **CMF** position sets the operating stages: to drive the burner to the high-flame stage, set CMF=1; to drive it to the low-flame stage, set CMF=2.



CMF

CMF = 0 stop at the current position

CMF = 1 high flame operation

CMF = 2 low flame operation

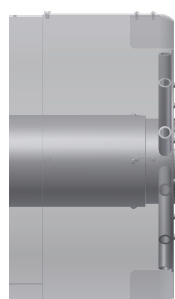
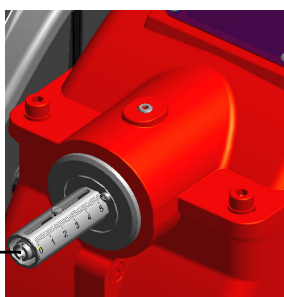
CMF = 3 automatic operation

## Adjusting the combustion head

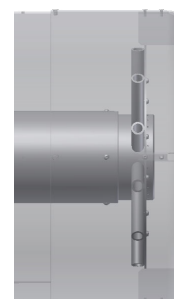
### Head adjusting

The combustion head position affects the flame stability. The diffuser position must be set during the commissioning according to the regulation needs. The diffuser position is factory set as shown in figure "A" ( $x = 10$  mm). If different settings are required, it is possible to change the position: loosen the VB screw and slightly move the combustion head backwards, turning clockwise the knob VRT. Fasten VB screw when the adjustment is accomplished.

VRT

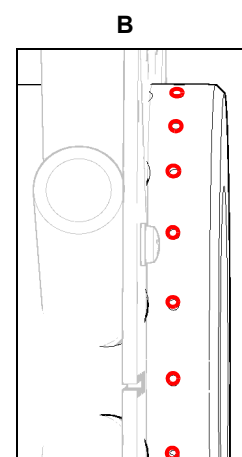
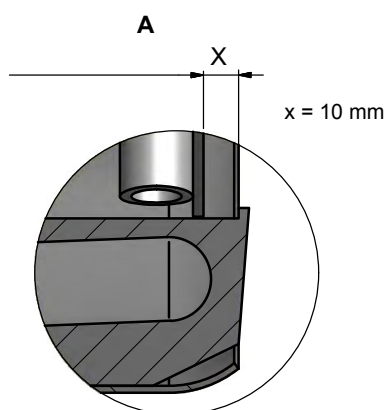
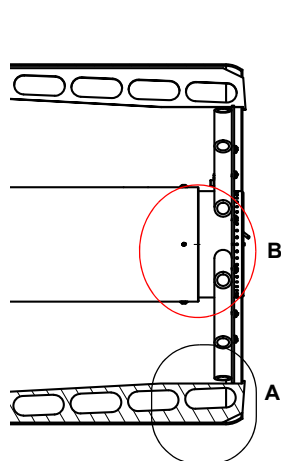


"all-ahead" position



"all-backwards" head position

Depending on the boiler application, it is possible to act on the holes (figure B) to improve the flame stability and NOx, CO emission values. If necessary, close/open the holes in figure "B" using the screws kit given with the burner.



**CAUTION:** perform these adjustments once the burner is turned off and cooled.



**Attention!** if it is necessary to change the head position, repeat the air and fuel adjustments described above.

## Adjusting the gas valves group

### Multibloc MB-DLE

The multibloc unit is a compact unit consisting of two valves, gas pressure switch, pressure stabilizer and gas filter.

The valve is adjusted by means of the **RP** regulator after slackening the locking screw **VB** by a number of turns. By unscrewing the regulator **RP** the valve opens, screwing the valve closes. To set the fast opening remove cover **T**, reverse it upside down and use it as a tool to rotate screw **VR**. Clockwise rotation reduces start flow rate, anticlockwise rotation increases it.

Do not use a screwdriver on the screw **VR**!

The pressure stabilizer is adjusted by operating the screw **VS** located under the cover **C**. By screwing down the pressure is increased and by unscrewing it is reduced.

Note: the screw **VSB** must be removed only in case of replacement of the coil.

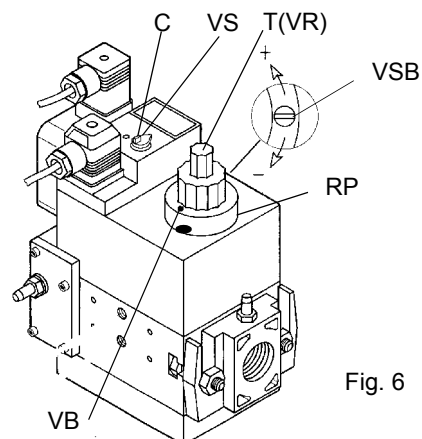


Fig. 6

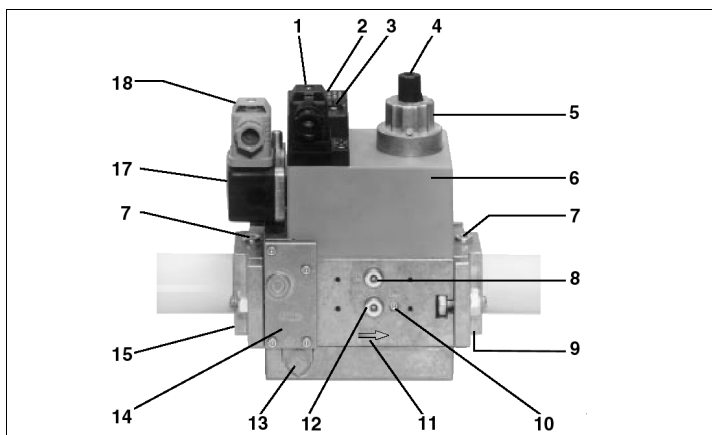


Fig. 7

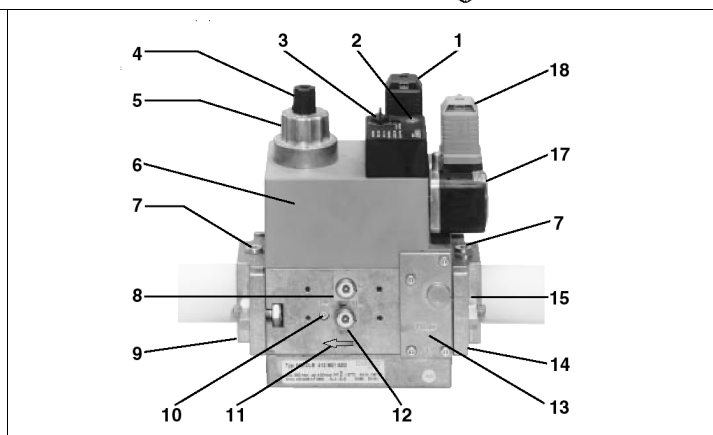


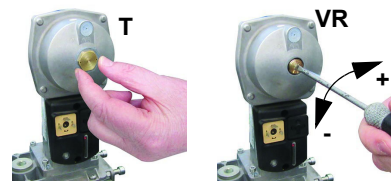
Fig. 8

#### Key

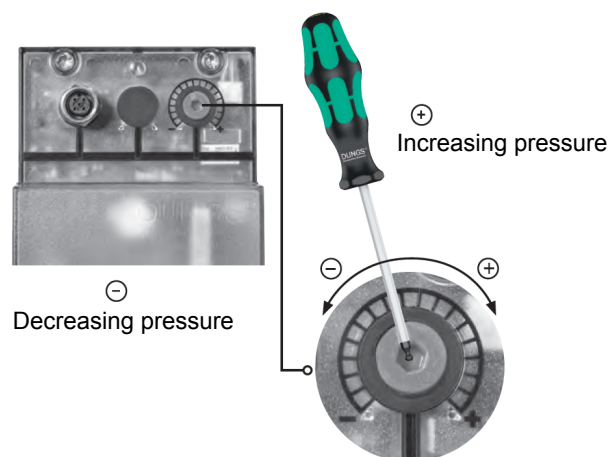
- |  |   |
|--|---|
| 1 Electrical connection for valves                                 | 9 Output flange   |
| 2 Operation display (optional)                                     | 10 Test point connection M4 downstream of valve 2             |
| 3 Pressure governor closing tap                                    | 11 Gas flow direction   |
| 4 Start setting cap  | 12 Test connection G 1/8 downstream of valve 1, on both sides |
| 5 Hydraulic brake and rate regulator                               | 13 Vent nozzle pressure regulator                             |
| 6 Coil   | 14 Filter (below cover)                                       |
| 7 Test point connection G 1/8                                      | 15 Input flange   |
| 8 Test point connection G 1/8 downstream of valve 1, on both sides | 17 Pressure switch  |
|  | 18 Pressure switch electric connection                        |

### Gas valveversion with SKP2 (built-in pressure stabilizer)

To increase or decrease gas pressure, and therefore gas flow rate, remove the cap **T** and use a screwdriver to adjust the regulating screw **VR**. Turn clockwise to increase the flow rate, counterclockwise to reduce it.



## MultiBloc MBE Regulation VD-R whith PS



**Setting scale is „Not“ linear! Various sensors available. Output pressure according to sensor's measuring range.**



**Adjust the outlet pressure to the value specified by the burner or equipment manufacturer!**



**While making outlet pressure adjustments, do not exceed a value that creates a hazardous condition to the burner!**

Fig. 9

**ATTENTION:** To set the outlet pressure of the VD-R regulator, act on the adjustment ring nut (Fig. 10)

The position of the indicator in the dial indicates the value of the outlet pressure calculated as a percentage of the full scale of the PS sensor (Fig. 11)

Outlet pressure	MIN	10%	25%	50%	75%	MAX
<b>PS-10/40</b>	4 mbar 0,4 kPa 2 "w.c.	10 mbar 1,0 kPa 4 "w.c.	25 mbar 2,5 kPa 10 "w.c.	50 mbar 5,0 kPa 20 "w.c.	75 mbar 7,5 kPa 30 "w.c.	100 mbar 10,0 kPa 40 "w.c.
<b>PS-50/200</b>	20 mbar 2,0 kPa 8 "w.c.	50 mbar 5,0 kPa 20 "w.c.	125 mbar 12,5 kPa 50 "w.c.	250 mbar 25,0 kPa 100 "w.c.	375 mbar 37,5 kPa 150 "w.c.	500 mbar 50,0 kPa 200 "w.c.

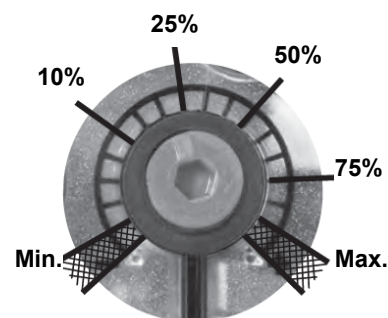


Fig. 10

Adjusting output pressure for positive pressure systems (requires PS-10/40 or PS-50/200):

## Pressure taps MultiBloc MBE

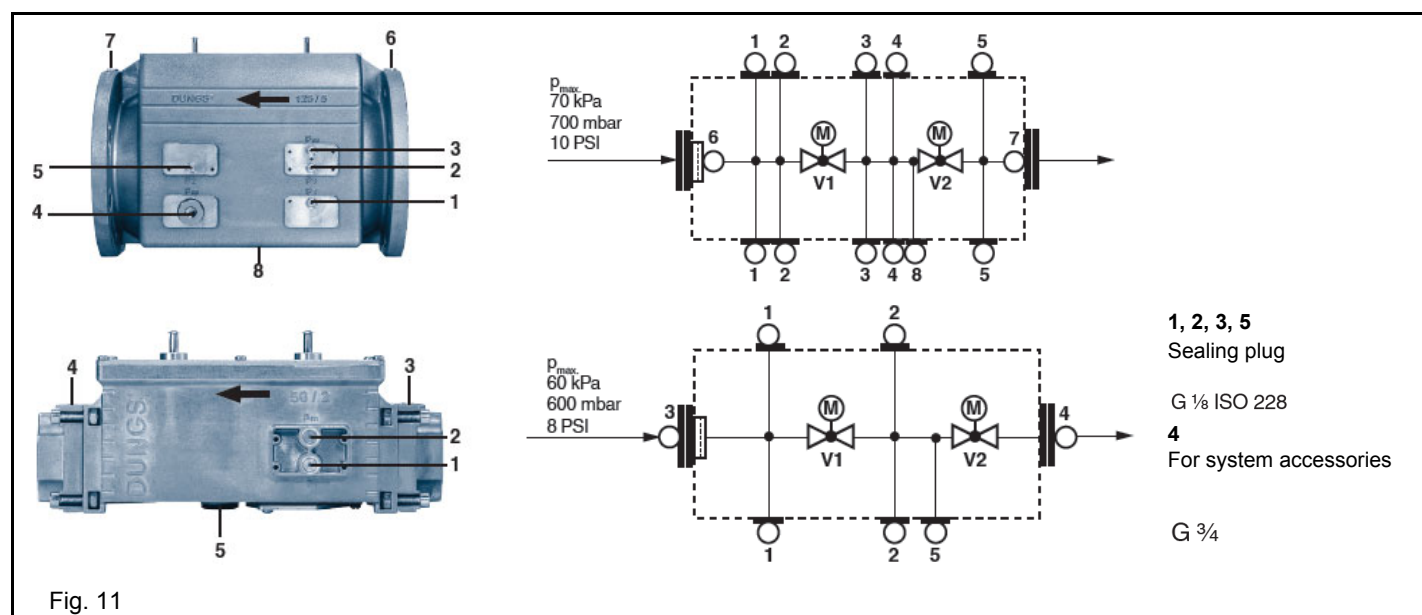


Fig. 11

### Calibration air and gas pressure switches

The **air pressure switch** locks the control box if the air pressure is not the one requested. If it happens, unlock the burner by means of the control box unlock pushbutton, placed on the burner control panel.

The **gas pressure switches** check the pressure to avoid the burner operate when the pressure value is not in the requested pressure range.



### Calibration the maximum gas pressure switch (when provided)

To calibrate the maximum pressure switch, proceed as follows according to its mounting position:

- remove the pressure switch plastic cover;
- if the maximum pressure switch is mounted upstream the gas valves: measure the gas pressure in the network, when flame is off; by means of the adjusting ring nut **VR**, set the value read, increased by the 30%.
- if the maximum pressure switch is mounted downstream the “gas governor-gas valves” group and upstream the butterfly valve: light the burner, adjust it according to the procedure in the previous paragraph. Then, measure the gas pressure at the operating flow rate, downstream the “gas governor-gas valves” group and upstream the butterfly valve; by means of the adjusting ring nut **VR**, set the value read on step 2, increased by the 30%;
- replace the plastic cover.

### Calibration of air pressure switch

To calibrate the air pressure switch, proceed as follows:

- Remove the transparent plastic cap.
- Once air and fuel setting have been accomplished, startup the burner.
- During the pre-purge phase of the operation, turn slowly the adjusting ring nut **VR** in the clockwise direction (to increase the adjusting pressure) until the burner lockout, then read the value on the pressure switch scale and set it to a value reduced by 15%.
- Repeat the ignition cycle of the burner and check it runs properly.
- Refit the transparent plastic cover on the pressure switch.

### Calibration of low gas pressure switch

As for the gas pressure switch calibration, proceed as follows:

- Be sure that the filter is clean.
- Remove the transparent plastic cap.
- While the burner is operating at the maximum output, test the gas pressure on the pressure port of the minimum gas pressure switch.
- Slowly close the manual cutoff valve (placed upstream the pressure switch, see gas train installation diagram), until the detected pressure is reduced by 50%. Pay attention that the CO value in the flue gas does not increase: if the CO values are higher than the limits laid down by law, slowly open the cutoff valve as to get values lower than these limits.
- Check that the burner is operating correctly.
- Clockwise turn the pressure switch adjusting ring nut (as to increase the pressure value) until the burner stops.
- Slowly fully open the manual cutoff valve.
- Refit the transparent plastic cover on the pressure switch.

### Calibration the maximum gas pressure switch (when provided)

To calibrate the maximum pressure switch, proceed as follows according to its mounting position:

- remove the pressure switch plastic cover;
- if the maximum pressure switch is mounted upstream the gas valves: measure the gas pressure in the network, when flame is off; by means of the adjusting ring nut **VR**, set the value read, increased by the 30%.
- if the maximum pressure switch is mounted downstream the “gas governor-gas valves” group and upstream the butterfly valve: light the burner, adjust it according to the procedure in the previous paragraph. Then, measure the gas pressure at the operating flow rate, downstream the “gas governor-gas valves” group and upstream the butterfly valve; by means of the adjusting ring nut **VR**, set the value read on step 2, increased by the 30%;
- replace the plastic cover.



## PART IV: MAINTENANCE

At least once a year carry out the maintenance operations listed below. In the case of seasonal servicing, it is recommended to carry out the maintenance at the end of each heating season; in the case of continuous operation the maintenance is carried out every 6 months.

### ROUTINE MAINTENANCE

- Check that the gas meter is not moving when the burner is off. In case it is rotating, look for possible leaks.
- Check the cleaning condition of the vent. Clean the vent by using exclusively a dry brush. If needed, disassemble it from the motor's shaft and wash it by using non corrosive detergents. Prior to disassemble the vent, take the measurements in relation to the motor's shaft, so as to reassemble it in the same position.
- Check that all parts in contact with combustive air (air box, protection mesh and Archimedean screw) are clean and free from any obstruction that might impede free afflux. Clean it with compressed air if available and/or a dry brush or cloths. Eventually wash it with non corrosive detergents.
- Check the blast tube; it must be substituted in case of obvious cracks or anomalous holes. Slight deformations that do not affect combustion may be tolerated
- Check the condition of the burner-boiler gasket. Eventually substitute it.
- Check the fan's motor: no specific maintenance is needed. In case of anomalous noises when running, check the condition of the bearings and eventually substitute them or completely substitute the motor.
- Clean and examine the gas filter cartridge and replace it if necessary;
- Remove and clean the combustion head;
- Examine and clean the ignition electrodes, adjust and replace them if necessary;
- Examine and clean the detection electrode/photoelement (according to the burner models), replace it if necessary, in case of doubt, check the detection circuit, after the burner start-up;
- Clean and grease leverages and rotating parts.
- At least every 2 months, or more often if needed, clean the room where the burner is installed.
- Avoid leaving installations, papers, nylon bags, etc., inside the room. They could be sucked by the burner and cause malfunctioning.
- Check that the room's vents are free from obstructions.



**ATTENTION** when servicing, if it was necessary to disassemble the gas train parts, remember to execute the gas proving test, once the gas train is reassembled, according to the procedure imposed by the law in force.

The replacement, adjustment and assembly of groups and/or components must be performed in the spaces provided during the installation phase and correct aeration of the rooms. Any operation must be carried out by qualified, trained and informed personnel, in compliance with the Manufacturer's instructions and the regulations in force. For anything not expressly mentioned in this chapter, contact the Manufacturer. The use of non original spare parts, any modification or even slight tampering, void the Warranty and release the Manufacturer from any responsibility regarding the functionality of the system the burner has been installed in, and the safety of people and/or property.



**ATTENTION:** Read carefully the "warnings" chapter at the beginning of this manual.

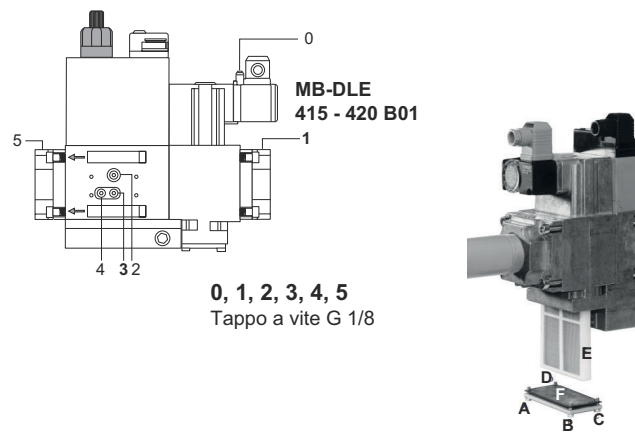
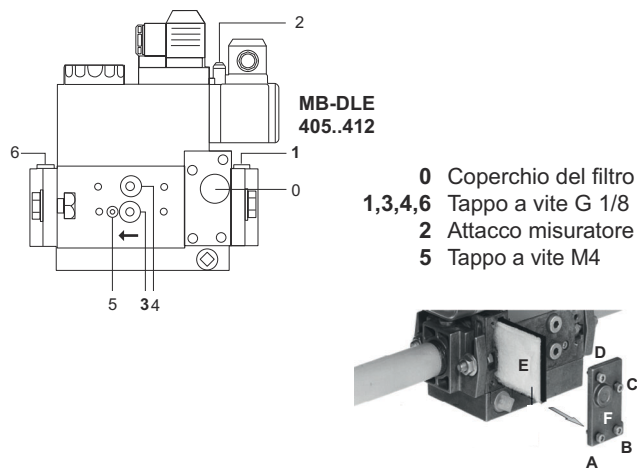


**WARNING:** All operations on the burner must be carried out with the mains disconnected and the fuel manual cutoff valves closed!



**ATTENTION!** Any maintenance, cleaning or check intervals are a mere indication: the functionality of the burner - and its components - depends, among other things, from capacity utilisation rate, environment, nature and quality of the fuels used.

## Adjusting the gas valves group and removing the filter

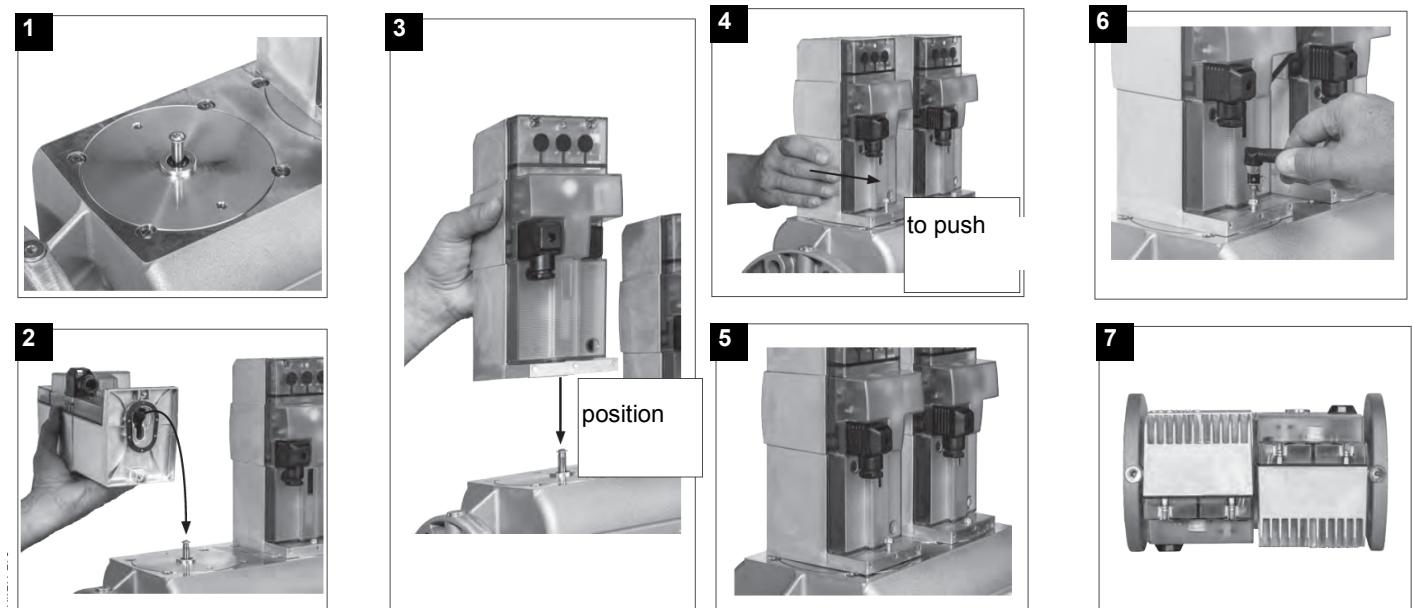


- Check the filter at least once a year!
- Change the filter if the pressure difference between pressure connection 1 and 3 (Fig. 1-Fig. 3) is  $\Delta p > 10$  mbar.
- Change the filter if the pressure difference between pressure connection 1 and 3 (Fig. 1-Fig. 3) is twice as high compared to the last check.

You can change the filter without removing the fitting.

- 1 Interrupt the gas supply closing the on-off valve.
- 2 Remove screws 1 ÷ 4 using the Allen key n. 3 and remove filter cover 5 in Fig. 5.
- 3 Remove the filter 6 and replace with a new one.
- 4 Replace filter cover 5 and tighten screws 1 ÷ 4 without using any force and fasten.
- 5 Perform leakage and functional test,  $p_{max.} = 360$  mbar.

## MultiBloc MBEMultiBloc VD Mounting

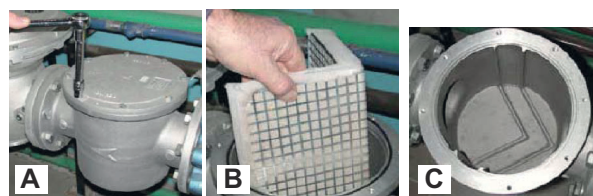


1. Position VD on VB, fig. 2+3.
2. Slide VD forward up to the stop, fig. 4.
3. Screw VD on with 2 M5 screws for each, max. 5 Nm/44 in.-lb., fig. 5/6.
4. VD can be mounted rotated by 180°, fig. 7.

## Gas filter maintenance

To clean or remove the filter, proceed as follows:

- 1 remove the cap unscrewing the fixing screws (A);
- 2 remove the filtering cartridge (B), clean it using water and soap, blow it with compressed air (or replace it, if necessary)
- 3 replace the cartridge in its proper position taking care to place it inbetween the guides as not to hamper the cap replacement;
- 4 be sure to replace the "O" ring into its place (C) and replace the cover fastening by the proper screws (A).

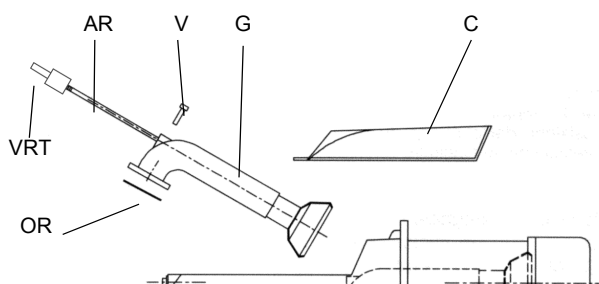


**WARNING:** Before opening the filter, close the manual cutoff valve downstream the filter and bleed the gas; check that inside the filter there is no pressurised gas.

## Removing the combustion head

- Remove the burner cover C.
- Unscrew the screws V holding in position the manifold G and pull out the complete group as shown in the picture.

Note: for the subsequent assembly carry out the above described operations in the reverse order, checking the correct position of the OR ring.



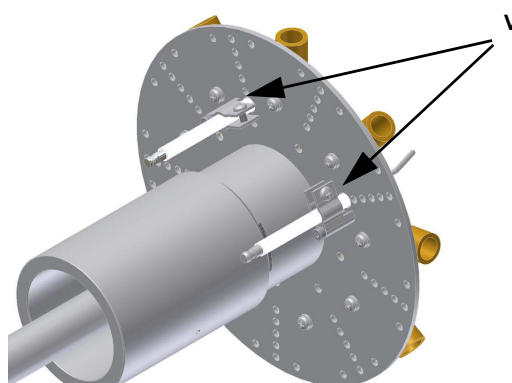
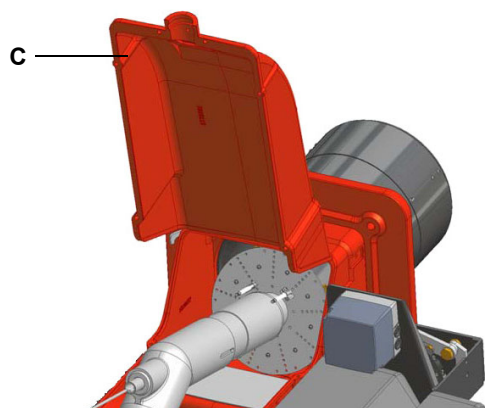
## Replacing the ignition electrodes



**ATTENTION:** avoid the ignition and detection electrodes to contact metallic parts (blast tube, head, etc.), otherwise the boiler's operation would be compromised. Check the electrodes position after any intervention on the combustion head.

To replace the electrodes, proceed as follows:

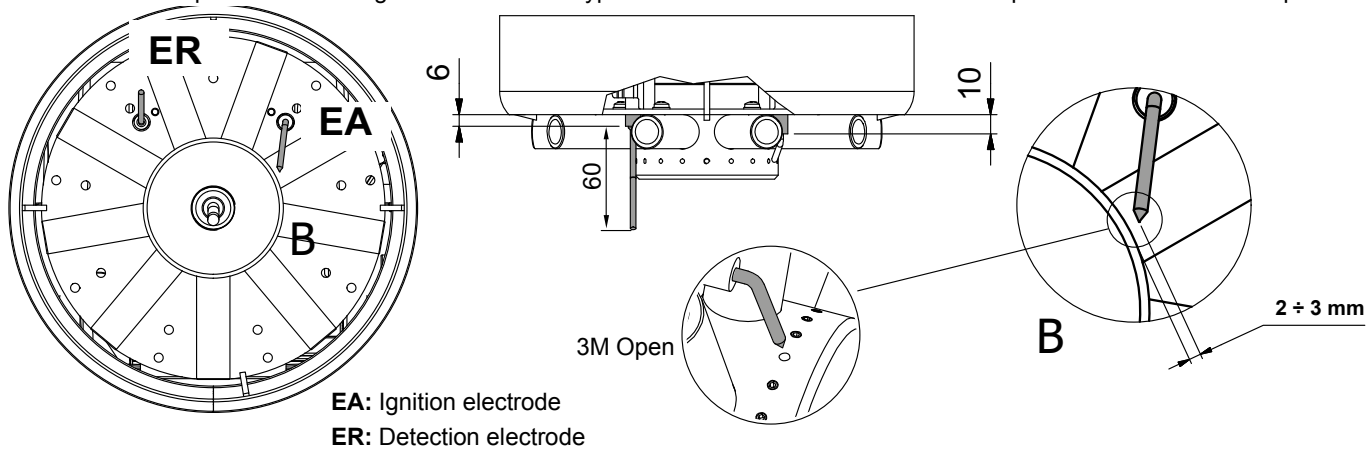
- 1 remove the burner cover C;
- 2 disconnect the electrodes cables;
- 3 remove the combustion head referring to paragraph "Removing the combustion head";
- 4 unscrew VE screws that fasten the electrodes (see next pictures)
- 5 remove the electrodes and replace them referring to the measures indicated in the previous paragraph;
- 6 reconnect the electrodes cables;
- 7 replace the combustion head;
- 8 replace the burner cover.





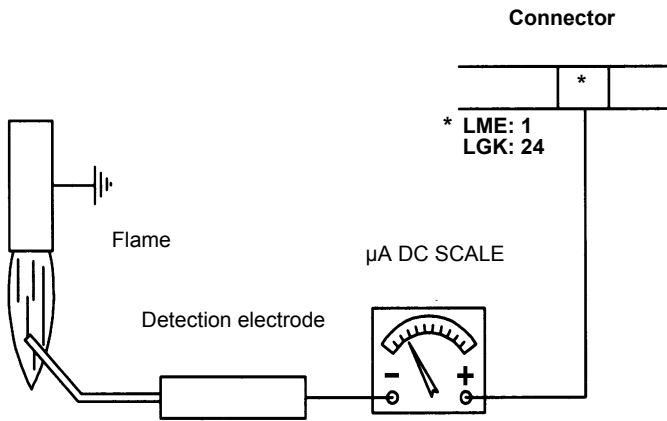
**ATTENTION:** avoid the ignition and detection electrodes to contact metallic parts (blast tube, head, etc.), otherwise the boiler's operation would be compromised. Check the electrodes position after any intervention on the combustion head.

Adjust the electrodes position according to the electrodes type installed on the burner. Follow the quotes shown on the next picture.



Checking the detection current with electrode (natural gas)

To check the detection signal follow the scheme in the picture below. If the signal is less than the value indicated, check the position of the detection electrode or detector, the electrical contacts and, if necessary, replace the electrode or the detector.



Control box	Minimum detection signal
Siemens LME21-22	3 $\mu$ A
LGK	12 $\mu$ A

**Burner service term**

- In optimal operating conditions, and with preventive maintenance, the burner can last up to 20 years.
- Upon expiry of the burner service term, it is necessary to carry out a technical diagnosis and, if necessary, an overall repair.
- The burner status is considered to be at its limit if it is technically impossible to continue using it due to non-compliance with safety requirements or a decrease in performance.
- The owner makes the decision whether to finish using the burner, or replacing and disposing of it based on the actual state of the appliance and any repair costs.
- The use of the burner for other purposes after the expiry of the terms of use is strictly prohibited.

**Seasonal stop**

To stop the burner in the seasonal stop, proceed as follows:

- 1 turn the burner main switch to 0 (Off position)
- 2 disconnect the power mains
- 3 close the fuel valve of the supply line

**Burner disposal**

In case of disposal, follow the instructions according to the laws in force in your country about the "Disposal of materials".

**WIRING DIAGRAMS**

Refer to the attached wiring diagrams.

**WARNING**

- 1 - Electrical supply 230V / 400V 50Hz 3N a.c.
- 2 - Do not reverse phase with neutral
- 3 - Ensure burner is properly earthed


## TROUBLESHOOTING GUIDE Gas operation

<b>BURNER DOESN'T LIGHT</b>	* No electric power supply	* Restore power supply
	* Main switch open	* Close switch
	* Thermostats open	* Check set points and thermostat connections
	* Bad thermostat set point or broken thermostat	* Reset or replace the thermostat
	* No gas pressure	* Restore gas pressure
	* Safety devices (manually operated safety thermostat, pressure switches and so on) open	* Restore safety devices; wait till boiler reaches operating temperature then check safety device functionality.
	* Broken fuses	* Replace fuses. Check current absorption
	* Fan thermal contacts open (three phases motors only)	* Reset contacts and check current absorption
	* Burner control lock out	* Reset and check its functionality
	* Burner control damaged	* Replace burner control
<b>GAS LEAKAGE: BURNER LOCKS OUT (NO FLAME)</b>	* Gas flow is too low	* Increase the gas flow * Check gas filter cleanness * Check butterfly valve opening when burner is starting (only Hi-Low flame and progressive)
	* Ignition electrodes discharge to ground because dirty or broken	* Clean or replace electrodes
	* Bad electrodes setting	* Check electrodes position referring to instruction manual
	* Electrical ignition cables damaged	* Replace cables
	* Bad position of cables in the ignition transformer or into the electrodes	* Improve the installation
	* Ignition transformer damaged	* Replace the transformer
<b>BURNER LOCKS OUT WITH FLAME PRESENCE</b>	* Bad flame detector set	
	* Flame detector damaged	* Replace or adjust flame detector
	* Bad cables of flame detector	* Check cables
	* Burner control damaged	* Replace burner control
	* Phase and neutral inverted	* Adjust connections
	* Ground missing or damaged	* Check ground continuity
	* Voltage on neutral	* Take off tension on neutral
	* Too small flame (due to not much gas)	* Adjust gas flow * Check gas filter cleanness
<b>only FOR LME22: BURNER CONTINUES TO PERFORM ALL ITS FEATURES WITHOUT IGNITING THE BURNER</b>	* Too much combustion air	* Adjust air flow rate
	* Air pressure switch damaged or bad links	* Check air pressure switch functions and links
<b>BURNER LOCKS OUT WITHOUT ANY GAS FLOW</b>	* Burner control damaged	* Replace burner control
	* Gas valves don't open	* Check voltage on valves; if necessary replace valve or the burner control * Check if the gas pressure is so high that the valve cannot open
	* Gas valves completely closed	* Open valves
	* Pressure governor too closed	* Adjust the pressure governor
	* Butterfly valve closed	* Open the butterfly valve
	* Maximum pressure switch open.	* Check connection and functionality
<b>THE BURNER IS BLOCKED AND THE EQUIPMENT PROVIDES A LOCK CODE "CAUSE AIR PRESSURE SWITCH FAULT"</b>	* Air pressure switch doesn't close the NO contact	* Check connections * Check pressure switch functionality
	* Air pressure switch damaged (it keeps the stand-by position or badly set)	* Check air pressure switch functionality * Reset air pressure switch
	* Air pressure switch connections wrong	* Check connections
	* Air fan damaged	* Replace motor
	* No power supply	* Reset power supply
<b>BURNER LOCKS OUT DURING NORMAL RUNNING</b>	* Air damper too closed	* Adjust air damper position
	* Flame detector circuit interrupted	* Check wiring * Check photocell
	* Burner control damaged	* Replace burner control
<b>THE BURNER STARTS AND AFTER A WHILE IT REPEATS THE STARTING CYCLE.</b>	* Maximum gas pressure switch damaged or badly set	* Reset pressure switch or replace it
	* Gas pressure switch badly set	* Reset the pressure switch
	* Gas filter dirty	* Clean gas filter
<b>BURNER STANDS WHILE RUNNING WITHOUT ANY SWITCHING OF THERMOSTATS</b>	* Gas governor too low or damaged	* Reset or replace the governor
	* Thermal contacts of fan motor open	* Reset contacts and check values * Check current absorption
<b>FAN MOTOR DOESN'T START</b>	* Internal motor wiring broken	* Replace wiring or complete motor
	* Fan motor starter broken	* Replace starter
	* Fuses broken (three phases only)	* Replace fuses and check current absorption
<b>BURNER DOESN'T SWITCH TO HIGH FLAME</b>	* Hi-low flame thermostat badly set or damaged	* Reset or replace thermostat
	* Servomotor cam badly set	* Reset servomotor cam
<b>mechanical only: SOMETIMES THE SERVOMOTOR RUNS IN THE WRONG WAY</b>	* Servomotor capacitor damaged	* Replace capacitor



## SIEMENS LME11/21/22 CONTROL BOX

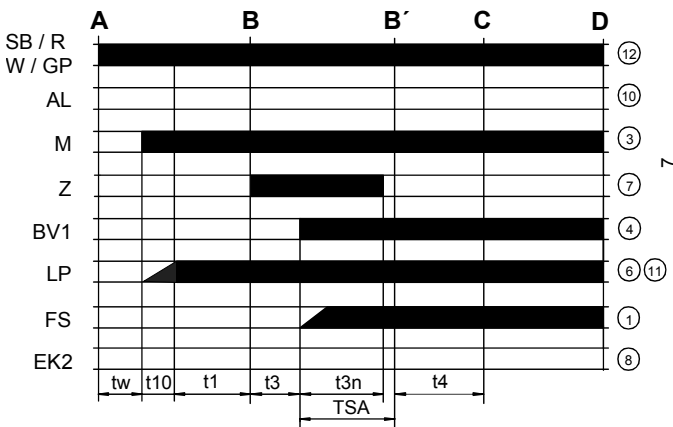
- Burner control must be reset
- All contacts in the line are closed, request for heat
- No undervoltage
- Air pressure switch LP must be in its “no-load” position
- Fan motor or AGK25 is closed
- Flame detector is darkened and there is no extraneous light

 <p>LED</p>	<p><b>red LED</b></p> <p><b>yellow LED</b></p> <p><b>green LED</b></p>	<p>Steady on</p> <p>.....</p> <p>Off</p> <p>○...</p>
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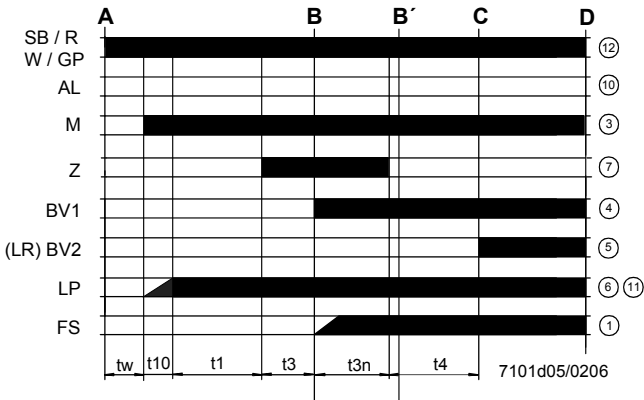
Status	Color code	Color
Waiting time tw, other waiting states	○.....	Off
Ignition phase, ignition controlled	● ○ ● ○ ● ○ ● ○ ● ○ ● ○ ● ○ ● ○	Flashing yellow
Operation, flame ok	□.....	Green
Operation, flame not ok	□ ○ □ ○ □ ○ □ ○ □ ○ □ ○ □ ○ □ ○	Flashing green
Extraneous light on burner startup	□ ▲ □ ▲ □ ▲ □ ▲ □ ▲ □ ▲ □ ▲	Green - red
Undervoltage	● ▲ ● ▲ ● ▲ ● ▲ ● ▲ ● ▲ ● ▲	Yellow - red
Fault, alarm	▲.....	Red
Error code output (refer to "Error code table")	▲○ ▲○ ▲○ ▲○ ▲○ ▲○	Flashing red

The burner stops and the control device is ready for a new startup.

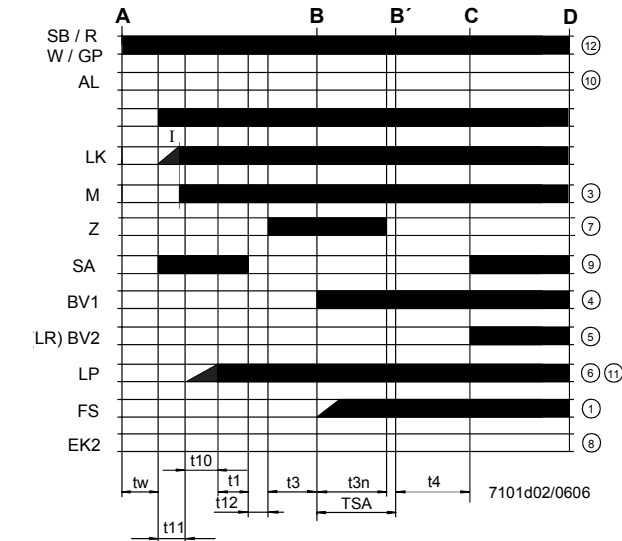
LME11 control sequence



LME21 control sequence



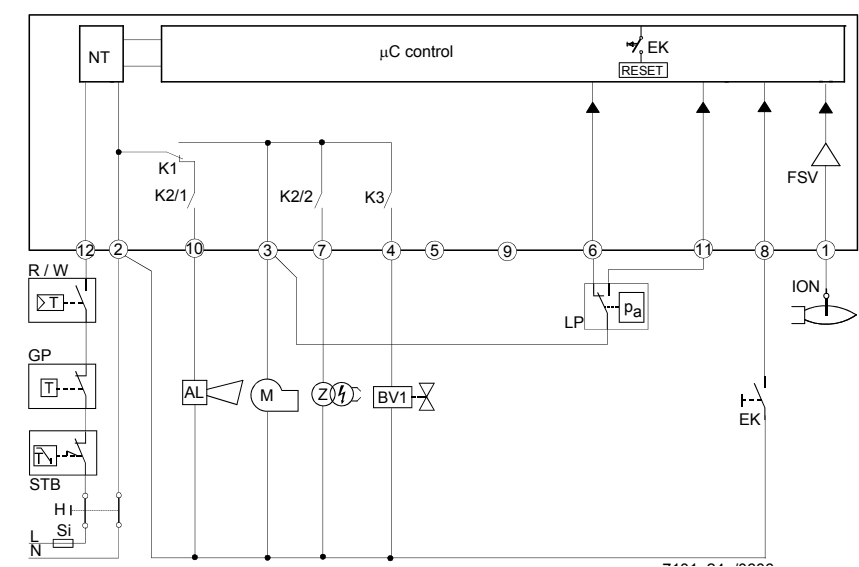
LME22 control sequence



Control sequence

- tw Waiting time
- t1 Purge time
- TSA Ignition safety time
- t3 Preignition time
- t3n Postignition time
- t4 Interval between BV1 and BV2/LR
- t10 Specified time for air pressure signal
- t11 Programmed opening time for actuator SA
- t12 Programmed closing time for actuator SA

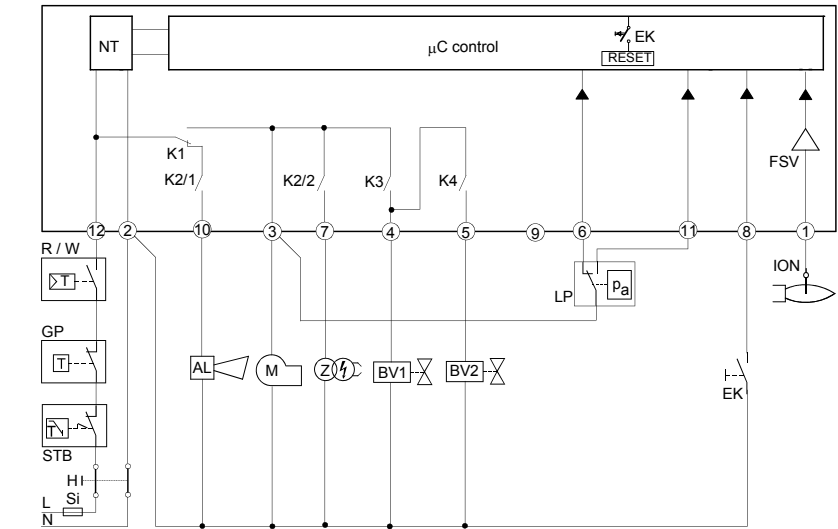
LME11 connection diagram



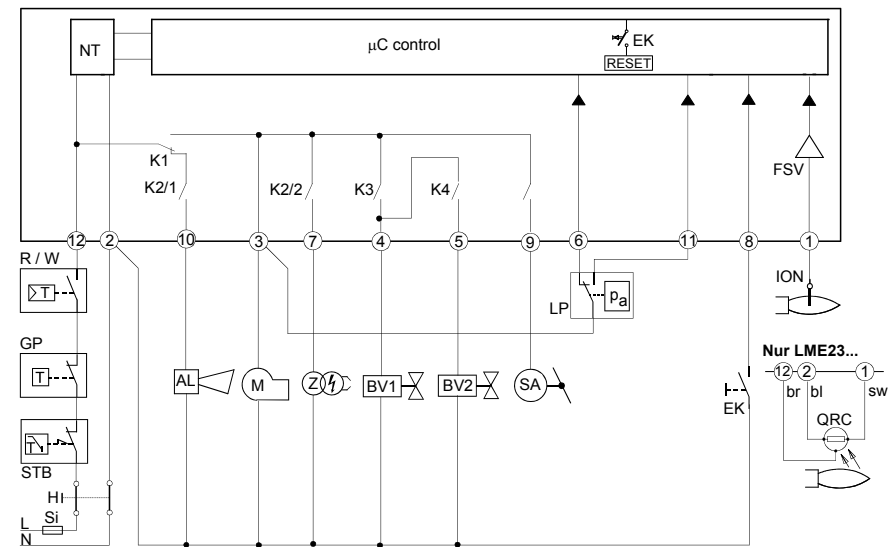
Connection diagram

- AL Error message (alarm)
- BV Fuel valve
- EK2 Remote lockout reset button
- FS Flame signal
- GP Gas pressure switch
- LP Air pressure switch
- LR Load controller
- M Fan motor
- R Control thermostat/pressurestat
- SB Safety limit thermostat
- W Limit thermostat /pressure switch
- Z Ignition transformer

LME21 connection diagram



LME22 connection diagram



## CONTROL PROGRAM IN THE EVENT OF FAULT

- If a fault occurs, all outputs will immediately be deactivated (in less than 1s).
- After an interruption of power, a restart will be made with the full program sequence.
- If the operating voltage drops below the undervoltage threshold, a safety shutdown is performed.
- If the operating voltage exceeds the undervoltage threshold, a restart will be performed.
- In case of extraneous light during "t1", a lockout occurs.
- In case of extraneous light during "tw", there is a prevention of startup and a lockout after 30 seconds.
- In case of no flame at the end of TSA, there will be max. 3 repetitions of the startup cycle, followed by a lockout at the end of TSA, for mod. LME11..; directly a lockout at the end of TSA for LME21-22 models.
- For LME11 model: if a loss of flame occurs during operation, in case of an establishment of flame at the end of TSA, there will be max. 3 repetitions, otherwise a lockout will occur.
- For LME21-22 models: if a loss of flame occurs during operation, there will be a lockout.
- If the contact of air pressure monitor LP is in working position, a prevention of startup and lockout after 65 seconds will occur.
- If the contact of air pressure monitor LP is in normal position, a lockout occurs at the end of t10.
- If no air pressure signal is present after completion of t1, a lockout will occur.

## CONTROL BOX LOCKED

In the event of lockout, the LME.. remains locked and the red signal lamp (LED) will light up. The burner control can immediately be reset. This state is also maintained in the case of mains failure.

## DIAGNOSTICS OF THE CAUSE OF FAULT

- Press the lockout reset button for more than 3 seconds to activate the visual diagnostics.
- Count the number of blinks of the red signal lamp and check the fault condition on the "Error code table" (the device repeats the blinks for regular intervals).

During diagnostics, the control outputs are deactivated:

- the burner remains shut down;
- external fault indication is deactivated;
- fault status is showed by the red LED, inside the LME's lockout reset button according to the "Error code table":

ERROR CODE TABLE	
2 blinks **	<b>No establishment of flame at the end of TSA</b> <ul style="list-style-type: none"><li>- Faulty or soiled fuel valves</li><li>- Faulty or soiled flame detector</li><li>- Inadequate adjustment of burner, no fuel</li><li>- Faulty ignition equipment</li></ul>
3 blinks ***	<b>The air pressure switch does not switch or remains in idle position:</b> <ul style="list-style-type: none"><li>- LP is faulty</li><li>- Loss of air pressure signal after t10</li><li>- LP is welded in normal position.</li></ul>
4 blinks ****	- Extraneous light when burner starts up.
5 blinks *****	- LP is working position.
6 blinks *****	Free.
7 blinks *****	<b>Loss of flame during operation</b> <ul style="list-style-type: none"><li>- Faulty or soiled fuel valves</li><li>- Faulty or soiled flame detector</li><li>- Inadequate adjustment of burner</li></ul>
8 ÷ 9 blinks	Free
10 blinks *****	<b>Faulty output contacts</b> <b>Attention: "lockout" remote signal (terminal no. 10) not enabled</b> <ul style="list-style-type: none"><li>- Wiring error</li><li>- Anomalous voltage on output terminals</li><li>- Other faults</li></ul>
14 blinks ***** (only for LME4x)	- CPI contact (gas valve microswitch) not closed.

## RESETTING THE BURNER CONTROL

When lockout occurs, the burner control can immediately be reset, by pressing the lockout reset button for about 1..3 seconds. The LME.. can only be reset when all contacts in the line are closed and when there is no undervoltage.

## LIMITATION OF REPETITIONS (only for LME11.. model)

If no flame is established at the end of TSA, or if the flame is lost during operation, a maximum of 3 repetitions per controller startup can be performed via "R", otherwise lockout will be initiated. Counting of repetitions is restarted each time a controlled startup via "R" takes place.

**⚠ Condensation, formation of ice and ingress of water are not permitted!**

## TECHNICAL CHARACTERISTICS

Mains voltage	120V AC +10% / -15% 230V AC +10% / -15%
Frequency	50 ... 60 Hz +/- 6%
Power consumption	12VA
External primary fuse	max. 10 A (slow)
input current at terminal 12	max. 5 A
Detection cable length	max. 3m (for electrode)
Detection cable length	max. 20 m (laid separately, for QRA probe)
Reset cable length	max. 20 m (posato separatamente)
Term. 8 & 10 cable length	max. 20 m
Thermostat cable length and other terminals	max. 3 m
Safety class	I
Index of protection	IP40 (to be ensured during mounting)
Operating conditions	-20... +60 °C, < 95% UR
Storage conditions	-20... +60 °C, < 95% UR
Weight	approx. 160 g

## SIEMENS LOK16.. / LGK16.. CONTROL BOX

Control boxes type LOK16... / LGK16... feature a self-checking flame supervision circuit. The supervision circuit initiates the required safety actions not only in the case of premature or missing flame signals, but also in the event of any kind of fault on the flame detector, the detector cables or the flame signal amplifier that could simulate a flame signal during burner operation.

The burner controls are therefore suited for use in all types of oil- or gas-fired combustion plant where self-checking flame supervision systems are either mandatory or recommended:

- Burners that operate continuously
- Burners in intermittent operation that, in the case of great heat demand, may operate continuously for more than 14 hours, e.g. in plant using boiler sequencing
- Burners that need to comply with the German TRD 411 and TRD 412 regulations for steam boilers
- Burners in plant where, for specific safety requirements, supervision of the burner by a self-checking flame supervision system seems advisable.

The control sequence and connection circuitry of the LOK16... / LGK16... burner controls are identical to those of the LAL2... and LFL1... respectively (with the exception of the LFL1.148), so that existing combustion plant can also be equipped with self-checking burner controls:

- provided very good flame detector current values are measured in the plant supervised so far by the LFL1..., and
- provided the following types of flame detectors are either installed or can subsequently be fitted:
  - Flame supervision when using LOK16:
    - Selenium photocell detector RAR...
  - Flame supervision when using LGK16:
    - Flame detector QRA53... / QRA55...
    - Ionization probe
    - Flame detector QRA53... / QRA55... together with ionization probe, e.g. in the case of burners using a pilot burner.

### WARNING NOTES

To avoid injury to persons, damage to property or the environment, the following warning notes should be observed!

- Do not open, interfere with or modify the unit!
- All activities (mounting, installation and service work, etc.) must be performed by qualified staff
- Before performing any wiring changes in the connection area of the LOK16... / LGK16..., completely isolate the burner control from the mains supply (all-polar disconnection)
- Ensure protection against electric shock hazard by providing adequate protection for the burner control's connection terminals
- Check to ensure that wiring is in an orderly state
- Press the lockout reset button only manually (applying a force of no more than 10 N) without using any tools or pointed objects
- Do not press the lockout reset button on the unit or the remote reset button (input 21) for more than 10 seconds, since this would damage the lockout relay inside the unit
- Fall or shock can adversely affect the safety functions. Such units must not be put into operation, even if they do not exhibit any damage

### Installation notes

- Always run the high-voltage ignition cables separately while observing the greatest possible distance to the unit and to other cables
- Neutral conductors must not be interchanged

### Commissioning notes

Prior to commissioning, check to ensure that wiring is in an orderly state.

When commissioning the plant or when doing maintenance work, make the following safety checks

Safety check	Anticipated response
Burner startup with flame detector darkened	Lockout at the end of «TSA»
Burner startup with simulated flame	Lockout after no more than 40 seconds
Burner operation with simulated loss of flame; for that purpose, darken the flame detector in operation and leave it in that state	- LOK16... with wire link cut: Start repetition followed by lockout at the end of «TSA» - LGK16... and LOK16... with wire link closed: Immediate lockout
Burner startup with response of air pressure switch	Prevention of startup / lockout during «t1»
Burner operation with simulated air pressure failure	Immediate lockout

### Principle of self-supervision

In contrast to conventional amplifiers, the signal delivered by the flame detector is handled dynamically and not statically. The flame detector signal is converted to a sequence of control pulses and then fed to the flame relay circuit. The latter is designed such that the flame relay can only be energized by a flame signal of the described form. If the pulses change due to a faulty detector or faulty detector cables, the relay will be deenergized and the burner control triggers the required safety actions. In the case of UV supervision, it must also be ensured that self-ignition of the UV tube (e.g. due to aging) does not simulate a flame signal. For that reason, incident radiation at the UV cell is periodically interrupted by a shutter. In addition to the self-checking facility, the flame signal circuit is subjected to a functional test during the prepurge time. If it does not operate correctly, the startup sequence will be aborted or lockout initiated. Furthermore, if mains voltage drops to a level where safe operation of the

burner control is no longer ensured, the burner will automatically shut down. When mains voltage returns to the normal level, the burner control repeats the startup sequence. If the detector signals are only slightly above the minimum levels, such mains voltage fluctuations can also give rise to burner lockout however.

### Prerequisites for burner startup:

- The burner control is reset and in the start position (terminals 11 and 12 must receive power)
- The air damper is closed. End switch «z» for the fully closed position must feed power from terminal 11 to terminal 8
- All control contacts between terminals 12 and 5 (limit thermostat, control thermostat, etc.) must be closed

**A Start:** When «R» closes, the control box sequence switch starts running. At the same time, the fan motor connected to terminal 6 (only prepurging) receives power and, on completion of «t7», the fan motor or flue gas fan at terminal 7 (pre- and postpurging) also receives power. On completion of «t16», the control command to open the air damper is given via terminal 9. During the running time of the motor, the sequence switch does not operate, as terminal 8, via which the motor of the sequence switch first receives power, is not live during that period of time. The sequence switch starts again and programs only after the air damper is fully open and end switch «a» has changed over to feed power to terminal 8.

**t1 Prepurge time** with air damper fully open (nominal amount of combustion air) Shortly after the start of the prepurge time, air pressure switch «LP» must change over, thus interrupting the current path between terminals 4 and 13. Otherwise, the burner control would go to lockout (start of air pressure check). At the same time, terminal 14 must be live since this current path is used to power the ignition transformer and the fuel valves.

**t3' With the LOK16...**, an ignition transformer connected to terminal 15 is therefore switched on at this point in time (long preignition). If there is no «LP», the ignition transformer receives power already with the start command. On completion of the prepurge time, the burner control via terminal 10 drives the air damper into the low-fire position, which is determined by the changeover point of auxiliary switch «m». During the positioning time, the sequence switch stops again until terminal 8 receives power from «m».

**t5 Interval** On completion of «t5», terminal 20 receives power. At the same time, control outputs 9 to 11 and input 8 are galvanically separated from the unit's control section, so that the latter is protected against reverse voltages from the load control circuit. The startup sequence of the burner control ends with the release of load controller «LR» at terminal 20. The sequence switch switches itself automatically off, depending on the time variant used, either immediately or after some so-called «idle steps», that is, without changing the contact positions.

**t3 Short preignition time;** followed by fuel release via terminal 18.

**TSA Safety time** (part load) On completion of the safety time latest, a flame signal must be present at the input of the flame signal amplifier, or else the burner control will initiate lockout.

**Only with LOK16...: t3n Postignition time** (provided the ignition transformer is connected to terminal 15).

**t4 Interval** until the fuel valve is released via terminal 19.

(Burners using a pilot burner)

**t3 / t3' Short preignition time;** followed by release of fuel for the pilot burner via terminal 17.

**TSA / TSA' First safety time** (ignition load) On completion of the safety time latest, a flame signal must be present at the input of the flame signal amplifier, or else the burner control will initiate lockout.

**t4 / t4' Interval** until the fuel valve at terminal 19 is released (start load of the main burner).

Times «TSA'», «t3'» and «t4'» are only programmed by burner controls type LGK16.335... and LGK16.635...

**t9 Second safety time:** On completion of the safety time, the main burner must have been ignited by the pilot burner, since the pilot gas valve is closed on completion of «t9».

### B Operating position of the burner

**B-C Burner operation** (generation of heat) During burner operation, the load controller drives the air damper to the nominal load or low-fire position, depending on heat demand. Here, the nominal load is released by auxiliary switch «v» in the air damper actuator.

**C Controlled shutdown by «R»** In the case of controlled shutdown, the fuel valves are immediately closed and, at the same time, the sequence switch starts again to program the postpurge time.

**t6 Postpurge time** (postpurging with fan «M2» connected to terminal 7). Shortly after the start of the postpurge time, voltage at terminal 10 is reinstated, so that the air damper is driven into the «MIN» position. The full closing of the air damper starts only shortly before the completion of the postpurge time initiated by the control signal on terminal 11, which also remains live during the following burner off period.

**t13 Permissible afterburn time** During «t13», the flame signal input may still receive a flame signal -> No lockout

**D-A End of control sequence** (= start position) When, on completion of «t6», the sequence switch has reset the control contacts to their start positions, thereby switching itself off, the detector and flame simulation test is started again. However, during the burner off period, lockout can occur only if the faulty flame signal lasts a few seconds. Hence, short ignition pulses of the UV detector caused by cosmic radiation do not initiate lockout.

### Control sequence in the event of fault and indication of lockout

In case of any disturbance, the supply of fuel will immediately be interrupted. At the same time, the sequence switch stops and thus the lockout indicator also. The symbol appearing above the reading mark indicates the kind of fault:

◀ No start, because one of the contacts is not closed (also refer to «Prerequisites for burner startup») or lockout during or after completion of the control sequence due to extraneous light (e.g. flame not extinguished, leaking fuel valves, faulty flame supervision circuit, or similar).

▲ Abortion of startup sequence, because end switch «a» has not fed the OPEN signal to terminal 8. Terminals 6, 7 and 14 and, in case LOK16... is used, terminal 15, also remain live until the fault is corrected.

P Lockout, because the air pressure signal has not been received at the start of the air pressure check.

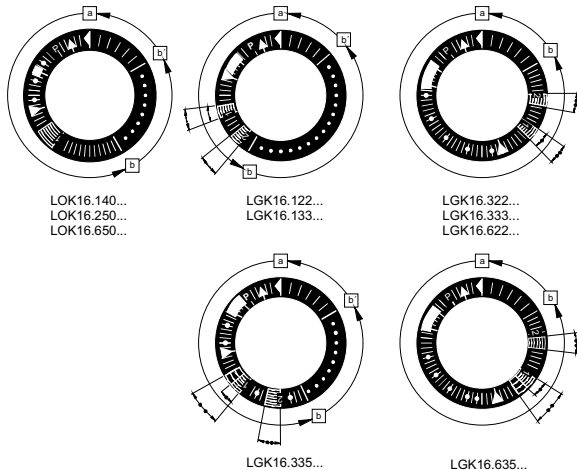
■ Lockout due to a fault in the flame supervision circuit.

▼ Abortion of startup sequence, because auxiliary switch «m» has not delivered the positioning signal for the low-fire position to terminal 8. Terminals 6, 7 and 14 and, in case LOK16... is used, terminal 15, also remain live until the fault is corrected.

- 1 Lockout, because no flame signal has been received on completion of the (first) safety time.
  - 2 Only with LGK16...: Lockout, because no flame signal has been received on completion of the second safety time (flame signal of the main flame with interrupted pilot burners).
- █ Lockout, because the flame signal has been lost during burner operation or air pressure failure has occurred.

#### Only with LOK16...:

If wire link «B» was cut off and the flame is lost during burner operation, the burner control programs a repetition of the startup sequence with the full program.



a-b Startup sequence

b-b' With certain time variants: «Idle steps» of the sequence switch up to the self-shutdown after burner startup (b' = operating position of the sequence switch)

b(b')-a Postpurge sequence after controlled shutdown. In start position «a», the sequence switch switches itself automatically off or immediately initiates another burner startup (e.g. after a fault has been corrected)

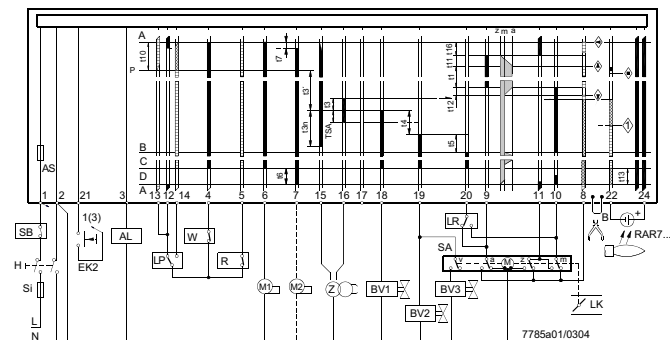
- Duration of safety time with expanding flame burners
- • Duration of safety times with interrupted pilot burners

When lockout has occurred, the burner control can immediately be reset. After resetting, and also after correction of a fault, which resulted in shutdown, or after a mains failure, the sequence switch always runs to its start position, whereby only terminals 7, 9, 10 and 11 receive power in accordance with the control sequence. It is only then that the burner control programs a burner restart.

**Note:** Do not press the lockout reset button for more than 10 seconds.

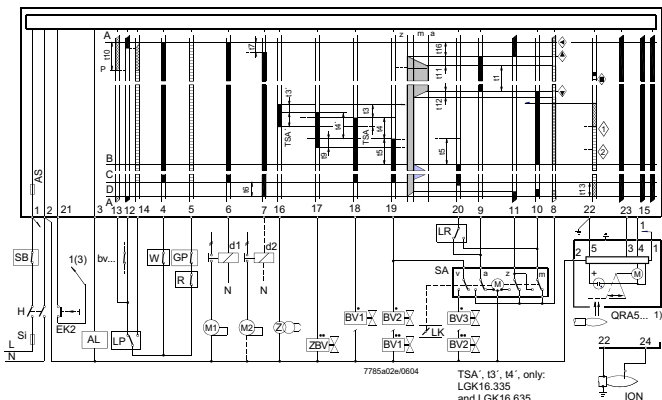
#### Connection diagrams

LOK16



Do not press lockout reset button «EK...» for more than 10 seconds!

LGK16



Do not press lockout reset button «EK...» for more than 10 seconds!

1) When used in connection with QRA53../QRA55..., earthing of terminal 22 is mandatory!

#### Keys

a Changeover end switch for air damper's fully open position

AL Remote lockout warning device (alarm)

AL Remote lockout warning device (alarm)

AS Unit fuse

B Wire link (on the burner control's base)

BR Lockout relay with «br» contacts

BV... Fuel valve

bv... Auxiliary contact in the valve actuator for the fully closed

d... Contactor or relay

EK... Lockout reset button

ION Ionization probe

FR Flame relay with «fr» contacts

FS Flame signal

GP Gas pressure switch

H Mains isolator

L... Lockout warning lamp

LK Air damper

LP Air pressure switch

LR Load controller

• Valid for expanding flame burners

• • Valid for burners with a pilot burner which is shut down after the main burner has ignited

m Auxiliary changeover switch for the air damper's MIN position AL Remote lockout warning device (alarm)

M... Fan or burner motor

NTC Resistor with negative temperature coefficient

QRA... UV detector

R Control thermostat or pressurestat

RAR... Selenium photocell detector

SA Air damper actuator

SB Safety limit thermostat

Si External fuse

SM Synchronous motor of sequence switch

v In the air damper actuator: Auxiliary changeover switch for release of fuel as a function of the air damper position

V Flame signal amplifier

W Limit thermostat or pressure switch

z In the air damper actuator: End switch for the air damper's fully closed position

Z Ignition transformer

ZBV Pilot valve

A Startup

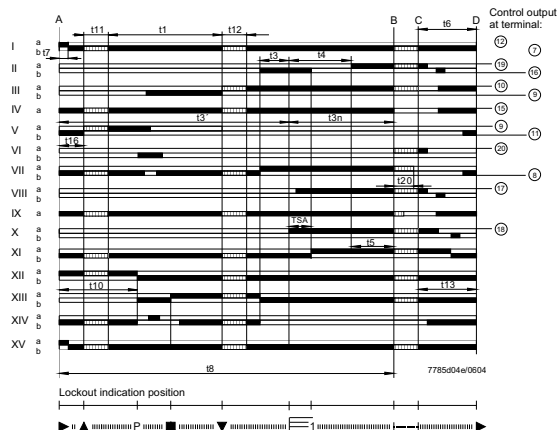
B Operating position

C Controlled shutdown

D End of control sequence

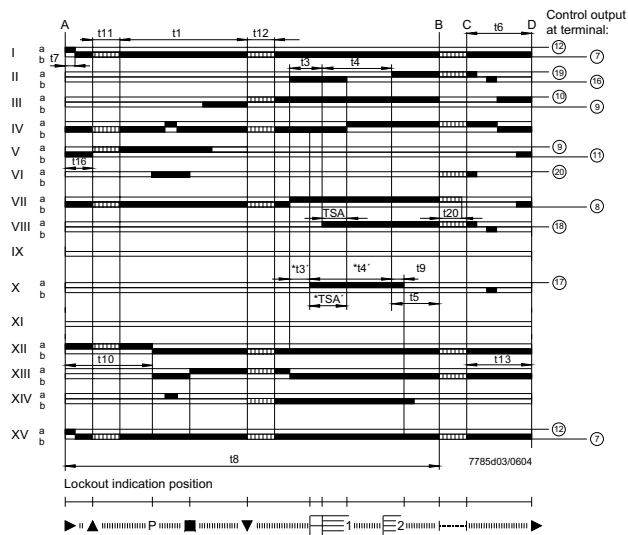
#### Program sequence

LOK16





## L GK16



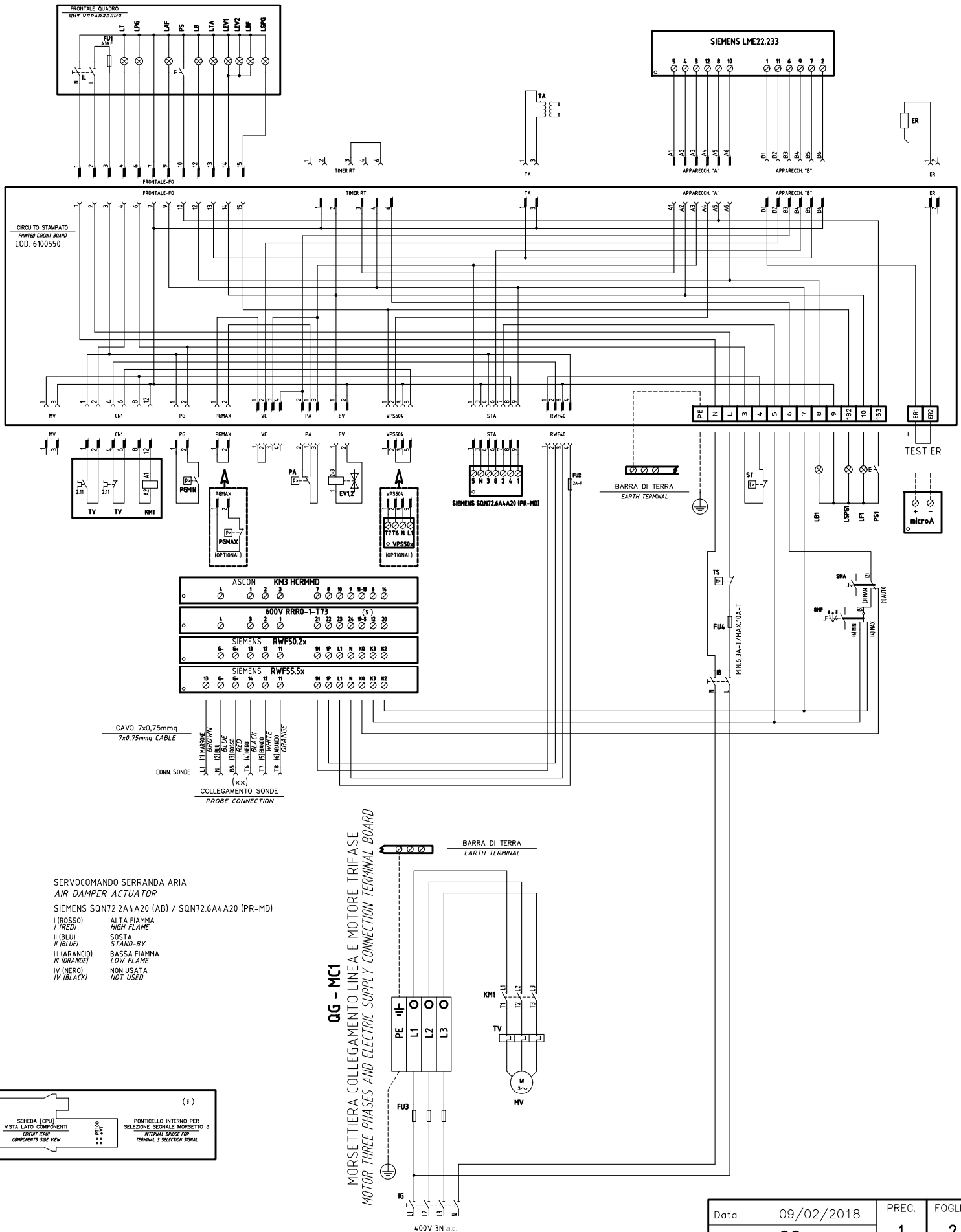
\* Times TSA', t3' and t4' are only programmed by burner controls LGK16.335... and LGK16.635...

## Technical data

Mains voltage	AC 220 V -15 %...AC 240 V +10 % AC 100 V -15 %...AC 110 V +10 %
Mains frequency	50...60 Hz $\pm$ 6 %
Unit fuse	T6,3H250V to DIN EN 60 127
Primary fuse (external)	max. 16 A (slow)
Power consumption	approx. 3.5 VA
Perm. input current at terminal 1	max. 5 A to VDE 0660 AC3
Perm. Current load of control terminals	max. 4 A to VDE 0660 AC3
Degree of protection	IP40 (to be ensured through mounting) with the exception of the connection area (terminal base)
Storage Temperature range	-20... +60 °C, < 95 % r.h.
Operation Temperature range	-20... +60 °C, < 95 % r.h.
Weight	approx. 1000 g



Data	09/02/2018	PREC.	FOGLIO
Revisione	00	/	1
Dis. N.	18 - 0317	SEQUE	TOTALE
		2	4



Data	09/02/2018	PREC.	FOGLIO
Revisione	00	1	2
Dis. N.	18 - 0317	SEQUE	TOTALE
		3	4



Sigla/Item	Funzione	Function
600V RRR0-1-T73	REGOLATORE MODULANTE (ALTERNATIVO)	BURNER MODULATOR (ALTERNATIVE)
ER	ELETTRODO RILEVAZIONE FIAMMA	FLAME DETECTION ELECTRODE
EV1,2	ELETTROVALVOLE GAS (O GRUPPO VALVOLE)	GAS ELECTRO-VALVES (OR VALVES GROUP)
FU1	FUSIBILE DI LINEA	LINE FUSE
FU2	FUSIBILE AUSILIARIO	AUXILIARY FUSE
FU3	FUSIBILI LINEA MOTORE VENTILATORE	FAN MOTOR LINE FUSES
FU4	FUSIBILE DI LINEA	LINE FUSE
IB	INTERRUTTORE LINEA BRUCIATORE	BURNER LINE SWITCH
IG	INTERRUTTORE GENERALE	MAINS SWITCH
IL	INTERRUTTORE LINEA AUSILIARI	AUXILIARY LINE SWITCH
KM1	CONTATTORE MOTORE VENTILATORE	FAN MOTOR CONTACTOR
KM3 HCRMMD	REGOLATORE MODULANTE (ALTERNATIVO)	BURNER MODULATOR (ALTERNATIVE)
LAF	LAMPADA SEGNALE ALTA FIAMMA BRUCIATORE	BURNER IN HIGH FLAME INDICATOR LIGHT
LB	LAMPADA SEGNALE BLOCCO BRUCIATORE	INDICATOR LIGHT FOR BURNER LOCK-OUT
LB1	LAMPADA SEGNALE BLOCCO BRUCIATORE	INDICATOR LIGHT FOR BURNER LOCK-OUT
LBF	LAMPADA SEGNALE BASSA FIAMMA BRUCIATORE	BURNER IN LOW FLAME INDICATOR LIGHT
LEV1	LAMPADA SEGNALE APERTURA [EV1]	INDICATOR LIGHT FOR OPENING OF ELECTRO-VALVE [EV1]
LEV2	LAMPADA SEGNALE APERTURA [EV2]	INDICATOR LIGHT FOR OPENING OF ELECTRO-VALVE [EV2]
LF1	LAMPADA SEGNALE FUNZIONAMENTO BRUCIATORE	INDICATOR LIGHT BURNER OPERATION
LPG	LAMPADA SEGNALE PRESENZA GAS IN RETE	INDICATOR LIGHT FOR PRESENCE OF GAS IN THE NETWORK
LSPG	LAMPADA SEGNALE BLOCCO CONTROLLO TENUTA VALVOLE	INDICATOR LIGHT FOR LEAKAGE OF VALVES
LSPG1	LAMPADA SEGNALE BLOCCO CONTROLLO TENUTA VALVOLE	INDICATOR LIGHT FOR LEAKAGE OF VALVES
LT	LAMPADA SEGNALE BLOCCO TERMICO	INDICATOR LIGHT FOR MOTOR OVERLOAD THERMAL CUTOUT
LTA	LAMPADA SEGNALE TRASFORMATORE DI ACCENSIONE	IGNITION TRANSFORMER INDICATOR LIGHT
MV	MOTORE VENTILATORE	FAN MOTOR
PA	PRESSOSTATO ARIA	AIR PRESSURE SWITCH
PGMAX	PRESSOSTATO GAS DI MASSIMA PRESSIONE	MAXIMUM PRESSURE GAS SWITCH
PGMIN	PRESSOSTATO GAS DI MINIMA PRESSIONE	MINIMUM GAS PRESSURE SWITCH
PS	PULSANTE SBLOCCO FIAMMA	FLAME UNLOCK BUTTON
PS1	PULSANTE SBLOCCO FIAMMA	FLAME UNLOCK BUTTON
PT100	SONDA DI TEMPERATURA	TEMPERATURE PROBE
RWF50.2x	REGOLATORE MODULANTE	BURNER MODULATOR
RWF55.5x	REGOLATORE MODULANTE (ALTERNATIVO)	BURNER MODULATOR (ALTERNATIVE)
SD-PRESS	SONDA DI PRESSIONE	PRESSURE PROBE
SD-TEMP.	SONDA DI TEMPERATURA	TEMPERATURE PROBE
SD - 0÷10V	TRASDUTTORE USCITA IN TENSIONE	TRANSDUCER VOLTAGE OUTPUT
SD - 4÷20mA	TRASDUTTORE USCITA IN CORRENTE	TRANSDUCER CURRENT OUTPUT
SIEMENS LME22.233	APPARECCHIATURA CONTROLLO FIAMMA	CONTROL BOX
SIEMENS LME22.331 / LME22.331	APPARECCHIATURA CONTROLLO FIAMMA	CONTROL BOX
SIEMENS SQN72.2A4A20 (AB)	SERVOCOMANDO SERRANDA ARIA	AIR DAMPER ACTUATOR
SIEMENS SQN72.6A4A20 (PR-MD)	SERVOCOMANDO SERRANDA ARIA	AIR DAMPER ACTUATOR
SMA	SELETTORE MANUALE/AUTOMATICO	MANUAL/AUTOMATIC SWITCH
SMF	SELETTORE MANUALE FUNZIONAMENTO MIN-0-MAX	MIN-0-MAX MANUAL OPERATION SWITCH
ST	SERIE TERMOSTATI/PRESSOSTATI	SERIES OF THERMOSTATS OR PRESSURE SWITCHES
TA	TRASFORMATORE DI ACCENSIONE	IGNITION TRANSFORMER
TAB	TERMOSTATO/PRESSOSTATO ALTA-BASSA FIAMMA	HIGH-LOW THERMOSTAT/PRESSURE SWITCHES
TC	TERMOCOPPIA	THERMOCOUPLE
TS	TERMOSTATO/PRESSOSTATO DI SICUREZZA	SAFETY THERMOSTAT OR PRESSURE SWITCH
TV	TERMICO MOTORE VENTILATORE	FAN MOTOR THERMAL
VPS50x	CONTROLLO DI TENUTA VALVOLE GAS (OPTIONAL)	GAS PROVING SYSTEM (OPTIONAL)
microA	MICROAMPEROMETRO	MICROAMMETER



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Note: specifications and data subject to change. Errors and omissions excepted.





## USER'S MANUAL

COD. M12925CA Rel 1.2 08/2014

SOFTWARE VERSION 1.0x T73  
code 80379 / Edition 01 - 06/2012

## 1 • INSTALLATION

### • Dimensions and cut-out; panel mounting



For correct and safe installation, follow the instructions and observe the warnings contained in this manual.

#### Panel mounting:

To fix the unit, insert the brackets provided into the seats on either side of the case.  
To mount two or more units side by side, respect the cut-out dimensions shown in the drawing.

**CE MARKING:** The instrument conforms to the European Directives 2004/108/CE and 2006/95/CE with reference to the generic standards: **EN 61000-6-2** (immunity in industrial environment) **EN 61000-6-3** (emission in residential environment) **EN 61010-1** (safety).

**MAINTENANCE:** Repairs must be done only by trained and specialized personnel.

Cut power to the device before accessing internal parts.

Do not clean the case with hydrocarbon-based solvents (Petrol, Trichlorethylene, etc.). Use of these solvents can reduce the mechanical reliability of the device. Use a cloth dampened in ethyl alcohol or water to clean the external plastic case.

**SERVICE:** GEFRAN has a service department. The warranty excludes defects caused by any use not conforming to these instructions.

EMC conformity has been tested with the following connections

FUNCTION	CABLE TYPE	LENGTH
Power supply cable	1 mm <sup>2</sup>	1 m
Relay output cable	1 mm <sup>2</sup>	3,5 m
TC input	0,8 mm <sup>2</sup> compensated	5 m
Pt100 input	1 mm <sup>2</sup>	3 m

## 2 • TECHNICAL SPECIFICATIONS

Display	2x4 digit green, high display 10 and 7mm
Keys	4 of mechanical type (Man/Aut, INC, DEC, F)
Accuracy	0.2% f.s. $\pm 1$ digit ambient temperature 25°C
Main input (settable digital filter)	TC, RTD, PTC, NTC 60mV, 1V Ri $\geq$ 1M $\Omega$ ; 5V, 10V Ri $\geq$ 10K $\Omega$ ; 20mA Ri=50 $\Omega$ Tempo di campionamento 120 msec.
Type TC Thermocouples (ITS90)	Type TC Thermocouples : J,K,R,S,T (IEC 584-1, CEI EN 60584-1, 60584-2) ; custom linearization is available / types B,E,N,L GOST,U,G,D,C are available by using the custom linearization.
Cold junction error	0,1° / °C
RTD type (scale configurable within indicated range, with or without decimal point) (ITS90) Max line resistance for RTD	DIN 43760 (Pt100), JPT100 20 $\Omega$
PTC type / NTC Type	990 $\Omega$ , 25°C / 1K $\Omega$ , 25°C
Safety	detection of short-circuit or opening of probes, LBA alarm
°C / °F selection	configurable from faceplate
Linear scale ranges	-1999 to 9999 with configurable decimal point position
Controls	PID, Self-tuning, on-off
pb - dt - it	0,0...999,9 % - 0,00...99,99 min - 0,00...99,99 min
Action	Heat / Cool
Control outputs	on / off
Maximum power limit heat / cool	0,0...100,0 %
Cycle time	0...200 sec
Main output type	relay, logic, continuous (0...10V Rload $\geq$ 250K $\Omega$ , 0/4...20mA Rload $\leq$ 500 $\Omega$ )
Softstart	0,0...500,0 min
Fault power setting	-100,0...100,0 %
Automatic blanking	Displays PV value, optional exclusion
Configurable alarms	Up to 3 alarm functions assignable to an output, configurable as: maximum, minimum, symmetrical, absolute/deviation, LBA
Alarm masking	- exclusion during warm up - latching reset from faceplate or external contact
Type of relay contact	NO (NC), 5A, 250V/30Vdc cos $\phi$ =1
Logic output for static relays	24V $\pm$ 10% (10V min at 20mA)
Transmitter power supply	15/24Vdc, max 30mA short-circuit protection
Power supply (switching type)	(std) 100 ... 240Vac $\pm$ 10% (opt.) 11...27Vac/dc $\pm$ 10%; 50/60Hz, 8VA max
Faceplate protection	IP65
Working / Storage temperature range	0...50°C / -20...70°C
Relative humidity	20 ... 85% non-condensing
Environmental conditions of use	for internal use only, altitude up to 2000m
Installation	Panel, plug-in from front
Weight	160g for the complete version

### 3 • DESCRIPTION OF FACEPLATE

#### Function indicators

Indicates modes of operation

- L1 MAN/AUTO = OFF (automatic control)  
ON (manual control)
- L2 PRE-HEATING = ON (running)
- L3 SELFTUNING = ON (enabled Self)  
OFF (disabled Self)

#### Automatic/Manual adjustment selection

Active only when PV display visualises the process variable (button pressed for at least 5 sec.)

#### "Inc" and "Dec" key

Press to increment (decrement) any numerical parameter • Increment (decrement) speed is proportional to time key stays pressed • The operation is not cyclic: once the maximum (minimum) value of a field is reached, the value will not change even if the key remains pressed.



#### Indication of output states

OUT 1 (AL1); OUT 2 (OPEN); OUT 3 (CLOSED)

#### PV Display: Indication of process variable

Error Indication: LO, HI, Sbr, Err  
**LO**= the value of process variable is < di LO\_S  
**HI**= the value of process variable is > di HI\_S  
**Sbr**= faulty sensor or input values higher than max. limits  
**Err**= PT100 third wire opened for PT100, PTC or input values lower than min. limits (i.e.: TC wrong connection)

#### SV display: Indication of setpoint

#### Function key

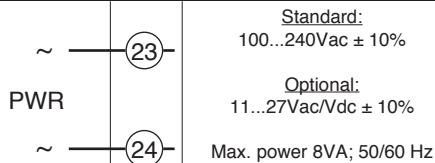
Gives access to the various configuration phases • Confirms change of set parameters and browses next or previous parameter (if Auto/Man key is pressed)

### 4 • CONNECTIONS

#### • Outputs



#### • Power Supply



TOP



#### • Inputs

##### • TC Input

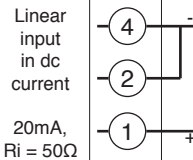
Available thermocouples:  
J, K, R, S, T  
(B, E, N, L, U, G, D, C custom linearization is available)  
- Observe polarities  
- For extensions, use the correct compensating cable for the type of TC used



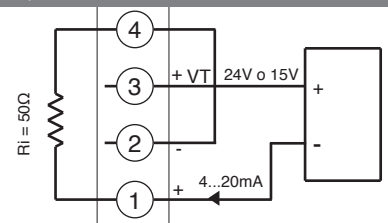
##### • Linear input with 3-wire transmitter



##### • Linear input (I)



##### • Input 1 linear with transmitter 2 wires



#### • Identification of boards

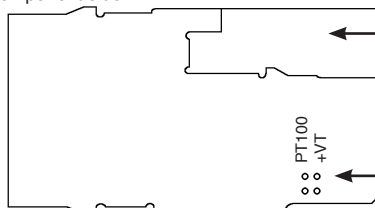
Power board - Solder side



Select transmitter voltage

**N.B. :** you can keep the **OUT1** relay energized at power-up by inserting jumper **S2** and removing resistance **R20**.

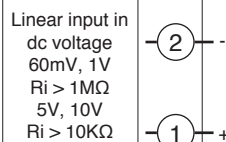
CPU board - Component side



IN/OUT boards (see appendix)

Select signal at contact 3

##### • Linear input (V)



##### • Pt100 / PTC / NTC

Use wires of adequate diameter (min. 1mm²)  
PT100, JPT100, PTC, NTC



#### • Device structure



## 5 • “EASY” PROGRAMMING and CONFIGURATION



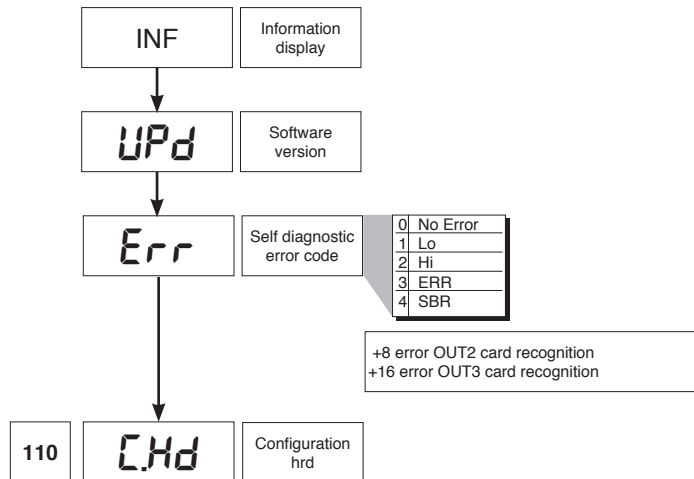
### • Prot



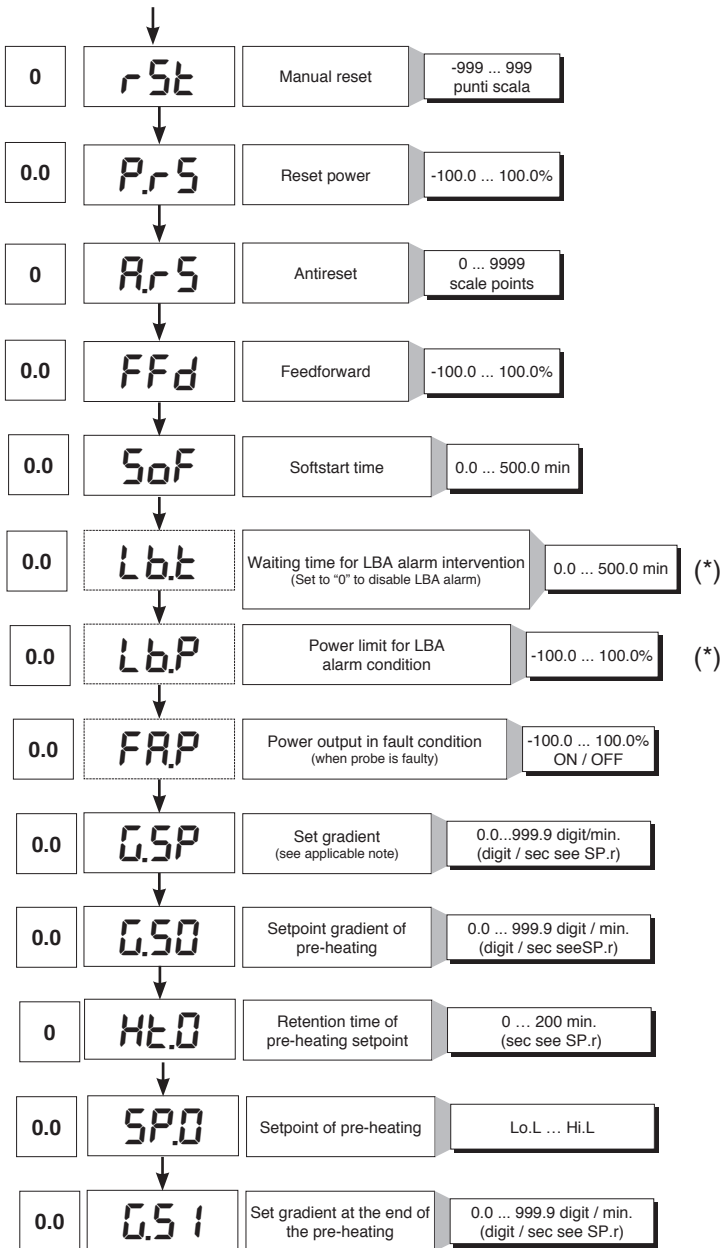
## 6 • PROGRAMMING and CONFIGURATION



**N.B.:** Once a particular configuration is entered, all unnecessary parameters are no longer displayed



• CFG



(\*) LBA alarm may be reset by simultaneously pressing  $\Delta$  +  $\nabla$  keys when OutP is displayed or by switching to Manual.



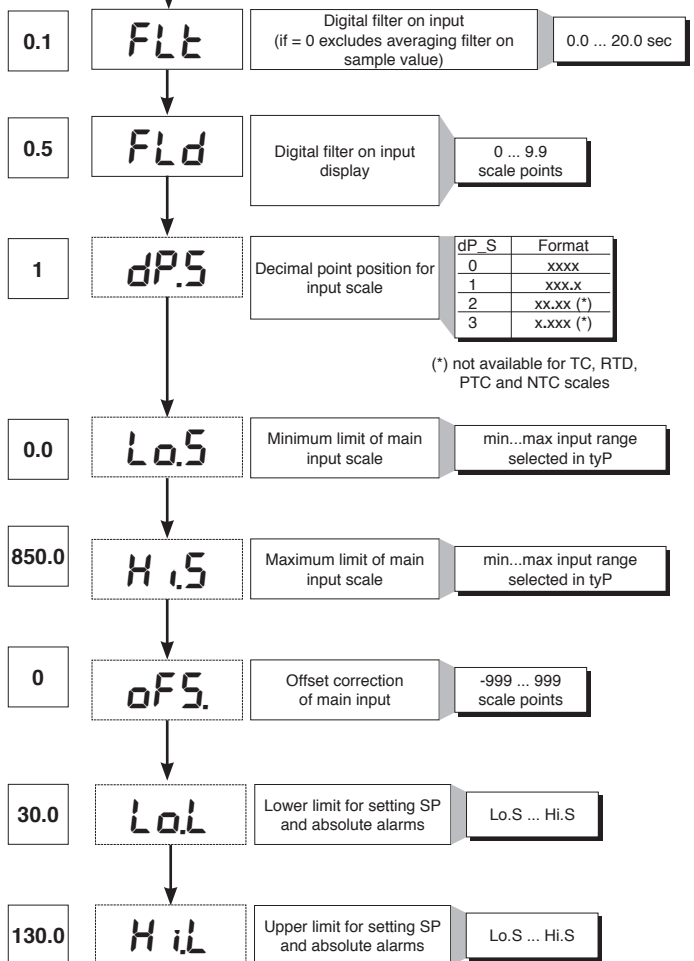
Type	Probe type	without decimal point	with decimal point
	Sensore:	TC	
0	TC J °C	0/1000	0.0/999.9
1	TC J °F	32/1832	32.0/999.9
2	TC K °C	0/1300	0.0/999.9
3	TC K °F	32/2372	32.0/999.9
4	TC R °C	0/1750	0.0/999.9
5	TC R °F	32/3182	32.0/999.9
6	TC S °C	0/1750	0.0/999.9
7	TC S °F	32/3182	32.0/999.9
8	TC T °C	-200/400	-199.9/400.0
9	TC T °F	-328/752	-199.9/752.0
28	TC	CUSTOM	CUSTOM
29	TC	CUSTOM	CUSTOM
30	PT100 °C	-200/850	-199.9/850.0
31	PT100 °F	-328/156.2	-199.9/999.9
32	JPT100 °C	-200/600	-199.9/600.0
33	JPT100 °F	-328/1112	-199.9/999.9
34	PTC °C	-55/120	-55.0/120.0
35	PTC °F	-67/248	-67.0/248.0
36	NTC °C	-10/70	-10.0/70.0
37	NTC °F	14/158	14.0/158.0
38	0...60 mV	-1999/9999	-199.9/999.9
39	0...60 mV	Custom scale	Custom scale
40	12...60 mV	-1999/9999	-199.9/999.9
41	12...60 mV	Custom scale	Custom scale
42	0...20 mA	-1999/9999	-199.9/999.9
43	0...20 mA	Custom scale	Custom scale
44	4...20 mA	-1999/9999	-199.9/999.9
45	4...20 mA	Custom scale	Custom scale
46	0...10 V	-1999/9999	-199.9/999.9
47	0...10 V	Custom scale	Custom scale
48	2...10 V	-1999/9999	-199.9/999.9
49	2...10 V	Custom scale	Custom scale
50	0...5 V	-1999/9999	-199.9/999.9
51	0...5 V	Custom scale	Custom scale
52	1...5 V	-1999/9999	-199.9/999.9
53	1...5 V	Custom scale	Custom scale
54	0...1 V	-1999/9999	-199.9/999.9
55	0...1 V	Custom scale	Custom scale
56	200mV...1V	-1999/9999	-199.9/999.9
57	200mV...1V	Custom scale	Custom scale
58	Cust10 V-20mA	-1999/9999	-199.9/999.9
59	Cust10 V-20mA	Custom scale	Custom scale
60	Cust 60mV	-1999/9999	-199.9/999.9
61	Cust 60mV	Custom scale	Custom scale
62	PT100-JPT	CUSTOM	CUSTOM
63	PTC	CUSTOM	CUSTOM
64	NTC	CUSTOM	CUSTOM

For custom linearization:  
 - LO signal is generated with variable below Lo.S or at minimum calibration value  
 - HI signal is generated with variable above Lo.S or at maximum calibration value

Max. non-linearity error for thermocouples (TC), resistors (PT100) and thermistors (PTC, NTC).  
 The error is calculated as deviation from theoretical value and is expressed as percentage of full scale (in °C).

**S, R** range 0...1750°C; error < 0.2% f.s. (t > 300°C) / for other range; error < 0.5% f.s.  
**T** error < 0.2% f.s. (t > -150°C)  
**B** range 44...1800°C; error < 0.5% f.s. (t > 300°C) / range 44,0...999,9; error < 1% f.s. (t > 300°C)  
**U** range -99,9...99,9 and -99...99°C; error < 0.5% f.s. / for other range; error < 0.2% f.s. (t > -150°C)  
**G** error < 0.2% f.s. (t > 300°C)  
**D** error < 0.2% f.s. (t > 200°C)  
**C** range 0...2300; error < 0.2% f.s. / for other range; error < 0.5% f.s.

**NTC error < 0.5% f.s.**  
 Tc: J, K, E, N, L error < 0,2% f.s.  
 JPT100 and PTC error < 0,2% f.s.  
 PT100 scale -200...850°C  
 Precision better than 0,2% f.s. at 25°C  
 In range 0...50°C:  
 • Precision better than 0,2% f.s. in range -200...400°C  
 • Precision better than 0,4% f.s. in range +400...850°C (where f.s. refers to range -200... +850°C)





## • Prot

12

*Pro*

Protection code

Prot	Display	Modification
0	SP, Hy.P, Hy.n, AL.2, AL.3, PoS, OuP, INF	SP, Hy.P, Hy.n, AL.2, AL.3, PoS
1	SP, Hy.P, Hy.n, AL.2, AL.3, PoS, OuP, INF	SP
2	SP, OuP, INF	

+ 4 to disable InP, Out  
+ 8 to disable CFG  
+ 16 to disable SW "power-up - power down"  
+ 32 disable manual power latching  
+ 64 to disable manual power modification  
+128 enables full configuration

Note: OuP and INF only display configuration extended

## • Hrd

*Hrd*

Hardware configuration

0

*hd.1*

Enable multiset instrument control by serial

6

*Ctrl*

Control type

Val	Control type
0	P heat
1	
2	
3	PI heat
4	
5	
6	PID heat
7	
8	
9	ON-OFF heat
10	
11	
12	
13	
14	

Selection of derivative action sampling time:  
+ 0 sample 1 sec.  
+ 16 sample 4 sec.  
+ 32 sample 8 sec.  
+ 64 sample 240 msec.

Note: LbA alarm is not enabled with ON/OFF type control

1

*AL.n*

Select number of enabled alarms

AL.nr	Alarm1	Alarm 2	Alarm 3
1	enabled	disabled	disabled

1

*but.*

Function of M/A keys

b u t t	
0	No function (key disenabled))
1	MAN / AUTO controller
2	
3	HOLD
4	
5	
6	Start/Stop selftuning
7	Start/Stop autotuning
8	

+ 16 disables the "back menu" function (Auto/Man + F keys) in the configuration menus

0

*dSP*

Defining SV display function

diSP	Lower display (SV) function
0	SSP - setpoint enabled
1	PoS - valve position
2	Control output value
3	Deviation (SSP - PV)

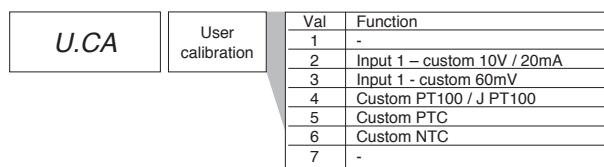




## • Lin



## • U.CAL



## 7 • CONSENT FOR BURNER AL1



Obtain burner consent by configuring alarm 1 as inverse deviation with positive hysteresis Hy.P and negative hysteresis Hy.n

## 8 • PRE-HEATING FUNCTION

Enable the pre-heating function by setting parameters GS.0, Ht.0, GS.1 other than zero.

It consists of three phases that are activated sequentially at firing:

### - Ramp 0 phase

Enabled by setting  $GS.0 > 0$ . Starting from setpoint = PV (initial state), it reaches pre-heating set SP.0 with gradient GS.0

### - Maintenance phase

Enabled by setting  $Ht.0 > 0$ . Maintains pre-heating setpoint SP.0 for time Ht.0

### - Ramp 1 phase

Enabled by setting  $GS.1 > 0$ . Starting from pre-heating setpoint SP.0, it reaches active \_SP set with gradient GS.1

In case of selftuning, the pre-heating function is not activated



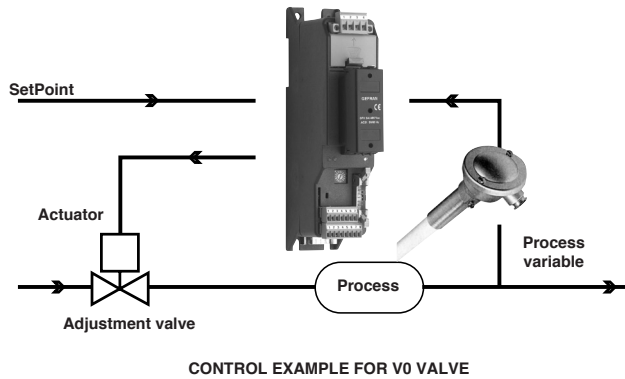
## 9 • ADJUSTMENT WITH MOTORIZED VALVE

In an adjustment process the adjustment valve has the function of varying fuel delivery (frequently corresponding to the thermal energy introduced into the process) in relation to the signal coming from the controller.

For this purpose it is provided with an actuator able to modify its opening value, overcoming the resistances produced by the fluid passing inside it.

The adjustment valves vary the delivery in a modulated manner, producing finite variations in the fluid passage inner area corresponding to finite variations of the actuator input signal, coming from the controller. The servomechanism, for example, comprises an electric motor, a reducer and a mechanical transmission system which actions the valve.

Various auxiliary components can be present such as the mechanical and electrical safety end travels, manual actioning systems.



The controller determines, on the basis of the dynamics of the process, the control output for the valve corresponding to the opening of the same in such a way so as to maintain the desired value of the process variable.

### Characteristic parameters for valves control

- Actuator time ( $A_c.t$ ) is the time employed by the valve to pass from entirely open to entirely closed (or vice-versa), and can be set with a resolution of one second. It is a mechanical feature of the valve+actuator unit.

**NOTE:** if the actuator's travel is mechanically limited it is necessary to proportionally reduce the  $A_c.t$  value.

- Minimum impulse ( $t.Lo$ ) expressed as a % of the actuator time (resolution 0.1%).

Represents the minimum change in position corresponding to a minimum change in power supplied by the instrument below which the actuator will not physically respond to the command.

This represents the minimum variation in position due to which the actuator does not physically respond to the command.

The minimum duration of the movement can be set in  $t.Lo$ , expressed as a % of actuator time.

- Impulsive intervention threshold ( $t.Hi$ ) expressed as a % of the actuator time (resolution 0.1%) represents the position displacement (requested position – real position) due to which the manoeuvre request becomes impulsive.

You can choose between 2 types of control:

1) ON time of movement =  $t.on$  and OFF time proportional to shift and greater than or equal to  $t.Lo$  (we recommend setting  $t.on = t.Lo$ ) (set  $t.oF = 0$ ).

2) ON time of movement =  $t.on$  and OFF time =  $t.oF$ . A value set for  $t.oF < t.on$  is forced to  $t.on$ . To activate this type, set  $t.oF > 0$ .

The type of movement approach allows fine control of the reverse drive valve (from potentiometer or not), especially useful in cases of high mechanical inertia.

Set  $t.Hi = 0$  to exclude modulation in positioning.

This type of modulated approach allows precise control of the feedback actioned valve, by a potentiometer or not, and is especially useful in cases of high mechanical inertia. Setting  $t.Hi = 0$  excludes modulation in positioning.

- Dead zone ( $dE.b$ ) is a displacement band between the adjustment setpoint and the process variable within which the controller does not supply any command to the valve (Open = OFF; Close = OFF). It is expressed as a percentage of the bottom scale and is positioned below the setpoint.

The dead zone is useful in an operative process to avoid straining the actuator with repeated commands and an insignificant effect on the adjustment. Setting  $dE.b = 0$  the dead zone is excluded.



Graph of behavior inside the band with integral time  $\neq 0$ .

With integral time = 0, movement ON time is always equal to OFF time.

$t_0 = t.Lo$

## Valve control modes

With the controller in manual, the setting of parameter At.y  $\geq 8$  allows direct control of the valve open and close commands through the keyboard Increments and Decrements on the front seats.

**V0** - for floating valve without potentiometer

Model V0 have similar behaviour: every manoeuvre request greater than the minimum impulse t.Lo is sent to the actuator by means of the OPEN/CLOSE relays; every action updates the presumed position of the virtual potentiometer calculated on the basis of the actuator travel declared time. In this way there is always a presumed position of the valve which is compared with the position request of the controller. Having reached a presumed extreme position (entirely open or entirely closed determined by the "virtual potentiometer") the controller provides a command in the same direction, in this way ensuring the real extreme position is reached (minimum command time = t.on). The actuators are usually protected against the OPEN command in the entirely open position or CLOSE command in the entirely closed position.

**V3** - for floating valve, PI control

When the difference between the position calculated by the controller and the only proportional component exceeds the value corresponding to the minimum impulse t.Lo the controller provides an OPEN or CLOSE command of the duration of the minimum impulse itself t.Lo. At each delivery the integral component of the command is set to zero (discharge of the integral). The frequency and duration of the impulses is correlated to the integral time (h.it or c.it).

*Non-movement behavior*

t.Hi = 0: with power = 100% or 0.0%, the corresponding open or close outputs always remain enabled (safety status).

*Movement behavior*

t.Hi  $\neq 0$ : with position attained corresponding to 100% or 0.0%, the corresponding open or close outputs are switched off.



If t.oF = 0, current function is maintained.

If t.oF  $\neq 0$  movement mode will be as shown on the graph

## 10 • CONTROL ACTIONS

*Proportional Action:*

action in which contribution to output is proportional to deviation at input (deviation = difference between controlled variable and setpoint).

*Derivative Action:*

action in which contribution to output is proportional to rate of variation input deviation.

*Integral Action:*

action in which contribution to output is proportional to integral of time of input deviation.

### Influence of Proportional, Derivative and Integral actions on response of process under control

- \* An increase in P.B. reduces oscillations but increases deviation.
  - \* A reduction in P.B. reduces the deviation but provokes oscillations of the controlled variable (the system tends to be unstable if P.B. value is too low).
  - \* An increase in Derivative Action corresponds to an increase in Derivative Time, reduces deviation and prevents oscillation up to a critical value of Derivative Time, beyond which deviation increases and prolonged oscillations occur.
  - \* An increase in Integral Action corresponds to a reduction in Integral Time, and tends to eliminate deviation between the controlled variable and the setpoint when the system is running at rated speed.
- If the Integral Time value is too long (Weak integral action), deviation between the controlled variable and the setpoint may persist.

Contact GEFRA for more information on control actions.

## 11 • MANUAL TUNING

- A) Enter the setpoint at its working value.
- B) Set the proportional band at 0.1% (with on-off type setting).
- C) Switch to automatic and observe the behavior of the variable. It will be similar to that in the figure:



D) The PID parameters are calculated as follows: Proportional band

$$P.B. = \frac{\text{Peak}}{(V_{\max} - V_{\min})} \times 100$$

(V max - V min) is the scale range.

Integral time:  $I_t = 1.5 \times T$

Derivative time:  $d_t = I_t/4$

E) Switch the unit to manual, set the calculated parameters. Return to PID action by setting the appropriate relay output cycle time, and switch back to Automatic.

F) If possible, to optimize parameters, change the setpoint and check temporary response. If an oscillation persists, increase the proportional band. If the response is too slow, reduce it.

## 12 • SET GRADIENT

SET GRADIENT: if set to  $\neq 0$ , the setpoint is assumed equal to PV at power-on and auto/man switchover. With gradient set, it reaches the local setpoint. Every variation in setpoint is subject to a gradient.

The set gradient is inhibited at power-on when self-tuning is engaged.

If the set gradient is set to  $\neq 0$ , it is active even with variations of the local setpoint.

The control setpoint reaches the set value at the speed defined by the gradient.

## 13 • SOFTWARE ON / OFF SWITCHING FUNCTION

**How to switch the unit OFF:** hold down the "F" and "Raise" keys simultaneously for 5 seconds to deactivate the unit, which will go to the OFF state while keeping the line supply connected and keeping the process value displayed. The SV display is OFF.

All outputs (alarms and controls) are OFF (logic level 0, relays de-energized) and all unit functions are disabled except the switch-on function and digital communication.

**How to switch the unit ON:** hold down the "F" key for 5 seconds and the unit will switch OFF to ON. If there is a power failure during the OFF state, the unit will remain in OFF state at the next power-up (ON/OFF state is memorized).

The function is normally enabled, but can be disabled by setting the parameter Prot = Prot +16.

## 14 • SELF-TUNING

The function works for single output systems (heating or cooling). The self-tuning action calculates optimum control parameter values during process startup. The variable (for example, temperature) must be that assumed at zero power (room temperature).

The controller supplies maximum power until an intermediate value between starting value and setpoint is reached, after which it zeros power.

PID parameters are calculated by measuring overshoot and the time needed to reach peak. When calculations are finished, the system disables automatically and the control proceeds until the setpoint is reached.

**How to activate self-tuning:**

### A. Activation at power-on

1. Set the setpoint to the required value
2. Enable selftuning by setting the Stun parameter to 2 (CFG menu)
3. Turn off the instrument
4. Make sure the temperature is near room temperature
5. Turn on the instrument again

### B. Activation from keyboard

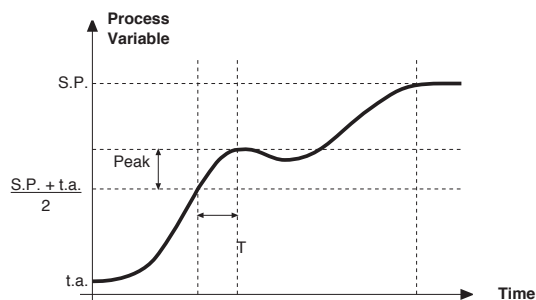
1. Make sure that key M/A is enabled for Start/Stop selftuning (code but = 6 Hrd menu)
2. Bring the temperature near room temperature
3. Set the setpoint to the required value
4. Press key M/A to activate selftuning (Attention: selftuning interrupts if the key is pressed again)

The procedure runs automatically until finished, when the new PID parameters are stored: proportional band, integral and derivative times calculated for the active action (heating or cooling). In case of double action (heating or cooling), parameters for the opposite action are calculated by maintaining the initial ratio between parameters (ex.:  $CPb = HPb \times K$ ; where  $K = CPb / HPb$  when self-tuning starts). When finished, the Stun code is automatically cancelled.

### Notes :

-The procedure does not start if the temperature is higher than the setpoint (heating control mode) or if the temperature is lower than the setpoint (cooling control mode). In this case, the Stun code is not cancelled.

-It is advisable to enable one of the configurable LEDs to signal selftuning status. By setting one of parameters LED1, LED2, LED3=4 or 20 on the Hrd menu, the respective LED will be on or flashing when selftuning is active.



## 15 • ACCESSORIES

### • Interface for instrument configuration

KIT PC USB / RS485 o TTL



Kit for PC via the USB port (Windows environment) for GEFTRAN instruments configuration:

Lets you read or write all of the parameters

- A single software for all models
- Easy and rapid configuration
- Saving and management of parameter recipes
- On-line trend and saving of historical data

Component Kit:

- Connection cable PC USB ... port TTL
- Connection cable PC USB ... RS485 port
- Serial line converter
- CD SW GF Express installation

### • ORDERING CODE

GF\_eXK-2-0-0

cod F049095

## 16 • ORDER CODE



### • WARNINGS

**WARNING:** this symbol indicates danger. It is placed near the power supply circuit and near high-voltage relay contacts.

**Read the following warnings before installing, connecting or using the device:**

- follow instructions precisely when connecting the device.
- always use cables that are suitable for the voltage and current levels indicated in the technical specifications.
- the device has no ON/OFF switch: it switches on immediately when power is turned on. For safety reasons, devices permanently connected to the power supply require a two-phase disconnecting switch with proper marking. Such switch must be located near the device and must be easily reachable by the user. A single switch can control several units.
- if the device is connected to electrically NON-ISOLATED equipment (e.g. thermocouples), a grounding wire must be applied to assure that this connection is not made directly through the machine structure.
- if the device is used in applications where there is risk of injury to persons and/or damage to machines or materials, it **MUST** be used with auxiliary alarm units. You should be able to check the correct operation of such units during normal operation of the device.
- before using the device, the user must check that all device parameters are correctly set in order to avoid injury to persons and/or damage to property.
- the device must **NOT** be used in inflammable or explosive environments. It may be connected to units operating in such environments only by means of suitable interfaces in conformity to local safety regulations.
- the device contains components that are sensitive to static electrical discharges. Therefore, take appropriate precautions when handling electronic circuit boards in order to prevent permanent damage to these components.

**Installation:** installation category II, pollution level 2, double isolation

The equipment is intended for permanent indoor installations within their own enclosure or panel mounted enclosing the rear housing and exposed terminals on the back.

- only for low power supply: supply from Class 2 or low voltage limited energy source
- power supply lines must be separated from device input and output lines; always check that the supply voltage matches the voltage indicated on the device label.
- install the instrumentation separately from the relays and power switching devices
- do not install high-power remote switches, contactors, relays, thyristor power units (particularly if "phase angle" type), motors, etc... in the same cabinet.
- avoid dust, humidity, corrosive gases and heat sources.
- do not close the ventilation holes; working temperature must be in the range of 0...50°C.

- surrounding air: 50°C
- use 60/75°C copper (Cu) conductor only, wire size range 2x No 22 - 14AWG, Solid/Stranded
- use terminal tightening torque 0.5N m

If the device has faston terminals, they must be protected and isolated; if the device has screw terminals, wires should be attached at least in pairs.

• **Power:** supplied from a disconnecting switch with fuse for the device section; path of wires from switch to devices should be as straight as possible; the same supply should not be used to power relays, contactors, solenoid valves, etc.; if the voltage waveform is strongly distorted by thyristor switching units or by electric motors, it is recommended that an isolation transformer be used only for the devices, connecting the screen to ground; it is important for the electrical system to have a good ground connection; voltage between neutral and ground must not exceed 1V and resistance must be less than 60hm; if the supply voltage is highly variable, use a voltage stabilizer for the device; use line filters in the vicinity of high frequency generators or arc welders; power supply lines must be separated from device input and output lines; always check that the supply voltage matches the voltage indicated on the device label.

• **Input and output connections:** external connected circuits must have double insulation; to connect analog inputs (TC, RTD) you have to: physically separate input wiring from power supply wiring, from output wiring, and from power connections; use twisted and screened cables, with screen connected to ground at only one point; to connect adjustment and alarm outputs (contactors, solenoid valves, motors, fans, etc.), install RC groups (resistor and capacitor in series) in parallel with inductive loads that work in AC (*Note: all capacitors must conform to VDE standards (class x2) and support at least 220 VAC. Resistors must be at least 2W*); fit a 1N4007 diode in parallel with the coil of inductive loads that operate in DC.

**GEFRAN spa will not be held liable for any injury to persons and/or damage to property deriving from tampering, from any incorrect or erroneous use, or from any use not conforming to the device specifications.**



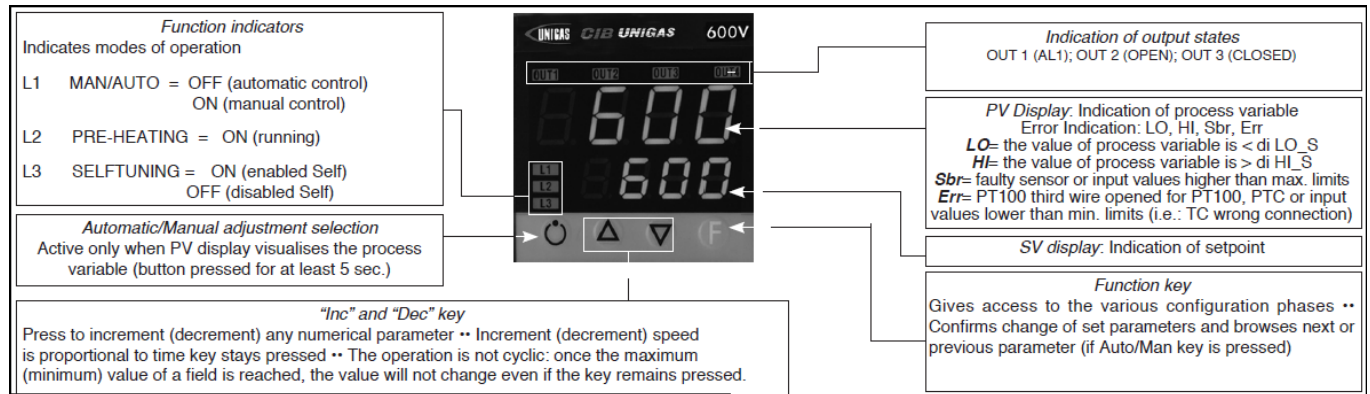


## Set-up for 600V RRR0-1-T73 regulator

### Set up for temperature probe Pt100 (ex Siemens QAE2120 130°C max.)

The regulator comes out of the factory preset with the corresponding values of the Siemens RWF40.000 and RWF50.2x

Verify wiring of the sensor



Regulation of the set-point = 80

It can be modified by using arrows "up" and "down".

By pushing **F** you go to parameters:

Hy.P	5 (hysteresis positive for output 1, terminals 21-22 (ex Q13-Q14))
Hy.n	-5 hysteresis negative for output ,1 terminals 21-22 (ex Q13-Q14)

Keep pushing **F** until you see **PASS**, release **F** and through the arrows set **99**, push **F** and visualize **Pro** (protection code) default is **12**, through the arrows set **128** and push **F**, keep it pushed until all parameters **InF**, **CFG**, **InP**, **Out**, **PASS** are visualized.

CFG	
S.tun	0
hPb	1,2
hIt	5,83
hdt	1,33
...	

InP	
....	
tyP	30 (Pt100)
...	
dP_S	1 (decimals num.)
Lo.S	0 (min. sensor scale)
Hi.S	850,0 (max sensor scale)
oFS	0 (offset of input correction)
Lo.L	30,0 (lower set-point range limit)
Hi.L	130,0 (upper set-point range limit)

Out	
A1.r	0
...	
A1.t	3 (operating mode AL1 =inverse-relative-normal)
...	
rL.1	2 (AL1)
rL.2	18 (open)
rL.3	19 (close)
rEL	0
A.ty	9 (type of servocontrol command)
Ac.t	12 (servocontrol running time: SQN72.4.../STA12..=12; SQM40.265=30)
t Lo	2
t Hi	0.0
t.on	2
t.oF	0.0
dE.b	0,1 (dead zone in % of end scale)

PAS	99 then push and keep pushed <b>F</b> until visualization of <b>Hrd</b>
Hrd	
...	
Ctrl	6 (PID warm)
AL.nr	1
but	1
diSP	0
Ld.1	1
Ld.2	28
Ld.3	20

Keep pushed **F** until you visualize **PASS**, release **F** and through the arrows set **99**, push **F** and visualize **Pro** (protection code) from **128**, through the arrows, bring it back to **12**, and keep **F** pushed until you come back to set-point value.

#### Manual operation :

Keep pushed the lower left key for at least 5 sec.

The instrument will enter the "MAN" mode (see also "Ld1" switching on).

Through the arrows, "Open" and "Close" outputs are activated.

To come back to normal working keep the lower left key pushed for at least 5 sec.

#### Software switch off :

By keeping pushed keys **Arrow up** + **F** for more than 5 sec. the instrument switches off the software, does not command the outputs and visualize only the variable of process measured by the probe.

To restore keep pushed **F** for more than 5 sec.

## Set up for temperature probe Pt100 for high temperature (350°C max.)

Verify wiring of the sensor



Regulation of the set-point = **80**

It can be modified by using arrows "up" and "down".

By pushing **F** you go to parameters:

Hy.P	10 (hysteresis positive for output 1 terminals 21-22 (ex Q13-Q14))
Hy.n	-5 (hysteresis negative for output 1 terminals 21-22 (ex Q13-Q14))

Keep pushing **F** until you see **PASS**, release **F** and through the arrows set **99**, push **F** and visualize **Pro** (protection code) default is **12**, through the arrows set **128** and push **F**, keep it pushed until all parameters **InF**, **CFG**, **InP**, **Out**, **PASS** are visualized.

CFG	
S.tun	0
hPb	1,2
hlt	5,83
hdt	1,33
...	

InP	
....	
tyP	30 (Pt100)
...	
dP_S	1 (decimals num.)
Lo.S	0 (min. sensor scale)
Hi.S	850,0 (max sensor scale)
oFS	0 (offset of input correction)
Lo.L	0,0 (lower set-point range limit)
Hi.L	350,0 (upper set-point range limit)

Out	
A1.r	0
...	
A1.t	3 (mode AL1 =inverse-relative-normal)
...	
rL.1	2 (AL1)
rL.2	18 (open)
rL.3	19 (close)
rEL	0
A.ty	9 (type of servocontrol command)
Ac.t	12 (servocontrol running time: SQN72.4.../STA12..=12; SQM40.265=30)
t Lo	2
t Hi	0.0
t.on	2
t.oF	0.0
dE.b	0,1 (dead zone in % of end scale)

PAS	99 then push and keep pushed F until visualization of Hrd
Hrd	
...	
Ctrl	6 (PID warm)
AL.nr	1
but	1
diSP	0
Ld.1	1
Ld.2	28
Ld.3	20

Keep pushed **F** until you visualize **PASS**, release **F** and through the arrows set **99**, push **F** and visualize **Pro** (protection code) from **128**, through the arrows, bring it back to **12**, and keep **F** pushed until you come back to set-point value.

#### Manual operation:

Keep pushed the lower left key for at least 5 sec.

The instrument will enter the "MAN" mode (see also "Ld1" switching on).

Through the arrows, "Open" and "Close" outputs are activated.

To come back to normal working keep the lower left key pushed for at least 5 sec.

#### Software switch off :

By keeping pushed keys **Arrow up** + **F** for more than 5 sec. the instrument switches off the software, does not command the outputs and visualize only the variable of process measured by the probe.

To restore keep pushed **F** for more than 5 sec.

## Set up for pressure transmitter 2 wires signal 4÷20mA



With pressure transmitters first we need to enable their power supply: remove the part as shown below, then, on the CPU unit, move the bridge from Pt100 to +Vt



Verify wiring of the sensor

Impostazione set-point

Transmitter	1,6bar	3bar	10bar	16bar	25bar	40bar
Set-point	1bar	1,5bar	6bar	6bar	6bar	6bar

To modify it directly use "up" and "down" arrows.

By pushing **F** you go to parameter:

Transmitter	1,6bar	3bar	10bar	16bar	25bar	40bar
Hy.P	0,2bar	0,5bar	0,5bar	0,8bar	1,25bar	2bar
Hy.n	0bar	0bar	0bar	0bar	0bar	0bar

Keep pushing **F** until you see **PASS**, release **F** and through the arrows set **99**, push **F** and visualize **Pro** (protection code) default is **12**, through the arrows set **128** and push **F**, keep it pushed until all parameters **InF**, **CFG**, **InP**, **Out**, **PASS** are visualized.

CFG	
S.tun	0
hPb	5
hIt	1,33
hdt	0,33
...	

InP	
....	
tyP	44 (4÷20mA)
...	
dP_S	2 (decimals num.)

Transmitter	1,6bar	3bar	10bar	16bar	25bar	40bar	
Lo.S	0,00	0,00	0,00	0,00	0,00	0,00	min. sensor scale
Hi.S	1,60	3,00	10,00	16,00	25,00	40,00	max sensor scale
oFS	0	0	0	0	0	0	offset of input correction
Lo.L	0,00	0,00	0,00	0,00	0,00	0,00	lower set-point setting
Hi.L	1,60	3,00	10,00	16,00	25,00	40,00	upper set-point setting

Out	
A1.r	0
...	
A1.t	3 (mode AL1 =inverse-relative-normal)
...	
rL.1	2 (AL1)
rL.2	18 (open)
rL.3	19 (close)
rEL	0
A.ty	9 (type of servocontrol command)
Ac.t	12 (servocontrol running time: SQN72.4.../STA12..=12; SQM40.265=30)
t Lo	2
t Hi	0.0
t.on	2
t.oF	0.0
dE.b	0,1 (dead zone in % of end scale)

<b>PAS</b>	99 then push and keep pushed <b>F</b> until visualization of <b>Hrd</b>
Hrd	
...	
Ctrl	6 (PID warm)
AL.nr	1
but	1
diSP	0
Ld.1	1
Ld.2	28
Ld.3	20

Keep pushed **F** until you visualize **PASS**, release **F** and through the arrows set **99**, push **F** and visualize **Pro** (protection code) from **128**, through the arrows, bring it back to **12**, and keep **F** pushed until you come back to set-point value.

#### Manual operation:

Keep pushed the lower left key for at least 5 sec.

The instrument will enter the "MAN" mode (see also "Ld1" switching on).

Through the arrows, "Open" and "Close" outputs are activated.

To come back to normal working keep the lower left key pushed for at least 5 sec.

#### Software switch off :

By keeping pushed keys **Arrow up** + **F** for more than 5 sec. the instrument switches off the software, does not command the outputs and visualize only the variable of process measured by the probe.

To restore keep pushed **F** for more than 5 sec.

## Set-up for thermocouples type **K** or **J**

Verify wiring of the sensor



Regulation of the set-point = **80**

It can be modified by using arrows "up" and "down".

By pushing **F** you go to parameters:

Hy.P	10 (hysteresis positive for output 1 terminals 21-22 (ex Q13-Q14))
Hy.n	-5 (hysteresis negative for output 1 terminals 21-22 (ex Q13-Q14))

Keep pushing **F** until you see **PASS**, release **F** and through the arrows set **99**, push **F** and visualize **Pro** (protection code) default is **12**, through the arrows set **128** and push **F**, keep it pushed until all parameters **InF**, **CFG**, **InP**, **Out**, **PASS** are visualized.

CFG	
S.tun	0
hPb	1,2
hIt	5,83
hdt	1,33
...	

InP	
...	
tyP	2 (thermocouple <b>K</b> 0÷1300°C) / 0 (thermocouple <b>J</b> 0÷1000°C)
...	
dP_S	0 (no decimal) / 1 (1 decimal)
Lo.S	0 (min. sensor scale)
Hi.S	1300 (max sensor scale for tc <b>K</b> ) / 1000 (max sensor scale for tc <b>J</b> )
oFS	0 (offset of input correction)
Lo.L	0 (lower set-point range limit)
Hi.L	1300 (upper set-point range limit) per tc <b>K</b> / 1000 for tc <b>J</b>



Out	
A1.r	0
...	
A1.t	3 (mode AL1 =inverse-relative-normal)
...	
rL.1	2 (AL1)
rL.2	18 (open)
rL.3	19 (close)
rEL	0
A.ty	9 (type of servocontrol command)
Ac.t	12 (servocontrol running time: SQN72.4.../STA12..=12; SQM40.265=30)
t Lo	2
t Hi	0.0
t.on	2
t.oF	0.0
dE.b	0,1 (dead zone in % of end scale)

<b>PAS</b>	99 then push and keep pushed <b>F</b> until visualization of <b>Hrd</b>
Hrd	
...	
Ctrl	6 (PID warm)
AL.nr	1
but	1
diSP	0
Ld.1	1
Ld.2	28
Ld.3	20

Keep pushed **F** until you visualize **PASS**, release **F** and through the arrows set **99**, push **F** and visualize **Pro** (protection code) from **128**, through the arrows, bring it back to **12**, and keep **F** pushed until you come back to set-point value.

#### Manual operation:

Keep pushed the lower left key for at least 5 sec.

The instrument will enter the "MAN" mode (see also "Ld1" switching on).

Through the arrows, "Open" and "Close" outputs are activated.

To come back to normal working keep the lower left key pushed for at least 5 sec.

#### Software switch off :

By keeping pushed keys **Arrow up** + **F** for more than 5 sec. the instrument switches off the software, does not command the outputs and visualize only the variable of process measured by the probe.

To restore keep pushed **F** for more than 5 sec.







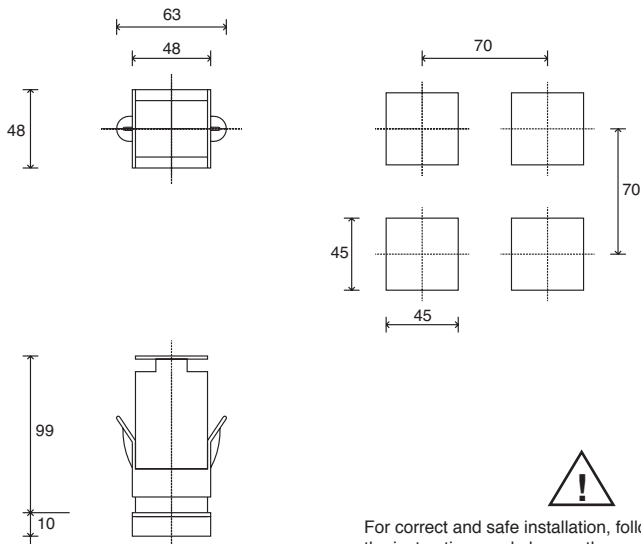
## USER'S MANUAL

COD. M12925CA Rel 1.2 08/2014

SOFTWARE VERSION 1.0x T73  
code 80379 / Edition 01 - 06/2012

## 1 • INSTALLATION

### • Dimensions and cut-out; panel mounting



For correct and safe installation, follow the instructions and observe the warnings contained in this manual.

#### Panel mounting:

To fix the unit, insert the brackets provided into the seats on either side of the case.  
To mount two or more units side by side, respect the cut-out dimensions shown in the drawing.

**CE MARKING:** The instrument conforms to the European Directives 2004/108/CE and 2006/95/CE with reference to the generic standards: **EN 61000-6-2** (immunity in industrial environment) **EN 61000-6-3** (emission in residential environment) **EN 61010-1** (safety).

**MAINTENANCE:** Repairs must be done only by trained and specialized personnel.

Cut power to the device before accessing internal parts.

Do not clean the case with hydrocarbon-based solvents (Petrol, Trichlorethylene, etc.). Use of these solvents can reduce the mechanical reliability of the device. Use a cloth dampened in ethyl alcohol or water to clean the external plastic case.

**SERVICE:** GEFRAN has a service department. The warranty excludes defects caused by any use not conforming to these instructions.

EMC conformity has been tested with the following connections

FUNCTION	CABLE TYPE	LENGTH
Power supply cable	1 mm <sup>2</sup>	1 m
Relay output cable	1 mm <sup>2</sup>	3,5 m
TC input	0,8 mm <sup>2</sup> compensated	5 m
Pt100 input	1 mm <sup>2</sup>	3 m

## 2 • TECHNICAL SPECIFICATIONS

Display	2x4 digit green, high display 10 and 7mm
Keys	4 of mechanical type (Man/Aut, INC, DEC, F)
Accuracy	0.2% f.s. $\pm 1$ digit ambient temperature 25°C
Main input (settable digital filter)	TC, RTD, PTC, NTC 60mV, 1V Ri $\geq$ 1M $\Omega$ ; 5V, 10V Ri $\geq$ 10K $\Omega$ ; 20mA Ri=50 $\Omega$ Tempo di campionamento 120 msec.
Type TC Thermocouples (ITS90)	Type TC Thermocouples : J, K, R, S, T (IEC 584-1, CEI EN 60584-1, 60584-2) ; custom linearization is available / types B, E, N, L GOST, U, G, D, C are available by using the custom linearization.
Cold junction error	0,1° / °C
RTD type (scale configurable within indicated range, with or without decimal point) (ITS90) Max line resistance for RTD	DIN 43760 (Pt100), JPT100 20 $\Omega$
PTC type / NTC Type	990 $\Omega$ , 25°C / 1K $\Omega$ , 25°C
Safety	detection of short-circuit or opening of probes, LBA alarm
°C / °F selection	configurable from faceplate
Linear scale ranges	-1999 to 9999 with configurable decimal point position
Controls	PID, Self-tuning, on-off
pb - dt - it	0,0...999,9 % - 0,00...99,99 min - 0,00...99,99 min
Action	Heat / Cool
Control outputs	on / off
Maximum power limit heat / cool	0,0...100,0 %
Cycle time	0...200 sec
Main output type	relay, logic, continuous (0...10V Rload $\geq$ 250K $\Omega$ , 0/4...20mA Rload $\leq$ 500 $\Omega$ )
Softstart	0,0...500,0 min
Fault power setting	-100,0...100,0 %
Automatic blanking	Displays PV value, optional exclusion
Configurable alarms	Up to 3 alarm functions assignable to an output, configurable as: maximum, minimum, symmetrical, absolute/deviation, LBA
Alarm masking	- exclusion during warm up - latching reset from faceplate or external contact
Type of relay contact	NO (NC), 5A, 250V/30Vdc cos $\phi$ =1
Logic output for static relays	24V $\pm$ 10% (10V min at 20mA)
Transmitter power supply	15/24Vdc, max 30mA short-circuit protection
Power supply (switching type)	(std) 100 ... 240Vac $\pm$ 10% (opt.) 11...27Vac/dc $\pm$ 10%; 50/60Hz, 8VA max
Faceplate protection	IP65
Working / Storage temperature range	0...50°C / -20...70°C
Relative humidity	20 ... 85% non-condensing
Environmental conditions of use	for internal use only, altitude up to 2000m
Installation	Panel, plug-in from front
Weight	160g for the complete version

### 3 • DESCRIPTION OF FACEPLATE

#### Function indicators

- Indicates modes of operation
- L1 MAN/AUTO = OFF (automatic control)  
ON (manual control)
  - L2 PRE-HEATING = ON (running)
  - L3 SELFTUNING = ON (enabled Self)  
OFF (disabled Self)

#### Automatic/Manual adjustment selection

Active only when PV display visualises the process variable (button pressed for at least 5 sec.)

#### "Inc" and "Dec" key

Press to increment (decrement) any numerical parameter • Increment (decrement) speed is proportional to time key stays pressed • The operation is not cyclic: once the maximum (minimum) value of a field is reached, the value will not change even if the key remains pressed.



#### Indication of output states

OUT 1 (AL1); OUT 2 (OPEN); OUT 3 (CLOSED)

#### PV Display: Indication of process variable

Error Indication: LO, HI, Sbr, Err  
**LO**= the value of process variable is < di LO\_S  
**HI**= the value of process variable is > di HI\_S  
**Sbr**= faulty sensor or input values higher than max. limits  
**Err**= PT100 third wire opened for PT100, PTC or input values lower than min. limits (i.e.: TC wrong connection)

#### SV display: Indication of setpoint

#### Function key

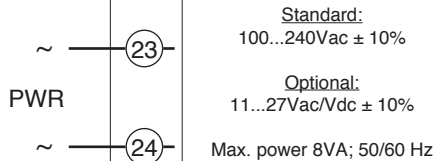
Gives access to the various configuration phases • Confirms change of set parameters and browses next or previous parameter (if Auto/Man key is pressed)

### 4 • CONNECTIONS

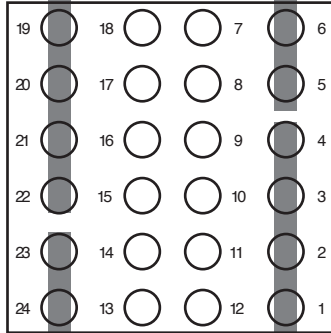
#### • Outputs



#### • Power Supply



TOP



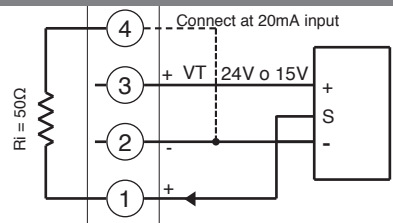
#### • Inputs

##### • TC Input

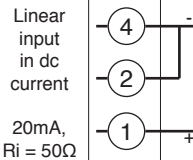
Available thermocouples:  
 J, K, R, S, T  
 (B, E, N, L, U, G, D, C custom linearization is available)  
 - Observe polarities  
 - For extensions, use the correct compensating cable for the type of TC used



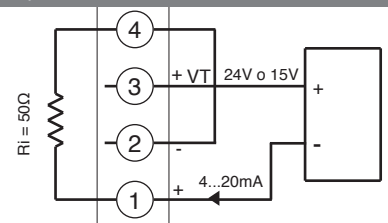
##### • Linear input with 3-wire transmitter



##### • Linear input (I)

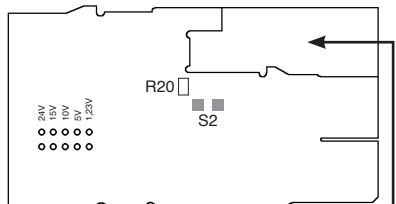


##### • Input 1 linear with transmitter 2 wires



#### • Identification of boards

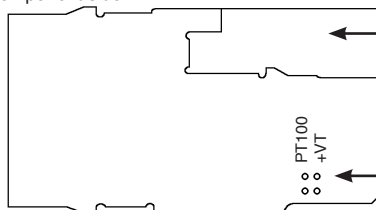
Power board - Solder side



Select transmitter voltage

**N.B. :** you can keep the **OUT1** relay energized at power-up by inserting jumper **S2** and removing resistance **R20**.

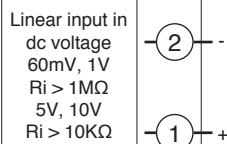
CPU board - Component side



IN/OUT boards (see appendix)

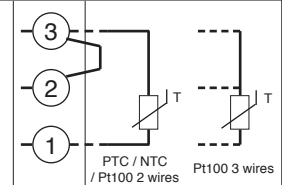
Select signal at contact 3

##### • Linear input (V)

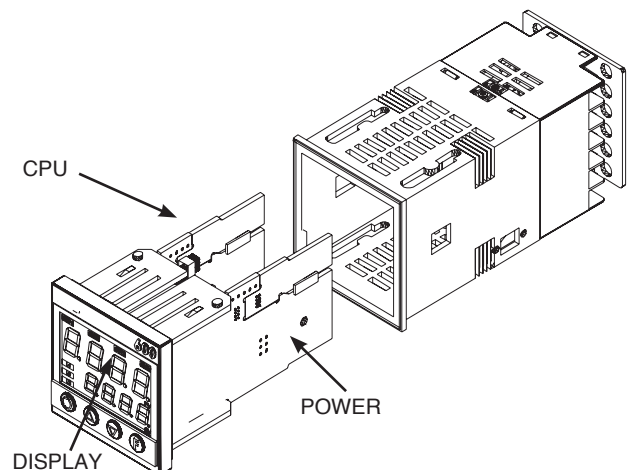


##### • Pt100 / PTC / NTC

Use wires of adequate diameter (min. 1mm²)  
 PT100, JPT100, PTC, NTC

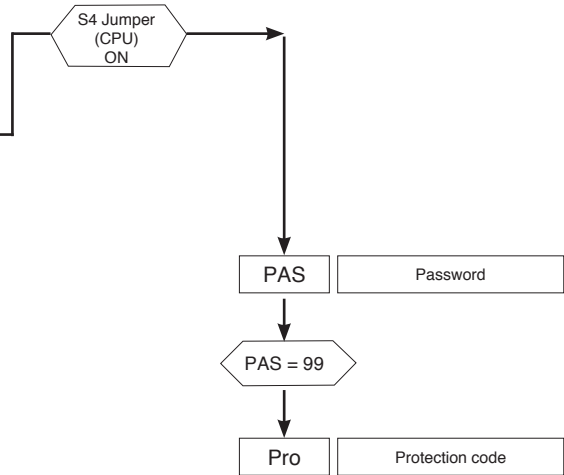
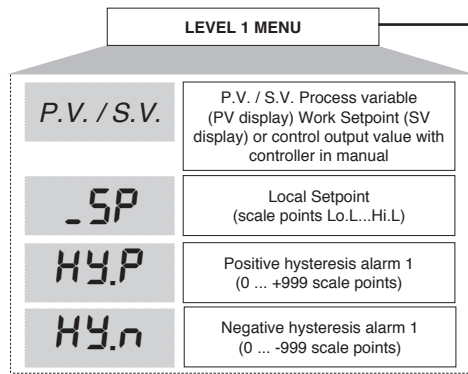


#### • Device structure

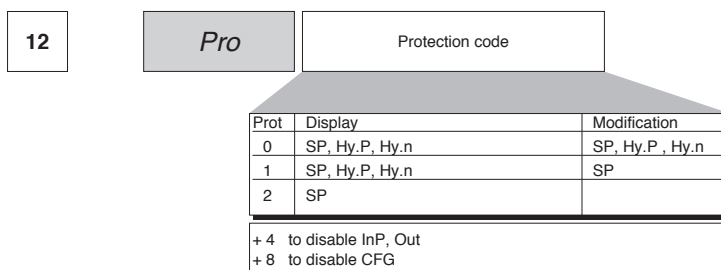


## 5 • “EASY” PROGRAMMING and CONFIGURATION

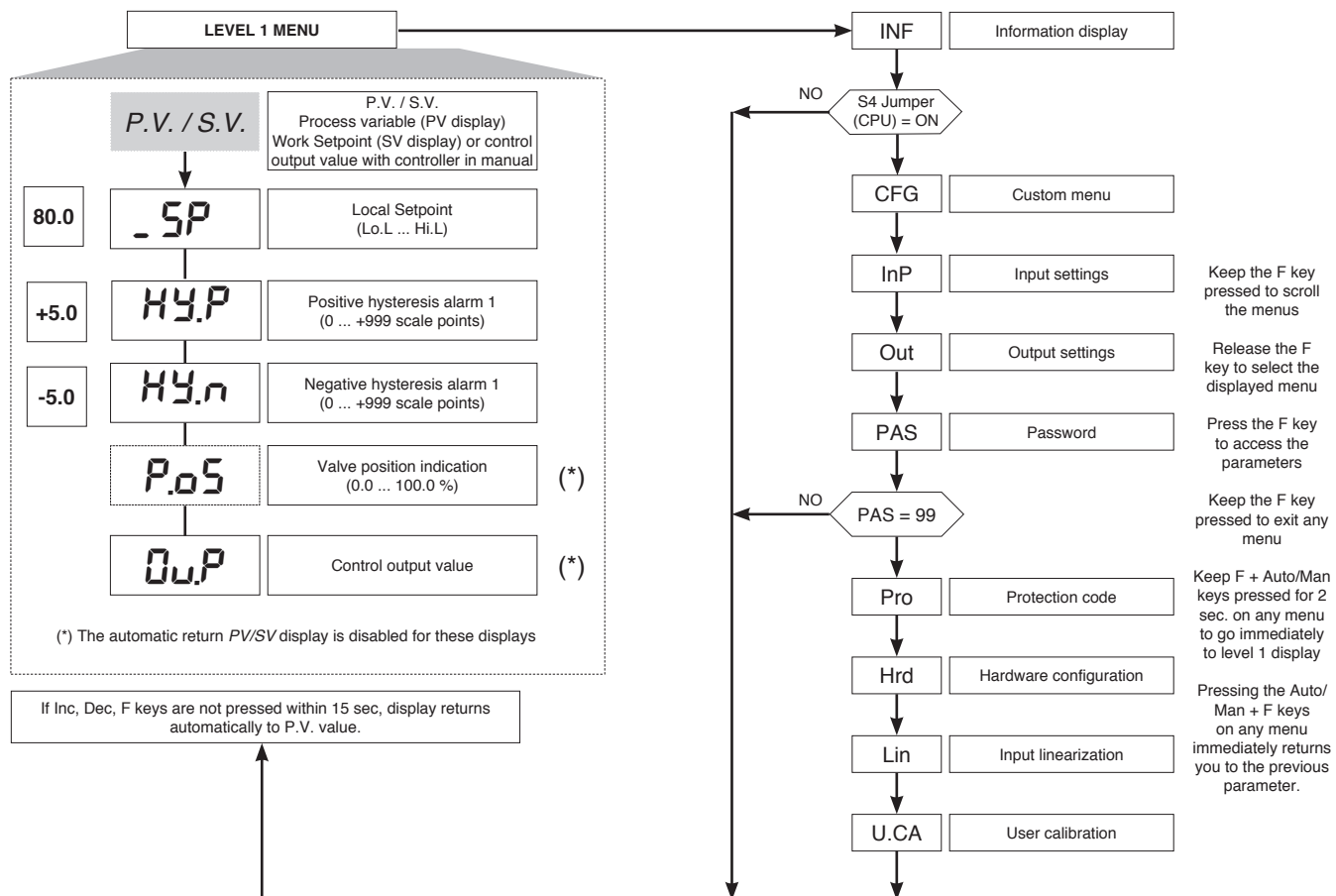
THE EASY CONFIGURATION (Pro=0...12) IS SUITABLE FOR VERSIONS WITH AL1/OPEN/CLOSED



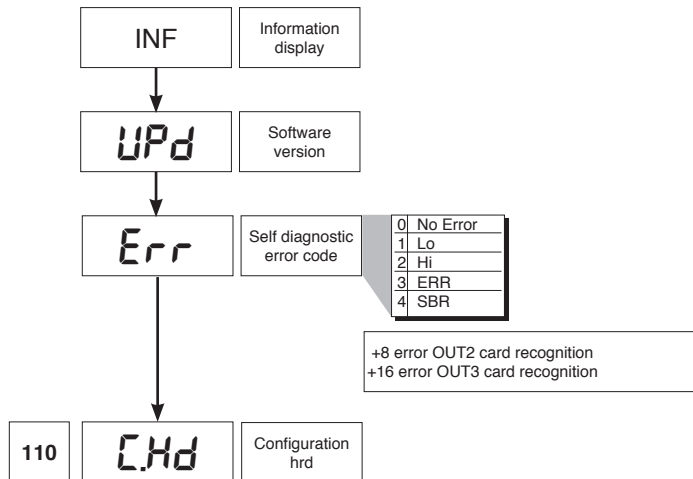
### • Prot



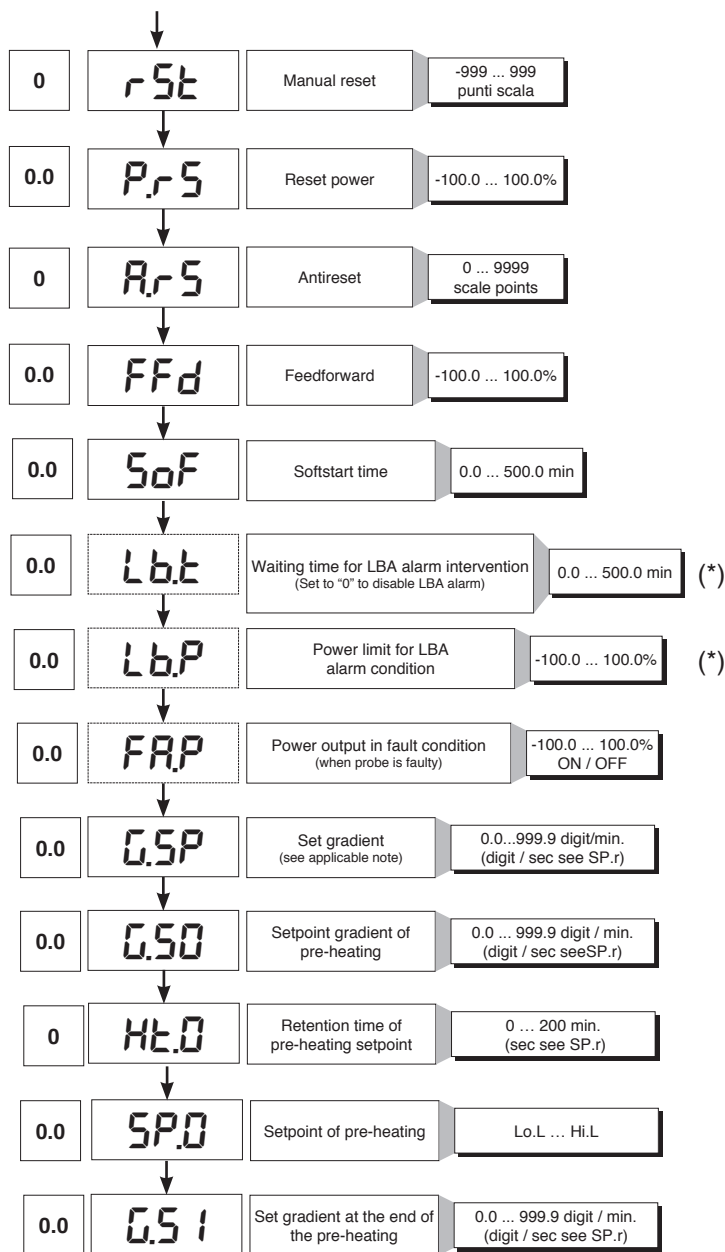
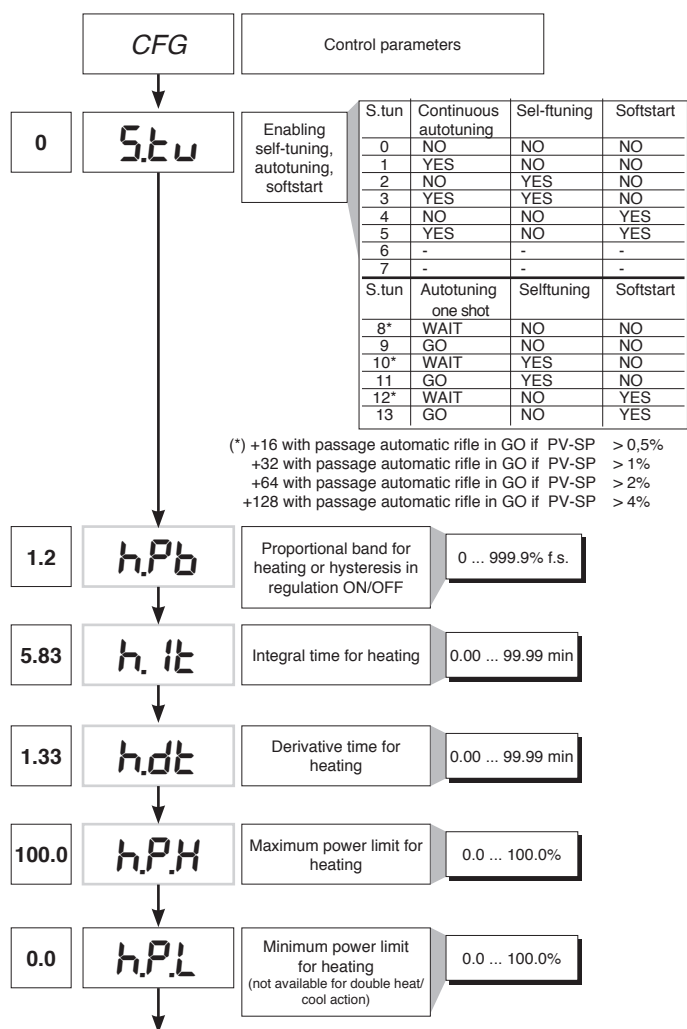
## 6 • PROGRAMMING and CONFIGURATION



**N.B.:** Once a particular configuration is entered, all unnecessary parameters are no longer displayed

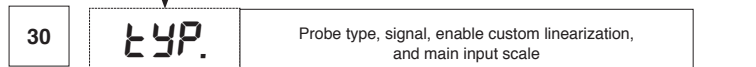
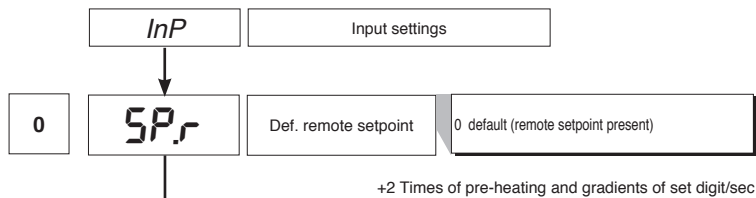


• CFG



(\*) LBA alarm may be reset by simultaneously pressing  $\Delta$  +  $\nabla$  keys when OutP is displayed or by switching to Manual.





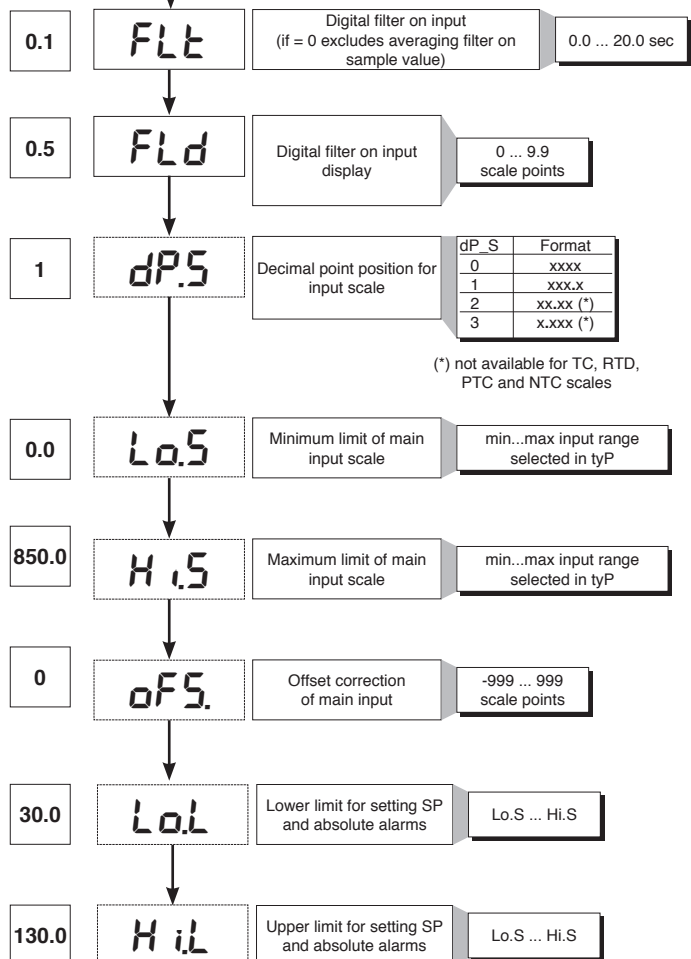
Type	Probe type	without decimal point	with decimal point
Sensore: TC			
0	TC J °C	0/1000	0.0/999.9
1	TC J °F	32/1832	32.0/999.9
2	TC K °C	0/1300	0.0/999.9
3	TC K °F	32/2372	32.0/999.9
4	TC R °C	0/1750	0.0/999.9
5	TC R °F	32/3182	32.0/999.9
6	TC S °C	0/1750	0.0/999.9
7	TC S °F	32/3182	32.0/999.9
8	TC T °C	-200/400	-199.9/400.0
9	TC T °F	-328/752	-199.9/752.0
28	TC	CUSTOM	CUSTOM
29	TC	CUSTOM	CUSTOM
30	PT100 °C	-200/850	-199.9/850.0
31	PT100 °F	-328/156.2	-199.9/999.9
32	JPT100 °C	-200/600	-199.9/600.0
33	JPT100 °F	-328/1112	-199.9/999.9
34	PTC °C	-55/120	-55.0/120.0
35	PTC °F	-67/248	-67.0/248.0
36	NTC °C	-10/70	-10.0/70.0
37	NTC °F	14/158	14.0/158.0
38	0...60 mV	-1999/9999	-199.9/999.9
39	0...60 mV	Custom scale	Custom scale
40	12...60 mV	-1999/9999	-199.9/999.9
41	12...60 mV	Custom scale	Custom scale
42	0...20 mA	-1999/9999	-199.9/999.9
43	0...20 mA	Custom scale	Custom scale
44	4...20 mA	-1999/9999	-199.9/999.9
45	4...20 mA	Custom scale	Custom scale
46	0...10 V	-1999/9999	-199.9/999.9
47	0...10 V	Custom scale	Custom scale
48	2...10 V	-1999/9999	-199.9/999.9
49	2...10 V	Custom scale	Custom scale
50	0...5 V	-1999/9999	-199.9/999.9
51	0...5 V	Custom scale	Custom scale
52	1...5 V	-1999/9999	-199.9/999.9
53	1...5 V	Custom scale	Custom scale
54	0...1 V	-1999/9999	-199.9/999.9
55	0...1 V	Custom scale	Custom scale
56	200mV...1V	-1999/9999	-199.9/999.9
57	200mV...1V	Custom scale	Custom scale
58	Cust10 V-20mA	-1999/9999	-199.9/999.9
59	Cust10 V-20mA	Custom scale	Custom scale
60	Cust 60mV	-1999/9999	-199.9/999.9
61	Cust 60mV	Custom scale	Custom scale
62	PT100-JPT	CUSTOM	CUSTOM
63	PTC	CUSTOM	CUSTOM
64	NTC	CUSTOM	CUSTOM

For custom linearization:  
 - LO signal is generated with variable below Lo.S or at minimum calibration value  
 - HI signal is generated with variable above Lo.S or at maximum calibration value

Max. non-linearity error for thermocouples (TC), resistors (PT100) and thermistors (PTC, NTC).  
 The error is calculated as deviation from theoretical value and is expressed as percentage of full scale (in °C).

**S, R** range 0...1750°C; error < 0.2% f.s. (t > 300°C) / for other range; error < 0.5% f.s.  
**T** error < 0.2% f.s. (t > -150°C)  
**B** range 44...1800°C; error < 0.5% f.s. (t > 300°C) / range 44,0...999,9; error < 1% f.s. (t > 300°C)  
**U** range -99,9...99,9 and -99...99°C; error < 0.5% f.s. / for other range; error < 0.2% f.s. (t > -150°C)  
**G** error < 0.2% f.s. (t > 300°C)  
**D** error < 0.2% f.s. (t > 200°C)  
**C** range 0...2300; error < 0.2% f.s. / for other range; error < 0.5% f.s.

**NTC error < 0.5% f.s.**  
 Tc: J, K, E, N, L error < 0,2% f.s.  
 JPT100 and PTC error < 0,2% f.s.  
 PT100 scale -200...850°C  
 Precision better than 0,2% f.s. at 25°C  
 In range 0...50°C:  
 • Precision better than 0,2% f.s. in range -200...400°C  
 • Precision better than 0,4% f.s. in range +400...850°C (where f.s. refers to range -200... +850°C)





## • Prot

12

*Pro*

Protection code

Prot	Display	Modification
0	SP, Hy.P, Hy.n, AL.2, AL.3, PoS, OuP, INF	SP, Hy.P, Hy.n, AL.2, AL.3, PoS
1	SP, Hy.P, Hy.n, AL.2, AL.3, PoS, OuP, INF	SP
2	SP, OuP, INF	

+ 4 to disable InP, Out  
+ 8 to disable CFG  
+ 16 to disable SW "power-up - power down"  
+ 32 disable manual power latching  
+ 64 to disable manual power modification  
+128 enables full configuration

Note: OuP and INF only display configuration extended

## • Hrd

*Hrd*

Hardware configuration

0

*hd.1*

Enable multiset instrument control by serial

6

*Ctrl*

Control type

Val	Control type
0	P heat
1	
2	
3	PI heat
4	
5	
6	PID heat
7	
8	
9	ON-OFF heat
10	
11	
12	
13	
14	

Selection of derivative action sampling time:  
+ 0 sample 1 sec.  
+ 16 sample 4 sec.  
+ 32 sample 8 sec.  
+ 64 sample 240 msec.

Note: LbA alarm is not enabled with ON/OFF type control

1

*AL.n*

Select number of enabled alarms

AL.nr	Alarm1	Alarm 2	Alarm 3
1	enabled	disabled	disabled

1

*but.*

Function of M/A keys

b u t t	
0	No function (key disenabled))
1	MAN / AUTO controller
2	
3	HOLD
4	
5	
6	Start/Stop selftuning
7	Start/Stop autotuning
8	

+ 16 disables the "back menu" function (Auto/Man + F keys) in the configuration menus

0

*dSP*

Defining SV display function

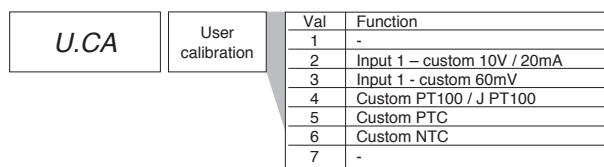
diSP	Lower display (SV) function
0	SSP - setpoint enabled
1	PoS - valve position
2	Control output value
3	Deviation (SSP - PV)



## • Lin



## • U.CAL



## 7 • CONSENT FOR BURNER AL1



Obtain burner consent by configuring alarm 1 as inverse deviation with positive hysteresis Hy.P and negative hysteresis Hy.n

## 8 • PRE-HEATING FUNCTION

Enable the pre-heating function by setting parameters GS.0, Ht.0, GS.1 other than zero.

It consists of three phases that are activated sequentially at firing:

### - Ramp 0 phase

Enabled by setting  $GS.0 > 0$ . Starting from setpoint = PV (initial state), it reaches pre-heating set SP.0 with gradient GS.0

### - Maintenance phase

Enabled by setting  $Ht.0 > 0$ . Maintains pre-heating setpoint SP.0 for time Ht.0

### - Ramp 1 phase

Enabled by setting  $GS.1 > 0$ . Starting from pre-heating setpoint SP.0, it reaches active \_SP set with gradient GS.1

In case of selftuning, the pre-heating function is not activated



## 9 • ADJUSTMENT WITH MOTORIZED VALVE

In an adjustment process the adjustment valve has the function of varying fuel delivery (frequently corresponding to the thermal energy introduced into the process) in relation to the signal coming from the controller.

For this purpose it is provided with an actuator able to modify its opening value, overcoming the resistances produced by the fluid passing inside it.

The adjustment valves vary the delivery in a modulated manner, producing finite variations in the fluid passage inner area corresponding to finite variations of the actuator input signal, coming from the controller. The servomechanism, for example, comprises an electric motor, a reducer and a mechanical transmission system which actions the valve.

Various auxiliary components can be present such as the mechanical and electrical safety end travels, manual actioning systems.



The controller determines, on the basis of the dynamics of the process, the control output for the valve corresponding to the opening of the same in such a way so as to maintain the desired value of the process variable.

### Characteristic parameters for valves control

- Actuator time ( $A_c.t$ ) is the time employed by the valve to pass from entirely open to entirely closed (or vice-versa), and can be set with a resolution of one second. It is a mechanical feature of the valve+actuator unit.

**NOTE:** if the actuator's travel is mechanically limited it is necessary to proportionally reduce the  $A_c.t$  value.

- Minimum impulse ( $t.Lo$ ) expressed as a % of the actuator time (resolution 0.1%).

Represents the minimum change in position corresponding to a minimum change in power supplied by the instrument below which the actuator will not physically respond to the command.

This represents the minimum variation in position due to which the actuator does not physically respond to the command.

The minimum duration of the movement can be set in  $t.Lo$ , expressed as a % of actuator time.

- Impulsive intervention threshold ( $t.Hi$ ) expressed as a % of the actuator time (resolution 0.1%) represents the position displacement (requested position – real position) due to which the manoeuvre request becomes impulsive.

You can choose between 2 types of control:

1) ON time of movement =  $t.on$  and OFF time proportional to shift and greater than or equal to  $t.Lo$  (we recommend setting  $t.on = t.Lo$ ) (set  $t.oF = 0$ ).

2) ON time of movement =  $t.on$  and OFF time =  $t.oF$ . A value set for  $t.oF < t.on$  is forced to  $t.on$ . To activate this type, set  $t.oF > 0$ .

The type of movement approach allows fine control of the reverse drive valve (from potentiometer or not), especially useful in cases of high mechanical inertia.

Set  $t.Hi = 0$  to exclude modulation in positioning.

This type of modulated approach allows precise control of the feedback actioned valve, by a potentiometer or not, and is especially useful in cases of high mechanical inertia. Setting  $t.Hi = 0$  excludes modulation in positioning.

- Dead zone ( $dE.b$ ) is a displacement band between the adjustment setpoint and the process variable within which the controller does not supply any command to the valve (Open = OFF; Close = OFF). It is expressed as a percentage of the bottom scale and is positioned below the setpoint.

The dead zone is useful in an operative process to avoid straining the actuator with repeated commands and an insignificant effect on the adjustment. Setting  $dE.b = 0$  the dead zone is excluded.



## Valve control modes

With the controller in manual, the setting of parameter At.y  $\geq 8$  allows direct control of the valve open and close commands through the keyboard Increments and Decrements on the front seats.

**V0** - for floating valve without potentiometer

Model V0 have similar behaviour: every manoeuvre request greater than the minimum impulse t.Lo is sent to the actuator by means of the OPEN/CLOSE relays; every action updates the presumed position of the virtual potentiometer calculated on the basis of the actuator travel declared time. In this way there is always a presumed position of the valve which is compared with the position request of the controller. Having reached a presumed extreme position (entirely open or entirely closed determined by the "virtual potentiometer") the controller provides a command in the same direction, in this way ensuring the real extreme position is reached (minimum command time = t.on). The actuators are usually protected against the OPEN command in the entirely open position or CLOSE command in the entirely closed position.

**V3** - for floating valve, PI control

When the difference between the position calculated by the controller and the only proportional component exceeds the value corresponding to the minimum impulse t.Lo the controller provides an OPEN or CLOSE command of the duration of the minimum impulse itself t.Lo. At each delivery the integral component of the command is set to zero (discharge of the integral). The frequency and duration of the impulses is correlated to the integral time (h.it or c.it).

*Non-movement behavior*

t.Hi = 0: with power = 100% or 0.0%, the corresponding open or close outputs always remain enabled (safety status).

*Movement behavior*

t.Hi  $\neq 0$ : with position attained corresponding to 100% or 0.0%, the corresponding open or close outputs are switched off.



If t.oF = 0, current function is maintained.

If t.oF  $\neq 0$  movement mode will be as shown on the graph

## 10 • CONTROL ACTIONS

*Proportional Action:*

action in which contribution to output is proportional to deviation at input (deviation = difference between controlled variable and setpoint).

*Derivative Action:*

action in which contribution to output is proportional to rate of variation input deviation.

*Integral Action:*

action in which contribution to output is proportional to integral of time of input deviation.

### Influence of Proportional, Derivative and Integral actions on response of process under control

- \* An increase in P.B. reduces oscillations but increases deviation.
  - \* A reduction in P.B. reduces the deviation but provokes oscillations of the controlled variable (the system tends to be unstable if P.B. value is too low).
  - \* An increase in Derivative Action corresponds to an increase in Derivative Time, reduces deviation and prevents oscillation up to a critical value of Derivative Time, beyond which deviation increases and prolonged oscillations occur.
  - \* An increase in Integral Action corresponds to a reduction in Integral Time, and tends to eliminate deviation between the controlled variable and the setpoint when the system is running at rated speed.
- If the Integral Time value is too long (Weak integral action), deviation between the controlled variable and the setpoint may persist.

Contact GEFRA for more information on control actions.

## 11 • MANUAL TUNING

- A) Enter the setpoint at its working value.  
 B) Set the proportional band at 0.1% (with on-off type setting).  
 C) Switch to automatic and observe the behavior of the variable. It will be similar to that in the figure:



D) The PID parameters are calculated as follows: Proportional band

$$P.B. = \frac{\text{Peak}}{(V_{\max} - V_{\min})} \times 100$$

(V max - V min) is the scale range.

Integral time:  $I_t = 1.5 \times T$

Derivative time:  $d_t = I_t/4$

E) Switch the unit to manual, set the calculated parameters. Return to PID action by setting the appropriate relay output cycle time, and switch back to Automatic.

F) If possible, to optimize parameters, change the setpoint and check temporary response. If an oscillation persists, increase the proportional band. If the response is too slow, reduce it.

## 12 • SET GRADIENT

SET GRADIENT: if set to  $\neq 0$ , the setpoint is assumed equal to PV at power-on and auto/man switchover. With gradient set, it reaches the local setpoint. Every variation in setpoint is subject to a gradient.

The set gradient is inhibited at power-on when self-tuning is engaged.

If the set gradient is set to  $\neq 0$ , it is active even with variations of the local setpoint.

The control setpoint reaches the set value at the speed defined by the gradient.

## 13 • SOFTWARE ON / OFF SWITCHING FUNCTION

**How to switch the unit OFF:** hold down the “F” and “Raise” keys simultaneously for 5 seconds to deactivate the unit, which will go to the OFF state while keeping the line supply connected and keeping the process value displayed. The SV display is OFF.

All outputs (alarms and controls) are OFF (logic level 0, relays de-energized) and all unit functions are disabled except the switch-on function and digital communication.

**How to switch the unit ON:** hold down the “F” key for 5 seconds and the unit will switch OFF to ON. If there is a power failure during the OFF state, the unit will remain in OFF state at the next power-up (ON/OFF state is memorized).

The function is normally enabled, but can be disabled by setting the parameter Prot = Prot +16.

## 14 • SELF-TUNING

The function works for single output systems (heating or cooling). The self-tuning action calculates optimum control parameter values during process startup. The variable (for example, temperature) must be that assumed at zero power (room temperature).

The controller supplies maximum power until an intermediate value between starting value and setpoint is reached, after which it zeros power.

PID parameters are calculated by measuring overshoot and the time needed to reach peak. When calculations are finished, the system disables automatically and the control proceeds until the setpoint is reached.

**How to activate self-tuning:**

### A. Activation at power-on

1. Set the setpoint to the required value
2. Enable selftuning by setting the Stun parameter to 2 (CFG menu)
3. Turn off the instrument
4. Make sure the temperature is near room temperature
5. Turn on the instrument again

### B. Activation from keyboard

1. Make sure that key M/A is enabled for Start/Stop selftuning (code but = 6 Hrd menu)
2. Bring the temperature near room temperature
3. Set the setpoint to the required value
4. Press key M/A to activate selftuning (Attention: selftuning interrupts if the key is pressed again)

The procedure runs automatically until finished, when the new PID parameters are stored: proportional band, integral and derivative times calculated for the active action (heating or cooling). In case of double action (heating or cooling), parameters for the opposite action are calculated by maintaining the initial ratio between parameters (ex.:  $CPb = HPb \times K$ ; where  $K = CPb / HPb$  when self-tuning starts). When finished, the Stun code is automatically cancelled.

### Notes :

-The procedure does not start if the temperature is higher than the setpoint (heating control mode) or if the temperature is lower than the setpoint (cooling control mode). In this case, the Stun code is not cancelled.

-It is advisable to enable one of the configurable LEDs to signal selftuning status. By setting one of parameters LED1, LED2, LED3=4 or 20 on the Hrd menu, the respective LED will be on or flashing when selftuning is active.





## 15 • ACCESSORIES

### • Interface for instrument configuration

KIT PC USB / RS485 o TTL



Kit for PC via the USB port (Windows environment) for GEFTRAN instruments configuration:

Lets you read or write all of the parameters

- A single software for all models
- Easy and rapid configuration
- Saving and management of parameter recipes
- On-line trend and saving of historical data

Component Kit:

- Connection cable PC USB ... port TTL
- Connection cable PC USB ... RS485 port
- Serial line converter
- CD SW GF Express installation

### • ORDERING CODE

GF\_eXK-2-0-0

cod F049095

## 16 • ORDER CODE



### • WARNINGS

**WARNING:** this symbol indicates danger. It is placed near the power supply circuit and near high-voltage relay contacts.

**Read the following warnings before installing, connecting or using the device:**

- follow instructions precisely when connecting the device.
- always use cables that are suitable for the voltage and current levels indicated in the technical specifications.
- the device has no ON/OFF switch: it switches on immediately when power is turned on. For safety reasons, devices permanently connected to the power supply require a two-phase disconnecting switch with proper marking. Such switch must be located near the device and must be easily reachable by the user. A single switch can control several units.
- if the device is connected to electrically NON-ISOLATED equipment (e.g. thermocouples), a grounding wire must be applied to assure that this connection is not made directly through the machine structure.
- if the device is used in applications where there is risk of injury to persons and/or damage to machines or materials, it MUST be used with auxiliary alarm units. You should be able to check the correct operation of such units during normal operation of the device.
- before using the device, the user must check that all device parameters are correctly set in order to avoid injury to persons and/or damage to property.
- the device must NOT be used in inflammable or explosive environments. It may be connected to units operating in such environments only by means of suitable interfaces in conformity to local safety regulations.
- the device contains components that are sensitive to static electrical discharges. Therefore, take appropriate precautions when handling electronic circuit boards in order to prevent permanent damage to these components.

**Installation:** installation category II, pollution level 2, double isolation

The equipment is intended for permanent indoor installations within their own enclosure or panel mounted enclosing the rear housing and exposed terminals on the back.

- only for low power supply: supply from Class 2 or low voltage limited energy source
- power supply lines must be separated from device input and output lines; always check that the supply voltage matches the voltage indicated on the device label.
- install the instrumentation separately from the relays and power switching devices
- do not install high-power remote switches, contactors, relays, thyristor power units (particularly if "phase angle" type), motors, etc... in the same cabinet.
- avoid dust, humidity, corrosive gases and heat sources.
- do not close the ventilation holes; working temperature must be in the range of 0...50°C.

- surrounding air: 50°C
- use 60/75°C copper (Cu) conductor only, wire size range 2x No 22 - 14AWG, Solid/Stranded
- use terminal tightening torque 0.5N m

If the device has faston terminals, they must be protected and isolated; if the device has screw terminals, wires should be attached at least in pairs.

• **Power:** supplied from a disconnecting switch with fuse for the device section; path of wires from switch to devices should be as straight as possible; the same supply should not be used to power relays, contactors, solenoid valves, etc.; if the voltage waveform is strongly distorted by thyristor switching units or by electric motors, it is recommended that an isolation transformer be used only for the devices, connecting the screen to ground; it is important for the electrical system to have a good ground connection; voltage between neutral and ground must not exceed 1V and resistance must be less than 60Ωm; if the supply voltage is highly variable, use a voltage stabilizer for the device; use line filters in the vicinity of high frequency generators or arc welders; power supply lines must be separated from device input and output lines; always check that the supply voltage matches the voltage indicated on the device label.

• **Input and output connections:** external connected circuits must have double insulation; to connect analog inputs (TC, RTD) you have to: physically separate input wiring from power supply wiring, from output wiring, and from power connections; use twisted and screened cables, with screen connected to ground at only one point; to connect adjustment and alarm outputs (contactors, solenoid valves, motors, fans, etc.), install RC groups (resistor and capacitor in series) in parallel with inductive loads that work in AC (*Note: all capacitors must conform to VDE standards (class x2) and support at least 220 VAC. Resistors must be at least 2W*); fit a 1N4007 diode in parallel with the coil of inductive loads that operate in DC.

**GEFRAN spa will not be held liable for any injury to persons and/or damage to property deriving from tampering, from any incorrect or erroneous use, or from any use not conforming to the device specifications.**



## Set-up for 600V RRR0-1-T73 regulator

### Set up for temperature probe Pt100 (ex Siemens QAE2120 130°C max.)

The regulator comes out of the factory preset with the corresponding values of the Siemens RWF40.000 and RWF50.2x

Verify wiring of the sensor



Regulation of the set-point = 80

It can be modified by using arrows "up" and "down".

By pushing **F** you go to parameters:

Hy.P	5 (hysteresis positive for output 1, terminals 21-22 (ex Q13-Q14))
Hy.n	-5 hysteresis negative for output ,1 terminals 21-22 (ex Q13-Q14)

Keep pushing **F** until you see **PASS**, release **F** and through the arrows set **99**, push **F** and visualize **Pro** (protection code) default is **12**, through the arrows set **128** and push **F**, keep it pushed until all parameters **InF**, **CFG**, **InP**, **Out**, **PASS** are visualized.

CFG	
S.tun	0
hPb	1,2
hIt	5,83
hdt	1,33
...	

InP	
....	
tyP	30 (Pt100)
...	
dP_S	1 (decimals num.)
Lo.S	0 (min. sensor scale)
Hi.S	850,0 (max sensor scale)
oFS	0 (offset of input correction)
Lo.L	30,0 (lower set-point range limit)
Hi.L	130,0 (upper set-point range limit)

Out	
A1.r	0
...	
A1.t	3 (operating mode AL1 =inverse-relative-normal)
...	
rL.1	2 (AL1)
rL.2	18 (open)
rL.3	19 (close)
rEL	0
A.ty	9 (type of servocontrol command)
Ac.t	12 (servocontrol running time: SQN72.4.../STA12..=12; SQM40.265=30)
t Lo	2
t Hi	0.0
t.on	2
t.oF	0.0
dE.b	0,1 (dead zone in % of end scale)

PAS	99 then push and keep pushed <b>F</b> until visualization of <b>Hrd</b>
Hrd	
...	
Ctrl	6 (PID warm)
AL.nr	1
but	1
diSP	0
Ld.1	1
Ld.2	28
Ld.3	20

Keep pushed **F** until you visualize **PASS**, release **F** and through the arrows set **99**, push **F** and visualize **Pro** (protection code) from **128**, through the arrows, bring it back to **12**, and keep **F** pushed until you come back to set-point value.

#### Manual operation :

Keep pushed the lower left key for at least 5 sec.

The instrument will enter the "MAN" mode (see also "Ld1" switching on).

Through the arrows, "Open" and "Close" outputs are activated.

To come back to normal working keep the lower left key pushed for at least 5 sec.

#### Software switch off :

By keeping pushed keys **Arrow up** + **F** for more than 5 sec. the instrument switches off the software, does not command the outputs and visualize only the variable of process measured by the probe.

To restore keep pushed **F** for more than 5 sec.

## Set up for temperature probe Pt100 for high temperature (350°C max.)

Verify wiring of the sensor



Regulation of the set-point = **80**

It can be modified by using arrows "up" and "down".

By pushing **F** you go to parameters:

Hy.P	10 (hysteresis positive for output 1 terminals 21-22 (ex Q13-Q14))
Hy.n	-5 (hysteresis negative for output 1 terminals 21-22 (ex Q13-Q14))

Keep pushing **F** until you see **PASS**, release **F** and through the arrows set **99**, push **F** and visualize **Pro** (protection code) default is **12**, through the arrows set **128** and push **F**, keep it pushed until all parameters **InF**, **CFG**, **InP**, **Out**, **PASS** are visualized.

CFG	
S.tun	0
hPb	1,2
hlt	5,83
hdt	1,33
...	

InP	
....	
tyP	30 (Pt100)
...	
dP_S	1 (decimals num.)
Lo.S	0 (min. sensor scale)
Hi.S	850,0 (max sensor scale)
oFS	0 (offset of input correction)
Lo.L	0,0 (lower set-point range limit)
Hi.L	350,0 (upper set-point range limit)

Out	
A1.r	0
...	
A1.t	3 (mode AL1 =inverse-relative-normal)
...	
rL.1	2 (AL1)
rL.2	18 (open)
rL.3	19 (close)
rEL	0
A.ty	9 (type of servocontrol command)
Ac.t	12 (servocontrol running time: SQN72.4.../STA12..=12; SQM40.265=30)
t Lo	2
t Hi	0.0
t.on	2
t.oF	0.0
dE.b	0,1 (dead zone in % of end scale)

PAS	99 then push and keep pushed F until visualization of Hrd
Hrd	
...	
Ctrl	6 (PID warm)
AL.nr	1
but	1
diSP	0
Ld.1	1
Ld.2	28
Ld.3	20

Keep pushed **F** until you visualize **PASS**, release **F** and through the arrows set **99**, push **F** and visualize **Pro** (protection code) from **128**, through the arrows, bring it back to **12**, and keep **F** pushed until you come back to set-point value.

#### Manual operation:

Keep pushed the lower left key for at least 5 sec.

The instrument will enter the "MAN" mode (see also "Ld1" switching on).

Through the arrows, "Open" and "Close" outputs are activated.

To come back to normal working keep the lower left key pushed for at least 5 sec.

#### Software switch off :

By keeping pushed keys **Arrow up** + **F** for more than 5 sec. the instrument switches off the software, does not command the outputs and visualize only the variable of process measured by the probe.

To restore keep pushed **F** for more than 5 sec.

## Set up for pressure transmitter 2 wires signal 4÷20mA



With pressure transmitters first we need to enable their power supply: remove the part as shown below, then, on the CPU unit, move the bridge from Pt100 to +Vt



Verify wiring of the sensor

Impostazione set-point

Transmitter	1,6bar	3bar	10bar	16bar	25bar	40bar
Set-point	1bar	1,5bar	6bar	6bar	6bar	6bar

To modify it directly use "up" and "down" arrows.

By pushing **F** you go to parameter:

Transmitter	1,6bar	3bar	10bar	16bar	25bar	40bar
Hy.P	0,2bar	0,5bar	0,5bar	0,8bar	1,25bar	2bar
Hy.n	0bar	0bar	0bar	0bar	0bar	0bar

Keep pushing **F** until you see **PASS**, release **F** and through the arrows set **99**, push **F** and visualize **Pro** (protection code) default is **12**, through the arrows set **128** and push **F**, keep it pushed until all parameters **InF**, **CFG**, **InP**, **Out**, **PASS** are visualized.

CFG	
S.tun	0
hPb	5
hIt	1,33
hdt	0,33
...	

InP	
....	
tyP	44 (4÷20mA)
...	
dP_S	2 (decimals num.)

Transmitter	1,6bar	3bar	10bar	16bar	25bar	40bar	
Lo.S	0,00	0,00	0,00	0,00	0,00	0,00	min. sensor scale
Hi.S	1,60	3,00	10,00	16,00	25,00	40,00	max sensor scale
oFS	0	0	0	0	0	0	offset of input correction
Lo.L	0,00	0,00	0,00	0,00	0,00	0,00	lower set-point setting
Hi.L	1,60	3,00	10,00	16,00	25,00	40,00	upper set-point setting

Out	
A1.r	0
...	
A1.t	3 (mode AL1 =inverse-relative-normal)
...	
rL.1	2 (AL1)
rL.2	18 (open)
rL.3	19 (close)
rEL	0
A.ty	9 (type of servocontrol command)
Ac.t	12 (servocontrol running time: SQN72.4.../STA12..=12; SQM40.265=30)
t Lo	2
t Hi	0.0
t.on	2
t.oF	0.0
dE.b	0,1 (dead zone in % of end scale)

<b>PAS</b>	99 then push and keep pushed <b>F</b> until visualization of <b>Hrd</b>
Hrd	
...	
Ctrl	6 (PID warm)
AL.nr	1
but	1
diSP	0
Ld.1	1
Ld.2	28
Ld.3	20

Keep pushed **F** until you visualize **PASS**, release **F** and through the arrows set **99**, push **F** and visualize **Pro** (protection code) from **128**, through the arrows, bring it back to **12**, and keep **F** pushed until you come back to set-point value.

#### Manual operation:

Keep pushed the lower left key for at least 5 sec.

The instrument will enter the "MAN" mode (see also "Ld1" switching on).

Through the arrows, "Open" and "Close" outputs are activated.

To come back to normal working keep the lower left key pushed for at least 5 sec.

#### Software switch off :

By keeping pushed keys **Arrow up** + **F** for more than 5 sec. the instrument switches off the software, does not command the outputs and visualize only the variable of process measured by the probe.

To restore keep pushed **F** for more than 5 sec.



## Set-up for thermocouples type **K** or **J**

Verify wiring of the sensor



Regulation of the set-point = **80**

It can be modified by using arrows "up" and "down".

By pushing **F** you go to parameters:

Hy.P	10 (hysteresis positive for output 1 terminals 21-22 (ex Q13-Q14))
Hy.n	-5 (hysteresis negative for output 1 terminals 21-22 (ex Q13-Q14))

Keep pushing **F** until you see **PASS**, release **F** and through the arrows set **99**, push **F** and visualize **Pro** (protection code) default is **12**, through the arrows set **128** and push **F**, keep it pushed until all parameters **InF**, **CFG**, **InP**, **Out**, **PASS** are visualized.

CFG	
S.tun	0
hPb	1,2
hIt	5,83
hdt	1,33
...	

InP	
...	
tyP	2 (thermocouple <b>K</b> 0÷1300°C) / 0 (thermocouple <b>J</b> 0÷1000°C)
...	
dP_S	0 (no decimal) / 1 (1 decimal)
Lo.S	0 (min. sensor scale)
Hi.S	1300 (max sensor scale for tc <b>K</b> ) / 1000 (max sensor scale for tc <b>J</b> )
oFS	0 (offset of input correction)
Lo.L	0 (lower set-point range limit)
Hi.L	1300 (upper set-point range limit) per tc <b>K</b> / 1000 for tc <b>J</b>

Out	
A1.r	0
...	
A1.t	3 (mode AL1 =inverse-relative-normal)
...	
rL.1	2 (AL1)
rL.2	18 (open)
rL.3	19 (close)
rEL	0
A.ty	9 (type of servocontrol command)
Ac.t	12 (servocontrol running time: SQN72.4.../STA12..=12; SQM40.265=30)
t Lo	2
t Hi	0.0
t.on	2
t.oF	0.0
dE.b	0,1 (dead zone in % of end scale)

<b>PAS</b>	99 then push and keep pushed <b>F</b> until visualization of <b>Hrd</b>
Hrd	
...	
Ctrl	6 (PID warm)
AL.nr	1
but	1
diSP	0
Ld.1	1
Ld.2	28
Ld.3	20

Keep pushed **F** until you visualize **PASS**, release **F** and through the arrows set **99**, push **F** and visualize **Pro** (protection code) from **128**, through the arrows, bring it back to **12**, and keep **F** pushed until you come back to set-point value.

#### Manual operation:

Keep pushed the lower left key for at least 5 sec.

The instrument will enter the "MAN" mode (see also "Ld1" switching on).

Through the arrows, "Open" and "Close" outputs are activated.

To come back to normal working keep the lower left key pushed for at least 5 sec.

#### Software switch off :

By keeping pushed keys **Arrow up** + **F** for more than 5 sec. the instrument switches off the software, does not command the outputs and visualize only the variable of process measured by the probe.

To restore keep pushed **F** for more than 5 sec.





# RWF50.2x & RWF50.3x



*User manual*

## DEVICE INSTALLATION

Install the device using the relevant tools as shown in the figure.

To wire the device and sensors, follow the instructions on the burner wiring diagram.



FRONT PANEL



NAVIGATION MENU



RWF5 is preset good for 90% of applications. However, you can set or edit parameters as follow:

#### Set-point: set or modification:

When the burner is in stand-by, (safety loop open, that is terminals 3-4/T1-T2 on the 7 pole plug open) push the **Enter** button: on the lower display (green) **Opr** appears; push **Enter** again and in the same display **SP1** appears. Push **Enter** again and the lower display (green **SP1**) flashes. Using the **up and down arrows** change the set-point on the upper display (red). Push **Enter** to confirm and push **ESC** more times to get the home position.

#### PID parameters set and modifications (see table below):

- Push **Enter** button, on the green display **Opr** appears; using the **down arrow**, scroll until group **PARA** is reached and push **Enter**.
- on the green display **Pb1** e appears and on the red one the set parameter.
- Push in sequence the **down or up** arrow the menu is scrolled.
- Push **Enter** to select and the **arrows** to choose the desired value. **Enter** to confirm.

Parameter	Display	Range	Factory setting	Remarks
Proportional band	PB.1	1... 9999 digit	10	Typical value for temperature
Derivative action	dt	0... 9999 sec.	80	Typical value for temperature
Integral action	rt	0... 9999 sec.	350	Typical value for temperature
Dead band (*)	db	0... 999,9 digit	1	Typical value
Servocontrol running time	tt	10... 3000 sec.	15	Set servocontrol running time
Switch-on differential (*)	HYS1	0,0... -1999 digit	-5	Value under setpoint below which the burner switches back on (1N-1P closes)
Switch-off differential 2° stage (*)	HYS2	0,0 ... HYS3	3	(enable only with parameter <b>bin1</b> = 4)
Upper switch-off differential (*)	HYS3	0,0... 9999 digit	5	Value over setpoint above which the burner switches off (1N-1P opens)
Switch-on differential on cooling controller (*)	HYS4	0,0... 9999 digit	5	Do not used (enable only with parameter <b>CACt</b> = 0)
Switch-off differential 2° stage on cooling controller (*)	HYS5	HYS6...0,0 digit	5	Do not used (enable only with parameters <b>CACt</b> = 0 and <b>bin1</b> = 4)
Upper switch-off differential on cooling controller (*)	HYS6	0,0... -1999 digit	5	Do not used (enable only with parameter <b>CACt</b> = 0)
Delay modulation	q	0,0... 999,9 digit	0	Do not alter

(\*)Parameters affected by setting of decimal place (**ConF** > **dISP** parameter **dECP**)



#### Setting the kind of sensor to be connected to the device:

- push the **Enter** button: on the lower display (green) **Opr** appears. Using the **up and down arrows** find **ConF**. Push **Enter** to confirm.
- Now on the green display the group **InP** appears. Push **Enter** and **InP1** is displayed. Enter to confirm.
- You are inside **InP1**; the green display shows **Sen1 (sensor type)**, while the red display shows the chosen sensor code
- Push **Enter** to enter the **Sen1** parameter, then choose the desired sensor using the **arrows**. Push **Enter** to confirm and **ESC** to escape.
- Once selected the sensor, you can modify all the other parameters using **up and down arrows** according to the tables here below.

#### ConF > InP > InP1

Parameter	Value	Description
SEn1 type of sensor for analog input 1	<b>1</b>	<b>Pt100 3 fili</b>
	2	Pt100 2 fili
	3	Pt1000 3 fili
	4	Pt1000 2 fili
	5	Ni1000 3 fili
	6	Ni1000 2 fili
	7	0 ÷ 135 ohm
	15	0 ÷ 20mA
	16	4 ÷ 20mA
	17	0 ÷ 10V
	18	0 ÷ 5V
	19	1 ÷ 5V
OFF1 sensor offset	-1999.. <b>0</b> .. +9999	Using the measured value correction (offset), a measured value can be corrected to a certain degree, either up or down
SCL1 scale low level	-1999.. <b>0</b> .. +9999	In the case of a measuring transducer with standard signal, the physical signal is assigned a display value here (for input ohm, mA, V)
SCH1 scale high level	-1999.. <b>100</b> .. +9999	In the case of a measuring transducer with standard signal, the physical signal is assigned a display value here (for input ohm, mA, V)
dF1 digital filter	0... <b>0,6</b> ...100	Is used to adapt the digital 2nd order input filter (time in s; 0 s = filter off)
Unit temperature unit	<b>1</b> 2	<b>1 = degrees Celsius</b> 2 = degrees Fahrenheit

(**bold** = factory settings)

#### Remark:

RWF50.2 e RWF50.3 cannot be connected to thermocouples.

If thermocouples have to be connected, convert the signal to a 4-20 mA one and set the RWF accordingly.

## ConF > Cntr

Parameter	Value	Description
CtYP controller type	<b>1</b> 2	<b>1 = 3-position controller (open-stop-close only RWF50.2)</b> 2 = continuative action controller (only RWF50.3)
CACt control action	<b>1</b> 0	<b>1 = heating controller</b> 0 = cooling controller
SPL least value of the set-point range	-1999.. <b>0</b> ..+9999	set-point limitation prevents entry of values outside the defined range
SPH maximum value of the set-point range	-1999.. <b>100</b> ..+9999	set-point limitation prevents entry of values outside the defined range
oLLo set-point limitation start, operation limit low	<b>-1999</b> .... +9999	lower working range limit
oLHi set-point limitation end, operation limit high	-1999.... <b>+9999</b>	upper working range limit

(**bold** = factory settings)

## ConF > rAFC

### Activation boiler shock termic protetion:

RWF50.. can activate the thermal shock protection only on sites where the set-point is lower than 250°C and according to **rAL** parameter.

Parameter	Value	Description
FnCT function	<b>0</b> 1 2	Choose type of range degrees/time <b>0 = deactivated</b> 1 = Kelvin degrees/minute 2 = Kelvin degrees/hour
rASL ramp rate	<b>0,0</b> ... 999,9	Slope of thermal shock protection (only with functions 1 and 2)
toLP tolerance band ramp	<b>0</b> ...9999	width of tolerance band (in K) about the set-point <b>0 = tolerance band inactive</b> 
rAL ramp limit	<b>0</b> ...250	Ramp limit. When this value is lower than the temperature set-point, the RWF controls the output increasing the temp set point step by step according to rASL. If this is over the temp set point, the control is performed in cooling.

(**bold** = factory settings)

### ConF > OutP (parameter under group only for RWF50.3)

Parameter	Value	Description
FnCt tipo di controllo	1 <b>4</b>	1 = analog input 1 doubling with possibility to convert (depending on par <b>SiGn</b> ) <b>4 = modulation controller</b>
SiGn type of output signal	<b>0</b> 1 2	physical output signal (terminals A+, A-) <b>0 = 0÷20mA</b> 1 = 4÷20mA 2 = 0÷10V
rOut Value when out of input range	<b>0...101</b>	signal (in percent) when measurement range is crossed
oPnt zero point	-1999... <b>0</b> ...+9999	value range of the output variable is assigned to a physical output signal Per default, the setting corresponds to 0...100% angular positioning for the controller outputs (terminals A+, A-) (effective only with <b>FnCt</b> = 1)
End End value	-1999... <b>100</b> ...+9999	value range of the output variable is assigned to a physical output signal Per default, the setting corresponds to 0...100% angular positioning for the controller outputs (terminals A+, A-) (effective only with <b>FnCt</b> = 1)

(**bold** = factory settings)

### ConF > binF

Parameter	Value	Description
bin1 digital inputs (terminals DG - D1)	<b>0</b> 1 2 4	<b>0 = without function</b> 1 = set-point changeover (SP1 / SP2) 2 = set-point shift ( <b>Opr</b> > <b>dSP</b> parameter = value of set-point modify) 4 = changeover of operating mode open – modulating operation; close – 2 stage operation.

(**bold** = factory settings)

### ConF > dISP

Parameter	Value	Description
diSU upper display (red)	0 <b>1</b> 4 6 7	display value for upper display: 0 = display power-off <b>1 = analog input value</b> 4 = Controller's angular positioning 6 = set-point value 7 = end value with thermal shock protection
diSL lower display (green)	0 1 4 <b>6</b> 7	display value for lower display: 0 = display power-off 1 = analog input value 4 = Controller's angular positioning <b>6 = set-point value</b> 7 = end value with thermal shock protection
tout timeout	<b>0..180</b> ..250	time (s) on completion of which the controller returns automatically to the basic display, if no button is pressed
dECP decimal point	<b>0</b> 1 2	<b>0 = no decimal place</b> 1 = one decimal place 2 = two decimal places
CodE level lockout	<b>0</b> 1 2 3	<b>0 = no lockout</b> 1 = configuration level lockout (ConF) 2 = Parameter and configuration level lockout (PArA & ConF) 3 = keyboard lockout

(**bold** = factory settings)

#### Manual control :

- in order to manual change the burner load, while firing keep pushing the **ESC** button for more than 5 s; on the lower green display **Hand** appears.
- using the **UP** and **DOWN** arrows, the load varies.
- Keep pushing the **ESC** button for getting the normal operation again.
- **NB:** every time the device shuts the burner down (start led switched off - contact 1N-1P open), the manual control is not active.

#### Device self-setting (auto-tuning):

If the burner in the steady state does not respond properly to heat generator requests, you can activate the Device's self-setting function, which recalculates PID values for its operation, deciding which are most suitable for the specific kind of request



7866204/0911

Follow the below instructions:

push the **UP** and **DOWN** arrows for more than 5 s; on the green lower display **TUNE** appears. Now the device pushes the burner to increase and decrease its output. During this time, the device calculates PID parameters (**Pb1**, **dt** and **rt**). After the calculations, the TUNE is automatically deactivated and the device has already stored them.

In order to stop the Auto-tuning function while it works, push again the **UP** and **DOWN** arrows for more than 5 s. The calculated PID parameters can be manually modified following the previously described instructions.

#### Display of software version :



7866205/0911

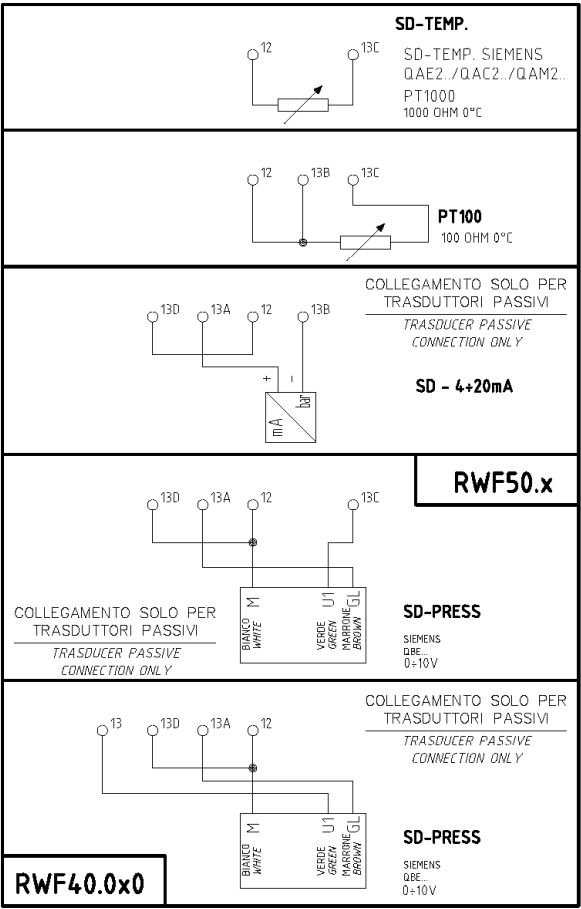
The software version is shown by pushing **Enter + UP arrow** on the upper display

Electric connection :

With 7 pins connector version



With terminals version



Matches terminals between RWF50.2 and RWF40.0x0



Parameters summarising for RWF50.2x:

Navigation menù	Conf					Conf									Opr
	Inp							diSP							
	Inp1								Cntr		PArA				
Types of probe	SEn1	OFF1	SCL1	SCH1	Unit	SPL	SPH	dECP	Pb. 1	dt	rt	tt	HYS1 (*)	HYS3 (*)	SP1 (*)
Siemens QAE2120...	6	0	needless	needless	1	30	95	1	10	80	350	(#)	-5	5	80 °C
Siemens QAM2120..	6	0	needless	needless	1	0	80	1	10	80	350	(#)	-2,5	2,5	40°C
Pt1000 (130°C max.)	4	0	needless	needless	1	30	95	1	10	80	350	(#)	-5	5	80°C
Pt1000 (350°C max.)	4	0	needless	needless	1	0	350	1	10	80	350	(#)	-5	10	80°C
Pt100 (130°C max.)	1	0	needless	needless	1	0	95	1	10	80	350	(#)	-5	5	80°C
Pt100 (350°C max)	1	0	needless	needless	1	0	350	1	10	80	350	(#)	-5	10	80°C
Probe 4÷20mA / 0÷1,6bar	16	0	0	160	needless	0	160	0	5	20	80	(#)	0	20	100 kPa
Probe 4÷20mA / 0÷3bar	16	0	0	300	needless	0	300	0	5	20	80	(#)	0	20	200 kPa
Probe 4÷20mA / 0÷10bar	16	0	0	1000	needless	0	1000	0	5	20	80	(#)	0	50	600 kPa
Probe 4÷20mA / 0÷16bar	16	0	0	1600	needless	0	1600	0	5	20	80	(#)	0	80	600 kPa
Probe 4÷20mA / 0÷25bar	16	0	0	2500	needless	0	2500	0	5	20	80	(#)	0	125	600 kPa
Probe 4÷20mA / 0÷40bar	16	0	0	4000	needless	0	4000	0	5	20	80	(#)	0	200	600 kPa
Siemens QBE2002 P4	17	0	0	400	needless	0	400	0	5	20	80	(#)	0	20	200 kPa
Siemens QBE2002 P10	17	0	0	1000	needless	0	1000	0	5	20	80	(#)	0	50	600 kPa
Siemens QBE2002 P16	17	0	0	1600	needless	0	1600	0	5	20	80	(#)	0	80	600 kPa
Siemens QBE2002 P25	17	0	0	2500	needless	0	2500	0	5	20	80	(#)	0	125	600 kPa
Siemens QBE2002 P40	17	0	0	4000	needless	0	4000	0	5	20	80	(#)	0	200	600 kPa
Segnale 0÷10V	17	0	to be fixed	to be fixed	needless	to be fixed	to be fixed	to be fixed	5	20	80	(#)	to be fixed	to be fixed	to be fixed
Segnale 4÷20mA	16	0	to be fixed	to be fixed	needless	to be fixed	to be fixed	to be fixed	5	20	80	(#)	to be fixed	to be fixed	to be fixed

**NOTE :**

(#) tt – servo control run time

SQL33 ; STM30; SQM10; SQM40; SQM50; SQM54 = **30** (secondi) - STA12B3.41; SQN30.251; SQN72.4A4A20 = **12** (secondi)

(\*)These values are factory set - values **must be** set during operation at the plant based on the real working temperature/pressure value.

**WARNING :** With pressure probes the parameters SP1, SCH, SCL, HYS1, HYS3 must be selected, and visualized in kPa (kilo Pascal). (1bar ≡ 100.000Pa ≡ 100kPa)

## APPENDIX: PROBES CONNECTION

To assure the utmost comfort, the control system needs reliable information, which can be obtained provided the sensors have been installed correctly. Sensors measure and transmit all variations encountered at their location.

Measurement is taken based on design features (time constant) and according to specific operating conditions. With wiring run in raceways, the sheath (or pipe) containing the wires must be plugged at the sensor's terminal board so that currents of air cannot affect the sensor's measurements.

### Ambient probes (or ambient thermostats)

#### Installation

The sensors (or room thermostats) must be located in reference rooms in a position where they can take real temperature measurements without being affected by foreign factors.



### Outside probes (weather)

#### Installation

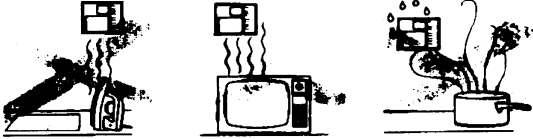
In heating or air-conditioning systems featuring adjustment in response to outside temperature, the sensor's positioning is of paramount importance.



**General rule:** on the outer wall of the building where the living rooms are, never on the south-facing wall or in a position where they will be affected by morning sun. If in any doubt, place them on the north or north-east façade.

### It's good to be admired ...even better to be effective

Heating systems: the room sensor must not be installed in rooms with heating units complete with thermostatic valves. Avoid all sources of heat foreign to the system.



### Location

On an inner wall on the other side of the room to heating units height above floor 1.5 m, at least 1.5 m away from external sources of heat (or cold).



### Installation position to be avoided

near shelving or alcoves and recesses, near doors or windows, inside outer walls exposed to solar radiation or currents of cold air, on inner walls with heating system pipes, domestic hot water pipes, or cooling system pipes running through them.

### Positions to be avoided



Avoid installing near windows, vents, outside the boiler room, on chimney breasts or where they are protected by balconies, cantilever roofs.

**The sensor must not be painted (measurement error).**

## Duct or pipe sensors

### Installing temperature sensors

For measuring outlet air:

- after delivery fan or
- after coil to be controlled, at a distance of at least 0,5 m

For measuring room temperature:

- before return air intake fan and near room's return air intake. For measuring saturation temperature: after mist eliminator.



Bend 0.4m sensor by hand (never use tools) as illustrated.



Use whole cross-section of duct, min. distance from walls 50 mm, radius of curvature 10 mm for 2m or 6m sensors.

### Installing combined humidity sensors

As max. humidity limit sensor on outlet (steam humidifiers).



### Installing pressure sensors

A - installation on ducts carrying fluids at max. temperature 80°C

B - installation on ducts at temperature over 80°C and for refrigerants

C - installation on ducts at high temperatures:

- increase length of siphon
- place sensor at side to prevent it being hit by hot air coming from the pipe.



### Installing differential pressure sensors for water

- Installation with casing facing down not allowed.-With temperature over 80°C, siphons are needed.
- To avoid damaging the sensor, you must comply with the following instructions

#### when installing:

- make sure pressure difference is not greater than the value permitted by the sensor
- when there are high static pressures, make sure you insert shutoff valves A-B-C.

### Putting into operation

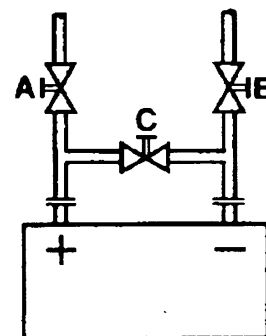
Start disable

1=open C1=open C

2=open A2=close B

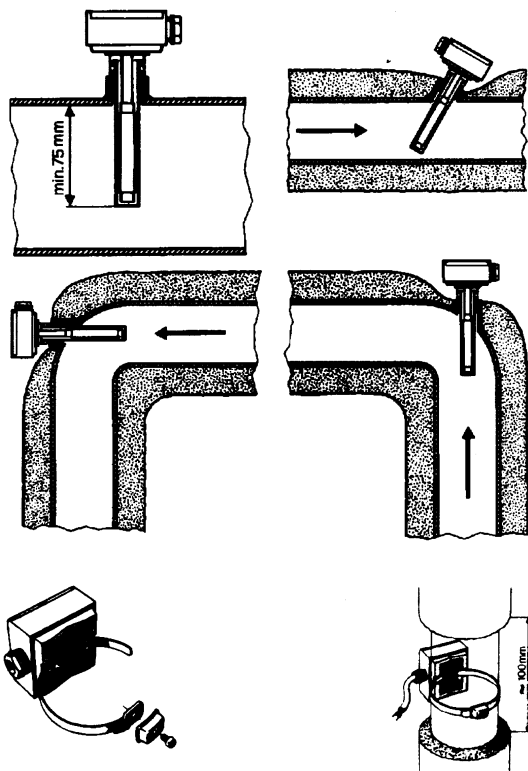
3=open B3=close A

4= close C





## Immersion or strap-on sensors



Placing the probes (QAD22.../QAE21.../QAP21.../RCA...)

## Immersion probes installation

Sensors must be installed on the stretch of pipe in which fluid circulates all the time.

The rigid stem (sensing element doing the measuring) must be inserted by at least 75mm and must face the direction of flow.

Recommended locations: on a bend or on a straight stretch of pipe but tilted by 45° and against the flow of fluid.

Protect them to prevent water from infiltrating (dripping gates, condensation from pipes etc.)

## Installing QAD2.. strap-on sensors

Make sure fluid is circulating in the chosen location.

Eliminate insulation and paintwork (including rust inhibitor) on a min. 100mm length of pipe.

Sensors come with straps for pipes up to 100 mm in diameter

## With pumps on outlet

with 3 ways valves / with 4 ways valves



Panel system / burner control



## Strap-on or immersion sensors?

### QAD2.. strap-on sensors

Advantages :

- 10 sec. time constant
- Installed with system running (no plumbing work)
- Installation can be changed easily if it proves incorrect.

Limits:

- Suitable for pipe diameters max. 100 mm
- Can be affected by currents of air etc.

### QAE2... immersion sensors

Advantages:

- Measure "mean" fluid temperature
- No external influence on measurement such as: currents of air, nearby pipes etc.

Limits:

- Time constant with sheath: 20 sec.
- Hard to change installation position if it proves incorrect.

## With pumps on return

with 3 ways valves / with 4 ways valves



## Duct pressure switches and sensors

### Installing differential pressure probes for air



A - Control a filter (clogging)



B - Control a fan (upstream/downstream)



C - Measurement of difference in pressure between two ducts



D - Measurement of difference in pressure between two rooms or of inside of duct and outside

### Basic principles

Measuring static pressure (i.e. pressure exerted by air on pipe walls)



### Measuring dynamic pressure



$$Pd = \frac{\gamma v^2}{2g}$$

### Key

$\gamma$	Kg/m <sup>3</sup> , specific weight of air
$v$	m/s, air speed
$g$	9.81 m/s <sup>2</sup> gravity acceleration
$Pd$	mm C.A., dynamic pressure

### Measuring total pressure



## Spare parts

Description	Code
Modulator RWF50.2 (uscita a 3 punti - apri, fermo, chiudi)	2570148
Modulator RWF50.3 (uscita continua 0÷20mA, 4÷20mA, 0÷10V)	2570149
Temperature probe Siemens QAE2120.010A (30÷130°C)	2560101
Temperature probe Siemens QAM2120.040 (-15÷+50°C)	2560135
Thermoresistor Pt1000 ø6mm L100mm (30÷130°C)	2560188
Thermoresistor Pt1000 ø10mm L200mm (0÷350°C)	2560103
Thermoresistor Pt100 ø10mm L200mm (0÷350°C)	2560145
Thermoresistor Pt100 ø8mm L85mm (0÷120°C)	25601C3
Pressure probe Siemens QBE2.. P4 (0÷4bar)	2560159
Pressure probe Siemens QBE2.. P10 (0÷10bar / signal 0÷10V)	2560160
Pressure probe Siemens QBE2.. P16 (0÷16bar / signal 0÷10V)	2560167
Pressure probe Siemens QBE2.. P25 (0÷25bar / signal 0÷10V)	2560161
Pressure probe Siemens QBE2.. P40 (0÷40bar / signal 0÷10V)	2560162
Pressure probe Danfoss MBS 3200 P 1,6 (0÷1,6bar / signal 4÷20mA)	2560189
Pressure probe Danfoss MBS 3200 P 10 (0÷10bar / signal 4÷20mA)	2560190
Pressure probe Danfoss MBS 3200 P 16 (0÷16bar / signal 4÷20mA)	2560191
Pressure probe Danfoss MBS 3200 P 25 (0÷25bar / signal 4÷20mA)	2560192
Pressure probe Danfoss MBS 3200 P 40 (0÷40bar / signal 4÷20mA)	2560193
Pressure probe Siemens 7MF1565-3BB00-1AA1 (0÷1,6bar / signal 4÷20mA)	25601A3
Pressure probe Siemens 7MF1565-3CA00-1AA1 (0÷10bar / signal 4÷20mA)	25601A4
Sonda di pressione Siemens 7MF1565-3CB00-1AA1 (0÷16bar / signal	25601A5
Pressure probe Siemens 7MF1565-3CD00-1AA1 (0÷25bar / signal 4÷20mA)	25601A6
Pressure probe Siemens 7MF1565-3CE00-1AA1 (0÷40bar / signal 4÷20mA)	25601A7
Pressure probe Gefran E3E B1V6 MV (0÷1,6bar / segnale 4÷20mA)	25601C4
Pressure probe Danfoss E3E B01D MV (0÷10bar / segnale 4÷20mA)	25601C5
Pressure probe Danfoss E3E B16U MV (0÷16bar / segnale 4÷20mA)	25601C6
Pressure probe Danfoss E3E B25U MV (0÷25bar / segnale 4÷20mA)	25601C7
Pressure probe Danfoss E3E B04D MV (0÷40bar / segnale 4÷20mA))	25601C8

Note: Specifications and data subject to change. Errors and omissions excepted.

# **KM3 Modulator**

## **USER MANUAL**

**MOUNTING**

## DISPLAY AND KEYS



	Operator Mode	Editing Mode
	Access to: - Operator Commands (Timer, Setpoint selection ...) - Parameters - Configuration	Confirm and go to Next parameter
	Access to: - Operator additional information (Output value, running time ...)	Increase the displayed value or select the next element of the parameters list
	Access to: - Set Point	Decrease the displayed value or select the previous element
	Programmable key: Start the programmed function (Autotune, Auto/Man, Timer ...)	Exit from Operator commands/Parameter setting/Configuration

## CONNECTIONS DIAGRAM



### Probe connection:

- **PT1000/NTC/PTC:** between terminal 3 and 2
- **PT 100:** between terminal 3 and 2 with terminal 1
- **Passive pressure probe** 0/4-20 mA: between terminal 4 ( + ) e 1 ( - )  
Note: out4 must be activated ( IO4F must be set to ON )
- **Powered pressure probe** 0/4-20 mA between terminal 4 (power supply), 2 ( negative) e 1 (positive)  
Note: set IO4F to ON to activate Out4

### Power supply connection:

- **Neutral wire:** terminal 9
- **Phase:** terminal 10 ( 100...240 Vac )
- Close terminals 15-16 to switch to the set point 2

### Output connection:

- **Channel 1:** terminal 7 and 8 ( burner on – off )
- **Channel 2:** terminal 11 and 12 (servomotor opens)
- **Channel 3:** terminal 13 and 14 (servomotor closes)



## SETPOINT AND HYSTERESIS CONFIGURATION (SP, AL1, HAL1 parameters)

Push the  button to enter into the setpoint configuration:



To return to normal mode, press the  key for 3 seconds or wait the 10s timeout

### Operation example



## LIMITED ACCESS LEVEL

Proceed as follows to change some parameters that are not visible in standard user mode:



Param	Description	Values	Default
SEnS	Input type	Pt1 = RTD Pt100 Pt10 = RTD Pt1000 0.20 = 0..20mA 4.20 = 4..20mA Pressure probe 0.10 = 0..10V 2.10 = 2..10V crAL= Thermocouple K	Depends on the probe
SP	Set point 1	SPLL ... SPLH	See page 7
AL1	AL1 threshold	AL1L... AL1H (E.U.)	
HAL1	AL1 hysteresis	1... 9999 (E.U.)	
Pb	Proportional band	1... 9999 (E.U.)	
ti	Integral time	0 (oFF) ... 9999 (s)	
td	Derivative time	0 (oFF) ... 9999 (s)	
Str.t	Servomotor stroke time	5...1000 seconds	
db.S	Servomotor dead band	0...100%	
SPLL	Minimum set point value	-1999 ... SPLH	
SPHL	Maximum set point value	SPLL ... 9999	
dp	Decimal point position	0... 3	
SP 2	Set point 2	SPLL...SPLH	60
A.SP	Selection of the active set point	"SP" ... "nSP"	SP

To exit the parameter setting procedure press the key (for 3 s) or wait until the timeout expiration (about 30 seconds)

### Probe parameters configuration MODULATORE ASCON KM3

Parameter Group		inP							AL1		rEG					SP			
Parameter		Sens	dp	SSC	FSc	unit	IO4.F (**)	AL1 (***)	HAL1 (***)	Pb (***)	ti (***)	td (***)	Str.t	db.S	SPLL	SPHL	SP		
Probes			Dec Point	Scale Min	Scale Max			Off	On	p	i	d	servo time s	Band Mo.	SP Min	SP Max	Set point		
Pt1000 (130°C max)		Pt10	1			°C	on	5	10	10	350	1	*	5	30	95	80		
Pt1000 ( 350°C max)		PT10	1			°C	on	10	10	10	350	1	*	5	0	350	80		
Pt100 (130°C max)		PT1	1			°C	on	5	10	10	350	1	*	5	0	95	80		
Pt100 (350°C max)		Pt1	1			°C	on	10	10	10	350	1	*	5	0	350	80		
Pt100 (0÷100°C 4÷20mA)		4.20	1	0	100		on	5	10	10	350	1	*	5	0	95	80		
Thermocouple K (1200°C max)		crAL	0			°C	on	20	25	10	350	1	*	5	0	1200	80		
Thermocouple J (1000°C max)		J	0			°C	on	20	25	10	350	1	*	5	0	1000	80		
4-20mA / 0-1,6barPressure probe		4.20	0	0	160		on	20	20	5	120	1	*	5	0	160	100		
4-20mA / 0-10bar Pressure probe		4.20	0	0	1000		on	50	50	5	120	1	*	5	0	1000	600		
4-20mA / 0-16bar Pressure probe		4.20	0	0	1600		on	80	80	5	120	1	*	5	0	1600	600		
4-20mA / 0-25bar Pressure probe		4.20	0	0	2500		on	125	125	5	120	1	*	5	0	2500	600		
4-20mA / 0-40bar Pressure probe		4.20	0	0	4000		on	200	200	5	120	1	*	5	0	4000	600		
QBE2002 / 0-25bar Pressure probe		0.10	0	0	2500		On	125	125	5	120	1	*	5	0	2500	600		

Note:

(\*) Str.t - Servomotor stroke time

SQL33; STM30; SQM10; SQM40; SQM50; SQM54 = 30 (Seconds)

STA12B3.41; SQN30.251; SQN72.4A4A20 = 12 (Seconds)

**(\*\*) Out 4 ... on Display led °4 must be switched on, otherwise change the io4.F parameter value from "on" to "out4", confirm the value, quit the configuration mode then change again the io4.F parameter value from "out4" to "on".**

(\*\*\*) Factory settings. These values must be adapted to machine conditions

N.B. For pressure probe, SP, SPHL, SPLL parameters values are expressed in Kpa (1 bar = 100 Kpa).

## CONFIGURATION

### How to access configuration level

The configuration parameters are collected in various groups. Every group defines all parameters related with a specific function (e.g.: control, alarms, output functions).

1. Push the  button for more than 5 seconds. The upper display will show PASS while the lower display will show 0.
2. Using  and  buttons set the programmed password.  
According to the entered password, it is possible to see a part of the parameters listed in the "configuration parameters" section.
  - a. Enter "30" as password to view all the configuration parameters
  - b. Enter "20" as password to view the parameters of the "limited access level". At this point, only the parameters with attribute **Liv = A** or **Liv = O** will be editable.
  - c. Leave the password blank to edit "user level" parameters, that are identified by attribute **Liv = O**
3. Push the  button. If the password is correct the display will show the acronym of the first parameter group preceded by the symbol: . In other words the upper display will show:  inP (group of the **Input parameters**).

The instrument is in configuration mode. To press  for more than 5 seconds, the instrument will return to the "standard display".

#### Keyboard functions during parameter changing:

Operator Mode	
	When the upper display is showing a group and the lower display is blank, this key allows to enter in the selected group. When the upper display is showing a parameter and the lower display is showing its value, this key allows to store the selected value for the current parameter and access the next parameter within the same group.
	Allows to increase the value of the selected parameter.
	Allows to decrease the value of the selected parameter.
	Short presses allow you to exit the current group of parameters and select a new group. A long press terminates the configuration procedure (the instrument returns to the normal display).
 + 	These two keys allow to return to the previous group. Proceed as follows: Push the  button and maintaining the pressure, then push the  ; release both the buttons.

### Configuration Parameters

inP GROUP - input configuration					
Liv	N°	Param	Description	Values	Default
A	1	SEnS	Input type	Pt1 = RTD Pt100 Pt10 = RTD Pt1000 0.20 = 0..20mA 4.20 = 4..20mA Pressure probe 0.10 = 0..10V 2.10 = 2..10V crAL= Thermocouple K	Depends on the probe
A	2	dp	Decimal point position	0... 3	See page 7
A	3	SSc	Initial scale read-out for linear inputs (available only if SEnS parameter is not equal to Pt1, Pt10, crAL values)	-1999... 9999	0
C	4	FSc	Full scale read-out for linear input inputs (available only if SEnS parameter is not equal to Pt1, Pt10, crAL values)	-1999... 9999	Depends on the probe
C	5	unit	Unit of measure (present only in the case of temperature probe)	°C/°F	°C
C	6	Fil	Digital filter on the measured value	0 (= OFF)... 20.0 s	1.0
C	7	inE	Selection of the Sensor Out of Range type that will enable the safety output value	or = Over range ou = Under range our = over e under range	or

C	8	oPE	Safety output value	-100... 100	0
C	9	io4.F	I/O4 function selection	on = Out4 will be ever ON (used as a transmitter power supply) ,out4 = Uscita 4 (Used as digital output 4), dG2c = Digital input 2 for contact closure, dG2U = Digital input 2 driven by 12... 24 VDC	on
C	10	diF1	Digital input 1 function	oFF = Not used, 1 = Alarm reset, 2 = Alarm acknowledge (ACK), 3 = Hold of the measured value, 4 = Stand by mode, 5 = Manual mode, 6 = HEAt with SP1 and CoOL with SP2, 7 = Timer RUN/Hold/Reset, 8 = Timer Run, 9 = Timer Reset, 10 = Timer Run/Hold, 11 = Timer Run/Reset, 12 = Timer Run/Reset with lock, 13 = Program Start, 14 = Program Reset, 15 = Program Hold, 16 = Program Run/Hold, 17 = Program Run/Reset, 18 = Sequential SP selection, 19 = SP1 - SP2 selection, 20 = SP1... SP4 binary selection, 21 = Digital inputs in parallel	19
C	12	di.A	Digital Inputs Action (DI2 only if configured)	0 = DI1 direct action, DI2 direct action 1 = DI1 reverse action, DI2 direct action 2 = DI1 direct action, DI2 reverse action 3 = DI1 reverse action, DI2 reverse action	0

**Out GROUP- Output parameters**

Liv	N°	Param	Description	Values	Default
C	14	o1F	Out 1 function	AL = Alarm output	AL
C	15	o1AL	Initial scale value of the analog retransmission	-1999 ... Ao1H	1
C	18	o1Ac	Out 1 action	dir = Direct action rEU = Reverse action dir.r = Direct with reversed LED ReU.r = Reverse with reversed LED	rEU.r
C	19	o2F	Out 2 function	H.rEG = Heating output	H.rEG
C	21	o2Ac	Out 2 action	dir = Direct action rEU = Reverse action dir.r = Direct with reversed LED ReU.r = Reverse with reversed LED	dir
C	22	o3F	Out 3 function	H.rEG = Heating output	H.rEG
C	24	o3Ac	Out 3 action	dir = Direct action rEU = Reverse action dir.r = Direct with reversed LED ReU.r = Reverse with reversed LED	dir

**AL1 GROUP - Alarm 1 parameters**

Liv	N°	Param	Descrizione	Values	Default
C	28	AL1t	Tipo allarme AL1	nonE = Alarm not used LoAb = Absolute low alarm HiAb = Absolute high alarm LHAo = Windows alarm in alarm outside the windows LHAI = Windows alarm in alarm inside the	HidE

				windows SE.br = Sensor Break LoDE = Deviation low alarm (relative) HiDE = Deviation high alarm (relative) LHdo = Relative band alarm in alarm out of the band LHdi = Relative band alarm in alarm inside the band	
C	29	Ab1	Alarm 1 function	0... 15 +1 = Not active at power up +2 = Latched alarm (manual reset) +4 = Acknowledgeable alarm +8 = Relative alarm not active at set point change	0
C	30	AL1L	-- For High and low alarms, it is the low limit of the AL1 threshold; -- For band alarm, it is low alarm threshold	-1999... AL1H (E.U.)	-199.9
C	31	AL1H	-- For High and low alarms, it is the high limit of the AL1 threshold; -- For band alarm, it is high alarm threshold	AL1L... 9999 (E.U.)	999.9
O	32	AL1	AL1 threshold	AL1L... AL1H (E.U.)	See page 7
O	33	HAL1	AL1 hysteresis	1... 9999 (E.U.)	See page 7
C	34	AL1d	AL1 delay	0 (oFF)... 9999 (s)	oFF
C	35	AL1o	Alarm 1 enabling during Stand-by mode and out of range conditions	0 = Alarm 1 disabled during Stand by and out of range 1 = Alarm 1 enabled in stand by mode 2 = Alarm 1 enabled in out of range condition 3 = Alarm 1 enabled in stand by mode and in overrange condition	1

**GRUPPO AL2 - parametri allarme 2**

Liv	N°	Param	Description	Values	Default
C	36	AL2t	Alarm 2 type	nonE = Alarm not used LoAb = Absolute low alarm HiAb = Absolute high alarm LHAo = Windows alarm in alarm outside the windows LHAi = Windows alarm in alarm inside the windows SE.br = Sensor Break LoDE = Deviation low alarm (relative) HiDE = Deviation high alarm (relative) LHdo = Relative band alarm in alarm out of the band LHdi = Relative band alarm in alarm inside the band	SE.br
C	37	Ab2	Alarm 2 function	0... 15 +1 = Not active at power up +2 = Latched alarm (manual reset) +4 = Acknowledgeable alarm +8 = Relative alarm not active at set point change	0
C	42	AL2d	AL2 hysteresis	0 (oFF)... 9999 (s)	oFF
C	43	AL2o	Alarm 2 enabling during Stand-by mode and out of range conditions	0 = Alarm 2 disabled during Stand by and out of range 1 = Alarm 2 enabled in stand by mode 2 = Alarm 2 enabled in out of range condition 3 = Alarm 2 enabled in stand by mode and in overrange condition	0

AL3 Group - alarm 3 parameters					
Liv	N°	Param	Description	Values	Default
	44	AL3t	Alarm 3 type	nonE = Alarm not used LoAb = Absolute low alarm HiAb = Absolute high alarm LHAo = Windows alarm in alarm outside the windows LHAI = Windows alarm in alarm inside the windows SE.br = Sensor Break LoDE = Deviation low alarm (relative) HiDE = Deviation high alarm (relative) LHdo = Relative band alarm in alarm out of the band LHdi = Relative band alarm in alarm inside the band	nonE

LbA Group - Loop break alarm					
Liv	N°	Param	Descrizione	Values	Default
C	52	LbAt	LBA time	Da 0 (oFF) a 9999 (s)	oFF

rEG Group - Control parameters					
Liv	N°	Param	Description	Values	Default
C	56	cont	Control type	Pid = PID (heat and/or) On.FA = ON/OFF asymmetric hysteresis On.FS = ON/OFF symmetric hysteresis nr = Heat/Cool ON/OFF control with neutral zone 3Pt = Servomotor control (available only when Output 2 and Output 3 have been ordered as "M")	3pt
C	57	Auto	Autotuning selection	-4 = Oscillating auto-tune with automatic restart at power up and after all point change -3 = Oscillating auto-tune with manual start -2 = Oscillating -tune with auto-matic start at the first power up only -1 = Oscillating auto-tune with auto-matic restart at every power up 0 = Not used 1 = Fast auto tuning with automatic restart at every power up 2 = Fast auto-tune with automatic start the first power up only 3 = FAST auto-tune with manual start 4 = FAST auto-tune with automatic restart at power up and after set point change 5 = Evo-tune with automatic restart at every power up 6 = Evo-tune with automatic start the first power up only 7 = Evo-tune with manual start 8 = Evo-tune with automatic restart at power up and after a set point change	7
C	58	tunE	Manual start of the Autotuning	oFF = Not active on = Active	oFF

C	59	SELF	Self tuning enabling	no = The instrument does not perform the self-tuning YES = The instrument is performing the self-tuning	No
A	62	Pb	Proportional band	1... 9999 (E.U.)	See page 7
A	63	ti	Integral time	0 (oFF) ... 9999 (s)	See page 7
A	64	td	Derivative time	0 (oFF) ... 9999 (s)	See page 7
C	65	Fuoc	Fuzzy overshoot control	0.00... 2.00	1
C	69	rS	Manual reset (Integral pre-load)	-100.0... +100.0 (%)	0.0
A	70	Str.t	Servomotor stroke time	5...1000 seconds	See page 7
A	71	db.S	Servomotor dead band	0...100%	5
C	72	od	Delay at power up	0.00 (oFF) ... 99.59 (hh.mm)	oFF

**SP Group - Set point parameters**

Liv	N°	Param	Description	Values	Default
C	76	nSP	Number of used set points	1... 4	2
A	77	SPLL	Minimum set point value	-1999 ... SPHL	See page 7
A	78	SPHL	Maximum set point value	SPLL ... 9999	See page 7
O	79	SP	Set point 1	SPLL ... SPLH	See page 7
C	80	SP 2	Set point 2	SPLL ... SPLH	60
	83	A.SP	Selection of the active set point	"SP" ... "nSP"	SP
C	84	SP.rt	Remote set point type	RSP = The value coming from serial link is used as remote set point trin = The value will be added to the local set point selected by A.SP and the sum becomes the operative set point PERc = The value will be scaled on the input range and this value will be used as remote SP	trin
C	85	SPLr	Local/remote set point selection	Loc = Local rEn = Remote	Loc
C	86	SP.u	Rate of rise for POSITIVE set point change (ramp UP)	0.01... 99.99 (inF) Eng. units per minute	inF
C	87	SP.d	Rate of rise for NEGATIVE set point change (ramp DOWN)	0.01... 99.99 (inF) Eng. units per minute	inF

**PAn Group - Operator HMI**

Liv	N°	Param	Description	Values	Default
C	118	PAS2	Level 2 password (limited access level)	oFF (Level 2 not protected by password) 1... 200	20
C	119	PAS3	Level 3 password (complete configuration level)	3... 300	30
C	120	PAS4	Password livello (livello configurazione a codice)	201... 400	300
C	121	uSrb	button function during RUN TIME	nonE = No function tunE = Auto-tune/self-tune enabling. A single press (longer than 1 second) starts the auto-tune oPLo = Manual mode. The first pressure puts the instrument in manual mode (OPLO) while a second one puts the instrument in Auto mode	tunE



				AAC = Alarm reset ASi = Alarm acknowledge chSP = Sequential set point selection St.by = Stand by mode. The first press puts the instrument in stand by mode while a second one puts the instrument in Auto mode. Str.t = Timer run/hold/reset P.run = Program run P.rES = Program reset P.r.H.r = Program run/hold/reset	
C	122	diSP	Display management	Spo = Operative set point	SPo
C	123	di.cL	Display colour	0 = The display colour is used to show the actual deviation (PV - SP) 1 = Display red (fix) 2 = Display green (fix) 3 = Display orange (fix)	2
	125	diS.t	Display Timeout	-- oFF (display always ON) -- 0.1... 99.59 (mm.ss)	oFF
C	126	fiLd	Filter on the displayed value	-- oFF (filter disabled) -- From 0.0 (oFF) to 20.0 (E.U.)	oFF
C	128	dSPu	Instrument status at power ON	AS.Pr = Starts in the same way it was prior to the power down Auto = Starts in Auto mode oP.0 = Starts in manual mode with a power output equal to zero St.bY = Starts in stand-by mode	Auto
C	129	oPr.E	Operative modes enabling	ALL = All modes will be selectable by the next parameter Au.oP = Auto and manual (OPLO) mode only will be selectable by the next parameter Au.Sb = Auto and Stand-by modes only will be selectable by the next parameter	ALL
C	130	oPEr	Operative mode selection	If oPr.E = ALL: - Auto = Auto mode - oPLo = Manual mode - St.bY = Stand by mode If oPr.E = Au.oP: - Auto = Auto mode - oPLo = Manual mode If oPr.E = Au.Sb: - Auto = Auto mode - St.bY = Stand by mode	Auto

**SEr Group - Serial link parameter**

Liv	N°	Param	Description	Values	Default
C	131	Add	Instrument address	-- oFF -- 1... 254	1
C	132	bAud	baud rate	1200 = 1200 baud 2400 = 2400 baud 9600 = 9600 baud 19.2 = 19200 baud 38.4 = 38400 baud	9600
C	133	trSP	Selection of the value to be retransmitted (Master)	nonE = Retransmission not used (the instrument is a slave) rSP = The instrument becomes a Master and retransmits the operative set point PErc = The instrument become a Master and it retransmits the power output	nonE

con Group - Consumption parameters					
Liv	N°	Param	Description	Values	Default
C	134	Co.tY	Count type	oFF = Not used 1 = Instantaneous power (kW) 2 = Power consumption (kW/h) 3 = Energy used during program execution. This measure starts from zero when a program runs end stops at the end of the program. A new program execution will reset the value 4 = Total worked days: number of hours the instrument is turned ON divided by 24. 5 = Total worked hours: number of hours the instrument is turned ON. 6 = Total worked days with threshold: number of hours the instrument is turned ON divided by 24, the controller is forced in stand-by when Co.ty value reaches the threshold set in [137] h.Job. 7 = Total worked hours with threshold: number of hours the instrument is turned ON, the controller is forced in stand-by when Co.ty value reaches the threshold set in [137] h.Job. 8 = Totalizer of control relay worked days: number of hours the control relay has been in ON condition, divided by 24. 9 = Totalizer of control relay worked hours: number of hours the control relay has been in ON condition. 10 = Totalizer of control relay worked days with threshold: number of hours the control relay has been in ON condition divided by 24, the controller is forced in stand-by when Co.ty value reaches the threshold set in [137] h.Job. 11 = Totalizer of control relay worked hours with threshold: number of hours the control relay has been in ON condition, the controller is forced in stand-by when Co.ty value reaches the threshold set in [137] h.Job.	oFF
C	138	t.Job	Worked time (not resettable)	0... 9999 days	0

cAL Group - User calibration group					
Liv	N°	Param	Description	Values	Default
C	139	AL.P	Adjust Low Point	From -1999 to (AH.P - 10) in engineering units	0
C	140	AL.o	Adjust Low Offset	-300... +300 (E.U.)	0
C	141	AH.P	Adjust High Point	From (AL.P + 10) to 9999 engineering units	999.9
C	142	AH.o	Adjust High Offset	-300... +300	0

## OPERATIVE MODES

When the instrument is powered, it starts immediately to work according to the parameters values loaded in its memory. The instrument behaviour and its performance are governed by the value of the stored parameters.

At power ON the instrument can start in one of the following mode depending on its configuration:

**Automatic Mode** In Automatic mode the instrument drives automatically the control output according to the parameter value set and the set point/measured value.

**Manual Mode (OPLO):** In Manual mode the the upper display shows the measured value while the lower display shows the power output. The lower display shows the power output [preceded by H (for heating) or C (for cooling)], MAN is lit and the instrument allows you to set manually the control output power. No Automatic action will be made.

**Stand by Mode (St.bY):** In stand-by mode the instrument operates as an indicator. It will show on the upper display the measured value and on the lower display the set point alternately to the "St.bY" messages and forces the control outputs to zero.

We define all the above described conditions as "Standard Display".

As we have seen, it is always possible to modify the value assigned to a parameter independently from the operative modes selected.

## AUTOMATIC MODE

Keyboard function when the instrument is in Auto mode:

	Modo Operatore
	Allows entry into parameter modification procedures
	Allows you to start the "Direct set point modification" function (see below).
	Allows you to display the "additional informations" (see below).
	Performs the action programmed by [121] uSrb (  button function during RUN TIME) parameter

### Additional information

This instrument is able to show you some additional informations that can help you to manage your system. The additional informations are related to how the instrument is programmed, hence in many cases, only part of this information is available.





1. When the instrument is showing the "standard display" push  button. The lower display will show H or c followed by a number. This value is the current power output applied to the process. The H show you that the action is a Heating action while the "c" show you that the action is a Cooling action
2. Push  button again. When the programmer is running the lower display will show the segment currently performed and the Event status as shown below:  
 where the first character can be r for a ramp or S for a soak, the next digit show the number of the segment (e.g. S3 means Soak number 3) and the two less significant digits (LSD) show you the status of the two event (the LSD is the Event 2)..
3. Push  button again. When the programmer is running the lower display will show the theoretical remaining time to the end of the program preceded by a "P" letter:  

4. Push  button again. When the wattmeter function is running the lower display will show U followed by the measured energy..
5. Push  button. When the "Worked time count" is running the lower display will show "d" for days or "h" for hours followed by the measured time.
6. Push  button. The instrument returns to the "standard display".

Note: The additional information visualization is subject to a time out. If no button is pressed for more than 10 second the instrument comes automatically back to the Standard display..

**Direct set point modification**

This function allows to modify rapidly the set point value selected by [83] A.SP (selection of the active Set point) or to the set point of the segment group (of the programmer) currently in progress.

1. Push  button. The upper display shows the acronym of the selected set point (e.g. SP2) and the lower display will show its value.
2. By  and  buttons, assign to this parameter the desired value
3. Do not push any button for more than 5 second or push the  button. In both cases the instrument memorize the new value and come back to the “standard display”.

**Manual mode**

This operative mode allows you to deactivate automatic control and manually program the percentage power output to the process. When the instrument is in manual mode, the upper display shows the measured value while the lower display shows the power output [preceded by H (for heating action) or C (for cooling action)] The MAN LED is lit. When manual control is selected, the instrument will start to operate with the same power output as the last one supplied by automatic mode and can be modified using the  and  buttons.

In case of ON/OFF control, 0% corresponds to the deactivated output while any value different from 0 corresponds to the activated output. As in the case of visualization, the programmable values range from H100 (100% output power with reverse action) to C100 (100% output power with direct action).

**Notes:**

- During manual mode, the alarms are operative.
- If you set manual modes during program execution, the program will be frozen and it will restart when the instrument will come back to Auto mode.
- If you set manual modes during self-tune execution, the self- tune function will be aborted.
- During manual mode, all functions not related with the control (wattmeter, independent timer, “worked time”, etc) continue to operate normally..

**STAND-BY MODE**

This operative mode also deactivates the automatic control but forces the control output to zero. In this mode the instrument operates as an indicator. When the instrument is in stand by mode the upper display will show the measured value while the lower display will show alternately the set point and the message “St.bY”.

**Notes:**

- During stand by mode, the relative alarms are disabled while the absolute alarms are operative or not according to the ALxo (Alarm x enabling during Stand-by mode) parameter setting.
- If you set stand by mode during program execution, the program will be aborted.
- If you set stand by mode during self-tune execution, the self- tune function will be aborted.
- During stand by mode, all functions not related with the control (wattmeter, independent timer, “worked time”, etc) continue to operate normally.
- When the instrument is swapped from stand by to auto modes, the instrument will start automatically the alarm masking, the soft start functions and the auto-tune (if programmed).

**AUTOTUNE (EVOTUNE)**

Evotune is a fast and fully automatic procedure that can be started in any condition, regardless the deviation from SP. The controller selects automatically the best tune method and computes the optimum PID parameters. To activate Evotune press  button for 3 seconds.

## ERROR MESSAGES

The upper display shows the OVER-RANGE and UNDERRANGE conditions with the following indications:

Over-range: 

Under-range 

The sensor break will be signalled as an out of range: - - - -

Note: When an over-range or an under-range is detected, the alarms operate as in presence of the maximum or the minimum measurable value respectively.

To check the out of span Error condition, proceed as follows:

1. Check the input signal source and the connecting line.
2. Make sure that the input signal is in accordance with the instrument configuration. Otherwise, modify the input configuration.
3. If no error is detected, send the instrument to your supplier to be checked.

### List of possible errors

**ErAT** Fast Auto-tune cannot start. The measure value is too close to the set point. Push the button in order to delete the error message.

**ouLd** Overload on the out 4. The messages shows that a short circuit is present on the Out 4 when it is used as output or as a transmitter power supply. When the short circuit disappears the output restart to operate..

**NoAt** Auto-tune not finished within 12 hours.

**ErEP** Possible problem of the instrument memory. The messages disappears automatically. When the error continues, send the instrument to your supplier.

**RonE** Possible problem of the firmware memory. When this error is detected, send the instrument to your supplier.

**Errt** Possible problem of the calibration memory. When this error is detected, send the instrument to your supplier.

## FACTORY RESET

Sometime, e.g. when you re-configure an instrument previously used for other works or from other people or when you have made too many errors during configuration and you decided to re-configure the instrument, it is possible to restore the factory configuration. This action allows to put the instrument in a defined condition (the same it was at the first power ON).

The default data are those typical values loaded in the instrument prior to ship it from factory. To load the factory default parameter set, proceed as follows:

1. Press the  button for more than 5 seconds. The upper display will show PASS while the lower display shows 0;
2. Using  and  buttons set the value -481;
3. Push  button;
4. The instrument will turn OFF all LEDs for a few seconds, then the upper display will show dFLt (default) and then all LEDs are turned ON for 2 seconds. At this point the instrument restarts as for a new power ON.

The procedure is complete.

Note: The complete list of the default parameters is available in Chapter "Configuration".

# RWF55.5X & RWF55.6X



*User manual*

## DEVICE INSTALLATION

### Fixing system



### Drilling dimensions:



## FRONT PANEL







RWF55 is preset good for 90% of applications. However, you can set or edit parameters as follow:

**Set-point: set or modification:**

When the burner is in stand-by, (safety loop open, that is terminals 3-4/T1-T2 on the 7 pole plug open) push the Enter button: on the lower display (green) Opr appears; push Enter again and in the same display SP1 appears. Push Enter again and the lower display (green SP1) flashes. Using the up and down arrows change the set-point on the upper display (red). Push Enter to confirm and push ESC more times to get the home position.

### **PID parameters set and modifications (PARA):**

Push **Enter** button, on the green display **Opr** appears; using the **down arrow**, scroll until group **PARA** is reached and push **Enter**.

On the green display **Pb1** e appears and on the red one the set parameter. Push is sequence the **down or up** arrow the menu is scrolled.

Push **Enter** to select and the **arrows** to choose the desired value. **Enter** to confirm

Parameter	Display	Range	Factory setting	Remarks
Proportional band	Pb1	1... 9999 digit	10	Typical value for temperature
Derivative action	dt	0... 9999 sec.	80	Typical value for temperature
Integral action	rt	0... 9999 sec.	350	Typical value for temperature
Dead band (*)	db	0... 999,9 digit	1	Typical value
Servocontrol running time	tt	10... 3000 sec.	15	Set servocontrol running time
Switch-on differential (*)	HYS1	0,0... -1999 digit	-5	Value under setpoint below which the burner switches back on (1N-1P closes)
Switch-off differential 2° stage (*)	HYS2	0,0 ... HYS3	3	(enable only with parameter bin1 = 4)
Upper switch-off differential (*)	HYS3	0,0... 9999 digit	5	Value over setpoint above which the burner switches off (1N-1P opens)
Switch-on differential on cooling controller (*)	HYS4	0,0... 9999 digit	5	Do not used (enable only with parameter <b>CACT</b> = 0)
Switch-off differential 2° stage on cooling controller (*)	HYS5	HYS6...0,0 digit	5	Do not used (enable only with parameter <b>CACT</b> = 0 and parameter <b>bin1</b> =0)
Upper switch-off differential on cooling controller (*)	HYS6	0,0... -1999 digit	5	Do not used (enable only with parameter <b>CACT</b> = 0)
Delay modulation	q	0,0... 999,9 digit	0	Do not alter
Outside temperature Curve point 1 (*)	At1	-40 ...120 digit	-10	First point of external temperature for climatic curve
Boiler temperature Curve point 1 (*)	Ht1	SPL...SPH	60	Set-point temperature for the external temperature 1
Outside temperature Curve point 2 (*)	At2	-40 ...120 digit	20	Second point of external temperature for climatic curve
Boiler temperature Curve point 2 (*)	Ht2	SPL...SPH	50	Set-point temperature for the external temperature 2

(\*) Parameters affected by setting of decimal place (**ConF** > **dISP** parameter **dECP**)

### Setting the kind of sensor to be connected to the device:

Push the **Enter** button: on the lower display (green) **Opr** appears. Using the **up and down arrows** find **ConF**. Push **Enter** to confirm. Now on the green display the group **InP** appears. Push **Enter** and **InP1** is displayed. Enter to confirm. You are inside **InP1**; the green display shows **Sen1 (sensor type)**, while the red display shows the chosen sensor code. Push **Enter** to enter the **Sen1** parameter, then choose the desired sensor using the **arrows**. Push **Enter** to confirm and **ESC** to escape.

Once selected the sensor, you can modify all the other parameters using **up and down arrows** according to the tables here below :

#### ConF > InP > InP1

Parameter	Value	Description
SEn1 type of sensor for analog input 1	1	Pt100 3 wire
	2	Pt100 2 wire
	3	Pt1000 3 wire
	4	Pt1000 2 wire
	5	Ni1000 3 wire
	6	Ni1000 2 wire
	7	0 ÷ 135 ohm
	8	Cu-CuNi T
	9	Fe-CuNi J
	10	NiCr-Ni K
	11	NiCrSi-NiSi N
	12	Pt10Rh-Pt S
	13	Pt13Rh-Pt R
	14	Pt30Rh-Pt6Rh B
	15	0 ÷ 20mA
	16	4 ÷ 20mA
	17	0 ÷ 10V
	18	0 ÷ 5V
	19	1 ÷ 5V
OFF1 Sensor offset	-1999.. <b>0</b> .. +9999	Correction value measured by the sensor
SCL1 scale low level	-1999.. <b>0</b> .. +9999	minimum scale value(for input ohm, mA, V)
SCH1 scale high level	-1999.. <b>100</b> .. +9999	maximum scale value(for input ohm, mA, V)
dF1 digital filter	0... <b>0,6</b> ...100	Is used to adapt the digital 2nd order input filter (time in s; 0 s = filter off)
Unit temperature unit	<b>1</b>	1 = <b>degrees</b> Celsius
	2	2 = degrees Fahrenheit

(**bold** = factory settings)

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### ConF > InP > InP2

Input 2 : this input can be used to specify an external setpoint or carry out setpoint shifting

Parameter	Value	Description
FnC2	0	0= <b>no function</b>
	1	1= external setpoint (display <b>SPE</b> )
	2	2 =setpoint shifting (display <b>dSP</b> )
	3	3 = angular positioning feedback
SEn2 tisensor type input 2	1	0 ÷ 20mA
	2	4 ÷ 20mA
	3	0 ÷ 10V
	4	0 ÷ 5V
	5	1 ÷ 5V
	1	0 ÷ 20mA
OFF2 Sensor offset	-1999.. <b>0</b> .. +9999	Correction value measured by the sensor
SCL2 scale low level	-1999.. <b>0</b> .. +9999	minimum scale value(for input ohm, mA, V)
SCH2 scale high level	-1999.. <b>100</b> .. +9999	maximum scale value(for input ohm, mA, V)
dF2 digital filter	0... <b>2</b> ...100	Is used to adapt the digital 2nd order input filter (time in s; 0 s = filter off)

(**bold** = factory settings)

### ConF > InP > InP3

Input 3: this input is used to acquire the outside temperature

Parameter	Value	Description
SEn3 sensor type input 3sensor type input 2	0	0 =
	1	1 = wire
	2	2 = wire
OFF3 Sensor offset	-1999.. <b>0</b> .. +9999	Correction value measured by the sensor
dF3 digital filter	0... <b>1278</b> ...1500	Is used to adapt the digital 2nd order input filter (time in s; 0 s = filter off)

(**bold** = factory settings)

### ConF > Cntr

Here, the type of controller, operating action, setpoint limits and presets for self-optimization are selected

Parameter	Value	Description
CtYP controller type	1 2	<b>1 = 3-position controller (open-stop-close)</b> 2 = continuative action controller (0 ÷ 10V or 4 ÷ 20mA)
CACt control action	1 0	<b>1 = heating controller</b> 0 = cooling controller
SPL least value of the set-point range	-1999.. <b>0</b> ..+9999	minimum set-point scale
SPH maximum value of the set-point range	-1999.. <b>100</b> ..+999	maximum set-point scale
Self-optimization	0 1	<b>0 = Free</b> 1 = Locked Self-optimization can only be disabled or enabled via the ACS411 setup program. Self-optimization is also disabled when the parameter level is locked
pLLo set-point limitation start, operation limit low	-1999.... +9999	lower working range limit
pLHi set-point limitation end, operation limit high	-1999.... <b>+9999</b>	upper working range limit

(**bold** = factory settings)

### ConF > rAFC

Activation boiler shock termic protetion:

RWF55.. can activate the thermal shock protection only on sites where the set-point is lower than 250°C and according to **rAL** parameter

Parameter	Value	Description
FnCT type of control	<b>0</b> 1 2	choose type of range degrees/time <b>0 = deactivated</b> 1 = Kelvin degrees/minute 2 = Kelvin degrees/hour
rASL ramp rate	<b>0,0</b> ... 999,9	Slope of thermal shock protection (only with functions 1 and 2)
tolP tolerance band ramp	<b>2 x (HYS1) = 10</b> ...9999	width of tolerance band (in K) about the set-point <b>0 = tolerance band inactive</b>
rAL ramp limit	<b>0</b> ...250	Ramp limit. When this value is lower than the temperature set-point, the RWF controls the output increasing the temp set point step by step according to <b>rASL</b> . If this is over the temp set point, the control is performed in cooling



(**bold** = factory settings)

## Alarm functionAF

The alarm function can be used to monitor the analog inputs. If the limit value is exceeded, multifunctional relay K6 (terminals **6N** and **6P**) is activated (depending on the switching characteristic)

The alarm function can have different switching functions (Ik1 to Ik8) and can be set to a deviation from the active setpoint or to a fixed limit value

Limit value **AL** relative to setpoint (x)



Fixed limit value **AL**



## ConF > AF

Parameter	Value	Description
FnCt type of control	0 1 2 3 4 5 6 7 8 9 10 11 12	0 = <b>Without function</b> Ik1 = monitored input InP1 Ik2 = monitored input InP1 Ik3 = monitored input InP1 Ik4 = monitored input InP1 Ik5 = monitored input InP1 Ik6 = monitored input InP1 Ik7 = monitored input InP1 Ik8 = monitored input InP1 Ik7 = monitored input InP2 Ik8 = monitored input InP2 Ik7 = monitored input InP3 Ik8 = monitored input InP3
Alarm value AL	-1999 ... <b>0</b> 1999	Limit value or deviation from setpoint to be monitored (see alarm functions <b>Ik1 to Ik8</b> : limit value <b>AL</b> ) Limit value range for <b>Ik1</b> and <b>Ik20</b> ...9999
HySt switching differential	0... 1... 9999	Switching differential for limit value <b>AL</b>
ACrA response by out of range	<b>0</b> 1	<b>Switched-off</b> ON Switching state in the case of measuring range overshoot or undershoot (Out of Range)

(**bold** = factory settings)

## ConF > OutP

For fuel-air ratio control purposes, the RWF55 has the binary outputs K2, K3 (terminals KQ,K2, K3) and the analog output (terminals A+, A-). The burner is released via relay K1 (terminals 1N, 1P) .

The binary outputs of the RWF55 offer no setting choices

The RWF55 has an analog output.

The analog output offers the following setting choices:

Parameter	Value	Description
FnCt type of control	1 2 3 <b>4</b>	1 = analog input 1 doubling with possibility to convert 2 = analog input 2 doubling with possibility to convert 3 = analog input 3 doubling with possibility to convert <b>4 = Controller's angular positioning is delivered (modulating controller)</b>
SiGn type of output signal	<b>0</b> 1 2	physical output signal (terminals A+, A-) <b>0 = 0÷20mA</b> 1 = 4÷20mA 2 = 0÷10V DC
rOut value when out of input range	<b>0</b> ...101	signal (in percent) when measurement range is crossed
oPnt zero point	-1999... <b>0</b> ...+9999	A value range of the output variable is assigned to a physical output signal (for <b>FnCt</b> = 1, 2, 3)
End end point	-1999... <b>100</b> ...+9999	A value range of the output variable is assigned to a physical output signal (for <b>FnCt</b> = 1, 2, 3)

(**bold** = factory settings)

## ConF > binF

This setting decides on the use of the binary inputs **D1**, **D2**, **DG**

b

Parameter	Value	Description
bin1 binary input 1 (terminals <b>DG</b> – <b>D1</b> )	<b>0</b> 1 2 3	<b>0 = without function</b> 1 = set-point changeover (SP1 / SP2) 2 = lset-point shift (Opr > dSP parameter = value of set-point modify) 3 = input alarm
bin2 binary input 2 (terminals <b>DG</b> – <b>D2</b> )	<b>4</b>	<b>changeover of operating mode</b> DG-D2 open = modulating operation DG-D2 close = 2 stage operation

(**bold** = factory settings)

## ConF > dISP

Both displays can be customized to suit your needs by configuring the displayed value, decimal, time out and blocking

Parameter	Value	Description
diSU upper display (red)	<b>0</b> 1 2 3 4 6 7	Display value for upper display: 0 = display power-off <b>1 = analog input 1 (InP1) value</b> 2 = analog input 2 (InP2) value 3 = analog input 3 (InP3) value 4 = controller's angular positioning 6 = set-point values 7 = end value with thermal shock protection
diSL lower display (green)	<b>0</b> 1 2 3 4 6 7	Display value for lower display: 0 = display power-off 1 = analog input 2 (InP2) value 2 = analog input 2 (InP2) value 3 = analog input 2 (InP2) value 4 = controller's angular positioning <b>6 = set-point values</b> 7 = end value with thermal shock protection
tout timeout	0.. <b>180</b> ..250	time (s) on completion of which the controller returns automatically to the basic display, if no button is pressed
dECP decimal point	<b>0</b> 1 2	<b>0 = no decimal place</b> 1 = one decimal place 2 = two decimal place
CodE level lockout	<b>0</b> 1 2 3	<b>0 = no lockout</b> 1 = configuration level lockout ( <b>ConF</b> ) 2 = parameter and configuration level lockout ( <b>PARa</b> & <b>ConF</b> ) 3 = keyboard lockout

(**bold** = factory settings)



## ConF > IntF

The controller can be integrated into a data network using an optional RS-485 (terminals R+ and R-) interface or an optional Profibus DP interface(only model **RWF55.6x** terminals C1-C2-C3-C4)

Parameter	Value	Description
bdr baudrate	<b>0</b> 1 2 3	<b>0 = 4800 baud</b> 1 = 9600 baud 2 = 19200 baud 3 = 38400 baud
Adr Device address Modbus	0.. <b>1</b> .. 254	Address in the data network
dP Device address Profibus	0.. <b>125</b>	only with RWF55.6x
dt Remote detection time	0.. <b>30</b> .. 7200s	0 = switched-off

(**bold** = factory settings)

## Manual control :

In order to manual change the burner load, while firing keep pushing the **ESC** button for more than 5 s; on the lower green display **Hand** appears.

using the **UP** and **DOWN** arrows, the load varies.

Keep pushing the **ESC** button for getting the normal operation again.

NB: every time the device shuts the burner down (start led switched off - contact 1N-1P open), the manual control is not active.

## Device self-setting (auto-tuning):

If the burner in the steady state does not respond properly to heat generator requests, you can activate the Device's self-setting function, which recalculates PID values for its operation, deciding which are most suitable for the specific kind of request



Follow the below instructions:

push the **UP** and **DOWN** arrows for more than 5 s; on the green lower display **tUNE** appears. Now the device pushes the burner to increase and decrease its output. During this time, the device calculates **PID** parameters (**Pb1**, **dt** and **rt**). After the calculations, the **tUNE** is automatically deactivated and the device has already stored them.

In order to stop the Auto-tuning function while it works, push again the **UP** and **DOWN** arrows for more than 5 s. The calculated **PID** parameters can be manually modified following the previously described instructions.

### Display of software version :

The software version is shown by pushing Enter + UP arrow on the upper display.



### Weather-compensated setpoint shifting(climatic regulation):

The RWF55 can be configured so that weather-compensated setpoint shifting is activated when an LG-Ni1000 outside sensor or a Pt1000 is connected (see parameter **InP3**).

To take into account the time response of a building, weather-compensated setpoint shifting uses the attenuated outside temperature rather than the current outside temperature

The minimum and maximum setpoints can be set using the lower setpoint limit **SPL** and the upper setpoint limit **SPH** of the menu **Crtr**.

The system also prevents the lower working range limit **oLLo** and upper working range limit **oLHi** from exceeding/dropping below the system temperature limits.

The heating curve describes the relationship between the boiler temperature setpoint and the outside temperature. It is defined by 2 curve points. For 2 outside temperatures, the user defines the boiler temperature setpoint that is required in each case. The heating curve for the weather-compensated setpoint is calculated on this basis. The effective boiler temperature setpoint is limited by the upper setpoint limit **SPH** and the lower setpoint limit **SPL**.



For setting climatic regulation function set:

**PArA** > parameters **At1**, **Ht1**, **At2**, **Ht2**

**ConF** > **InP** > **InP3** parameters **SEn3**, **FnC3** = 1 (Weather-compensated setpoint).

---

## Modbus interface

The tables that follow in this chapter specify the addresses of the readable and writable words that the customer is able to access. The customer may read and/or write the values using SCADA programs, PLCs, or similar.

The entries under Access have the following meanings:

**R/O** Read Only, value can only be read

**R/W** Read/Write, value can be read and written

The number of characters specified under Data type in the case of character strings includes the final \0.

Char10 means that the text is up to 9 characters long. The final \0 character is then added to this

### User level

Address	Access	Data type	Signal reference	Parameter
0x0000	R/O	Float	X1	Analog input InP1
0x0002	R/O	Float	X2	Analog input InP2
0x0004	R/O	Float	X3	Analog input InP2
0x0006	R/O	Float	WR	Actual setpoint
0x0008	R/W	Float	SP1	Setpoint 1
0x000A	R/W	Float	SP2 (= dSP)	Setpoint 2
0x1035	R/O	Float	---	Analog input InP3 (unfiltered)
0x1043	R/O	Float	---	Actual angular positioning
0x1058	R/O	Word	B1	Burner alarm

### Parameter level

Address	Access	Data type	Signal reference	Parameter
0x3000	R/W	Float	Pb1	Proportional range 1
0x3004	R/W	Float	dt	Derivative action time
0x3006	R/W	Float	rt	Integral action time
0x300C	R/W	Float	db	Dead band
0x3012	R/W	Word	tt	Controlling element running time
0x3016	R/W	Float	HYS1	Switch-on threshold
0x3018	R/W	Float	HYS2	Switch-off threshold down
0x301A	R/W	Float	HYS3	Switch-off threshold up
0x301C	R/W	Float	HYS4	Switch-on threshold (cooling)
0x301E	R/W	Float	HYS5	Switch-off threshold down (cooling)
0x3020	R/W	Float	HYS6	Switch-off threshold up (cooling)
0x3022	R/W	Float	q	Reaction threshold
0x3080	R/W	Float	At1	Outside temperature 1
0x3082	R/W	Float	Ht2	Boiler temperature 1
0x3084	R/W	Float	At2	Outside temperature 2
0x3086	R/W	Float	Ht2	Boiler temperature 2

## Configuration level

Address	Access	Data type	Signal reference	Parameter
0x3426	R/W	Float	SCL1	Start of display input 1
0x3428	R/W	Float	SCH1	End of display input 1
0x3432	R/W	Float	SCL2	Start value input 2
0x3434	R/W	Float	SCH2	End value input 2
0x3486	R/W	Float	SPL	Start of setpoint limitation
0x3488	R/W	Float	SPH	End of setpoint limitation
0x342A	R/W	Float	OFFS1	Offset input E1
0x3436	R/W	Float	OFFS2	Offset input E2
0x343A	R/W	Float	OFFS3	Offset input E3
0x1063	R/W	Word	FnCt	Ramp function
0x1065	R/W	Float	rASL	Ramp slope
0x1067	R/W	Float	toLP	Tolerance band ramp
0x1069	R/W	Float	rAL	Limit value
0x1075	R/W	Float	dtT	Remote Detection Timer
0x1077	R/W	Float	dF1	Filter constant input 1
0x1079	R/W	Float	dF2	Filter constant input 2
0x107B	R/W	Float	dF3	Filter constant input 3
0x107D	R/O	Float	oLLo	Lower working range limit
0x107F	R/O	Float	oLHi	Upper working range limit
0x106D	R/W	Word	FnCt	Alarm relay function
0x106F	R/W	Float	AL	Alarm relay limit value (limit value alarm)
0x1071	R/W	Float	HYSt	Alarm relay hysteresis

## Remote operation

Address	Access	Data type	Signal reference	Parameter
0x0500	R/W	Word	REM	Activation remote operation *
0x0501	R/W	Word	rOFF	Controller OFF in remote setpoint **
0x0502	R/W	Float	rHYS1	Switch-on threshold remote
0x0504	R/W	Float	rHYS2	Switch-off threshold down remote
0x0506	R/W	Float	rHYS3	Switch-off threshold up remote
0x0508	R/W	Float	SPr	Setpoint remote
0x050A	R/W	Word	RK1	Burner release remote operation
0x050B	R/W	Word	RK2	Relay K2 remote operation
0x050C	R/W	Word	RK3	Relay K3 remote operation
0x050D	R/W	Word	RK6	Relay K6 remote operation
0x050E	R/W	Word	rStEP	Step-by-step control remote operation
0x050F	R/W	Float	rY	Angular positioning output remote operation
0x0511	R/W	Float	rHYS4	Switch-on threshold remote (cooling)
0x0513	R/W	Float	rHYS5	Switch-off threshold down remote (cooling)
0x0515	R/W	Float	rHYS6	Switch-off threshold up remote (cooling)

### Legend

\* = Local

\*\* = Controller OFF

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**Dati dell'apparecchio**

Address	Access	Data type	Signal reference	Parameter
0x8000	R/O	Char12	---	Software version
0x8006	R/O	Char14	---	VdN number

**Stato dell'apparecchio**

Address	Access	Data type	Signal reference	Parameter
0x0200	R/O	Word	---	Outputs and states
			Bit 0	Output 1
			Bit 1	Output 3
			Bit 2	Output 2
			Bit 3	Output 4
			Bit 8	Hysteresis limitation
			Bit 9	Control system
			Bit 10	Self-optimization
			Bit 11	Second setpoint
			Bit 12	Measuring range overshoot InP1
			Bit 13	Measuring range overshoot InP2
			Bit 14	Measuring range overshoot InP3
			Bit 15	Calibration mode
0x0201	R/O	Word	---	Binary signals and hardware detection
			Bit 0	Operation mode 2-stage
			Bit 1	Manual mode
			Bit 2	Binary input D1
			Bit 3	Binary input D2
			Bit 4	Thermostat function
			Bit 5	First controller output
			Bit 6	Second controller output
			Bit 7	Alarm relay
			Bit 13	Analog output available
			Bit 14	Interface available

Electric connections :

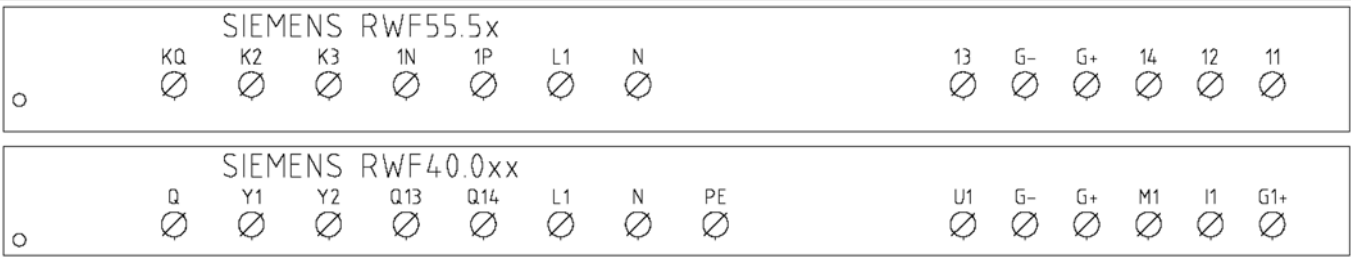
With 7 pins connector version



With terminals version



Correspondences bornes entre RWF55.5x y RWF40.0x0Matches terminals betweenRWF55.5x and RWF40.0x0



## Parameters summarising for RWF55.xx :

Navigation menü	ConF					ConF									Opr
	Inp							diSP							
	Inp1								Cntr		PArA				
	Types of probe	SEn1	OFF1	SCL	SCH	Unit	SPL	SPH	dECP	Pb. 1	dt	rt	tt	HYS1 (*)	
Siemens QAE2120...	6	0	needless	needless	1	30	95	1	10	80	350	(#)	-5	5	80 °C
Siemens QAM2120..	6	0	needless	needless	1	0	80	1	10	80	350	(#)	-2,5	2,5	40°C
Pt1000 (130°C max.)	4	0	needless	needless	1	30	95	1	10	80	350	(#)	-5	5	80°C
Pt1000 (350°C max.)	4	0	needless	needless	1	0	350	1	10	80	350	(#)	-5	10	80°C
Pt100 (130°C max.)	1	0	needless	needless	1	0	95	1	10	80	350	(#)	-5	5	80°C
Pt100 (350°C max)	1	0	needless	needless	1	0	350	1	10	80	350	(#)	-5	10	80°C
Probe4+20mA / 0÷1,6bar	16	0	0	160	needless	0	160	0	5	20	80	(#)	0	20	100 kPa
Probe4+20mA / 0÷3bar	16	0	0	300	needless	0	300	0	5	20	80	(#)	0	20	200 kPa
Probe 4+20mA / 0÷10bar	16	0	0	1000	needless	0	1000	0	5	20	80	(#)	0	50	600 kPa
Probe 4+20mA / 0÷16bar	16	0	0	1600	needless	0	1600	0	5	20	80	(#)	0	80	600 kPa
Probe 4+20mA / 0÷25bar	16	0	0	2500	needless	0	2500	0	5	20	80	(#)	0	125	600 kPa
Probe 4+20mA / 0÷40bar	16	0	0	4000	needless	0	4000	0	5	20	80	(#)	0	200	600 kPa
Probe 4+20mA / 0÷60PSI	16	0	0	600	needless	0	600	0	5	20	80	(#)	0	30	300 (30PSI)
Probe4+20mA / 0÷200PSI	16	0	0	2000	needless	0	2000	0	5	20	80	(#)	0	75	600 (60PSI)
Probe4+20mA / 0÷300PSI	16	0	0	3000	needless	0	3000	0	5	20	80	(#)	0	120	600 (60PSI)
Siemens QBE2002 P4	17	0	0	400	needless	0	400	0	5	20	80	(#)	0	20	200 kPa
Siemens QBE2002 P10	17	0	0	1000	needless	0	1000	0	5	20	80	(#)	0	50	600 kPa
Siemens QBE2002 P16	17	0	0	1600	needless	0	1600	0	5	20	80	(#)	0	80	600 kPa
Siemens QBE2002 P25	17	0	0	2500	needless	0	2500	0	5	20	80	(#)	0	125	600 kPa
Siemens QBE2002 P40	17	0	0	4000	needless	0	4000	0	5	20	80	(#)	0	200	600 kPa
Signal 0÷10V	17	0	needless	needless	needless	needless	needless	needless	5	20	80	(#)			
Signal 4÷20mA	16	0	needless	needless	needless	needless	needless	needless	5	20	80	(#)			

### NOTE:

(#) tt – servo control run time

SQL33 ; STM30; SQM10; SQM40; SQM50; SQM54 = 30 (secondi) - STA12B3.41; SQN30.251; SQN72.4A4A20 = 12 (secondi)

(\*)These values are factory set - values must be set during operation at the plant based on the real working temperature/pressure value.

### WARNING :

With pressure probes in bar the parameters SP1, SCH, SCL, HYS1, HYS3 must be set and displayed in kPa (kilo Pascal); 1bar = 100,000Pa = 100kPa.

With pressure probes in PSI the parameters SP1, SCH, SCL, HYS1, HYS3 must be set and displayed in PSI x10 (example: 150PSI > I display 1500).

## APPENDIX: PROBES CONNECTION

To assure the utmost comfort, the control system needs reliable information, which can be obtained provided the sensors have been installed correctly. Sensors measure and transmit all variations encountered at their location.

Measurement is taken based on design features (time constant) and according to specific operating conditions. With wiring run in raceways, the sheath (or pipe) containing the wires must be plugged at the sensor's terminal board so that currents of air cannot affect the sensor's measurements.

### Ambient probes (or ambient thermostats)

#### Installation

The sensors (or room thermostats) must be located in reference rooms in a position where they can take real temperature measurements without being affected by foreign factors.



#### Outside probes (weather) Installation

In heating or air-conditioning systems featuring adjustment in response to outside temperature, the sensor's positioning is of paramount importance.

#### It's good to be admired ...even better to be effective

Heating systems: the room sensor must not be installed in rooms with heating units complete with thermostatic valves. Avoid all sources of heat foreign to the system.



**General rule:** en on the outer wall of the building where the living rooms are, never on the south-facing wall or in a position where they will be affected by morning sun. If in any doubt, place them on the north or north-east façade.

#### Positions to be avoided



#### Location

On an inner wall on the other side of the room to heating units height above floor 1.5 m, at least 1.5 m away from external sources of heat (or cold).



#### Installation position to be avoided

near shelving or alcoves and recesses, near doors or windows, inside outer walls exposed to solar radiation or currents of cold air, on inner walls with heating system pipes, domestic hot water pipes, or cooling system pipes running through them.

Avoid installing near windows, vents, outside the boiler room, on chimney breasts or where they are protected by balconies, cantilever roofs.

**The sensor must not be painted (measurement error).**



## Duct or pipe sensors

### Installing temperature sensors

For measuring outlet air:

"after delivery fan or

"after coil to be controlled, at a distance of at least 0,5 m

For measuring room temperature:

"before return air intake fan and near room's return airintake.

For measuring saturation temperature: after mist eliminator.



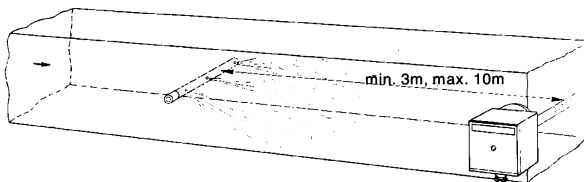
Bend 0.4m sensor by hand (never use tools) as illustrated .



Use whole cross-section of duct, min. distance from walls 50 mm, radius of curvature 10 mm for 2m or 6m sensors

### Installing combined humidity sensors

As max. humidity limit sensor on outlet (steam humidifiers) .



### Installing pressure sensors

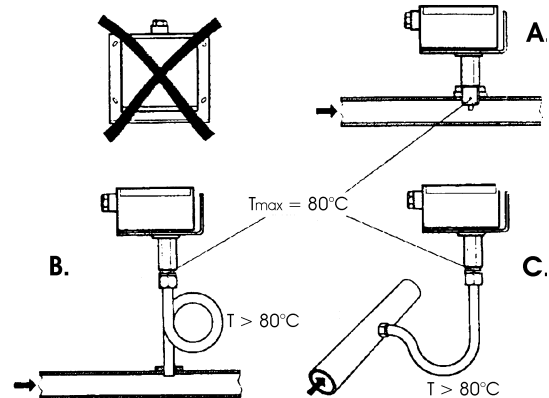
A - installation on ducts carrying fluids at max. temperature 80°C

B - installation on ducts at temperature over 80°C and for refrigerants

C - installation on ducts at high temperatures :

· "increase length of siphon

"place sensor at side to prevent it being hit by hot air coming from the pipe.



### Installing differential pressure sensors for water

Installation with casing facing down not allowed.

With temperature over 80°C, siphons are needed.

To avoid damaging the sensor, you must comply with the following instructions :

when installing: make sure pressure difference is not greater than the value permitted by the sensor

when there are high static pressures, make sure you insert shutoff valves A-B-C.

### Putting into operation

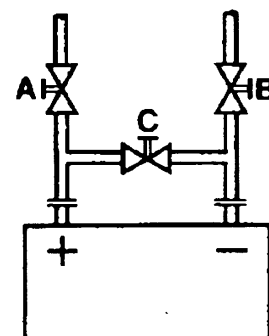
Start disable

1=open C1=open C

2=open A2=close B

3=open B3=close A

4= close C



## Immersion or strap-on sensors



### Immersion probes installation

Sensors must be installed on the stretch of pipe in which fluid circulates all the time.

The rigid stem (sensing element doing the measuring) must be inserted by at least 75mm and must face the direction of flow.

Recommended locations: on a bend or on a straight stretch of pipe but tilted by 45° and against the flow of fluid.

Protect them to prevent water from infiltrating (dripping gates, condensation from pipes etc.) .

### Installing QAD2.. strap-on sensors

Make sure fluid is circulating in the chosen location.

Eliminate insulation and paintwork (including rust inhibitor) on a min. 100mm length of pipe.

Sensors come with straps for pipes up to 100 mm in diameter .

## Placing the probes (QAD22.../QAE21.../QAP21.../RCA...)

### With pumps on outlet

with 3 ways valves / with 4 ways valves



Panel system / burner control



### With pumps on return

with 3 ways valves / with 4 ways valves



### Strap-on or immersion sensors?

#### QAD2.. strap-on sensors

Advantages :

- 10 sec. time constant
- Installed with system running (no plumbing work)
- Installation can be changed easily if it proves incorrect

ΠLimits:

- Suitable for pipe diameters max. 100 mm
- Can be affected by currents of air etc.

#### QAE2... immersion sensors

Advantages:

- Measure "mean" fluid temperature
- No external influence on measurement such as: currents of air, nearby pipes etc.

Limits:

- Time constant with sheath: 20 sec.
- Hard to change installation position if it proves incorrect

Installing differential pressure probes for air



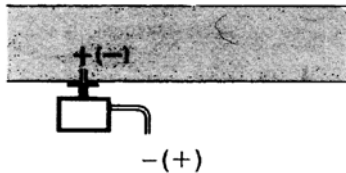
A - Control a filter (clogging)



B - Control a fan (upstream/downstream)



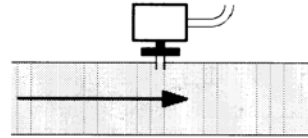
C - Measurement of difference in pressure between two ducts



D - Measurement of difference in pressure between two rooms or of inside of duct and outside

Basic principles

Measuring static pressure(i.e. pressure exerted by air on pipe walls)



Measuring dynamic pressure



$$P_d = \frac{\gamma q^2}{2g}$$

Legend

- $\gamma$  Kg/m<sup>3</sup>, specific weight of air
- $q$  m/s, air speed
- $g$  9.81 m/s<sup>2</sup> gravity acceleration
- $P_d$  mm C.A., dynamic pressure

Measuring total pressure

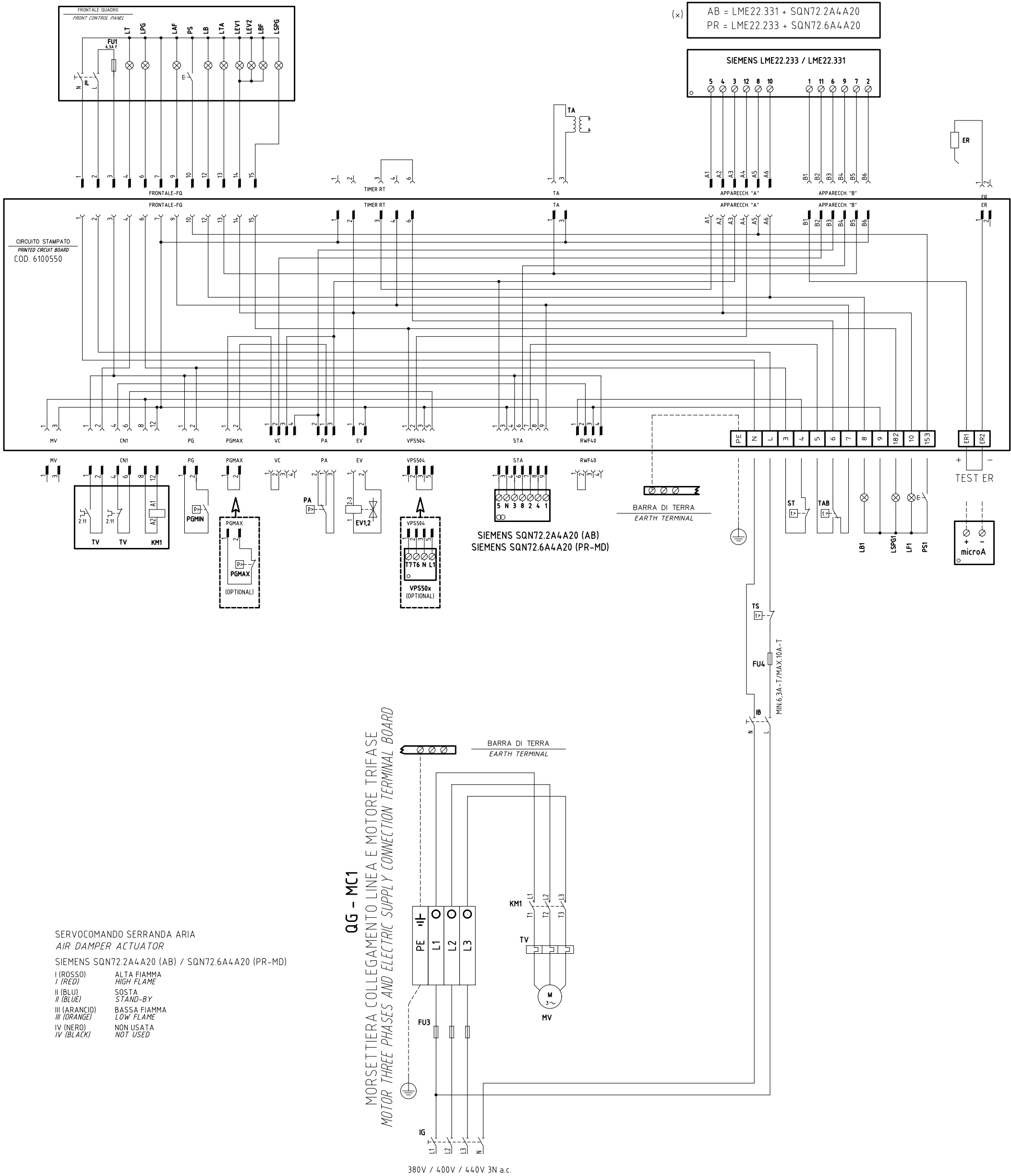





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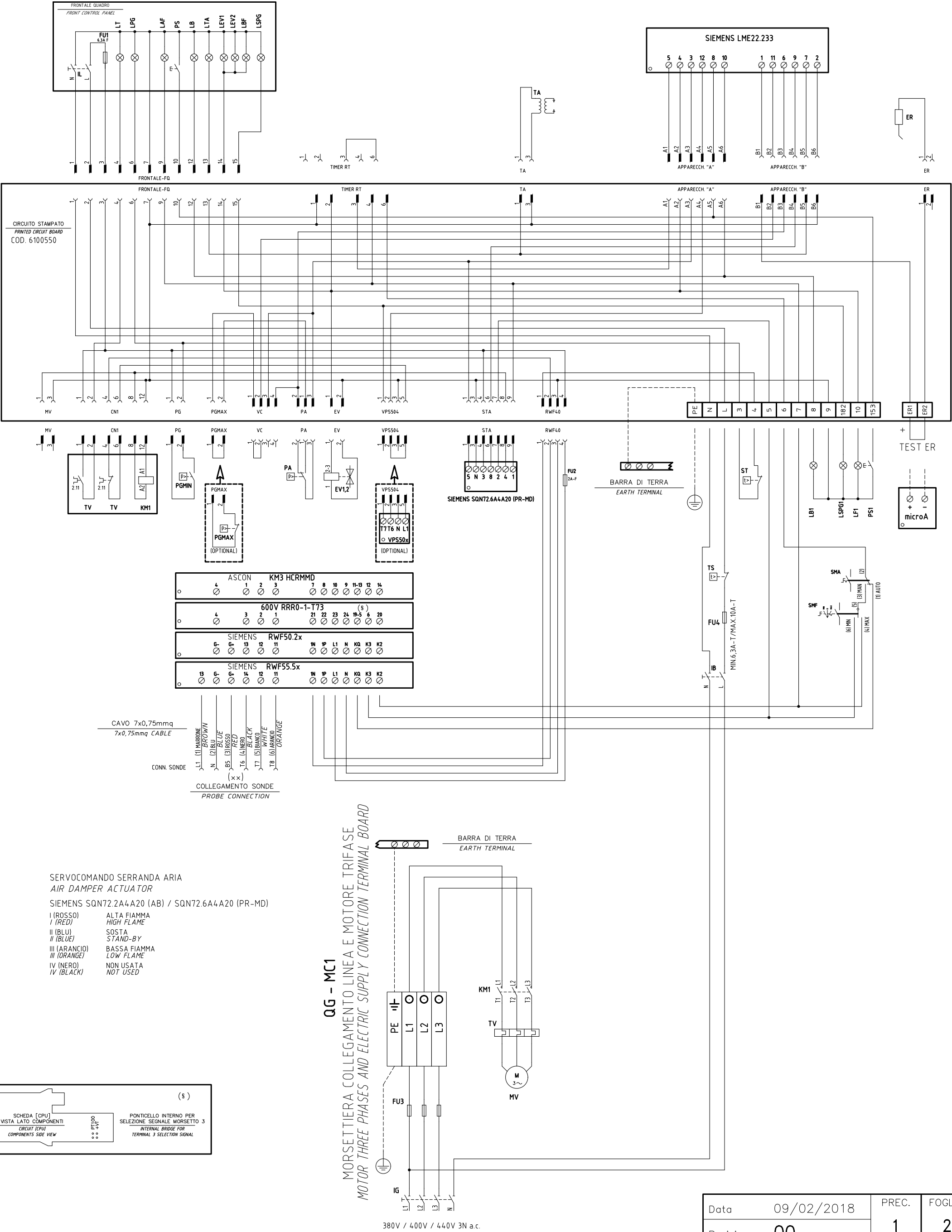
Note: Specifications and data subject to change. Errors and omissions excepted.

VERSIONE ALTA-BASSA FIAMMA "AB" / PROGRESSIVO "PR"  
"AB" HIGH-LOW / "PR" PROGRESSIVE VERSION



	Impianto	Ordine		Data	09/02/2018	PREC.	FOGLIO
	TIPI/TYPES CxxA/CxxX/ExxxA/ExxxX MODELLO x-.AB.xx.xx.A.xx	Commessa	Data Controllato 09/02/2018	Revisione	00	/	1
	Descrizione	Esecutore U. PINTON	Controllato M. MASCHIO	Dis. N.	18 - 0317	SEGUE	TOTALE
	TIPI/TYPES CxxA/CxxX/ExxxA/ExxxX/CxxX-FGR/ExxxX-FGR MODELLO x-.PR(MD).xx.xx.A.xx					2	4

VERSIONE MODULANTE "MD"  
"MD"MODULATING VERSION



Data	09/02/2018	PREC.	FOGLIO
Revisione	00	1	2
Dis. N.	18 - 0317	SEGUE	TOTALE
		3	4

(xx)

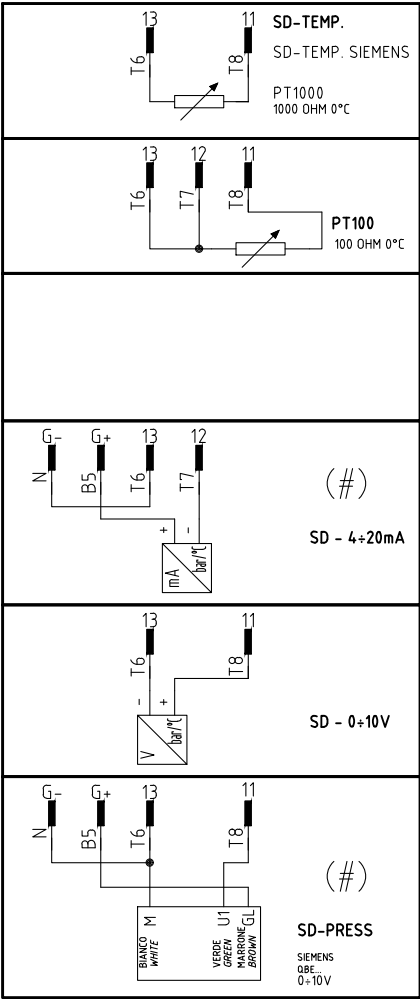
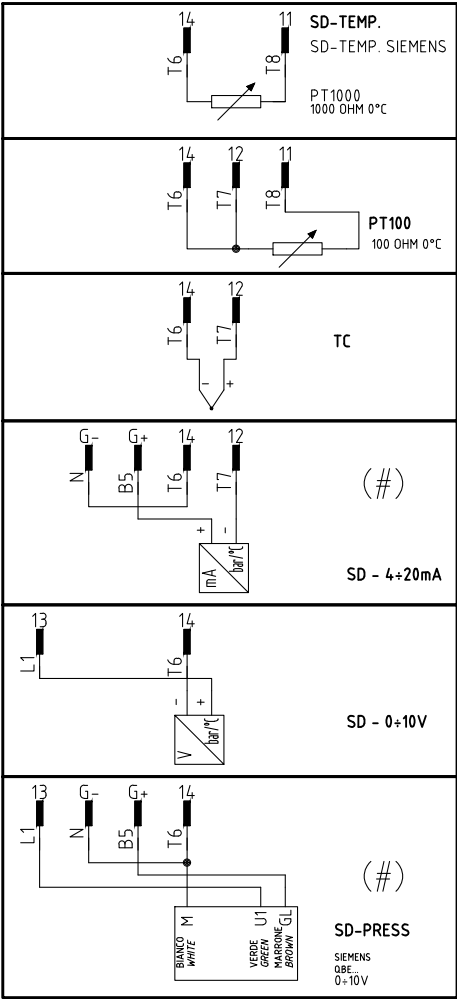
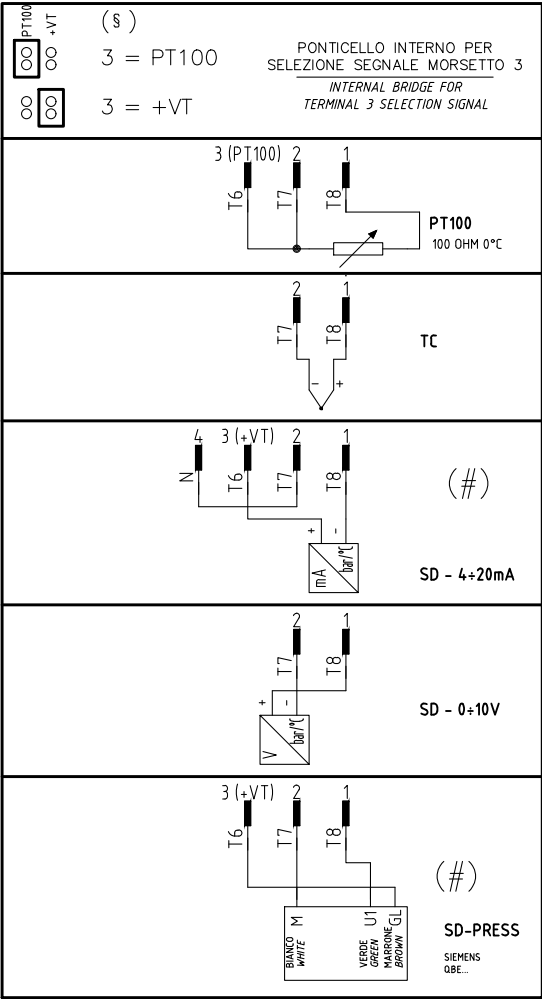
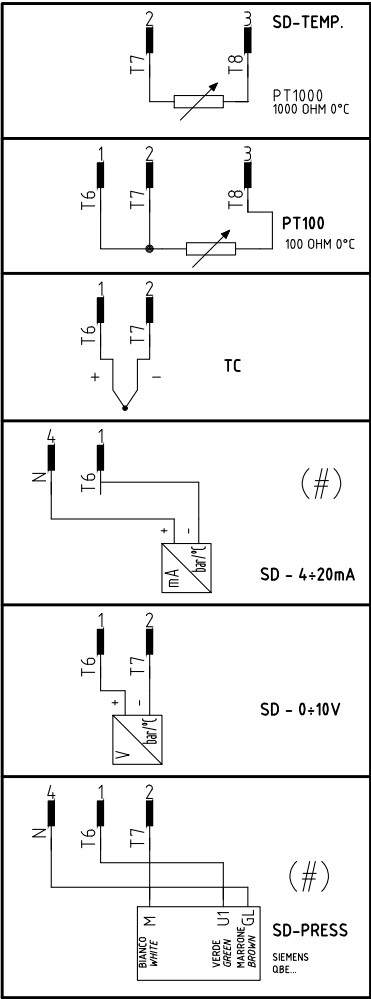
ATTENZIONE COLLEGAMENTO SONDE CON CONNETTORE 7 POLI  
WARNING PROBE CONNECTION WITH 7 PINS CONNECTOR

KM3 HCRMMD

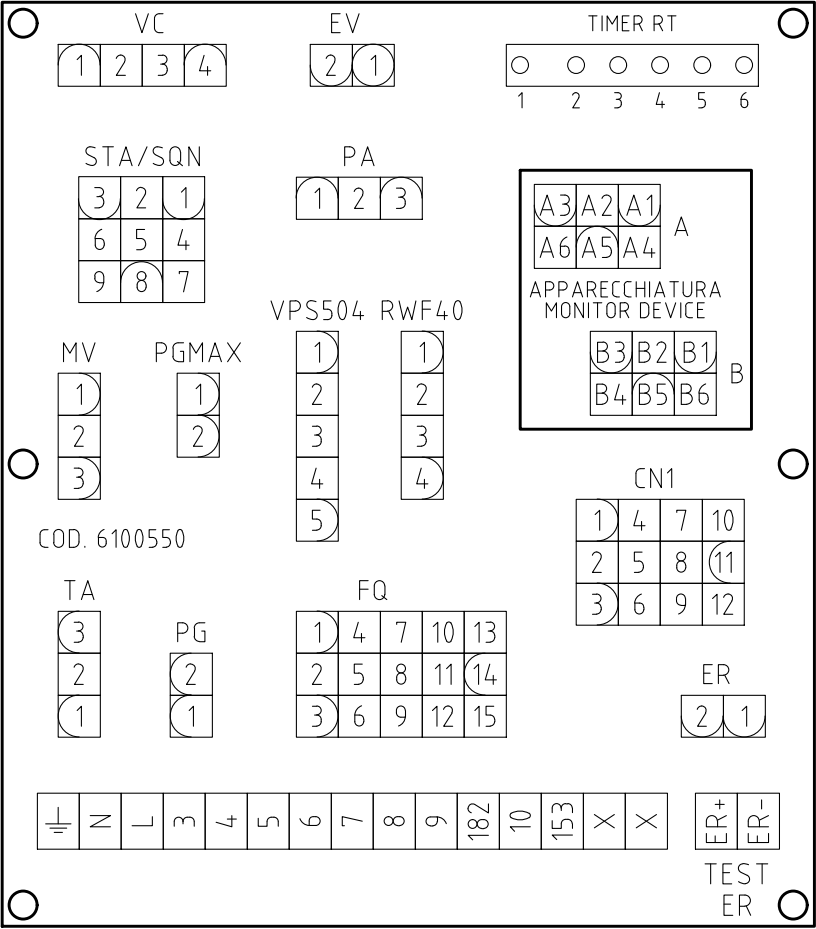
600V RRR0-1-T73

RWF55.5x

RWF50.2x



(#)  
COLLEGAMENTO SOLO PER  
TRASDUTTORI PASSIVI  
TRASDUCER PASSIVE  
CONNECTION ONLY





Sigla/Item	Funzione	Function
600V RRR0–1–T73	REGOLATORE MODULANTE (ALTERNATIVO)	BURNER MODULATOR (ALTERNATIVE)
ER	ELETTRODO RILEVAZIONE FIAMMA	FLAME DETECTION ELECTRODE
EV1,2	ELETTROVALVOLE GAS (O GRUPPO VALVOLE)	GAS ELECTRO–VALVES (OR VALVES GROUP)
FU1	FUSIBILE DI LINEA	LINE FUSE
FU2	FUSIBILE AUSILIARIO	AUXILIARY FUSE
FU3	FUSIBILI LINEA MOTORE VENTILATORE	FAN MOTOR LINE FUSES
FU4	FUSIBILE DI LINEA	LINE FUSE
IB	INTERRUTTORE LINEA BRUCIATORE	BURNER LINE SWITCH
IG	INTERRUTTORE GENERALE	MAINS SWITCH
IL	INTERRUTTORE LINEA AUSILIARI	AUXILIARY LINE SWITCH
KM1	CONTATTORE MOTORE VENTILATORE	FAN MOTOR CONTACTOR
KM3 HCRMMD	REGOLATORE MODULANTE (ALTERNATIVO)	BURNER MODULATOR (ALTERNATIVE)
LAF	LAMPADA SEGNALAZIONE ALTA FIAMMA BRUCIATORE	BURNER IN HIGH FLAME INDICATOR LIGHT
LB	LAMPADA SEGNALAZIONE BLOCCO BRUCIATORE	INDICATOR LIGHT FOR BURNER LOCK–OUT
LB1	LAMPADA SEGNALAZIONE BLOCCO BRUCIATORE	INDICATOR LIGHT FOR BURNER LOCK–OUT
LBF	LAMPADA SEGNALAZIONE BASSA FIAMMA BRUCIATORE	BURNER IN LOW FLAME INDICATOR LIGHT
LEV1	LAMPADA SEGNALAZIONE APERTURA [EV1]	INDICATOR LIGHT FOR OPENING OF ELECTRO–VALVE [EV1]
LEV2	LAMPADA SEGNALAZIONE APERTURA [EV2]	INDICATOR LIGHT FOR OPENING OF ELECTRO–VALVE [EV2]
LF1	LAMPADA SEGNALAZIONE FUNZIONAMENTO BRUCIATORE	INDICATOR LIGHT BURNER OPERATION
LPG	LAMPADA SEGNALAZIONE PRESENZA GAS IN RETE	INDICATOR LIGHT FOR PRESENCE OF GAS IN THE NETWORK
LSPG	LAMPADA SEGNALAZIONE BLOCCO CONTROLLO TENUTA VALVOLE	INDICATOR LIGHT FOR LEAKAGE OF VALVES
LSPG1	LAMPADA SEGNALAZIONE BLOCCO CONTROLLO TENUTA VALVOLE	INDICATOR LIGHT FOR LEAKAGE OF VALVES
LT	LAMPADA SEGNALAZIONE BLOCCO TERMICO	INDICATOR LIGHT FOR MOTOR OVERLOAD THERMAL CUTOUT
LTA	LAMPADA SEGNALAZIONE TRASFORMATORE DI ACCENSIONE	IGNITION TRANSFORMER INDICATOR LIGHT
MV	MOTORE VENTILATORE	FAN MOTOR
PA	PRESSOSTATO ARIA	AIR PRESSURE SWITCH
PGMAX	PRESSOSTATO GAS DI MASSIMA PRESSIONE	MAXIMUM PRESSURE GAS SWITCH
PGMIN	PRESSOSTATO GAS DI MINIMA PRESSIONE	MINIMUM GAS PRESSURE SWITCH
PS	PULSANTE SBLOCCO FIAMMA	FLAME UNLOCK BUTTON
PS1	PULSANTE SBLOCCO FIAMMA	FLAME UNLOCK BUTTON
PT100	SONDA DI TEMPERATURA	TEMPERATURE PROBE
RWF50.2x	REGOLATORE MODULANTE	BURNER MODULATOR
RWF55.5x	REGOLATORE MODULANTE (ALTERNATIVO)	BURNER MODULATOR (ALTERNATIVE)
SD–PRESS	SONDA DI PRESSIONE	PRESSURE PROBE
SD–TEMP.	SONDA DI TEMPERATURA	TEMPERATURE PROBE
SD – 0÷ 10V	TRASDUTTORE USCITA IN TENSIONE	TRANSDUCER VOLTAGE OUTPUT
SD – 4÷ 20mA	TRASDUTTORE USCITA IN CORRENTE	TRANSDUCER CURRENT OUTPUT
SIEMENS LME22.233	APPARECCHIATURA CONTROLLO FIAMMA	CONTROL BOX
SIEMENS LME22.233 / LME22.331	APPARECCHIATURA CONTROLLO FIAMMA	CONTROL BOX
SIEMENS SQN72.2A4A20 (AB)	SERVOCOMANDO SERRANDA ARIA	AIR DAMPER ACTUATOR
SIEMENS SQN72.6A4A20 (PR–MD)	SERVOCOMANDO SERRANDA ARIA	AIR DAMPER ACTUATOR
SMA	SELETTORE MANUALE/AUTOMATICO	MANUAL/AUTOMATIC SWITCH
SMF	SELETTORE MANUALE FUNZIONAMENTO MIN–0–MAX	MIN–0–MAX MANUAL OPERATION SWITCH
ST	SERIE TERMOSTATI/PRESSOSTATI	SERIES OF THERMOSTATS OR PRESSURE SWITCHES
TA	TRASFORMATORE DI ACCENSIONE	IGNITION TRANSFORMER
TAB	TERMOSTATO/PRESSOSTATO ALTA–BASSA FIAMMA	HIGH–LOW THERMOSTAT/PRESSURE SWITCHES
TC	TERMOCOPPIA	THERMOCOUPLE
TS	TERMOSTATO/PRESSOSTATO DI SICUREZZA	SAFETY THERMOSTAT OR PRESSURE SWITCH
TV	TERMICO MOTORE VENTILATORE	FAN MOTOR THERMAL
VPS50x	CONTROLLO DI TENUTA VALVOLE GAS (OPTIONAL)	GAS PROVING SYSTEM (OPTIONAL)
microA	MICROAMPEROMETRO	MICROAMMETER