

**KR1025**  
**KR1030**  
**KR1040**

***Progressive  
and fully-modulating  
gas - heavy oil 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)
- 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 - 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

**Burner model identification**

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

|      |               |       |            |            |            |            |            |            |            |
|------|---------------|-------|------------|------------|------------|------------|------------|------------|------------|
| Type | <b>KR1025</b> | Model | <b>MD.</b> | <b>PR.</b> | <b>S.</b>  | <b>.</b>   | <b>A.</b>  | <b>1.</b>  | <b>80</b>  |
|      | <b>(1)</b>    |       | <b>(2)</b> | <b>(3)</b> | <b>(4)</b> | <b>(5)</b> | <b>(6)</b> | <b>(7)</b> | <b>(8)</b> |

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

|                                  |                                                                                                                                                                                                                                                 |  |  |  |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|
| (1) BURNER TYPE                  | <b>KR1025 - KR1030 - KR1040</b>                                                                                                                                                                                                                 |  |  |  |
| (2) FUEL                         | N - Heavy oil, viscosity $\leq 50\text{cSt}$ (7° E) @ 50° C<br>E - Heavy oil, viscosity $\leq 110\text{cSt}$ (15° E) @ 50° C<br>D - Heavy oil, viscosity $\leq 400\text{cSt}$ (50° E) @ 50° C<br>P - Petroleum, viscosity 89cSt (12° E) @ 50° C |  |  |  |
| (3) OPERATION Available versions | PR - Progressive MD - Fully modulating                                                                                                                                                                                                          |  |  |  |
| (4) BLAST TUBE                   | S - Standard                                                                                                                                                                                                                                    |  |  |  |
| (5) DESTINATION COUNTRY          | * - see data plate                                                                                                                                                                                                                              |  |  |  |
| (6) BURNER VERSION               | A - Standard                                                                                                                                                                                                                                    |  |  |  |
| (7) EQUIPMENT                    | 1 = 2 Gas valves + gas proving system<br>8 = 2 Gas valves + gas proving system + maximum gas pressure switch                                                                                                                                    |  |  |  |
| (8) GAS CONNECTION               | 65 = DN65 80 = DN80 100 = DN100 125 = DN125                                                                                                                                                                                                     |  |  |  |

| BURNERS                             |                                   | KR1025                                  | KR1030<br>..DN65 | KR1030<br>..DN80 / DN100 | KR1040       |
|-------------------------------------|-----------------------------------|-----------------------------------------|------------------|--------------------------|--------------|
| Output                              | min. - max. kW                    | 1200 - 8700                             | 1200 - 9500      | 1200 - 10600             | 1200 - 13000 |
| Fuel                                |                                   | Natural gas - Heavy oil                 |                  |                          |              |
| Category                            |                                   | (see next paragraph)                    |                  |                          |              |
| Viscosity                           | °E @ 50 °C                        | See "Burner model identification" table |                  |                          |              |
| Gas rate                            | min. - max. (Stm <sup>3</sup> /h) | 127 - 921                               | 127 - 1005       | 127 - 1122               | 127 - 1376   |
| Gas pressure                        | min. - max. mbar                  | (Note2)                                 |                  |                          |              |
| Heavy oil rate                      | min. - max. kg/h                  | 105 - 759                               | 105 - 828        | 105 - 924                | 227 - 1133   |
| Power supply                        |                                   | 400V 3N ~ 50Hz                          |                  |                          |              |
| Total power consumption (Heavy oil) | kW                                | 71                                      | 76               | 76                       | 84           |
| Fan motor                           | kW                                | 18.5                                    | 22               | 22                       | 30           |
| Pump motor                          | kW                                | 4                                       | 5.5              | 5.5                      | 5.5          |
| Pre-heater resistors (heavy oil)    | kW                                | 24+24                                   | 24+24            | 24+24                    | 24+24        |
| Protection                          |                                   | IP40                                    |                  |                          |              |
| Operation                           |                                   | Progressive - Fully modulating          |                  |                          |              |
| Gas Train DN65                      | Valves size/ Gas connection       | 65 / DN65                               | 65 / DN65        | -                        | -            |
| Gas Train DN80                      | Valves size/ Gas connection       | 80 / DN80                               | -                | 80 / DN80                | 80 / DN80    |
| Gas Train DN100                     | Valves size/ Gas connection       | 100 / DN100                             | -                | 100 / DN100              | 100 / DN100  |
| Gas Train DN125                     | Valves size/ Gas connection       | -                                       | -                | -                        | 125 / DN125  |
| 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> ); |
| <b>Note2:</b> | Maximum gas pressure = 500mbar (with Siemens VGD or Dungs MultiBloc MBE)<br>Minimum gas pressure = see gas curves.                                                                                      |
| <b>Note3:</b> | Burners are suitable only for indoor operation with a maximum relative humidity of 80 %                                                                                                                 |

\* **NOTE ON THE BURNER WORKING SERVICE:** for safety reasons, one controlled shutdown must be performed every 24 hours of continuous operation.

**NOTE:** Choosing the nozzle for heavy oil, consider H<sub>i</sub> equal to 40.43MJ/kg.

**Country and usefulness gas categories**

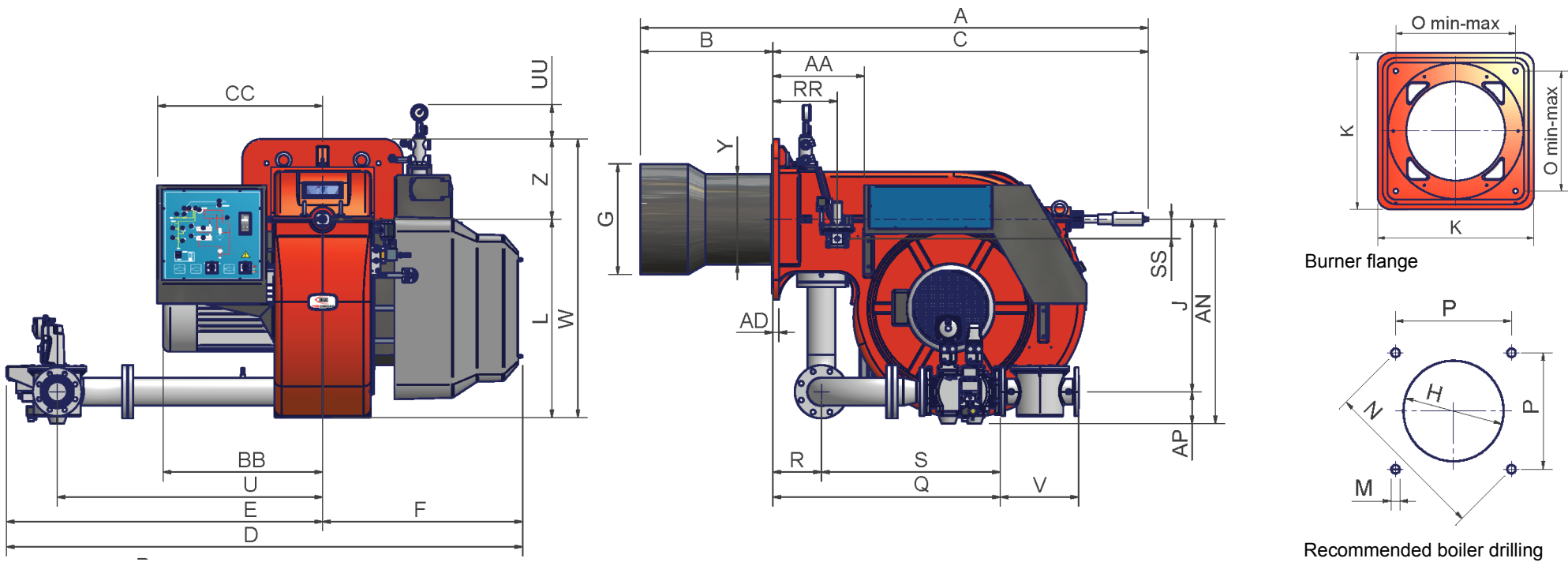
| GAS CATEGORY           | COUNTRY |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|------------------------|---------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| I <sub>2H</sub>        | AT      | ES | GR | SE | FI | IE | HU | IS | NO | CZ | DK | GB | IT | PT | CY | EE | LV | SI | MT | SK |
| I <sub>2E</sub>        | LU      | PL | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  |
| I <sub>2E( R ) B</sub> | BE      | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  |
| I <sub>2L</sub>        | NL      | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  |
| I <sub>2ELL</sub>      | DE      | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  |
| I <sub>2Er</sub>       | FR      | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  |

**Fuel**

**DANGER! 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.  | -- |

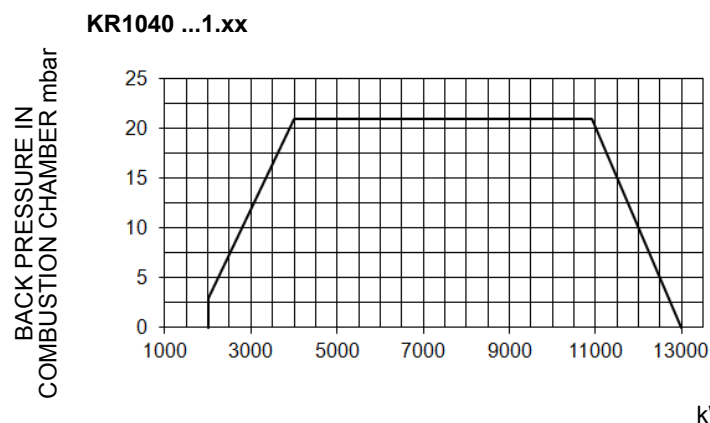
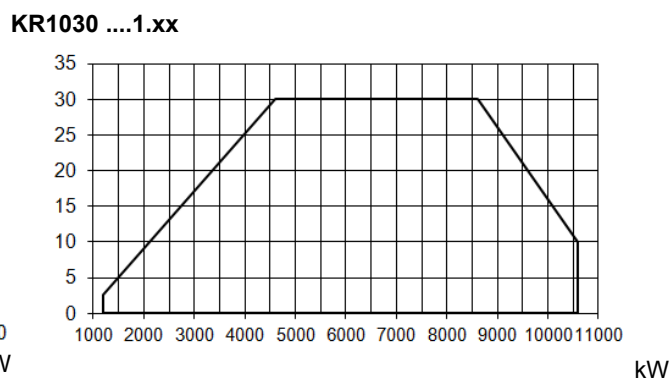
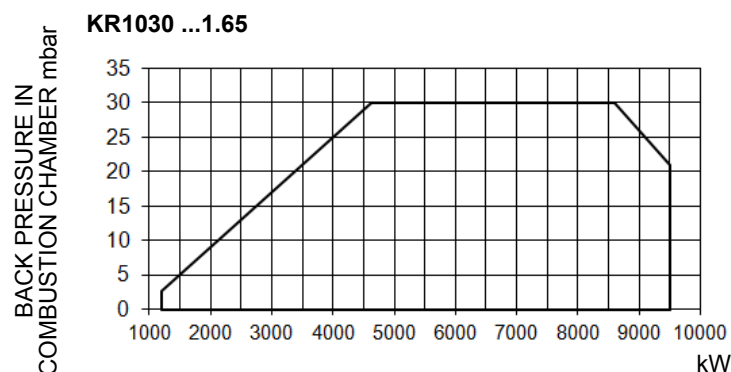
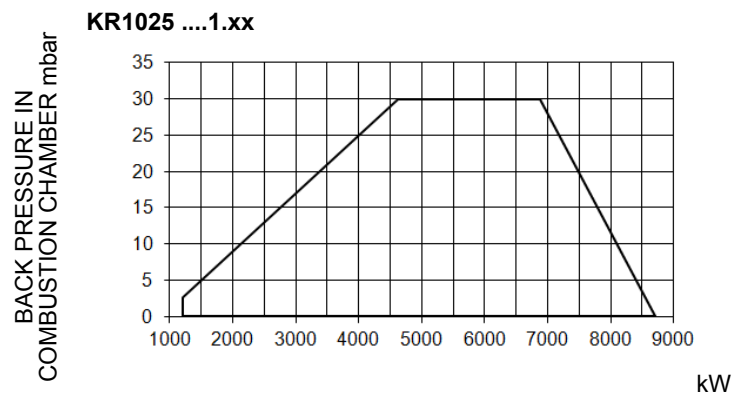
Overall dimensions (mm)



|        | DN* | A    | AA  | AD | AN  | AP  | B   | BB  | C    | CC  | D    | E    | F   | G   | H   | J   | K   | L   | M   | N   | O   | P   | Q    | R   | RR  | S   | SS | U    | UU  | V   | W    | Y   | Z   |
|--------|-----|------|-----|----|-----|-----|-----|-----|------|-----|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|-----|-----|-----|----|------|-----|-----|------|-----|-----|
| KR1025 | 50  | 2088 | 377 | 25 | 809 | 100 | 544 | 641 | 1544 | 680 | 2142 | 1320 | 822 | 400 | 450 | 709 | 660 | 815 | M16 | 651 | 460 | 460 | 1036 | 200 | 265 | 836 | 80 | 1092 | 142 | 216 | 1145 | 379 | 330 |
|        | 65  | 2088 | 377 | 25 | 827 | 118 | 544 | 641 | 1544 | 680 | 2121 | 1299 | 822 | 400 | 450 | 709 | 660 | 815 | M16 | 651 | 460 | 460 | 914  | 200 | 265 | 714 | 80 | 1092 | 142 | 292 | 1145 | 379 | 330 |
|        | 80  | 2088 | 377 | 25 | 841 | 132 | 544 | 641 | 1544 | 680 | 2123 | 1301 | 822 | 400 | 450 | 709 | 660 | 815 | M16 | 651 | 460 | 460 | 936  | 200 | 265 | 736 | 80 | 1092 | 142 | 322 | 1145 | 379 | 330 |
|        | 100 | 2088 | 377 | 25 | 854 | 145 | 544 | 641 | 1544 | 680 | 2139 | 1317 | 822 | 400 | 450 | 709 | 660 | 815 | M16 | 651 | 460 | 460 | 842  | 200 | 265 | 642 | 80 | 1092 | 142 | 382 | 1145 | 379 | 330 |
| KR1030 | 65  | 2088 | 377 | 25 | 827 | 118 | 544 | 657 | 1544 | 680 | 2121 | 1299 | 822 | 454 | 504 | 709 | 660 | 815 | M16 | 651 | 460 | 460 | 914  | 200 | 265 | 714 | 80 | 1092 | 142 | 292 | 1145 | 372 | 330 |
|        | 80  | 2088 | 377 | 25 | 841 | 132 | 544 | 657 | 1544 | 680 | 2123 | 1301 | 822 | 454 | 504 | 709 | 660 | 815 | M16 | 651 | 460 | 460 | 936  | 200 | 265 | 736 | 80 | 1092 | 142 | 322 | 1145 | 372 | 330 |
|        | 100 | 2088 | 377 | 25 | 854 | 145 | 544 | 657 | 1544 | 680 | 2139 | 1317 | 822 | 454 | 504 | 709 | 660 | 815 | M16 | 651 | 460 | 460 | 842  | 200 | 265 | 642 | 80 | 1092 | 142 | 382 | 1145 | 372 | 330 |
| KR1040 | 80  | 2106 | 377 | 25 | 841 | 132 | 544 | 657 | 1562 | 680 | 2123 | 1301 | 822 | 514 | 564 | 709 | 660 | 815 | M16 | 651 | 460 | 460 | 936  | 200 | 265 | 736 | 80 | 1092 | 142 | 322 | 1145 | 408 | 330 |
|        | 100 | 2106 | 377 | 25 | 854 | 145 | 544 | 657 | 1562 | 680 | 2139 | 1317 | 822 | 514 | 564 | 709 | 660 | 815 | M16 | 651 | 460 | 460 | 842  | 200 | 265 | 642 | 80 | 1092 | 142 | 382 | 1145 | 408 | 330 |
|        | 125 | 2106 | 377 | 25 | 884 | 175 | 544 | 657 | 1562 | 680 | 2254 | 1432 | 822 | 514 | 564 | 709 | 660 | 815 | M16 | 651 | 460 | 460 | 954  | 200 | 265 | 754 | 80 | 1192 | 142 | 480 | 1145 | 408 | 330 |

\*DN = gas valves size

NOTE: the overall dimensions are referred to burners provided with Siemens VGD valves.

**Performance curves****Performance Curves**

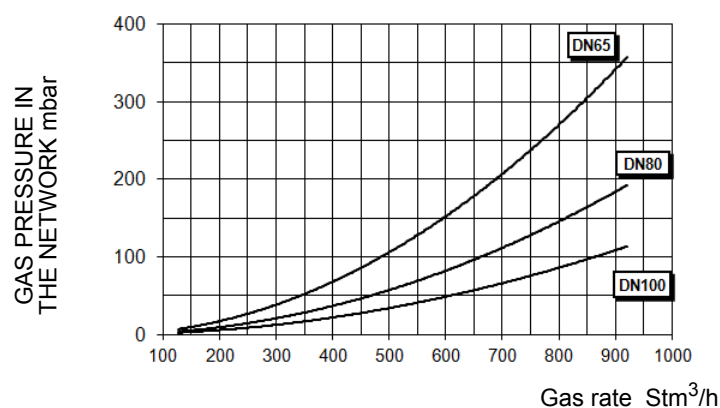
To get the input in kcal/h, multiply value in kW by 860.

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

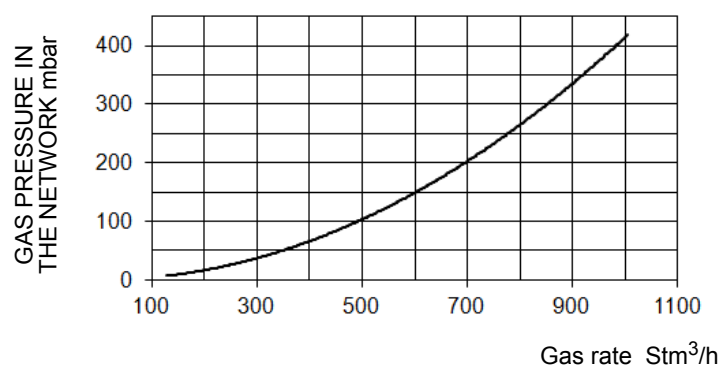
**NOTE:** The performance curve is a diagram that represents the burner performance in the type approval phase or in the laboratory tests, but does not represent the regulation range of the machine. On this diagram the maximum output point is usually reached by adjusting the combustion head to its "MAX" 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

## Pressure in the Network / gas flow rate curves (natural gas)

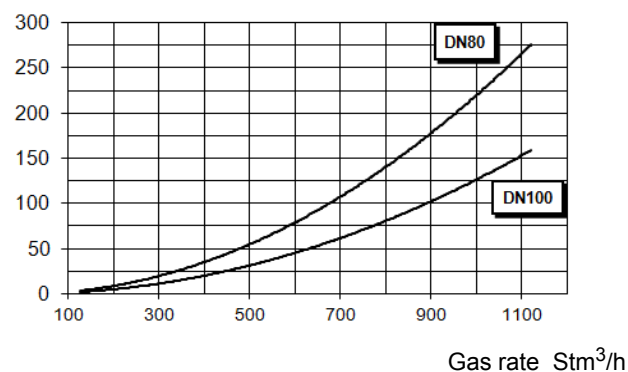
R1025 M-....1.xx



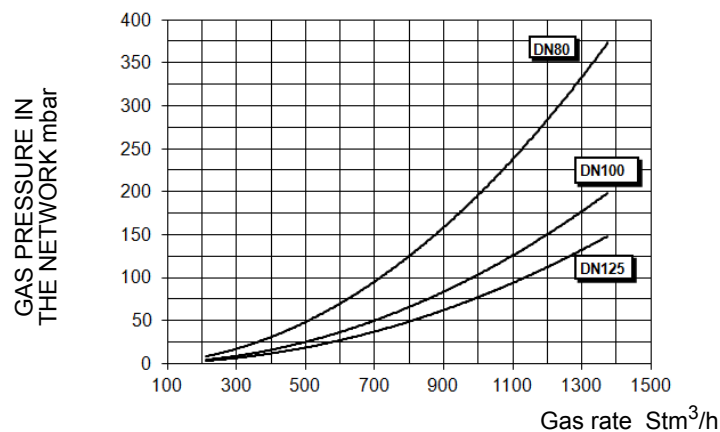
R1030 M-.....65



R1030 M-....1.xx



R1040 M-.



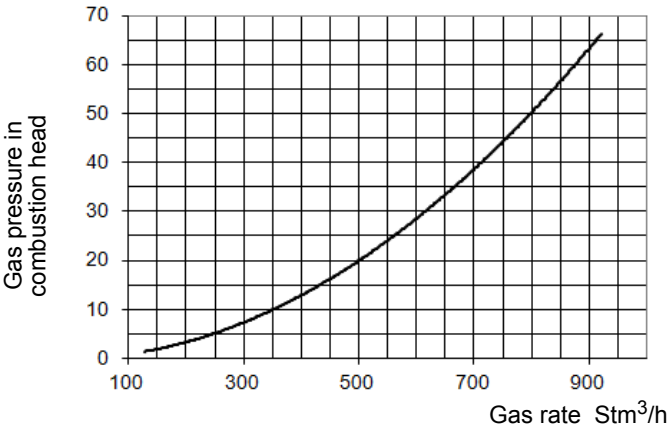
**Caution:** the gas rate value is quoted on the x-axis, the related network pressure is quoted on the y-axis (pressure value in the combustion chamber is not included). To know the minimum pressure at the gas train inlet, necessary to get the requested gas rate, add the pressure value in the combustion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

Pressure - rate in combustion head curves (natural gas)

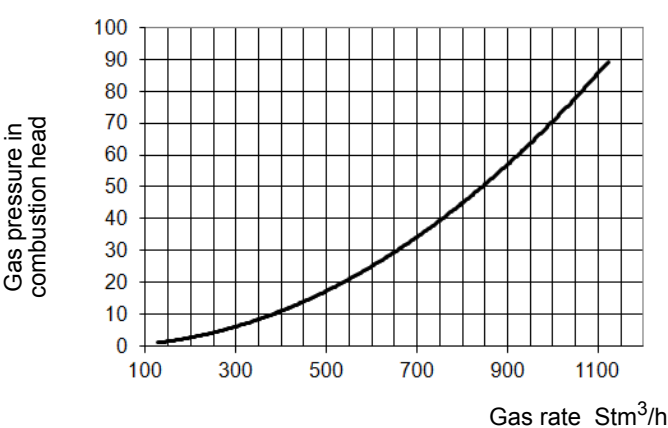


Curves are referred to pressure = 0 mbar in the combustion chamber!

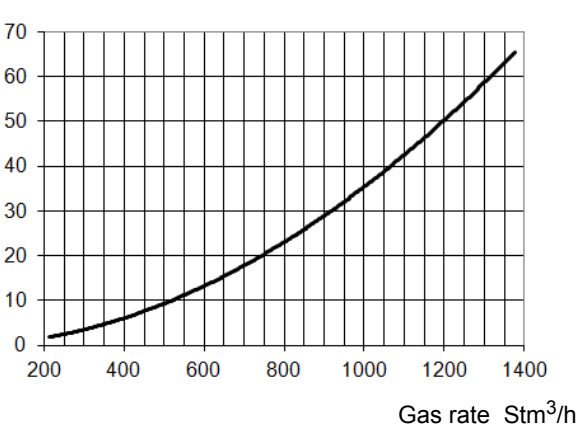
R1025 M-..



R1030 M-..

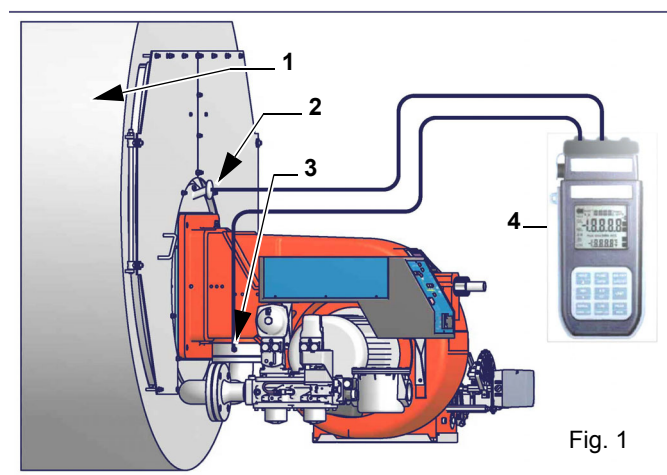


R1040 M-..



## 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.



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.

## 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.

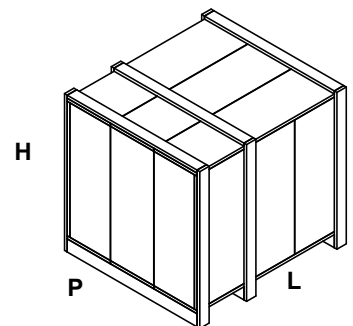
## Packing

The burners are despatched wooden cages whose dimensions:

Burner: 2270mm x 1720mm x 1360mm (L x P x H)

- burner with gas train detached;
- ceramic fibre plait to be inserted between the burner and the boiler;
- flexible oil pipes;
- oil filter;
- envelope containing this manual

Pumping unit: 1170mm x 870mm x 1610mm (L x P x H)



Packing cases of this kind are affected by humidity and are not suitable for stacking. The following are placed in each packing case:

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

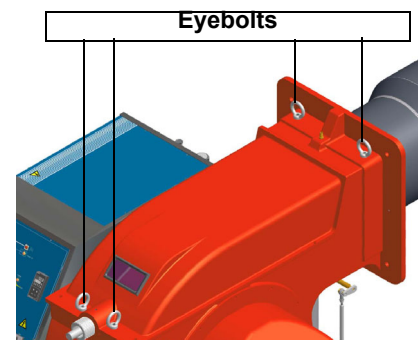
## Handling the burner



**ATTENTION!** the lifting and moving operations must be carried out by specialised and trained personnel. If these operations are not carried out perfectly, there is the residual risk of the burner to overturn and fall down.

As for moving the burner, use means suited for the weight to sustain (see paragraph "Technical specifications").

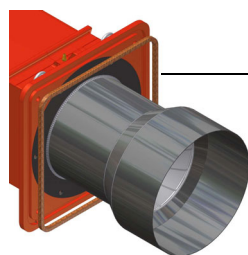
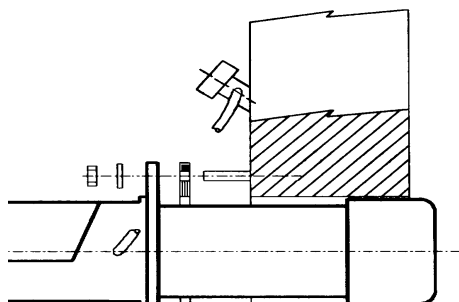
The burner is provided with eyebolts, for handling operations.



### Fitting the burner to the boiler

To perform the installation, proceed as follows:

- 1 drill the furnace plate as described in paragraph "Overall dimensions";
- 2 place the burner towards the furnace plate: lift and move the burner by means of its eyebolts placed on the top side (see "Lifting and moving the burner");
- 3 screw the stud bolts (5) in the plate holes, according to the burner's drilling plate described on paragraph "Overall dimensions";
- 4 place the ceramic fibre rope on the burner flange (if necessary, use a spray adhesive on the flange).
- 5 install the burner into the boiler;
- 6 fix the burner to the stud bolts, by means of the fixing nuts, according to the picture below.
- 7 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

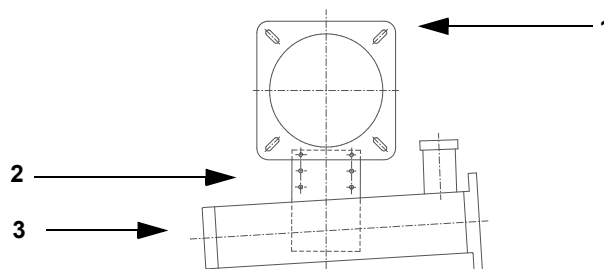
- |   |                     |
|---|---------------------|
| 1 | Burner              |
| 2 | Fixing nut          |
| 3 | Washer              |
| 4 | Ceramic fibre plait |
| 5 | Stud bolt           |
| 7 | Blast tube          |

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 or to design a blast tube that suits the utilisation (please, contact the manufacturer).

Set the upper side of the burner flange in a horizontal position, in order to obtain the correct inclination of the pre-heating tank.

#### Key

- |   |                                      |
|---|--------------------------------------|
| 1 | Burner flange (upper side indicated) |
| 2 | Bracket                              |
| 3 | Pre-heating tank on the burner       |



## Matching the burner to the boiler

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 follow the instructions of the boiler manufacturer. In absence of these consider the following:

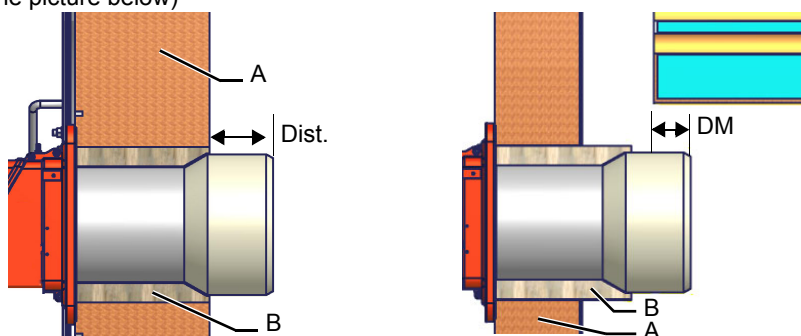
- Cast-iron boilers, three pass flue boilers (with the first pass in the rear part): the blast tube must protrude no more than **Dist** = 100 mm into the combustion chamber. (please see the picture below)
- Pressurised boilers with flame reversal: in this case the blast tube must penetrate **Dm** 50 ÷ 100 mm into combustion chamber in respect to the tube bundle plate.(please see the picture below)

A: ceramic fibre

B: refractory wall

Dist. = 100 mm

DM = 50 ÷ 100 mm



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

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 or to design a blast tube that suits the utilisation (please, contact the manufacturer).

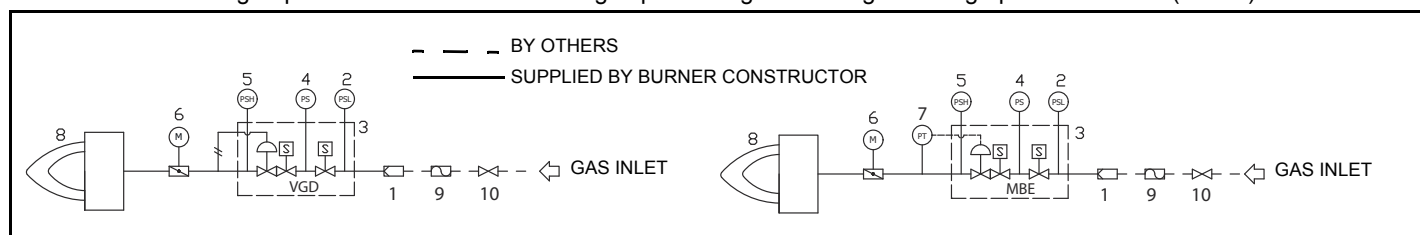
## Gas train connections

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.



**ATTENTION:** BEFORE EXECUTING THE CONNECTIONS TO THE GAS PIPE NETWORK, BE SURE THAT THE MANUAL CUTOFF VALVES ARE CLOSED. READ CAREFULLY THE "WARNINGS" CHAPTER AT THE BEGINNING OF THIS MANUAL.

Gas train with valves group VGD and MBE with built-in gas pressure governor + gas leakage pressure switch (PGCP)

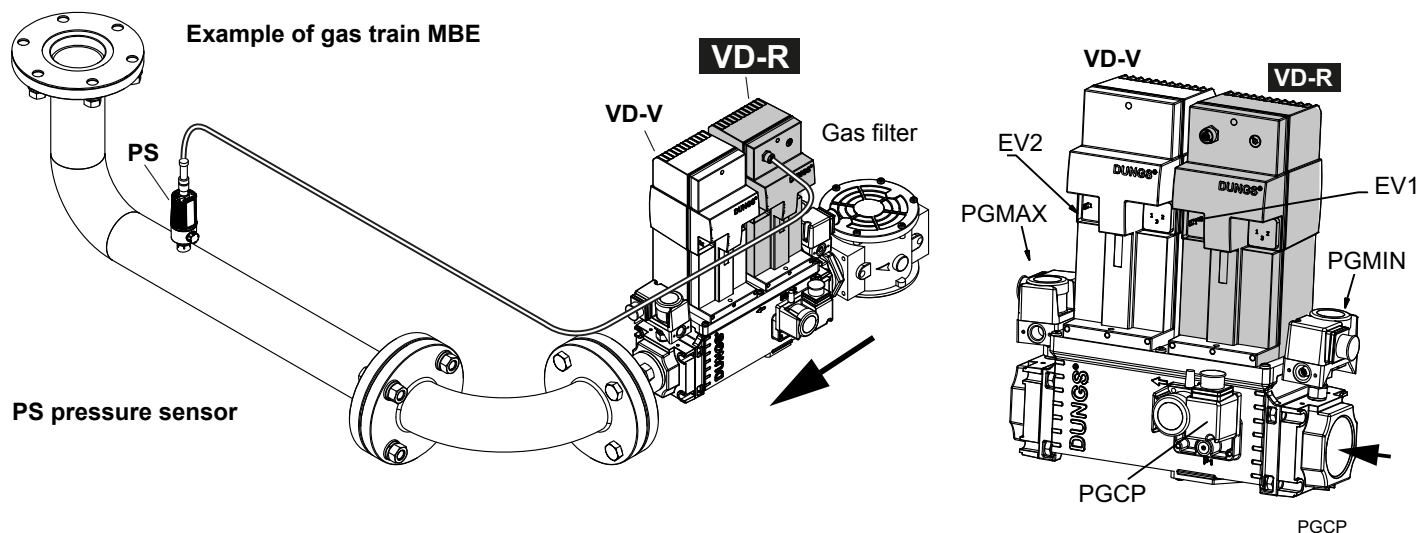


## Legend

|   |                                                                       |    |                                 |
|---|-----------------------------------------------------------------------|----|---------------------------------|
| 1 | Filter                                                                | 6  | Butterfly valve                 |
| 2 | Pressure switch - PGMIN                                               | 7  | Pressure transducer             |
| 3 | Safety valve with built in gas governor                               | 8  | Main burner                     |
| 4 | Proving system pressure switch - PGCP                                 | 9  | Antivibration joint (*optional) |
| 5 | Pressure switch PGMAX: mandatory for MBE, optional for VGD and MB-DLE | 10 | Manual valve(*optional)         |

\* Note: the maximum gas pressure switch can be mounted either upstream or downstream the gas valve but upstream the butterfly gas valve (see item no.4 in the scheme above).

## 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.

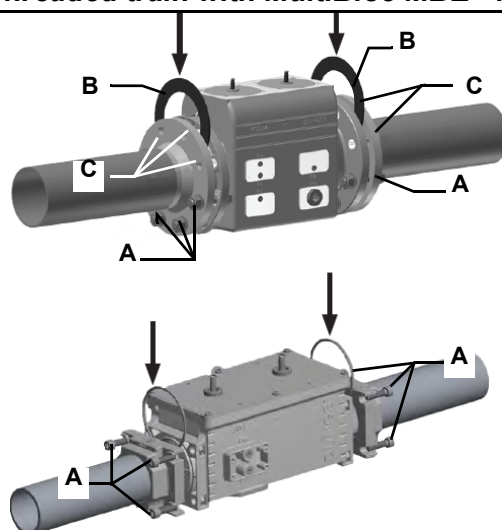


**ATTENTION:** it is recommended to mount filter and gas valves to avoid that extraneous material drops inside the valves, during maintenance and cleaning operation of the filters (both the filters outside the valves group and the ones built-in the gas valves).



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

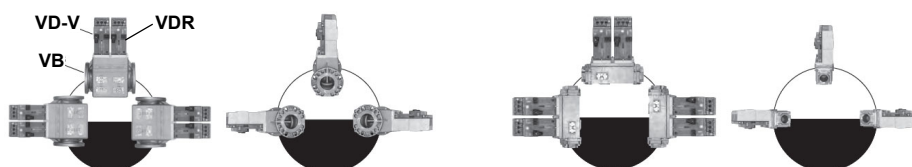
## Threaded train with MultiBloc MBE - Mounting

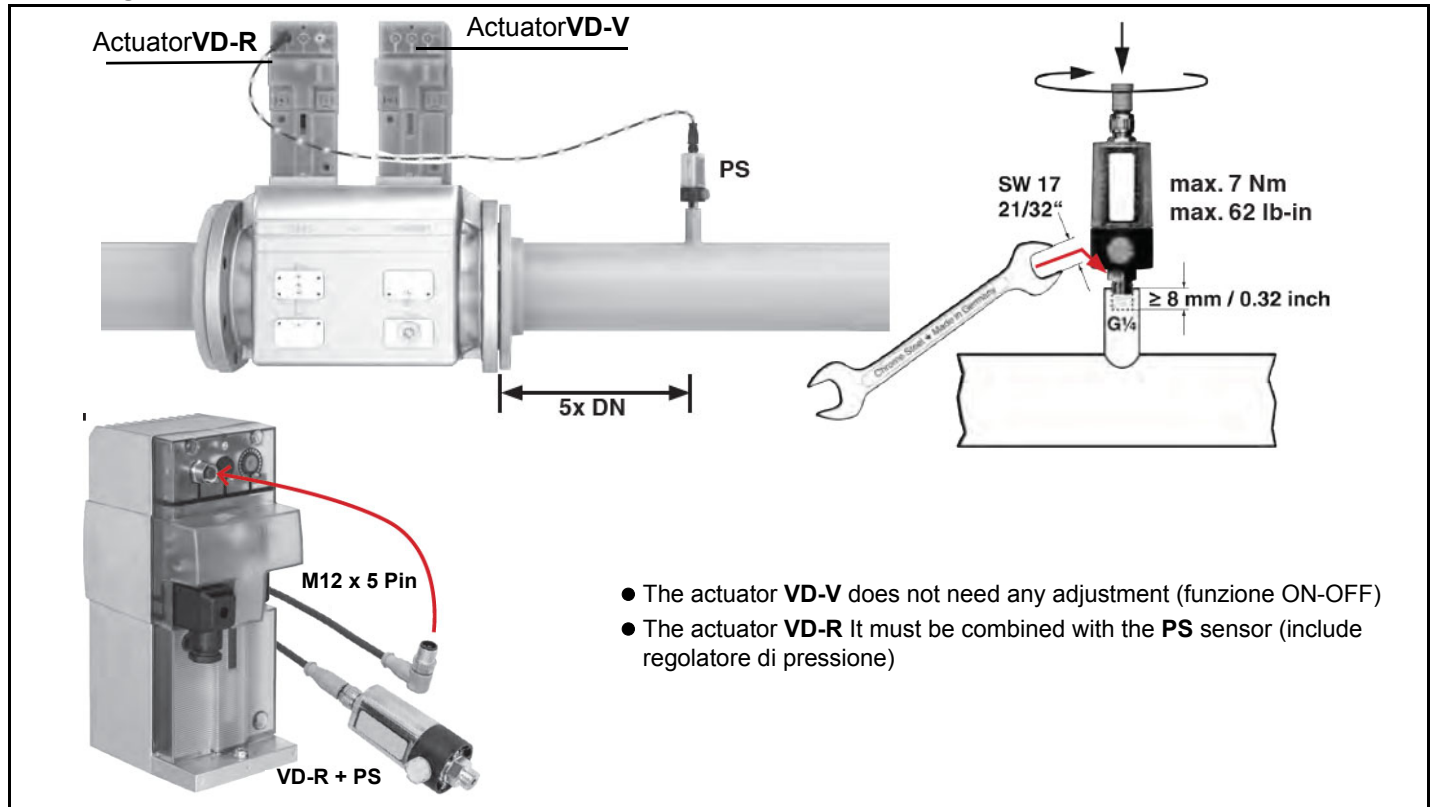


1. Insert studs A.
2. Insert seals B.
3. Insert studs C.
4. Tighten studs in accordance with section 8.
- Ensure correct position of the seal!**
5. Perform leak and functional tests after mounting.
6. Screws (4xM5x20) for VD assembly are supplied.

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)

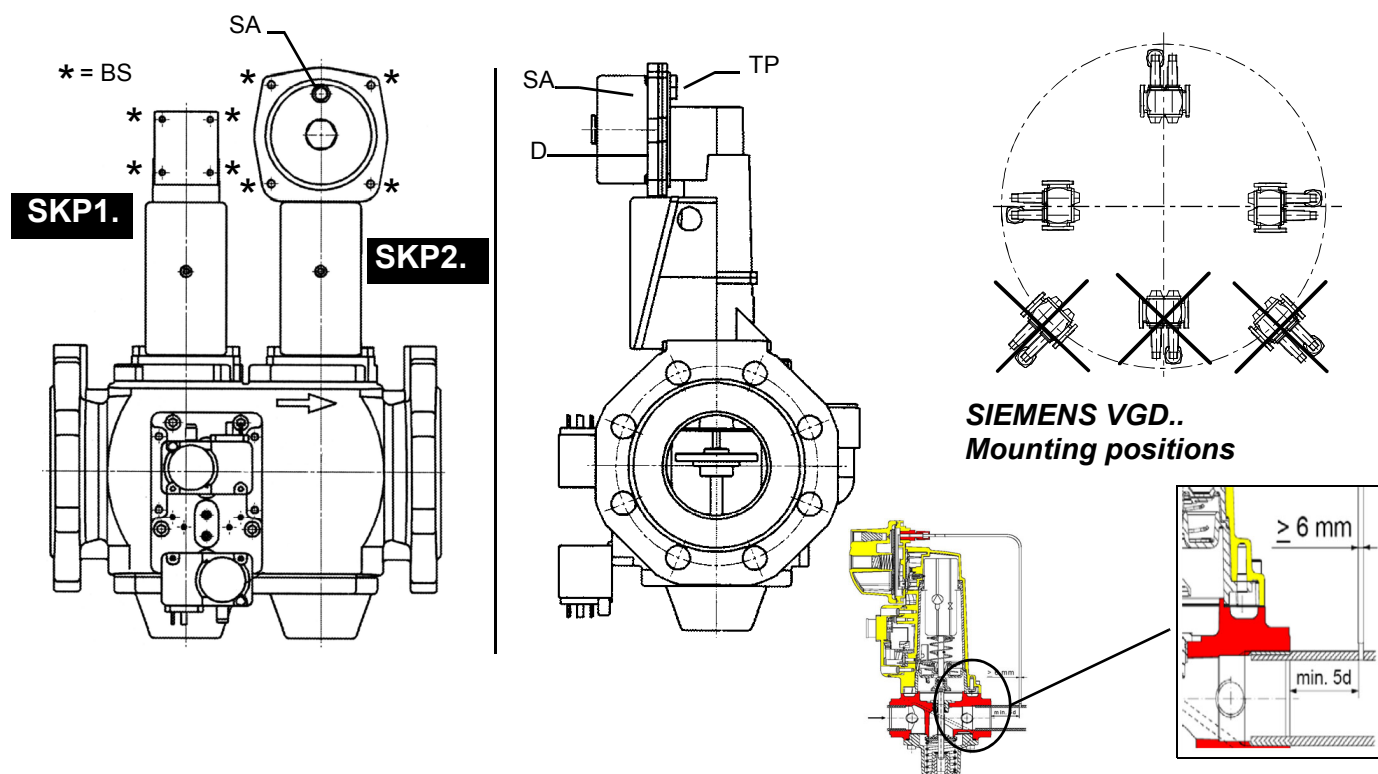
- Connect the reference gas pipe (**TP** in figure; 8mm-external size pipe supplied loose), to the gas pressure nipples placed on the gas pipe, downstream the gas valves: gas pressure must be measured at a distance that must be at least 5 times the pipe size.
- Leave the blowhole free (**SA** in figure).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



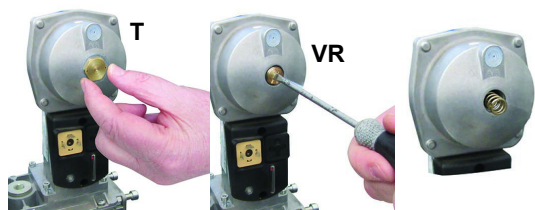
**Caution:** the SKP2 diaphragm **D** must be vertical



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



### 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 | 0 - 22  | 15 - 120 | 100 - 250 |
| Spring colour     | neutral | yellow   | red       |

### 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.

## RECOMMENDATIONS TO DESIGN HEAVY OIL FEEDING PLANTS

This paragraph is intended to give some suggestions to make feeding plants for heavy oil burners. To get a regular burner operation, it is very important to design the supplying system properly. Here some suggestions will be mentioned to give a brief description.

The term "heavy oil" is generic and summarises several chemical-physical properties, above all viscosity. The excessive viscosity makes the oil impossible to be pumped, so it must be heated to let it flow in the pipeline; because of the low-boiling hydrocarbons and dissolved gases, the oil must be also pressurised. The pressurisation is also necessary to feed the burner pump avoiding its cavitation because of the high suction at the inlet. The supplying system scope is to pump and heat oil.

The oil viscosity is referred in various unit measures; the most common are: °E, cSt, Saybolt and Redwood scales. Table 3 shows the various unit conversions (e.g.: 132 cSt viscosity corresponds to 17.5°E viscosity). The diagram in Fig. 1 shows how the heavy oil viscosity changes according to its temperature.

Example: an oil with 22°E viscosity at 50°C once heated to 100°C gets a 3 °E viscosity. As far as the pumping capability, it depends on the type of the pump that pushes the oil even if on diagram in Fig. 1 a generic limit is quoted at about 100 °E, so it is recommended to refer to the specifications of the pump provided. Usually the oil minimum temperature at the oil pump inlet increases as viscosity does, in order to make the oil easy to pump. Referring to the diagram on Fig. 2, it is possible to realise that to pump an oil with 50°E viscosity at 50°C, it must be heated at about 80°C.

### **Pipe heating system**

Pipe heating system must be provided, that is a system to heat pipes and plant components to maintain the viscosity in the pumping limits. Higher the oil viscosity and lower the ambient temperature, more necessary the pipe heating system.

### **Inlet minimum pressure of the pump (both for supplying system and burner)**

A very low pressure leads to cavitation (signalled by its peculiar noise): the pump manufacturer declares the minimum value. Therefore, check the pump technical sheets. By increasing the oil temperature, also the minimum inlet pressure at the pump must increase, to avoid the gassification of the oil low-boiling products and the cavitation. The cavitation compromises the burner operation, it causes the pump to break too. The diagram on Fig. 3 roughly shows the inlet pump pressure according to the oil temperature.

### **Pump operating maximum pressure (both for the supplying system and burner)**

Remember that pumps and all the system components through which the oil circulates, feature an upper limit. Always read the technical documentation for each component. Schemes on Fig. 5 and Fig. 6 are taken from UNI 9248 "liquid fuel feeding lines from tank to burner" standard and show how a feeding line should be designed. For other countries, see related laws in force. The pipe dimensioning, the execution and the winding dimensioning and other constructive details must be provided by the installer.

### **Adjusting the supplying oil ring**

According to the heavy oil viscosity used, in the table below indicative temperature and pressure values to be set are shown.

**Note:** the temperature and pressure range allowed by the supplying ring components must be checked in the specifications table of the components themselves.

| HEAVY OIL VISCOSITY AT 50 °C |            | PIPELINE PRESSURE | PIPELINE TEMPERATURE |
|------------------------------|------------|-------------------|----------------------|
| cSt (°E)                     |            | bar               | °C                   |
|                              | < 50 (7)   | 1- 2              | 20                   |
| > 50 (7)                     | < 110 (15) | 1- 2              | 50                   |
| > 110 (15)                   | < 400 (50) | 1- 2              | 65                   |

Tab. 1

Viscosity units conversion table

| Cinematics<br>viscosity<br>Centistokes (cSt) | Engler Degrees<br>(°E) | Saybolt<br>Seconds<br>Universal<br>(SSU) | Saybolt<br>Seconds<br>Furol (SSF) | Redwood<br>Seconds no.1<br>(Standard) | Redwood Seconds<br>no..2 (Admiralty) |
|----------------------------------------------|------------------------|------------------------------------------|-----------------------------------|---------------------------------------|--------------------------------------|
| 1                                            | 1                      | 31                                       | --                                | 29                                    | --                                   |
| 2.56                                         | 1.16                   | 35                                       | --                                | 32.1                                  | --                                   |
| 4.3                                          | 1.31                   | 40                                       | --                                | 36.2                                  | 5.1                                  |
| 7.4                                          | 1.58                   | 50                                       | --                                | 44.3                                  | 5.83                                 |
| 10.3                                         | 1.88                   | 60                                       | --                                | 52.3                                  | 6.77                                 |
| 13.1                                         | 2.17                   | 70                                       | 12.95                             | 60.9                                  | 7.6                                  |
| 15.7                                         | 2.45                   | 80                                       | 13.7                              | 69.2                                  | 8.44                                 |
| 18.2                                         | 2.73                   | 90                                       | 14.44                             | 77.6                                  | 9.3                                  |
| 20.6                                         | 3.02                   | 100                                      | 15.24                             | 85.6                                  | 10.12                                |
| 32.1                                         | 4.48                   | 150                                      | 19.3                              | 128                                   | 14.48                                |
| 43.2                                         | 5.92                   | 200                                      | 23.5                              | 170                                   | 18.9                                 |
| 54                                           | 7.35                   | 250                                      | 28                                | 212                                   | 23.45                                |
| 65                                           | 8.79                   | 300                                      | 32.5                              | 254                                   | 28                                   |
| 87.6                                         | 11.7                   | 400                                      | 41.9                              | 338                                   | 37.1                                 |
| 110                                          | 14.6                   | 500                                      | 51.6                              | 423                                   | 46.2                                 |
| 132                                          | 17.5                   | 600                                      | 61.4                              | 508                                   | 55.4                                 |
| 154                                          | 20.45                  | 700                                      | 71.1                              | 592                                   | 64.6                                 |
| 176                                          | 23.35                  | 800                                      | 81                                | 677                                   | 73.8                                 |
| 198                                          | 26.3                   | 900                                      | 91                                | 762                                   | 83                                   |
| 220                                          | 29.2                   | 1000                                     | 100.7                             | 896                                   | 92.1                                 |
| 330                                          | 43.8                   | 1500                                     | 150                               | 1270                                  | 138.2                                |
| 440                                          | 58.4                   | 2000                                     | 200                               | 1690                                  | 184.2                                |
| 550                                          | 73                     | 2500                                     | 250                               | 2120                                  | 230                                  |
| 660                                          | 87.6                   | 3000                                     | 300                               | 2540                                  | 276                                  |
| 880                                          | 117                    | 4000                                     | 400                               | 3380                                  | 368                                  |
| 1100                                         | 146                    | 5000                                     | 500                               | 4230                                  | 461                                  |
| 1320                                         | 175                    | 6000                                     | 600                               | 5080                                  | 553                                  |
| 1540                                         | 204.5                  | 7000                                     | 700                               | 5920                                  | 645                                  |
| 1760                                         | 233.5                  | 8000                                     | 800                               | 6770                                  | 737                                  |
| 1980                                         | 263                    | 9000                                     | 900                               | 7620                                  | 829                                  |
| 2200                                         | 292                    | 10000                                    | 1000                              | 8460                                  | 921                                  |
| 3300                                         | 438                    | 15000                                    | 1500                              | 13700                                 | --                                   |
| 4400                                         | 584                    | 20000                                    | 2000                              | 18400                                 | --                                   |

Tab. 2

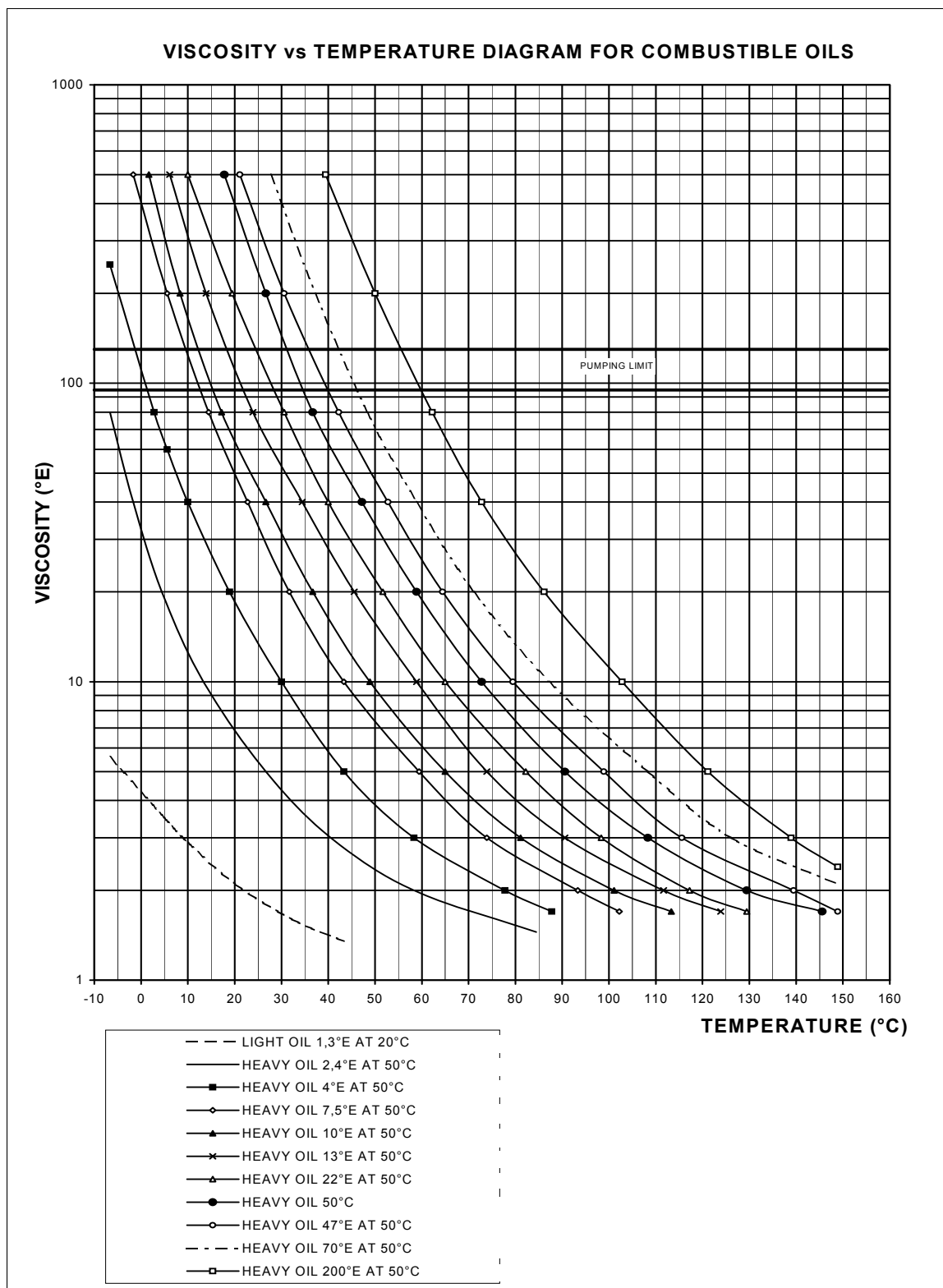


Fig. 1

**Indicative diagram showing the oil temperature at burner pump inlet vs. oil viscosity**

Example: if the oil has a 50°E @ 50°C viscosity, the oil temperature at the pump inlet should be 80°C (see diagram).

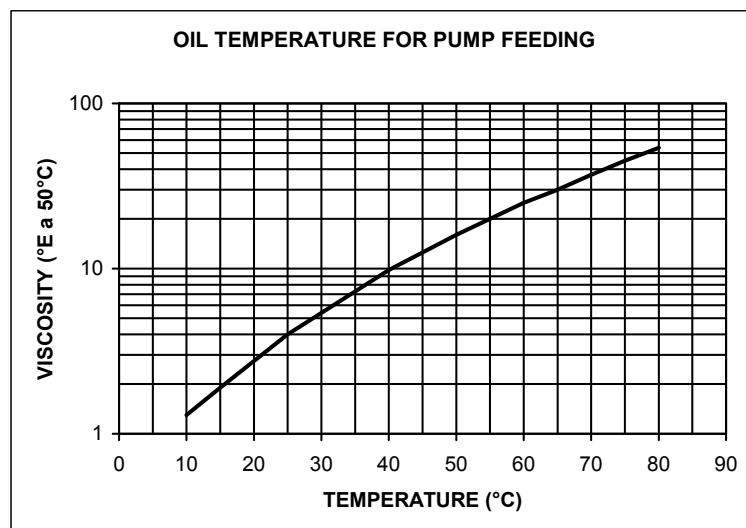


Fig. 2

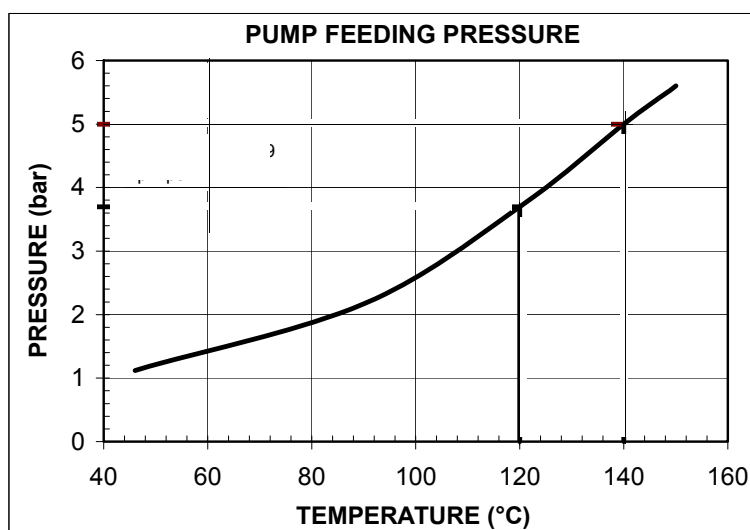
**Indicative diagram showing the oil pressure according to its temperature**

Fig. 3

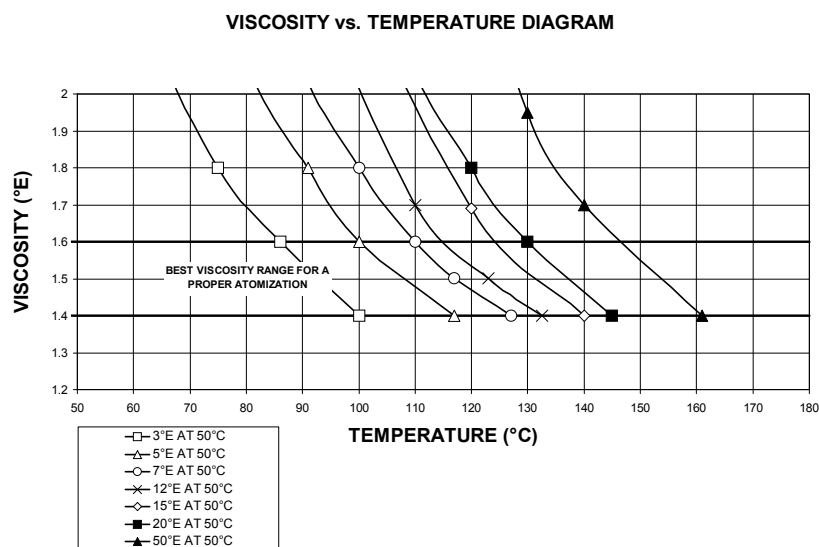
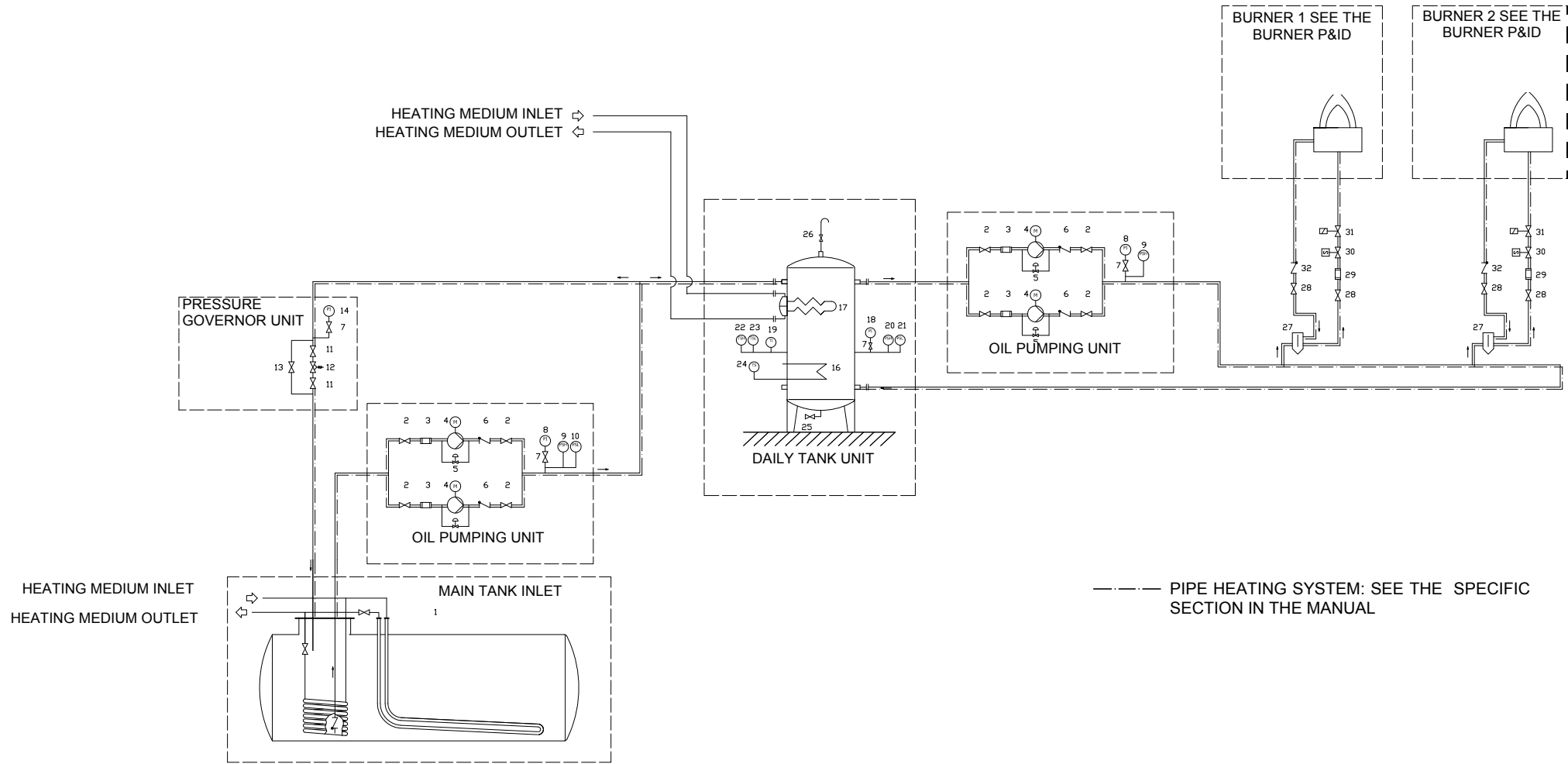
**Indicative diagram showing the oil atomising temperature according to its viscosity**

Fig. 4

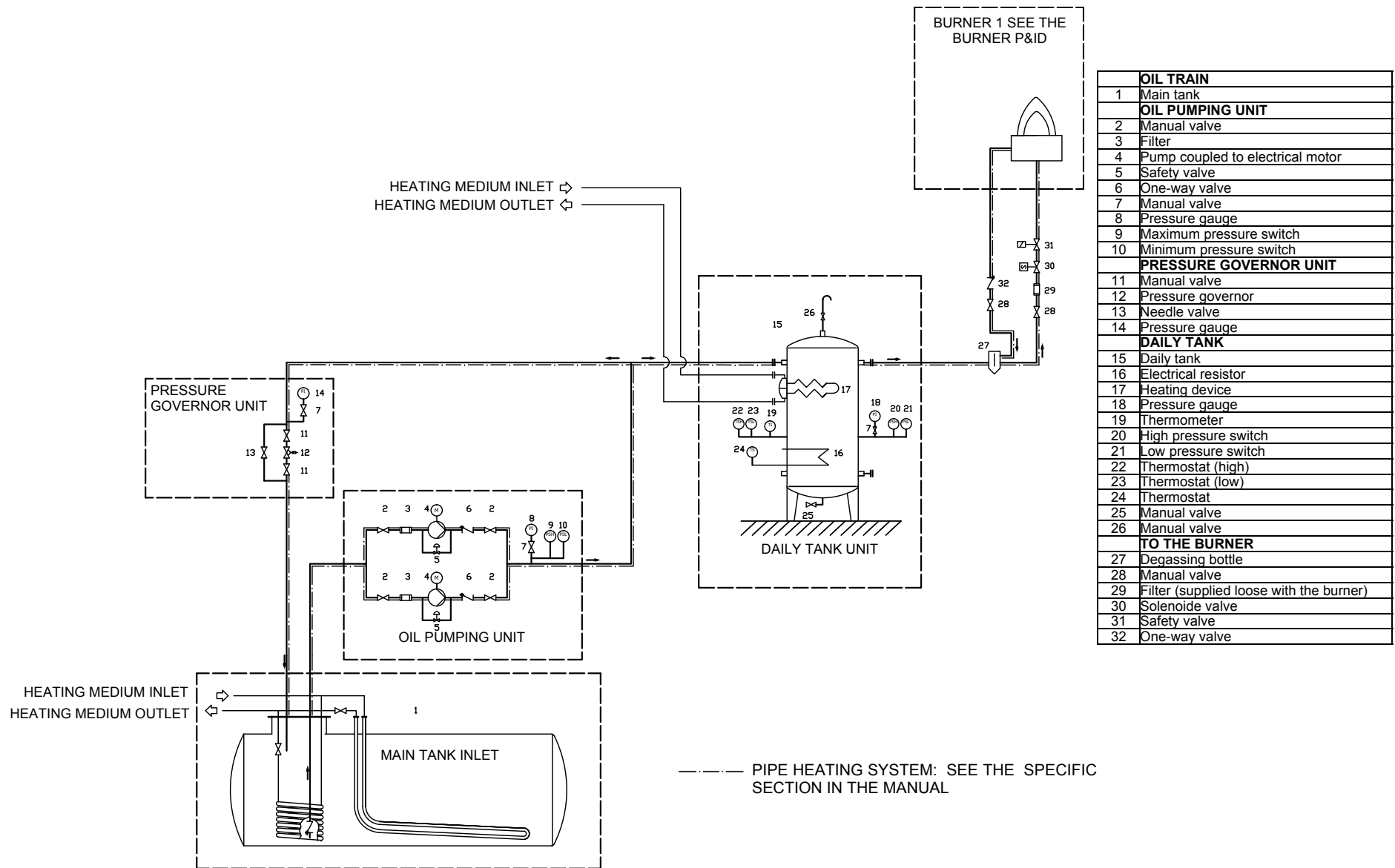
Example: if the oil has a 50°E @ 50°C viscosity, the oil atomising temperature should be between 145°C and 160°C (see diagram).

Fig. 5 3ID00014 v2 Hydraulic diagram - Two or more burners configuration



| OIL TRAIN        |                                  | PRESSURE GOVERNOR UNIT |                      |               |                                         |
|------------------|----------------------------------|------------------------|----------------------|---------------|-----------------------------------------|
| 1                | Main tank                        | 11                     | Manual valve         | 21            | Low pressure switch                     |
| OIL PUMPING UNIT |                                  | 12                     | Pressure governor    | 22            | Thermostat (high)                       |
| 2                | Manual valve                     | 13                     | Needle valve         | 23            | Thermostat (low)                        |
| 3                | Filter                           | 14                     | Pressure gauge       | 24            | Thermostat                              |
| 4                | Pump coupled to electrical motor | DAILY TANK             |                      | 25            | Manual valve                            |
| 5                | Safety valve                     | 15                     | Daily tank           | 26            | Manual valve                            |
| 6                | One-way valve                    | 16                     | Electrical resistor  | TO THE BURNER |                                         |
| 7                | Manual valve                     | 17                     | Heating device       | 27            | Degassing bottle                        |
| 8                | Pressure gauge                   | 18                     | Pressure gauge       | 28            | Manual valve                            |
| 9                | Maximum pressure switch          | 19                     | Thermometer          | 29            | Filter (supplied loose with the burner) |
| 10               | Minimum pressure switch          | 20                     | High pressure switch | 30            | Solenoid valve                          |
|                  |                                  |                        |                      | 31            | Safety valve                            |
|                  |                                  |                        |                      | 32            | One-way valve                           |

Fig. 6 - 3ID0023 v2 - Hydraulic diagram - Single burner configuration



## Hydraulic system

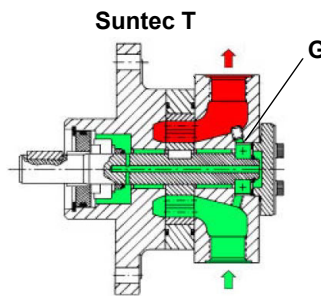
The pumps that are used can be installed both into single-pipe and double-pipe systems.

**Single-pipe system:** a single pipe drives the oil from the tank to the pump's inlet. Then, from the pump, the pressurised oil is driven to the nozzle: a part comes out from the nozzle while the other part goes back to the pump. In this system, the by-pass plug, if provided, must be removed and the optional return port, on the pump's body, must be sealed by steel plug and washer.

**Double-pipe system:** as for the single pipe system, a pipe that connects the tank to the pump's inlet is used besides another pipe that connects the pump's return port to the tank, as well. The excess of oil goes back to the tank: this installation can be considered self-bleeding. If provided, the inside by-pass plug must be installed to avoid air and fuel passing through the pump.

Burners come out from the factory provided for double-stage systems. They can be suited for single-pipe system (recommended in the case of gravity feed) as described before. To change from a 1-pipe system to a 2-pipe-system, insert the by-pass plug **G** (as for ccw-rotation- referring to the pump shaft).

**Caution:** Changing the direction of rotation, all connections on top and side are reversed.



## About the use of fuel pumps

- Do not use fuel with additives to avoid the possible formation over time of compounds which may deposit between the gear teeth, thus obstructing them.
- After filling the tank, wait before starting the burner. This will give any suspended impurities time to deposit on the bottom of the tank, thus avoiding the possibility that they might be sucked into the pump.
- On initial commissioning a "dry" operation is foreseen for a considerable length of time (for example, when there is a long suction line to bleed). To avoid damages inject some lubrication oil into the vacuum inlet.
- Care must be taken when installing the pump not to force the pump shaft along its axis or laterally to avoid excessive wear on the joint, noise and overloading the gears.
- Pipes should not contain air pockets. Rapid attachment joint should therefore be avoided and threaded or mechanical seal junctions preferred. Junction threads, elbow joints and couplings should be sealed with removable seal component. The number of junctions should be kept to a minimum as they are a possible source of leakage.
- Do not use PTFE tape on the suction and return line pipes to avoid the possibility that particles enter circulation. These could deposit on the pump filter or the nozzle, reducing efficiency. Always use O-Rings or mechanical seal (copper or aluminium gaskets) junctions if possible.
- An external filter should always be installed in the suction line upstream the fuel unit.



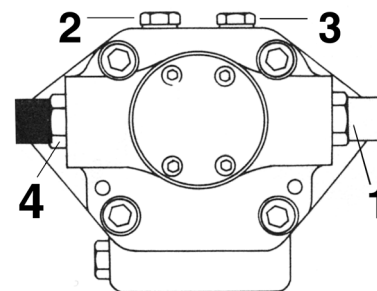
**ATTENTION:** before the burner first start, it is mandatory to fill the adduction pipes with diesel fuel and bleed out residual air bubbles. Prior to switching on the burner, check direction of rotation of the pump motor by briefly pressing the starter switch; ensure there are no anomalous sounds during equipment operation, and only then turn on the burner. Neglect to comply with this requirement will invalidate the burner warranty.

## Oil pumps

| Suntec T..               |                              |
|--------------------------|------------------------------|
| Viscosity                | 3 - 75 cSt                   |
| Oil temperature          | 0 - 150 °C                   |
| Minimum suction pressure | - 0.45 bar to prevent gasing |
| Maximum suction pressure | 5 bar                        |
| Rated speed              | 3600 rpm max.                |

### Key

- 1 Inlet G3/4
- 2 Pressure gauge port G1/4
- 3 Vacuum gauge port to measure the inlet vacuum G1/4
- 4 To pressure adjusting valve G3/4



"Note: pump with "C" rotation.

## Suntec TV Pressure governor

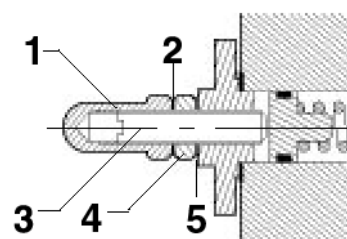
### Pressure adjustment

Remove cap-nut 1 and the gasket 2, unscrew the lock nut 4. To increase pressure, twist adjusting screw 3 clockwise.

To decrease the pressure, twist screw counterclockwise. Tight the lock nut 4, refit the gasket 2 and the cap nut 1.

### Key

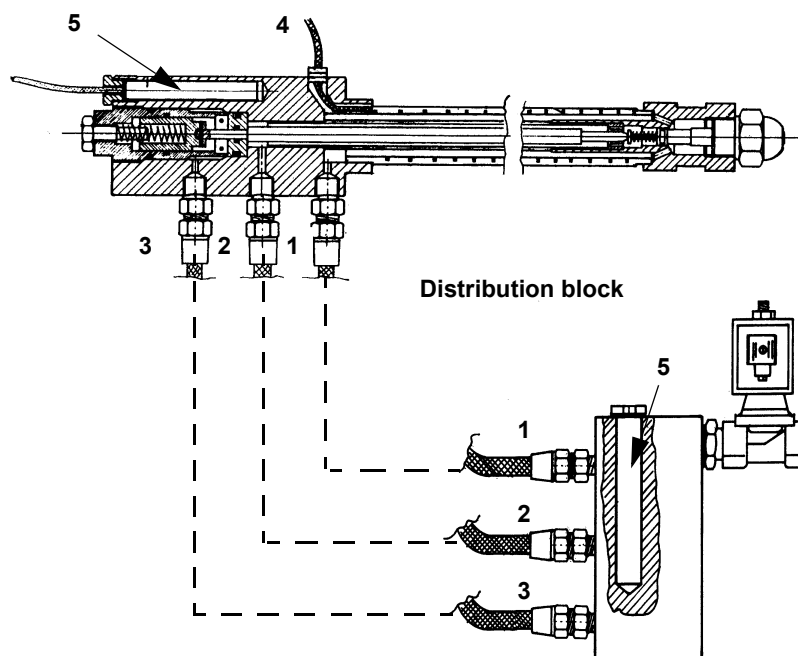
- 1 Cap nut
- 2 Gasket
- 3 Adjusting screw
- 4 Lock nut
- 5 Gasket



## Connections to the oil gun

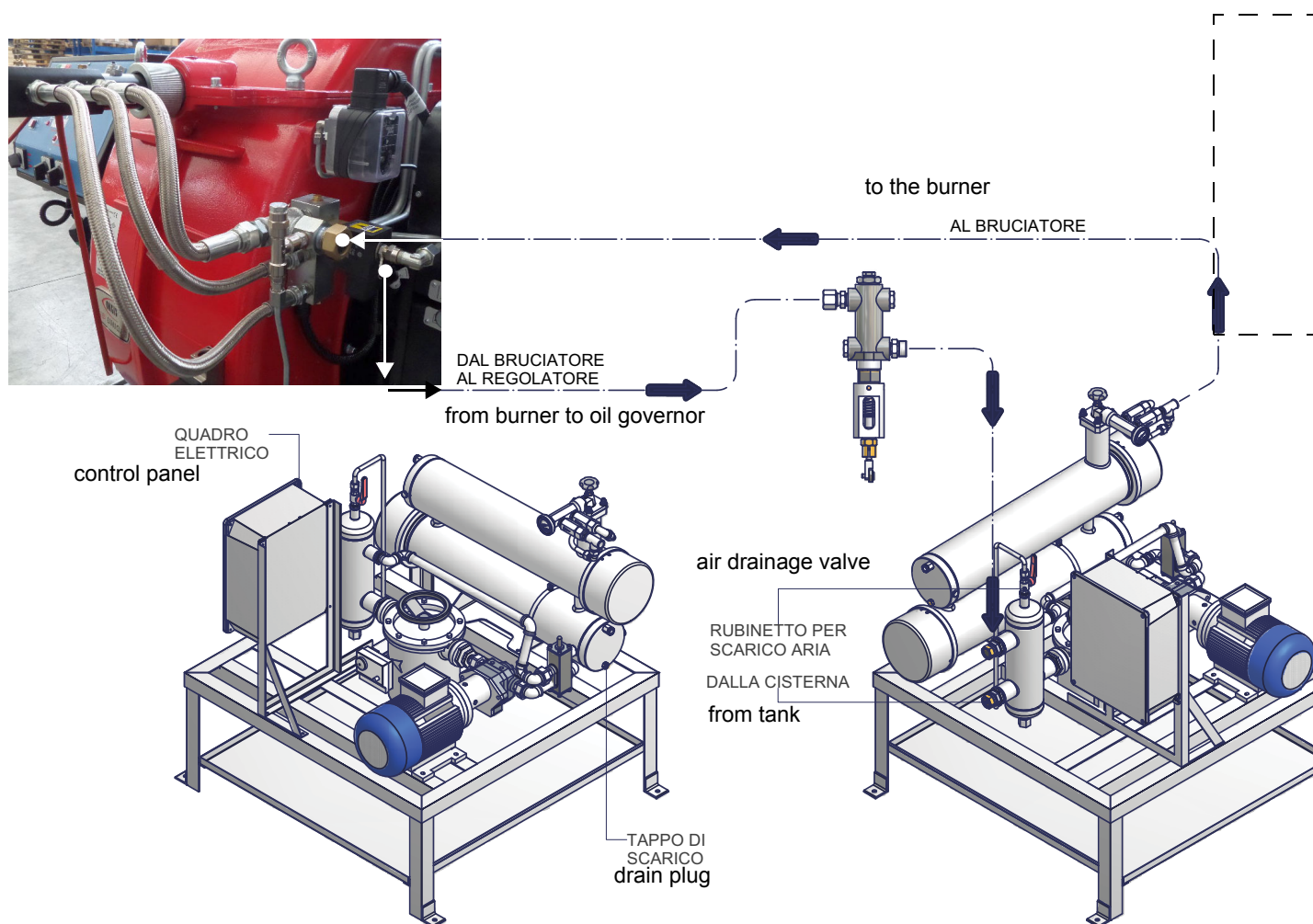
- 1 Inlet (C)
- 2 Return (B)
- 3 Lance opening (A)
- 4 Heating wire (only for high density oil burners)
- 5 Cartridge-type heater (only for Ecoden or heavy oil burners)

Gun with the oil nozzle inside



### Connecting the burner to the oil pumping unit

Follow the scheme in the picture below to connect the burner to the oil pumping unit. The pump sends the oil coming from the tank to the burner. The pressure governor makes the oil reach the nozzle at the required pressure, while the excess of oil goes back to the tank. To change the delivery pressure act on the adjusting screw of the delivery pressure governor.



**CAUTION:** caps are not sealing type but used for shipment only. The flexible hoses between the pump and the burner are the ones called (on the label) "Oil high pressure flexible hose". The flexible hose called "Oil low pressure flexible hose" is the one to be connected upstream the oil filter.

## ELECTRICAL CONNECTIONS



**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.

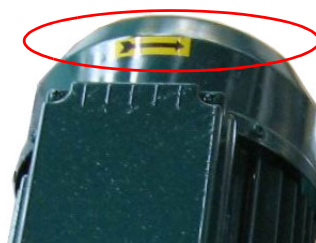
For further information, refer to the electrical diagram.

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.**

### 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.

## PART III: OPERATION

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.



**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!

- remove the pressure switch plastic cover;
- adjust the PGCP pressure switch to the same value set for the minimum gas pressure switch;
- replace the plastic cover.;

### 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.

To move the adjusting cam set CMF=1 or 2 and then CMF=0.

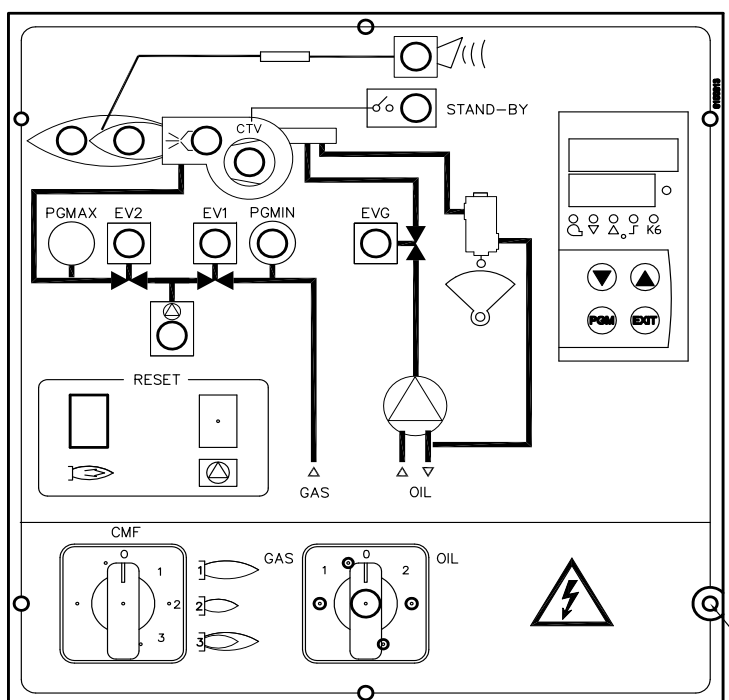
CMF \_\_\_\_\_

CMF = 0 stop at the current position

CMF = 1 high flame operation

CMF = 2 low flame operation

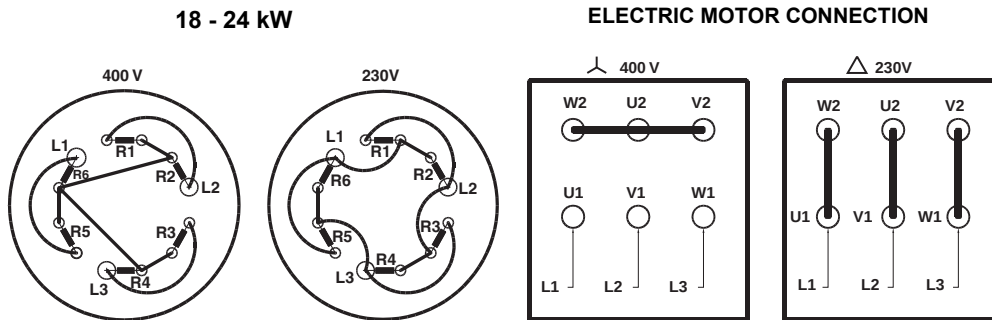
CMF = 3 automatic operation





**WARNING:** It is recommended to install a shunt trip disconnect switch that acts on the preheater unit supply line and avoids the oil overheating / resistance damage in case of a malfunction of the resistance contactor. Inside the electric board a free contact is provided (terminals 507 - 508) for this purpose.

### Connecting the oil heating resistors



## ADJUSTMENTS

### Oil thermostat adjustment

Progressive and fully modulating oil burners are equipped with electronic multi-thermostat Danfoss MCX, whose operation is controlled by thyristor. (for details refer to the attached technical documentation)



Fig. 7 - Danfoss MCX

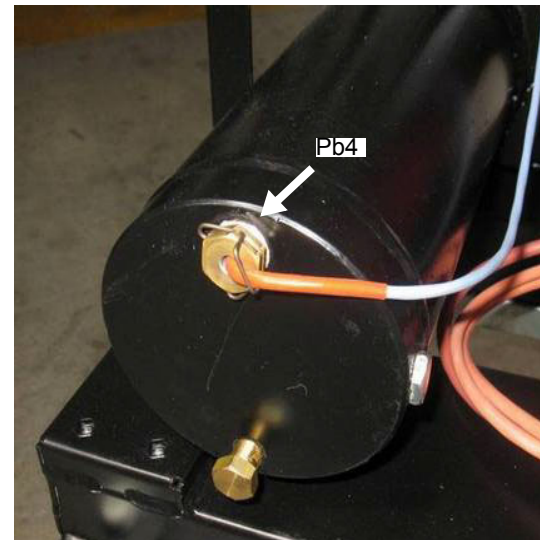
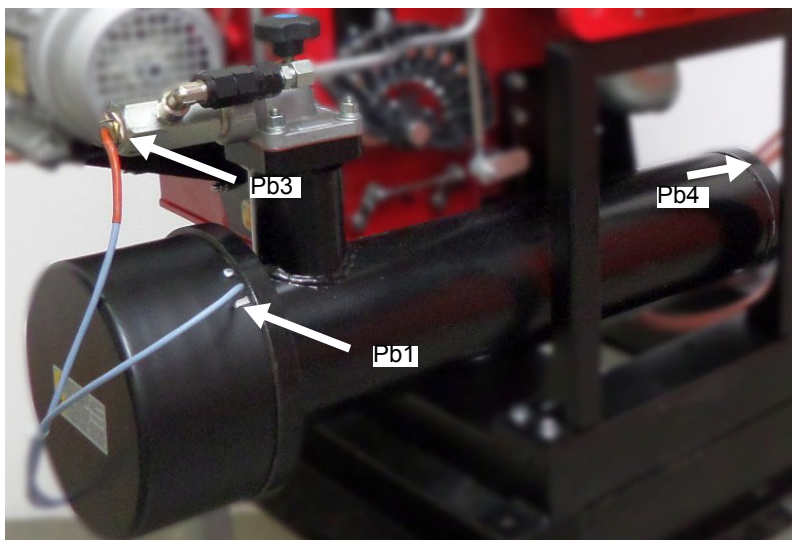


Fig. 8 - Probe connections (Danfoss MCX)

### Burners equipped with double tank

The first oil tank resistance is controlled by menas thermostats according to the below scheme. All thermostats are located inside the control panel. To set the temperature use a small screwdriver. The second oil tank is controlled by "MCX" electronic thermostat.

Such temperature must be set during burner operation, checking temperature in the thermometer mounted on the pre-heating tank. We suggest a thermometer with scale up to 200° C.

Adjust this thermostat to the correct value according to the viscosity-temperature diagram and check the temperature by using a thermometer with a scale of up to 200° C mounted on the pre-heating tank.

**Safety resistors thermostat TRS:** it is factory preset and sealed. Don not modify it!

When the set temperature is exceeded, check the reason and reset it by means of the push button PR

**Resistor thermostat TR:** check the best atomising oil temperature and set it on TR.

**Thermostat TCN** (it gives the enabling signal to the oil N.C. valve): set TCN at about 20° less than TR.

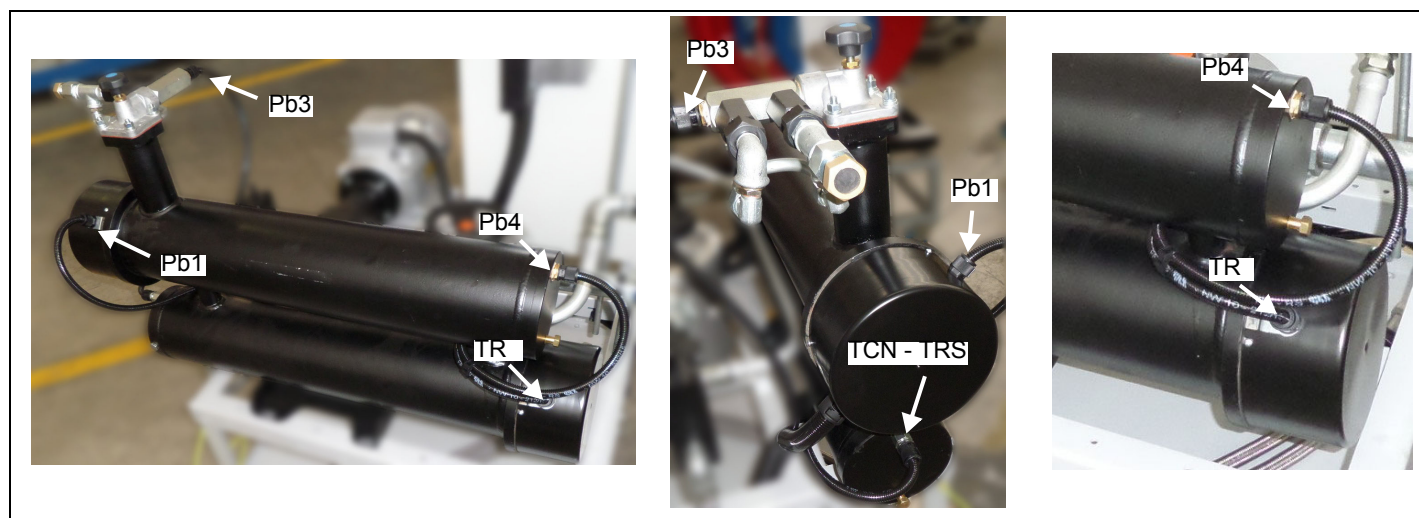
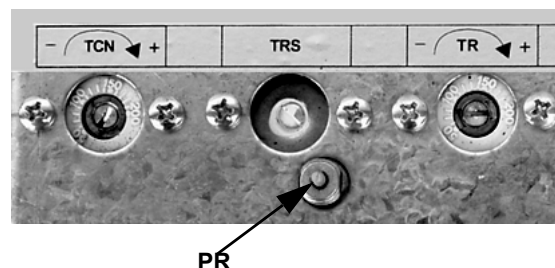


Fig. 9 - Probe connections (Danfoss MCX) and thermostats connections (Burners equipped with double tank)

Here below recommended settings:

|            | Fuel type letter shown in the burner model                    | P        | N          | E                     | D                      | H                       |
|------------|---------------------------------------------------------------|----------|------------|-----------------------|------------------------|-------------------------|
|            | Oil viscosity at 50 °C                                        | 89 cSt   | < 50 cSt   | > 50 cSt<br>< 110 cSt | > 110 cSt<br>< 400 cSt | > 400 cSt<br>< 4000 cSt |
|            |                                                               | 12 °E    | < 7°E      | > 7 °E<br>< 15 °E     | > 15 °E<br>< 50 °E     | > 50 °E<br>< 530 °E     |
| <b>TCI</b> | Temperature on the plant enabling thermostat (when installed) | 20 °C    | 70 °C      | 70 °C                 | 70 °C                  | ---                     |
| <b>TR</b>  | Temperature on the pre-heating resistors                      | 60-70 °C | 110-120 °C | 120-130 °C            | 130-140 °C             | 140-150 °C              |
| <b>TCN</b> | Temperature on the oil enabling thermostat                    | 40 °C    | 100 °C     | 100 °C                | 110 °C                 | 120 °C                  |
| <b>TRS</b> | Temperature of the resistors safety thermostat                | 120 °C   | 190-200 °C | 190-200 °C            | 190-200 °C             | 190-200 °C              |

The above temperature values are suggested and refer to a plant designed according to the prescriptions in the burner user manual. The suggested values can change in reference to the fuel oil specifications.

### Thermostat adjustment for petroleum burners

To find the thermostats, remove the burner switchboard cover. Adjust them using a screwdriver on the VR screw as shown in the next picture.

#### TCI -Installation enabling thermostat

Set this thermostat to about 40° C.

#### TCN - Oil enabling thermostat

Adjust this thermostat to a value between 45 and 50°C. Anyway, set TCN to a value possibly lower than the one set for TR (see below).

#### TR - Resistor thermostat

Adjust this thermostat to a value between 45 and 50°C. Check the temperature by using a thermometer mounted on the pre-heating tank.

#### TRS - Resistor safety thermostat

The thermostat is set during factory testing at about 190° C.

This thermostat trips when the operating temperature exceeds the set limit. Ascertain the cause of the malfunction and reset the thermostat by means of the PR button (see picture).

**CAUTION:** even if the adjusting ranges for the TR (Resistor thermostat) and TCN (Oil enabling thermostat) are the same, set TCN to a

value lower than the one set for TR.

### Adjusting air and gas flow rates



**ATTENTION:** 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.



**ATTENTION:** 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:** NEVER LOOSE THE SEALED SCREWS! OTHERWISE, THE DEVICE WARRANTY WILL BE INVALIDATE!



**IMPORTANT!** the combustion air excess must be adjusted according to the 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                        |
| Heavy oil                         | 11 ÷ 12                         | 4.2 ÷ 6.2                      |

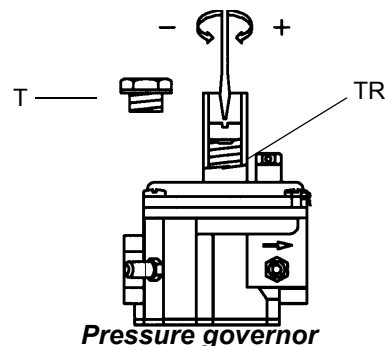
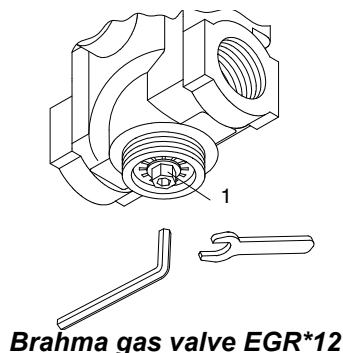
### Adjusting the pilot gas flow rate: gas pressure adjusting pilot valve Brahma EG12\*R and pressure governor

To change the pilot gas valve flow rate, proceed as follows:

- 1 remove the protection on the bottom of the valve, moving it counterclockwise (see next picture);
- 2 rotate clockwise the nut 1 as shown in to close the valve or counterclockwise to open.

To perform a finest adjustment, act directly on the pressure governor as follows (see next picture):

- 3 remove the cap T: to increase the gas pressure at the outlet use a screwdriver on the screw TR as shown below. Screw to increase the pressure, unscrew to decrease; once the regulation is performed, replace cap T.



### 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, as described on par. "Measuring the gas pressure in the combustion head" on page 28.
- 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.

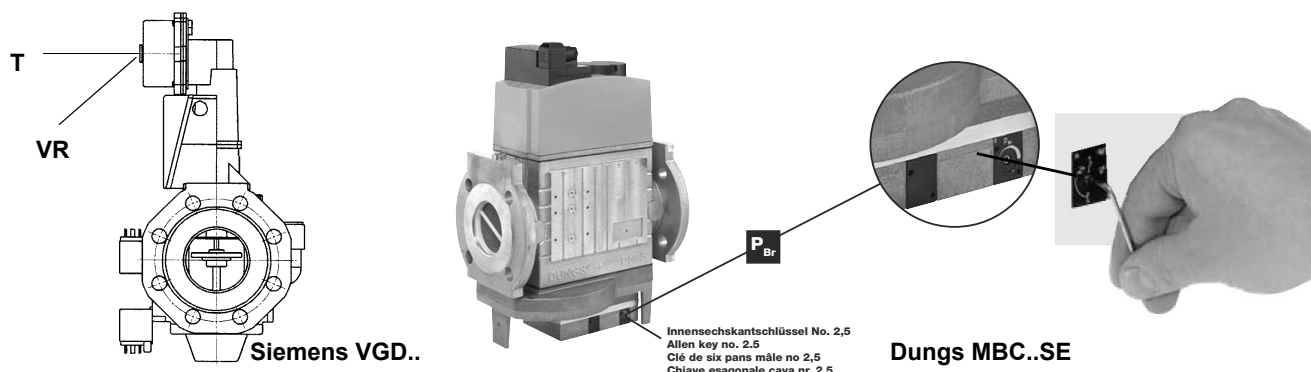
- 1 turn the burner on by selecting GAS fuel by means of the burner **CM** switch (it is placed on the burner control panel - see page 42)
- 2 check the fan motor rotation (see page 28).
- 3 Before starting the burner up, drive the high flame actuator microswitch matching the low flame one (in order to let the burner ope-

rates at the lowest output) to safely achieve the high flame stage.

- 4 Start the burner up by means of the thermostat series, closing terminals 3 and 4; wait until the pre-purge time comes to an end and that the burner starts up;
- 5 drive the burner to high flame stage, by means of the thermostat **TAB** (as far as fully-modulating burners, see the related paragraph).
- 6 Then move progressively the microswitch to higher values until it reaches the high flame position; always check the combustion values and eventually adjusting the gas by means of the valves group stabiliser.
- 7 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;
- 8 acting on the pressure stabiliser of the valves group, adjust the **gas flow rate in the high flame stage** as to meet the values requested by the boiler/utilisation:

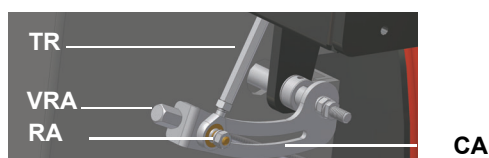
- **Siemens VGD valves group**: remove cap **T** and act on the **VR** adjusting screw to increase or decrease the pressure and consequently the gas rate; screwing **VR** the rate increases, unscrewing it decreases (see next figure).

- **Dungs MBC..SE valves group**: act on its pressure governor to increase or decrease the pressure and consequently the gas rate.

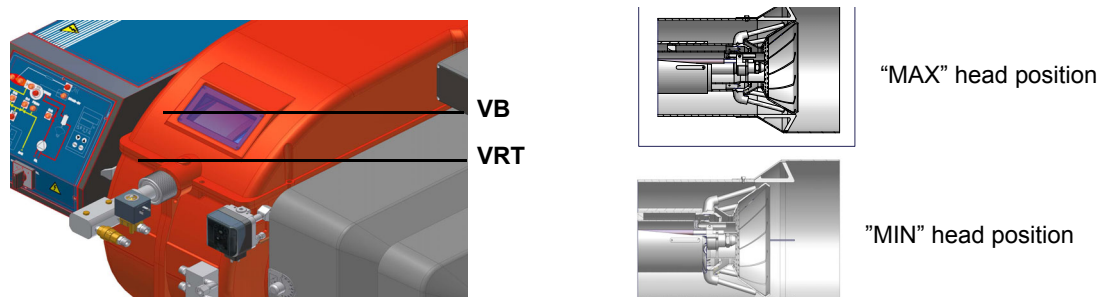


- 9 To adjust the **air flow rate in the high flame stage**, loose the **RA** nut and screw **VRA** as to get the desired air flow rate: moving the rod **TR** towards the air damper shaft, the air damper opens and consequently the air flow rate increases, moving it far from the shaft the air damper closes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

**Note:** once the procedure is performed, be sure that the blocking nut **RA** is fasten. Do not change the position of the air damper rods.

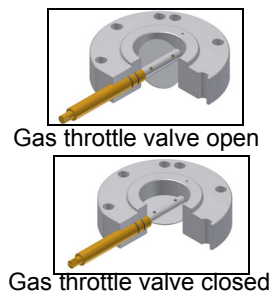
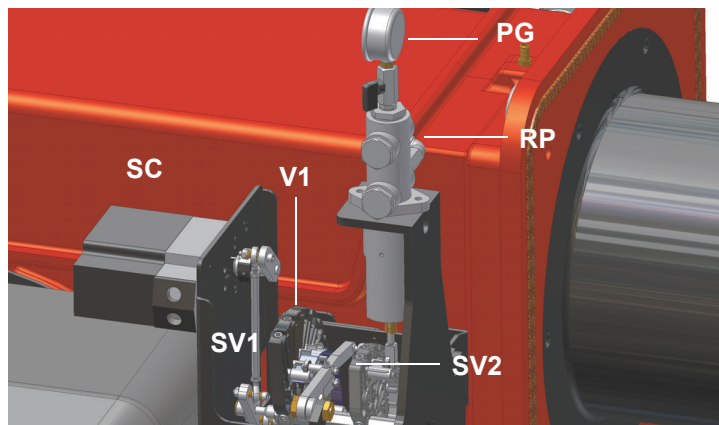


- 10 Only if necessary, change the combustion head position: to let the burner operate at a lower output, loose the **VB** screw and move progressively back the combustion head towards the MIN position, by turning clockwise the **VRT** ring nut. Fasten **VB** screw when the adjustment is accomplished.



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

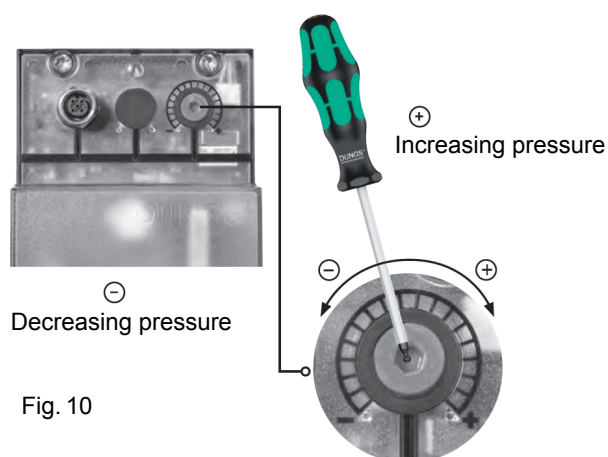
- 11 the air and gas rate are now adjusted at the maximum power stage, go on with the point to point adjustment on the **SV1** (gas side) adjusting cam as to reach the minimum output point.



- 12 as for the point-to-point regulation, move the gas low flame microswitch (cam III) a little lower than the maximum position (90°);
- 13 set the **TAB** thermostat to the minimum in order that the actuator moves progressively towards the low flame position;
- 14 move cam III 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 **V1** to increase the rate, unscrew to decrease.
- 15 Move again cam III 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.
- 16 Now adjust the pressure switches (see next paragraph).

## 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. 10

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

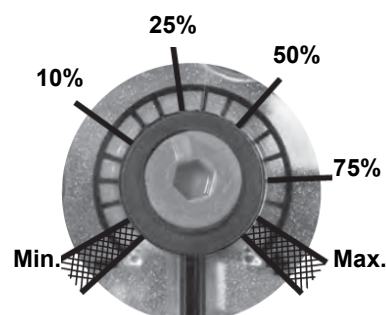


Fig. 11

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

## Pressure taps MultiBloc MBE

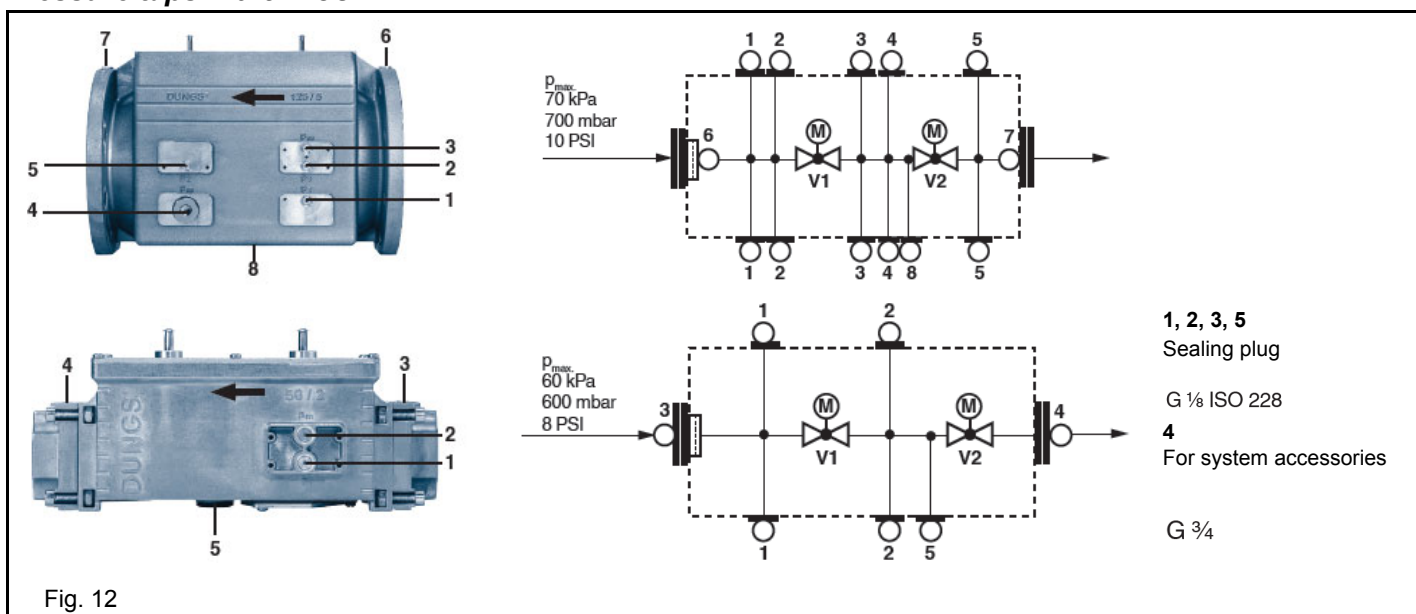
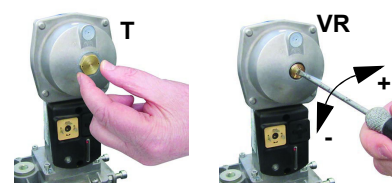


Fig. 12

## 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.



### 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 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.

### 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 gas leakage pressure switch (PGCP)

- remove the pressure switch plastic cover;
- adjust the PGCP pressure switch to the same value set for the minimum gas pressure switch;
- replace the plastic cover.

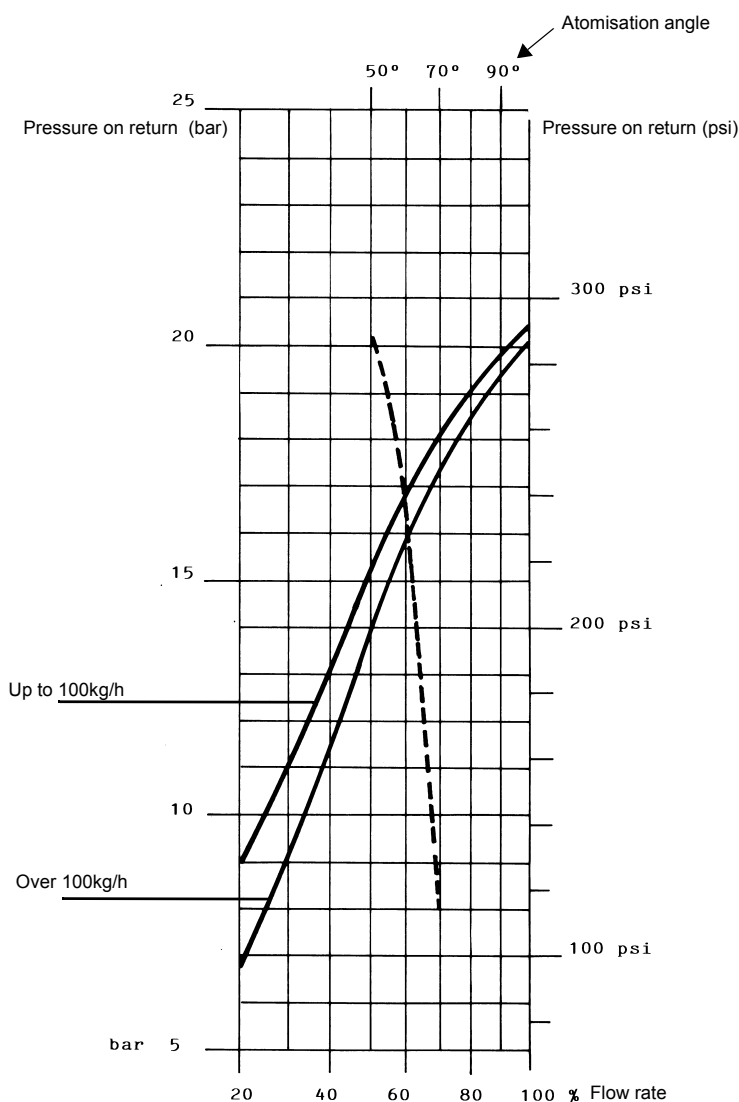
## Adjusting heavy oil flow rate

The oil flow rate can be adjusted choosing a nozzle that suits the boiler/utilisation output and setting the delivery and return pressure values according to the ones quoted on the following charts.

### FLUIDICS NOZZLE: REFERENCE DIAGRAM (INDICATIVE ONLY)

| DIMENSIONS | FLOW RATE kg/h |     | Indicative pressure on return (bar) |
|------------|----------------|-----|-------------------------------------|
|            | Min            | Max |                                     |
| 40         | 13             | 40  | 19                                  |
| 50         | 16             | 50  | 22                                  |
| 60         | 20             | 60  | 20                                  |
| 70         | 23             | 70  | 23                                  |
| 80         | 26             | 80  | 23                                  |
| 90         | 30             | 90  | 22                                  |
| 100        | 33             | 100 | 22                                  |
| 115        | 38             | 115 | 21                                  |
| 130        | 43             | 130 | 22                                  |
| 145        | 48             | 145 | 21                                  |
| 160        | 53             | 160 | 21                                  |
| 180        | 59             | 180 | 22                                  |
| 200        | 66             | 200 | 21                                  |
| 225        | 74             | 225 | 22                                  |
| 250        | 82             | 250 | 22                                  |
| 275        | 91             | 275 | 22                                  |
| 300        | 99             | 300 | 23                                  |
| 330        | 109            | 330 | 23                                  |
| 360        | 119            | 360 | 22                                  |
| 400        | 132            | 400 | 22                                  |
| 450        | 148            | 450 | 22                                  |
| 500        | 165            | 500 | 22                                  |
| 550        | 181            | 550 | 22                                  |
| 600        | 198            | 600 | 23                                  |
| 650        | 214            | 650 | 23                                  |
| 700        | 231            | 700 | 23                                  |
| 750        | 250            | 750 | 23                                  |
| 800        | 267            | 800 | 22                                  |

Tab. 3



**NOZZLE SUPPLY PRESSURE = 25 bar**

----- Atomisation angle according to the return pressure

———— % Flow rate

viscosity at nozzle = 5 cSt



**ATTENTION!** To achieve the maximum flow rate close completely the return line.

**Example:** as for over 100kg/h nozzles, the 80% of the nozzle flow rate can be obtained with a return pressure at about 18bar (see Fig. 20).

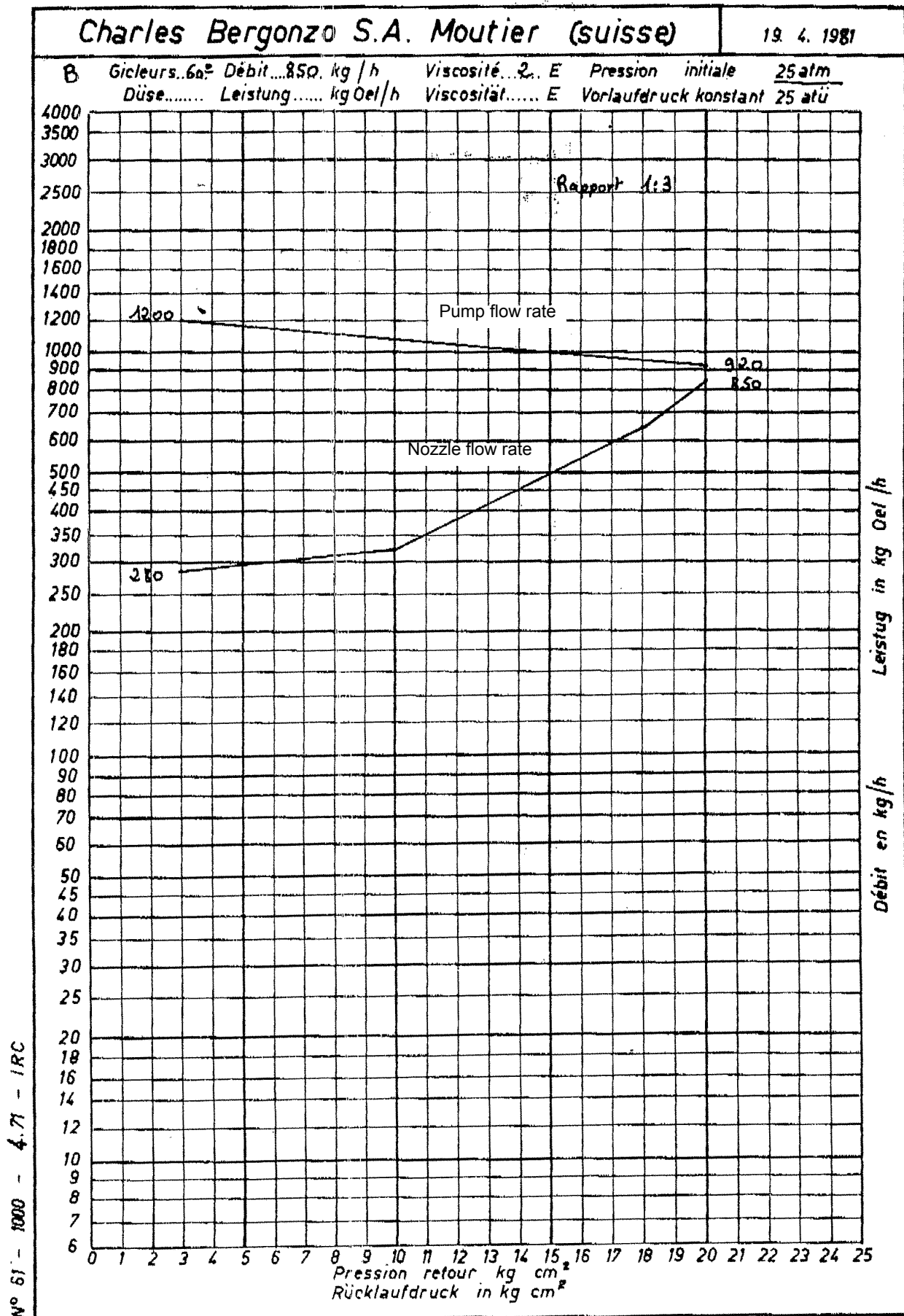


Fig. 13 - Bergonzo nozzle - example with 850kg/h nozzle

- 1 Once the air and gas flow rates are adjusted, turn the burner off, turn the burner on again by means of the **CM** selector to switch to the heavy oil operation (OIL, on the burner control panel - see page 42).
- 2 with the electrical panel open, prime the oil pump acting directly on the related **CP** contactor (see next picture): check the pump motor rotation and keep pressing for some seconds until the oil circuit is charged;
- 3 bleed the air from the **M** pressure gauge port (Fig. 14) by loosening the cap without removing it, then release the contactor.



Fig. 14

- 4 Before starting the burner up, drive the high flame actuator microswitch matching the low flame one (in order to let the burner operate at the lowest output) to achieve safely the high flame stage .
- 5 record the high flame value set during the gas operation adjustments (see previous paragraphs);
- 6 Start the burner up by means of the thermostat series, closing terminals 3 and 4; wait until the pre-purge time comes to an end and that the burner starts up;
- 7 drive the burner to high flame stage, by means of the thermostat **TAB** (as far as fully-modulating burners, see the related paragraph).
- 8 Then move progressively the microswitch to higher values until it reaches the high flame position; always check the combustion values and eventually adjusting the oil pressure (see next step).

the nozzle supply pressure is already factory-set and must not be changed. Only if necessary, adjust the supply pressure as follows (see related paragraph); insert a pressure gauge into the port shown on Fig. 22 and act on the pump adjusting screw **VR** (see Fig. 14 and page 23) as to get the nozzle pressure at 25bar (according to the nozzle model provided- see page 37).

#### SQM40 Actuator cams



#### SQM265CSV

- |     |                       |
|-----|-----------------------|
| I   | High flame            |
| II  | Stand-by              |
| III | Low flame - gas       |
| IV  | Low flame - light oil |

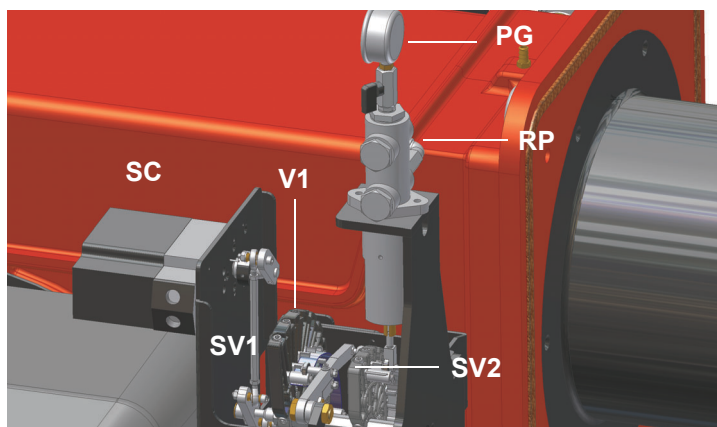


Fig. 15

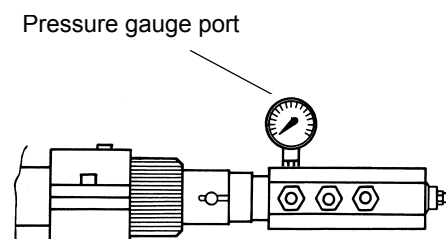


Fig. 16

- 9 in order to get the maximum oil flow rate, adjust the pressure (reading its value on the **PG** pressure gauge) without changing the air flow rate set during the gas operation adjustments (see previous paragraph): checking always the combustion parameters, the adjustment is to be performed by means of the **SV2** adjusting cam screw (see picture above) when the cam has reached the high flame position.

- 10 as for the point-to-point regulation in order to set the cam foil shape, move the oil low flame microswitch (cam IV) a little lower than the maximum position (90°);
- 11 set the **TAB** thermostat to the minimum in order that the actuator moves progressively towards the low flame position;
- 12 move cam IV (oil low flame) towards the minimum to move the actuator towards the low flame until the two bearings find the adjusting screw that refers to a lower position: screw **V2** to increase the rate, unscrew to decrease, in order to get the pressure as shown on chart/diagram on "Adjusting heavy oil flow rate" on page 37, according to the requested rate.
- 13 Move again cam V 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.
- 14 The low flame position must never match the ignition position that is why cam **IV** must be set 20° - 30° more than the ignition position.
- 15 Set cam V ("stroke limitation cam") 5° higher than the lowest "low flame cam" (cam III or cam IV).
- 16 Turn the burner off; then start it up again. If the adjustment is not correct, repeat the previous steps.
- 17 Replace the actuator and control panel covers.

As far as fully-modulating burners, see paragraph "Fully modulating burners" on page 29.

### Oil circuit

The fuel is pushed into the pump 1 to the nozzle 3 at the delivery pressure set by the pressure governor. The solenoid valve 2 stops the fuel immission into the combustion chamber. The fuel flow rate that is not burnt goes back to the tank through the return circuit. The spill-back nozzle is feeded at constant pressure, while the return line pressure is adjusted by means of the pressure governor controlled by an actuator coupled to an adjusting cam. The fuel amount to be burnt is adjusted by means of the burner actuator according to the adjustments set (see previous paragraph).

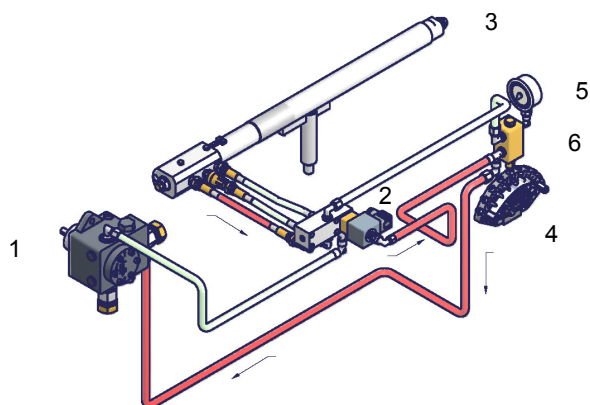


Fig. 17 - Stand-by

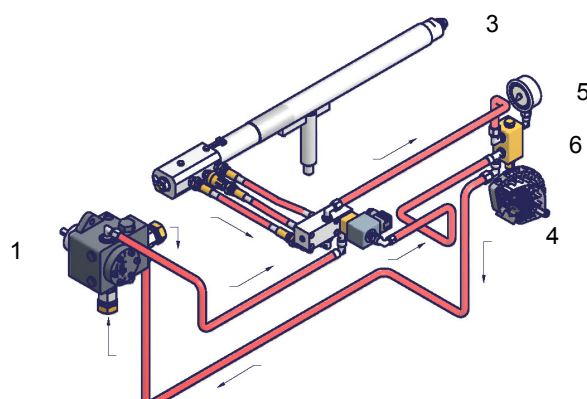


Fig. 18 - Pre-purge

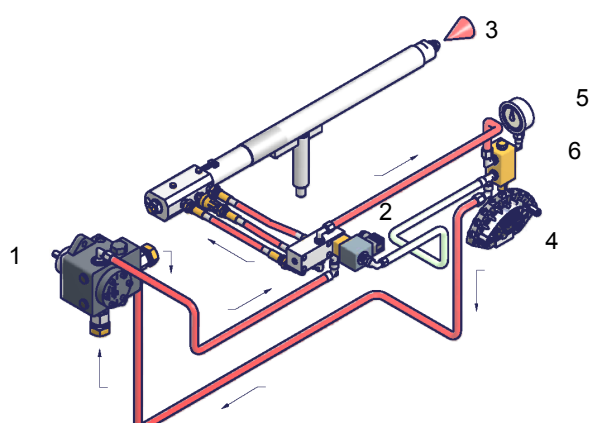


Fig. 19 - Low flame

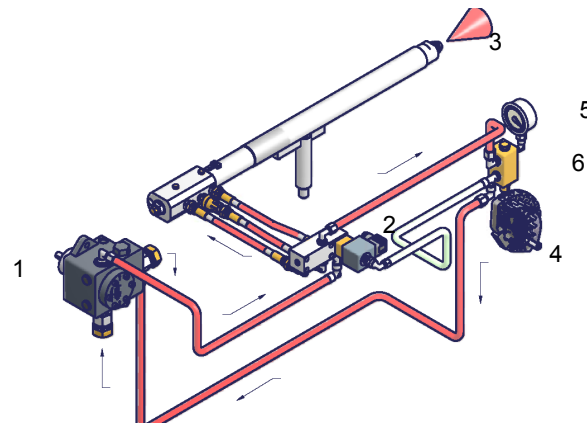


Fig. 20 - High flame

### Key

- 1 Oil pump
- 2 Oil solenoid valve
- 3 Nozzle
- 4 Adjusting cam
- 5 Pressure gauge
- 6 Pressure governor

## PART II: OPERATION

## 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.

OPERATE ONLY THE MAIN SWITCH, WHICH THROUGH ITS EASY ACCESSIBILITY AND RAPIDITY OF OPERATION ALSO FUNCTIONS AS AN EMERGENCY SWITCH, AND ON THE RESET BUTTON.

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.

## OPERATION



**ATTENTION:** 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". Read carefully the "WARNINGS" chapter in this manual.

Select the fuel by turning the switch CM on the burner control panel .

**N.B. if the heavy oil is used, be sure the cutoff valves on the delivery and return pipes are OPEN.**

- Check that the burner is not locked (LED **C** lights up); if so, reset it by pressing the reset button **D**.
- Check that the series of thermostats (or pressure switches) enable the burner to start up.

**Gas Operation**

- Check that the gas pressure in the circuit is high enough (LED **E** and **Q** on).
- The valve proving test begins.
- At the beginning of the start-up cycle the the air damper moves to the maximum opening, 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 LED **G** on the front panel.
- At the end of the pre-purge stage, the air damper moves to the ignition position, the ignition transformer is energised (signalled by LED **I** on the panel) and, after few seconds the two gas valves EV1 and EV2 are energised (indicator lights **L** and **M** on). Few seconds after the opening of the gas valves, the ignition transformer is de-energised and LED **I** is off.
- To move from the low flame position, the actuator opening time (<10 s) is controlled by the control box. When this time elapses, the burner operates according to the plant needs.

**Heavy oil Operation**

- At the beginning of the start-up cycle the air damper moves to the maximum opening, 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 LED **G** on the front panel.
- At the end of the pre-purge the air damper is brought to the ignition position and the ignition transformer is energised (signalled by LED **I** on the panel). Few seconds later, the oil valve opens and the ignition transformer is de-energized (LED **I** off).

The burner is now operating and after some seconds the burner is automatically driven into high flame (LED **G** on), or remains in low flame (LED **H** on) according to the plant needs.

As far as fully-modulating burners, refer to the burner modulator manual.

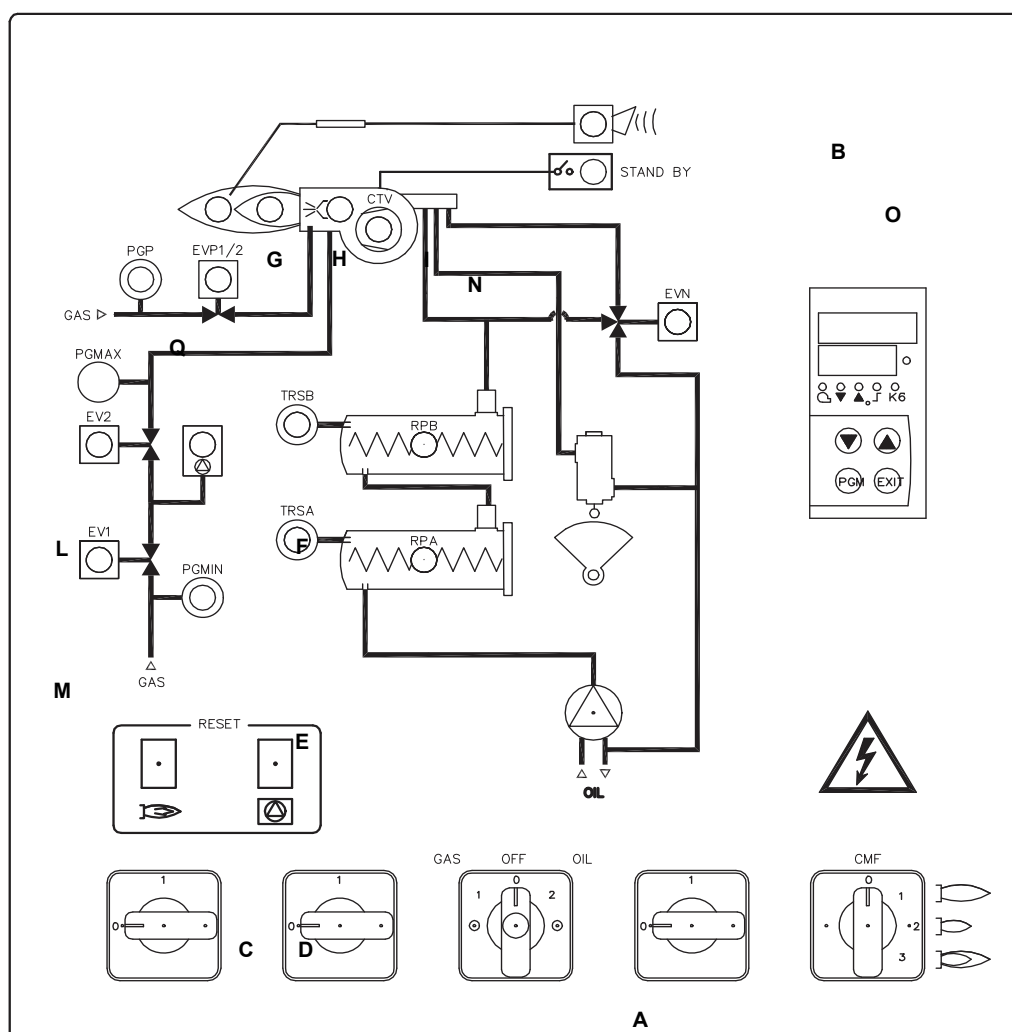
**Burner front panel**

Fig. 21 - Burner control panel

**Key**

|   |                                                                                       |   |                                                |
|---|---------------------------------------------------------------------------------------|---|------------------------------------------------|
| A | ON-OFF mains switch                                                                   | O | Burner in stand-by signalling lamp             |
| B | Lockout signalling lamp                                                               | P | Modulator (only fully modulating burners)      |
| C | Reset button for burner control device                                                | Q | Pilot pressure switch enabling signalling lamp |
| D | Reset button for burner gas proving system (only for burners fitted with Siemens LDU) | R | Valve EVP operation signalling lamp            |
| E | Gas pressure switch enabling signalling lamp                                          |   |                                                |
| F | Gas proving system lock signalling lamp                                               |   |                                                |
| G | High flame operation signalling lamp                                                  |   |                                                |
| H | Low flame operation signalling lamp                                                   |   |                                                |
| I | Ignition transformer operation signalling light                                       |   |                                                |
| L | Valve EV2 operation signalling light                                                  |   |                                                |
| M | Valve EV1 operation signalling light                                                  |   |                                                |
| N | Fan motor thermal cutout intervention signalling lamp                                 |   |                                                |

## PART III: 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.

|  |                                                                                                                                        |
|--|----------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>WARNING: ALL OPERATIONS ON THE BURNER MUST BE CARRIED OUT WITH THE MAINS DISCONNECTED AND THE FUEL MANUAL CUTOFF VALVES CLOSED!</b> |
|  | <b>ATTENTION: READ CAREFULLY THE “WARNINGS” CHAPTER AT THE BEGINNING OF THIS MANUAL.</b>                                               |

**ROUTINE MAINTENANCE**

- Clean and examine the gas filter and replace it if necessary.
- Clean and examine the oil filter cartridge and replace it if necessary.
- Examine the flexible hoses and check for possible leaks.
- Check and clean if necessary the oil heaters and the tank, according to the fuel type and its use; remove the heaters flange fixing nuts and remove the heaters from the tank: clean by using steam or solvents and not metallic things.
- Remove and clean the combustion head.
- Examine and clean the ignition electrode, adjust and replace if necessary.
- Examine and clean the detection probe, adjust and replace if necessary.
- Examine the detection current.
- Remove and clean the heavy oil nozzle (**Important: use solvents for cleaning, not metallic tools**) and at the end of the maintenance procedures, after replacing the burner, turn it on and check the shape of the flame; if in doubt replace the nozzle. Where the burner is used intensively it is recommended to replace the nozzle as a preventive measure, at the begin of the operating season.
- Clean and grease joints and rotating parts.

**IMPORTANT:** Remove the combustion head before checking the ignition electrode.

- Remove and clean the compressed air regulator
- Remove and clean the oil regulator (if provided)
- 



**CAUTION:** avoid the contact of steam, solvent and other liquids with the electric terminals of the resistor.  
On flanged heaters, replace the seal gasket before refitting it.  
Periodic inspections must be carried out to determine the frequency of cleaning.



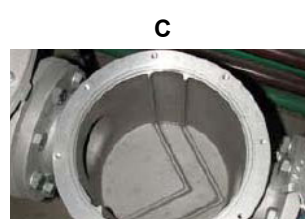
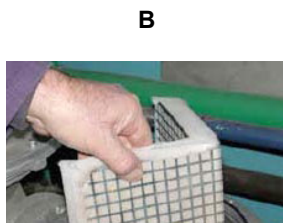
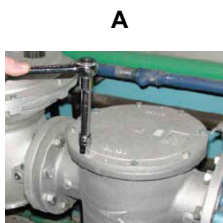
**ATTENTION** when servicing, if it was necessary to disassemble the gas train parts, remember to execute the gas proving test, once the gas train is reassembled, according to the procedure imposed by the law in force.

**Gas filter maintenance**

|  |                                                                                                                                                                               |
|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>ATTENTION:</b> 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. |
|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

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 in between the guides as not to hamper the cap replacement;
- 4 be sure to replace the Or ring into its place (C) and replace the cover fastening by the proper screws (A).





### ***Technical procedure of self cleaning filters substitution (valid for all models)***

- 1 Close the bowl valve before the self cleaning filter
- 2 Switch off any electrical equipment on board on the filter (example motorization or heaters)



**WARNING! Drain the system by unscrewing the drain screw on the bottom of the self cleaning filter**

- 3 Disconnect the outlet pipe from the cover of the self cleaning filter
- 4 Remove the cover with all the filter pack, leaving only the bowl on the line
- 5 Clean any residue on the bottom of the bowl and clean the seat of the O-ring seal

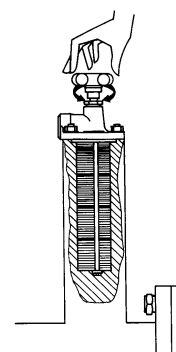


**WARNING! Replace the O-ring seal between the bowl and cover**

- 6 Insert the filter pack again making sure to respect the correct inlet/outlet direction or any references on the cover and tray
- 7 Replace the filter by following the reverse order operations
- 8 Make sure there is no leakage and give the power to any electrical equipment on the filter

### **Self-cleaning filter**

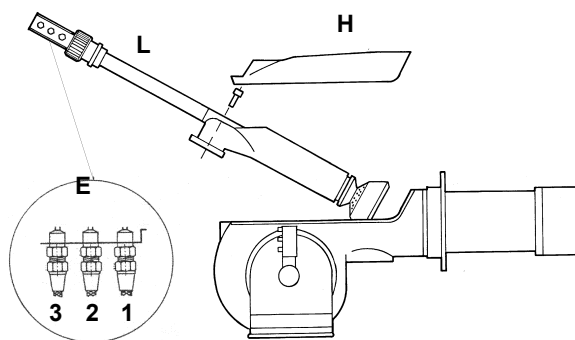
Fitted only on high viscosity oil burners. Periodically turn the knob to clean the filter.



### **Removing the combustion head**

- 1 Remove the cover **H**.
- 2 Slide the photoresistance out of its housing.
- 3 Unscrew the **V** screws that block the gas collector **G**, loosen the three joints **E** and remove the ass.y as shown on the following picture.
- 4 Clean the combustion head by means of a vacuum cleaner; scrape off the scale by means of a metallic brush.

**Note:** to remount the burner, follow the same procedure in the reversed order.

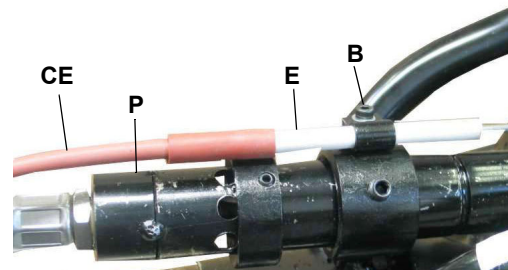


#### **Key**

- 1 Inlet
- 2 Return
- 3 Gun opening
- E Oil piping connections
- H Cover
- L Oil gun

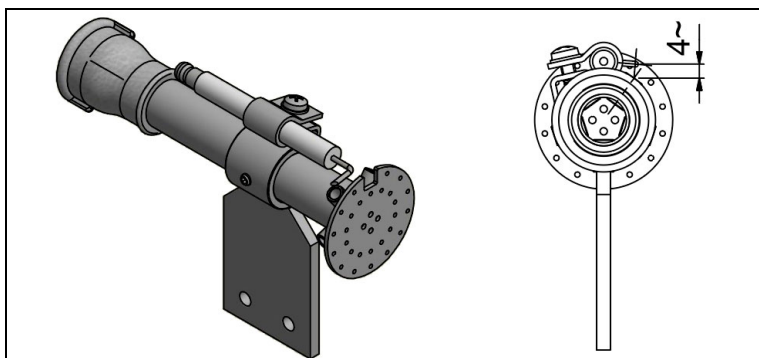
### Replacing the ignition electrode

- 1 To replace the ignition electrode, proceed as follows: remove the burner cover
- 2 disconnect the electrode (E) cable (CE);
- 3 remove the combustion head (see par. "Removing the combustion head");
- 4 loose screw (B) that fasten the ignition electrode (E) to the burner pilot (P);
- 5 remove the electrode and replace it, referring to the values quoted on figure.



**ATTENTION:** avoid the electrode to get in touch with metallic parts (blast tube, head, etc.), otherwise the boiler operation would be compromised. Check the electrode position after any intervention on the combustion head.

### Ignition pilot electrode positions



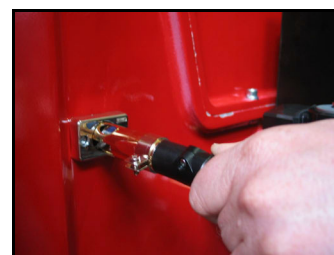
**ATTENTION:** avoid contact between electrodes and metallic parts (blast tube, head, etc.), otherwise the burner's operation would be compromised. Check the electrodes position after any intervention on the combustion head.

- 1 Move the combustion head "all-ahead" by the "head stroke limitation cam", acting on the ring nut **2**; fix it by means of screw **1**;
- 2 place the gas plate "**6**" according to measure **G** (gas plate opening) - (see table below) - acting on screw "**4**"
- 3 place the nozzle to "**F**" mm (see table below) from the diffuser disc, acting on screw "**3**"
- 4 place the electrodes according to measures **E, B, N** (see table below) acting on screw "**5**" (if the case, correct the measure, by deforming the electrode wire).

### Cleaning and replacing the detection photocell

To clean/replace the detection photocell, proceed as follows:

- 1 Disconnect the system from the electrical power supply.
  - 2 Shut off the fuel supply
  - 3 remove the photocell from its slot (see next picture);
  - 4 clean the bulbe if dirty, taking care not to touch it with bare hands;
  - 5 if necessary, replace the bulb;
- replace the photocell into its slot.



### Checking the detection current

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 LFL1.3.. | 70 $\mu$ A with UV detector) |

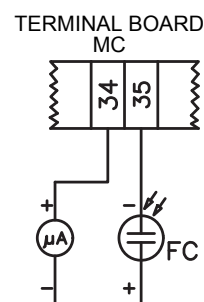
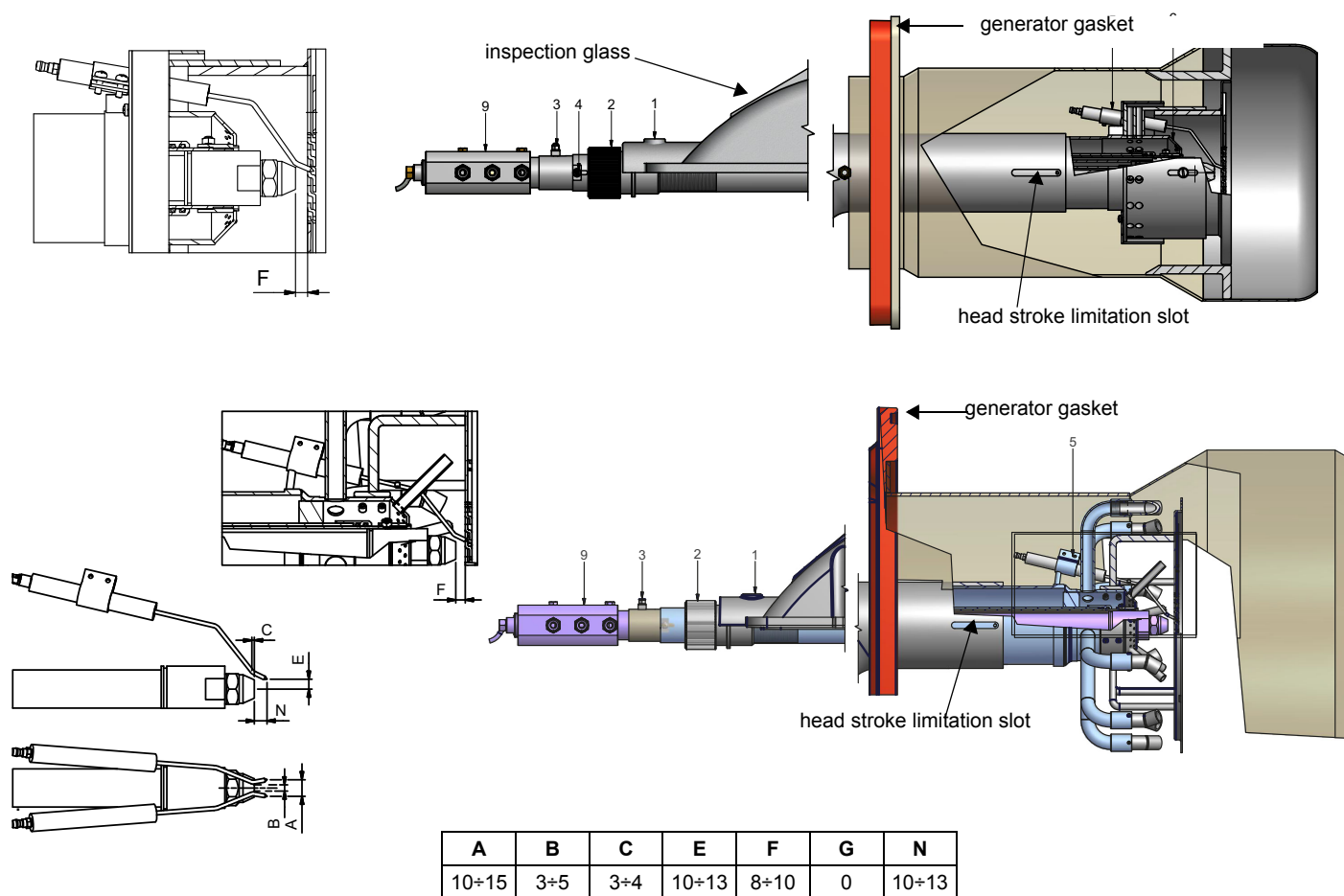


Fig. 22: Detection by photocell QRA..

### Adjusting the electrodes and nozzle position

Adjust the electrodes position, according to the measures (in mm) shown on the next picture.



- 1 Move the combustion head "all-ahead" by the "head stroke limitation cam", acting on the ring nut **M**; fix it by means of screw **T**;
- 2 place the nozzle to "**F**" mm (see table below) from the diffuser disc, acting on ring nut "**L**"
- 3 place the electrodes according to measures **E, B, N** (see table below) acting on screw "**5**" (if the case, correct the measure, by deforming the electrode wire).

## Removing the oil gun, replacing the nozzle and the electrodes



**ATTENTION:** avoid the electrodes to get in touch with metallic parts (blast tube, head, etc.), otherwise the boiler operation would be compromised. Check the electrodes position after any intervention on the combustion head.

To remove the oil gun, proceed as follows:

- 1 remove the combustion head as described on the previous paragraph;
- 2 loosen the **VL** screw and remove the oil gun and the electrodes: check the oil gun, replace it if necessary;
- 3 after removing the oil gun, unscrew the nozzle and replace it if necessary;

**Caution:** adjust the nozzle position according to the air pipe, by means of the **VU** screw, once the **VL** screw is fastened.

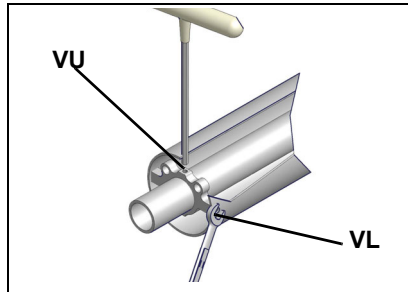


Fig. 23

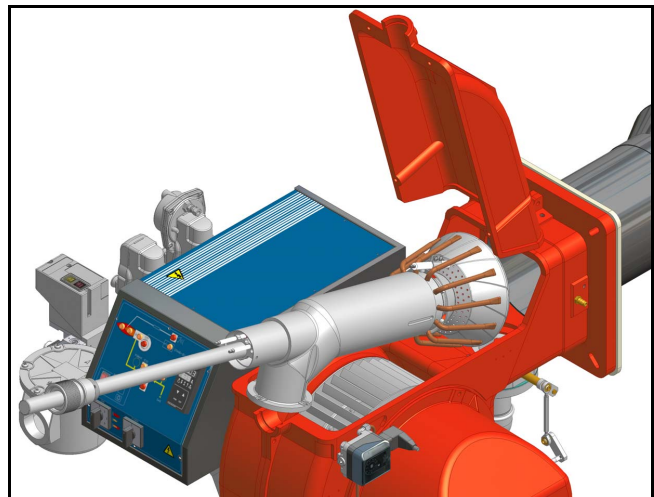
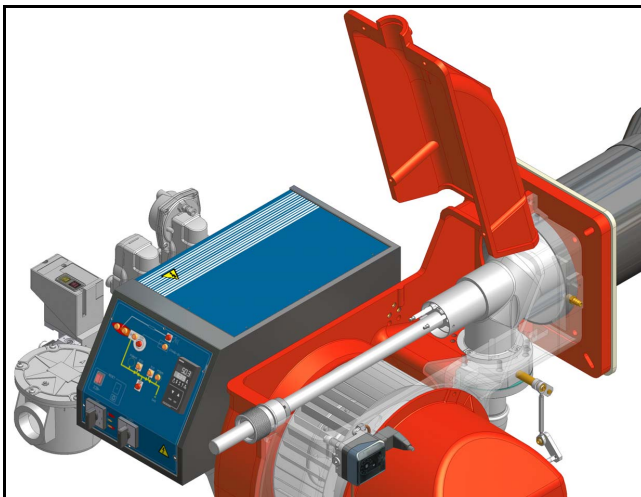
## Replacing the ignition electrode



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

To replace the ignition electrode, proceed as follows:

- 1 remove the burner cover
- 2 disconnect the electrode (E) cable (CE);
- 3 remove the combustion head (see par. "Removing the combustion head");
- 4 loose screw (B) that fasten the ignition electrode (E) to the burner pilot (P);
- 5 remove the electrode and replace it, referring to the values quoted on Fig. 27.



## 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****WIRING DIAGRAM SE12-072 - Progressive burners****WIRING DIAGRAM SE12-097 - Fully-modulating burners**

See the attached wiring diagrams.

**ATTENTION:**

- 1 - Electrical supply 400V 50Hz 3N a.c.
- 2 - Don't reverse phase with neutral
- 3 - Ensure to the burner a proper hearthing

## TROUBLESHOOTING

*Heavy oil operation*

|                                              | THE BURNER DOESN'T START | THE BURNER REPEATS PRE-PURGE | NOISY FUEL PUMP | THE BURNER DOESN'T START AND STOPS | THE BURNER STARTS AND STOPS | THE BURNER DOESN'T SWITCH TO HIGH FLAME | THE BURNER STOPS DURING OPERATION | THE BURNER STOPS AND REPEATS THE CYCLE DURING OPERATION |
|----------------------------------------------|--------------------------|------------------------------|-----------------|------------------------------------|-----------------------------|-----------------------------------------|-----------------------------------|---------------------------------------------------------|
| MAIN SWITCH OPEN                             | ●                        |                              |                 |                                    |                             |                                         |                                   |                                                         |
| LINE FUSE INTERVENTION                       | ●                        |                              |                 |                                    |                             |                                         |                                   |                                                         |
| MAX. PRESSURE SWITCH FAULT                   | ●                        |                              |                 |                                    |                             |                                         |                                   | ●                                                       |
| FAN THERMAL CUTOFF INTERVENTION              | ●                        |                              |                 |                                    |                             |                                         |                                   |                                                         |
| AUXILIARY RELAYS FUSES INTERVENTION          | ●                        |                              |                 |                                    |                             |                                         |                                   |                                                         |
| CONTROL BOX FAULT                            | ●                        | ●                            |                 | ●                                  | ●                           |                                         | ●                                 |                                                         |
| SERVOCONTROL FAULT                           |                          |                              |                 |                                    |                             | ●                                       |                                   |                                                         |
| SMOKEY FLAME                                 |                          |                              |                 |                                    | ●                           |                                         | ●                                 |                                                         |
| IGNITION TRANSFORMER FAULT                   |                          |                              |                 | ●                                  |                             |                                         |                                   |                                                         |
| IGNITION ELECTRODE DIRTY OR WRONG POSITIONED |                          |                              |                 | ●                                  |                             |                                         |                                   |                                                         |
| DIRTY NOZZLE                                 |                          |                              |                 | ●                                  |                             |                                         | ●                                 |                                                         |
| FUEL SOLENOID VALVE DEFECTIVE                |                          |                              |                 | ●                                  |                             |                                         | ●                                 |                                                         |
| PHOTORESISTOR DIRTY OR DEFECTIVE             |                          |                              |                 |                                    | ●                           |                                         | ●                                 |                                                         |
| HI-LO FLAME THERMOSTAT DEFECTIVE             |                          |                              |                 |                                    |                             | ●                                       |                                   |                                                         |
| WRONG POSITION OF SERVOCONTROL CAMS          |                          |                              |                 |                                    |                             | ●                                       |                                   |                                                         |
| FUEL PRESSURE TOO LOW                        |                          |                              |                 | ●                                  |                             |                                         |                                   |                                                         |
| DIRTY FUEL FILTERS                           |                          |                              | ●               | ●                                  |                             |                                         | ●                                 |                                                         |

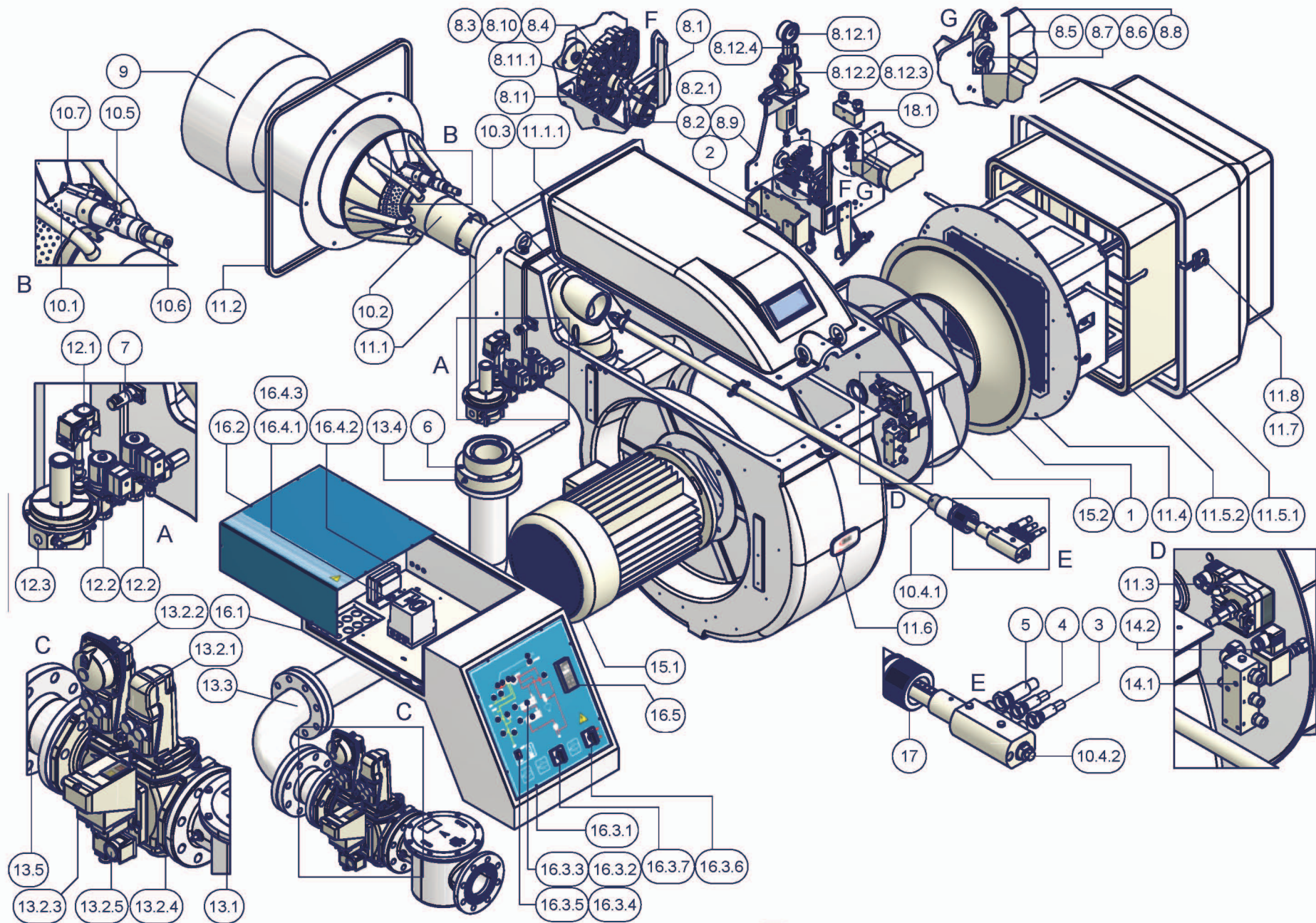
## TROUBLESHOOTING GUIDE Gas operation

|                                                                                                       |                                                                                          |                                                                                                                                                        |
|-------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| <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<br>* Check gas filter cleanness<br>* 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<br>* 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<br>* 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<br>* Check pressure switch functionality                                                                                           |
|                                                                                                       | * Air pressure switch damaged (it keeps the stand-by position or badly set)              | * Check air pressure switch functionality<br>* 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<br>* 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<br>* 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                                                                                                                                    |

## BURNER EXPLODED VIEW

| ITEM   | DESCRIPTION               |
|--------|---------------------------|
| 1      | AIR INLET CONE            |
| 2      | SPACER                    |
| 3      | FLEXIBLE HOSE             |
| 4      | FLEXIBLE HOSE             |
| 5      | FLEXIBLE HOSE             |
| 6      | BUTTERFLY GAS VALVE       |
| 7      | PHOTOCELL                 |
| 8.1    | LEVERAGE                  |
| 8.2    | ADJUSTING CAM             |
| 8.2.1  | ADJUSTING CAM FOIL        |
| 8.3    | ADJUSTING CAM SHAFT       |
| 8.4    | BUSH                      |
| 8.5    | ACTUATOR                  |
| 8.6    | INDEX LABEL               |
| 8.7    | ACTUATOR SHAFT            |
| 8.8    | BRACKET                   |
| 8.9    | BRACKET                   |
| 8.10   | BUSH                      |
| 8.11   | ADJUSTING CAM             |
| 8.11.1 | ADJUSTING CAM FOIL        |
| 8.12.1 | PRESSURE GAUGE            |
| 8.12.2 | PRESSURE GOVERNOR         |
| 8.12.3 | OIL GOVERNOR CYLINDER     |
| 8.12.4 | MANUAL VALVE              |
| 9      | STANDARD BLAST TUBE       |
| 10.1   | IGNITOR                   |
| 10.2   | COMBUSTION HEAD           |
| 10.3   | GAS MANIFOLD              |
| 10.4.1 | ADJUSTING BUSH            |
| 10.4.2 | STANDARD COMPLETE OIL GUN |
| 10.5   | IGNITION CABLE            |
| 10.6   | GAS FLEXIBLE HOSE         |
| 10.7   | IGNITION ELECTRODE        |
| 11.1   | BURNER HOUSING            |
| 11.1.1 | COVER                     |
| 11.2   | CERAMIC FIBRE PLAIT       |
| 11.3   | AIR PRESSURE SWITCH       |

| ITEM   | DESCRIPTION              |
|--------|--------------------------|
| 11.4   | AIR DAMPER               |
| 11.5.1 | SILENCER                 |
| 11.5.2 | AIR DAMPER SILENCER      |
| 11.6   | NAME PLATE               |
| 11.7   | INDEX LABEL              |
| 11.8   | AIR DAMPER INDEX         |
| 12.1   | GAS PRESSURE             |
| 12.2   | GAS SOLENOID VALVE       |
| 12.3   | GAS GOVERNOR WITH FILTER |
| 13.1   | GAS FILTER               |
| 13.2.1 | "SKP" ACTUATOR           |
| 13.2.2 | "SKP" ACTUATOR           |
| 13.2.3 | GAS PROVING SYSTEM       |
| 13.2.4 | GAS VALVE HOUSING        |
| 13.2.5 | GAS PRESSURE             |
| 13.3   | FLANGED REVERSIBLE CURVE |
| 13.4   | REVERSIBLE PIPE          |
| 13.5   | FLANGED PIPE             |
| 14.1   | OIL MANIFOLD             |
| 14.2   | SOLENOID VALVE           |
| 15.1   | MOTOR                    |
| 15.2   | FAN WHEEL                |
| 16.1   | BOARD                    |
| 16.2   | COVER                    |
| 16.3.1 | FRONT CONTROL PANEL      |
| 16.3.2 | LIGHT                    |
| 16.3.3 | LIGHT                    |
| 16.3.4 | LOCK-OUT RESET BUTTON    |
| 16.3.5 | PROTECTION               |
| 16.3.6 | SWITCH                   |
| 16.3.7 | SWITCH                   |
| 16.4.1 | CONTROL BOX              |
| 16.4.2 | IGNITION TRANSFORMER     |
| 16.4.3 | CONTROL BOX SOCKET       |
| 16.5   | OUTPUT CONTROLLER        |
| 17     | RING NUT                 |
| 18.1   | OIL MANIFOLD             |



## APPENDIX

### SIEMENS LFL 1.3.. CONTROL BOX

Automatic programme in the event of interruption and indication of position when interrupted

By default, in the event of any kind of interruption, the flow of fuel is immediately interrupted. At the same time the programmer stops and this indicates the position at the time of the interruption.

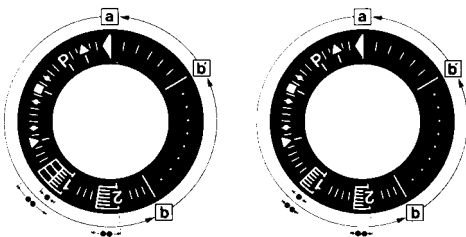
A symbol on the indicator disc shows each time the type of stoppage:

- ◀ No start-up (for example fault in the CLOSED signal for the limit contact "Z" at terminal 8 or some other contact between the terminals 12 and 4 or 4 and 5 is not closed).
- ◀ Start-up suspended because of a fault in the OPEN signal for the limit contact "A" at terminal 8.
- P Block due to absence of air pressure signal. From this moment onwards any absence of air pressure will cause a block.
- Block due to malfunction of the flame detector circuit.
- ▼ Start-up interrupted because there is a fault in the MINMUM signal for the auxiliary contact of the damper servo motor at terminal 8.
- 1 Block due to absence of flame signal at the end of the 1st safety period.

From this moment onwards any absence of a flame signal will cause a block.

- 2 Block due to absence of flame signal at the end of the 2nd safety period (flame signal of main burner).
- █ Block due to absence of flame signal or air pressure during operation.

Where a block stoppage occurs at any moment between switch on and pre-ignition without registering any symbol, the cause is normally an unscheduled flame signal.



a-b Start-up programme

b-b' For time variants: move the programmer on to the automatic stop after the burner starts up (b' = position of the programmer during normal burner operation).

b(b')-a Post-ventilation programme after a regulation stop. At the start-up position "a" the programmer stops automatically.

. Safety time duration for mono-tube burners

.. Safety time duration for twin-tube burners

The apparatus can be reset immediately after a block. After resetting (and after the elimination of any problem causing the stoppage or after a power failure) the programmer returns to its start-up position. In this event only the terminals 7, 9, 10 and 11 are live in accordance with the monitoring programme. Only after this the device programs a new startup.

#### Operation

The wiring system and also the control system of the programmer "P" have already been given in this manual. The response signals required for the active parts and the flame monitor circuit are shown by a hatching. In the absence of these response signals the mechanism interrupts the start-up programme; the exact time of the interruption can be identified from the visual indicator and will cause a block if the safety code requires it.

- A consent to start-up by means of the thermostat or pressostat "R"
- A-B start-up program
- B-C normal burner operation
- C regulation stop caused by "R"
- C-D programmer returns to start-up position A.

During the regulation stop only terminals 11 and 12 are live and the damper, through the limit contact "Z" of its servo-motor is in the CLOSED position. The flame detector circuit F is activated (terminals 22 and 23 or 23/4) for the detector test and the paracitic light test.

Where the burners do not have dampers (or have an independent 00 damper control mechanism) there must be a bridge between terminals 6 and 8, otherwise the mechanism will not start up the burner.

For a burner to start up the following conditions must be met:

- Mechanism not blocked/reset.
- Damper closed. Limit contact switch Z must be in the CLOSED position and allow current to flow between terminals 11 and 8.
- Any contacts checking that the fuel valve (bv...) is closed, or other contacts with similar functions, must be closed between terminal 12 and the air pressostat LP.
- The contact for the air pressostat LP must be in the off position (LP test) so as to feed terminal 4.
- The gas pressostat contacts GP and the safety thermostat and pressostat contacts W must also be closed.

#### Start-up program

A Start-up

(R closes the start-up control ring between terminals 4 and 5)

The programmer starts up. At the same time the ventilator motor is fed through terminal 6 (only for pre-ventilation) and, after t7, the ventilator motor or the combustion gas exhaust fan is fed through terminal 7 (pre-ventilation and post-ventilation).

At the end of t16, the command opening the damper passes through terminal 9; during the damper opening time the programmer does not move since terminal 8, through which the programmer is fed, is dead.

Only once the damper is fully open and the limit contact switch A has switched on, feeding terminal 8, does the programme proceed.

t1 Pre-ventilation time with damper fully open (nominal air flow).

Shortly after the beginning of the pre-ventilation time, the air pressostat should switch off the current between terminals 4 and 13; otherwise the apparatus would block (air pressure monitor).

At the same time the terminal 14 should be live since current feeding the ignition transformer and the fuel valves passes through this circuit.

During pre-ventilation time the flame detector circuit is checked and in the event of an operational defect the monitor brings about a block.

At the end of the pre-ventilation time the monitor automatically moves the damper servo-motor, through terminal 10, to the flame ignition position which is governed by the auxiliary contact "M".

During this period the programmer stops until terminal 8, is again activated through contact "M".

After a few seconds the little programmer motor is directly fed by the active part of the apparatus.

After this point terminal 8 plays no further part in the burner ignition process.

#### Mono-tube burner

t3 Pre-ignition time waiting the response from the fuel valve at terminal 18.

t2 Safety time (start up flame strenght); at the end of the safety time a flame signal should appear at terminal 22 of the amplifier and it should stay on until a regulation stop; if this does not happen the mechanism will block.

t4 Interval; at the end of t4, terminal 19 is live.

t5 Interval At the end of t5 terminal 20 is live. At the same time the monitor outlets from 9 and 11 and terminal 8 into the active part of the apparatus are kept galvanically separated so as to protect the monitor itself from recovery voltage through the capacity regulator circuit.

## Twin-tube burners (\*\*)

t3 Preignition time until the all clear to the pilot burner valve at terminal 17.

t2 First safety time (pilot flame strenght); at the end of the safety time a flame signal should appear at terminal 22 of the amplifier and it should stay on, until a regulation stop; if it does not, the apparatus will block.

t4 Interval until the consent to the fuel valve at terminal 19, for the first flame of the main burner.

t9 2nd safety time; at the end of the second safety time the main burner should be lit by means of the pilot. At the end of this period, terminal 17 is dead and therefore the pilot burner will be out.

t5 Interval; at the end of t5 terminal 20 is live. At the same time the monitor outlets from 9 to 11 and the terminal 8 at the input of the active part of the apparatus are galvanically separated so as to protect the apparatus itself from recovery voltage through the strenght regulator circuit.

When the strenght regulator LR at terminal 20 gives the consent, the start-up programme for the apparatus comes to an end. Depending on time variants, the programmer stops either immediately or at the end of a set time, without effecting the position of the contacts.

B Operational position of the burner

B-C Burner operation (production of heat)

While the burner is working the strenght regulator controls the damper, according to the demand for heat, by means of the positioning at nominal load of the auxiliary contact "V" of the damper servocontrol.

C Regulation stop for operation of "R"

When there is a regulation stop the fuel valves immediately close. At the same time the programmer starts to programme:

t6 Post-ventilation time (post-ventilation with the ventilator "G" at terminal 7). Shortly after beginning of the post-ventilation time terminal 10 becomes live and moves the damper to the "MIN" position. The full closure of the damper only happens towards the end of the post-ventilation time and is prompted by an automatic signal from terminal 11

t13 Admissible post-ignition time

During this time the flame monitor circuit may still receive a flame signal without the apparatus blocking.

D-A End of automatic programme

At the end of t6, at the point where the programmer and the automatic contacts have reverted to the starter position, the detection probe test restarts.

During an operational stop even an unscheduled flame signal lasting a few seconds can cause a block because during this period an NTC in the circuit acts as retarder. This means that brief unscheduled influences cannot cause a block.

(\*\*) Times t3, t2 and t4 only apply only to safety devices in the series 01.

## Specifications

|                                     |                                              |
|-------------------------------------|----------------------------------------------|
| Mains voltage                       | 220V -15%...240V +10%                        |
| Frequency                           | 50Hz -6%...60Hz +6%                          |
| Absorbed capacity                   | 3.5 VA                                       |
| Built-in fuse                       | T6.3/250E slow action DIN41571 No. 451915070 |
| External fuse                       | max. 16A                                     |
| Interference                        | N-VDE0875                                    |
| Flow permitted at terminal 1        | 5A (DIN 0660 AC3)                            |
| Flow permitted at control terminals | 4A (DIN 0660 AC3)                            |

|                           |                                                            |
|---------------------------|------------------------------------------------------------|
| Flow at monitor contacts: |                                                            |
| input at terminals 4 & 5  | 1A, 250V                                                   |
| input at terminals 4 & 11 | 1A, 250V                                                   |
| input at terminals 4 & 14 | function of the load at terminals 16 and 19, min. 1A, 250V |

|                                  |              |
|----------------------------------|--------------|
| Emplacement                      | Any          |
| Protection                       | IP40         |
| Permitted ambient temp           | -20...+60° C |
| Min. temperature (trans/storage) | -50° C       |

|           |                 |
|-----------|-----------------|
| Weight:   |                 |
| apparatus | approx. 1,000g. |
| base      | approx. 165g.   |

## Ionisation monitor

|                                                           |             |
|-----------------------------------------------------------|-------------|
| voltage in detector electrode                             |             |
| normal working                                            | 330V ±10%   |
| test                                                      | 380V ±10%   |
| short circuit current                                     | max. 0,5 mA |
| Ionisation current, min. request                          | 6 µA        |
| max. permitted length for connecting cables               |             |
| normal cable (laid separately**)                          | 80m         |
| armoured cable (high frequency) protection at terminal 22 | 140m        |

|                                                          |           |
|----------------------------------------------------------|-----------|
| UV monitor                                               |           |
| Voltage in UV detector                                   |           |
| normal working                                           | 330V ±10% |
| test                                                     | 380V ±10% |
| Detector current, min. request*                          | 70µA      |
| Max. detector current                                    |           |
| normal working                                           | 630 µA    |
| test                                                     | 1300 µA   |
| Max. length of connecting cable                          |           |
| normal cable (laid separately**) 100m                    |           |
| armoured cable (high frequency) protected at terminal 22 | 200m      |

|        |        |
|--------|--------|
| Weight |        |
| QRA2   | 60 g   |
| QRA10  | 450 g. |

\*Connect up in parallel to the measuring device a condenser 100µF, 10...25V.

\*\* The wire connecting up the detector electrode should not be in the same sleeve as the other conductor wires.

Ignition spark monitor with QRE1 series 02 detector  
Minimum detector current 30µA

## Operating times

|                                                                                  |                |
|----------------------------------------------------------------------------------|----------------|
| t7 initial delay for ventilator G2                                               | 2              |
| t16 initial delay of air damper OPEN consent                                     | 4              |
| t11 opening time for damper                                                      | any            |
| t10 initial delay for air pressure monitor                                       | 8              |
| t1 pre-ventilation time with damper open                                         | 36             |
| t12 travel time for air damper to MIN position                                   | any            |
| t3 t3' pre-ignition time                                                         | t3 4<br>t3 '-  |
| t2 t2' safety time (1st safety time for burners with intermittent pilot lighter) | t2 2<br>t2 '-  |
| t4 t4' interval between start of t2 and response to valve at terminal 19         | t4 10<br>t4 '- |

|                                                                                               |    |
|-----------------------------------------------------------------------------------------------|----|
| t9 2nd safety time for burners with intermittent pilot lighter                                | 2  |
| t5 interval between end of t4 and response at terminal 20                                     | 10 |
| t20 interval before programmer cuts out after start-up-duration of start-up                   | 60 |
| t6 post-ventilation time (G2 only)                                                            | 12 |
| t13 permitted post-ignition time                                                              | 12 |
| t16 initial delay from opening consent of the air damper                                      |    |
| t20 interval until the automatic shut-off of the programming mechanism after the burner start |    |

---

**Key**

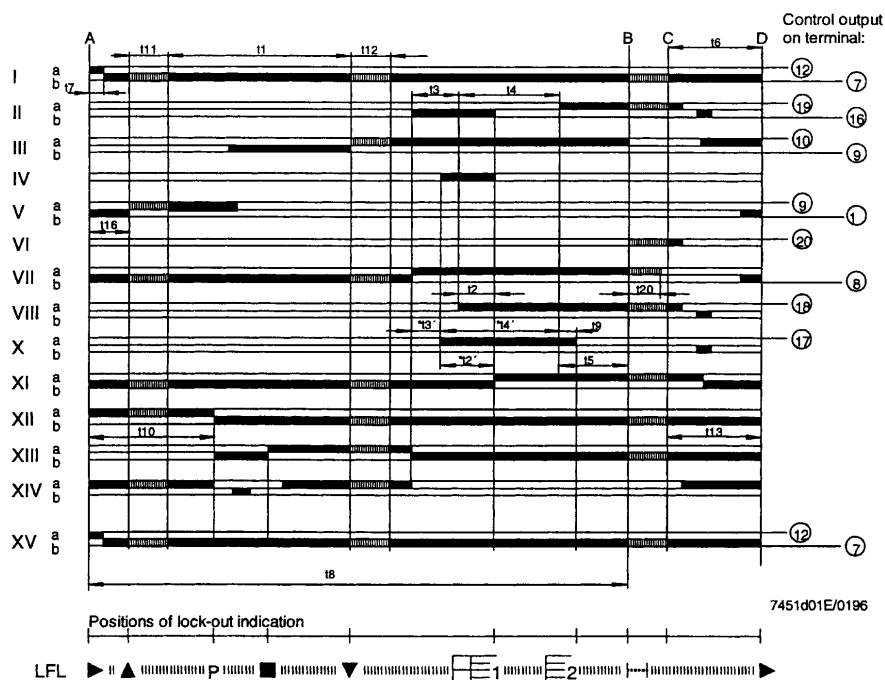
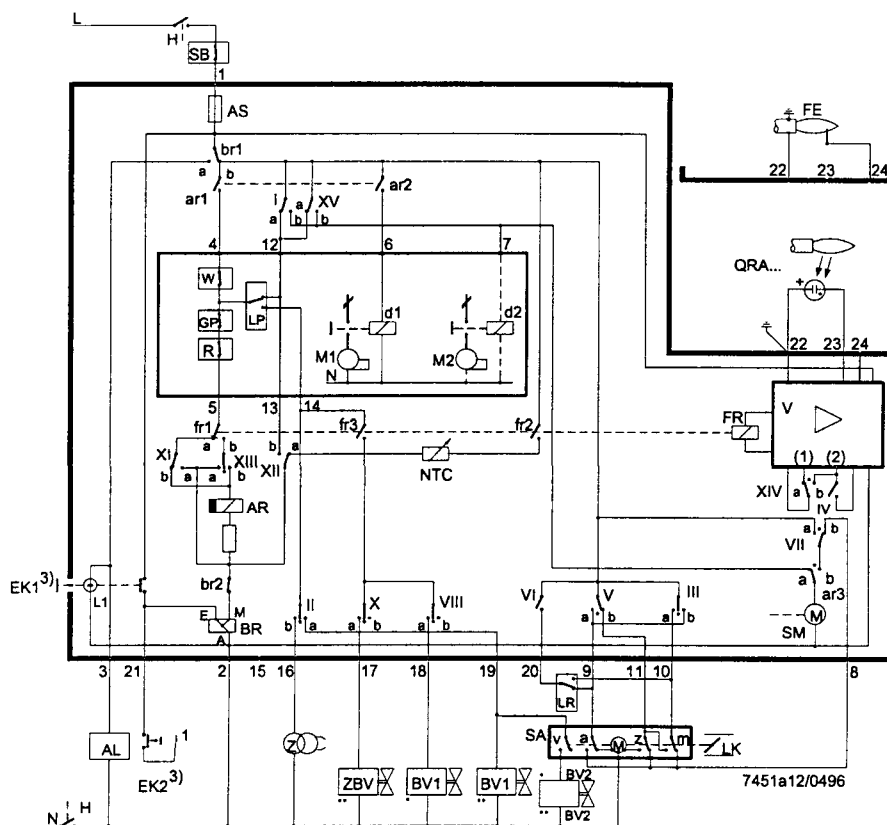
|     |                                                                                                     |
|-----|-----------------------------------------------------------------------------------------------------|
| A   | limit contact switch for damper OPEN position                                                       |
| AI  | block remote signal                                                                                 |
| AR  | main relay (working network) with contacts "ar"                                                     |
| AS  | Monitor fuse                                                                                        |
| BR  | block relay with "br" contacts                                                                      |
| BV  | fuel valve                                                                                          |
| EK  | reset button                                                                                        |
| FE  | detector electrode of ionisation circuit                                                            |
| FR  | flame relay with "fr" contacts                                                                      |
| G   | ventilator motor or burner motor                                                                    |
| GP  | gas pressure switch                                                                                 |
| H   | main interruptor switch                                                                             |
| L   | block stoppage LED                                                                                  |
| LK  | air damper                                                                                          |
| LP  | air pressostat                                                                                      |
| LR  | safety regulator                                                                                    |
| M   | auxiliary contact switch for damper "MIN" position                                                  |
| QRA | UV detector                                                                                         |
| QRE | ignition spark detector                                                                             |
| R   | thermostat or pressostat                                                                            |
| S   | fuse                                                                                                |
| SA  | damper servo-motor                                                                                  |
| SM  | synchronous programmer motor                                                                        |
| V   | flame signal amplifier                                                                              |
| V   | in case of servo-motor: auxiliary contact for response to fuel valve with regard of damper position |
| W   | safety pressostat or thermostat                                                                     |
| Z   | ignition transformer                                                                                |
| Z   | in case of servomotor: end of limit contact switch for damper CLOSED position                       |
| ZBV | pilot burner fuel valve                                                                             |
| °   | for mono-tube burners                                                                               |
| °°  | for twin-tube burners                                                                               |

- (1) input for raising QRA detector voltage to test level
- (2) input for excitation of flame relay during flame detector test circuit (contact XIV) and during safety time (contact IV)
- (3) Do not press EK for more than 10 seconds

**Programmer diagram**

|                                                                                                                           |                                                                    |
|---------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------|
| t1                                                                                                                        | pre-ventilation time                                               |
| t2                                                                                                                        | safety time                                                        |
| *t2                                                                                                                       | '1st safety time                                                   |
| t3                                                                                                                        | pre-ignition time                                                  |
| *t3                                                                                                                       | 'pre-ignition time                                                 |
| t4                                                                                                                        | interval for creating current between terminals 18 and 19          |
| *t4                                                                                                                       | 'interval for creating current between terminals 17 and 19         |
| t5                                                                                                                        | interval for creating current between terminals 19 and 20          |
| t6                                                                                                                        | post-ventilation time                                              |
| t7                                                                                                                        | interval between startup consent and current created at terminal 7 |
| t8                                                                                                                        | duration of start-up                                               |
| *t9                                                                                                                       | 2nd safety time                                                    |
| t10                                                                                                                       | interval before air pressure monitoring begins                     |
| t11                                                                                                                       | damper opening travel time                                         |
| t12                                                                                                                       | damper closure travel time                                         |
| t13                                                                                                                       | permissible post-combustion time                                   |
| t16                                                                                                                       | initial delay of damper OPEN response                              |
| t20                                                                                                                       | interval before programmer automatically stops                     |
| * These times are valid with the use of a series 01 safety device for monitoring burners with intermittent pilot lighter. |                                                                    |

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### VALVE PROVING SYSTEM SIEMENS LDU11

The LDU11... gas valve proving system is designed for use in gas-fired plant equipped with two safety shutoff valves. During each startup cycle, the control unit automatically programs the valve proving test and, in the event of a leak, prevents burner startup.

The LDU11... control unit is designed to provide automatic gas valve proving (leakage test) based on the pressure proving principle. It is for use in gas-fired plant with or without vent pipe to the atmosphere. For plants without vent pipe, where DIN/DVGW regulations apply, refer to the hints given on "Connection examples with vent pipe to the atmosphere".

Gas valve proving is initiated automatically with every burner startup using one or two standard pressure monitors, either

- prior to burner startup,
- during the pre-purge time, if it lasts at least 60 s,
- immediately after the controlled shutdown, or
- on completion of the burner control's control program, e.g. on completion of the post-purge time

The valve proving test is based on the two-stage pressure proving principle: first, the valve on the mains side is tested by evacuating the test space and by monitoring the atmospheric pressure in it. Then, the valve on the burner side is checked by pressurizing the test space and by monitoring the gas pressure. If the pressure increases excessively during the

first test phase (Test 1), or decreases excessively during the second test phase (Test 2), the control unit inhibits burner startup and goes to lockout. In that case, the lockout reset button lights up to indicate the fault. Remote indication of the fault is also possible.

A program indicator, which stops whenever a fault occurs, indicates which of the two valves is leaking.

**Mode of operation**

To carry out the first phase of the valve proving test, called "Test 1", there must be atmospheric pressure in the length of pipe between the two valves to be tested. In plants with a vent to the atmosphere, this pressure is available if the valve proving test is conducted prior to or during the pre-purge time. In plants without a vent pipe, atmospheric pressure is made available as the control unit opens the valve on the burner side during the time "t4". If the valve proving test is performed after the operation of the burner, the valve on the burner side after the controlled shutdown can be kept open until "t4" has elapsed, thus reducing the pressure in the test space and making certain its gas content is burnt off in the combustion chamber during the post-purge time. A prerequisite for this procedure is an appropriate control program of the burner control as provided by Landis & Staefa burner controls type LFE..., LFL..., LGK... or LEC.... The test space is closed off after it has been evacuated.

During the first test phase (Test 1) which follows immediately, the control unit checks if the atmospheric pressure in the test space is maintained using the pressure monitor. If the valve on the mains side is leaking, causing the pressure to rise above the switching point of the pressure monitor, the control unit initiates an alarm and goes to lockout.

The program indicator then stops and indicates "Test 1".

If the pressure does not increase because the valve closes correctly, the control unit immediately programs the second test phase (Test 2). To do this, the valve on the mains side is pressurized ("filling" of test space). During the second test phase, the pressure may not fall below the switching point of the pressure monitor due to a leak of the valve on the burner side.

If it does, the control unit goes to lockout again, thus inhibiting burner startup.

On the successful completion of the second test phase, the control unit closes the internal control loop between terminals 3 and 6 (circuit path: terminal 3 - contact "ar 2" - terminals 4 and 5 - contact III - terminal 6). This control loop is usually included in the start control loop of the burner control.

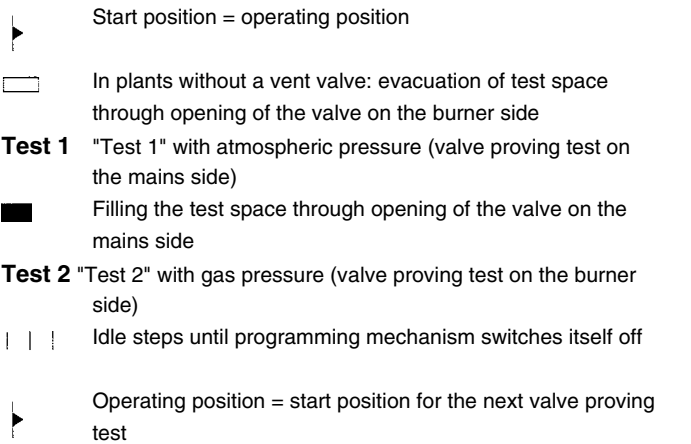
After the control loop has been closed, the programming mechanism of the control unit returns to its start position where it switches itself off. During these "idle steps", the position of the control contacts of the programming mechanism remains unchanged.

**Program and lockout indicator**

When the unit goes to lockout, the programming mechanism stops and also the position indicator fitted to the spindle of the mechanism. The symbol that stops above the reading mark not only indicates during which test phase lockout occurred, but also after how many programming steps within the test phase (1 step = 2.5 seconds).

**Specifications**

|                                                       |                                                                                                   |
|-------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| Mains voltage                                         | AC 220 V -15 %...240 V +10 % AC 100 V -15 %...110 V +10 % Mains frequency 50 Hz -6 %...60 Hz +6 % |
| Power consumption                                     |                                                                                                   |
| - during the test                                     | 3.5 VA                                                                                            |
| - during burner operation                             | 2.5 VA                                                                                            |
| Prefuse (externally)                                  | T16/500 V                                                                                         |
| Unit fuse                                             | T6,3H250 V to IEC 127                                                                             |
| Radio interference protection                         | N to VDE 0875                                                                                     |
| Perm. input current at terminal                       | 15 A continuous to VDE 0660 AC3                                                                   |
| Environmental conditions:                             |                                                                                                   |
| Temperature                                           | -50...+60 °C                                                                                      |
| Humidity                                              | < 95 % r.h.                                                                                       |
| Mechanical conditions                                 | class 2M2                                                                                         |
| Climatic conditions                                   | class 3K5                                                                                         |
| Temperature                                           | -20...+60 °C                                                                                      |
| Humidity                                              | < 95 % r.h.                                                                                       |
| Condensation, formation of ice and influence of water | are not permitted                                                                                 |
| Perm. current rating of control terminals             | 4 A to VDE 0660 AC3                                                                               |
| Required switching capacity of pressure switch "DW"   | 1 A min., AC 250 V                                                                                |
| Mounting position                                     | optional                                                                                          |
| Degree of protection                                  | IP40                                                                                              |
| Weight                                                |                                                                                                   |
| control unit approx.                                  | 1000 g                                                                                            |
| base approx.                                          | 165 g                                                                                             |
| CE conformity                                         | According to the directives of the European Community                                             |
| Electromagnetic compatibility                         | EMC 89/336                                                                                        |
| EWG include.                                          | 92/31 EEC, Gas appliance directive 90/396 EEC                                                     |
| Emissions                                             | EN 50081-1                                                                                        |
| Immunity                                              | EN 50082-2                                                                                        |



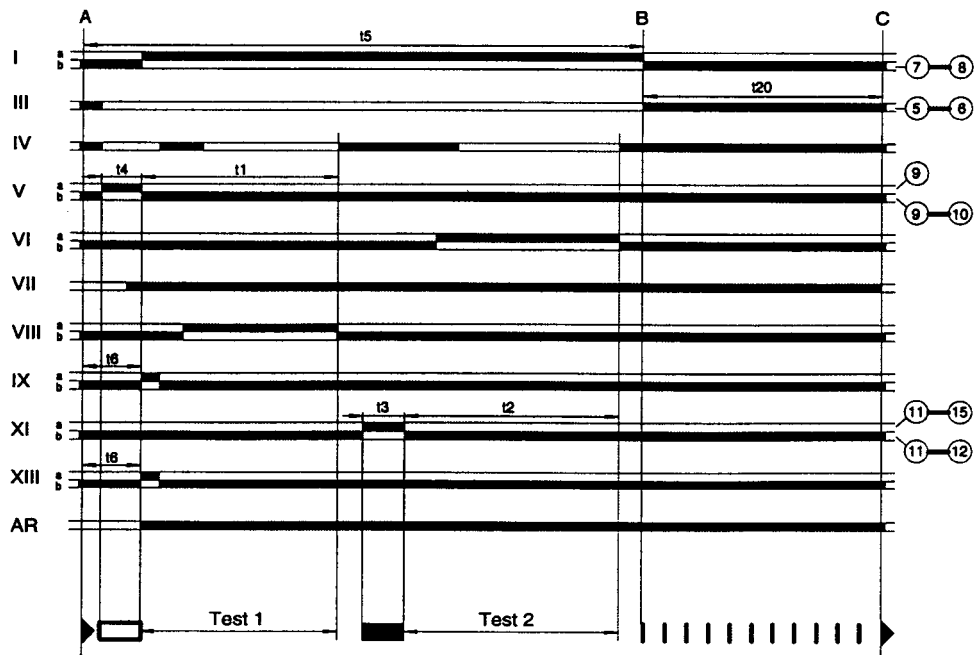
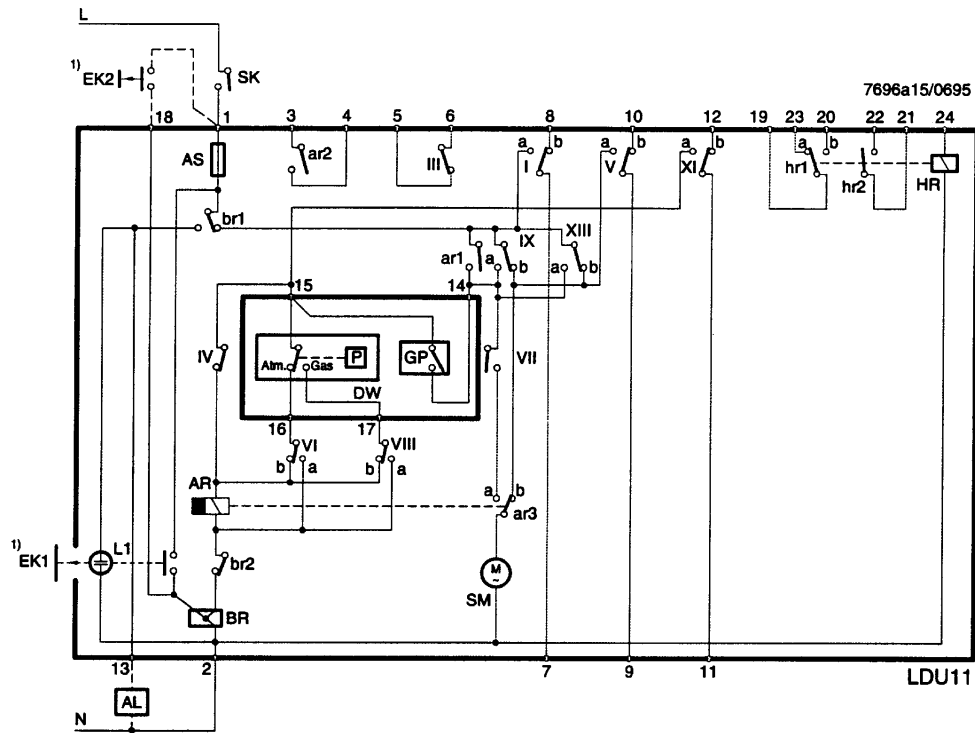
In the event of lockout, all terminals receiving voltage from the control unit are de-energized, except terminal 13, which is used for lockout indication. After the unit has been reset, the programming mechanism automatically returns to its start position and immediately reprograms a new valve proving test.

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

**Control program after a power failure**

A power failure prior to evacuating the test space does not cause the program sequence to change.

If a power failure occurs after the evacuation, the valve proving test will not be continued when power is restored, but the programming mechanism first returns to its start position to reprogram the complete proving test.



#### KEY

- AL Alarm signal "Leaking valve"
- AR Main relay with contacts "ar..."
- AS Built-in fuse
- BR Lockout relay with contacts "br..."
- DW Pressure monitor for valve proving test (does not replace the gas pressure monitor used to signal lack of gas)
- EK... Lockout reset button
- GP Gas pressure monitor (for lack of gas)
- HR Auxiliary relay with contacts "hr..."
- L1 Built-in lockout warning lamp
- SM Synchronous motor of programming mechanism
- SK Mains switch

#### Warning notes

- The electrical wiring must comply with local and country-specific standards and regulations!
- The LDU11... must be completely isolated from the mains before per-

forming any work on it!

- The LDU11... is a safety device. It is therefore not permitted to open, interfere with or modify the unit!
- Check wiring carefully before putting the unit into operation!
- Check all safety functions when putting the unit into operation or after replacing a fuse!
- Ensure protection against electric shock hazard on the unit and at all electrical connections through appropriate mounting!
- Electromagnetic emissions must be checked from an application point of view!
- The regulations and standards covering the specific application must be observed!
- All installation and commissioning work must be carried out by qualified personnel!
- In the geographical areas where DIN standards are in use, the installation must be in compliance with VDE requirement, particularly with the standards DIN/VDE 0100 and 0722!
- Condensation and ingress of humidity must be avoided!
- Ignition cable must always be laid separately, observing the greatest possible distance to other cables!



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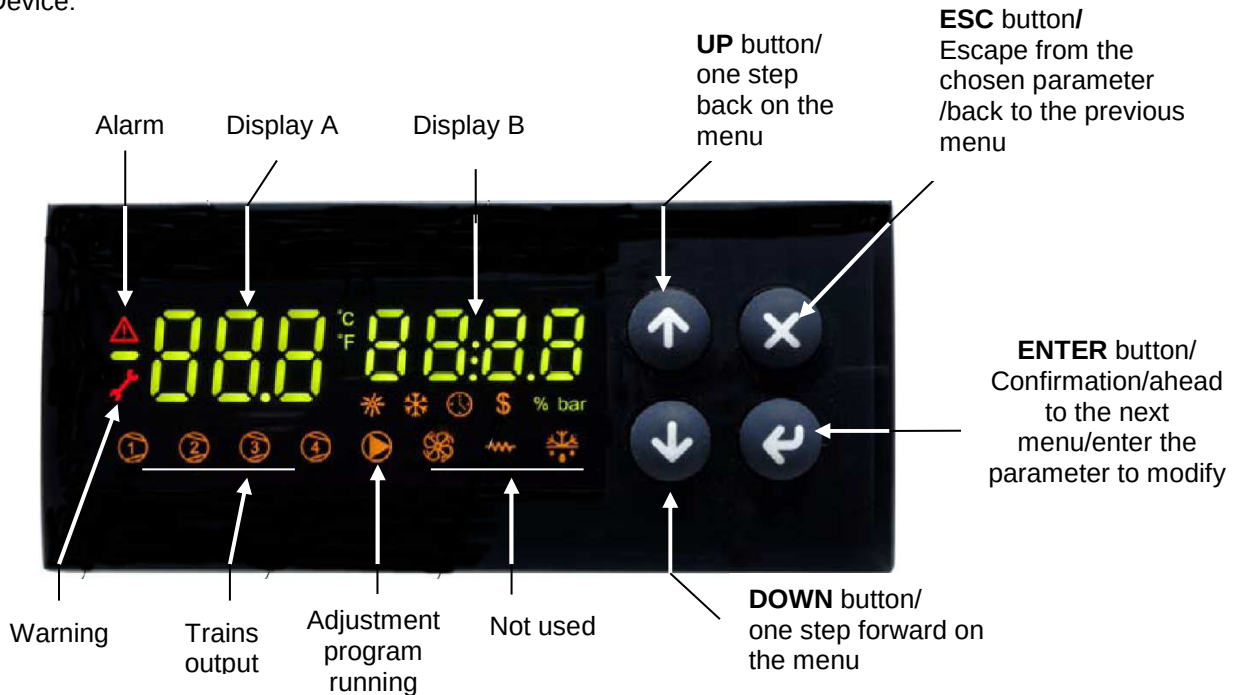
Note: specifications and data subject to change. Errors and omissions excepted.

# USER MANUAL OF MULTI-THERMOSTAT MCX06C

MCX06C is a multi-thermostat with four 100k NTC inputs. It can control up to 4 temperatures showing them (not more than 2 at the same time) on a couple of displays.  
It is used to check and adjust oil heater temperatures.

## User interface:

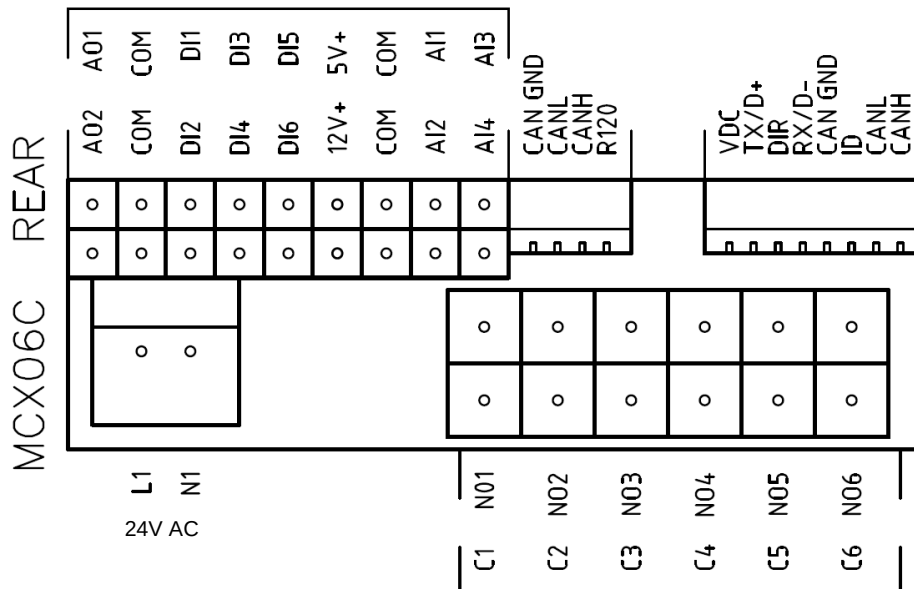
Device:



Note :

In normal operation, the display A shows the oil tank resistor temperature (probe Pb1).  
In normal operation, the display B shows the oil output temperature (probe Pb3).

## Connections from terminal side:



## Probe connection:

input **AI1** = probe **Pb1** = set-point "tr" = oil heater temperature probe;  
input **AI2** = probe **Pb2** = set-point "tCl" = plant consent temperature probe (when installed);  
input **AI3** = probe **Pb3** = set-point "OIL" = oil heater output temperature probe (PID regulation);  
input **AI4** = probe **Pb4** = set-point "tcn" = oil heater consent temperature probe.

**Menu:**

To enter the menu below, keep pushing **ENTER** for more than 3 s.

| Menu code | Sub-menu code | Function               | Notes                                                                                                                                                                                            |
|-----------|---------------|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Prb       |               | Probes values          | You can see in sequence the 4 probe values (UP and DOWN keys): the probe code is on display A (Pb1,..., Pb4) and the probe value is on display B (not fitted or out of work probes show "----"). |
| Log       |               | Login                  | It defines the access level to menu and parameters (password)                                                                                                                                    |
|           | PAS           | Password               | Password input                                                                                                                                                                                   |
| Par       |               | Parameters menu        | Access to parameters (you have to login first)                                                                                                                                                   |
|           | CnF           | Configuration menu     | Parameter configuration                                                                                                                                                                          |
|           | rEG           | Regulation menu        | Set to set-point, probe, thresholds etc.                                                                                                                                                         |
| ALA       |               | Alarm menu             | Access to alarm management                                                                                                                                                                       |
|           | Act           | Active alarms          | Show the active alarms                                                                                                                                                                           |
|           | rES           | Reset alarms & Warning | Reset of the manual reset alarms and warning                                                                                                                                                     |
| Loc       |               | Lock/Unlock functions  | Not used                                                                                                                                                                                         |
| InF       | rEL           | Software version       | Installed software version                                                                                                                                                                       |
| tUN       |               | Autotuning             | Activation On, deactivation ESC<br>PID parameter autotuning                                                                                                                                      |

**Alarms & Warning:**

When the red triangle on the top left lights, one or more alarms are activated.

When the red key on the left lights, the output N05-C5 is active and the relay **KTRS** switches the resistors OFF.

Check the reason, correct the failure and, as soon as the temperature is lower than **trS**, reset it through **ALA/rES**.

In order to show active alarms and warnings, select the relevant menu through **ALA/Act**.and, using the **UP** and **DOWN** buttons, scroll the lines.

In order to perform the manual reset, select **ALA/rES**.

| Code | Description                      | Sourse                | Active simbol | Reset type |
|------|----------------------------------|-----------------------|---------------|------------|
| trS  | High temperature resistors alarm | probe Pb4 > value trS | red key       | Manual     |
| EP1  | Probe Pb1 fault                  | Probe Pb1 fault       | red triangle  | Automatic  |
| EP2  | Probe Pb2 fault                  | Probe Pb2 fault       | red triangle  | Automatic  |
| EP3  | Probe Pb3 fault                  | Probe Pb3 fault       | red triangle  | Automatic  |
| EP4  | Probe Pb4 fault                  | Probe Pb4 fault       | red triangle  | Automatic  |

**Set point adjustment:**

All the parameters inside the **Par** menu are locked by a password.

The user can modify only set points (menu **rEG**), without using any passwords.

The oil viscosity at the nozzle, should be about 1,5<sup>°E</sup>, which guarantees correct and safe functioning of the burner.

The temperature values in the table, guarantee the respect of that parameter and are valid when the pre heating tank is installed on the burner. For different configurations, please refer to the chapter "Recommendations to design heavy oil feeding plants" in the burner manual.

Here below recommended set points:

| Menu path |     |     |                                                       | Oil viscosity at 50 °C according to the letter shown in the burner model |            |                       |                        |                         |
|-----------|-----|-----|-------------------------------------------------------|--------------------------------------------------------------------------|------------|-----------------------|------------------------|-------------------------|
|           |     |     |                                                       | <b>P</b>                                                                 | <b>N</b>   | <b>E</b>              | <b>D</b>               | <b>H</b>                |
|           |     |     |                                                       | 89 cSt                                                                   | < 50 cSt   | > 50 cSt<br>< 110 cSt | > 110 cSt<br>< 400 cSt | > 400 cSt<br>< 4000 cSt |
|           |     |     |                                                       | 12 °E                                                                    | < 7°E      | > 7 °E<br>< 15 °E     | > 15 °E<br>< 50 °E     | > 50 °E<br>< 530 °E     |
| Par       |     |     |                                                       |                                                                          |            |                       |                        |                         |
| rEG       | Pb1 | tr  | Oil heater temperature probe                          | parameter not visible                                                    |            |                       |                        |                         |
|           | Pb2 | tCl | Plant consent temperature probe (when installed)      | 20 °C                                                                    | 70 °C      | 70 °C                 | 70 °C                  | ---                     |
|           | Pb3 | Oil | oil heater output temperature probe (PID regulation); | 60-70 °C                                                                 | 110-120 °C | 120-130 °C            | 130-140 °C             | 140-150 ° C             |
|           |     | SP0 | Set-point oil heater with oil pump stopped (stand-by) | 45 °C                                                                    | 120 °C     | 130 °C                | 140 °C                 | 150 °C                  |
|           | Pb4 | tcn | Oil heater consent temperature probe                  | 40 °C                                                                    | 100 °C     | 100 °C                | 110 °C                 | 120 °C                  |
|           |     | trS | Safety temperature tank resistors (manual reset)      | 120 °C                                                                   | 190-200 °C | 190-200 °C            | 190-200 °C             | 190-200 °C              |

The above temperature values are suggested and refer to a plant designed according to the prescriptions in the burner user manual. The suggested values can change in reference to the fuel oil specifications.



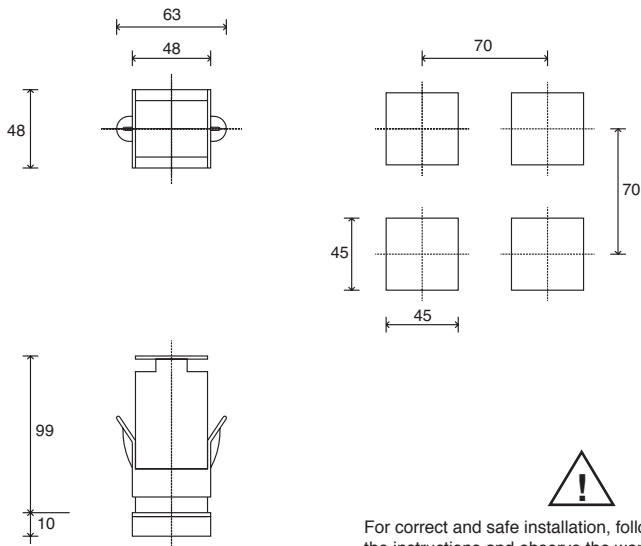
## USER'S MANUAL

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<br>60mV, 1V Ri $\geq$ 1M $\Omega$ ; 5V, 10V Ri $\geq$ 10K $\Omega$ ; 20mA Ri=50 $\Omega$<br>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)<br>Max line resistance for RTD | DIN 43760 (Pt100), JPT100<br>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<br>- 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%<br>(opt.) 11...27Vac/dc $\pm$ 10%;<br>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)

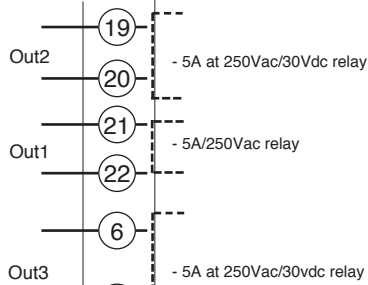
#### SV display: Indication of setpoint

#### Function key

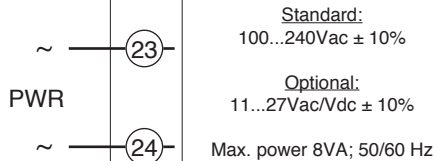
Gives access to the various configuration phases • Confirms change of set parameters and browses next or previous parameter (if Auto/Man key is pressed)

### 4 • CONNECTIONS

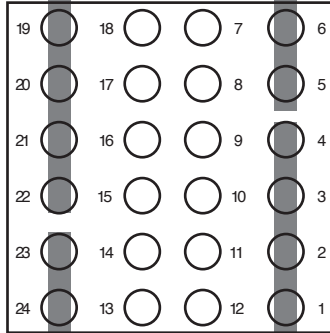
#### • Outputs



#### • Power Supply



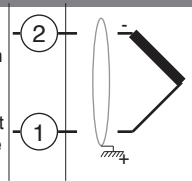
TOP



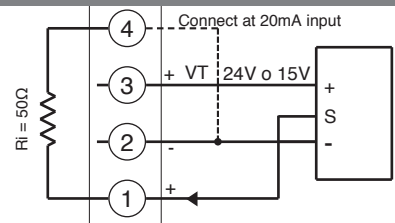
#### • Inputs

##### • TC Input

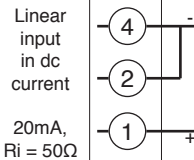
Available thermocouples:  
 J, K, R, S, T  
 (B, E, N, L, U, G, D, C custom linearization is available)  
 - Observe polarities  
 - For extensions, use the correct compensating cable for the type of TC used



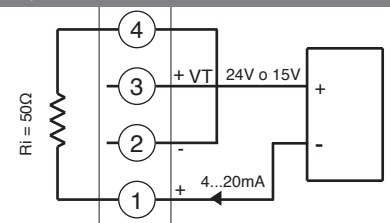
##### • Linear input with 3-wire transmitter



##### • Linear input (I)



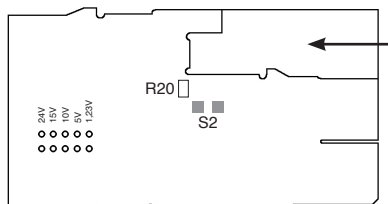
##### • Input 1 linear with transmitter 2 wires



#### • Identification of boards

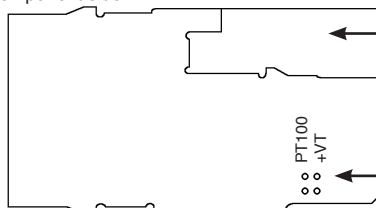
Power board - Solder side

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

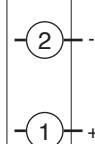


IN/OUT boards (see appendix)

Select signal at contact 3

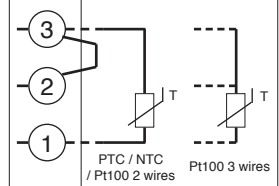
##### • Linear input (V)

Linear input in dc voltage  
 60mV, 1V  
 Ri > 1MΩ  
 5V, 10V  
 Ri > 10KΩ

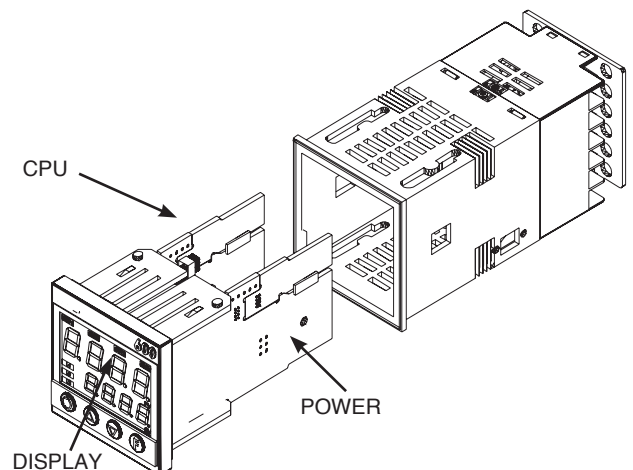


##### • Pt100 / PTC / NTC

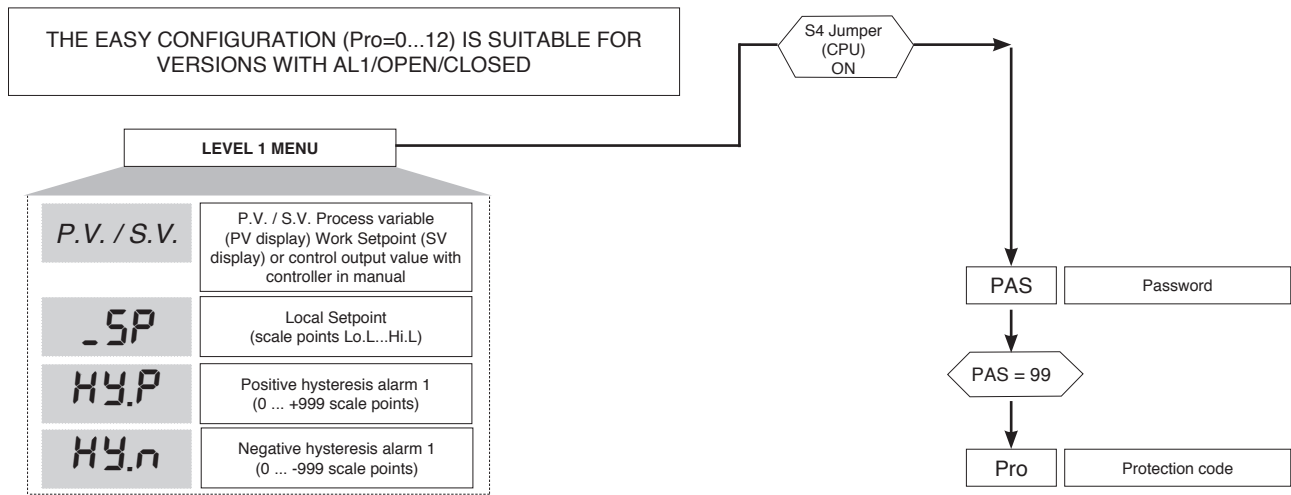
Use wires of adequate diameter (min. 1mm²)  
 PT100, JPT100, PTC, NTC



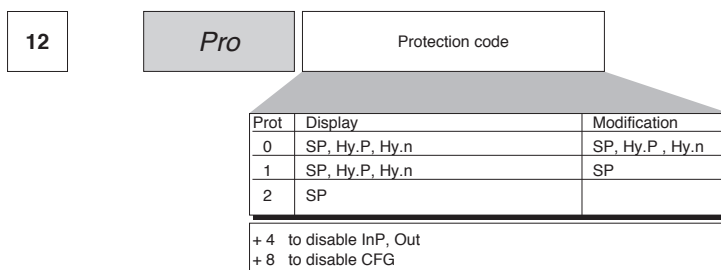
#### • Device structure



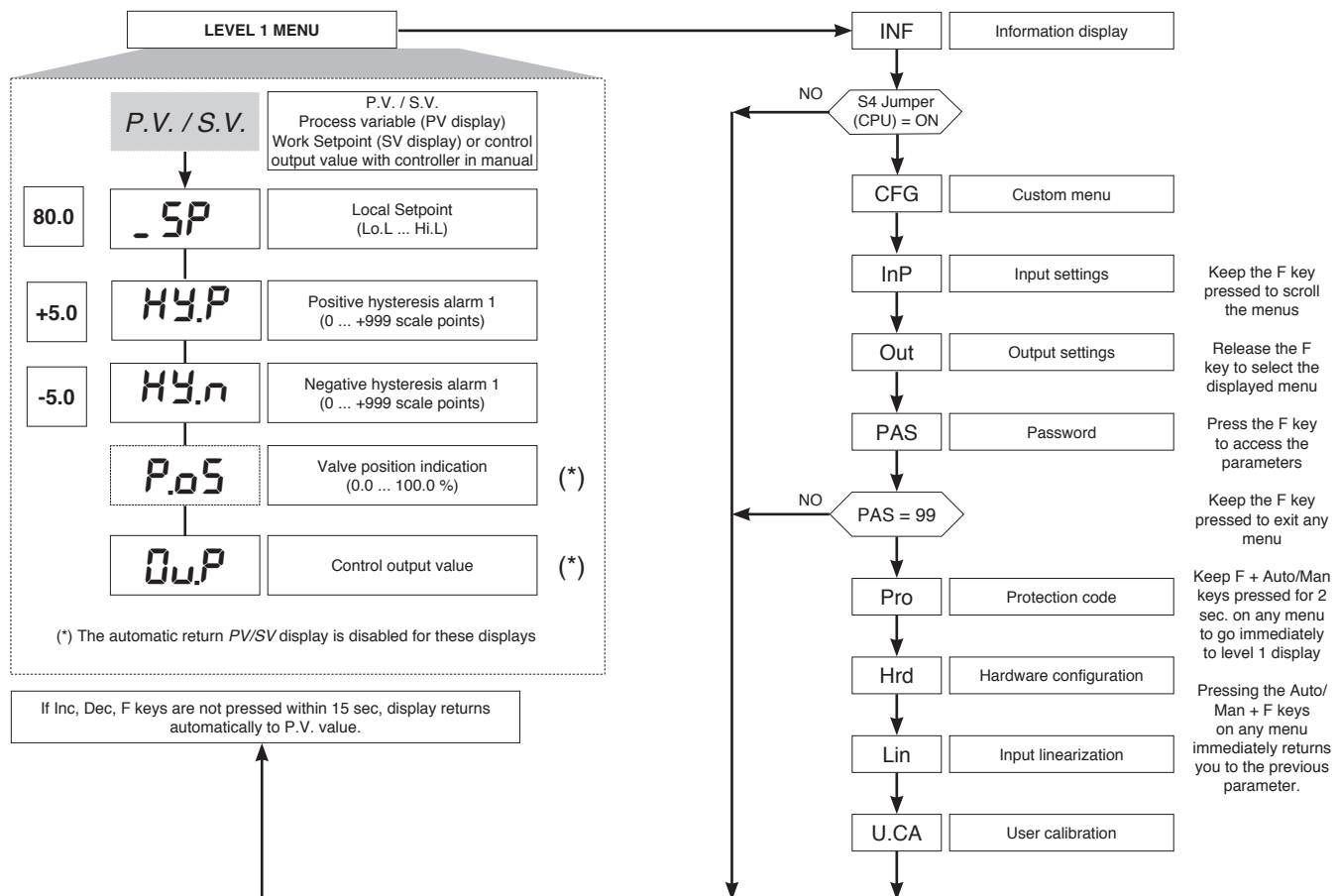
## 5 • “EASY” PROGRAMMING and CONFIGURATION



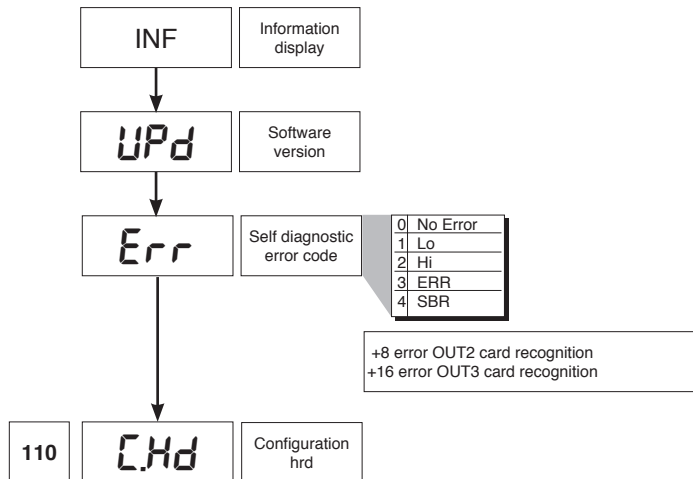
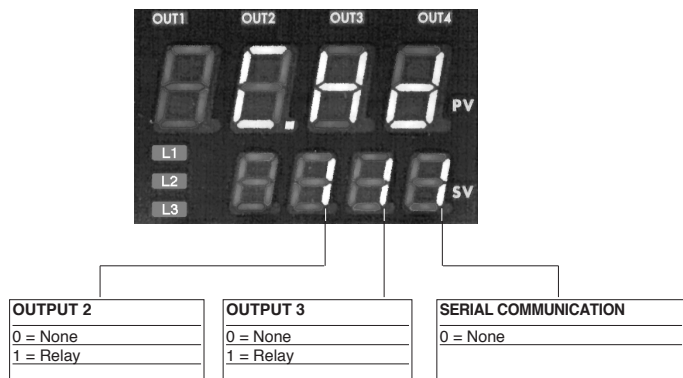
### • Prot



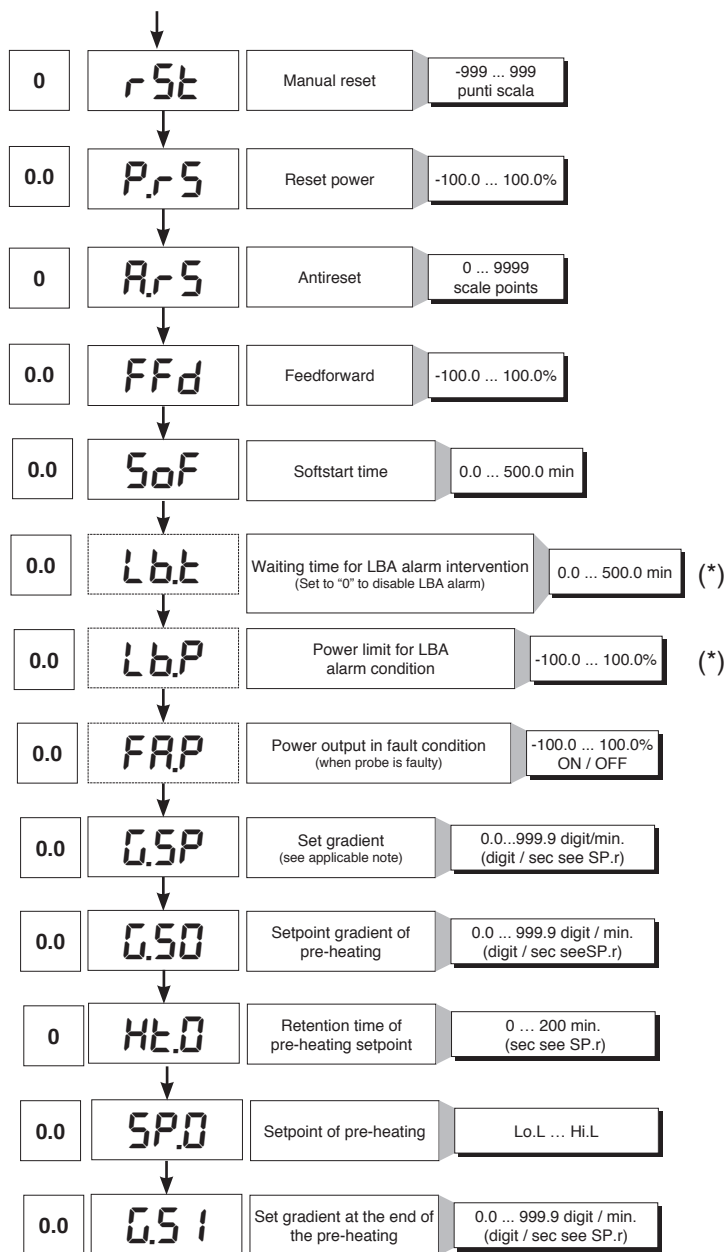
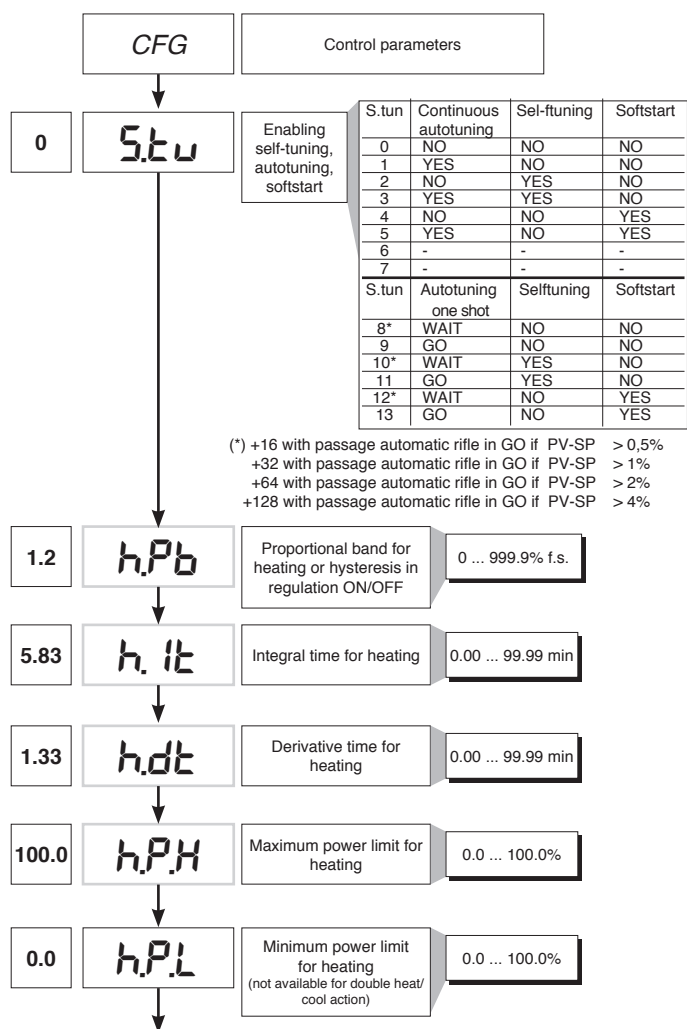
## 6 • PROGRAMMING and CONFIGURATION



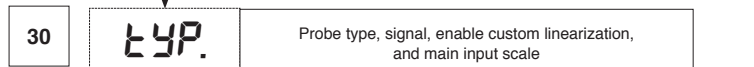
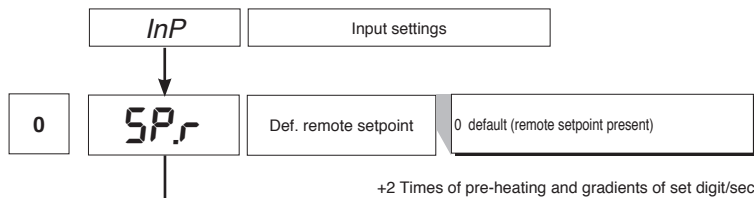
**N.B.:** Once a particular configuration is entered, all unnecessary parameters are no longer displayed



• CFG



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



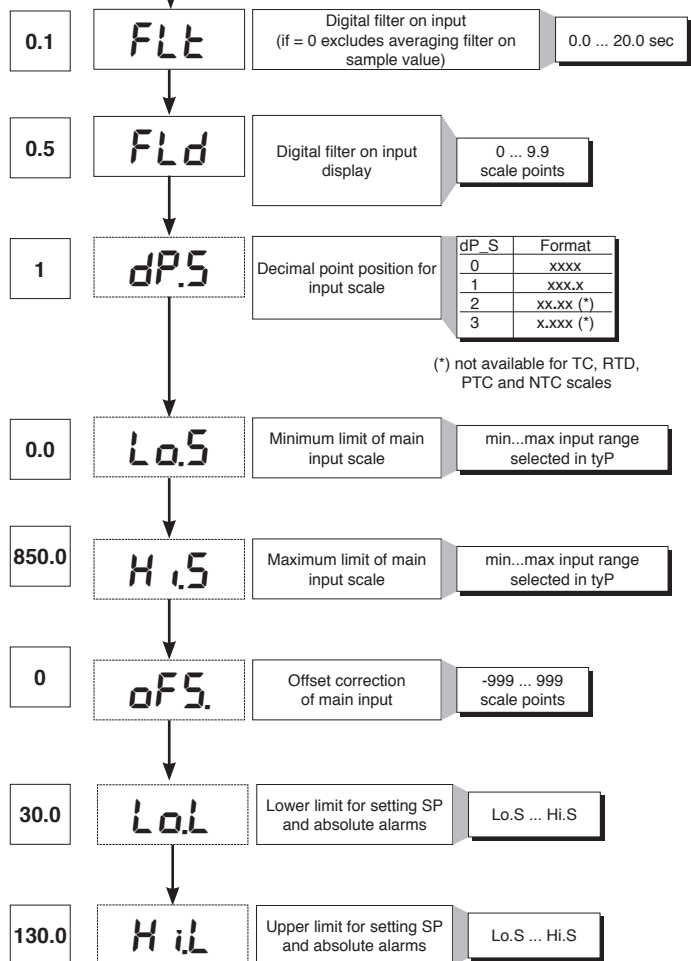
| Type | Probe type    | without decimal point | with decimal point |
|------|---------------|-----------------------|--------------------|
|      | Sensore:      | TC                    |                    |
| 0    | TC J °C       | 0/1000                | 0.0/999.9          |
| 1    | TC J °F       | 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             |

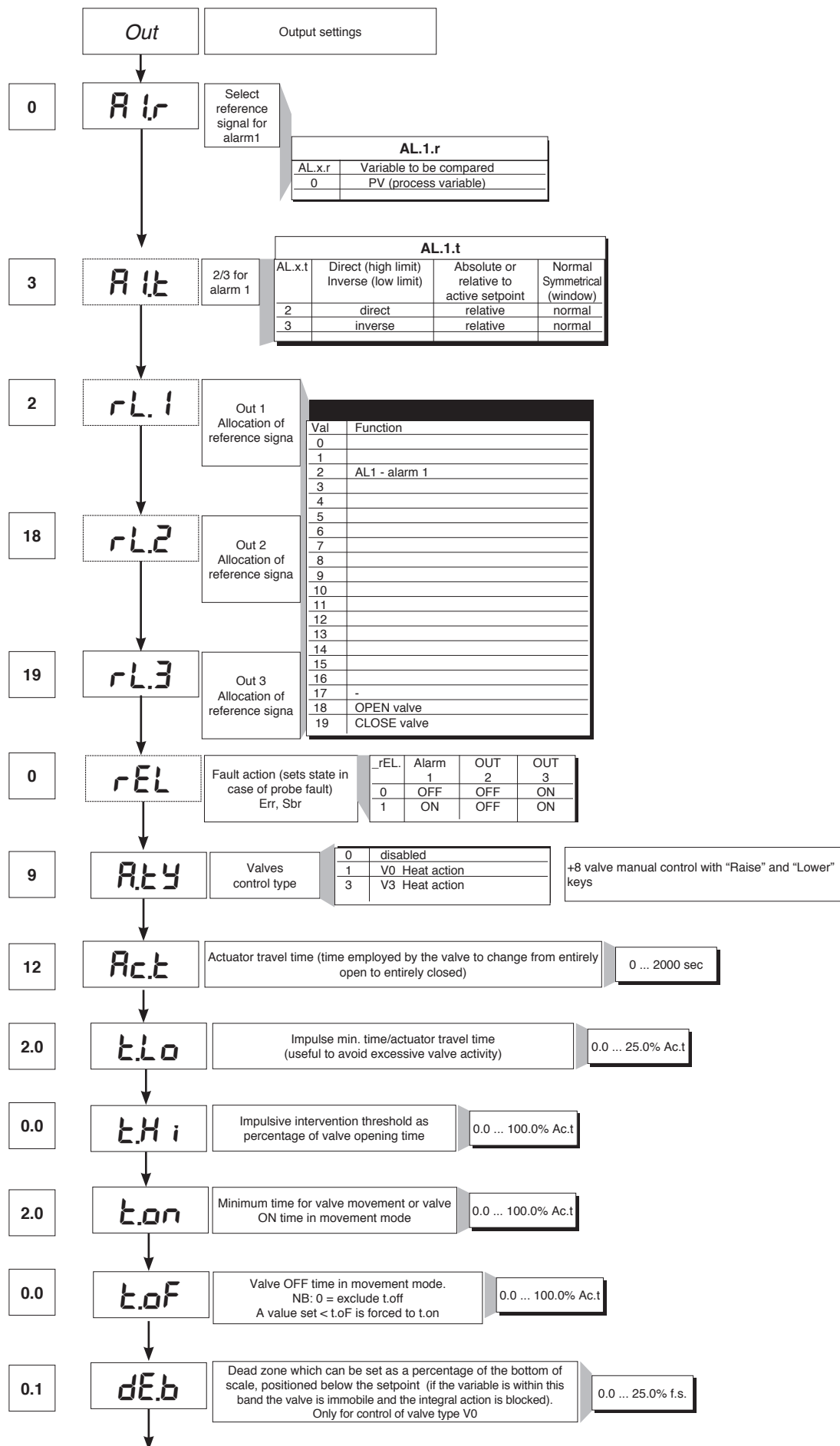
For custom linearization:  
 - LO signal is generated with variable below Lo.S or at minimum calibration value  
 - HI signal is generated with variable above Lo.S or at maximum calibration value

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       |                               |

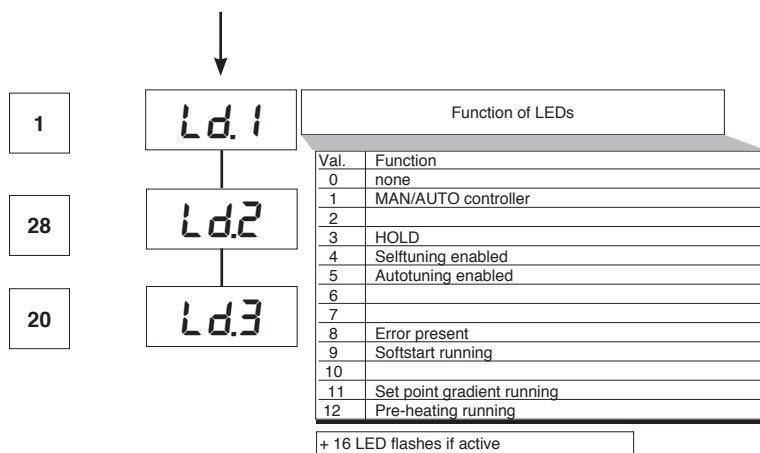
+ 16 disables the "back menu" function (Auto/Man + F keys) in the configuration menus

0

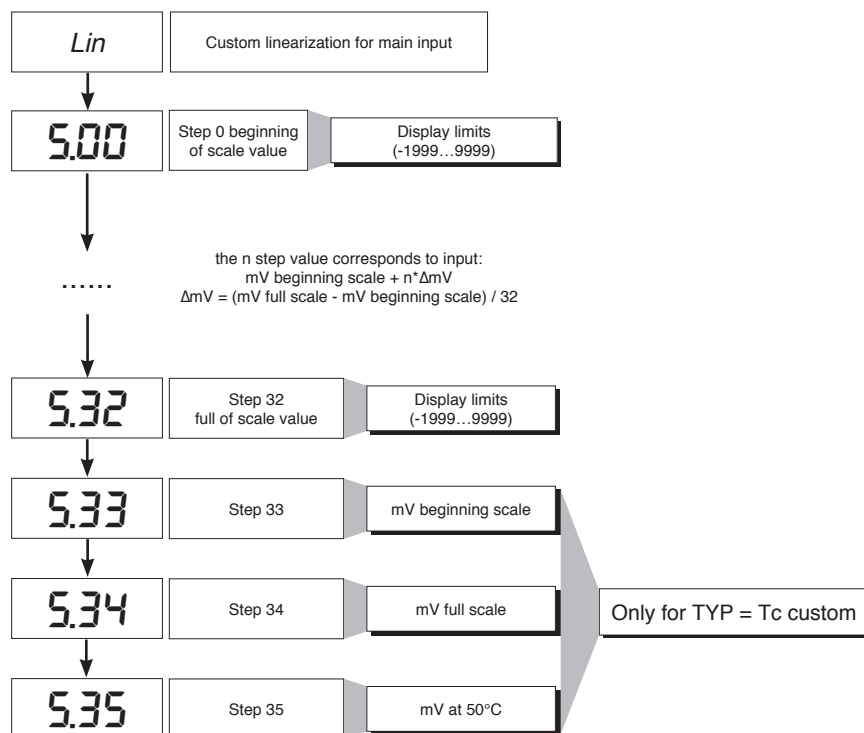
*dSP*

Defining SV display function

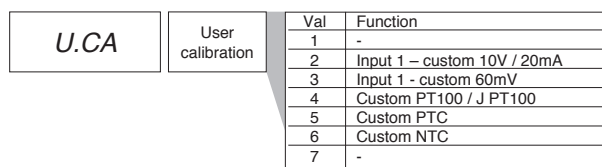
| diSP | Lower display (SV) function |
|------|-----------------------------|
| 0    | SSP - setpoint enabled      |
| 1    | PoS - valve position        |
| 2    | Control output value        |
| 3    | Deviation (SSP - PV)        |

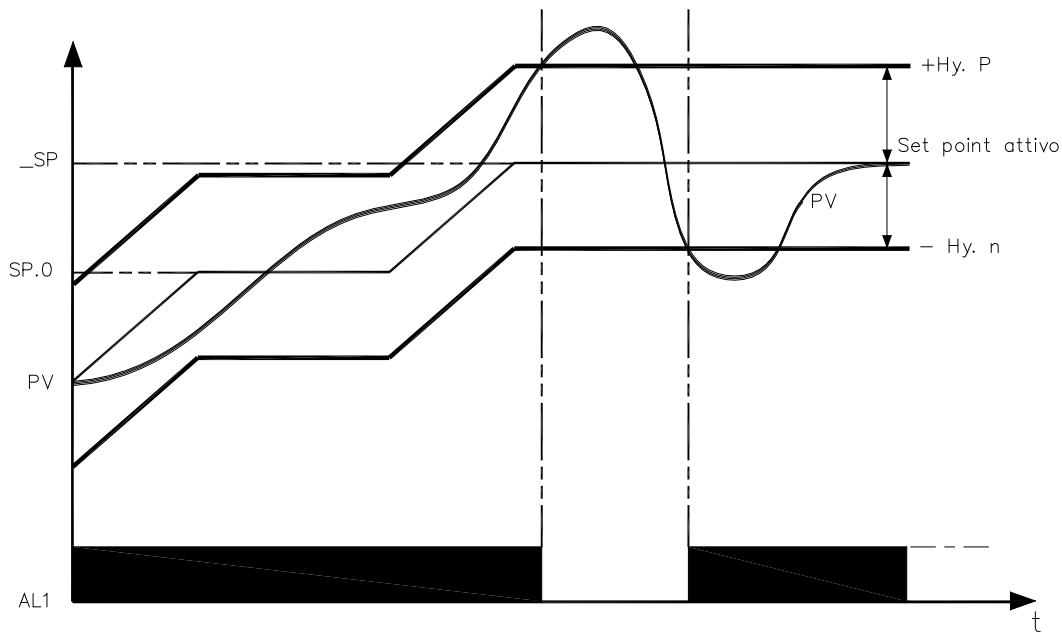


## • Lin



## • U.CAL





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

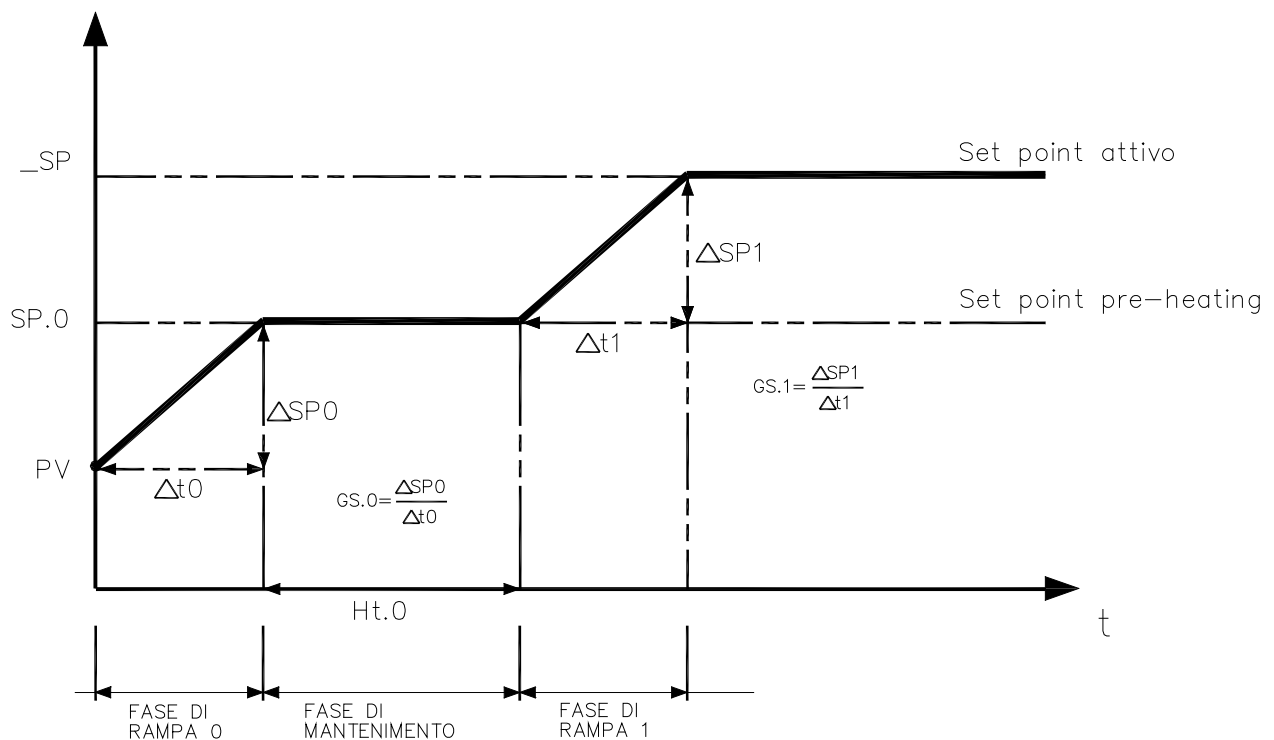
### - Maintenance phase

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



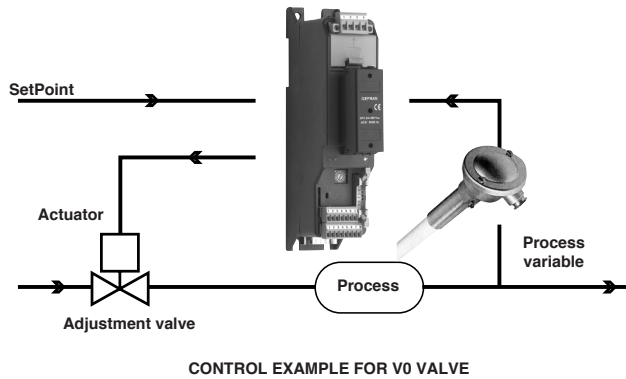
## 9 • ADJUSTMENT WITH MOTORIZED VALVE

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  $t.oF > 0$ .

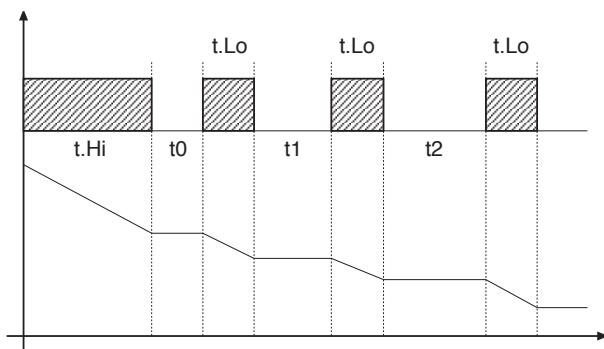
The type of movement approach allows fine control of the reverse drive valve (from potentiometer or not), especially useful in cases of high mechanical inertia.

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

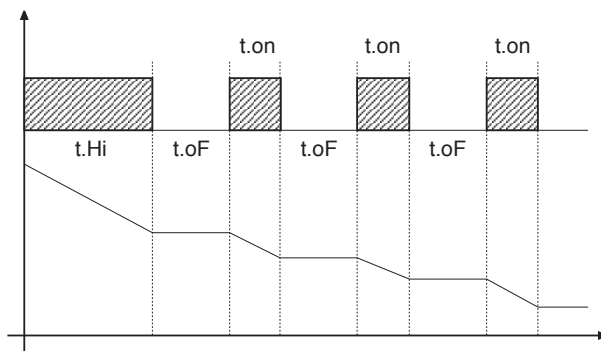
When the difference between the position calculated by the controller and the only proportional component exceeds the value corresponding to the minimum impulse t.Lo the controller provides an OPEN or CLOSE command of the duration of the minimum impulse itself t.Lo. At each delivery the integral component 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.

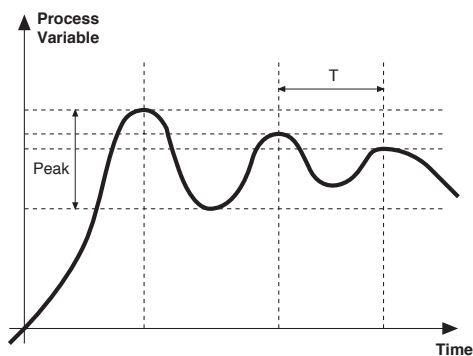
### Influence of Proportional, Derivative and Integral actions on response of process under control

- \* 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

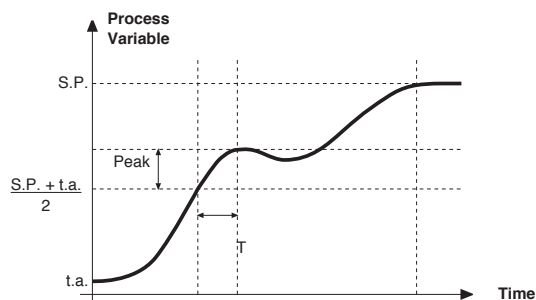
1. Make sure that key M/A is enabled for Start/Stop selftuning (code but = 6 Hrd menu)
2. Bring the temperature near room temperature
3. Set the setpoint to the required value
4. Press key M/A to activate selftuning (Attention: selftuning interrupts if the key is pressed again)

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:

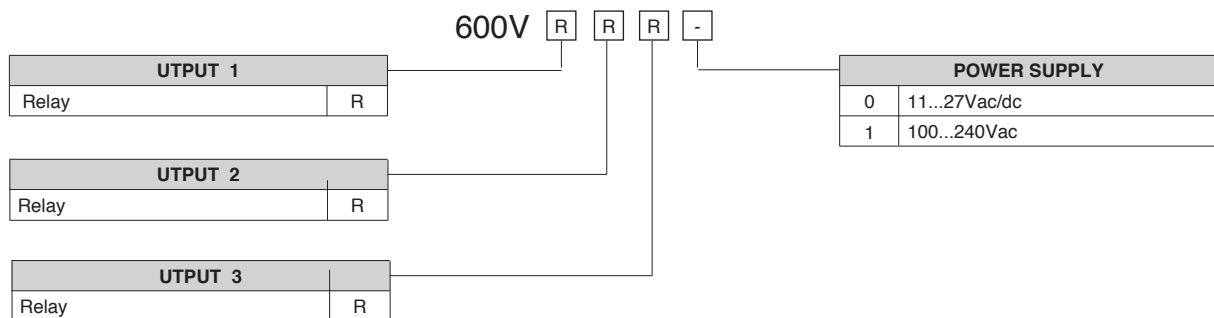
- Connection cable PC USB ... port TTL
- Connection cable PC USB ... RS485 port
- Serial line converter
- CD SW GF Express installation

### • 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.**

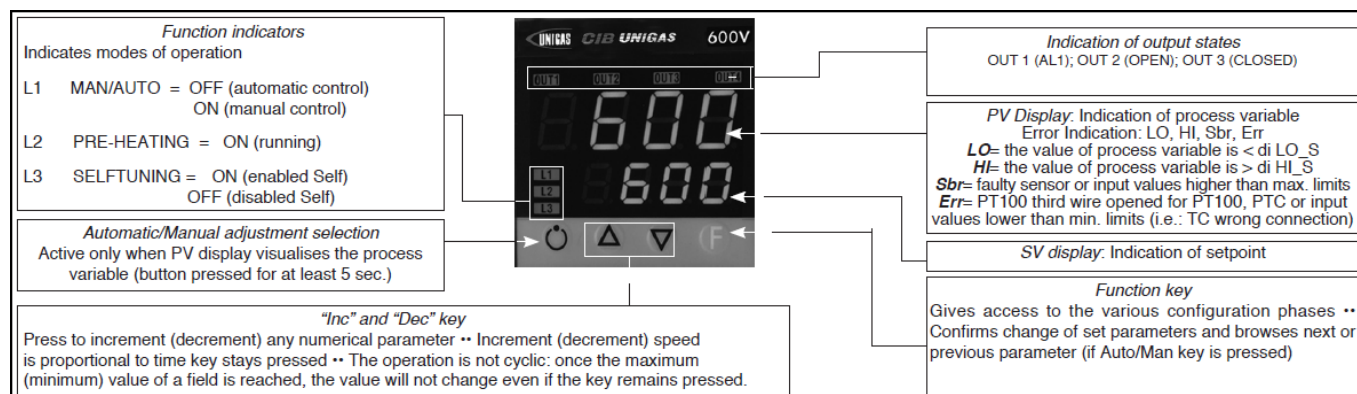


## Set-up for 600V RRR0-1-T73 regulator

### 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;<br>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.

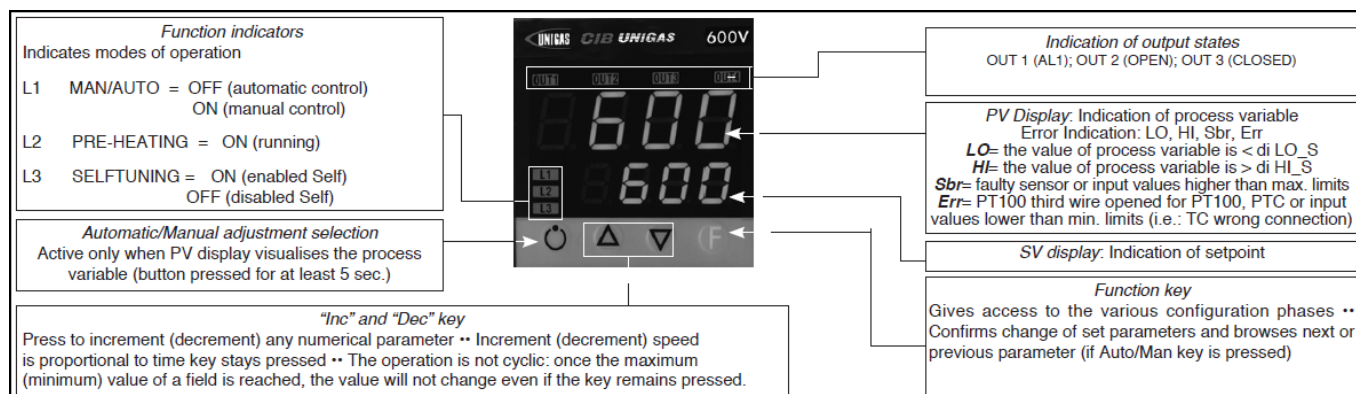
#### Software switch off :

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;<br>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.

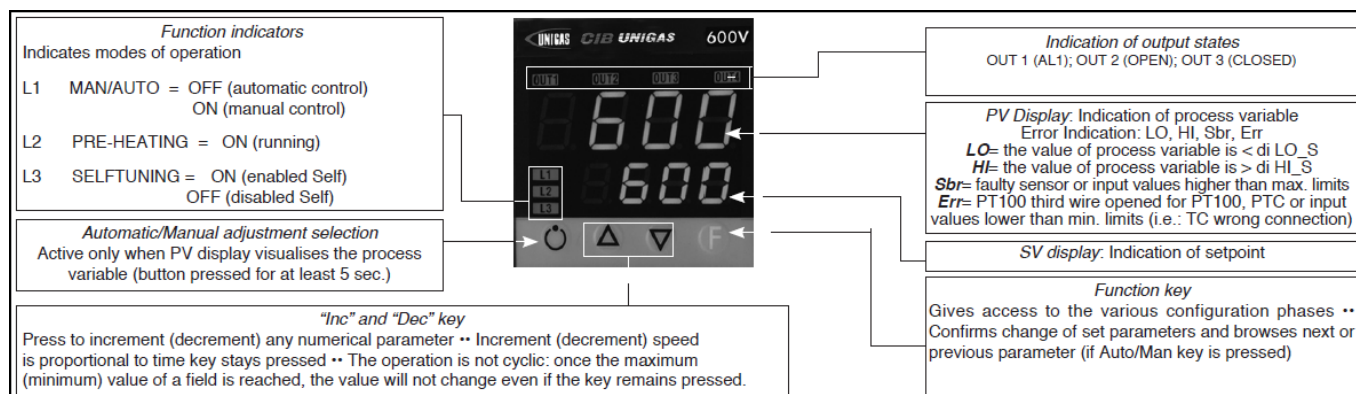
To come back to normal working keep the lower left key pushed for at least 5 sec.

#### Software switch off :

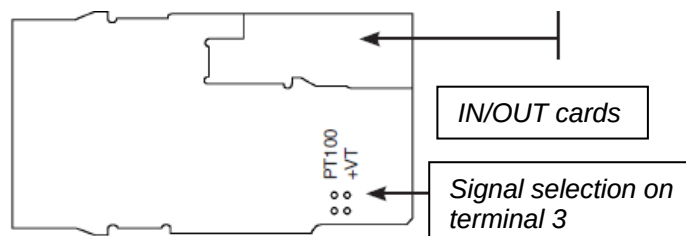
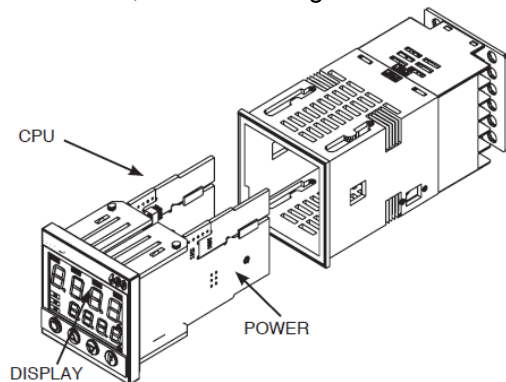
By keeping pushed keys **Arrow up** + **F** for more than 5 sec. the instrument switches off the software, does not command the outputs and visualize only the variable of process measured by the probe.

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;<br>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.

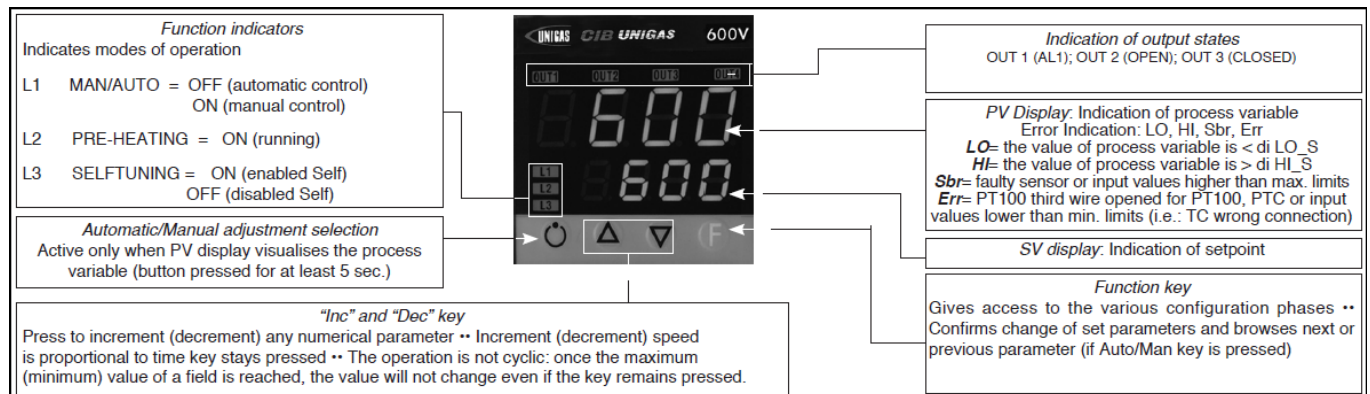
#### Software switch off :

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;<br>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

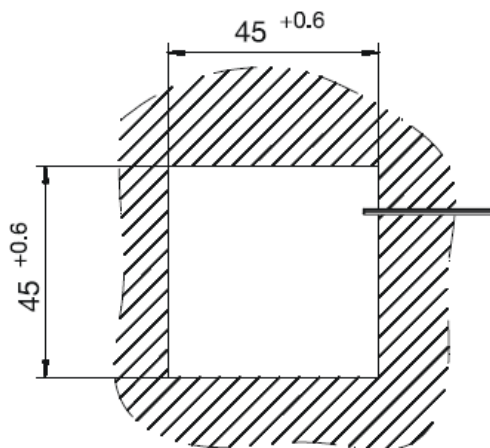
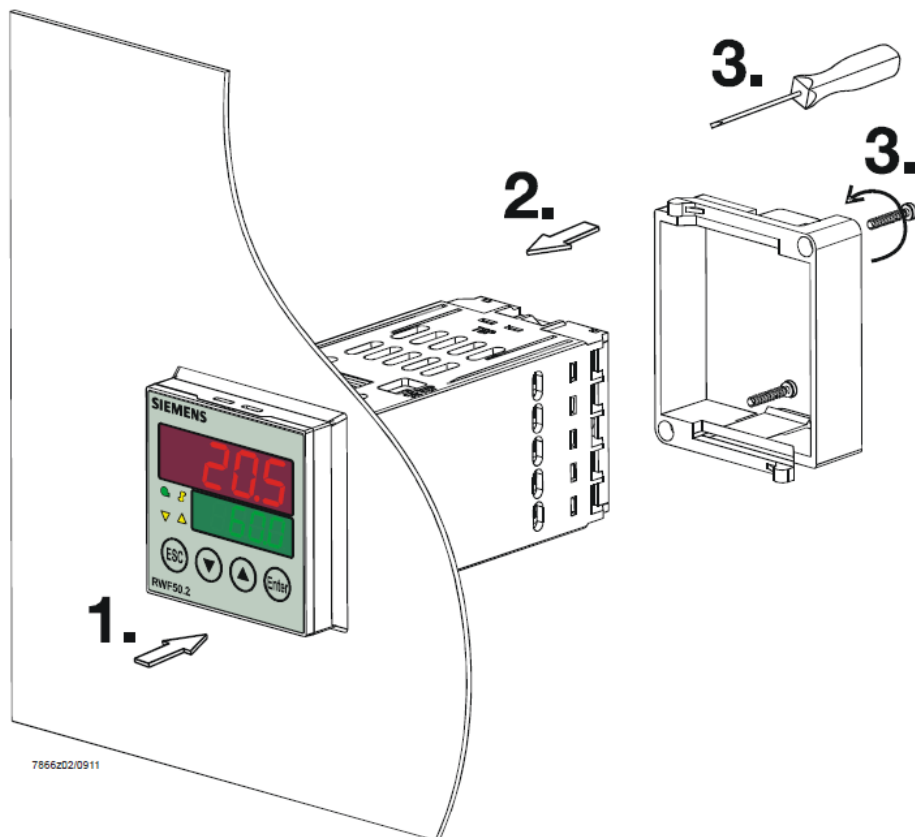


*User manual*

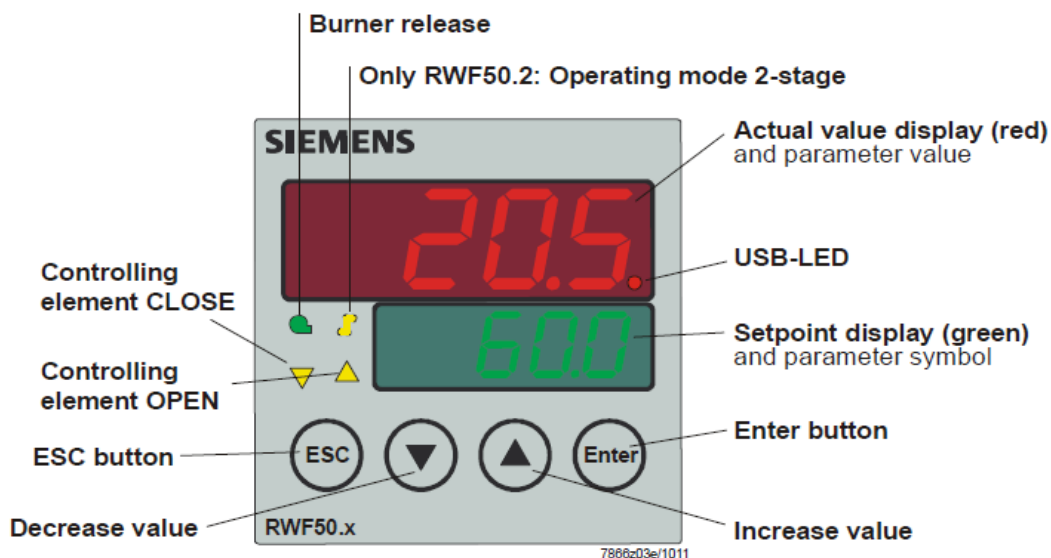
## DEVICE INSTALLATION

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

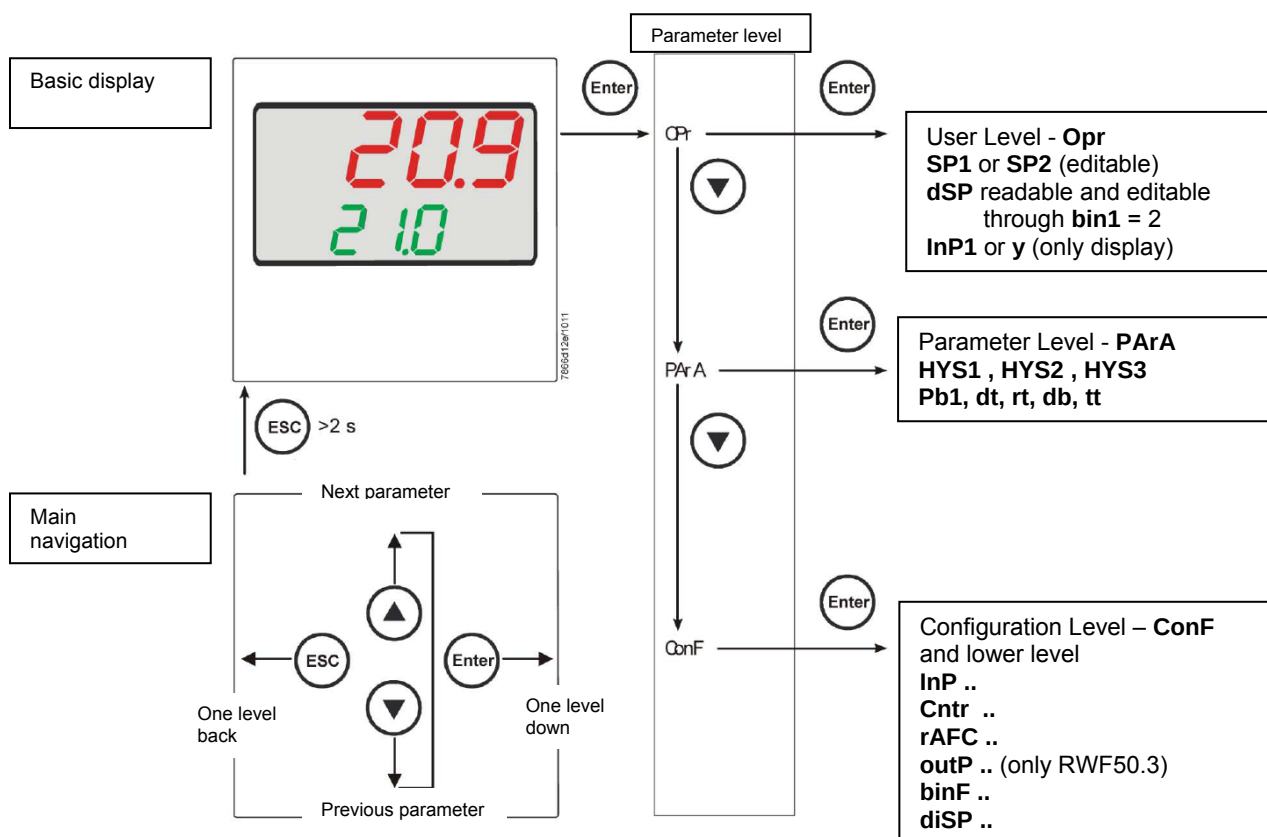
To wire the device and sensors, follow the instructions on the burner wiring diagram.



## 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<br>(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<br>(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<br>(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<br>type of sensor for<br>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<br>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<br>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<br>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<br>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<br>temperature unit                     | <b>1</b><br>2               | <b>1 = degrees Celsius</b><br>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

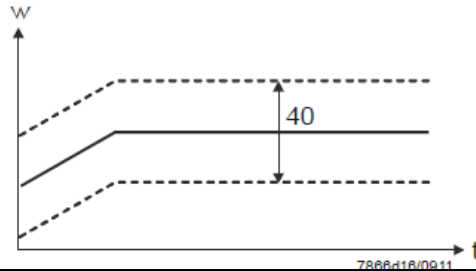
| Parameter                                               | Value                      | Description                                                                                                          |
|---------------------------------------------------------|----------------------------|----------------------------------------------------------------------------------------------------------------------|
| CtYP<br>controller type                                 | <b>1</b><br>2              | <b>1 = 3-position controller (open-stop-close only RWF50.2)</b><br>2 = continuative action controller (only RWF50.3) |
| CACt<br>control action                                  | <b>1</b><br>0              | <b>1 = heating controller</b><br>0 = cooling controller                                                              |
| SPL<br>least value of the set-point range               | -1999.. <b>0</b> ..+9999   | set-point limitation prevents entry of values outside the defined range                                              |
| SPH<br>maximum value of the set-point range             | -1999.. <b>100</b> ..+9999 | set-point limitation prevents entry of values outside the defined range                                              |
| oLLo<br>set-point limitation start, operation limit low | - <b>1999</b> .... +9999   | lower working range limit                                                                                            |
| oLHi<br>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<br>function            | <b>0</b><br>1<br>2   | Choose type of range degrees/time<br><b>0 = deactivated</b><br>1 = Kelvin degrees/minute<br>2 = Kelvin degrees/hour                                                                                                                     |
| rASL<br>ramp rate           | <b>0,0</b> ... 999,9 | Slope of thermal shock protection (only with functions 1 and 2)                                                                                                                                                                         |
| toLP<br>tolerance band ramp | <b>0</b> ...9999     | width of tolerance band (in K) about the set-point<br><b>0 = tolerance band inactive</b><br>                                                        |
| rAL<br>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<br>tipo di controllo             | 1<br><b>4</b>                | 1 = analog input 1 doubling with possibility to convert (depending on par <b>SiGn</b> )<br><b>4 = modulation controller</b>                                                                                                         |
| SiGn<br>type of output signal         | <b>0</b><br>1<br>2           | physical output signal (terminals A+, A-)<br><b>0 = 0÷20mA</b><br>1 = 4÷20mA<br>2 = 0÷10V                                                                                                                                           |
| rOut<br>Value when out of input range | <b>0...101</b>               | signal (in percent) when measurement range is crossed                                                                                                                                                                               |
| oPnt<br>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<br>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<br>digital inputs<br>(terminals DG - D1) | <b>0</b><br>1<br>2<br>4 | <b>0 = without function</b><br>1 = set-point changeover (SP1 / SP2)<br>2 = set-point shift ( <b>Opr</b> > <b>dSP</b> parameter = value of set-point modify)<br>4 = changeover of operating mode<br>open – modulating operation;<br>close – 2 stage operation. |

(**bold** = factory settings)

### ConF > dISP

| Parameter                        | Value                        | Description                                                                                                                                                                                              |
|----------------------------------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| diSU<br>upper display<br>(red)   | 0<br><b>1</b><br>4<br>6<br>7 | display value for upper display:<br>0 = display power-off<br><b>1 = analog input value</b><br>4 = Controller's angular positioning<br>6 = set-point value<br>7 = end value with thermal shock protection |
| diSL<br>lower display<br>(green) | 0<br>1<br>4<br><b>6</b><br>7 | display value for lower display:<br>0 = display power-off<br>1 = analog input value<br>4 = Controller's angular positioning<br><b>6 = set-point value</b><br>7 = end value with thermal shock protection |
| tout<br>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<br>decimal point            | <b>0</b><br>1<br>2           | <b>0 = no decimal place</b><br>1 = one decimal place<br>2 = two decimal places                                                                                                                           |
| CodE<br>level lockout            | <b>0</b><br>1<br>2<br>3      | <b>0 = no lockout</b><br>1 = configuration level lockout (ConF)<br>2 = Parameter and configuration level lockout (PArA & ConF)<br>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



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.

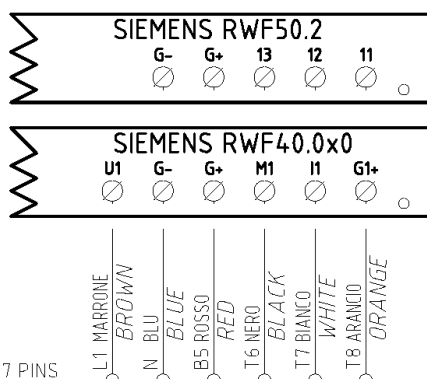
#### Display of software version :



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

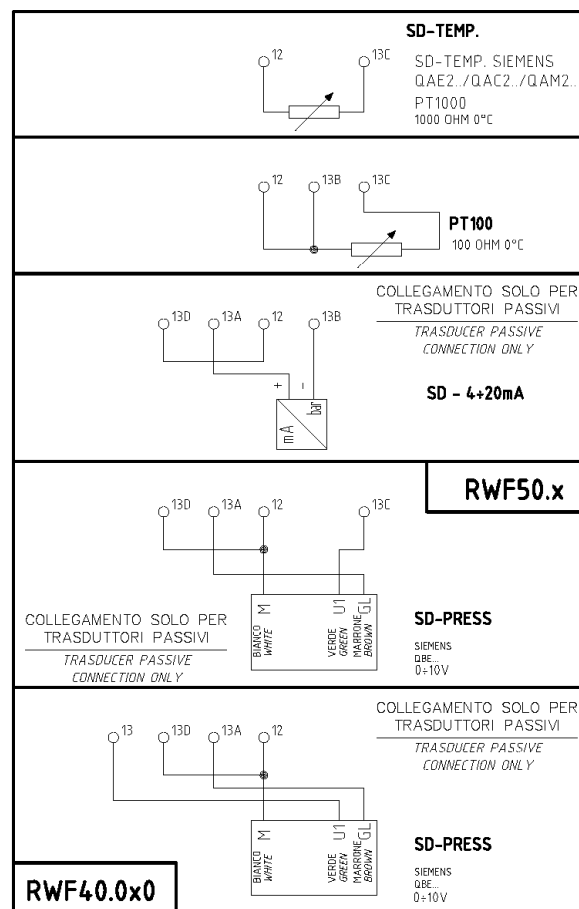
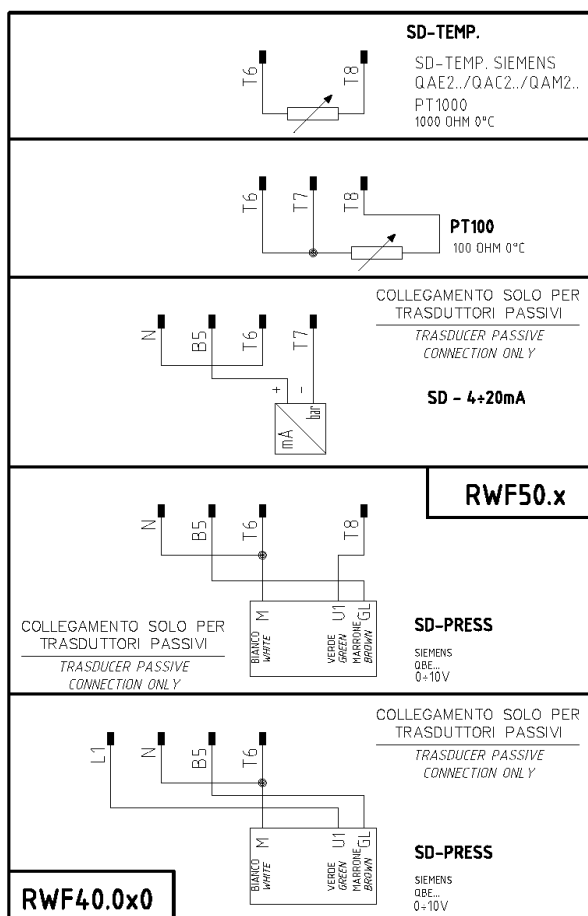
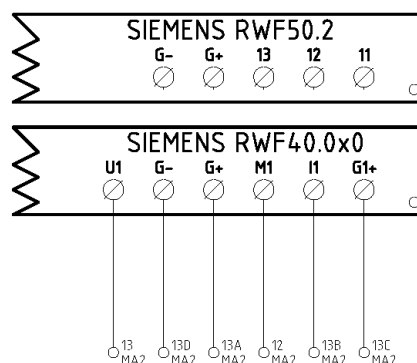
## Electric connection :

With 7 pins connector version



CONN. 7 PINS

With terminals version



Matches terminals between RWF50.2 and RWF40.0x0



# Parameters summarising for RWF50.2x:

| Navigation menù         | Conf<br>Inp |      |             |             |          | Conf        |             |             | PArA  |    |     |     |             |             | Opr         |
|-------------------------|-------------|------|-------------|-------------|----------|-------------|-------------|-------------|-------|----|-----|-----|-------------|-------------|-------------|
|                         | Inp1        |      |             |             |          | Cntr        |             | diSP        |       |    |     |     |             |             |             |
| Types of probe          | SEn1        | OFF1 | SCL         | SCH         | 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        |
| Sonda 4÷20mA / 0÷1,6bar | 16          | 0    | 0           | 160         | needless | 0           | 160         | 0           | 5     | 20 | 80  | (#) | 0           | 20          | 100 kPa     |
| Sonda 4÷20mA / 0÷10bar  | 16          | 0    | 0           | 1000        | needless | 0           | 1000        | 0           | 5     | 20 | 80  | (#) | 0           | 50          | 600 kPa     |
| Sonda 4÷20mA / 0÷16bar  | 16          | 0    | 0           | 1600        | needless | 0           | 1600        | 0           | 5     | 20 | 80  | (#) | 0           | 80          | 600 kPa     |
| Sonda 4÷20mA / 0÷25bar  | 16          | 0    | 0           | 2500        | needless | 0           | 2500        | 0           | 5     | 20 | 80  | (#) | 0           | 125         | 600 kPa     |
| Sonda 4÷20mA / 0÷40bar  | 16          | 0    | 0           | 4000        | needless | 0           | 4000        | 0           | 5     | 20 | 80  | (#) | 0           | 200         | 600 kPa     |
| Sonda 4÷20mA / 0÷60PSI  | 16          | 0    | 0           | 600         | needless | 0           | 600         | 0           | 5     | 20 | 80  | (#) | 0           | 30          | 300 (30PSI) |
| Sonda 4÷20mA / 0÷200PSI | 16          | 0    | 0           | 2000        | needless | 0           | 2000        | 0           | 5     | 20 | 80  | (#) | 0           | 75          | 600 (60PSI) |
| Sonda 4÷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     |
| 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 - Types of probe

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

(\*) 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).

## TABLE OF PARAMETERS TO BE MODIFIED FOR CALIBRATIONS RWF50.3x/RWF55.xx (CONTINUOUS OUTPUT 4÷20mA) INSTEAD OF 3 POINTS

| Navigation menù | Conf OutP |            |      |      |     |
|-----------------|-----------|------------|------|------|-----|
|                 | FnCt      | SiGn       | rOut | OPnt | End |
|                 | 4         | 1 (4÷20mA) | 0    | 0    | 100 |

**NOTE :** (#) tt - servocontrol travel time

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

STA12B3.41; SQN30.251; SQN72.4A4A20 = 12 (second)

(\*) Factory-set values, these values must be varied according to the actual working temperature/pressure of the system.

**WARNING :** With pressure probes in bar, 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 > display 1500).

## APPENDIX: PROBES CONNECTION

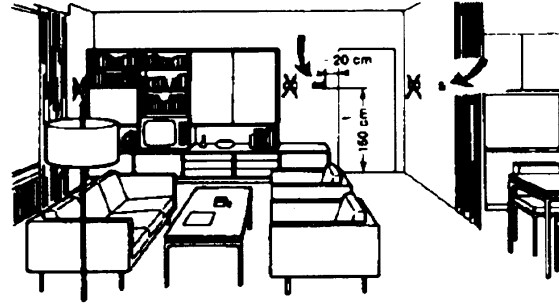
To assure the utmost comfort, the control system needs reliable information, which can be obtained provided the sensors have been installed correctly. Sensors measure and transmit all variations encountered at their location.

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)

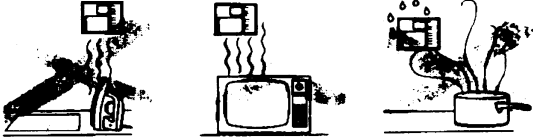
#### Installation

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

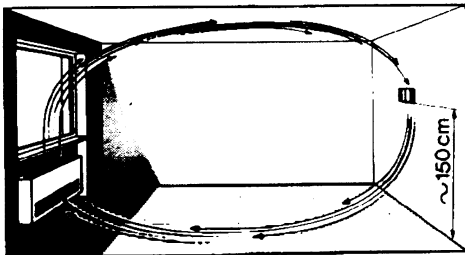
Heating systems: the room sensor must not be installed in rooms with heating units complete with thermostatic valves. Avoid all sources of heat foreign to the system.



**General rule:** 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.

### Location

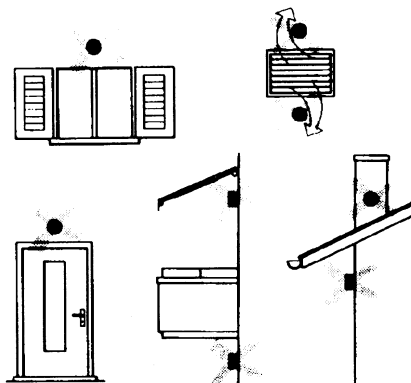
On an inner wall on the other side of the room to heating units height above floor 1.5 m, at least 1.5 m away from external sources of heat (or cold).



### 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

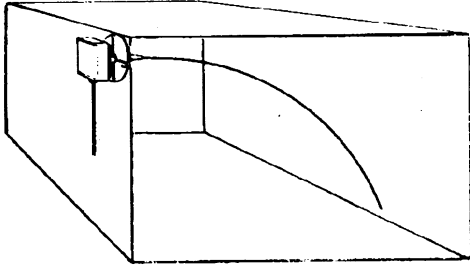
### Installing temperature sensors

For measuring outlet air:

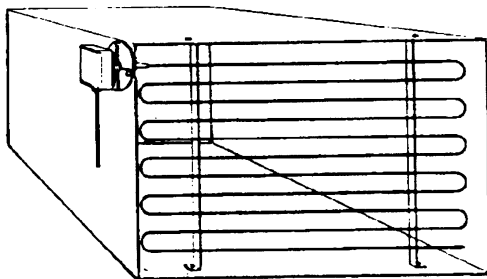
- after delivery fan or
- after coil to be controlled, at a distance of at least 0,5 m

For measuring room temperature:

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



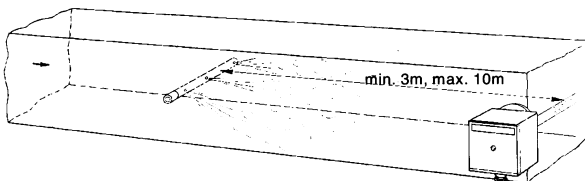
Bend 0.4m sensor by hand (never use tools) as illustrated.



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).



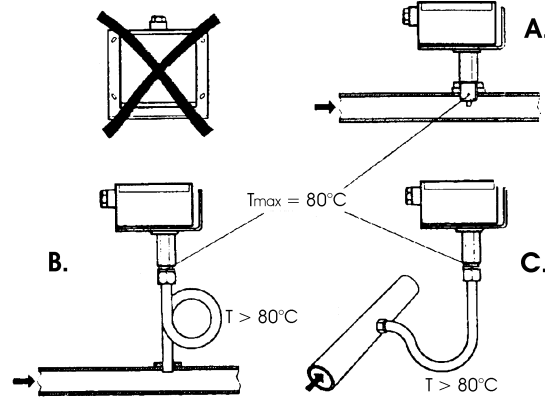
### Installing pressure sensors

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

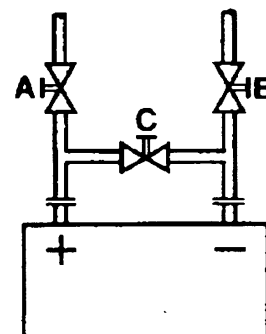
Start disable

1=open C1=open C

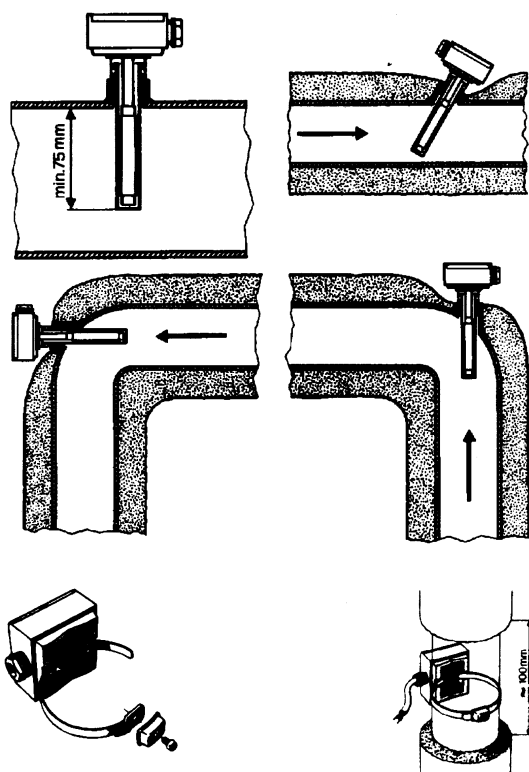
2=open A2=close B

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.

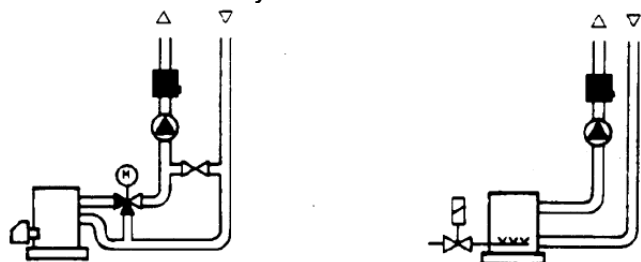
Sensors come with straps for pipes up to 100 mm in diameter

## 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.

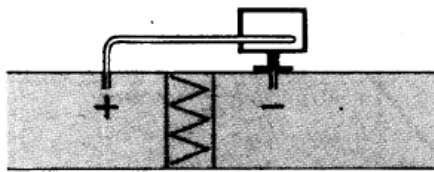
## With pumps on return

with 3 ways valves / with 4 ways valves

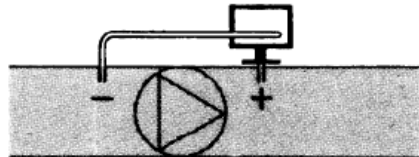


## Duct pressure switches and sensors

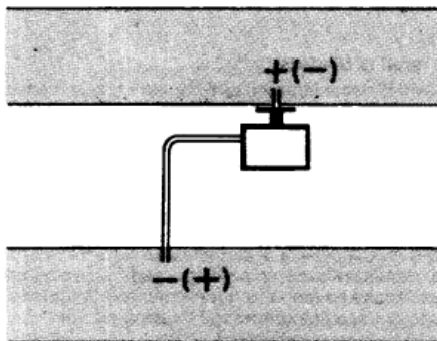
### Installing differential pressure probes for air



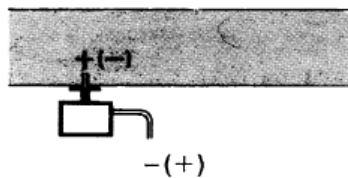
A - Control a filter (clogging)



B - Control a fan (upstream/downstream)



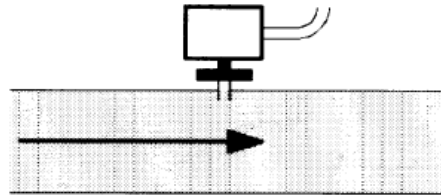
C - Measurement of difference in pressure between two ducts



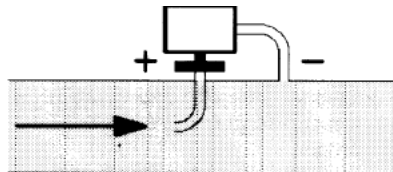
D - Measurement of difference in pressure between two rooms or of inside of duct and outside

### Basic principles

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



### Measuring dynamic pressure

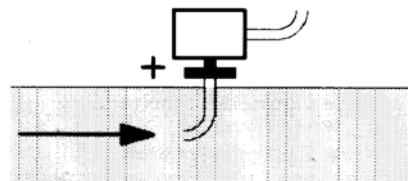


$$Pd = \frac{\gamma v^2}{2g}$$

### 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



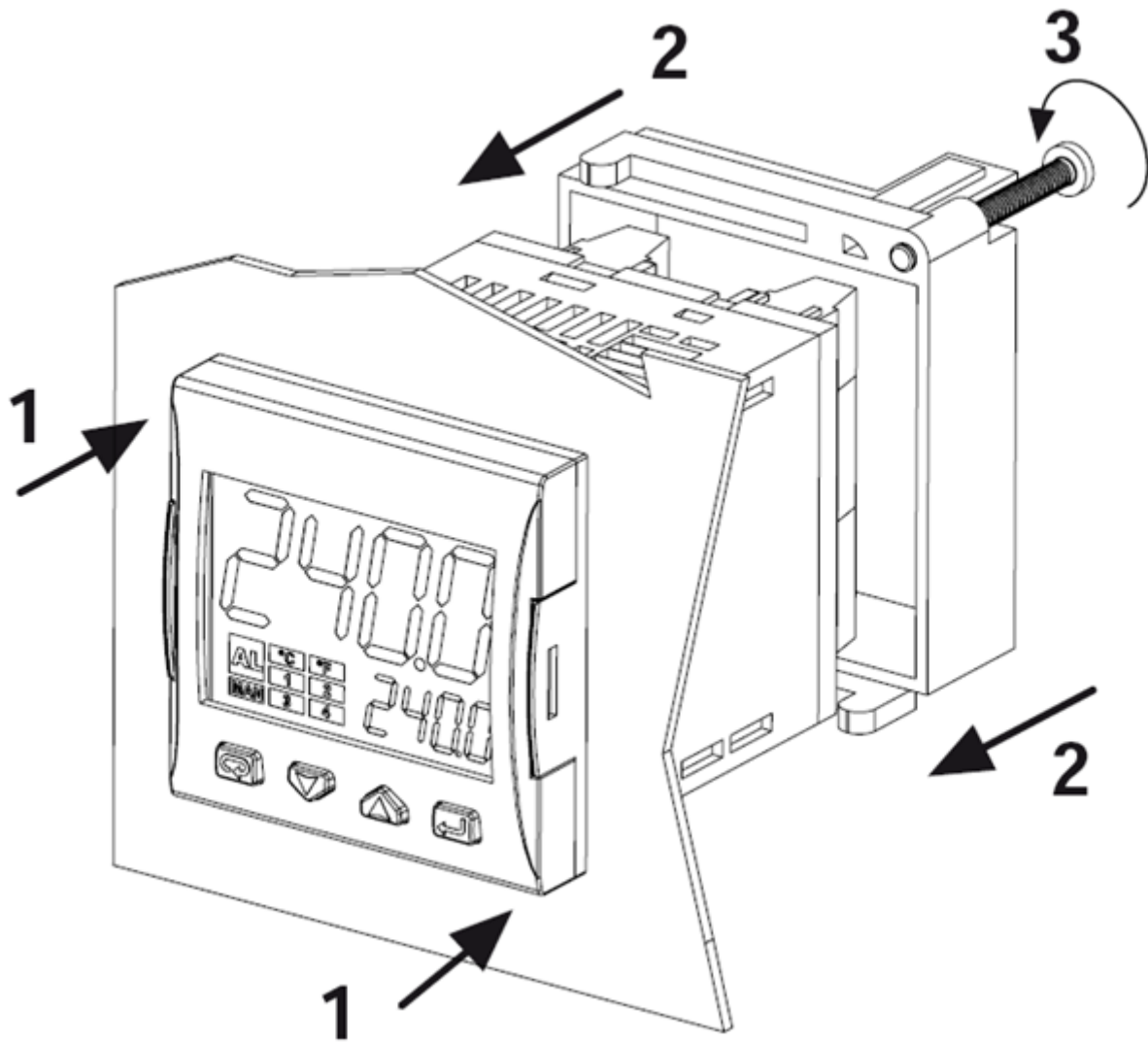
## Spare parts

| Description                                                                  | Code    |
|------------------------------------------------------------------------------|---------|
| Modulator RWF50.2 (uscita a 3 punti - apri, fermo, chiudi) 2570148           | 2570148 |
| Modulator RWF50.3 (uscita continua 0÷20mA, 4÷20mA, 0÷10V) 2570149            | 2570149 |
| Temperature probe Siemens QAE2120.010A (30÷130°C) 2560101                    | 2560101 |
| Temperature probe Siemens QAM2120.040 (-15÷+50°C) 2560135                    | 2560135 |
| Thermoresistor Pt1000 ø6mm L100mm (30÷130°C) 2560188                         | 2560188 |
| Thermoresistor Pt1000 ø10mm L200mm (0÷350°C) 2560103                         | 2560103 |
| Thermoresistor Pt100 ø10mm L200mm (0÷350°C) 2560145                          | 2560145 |
| Thermoresistor Pt100 ø8mm L85mm (0÷120°C) 25601C3                            | 25601C3 |
| Pressure probe Siemens QBE2.. P4 (0÷4bar) 2560159                            | 2560159 |
| Pressure probe Siemens QBE2.. P10 (0÷10bar / signal 0÷10V) 2560160           | 2560160 |
| Pressure probe Siemens QBE2.. P16 (0÷16bar / signal 0÷10V) 2560167           | 2560167 |
| Pressure probe Siemens QBE2.. P25 (0÷25bar / signal 0÷10V) 2560161           | 2560161 |
| Pressure probe Siemens QBE2.. P40 (0÷40bar / signal 0÷10V) 2560162           | 2560162 |
| Pressure probe Danfoss MBS 3200 P 1,6 (0÷1,6bar / signal 4÷20mA) 2560189     | 2560189 |
| Pressure probe Danfoss MBS 3200 P 10 (0÷10bar / signal 4÷20mA) 2560190       | 2560190 |
| Pressure probe Danfoss MBS 3200 P 16 (0÷16bar / signal 4÷20mA) 2560191       | 2560191 |
| Pressure probe Danfoss MBS 3200 P 25 (0÷25bar / signal 4÷20mA) 2560192       | 2560192 |
| Pressure probe Danfoss MBS 3200 P 40 (0÷40bar / signal 4÷20mA) 2560193       | 2560193 |
| Pressure probe Siemens 7MF1565-3BB00-1AA1 (0÷1,6bar / signal 4÷20mA) 25601A3 | 25601A3 |
| Pressure probe Siemens 7MF1565-3CA00-1AA1 (0÷10bar / signal 4÷20mA) 25601A4  | 25601A4 |
| Sonda di pressione Siemens 7MF1565-3CB00-1AA1 (0÷16bar / signal 25601A5      | 25601A5 |
| Pressure probe Siemens 7MF1565-3CD00-1AA1 (0÷25bar / signal 4÷20mA) 25601A6  | 25601A6 |
| Pressure probe Siemens 7MF1565-3CE00-1AA1 (0÷40bar / signal 4÷20mA) 25601A7  | 25601A7 |
| Pressure probe Gefran E3E B1V6 MV (0÷1,6bar / segnale 4÷20mA) 25601C4        | 25601C4 |
| Pressure probe Danfoss E3E B01D MV (0÷10bar / segnale 4÷20mA) 25601C5        | 25601C5 |
| Pressure probe Danfoss E3E B16U MV (0÷16bar / segnale 4÷20mA) 25601C6        | 25601C6 |
| Pressure probe Danfoss E3E B25U MV (0÷25bar / segnale 4÷20mA) 25601C7        | 25601C7 |
| Pressure probe Danfoss E3E B04D MV (0÷40bar / segnale 4÷20mA) 25601C8        | 25601C8 |
| Pressure probe Siemens 7MF1567-4CD00-1EA1 (0-300PSI 1/4NPT 4-20mA)           | 25601G0 |
| Pressure probe Siemens 7MF1567-4BF00-1EA1 (0-60PSI 1/4NPT 4-20mA)            | 25601G1 |
| Pressure probe Siemens 7MF1567-4CB00-1EA1 (0-200PSI 1/4NPT 4-20mA)           | 25601G2 |

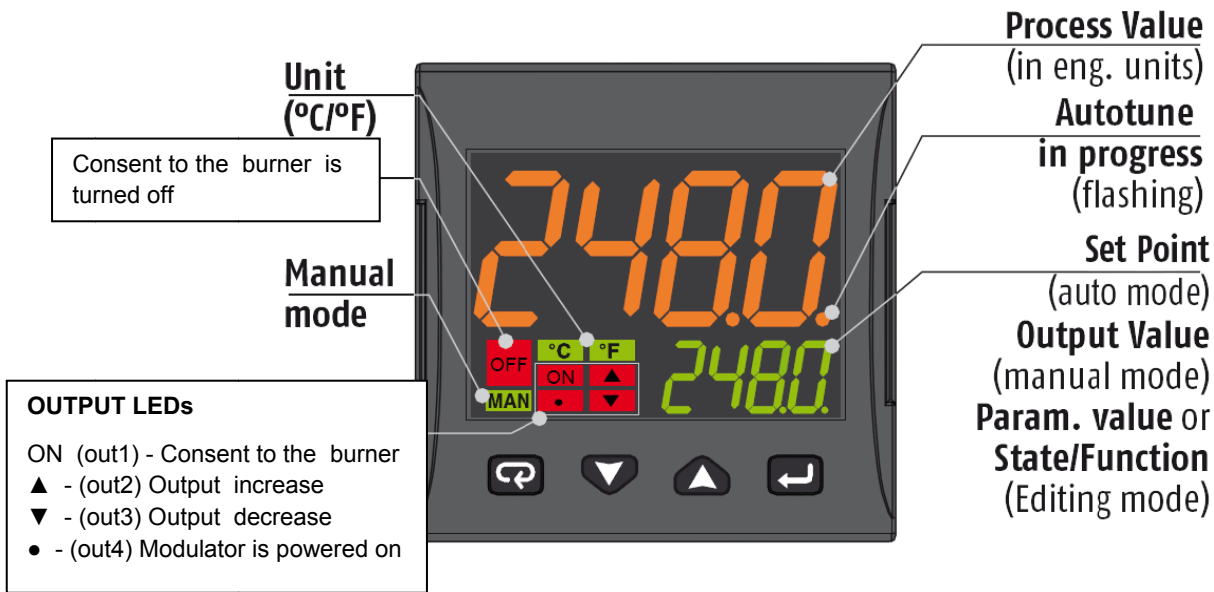
Note: Specifications and data subject to change. Errors and omissions excepted.

# **KM3 Modulator**

## **USER MANUAL**

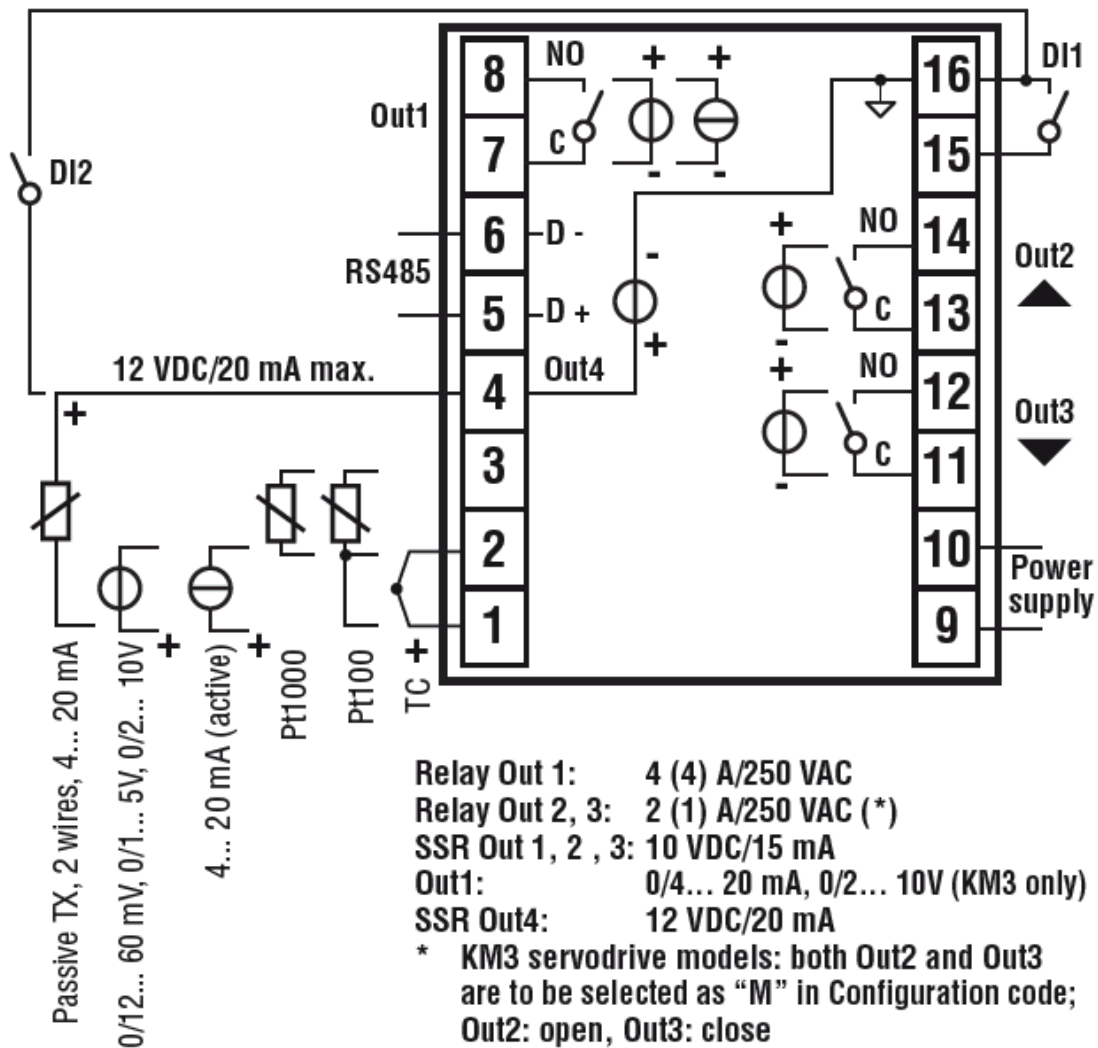
**MOUNTING**

## DISPLAY AND KEYS



|  | Operator Mode                                                                                        | Editing Mode                                                                   |
|--|------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
|  | Access to:<br>- Operator Commands (Timer, Setpoint selection ...)<br>- Parameters<br>- Configuration | Confirm and go to Next parameter                                               |
|  | Access to:<br>- Operator additional information (Output value, running time ...)                     | Increase the displayed value or select the next element of the parameters list |
|  | Access to:<br>- Set Point                                                                            | Decrease the displayed value or select the previous element                    |
|  | Programmable key:<br>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:

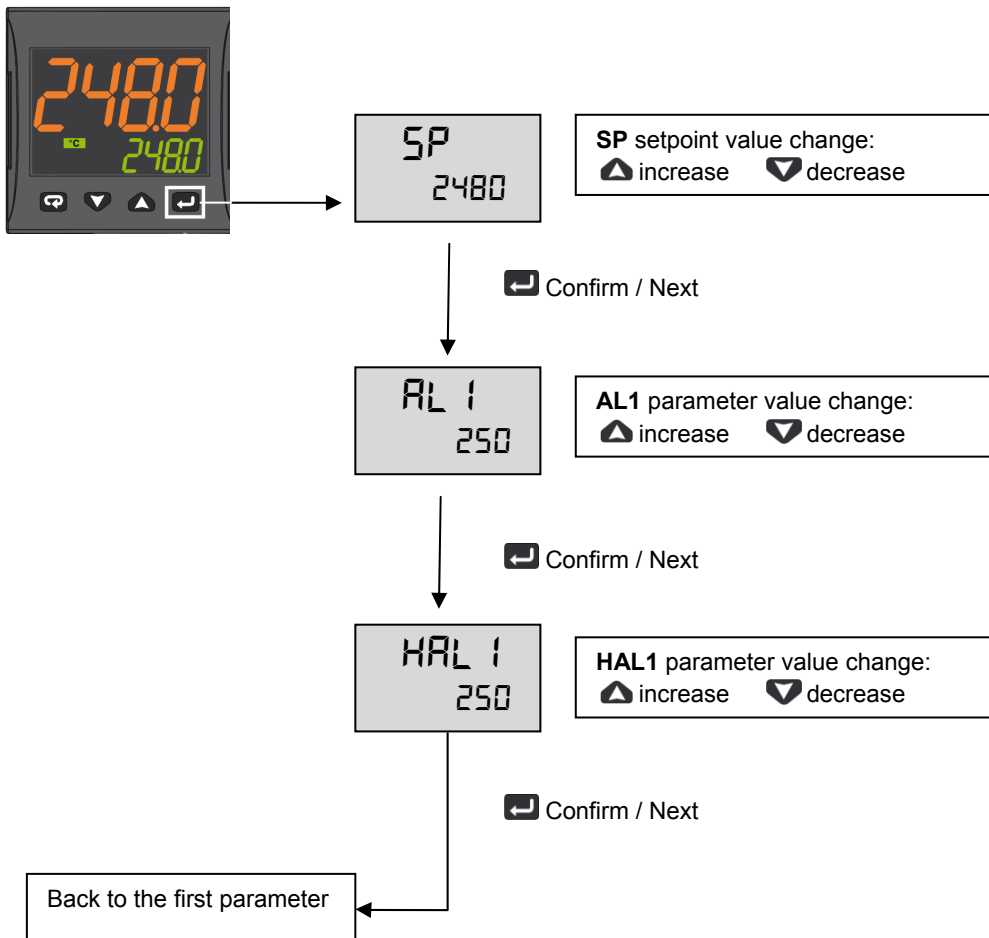
- **Neutral wire:** terminal 9
- **Phase:** terminal 10 ( 100...240 Vac )
- Close terminals 15-16 to switch to the set point 2

### 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)

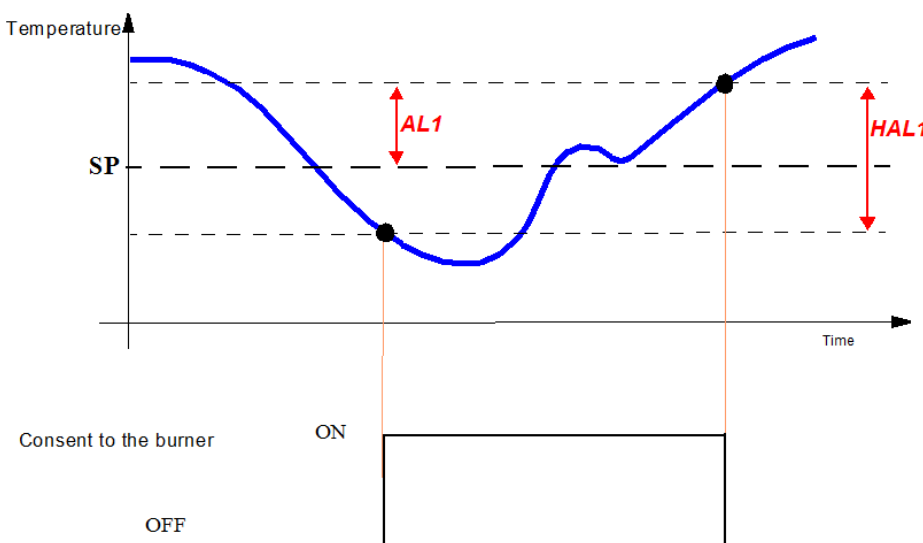
## SETPOINT AND HYSTERESIS CONFIGURATION (SP, AL1, HAL1 parameters)

Push the  button to enter into the setpoint configuration:



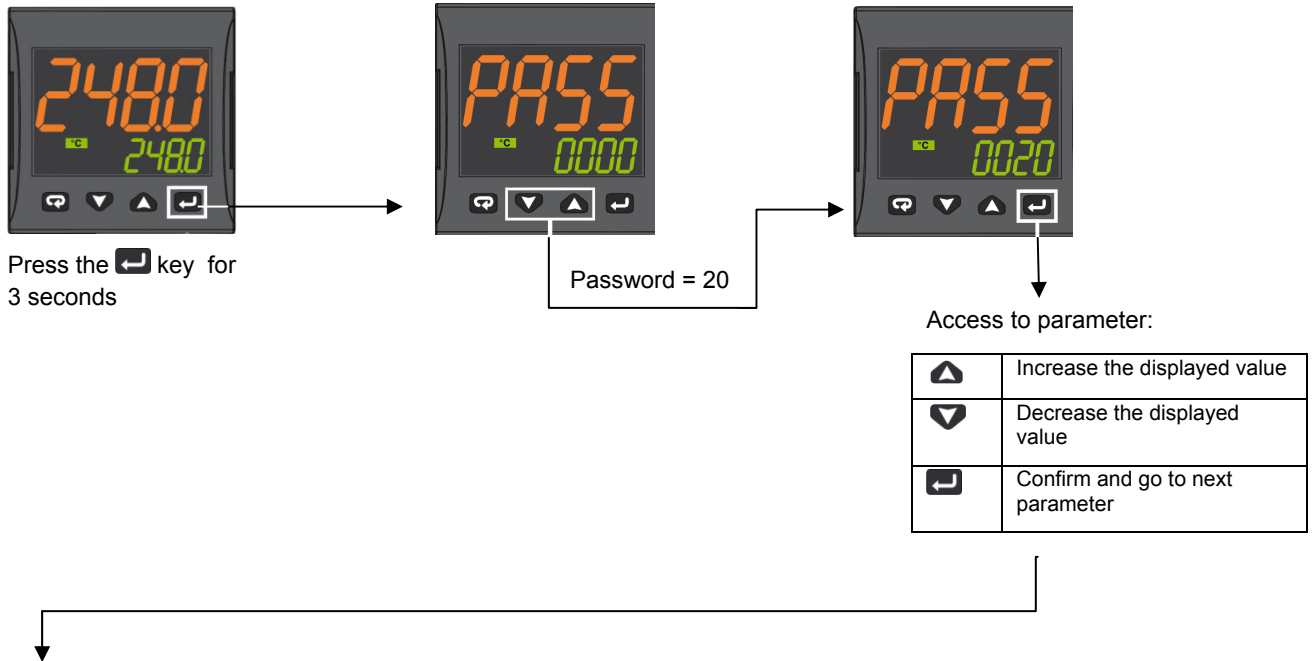
To return to normal mode, press the  key for 3 seconds or wait the 10s timeout

### 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<br>Pt10 = RTD Pt1000<br>0.20 = 0..20mA<br>4.20 = 4..20mA Pressure probe<br>0.10 = 0..10V<br>2.10 = 2..10V<br>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                                                                                                                                    |                      |
| SPLH  | 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<br>(**) | AL1<br>(***) | HAL1<br>(***) | Pb<br>(***) | ti<br>(***) | td<br>(***) | Str.t           | db.S        | SPLL      | SPHL      | SP           |  |  |
| Probes                           |  |      | Dec<br>Point | Scale<br>Min | Scale<br>Max |      |               | Off          | On            | p           | i           | d           | servo<br>time s | Band<br>Mo. | SP<br>Min | SP<br>Max | Set<br>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:<br>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<br>Pt10 = RTD Pt1000<br>0.20 = 0..20mA<br>4.20 = 4..20mA Pressure probe<br>0.10 = 0..10V<br>2.10 = 2..10V<br>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<br>ou = Under range<br>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,<br>1 = Alarm reset,<br>2 = Alarm acknowledge (ACK),<br>3 = Hold of the measured value,<br>4 = Stand by mode,<br>5 = Manual mode,<br>6 = HEAt with SP1 and CoOL with SP2,<br>7 = Timer RUN/Hold/Reset,<br>8 = Timer Run,<br>9 = Timer Reset,<br>10 = Timer Run/Hold,<br>11 = Timer Run/Reset,<br>12 = Timer Run/Reset with lock,<br>13 = Program Start,<br>14 = Program Reset,<br>15 = Program Hold,<br>16 = Program Run/Hold,<br>17 = Program Run/Reset,<br>18 = Sequential SP selection,<br>19 = SP1 - SP2 selection,<br>20 = SP1... SP4 binary selection,<br>21 = Digital inputs in parallel | 19 |
| C | 12 | di.A  | Digital Inputs Action (DI2 only if configured) | 0 = DI1 direct action, DI2 direct action<br>1 = DI1 reverse action, DI2 direct action<br>2 = DI1 direct action, DI2 reverse action<br>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<br>rEU = Reverse action<br>dir.r = Direct with reversed LED<br>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<br>rEU = Reverse action<br>dir.r = Direct with reversed LED<br>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<br>rEU = Reverse action<br>dir.r = Direct with reversed LED<br>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<br>LoAb = Absolute low alarm<br>HiAb = Absolute high alarm<br>LHAo = Windows alarm in alarm outside the windows<br>LHAi = Windows alarm in alarm inside the | HidE    |

|   |    |      |                                                                                                                         |                                                                                                                                                                                                                                  |            |
|---|----|------|-------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
|   |    |      |                                                                                                                         | windows<br>SE.br = Sensor Break<br>LoDE = Deviation low alarm (relative)<br>HiDE = Deviation high alarm (relative)<br>LHdo = Relative band alarm in alarm out of the band<br>LHdi = Relative band alarm in alarm inside the band |            |
| C | 29 | Ab1  | Alarm 1 function                                                                                                        | 0... 15<br>+1 = Not active at power up<br>+2 = Latched alarm (manual reset)<br>+4 = Acknowledgeable alarm<br>+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;<br>-- 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;<br>-- 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<br>1 = Alarm 1 enabled in stand by mode<br>2 = Alarm 1 enabled in out of range condition<br>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<br>LoAb = Absolute low alarm<br>HiAb = Absolute high alarm<br>LHAo = Windows alarm in alarm outside the windows<br>LHAi = Windows alarm in alarm inside the windows<br>SE.br = Sensor Break<br>LoDE = Deviation low alarm (relative)<br>HiDE = Deviation high alarm (relative)<br>LHdo = Relative band alarm in alarm out of the band<br>LHdi = Relative band alarm in alarm inside the band | SE.br   |
| C   | 37 | Ab2   | Alarm 2 function                                                  | 0... 15<br>+1 = Not active at power up<br>+2 = Latched alarm (manual reset)<br>+4 = Acknowledgeable alarm<br>+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<br>1 = Alarm 2 enabled in stand by mode<br>2 = Alarm 2 enabled in out of range condition<br>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<br>LoAb = Absolute low alarm<br>HiAb = Absolute high alarm<br>LHAo = Windows alarm in alarm outside the windows<br>LHAI = Windows alarm in alarm inside the windows<br>SE.br = Sensor Break<br>LoDE = Deviation low alarm (relative)<br>HiDE = Deviation high alarm (relative)<br>LHdo = Relative band alarm in alarm out of the band<br>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)<br>On.FA = ON/OFF asymmetric hysteresis<br>On.FS = ON/OFF symmetric hysteresis<br>nr = Heat/Cool ON/OFF control with neutral zone<br>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<br>-3 = Oscillating auto-tune with manual start<br>-2 = Oscillating -tune with auto-matic start at the first power up only<br>-1 = Oscillating auto-tune with auto-matic restart at every power up<br>0 = Not used<br>1 = Fast auto tuning with automatic restart at every power up<br>2 = Fast auto-tune with automatic start the first power up only<br>3 = FAST auto-tune with manual start<br>4 = FAST auto-tune with automatic restart at power up and after set point change<br>5 = Evo-tune with automatic restart at every power up<br>6 = Evo-tune with automatic start the first power up only<br>7 = Evo-tune with manual start<br>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<br>on = Active                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | oFF     |

|   |    |       |                                  |                                                                                                            |            |
|---|----|-------|----------------------------------|------------------------------------------------------------------------------------------------------------|------------|
| C | 59 | SELF  | Self tuning enabling             | no = The instrument does not perform the self-tuning<br>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<br>trin = The value will be added to the local set point selected by A.SP and the sum becomes the operative set point<br>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<br>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)<br>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<br>tunE = Auto-tune/self-tune enabling. A single press (longer than 1 second) starts the auto-tune<br>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<br>ASi = Alarm acknowledge<br>chSP = Sequential set point selection<br>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.<br>Str.t = Timer run/hold/reset<br>P.run = Program run<br>P.rES = Program reset<br>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)<br>1 = Display red (fix)<br>2 = Display green (fix)<br>3 = Display orange (fix)                                                                                                                                                                                         | 2    |
|   | 125 | diS.t | Display Timeout               | -- oFF (display always ON)<br>-- 0.1... 99.59 (mm.ss)                                                                                                                                                                                                                                                                                         | oFF  |
| C | 126 | fiLd  | Filter on the displayed value | -- oFF (filter disabled)<br>-- 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<br>Auto = Starts in Auto mode<br>oP.0 = Starts in manual mode with a power output equal to zero<br>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<br>Au.oP = Auto and manual (OPLO) mode only will be selectable by the next parameter<br>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<br>- oPLo = Manual mode<br>- St.bY = Stand by mode<br>If oPr.E = Au.oP: - Auto = Auto mode<br>- oPLo = Manual mode<br>If oPr.E = Au.Sb: - Auto = Auto mode<br>- St.bY = Stand by mode                                                                                                                      | Auto |

**SEr Group - Serial link parameter**

| Liv | N°  | Param | Description                                         | Values                                                                                                                                                                                                                   | Default |
|-----|-----|-------|-----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| C   | 131 | Add   | Instrument address                                  | -- oFF<br>-- 1... 254                                                                                                                                                                                                    | 1       |
| C   | 132 | bAud  | baud rate                                           | 1200 = 1200 baud<br>2400 = 2400 baud<br>9600 = 9600 baud<br>19.2 = 19200 baud<br>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)<br>rSP = The instrument becomes a Master and retransmits the operative set point<br>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<br>1 = Instantaneous power (kW)<br>2 = Power consumption (kW/h)<br>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<br>4 = Total worked days: number of hours the instrument is turned ON divided by 24.<br>5 = Total worked hours: number of hours the instrument is turned ON.<br>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.<br>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.<br>8 = Totalizer of control relay worked days: number of hours the control relay has been in ON condition, divided by 24.<br>9 = Totalizer of control relay worked hours: number of hours the control relay has been in ON condition.<br>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.<br>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.

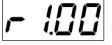
## AUTOMATIC MODE

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 twoless 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".

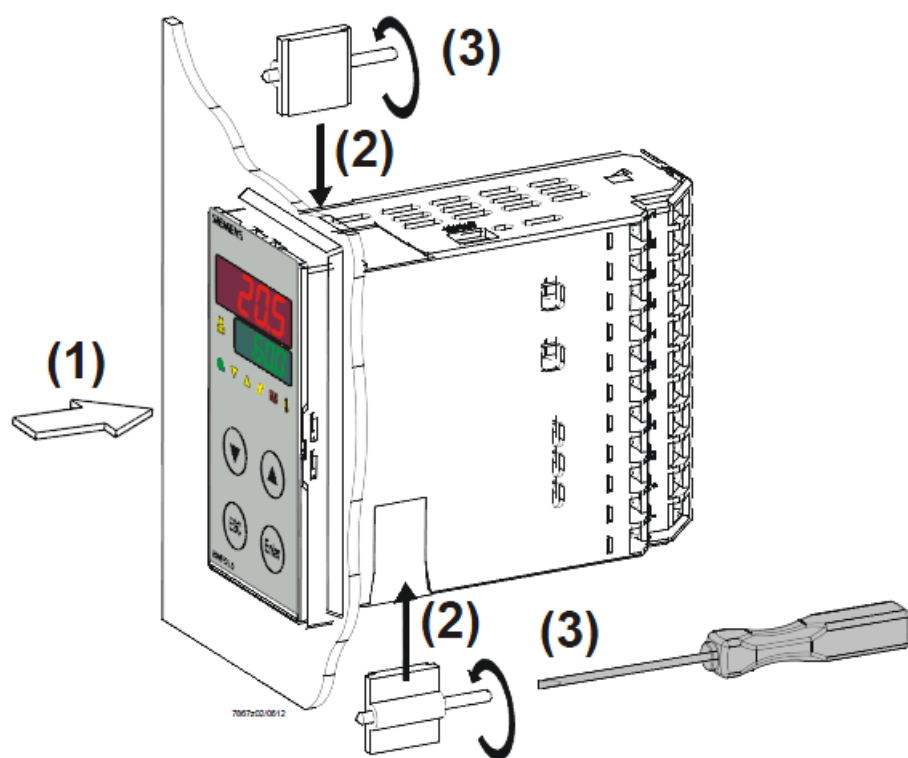
# RWF55.5X & RWF55.6X



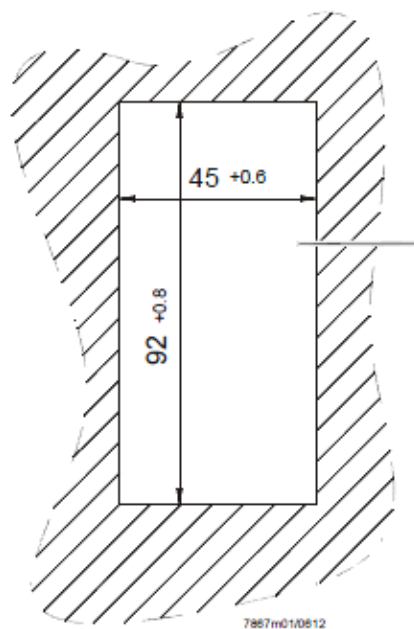
*User manual*

## DEVICE INSTALLATION

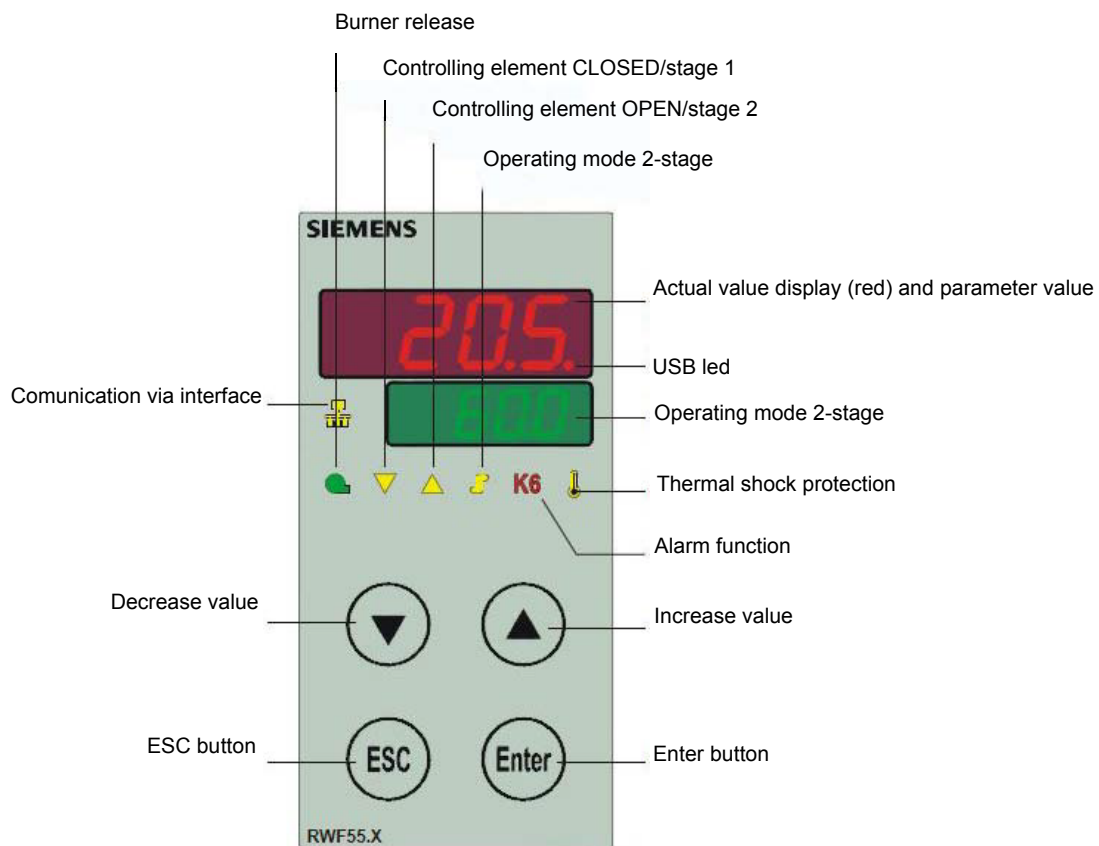
### Fixing system

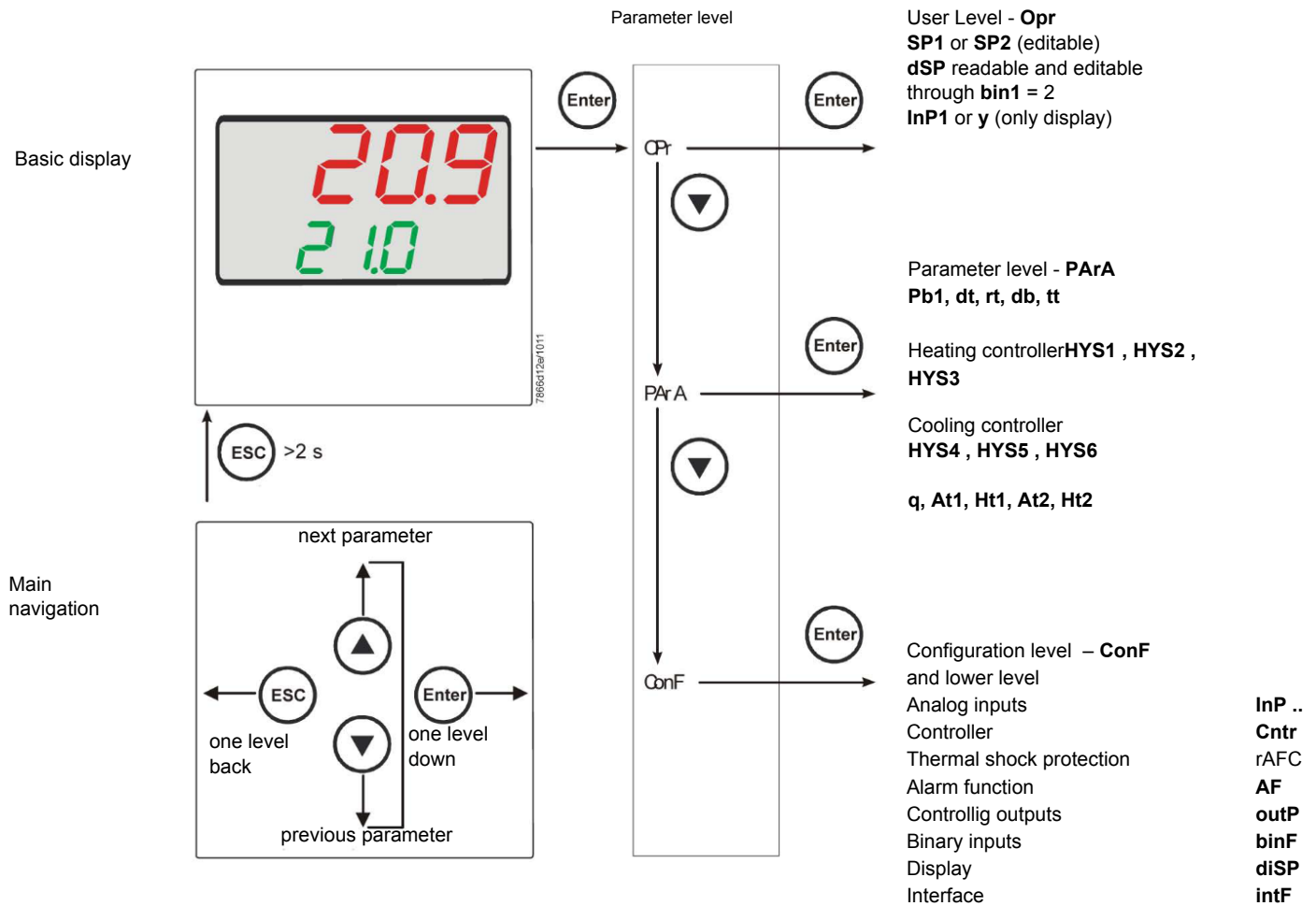


### Drilling dimensions:



## 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 **Op** appears; using the **down arrow**, scroll until group **PARA** is reached and push **Enter**.

On the green display **Pb1** 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<br>(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<br>(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<br>(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<br>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<br>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<br>type of sensor for analog<br>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<br>Sensor offset                        | -1999..0.. +9999            | Correction value measured by the sensor                                           |
| SCL1<br>scale low level                      | -1999..0.. +9999            | minimum scale value(for input ohm, mA, V)                                         |
| SCH1<br>scale high level                     | -1999.. <b>100</b> .. +9999 | maximum scale value(for input ohm, mA, V)                                         |
| dF1<br>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<br>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<br>tisensor type input 2 | 1                           | 0 ÷ 20mA                                                                          |
|                               | 2                           | 4 ÷ 20mA                                                                          |
|                               | 3                           | 0 ÷ 10V                                                                           |
|                               | 4                           | 0 ÷ 5V                                                                            |
|                               | 5                           | 1 ÷ 5V                                                                            |
|                               | 1                           | 0 ÷ 20mA                                                                          |
| OFF2<br>Sensor offset         | -1999.. <b>0</b> .. +9999   | Correction value measured by the sensor                                           |
| SCL2<br>scale low level       | -1999.. <b>0</b> .. +9999   | minimum scale value(for input ohm, mA, V)                                         |
| SCH2<br>scale high level      | -1999.. <b>100</b> .. +9999 | maximum scale value(for input ohm, mA, V)                                         |
| dF2<br>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<br>sensor type input 3sensor<br>type input 2 | 0                         | 0 =                                                                               |
|                                                   | 1                         | 1 = wire                                                                          |
|                                                   | 2                         | 2 = wire                                                                          |
| OFF3<br>Sensor offset                             | -1999.. <b>0</b> .. +9999 | Correction value measured by the sensor                                           |
| dF3<br>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<br>controller type                                 | 1<br>2                    | <b>1 = 3-position controller (open-stop-close)</b><br>2 = continuative action controller (0 ÷ 10V or 4 ÷ 20mA)                                                                            |
| CACt<br>control action                                  | 1<br>0                    | <b>1 = heating controller</b><br>0 = cooling controller                                                                                                                                   |
| SPL<br>least value of the set-point range               | -1999.. <b>0</b> ..+9999  | minimum set-point scale                                                                                                                                                                   |
| SPH<br>maximum value of the set-point range             | -1999.. <b>100</b> ..+999 | maximum set-point scale                                                                                                                                                                   |
| Self-optimization                                       | 0<br>1                    | <b>0 = Free</b><br>1 = Locked<br>Self-optimization can only be disabled or enabled via the ACS411 setup program.<br>Self-optimization is also disabled when the parameter level is locked |
| pLLo<br>set-point limitation start, operation limit low | -1999.... +9999           | lower working range limit                                                                                                                                                                 |
| pLHi<br>set-point limitation end, operation limit high  | -1999.... <b>+9999</b>    | upper working range limit                                                                                                                                                                 |

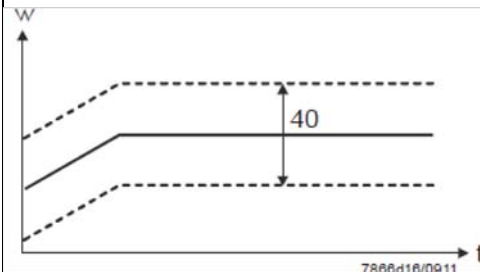
(**bold** = factory settings)

## 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<br>type of control     | <b>0</b><br>1<br>2             | choose type of range degrees/time<br><b>0 = deactivated</b><br>1 = Kelvin degrees/minute<br>2 = Kelvin degrees/hour                                                                                                                            |
| rASL<br>ramp rate           | <b>0,0</b> ... 999,9           | Slope of thermal shock protection (only with functions 1 and 2)                                                                                                                                                                                |
| tolP<br>tolerance band ramp | <b>2 x (HYS1) = 10</b> ...9999 | width of tolerance band (in K) about the set-point<br><b>0 = tolerance band inactive</b>                                                                                                                                                       |
| rAL<br>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 |



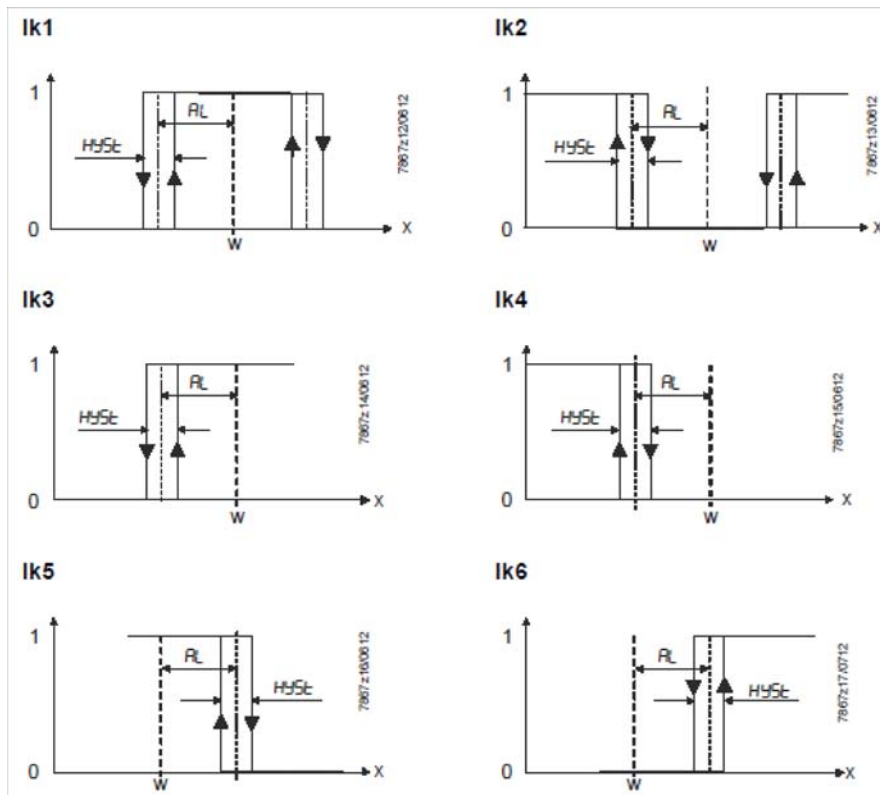
(**bold** = factory settings)

## Alarm functionAF

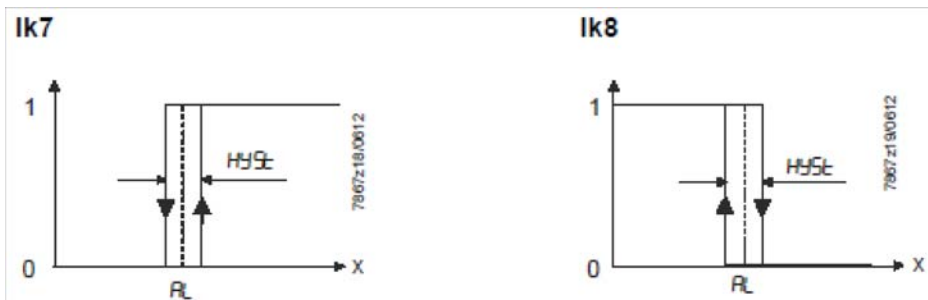
The alarm function can be used to monitor the analog inputs. If the limit value is exceeded, multifunctional relay K6 (terminals **6N** and **6P**) is activated (depending on the switching characteristic)

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<br>type of control          | 0<br>1<br>2<br>3<br>4<br>5<br>6<br>7<br>8<br>9<br>10<br>11<br>12 | 0 = <b>Without function</b><br>Ik1 = monitored input InP1<br>Ik2 = monitored input InP1<br>Ik3 = monitored input InP1<br>Ik4 = monitored input InP1<br>Ik5 = monitored input InP1<br>Ik6 = monitored input InP1<br>Ik7 = monitored input InP1<br>Ik8 = monitored input InP1<br>Ik7 = monitored input InP2<br>Ik8 = monitored input InP2<br>Ik7 = monitored input InP3<br>Ik8 = monitored input InP3 |
| Alarm value<br>AL                | -1999 ...<br><b>0</b><br>1999                                    | Limit value or deviation from setpoint to be monitored (see alarm functions<br><b>Ik1 to Ik8</b> : limit value <b>AL</b> )<br>Limit value range for <b>Ik1</b> and <b>Ik20</b> ...9999                                                                                                                                                                                                              |
| HySt<br>switching differential   | 0...<br>1...<br>9999                                             | Switching differential for limit value <b>AL</b>                                                                                                                                                                                                                                                                                                                                                    |
| ACrA<br>response by out of range | <b>0</b><br>1                                                    | <b>Switched-off</b><br>ON<br>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<br>type of control               | 1<br>2<br>3<br><b>4</b>      | 1 = analog input 1 doubling with possibility to convert<br>2 = analog input 2 doubling with possibility to convert<br>3 = analog input 3 doubling with possibility to convert<br><b>4 = Controller's angular positioning is delivered (modulating controller)</b> |
| SiGn<br>type of output signal         | <b>0</b><br>1<br>2           | physical output signal (terminals A+, A-)<br><b>0 = 0÷20mA</b><br>1 = 4÷20mA<br>2 = 0÷10V DC                                                                                                                                                                      |
| rOut<br>value when out of input range | <b>0</b> ...101              | signal (in percent) when measurement range is crossed                                                                                                                                                                                                             |
| oPnt<br>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<br>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<br>binary input 1 (terminals <b>DG</b> – <b>D1</b> ) | <b>0</b><br>1<br>2<br>3 | <b>0 = without function</b><br>1 = set-point changeover (SP1 / SP2)<br>2 = lset-point shift (Opr > dSP parameter = value of set-point modify)<br>3 = input alarm |
| bin2<br>binary input 2 (terminals <b>DG</b> – <b>D2</b> ) | <b>4</b>                | <b>changeover of operating mode</b><br>DG-D2 open = modulating operation<br>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<br>upper display (red)   | <b>0</b><br>1<br>2<br>3<br>4<br>6<br>7 | Display value for upper display:<br>0 = display power-off<br><b>1 = analog input 1 (InP1) value</b><br>2 = analog input 2 (InP2) value<br>3 = analog input 3 (InP3) value<br>4 = controller's angular positioning<br>6 = set-point values<br>7 = end value with thermal shock protection |
| diSL<br>lower display (green) | <b>0</b><br>1<br>2<br>3<br>4<br>6<br>7 | Display value for lower display:<br>0 = display power-off<br>1 = analog input 2 (InP2) value<br>2 = analog input 2 (InP2) value<br>3 = analog input 2 (InP2) value<br>4 = controller's angular positioning<br><b>6 = set-point values</b><br>7 = end value with thermal shock protection |
| tout<br>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<br>decimal point         | <b>0</b><br>1<br>2                     | <b>0 = no decimal place</b><br>1 = one decimal place<br>2 = two decimal place                                                                                                                                                                                                            |
| CodE<br>level lockout         | <b>0</b><br>1<br>2<br>3                | <b>0 = no lockout</b><br>1 = configuration level lockout ( <b>ConF</b> )<br>2 = parameter and configuration level lockout ( <b>PARa</b> & <b>ConF</b> )<br>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<br>baudrate               | <b>0</b><br>1<br>2<br>3      | <b>0 = 4800 baud</b><br>1 = 9600 baud<br>2 = 19200 baud<br>3 = 38400 baud |
| Adr<br>Device address Modbus  | 0..<br><b>1</b> ..<br>254    | Address in the data network                                               |
| dP<br>Device address Profibus | 0.. <b>125</b>               | only with RWF55.6x                                                        |
| dt<br>Remote detection time   | 0..<br><b>30</b> ..<br>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):

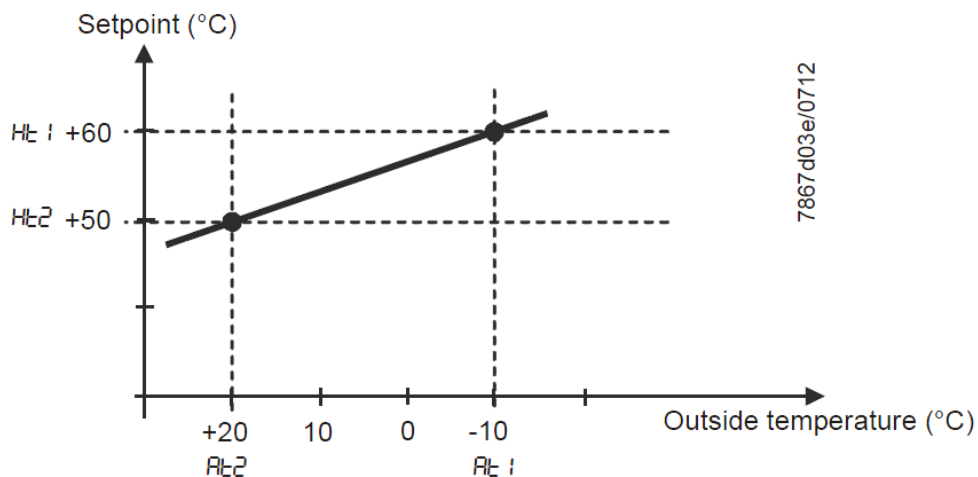
The RWF55 can be configured so that weather-compensated setpoint shifting is activated when an LG-Ni1000 outside sensor or a Pt1000 is connected (see parameter **InP3**).

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).

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## 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**

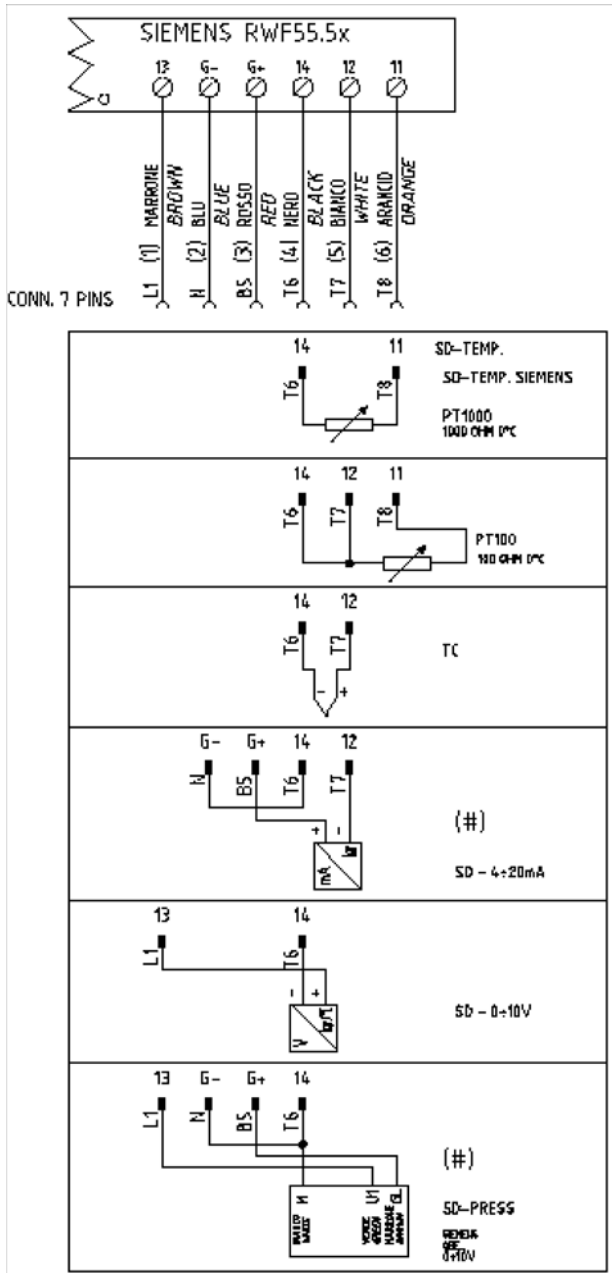
| Address | Access | Data type | Signal reference | Parameter        |
|---------|--------|-----------|------------------|------------------|
| 0x8000  | R/O    | Char12    | ---              | Software version |
| 0x8006  | R/O    | Char14    | ---              | VdN number       |

**Stato dell'apparecchio**

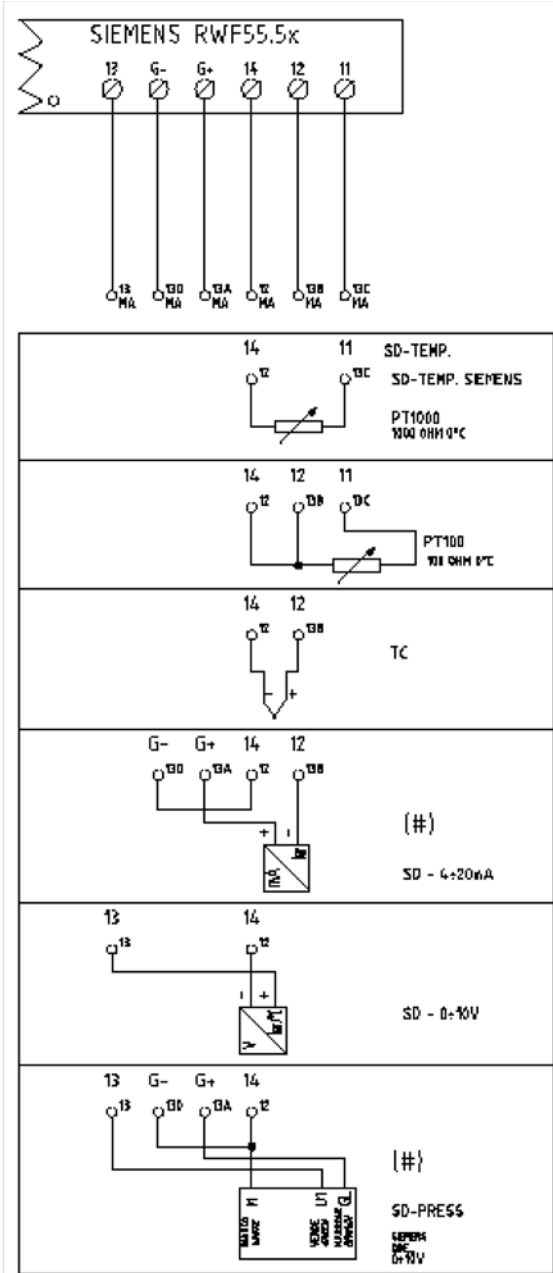
| Address | Access | Data type | Signal reference | Parameter                             |
|---------|--------|-----------|------------------|---------------------------------------|
| 0x0200  | R/O    | Word      | ---              | Outputs and states                    |
|         |        |           | 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 :

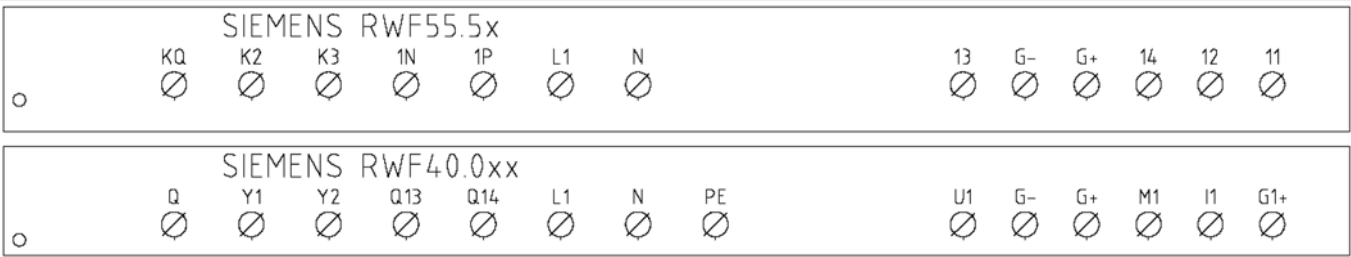
With 7 pins connector version



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

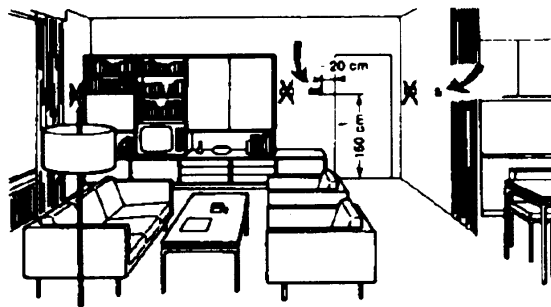
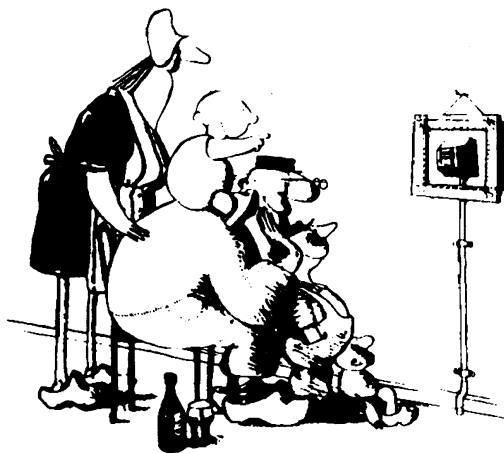
To assure the utmost comfort, the control system needs reliable information, which can be obtained provided the sensors have been installed correctly. Sensors measure and transmit all variations encountered at their location.

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.

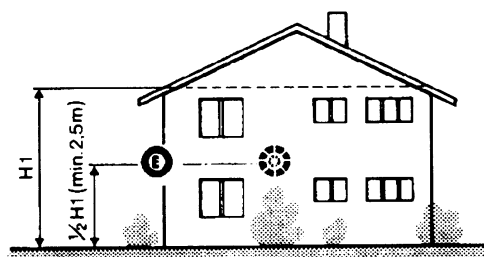
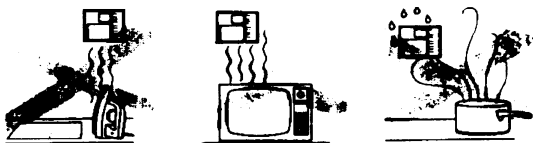


#### Outside probes (weather) Installation

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

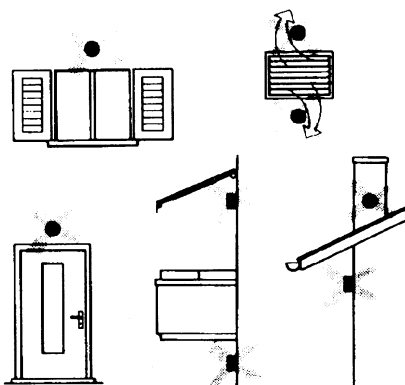
#### It's good to be admired ...even better to be effective

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.



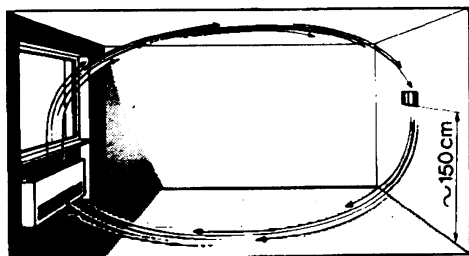
**General rule:** en on the outer wall of the building where the living rooms are, never on the south-facing wall or in a position where they will be affected by morning sun. If in any doubt, place them on the north or north-east façade.

#### 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:

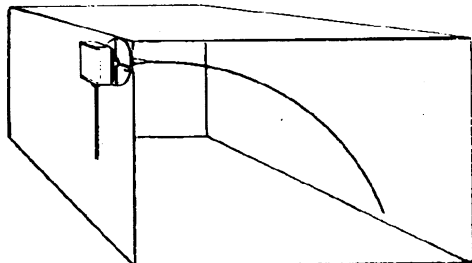
"after delivery fan or

"after coil to be controlled, at a distance of at least 0,5 m

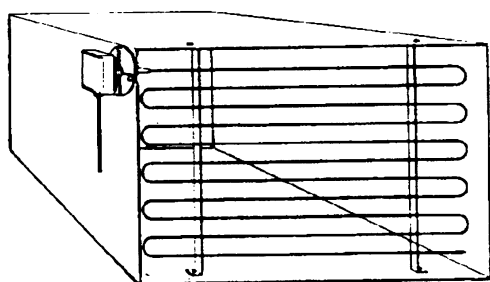
For measuring room temperature:

"before return air intake fan and near room's return airintake.

For measuring saturation temperature: after mist eliminator.



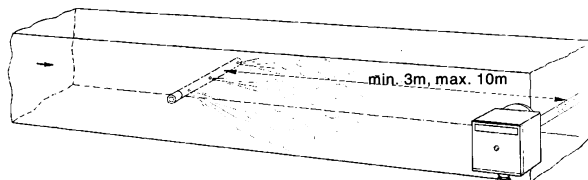
Bend 0.4m sensor by hand (never use tools) as illustrated .



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

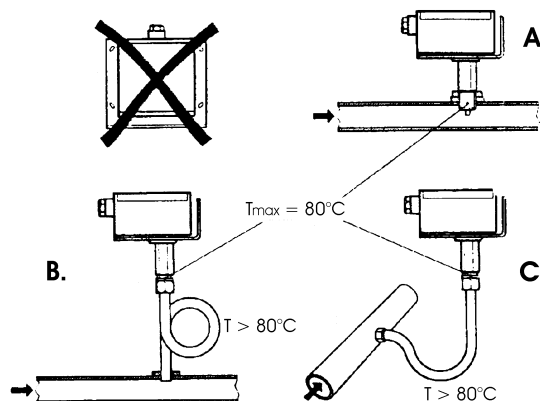
A - installation on ducts carrying fluids at max. temperature 80°C

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

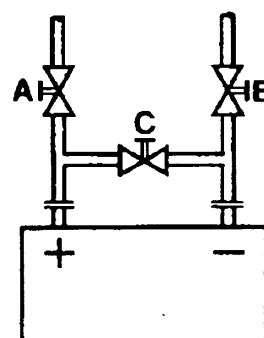
Start disable

1=open C1=open C

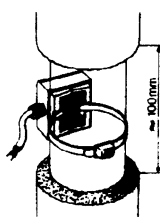
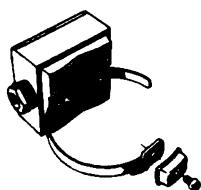
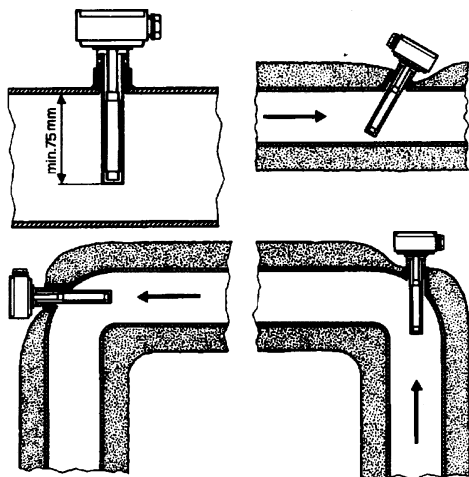
2=open A2=close B

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 .

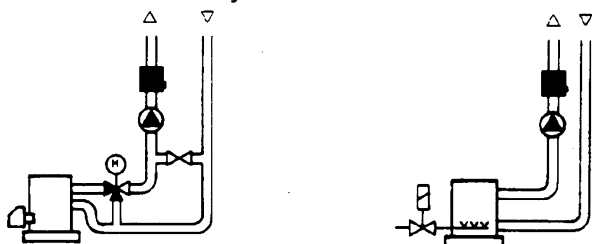
## Placing the probes (QAD22.../QAE21.../QAP21.../RCA...)

### 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

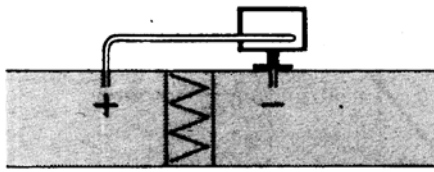
Advantages:

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

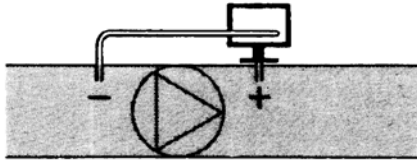
Limits:

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

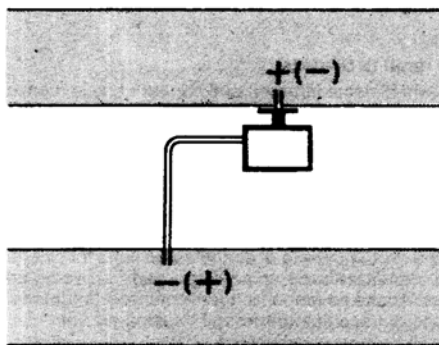
Installing differential pressure probes for air



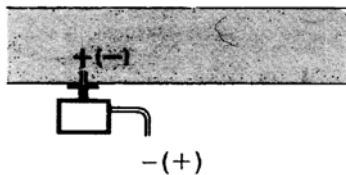
A - Control a filter (clogging)



B - Control a fan (upstream/downstream)



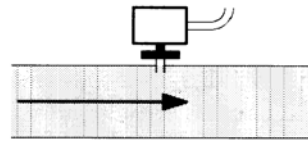
C - Measurement of difference in pressure between two ducts



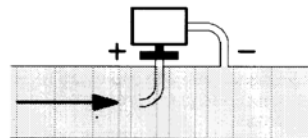
D - Measurement of difference in pressure between two rooms or of inside of duct and outside

Basic principles

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



Measuring dynamic pressure

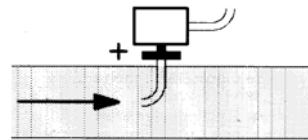


$$P_d = \frac{\gamma q^2}{2g}$$

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.

# MANUALE USER SUPPORT

## MULTI-THERMOSTAT

### MCX06C

MCX06C is a multi-thermostat with four 100k NTC inputs. It can control up to 4 temperatures showing them (not more than 2 at the same time) on a couple of displays.

It is used to check and adjust oil heater temperatures. it works as follows:

as soon as the burner control gives the GO to the digital 1 input (terminals DI1-COM), the adjustment program runs (the relevant LED is ON). Reading the outlet temperature through the probe **Pb3** (terminals AI3-COM), a PID signal is produced. This signal becomes the set-point for the electric resistors. The electric resistors temperature is read through the probe **Pb1** (terminals AI1-COM) so that a second PID signal is produced. This second PID drives a couple of SCR by means of 0-10 V impulses in order to control the electric resistors temperature.

When the burner is in stand-by, resistor set-point is kept at the temperature set in parameter "**p30**" (see parameter group **REG**).

Probe **Pb4** (terminals AI4-COM) controls the inner heater temperature. As soon the relevant set-point is got, it drives the output number 4 (terminals C4-NO4) linked to the relais KTCN. This allows the oil pump to start and also the burner control proceeds with its cycle.

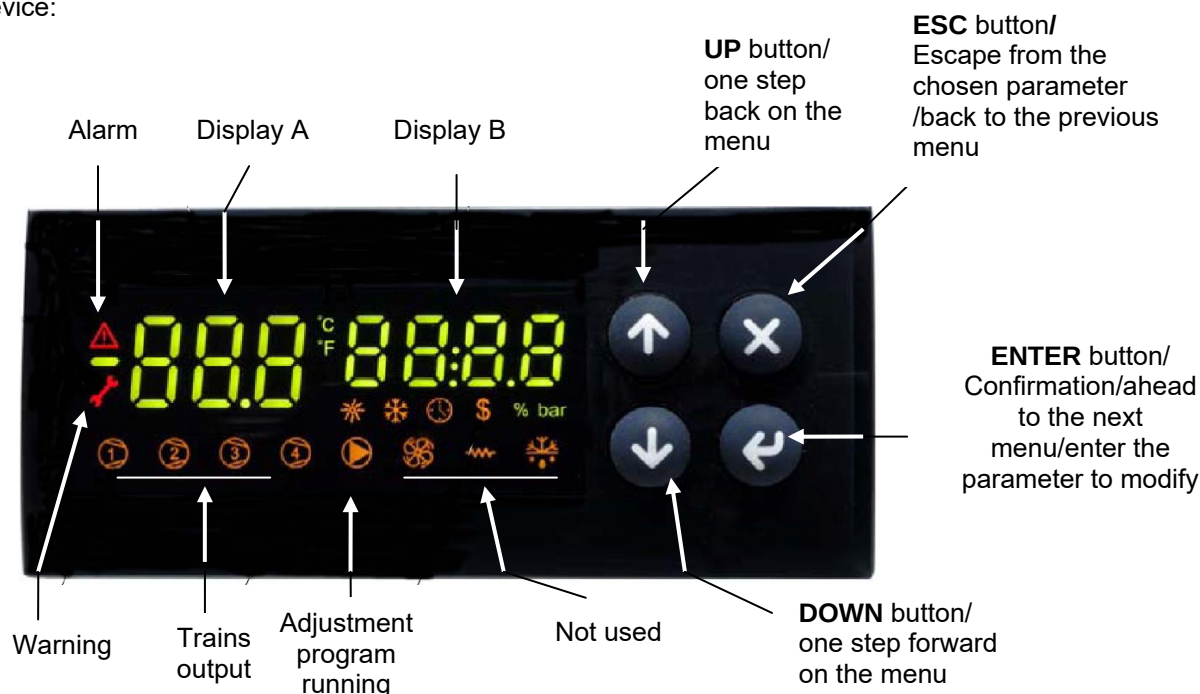
When set-point **trS** is got to, output number 5 is ON (terminals C5-NO5) linked to the relais KTRS. It switches the resistors off and activates an alarm on the device.

Probe **Pb2** (terminals AI2-COM), when fitted, drives output number 2 (terminals C2-NO2) linked to the relais KTCI. This allows the burner control to proceed with ignition.

See below the set-point recommended figures.

#### User interface:

Device:

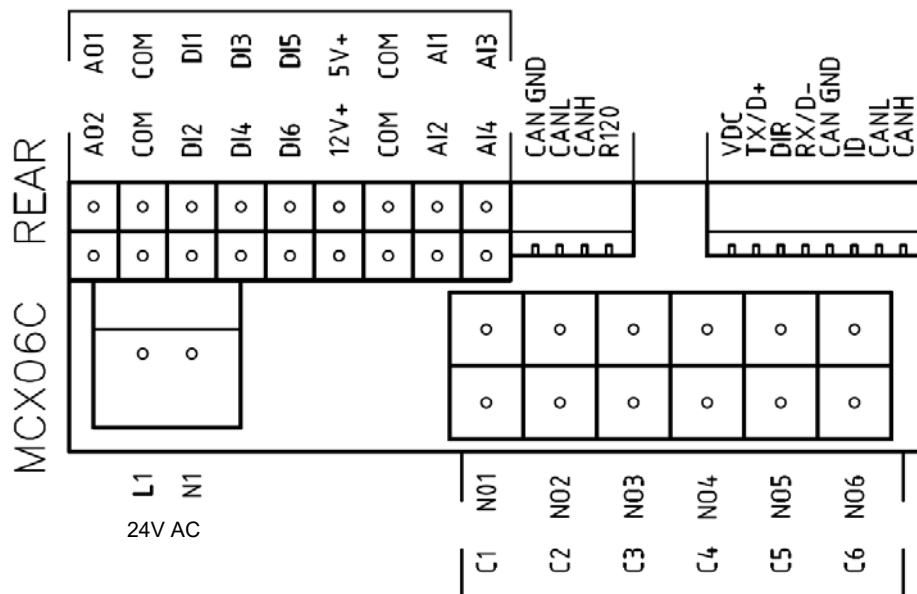


#### Note :

In normal operation, the display A shows the oil tank resistor temperature (probe Pb1).

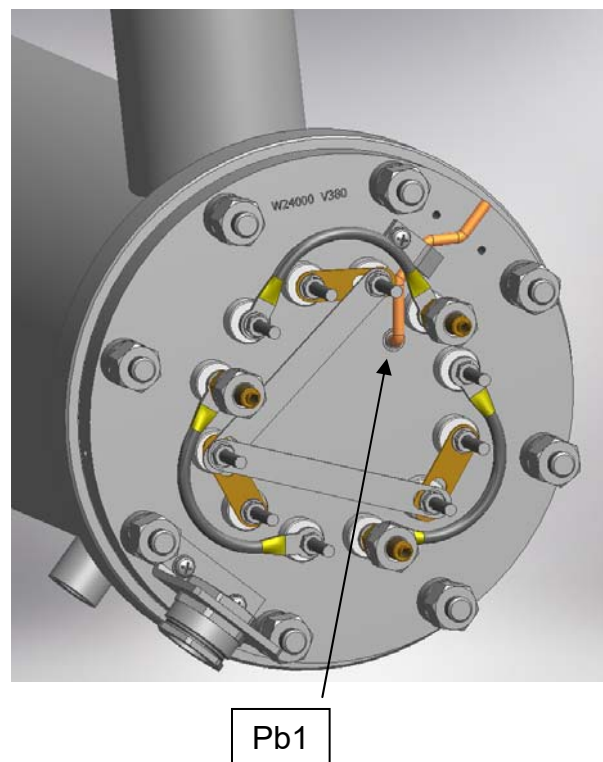
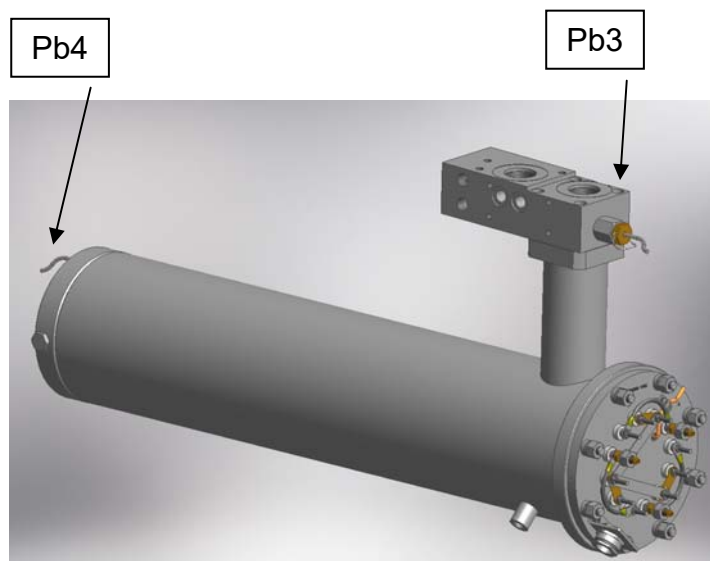
In normal operation, the display B shows the oil output temperature (probe Pb3).

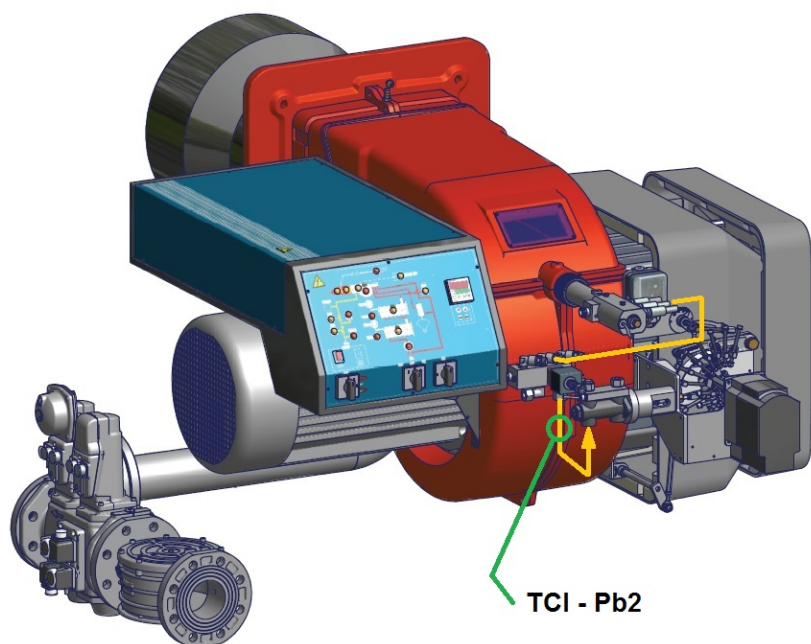
## Connections from terminal side :



## Probe connection:

input **AI1** = probe **Pb1** = set-point "**tr**" = oil heater temperature probe;  
input **AI2** = probe **Pb2** = set-point "**tCl**" = plant consent temperature probe (when installed);  
input **AI3** = probe **Pb3** = set-point "**OIL**" = oil heater output temperature probe (PID regulation);  
input **AI4** = probe **Pb4** = set-point "**tcn**" = oil heater consent temperature probe.





(tCI - Pb2 probe only for mechanical atomizing burners)

#### Menu :

To enter the menu below, keep pushing **ENTER** for more than 3 s.

| Menu code | Sub-menu code | Function              | Notes                                                                                                                                                                                            |
|-----------|---------------|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Prb       |               | Probes values         | You can see in sequence the 4 probe values (UP and DOWN keys): the probe code is on display A (Pb1,..., Pb4) and the probe value is on display B (not fitted or out of work probes show "----"). |
| Log       |               | Login                 | It defines the access level to menu and parameters (password)                                                                                                                                    |
|           | PAS           | Password              | Password input                                                                                                                                                                                   |
| Par       |               | Parameters menu       | Access to parameters (you have to login first)                                                                                                                                                   |
|           | CnF           | Configuration menu    | Parameter configuration                                                                                                                                                                          |
|           | rEG           | Regulation menu       | Set to set-point, probe, thresholds etc.                                                                                                                                                         |
| ALA       |               | Alarm menu            | Access to alarm management                                                                                                                                                                       |
|           | Act           | Active alarms         | Show the active alarms                                                                                                                                                                           |
|           | rES           | Reset alarms          | Reset of the manual reset alarms                                                                                                                                                                 |
| Loc       |               | Lock/Unlock functions | Not used                                                                                                                                                                                         |
| InF       | rEL           | Software version      | Installed software version                                                                                                                                                                       |
| tUN       |               | Autotuning            | Activation On, deactivation ESC<br>PID parameter autotuning                                                                                                                                      |

#### Login:

All the parameters inside the **Par** menu are locked by a password.

Without password, only set-points can be modified.

To login, on the log menu, press **ENTER** for more than 3 s. Input your password (level 2 or 3) inside **PAS**

With password for level 3 all the data can be set.

submenu **CnF** - configuration parameters group :

| Menu       | Parameter | Description                         | Additional description                                                 | Min    | Max   | Default | U.M. | Visibility condition | Password level | Modbus index |
|------------|-----------|-------------------------------------|------------------------------------------------------------------------|--------|-------|---------|------|----------------------|----------------|--------------|
| <b>CnF</b> |           | <b>CONFIGURATION</b>                |                                                                        |        |       |         |      |                      | 0              |              |
| AI1        |           | Analog Input 1                      |                                                                        |        |       |         |      |                      | 1              |              |
|            | A1P       | Probe 1 Presence                    | This parameter enables or disables the probe                           | 0      | 1     | 1       |      |                      | 2              | 1            |
|            | A1C       | Calibration Probe 1                 | Don't modify it                                                        | -20,0  | 20,0  | 0,0     | °C   | A1P >0               | 3              | 2            |
| AI2        |           | Analog Input 2                      |                                                                        |        |       |         |      |                      | 1              |              |
|            | A2P       | Probe 2 Presence                    | This parameter enables or disables the probe                           | 0      | 1     | 1       |      |                      | 2              | 3            |
|            | A2C       | Calibration Probe 2                 | Don't modify it                                                        | -20,0  | 20,0  | 0,0     | °C   | A2P >0               | 3              | 4            |
| AI3        |           | Analog Input 3                      |                                                                        |        |       |         |      |                      | 1              |              |
|            | A3P       | Probe 3 Presence                    | This parameter enables or disables the probe                           | 0      | 4     | 1       |      |                      | 2              | 5            |
|            | A3L       | Min. Value conversion AI3           | Don't modify it                                                        | -999,9 | 999,9 | 0,0     |      | A3P >2               | 3              | 6            |
|            | A3H       | Max. Value conversion AI3           | Don't modify it                                                        | -999,9 | 999,9 | 30,0    |      | A3P >2               | 3              | 7            |
|            | A3C       | Calibration Probe 3                 | Don't modify it                                                        | -20,0  | 20,0  | 0,0     | °C   | A3P >0               | 3              | 8            |
| AI4        |           | Analog Input 4                      |                                                                        |        |       |         |      |                      | 1              |              |
|            | A4P       | Probe 4 Presence                    | This parameter enables or disables the probe                           | 0      | 4     | 1       |      |                      | 2              | 9            |
|            | A4L       | Min. Value conversion AI4           | Don't modify it                                                        | -999,9 | 999,9 | 0,0     |      | A4P >2               | 3              | 10           |
|            | A4H       | Max. Value conversion AI4           | Don't modify it                                                        | -999,9 | 999,9 | 30,0    |      | A4P >2               | 3              | 11           |
|            | A4C       | Calibration Probe 4                 | Don't modify it                                                        | -20,0  | 20,0  | 0,0     | °C   | A4P >0               | 3              | 12           |
| dl         |           | Digital input                       |                                                                        |        |       |         |      |                      | 1              |              |
|            | dl1       | Input 1 polarity (Pump)             | Change type of digital input ( NC o NO)                                | 0      | 1     | 1       |      |                      | 3              | 13           |
|            | dl2       | Alarm polarity from input 2         | Change type of digital input ( NC o NO)                                | 0      | 2     | 2       |      |                      | 2              | 14           |
|            | dl3       | Alarm polarity from input 3         | Change type of digital input ( NC o NO)                                | 0      | 2     | 2       |      |                      | 2              | 15           |
|            | dl4       | Alarm polarity from input 4         | Change type of digital input ( NC o NO)                                | 0      | 2     | 2       |      |                      | 2              | 16           |
|            | dl5       | Alarm polarity from input 5         | Change type of digital input ( NC o NO)                                | 0      | 2     | 2       |      |                      | 2              | 17           |
|            | dl6       | Alarm polarity from input 6         | Change type of digital input ( NC o NO)                                | 0      | 2     | 2       |      |                      | 2              | 18           |
| dl         |           | Digital output<br>Alarm and Warning |                                                                        |        |       |         |      |                      | 1              |              |
|            | dO5       | Polarity output Warning             | Change type of digital input ( NC o NO)                                | 0      | 1     | 0       |      |                      | 3              | 19           |
|            | dO6       | Polarity output Alarm               | Change type of digital input ( NC o NO)                                | 0      | 1     | 0       |      |                      | 3              | 20           |
| SIC        |           | Safety probe                        |                                                                        |        |       |         |      |                      | 1              |              |
|            | Slp       | Selection of safety probe           | Probe which also activates the relay<br>Warning (ns. KTRS)             | 0      | 4     | 4       |      |                      | 3              | 21           |
| SyS        |           | System                              |                                                                        |        |       |         |      |                      | 0              |              |
|            | dSA       | display A output                    | Probe temperature or set-point to be<br>displayed in the left display  | 0      | 8     | 1       |      |                      | 3              | 22           |
|            | dSb       | display B output                    | Probe temperature or set-point to be<br>displayed in the right display | 0      | 8     | 3       |      |                      | 3              | 23           |
| PAS        |           | Password                            |                                                                        |        |       |         |      |                      | 1              |              |
|            | PL1       | Password level 1                    |                                                                        | 0      | 9999  | 0       |      |                      | 1              | 32           |
|            | PL2       | Password level 2                    |                                                                        | 0      | 9999  |         |      |                      | 2              | 33           |
|            | PL3       | Password level 3                    |                                                                        | 0      | 9999  |         |      |                      | 3              | 34           |

| Menu | Parameter | Description                                                         | Additional description | Min  | Max   | Default | U.M. | Visibility condition | Level | Modbus index |
|------|-----------|---------------------------------------------------------------------|------------------------|------|-------|---------|------|----------------------|-------|--------------|
| tUN  |           | Autotuning                                                          |                        |      |       |         |      |                      | 3     |              |
|      | tU1       | Output temperature hysteresis                                       | Don't modify it        | 0    | 50,0  | 0,5     | °C   |                      | 3     | 35           |
|      | tU2       | Startup number                                                      | Don't modify it        | 0    | 5     | 2       |      |                      | 3     | 36           |
|      | tU3       | Measurement cycles number                                           | Don't modify it        | 1    | 4     | 2       |      |                      | 3     | 37           |
|      | tU4       | Max. differential command exit                                      | Don't modify it        | 0,01 | 10,00 | 10,00   | V    |                      | 3     | 38           |
|      | tU5       | Differential reduction exit command (%)                             | Don't modify it        | 0    | 100   | 15      |      |                      | 3     | 39           |
|      | tU6       | Calculating mode:<br>0= Symmetrical;<br>1=Asymmetrical;<br>2=Simple | Don't modify it        | 0    | 2     | 2       |      |                      | 3     | 40           |
|      | tU7       | Enabling                                                            | Don't modify it        | 0    | 1     | 1       |      |                      | 3     | 41           |

Submenu **REG** – regulation parameters group :

| Menu       | Parameter | Description                                                | Additional description                                                      | Min   | Max    | Default | U.M. | Visibility condition | Level | Modbus index |
|------------|-----------|------------------------------------------------------------|-----------------------------------------------------------------------------|-------|--------|---------|------|----------------------|-------|--------------|
| <b>REG</b> |           | <b>REGULATION</b>                                          |                                                                             |       |        |         |      |                      | 0     |              |
| Pb1        |           | Probe 1                                                    |                                                                             |       |        |         |      |                      | 0     |              |
|            | rES       | Set-point Probe 1 (Tank resistor)                          | Don't modify it                                                             | -50,0 | 200,0  | 0,0     | °C   |                      | 3     | 42           |
|            | AL1       | Probe 1 - Low Temperature Alarm Threshold                  | Don't modify it                                                             | -50,0 | 200,0  | -50,0   | °C   |                      | 3     | 43           |
|            | AH1       | Probe 1 - High Temperature Alarm Threshold                 | Don't modify it                                                             | -50,0 | 200,0  | 200,0   | °C   |                      | 3     | 44           |
|            | d01       | Probe 1 differential                                       |                                                                             | 0,0   | 20,0   | 3,0     | °C   |                      | 3     | 45           |
| Pb2        |           | Probe 2                                                    |                                                                             |       |        |         |      |                      | 0     |              |
|            | tCI       | Set-point Probe 2 (Plant Consent)                          | Plant consent according to table <b>"Set point adjustment"</b>              | -50,0 | 200,0  | 120,0   | °C   |                      | 0     | 46           |
|            | AL2       | Probe 2 - Low Temperature Alarm Threshold                  | Don't modify it                                                             | -50,0 | 200,0  | -50,0   | °C   |                      | 2     | 47           |
|            | AH2       | Probe 2 - High Temperature Alarm Threshold                 | Don't modify it                                                             | -50,0 | 200,0  | 200,0   | °C   |                      | 2     | 48           |
|            | d02       | Probe 2 differential                                       |                                                                             | 0,0   | 20,0   | 3,0     | °C   |                      | 2     | 49           |
| Pb3        |           | Probe 3                                                    |                                                                             |       |        |         |      |                      | 0     |              |
|            | rE3       | Type of regulation of probe 3 (Oil tank exit)              | Type of regulation<br>0= thermostat; 1= PID (don't modify)                  | 0     | 1      | 1       |      |                      | 3     | 50           |
|            | OIL       | Set-point Probe 3 (Oil tank exit)                          | Nozzle oil temperature according to the table <b>"Set point adjustment"</b> | -50,0 | 200,0  | 130,0   | °C   |                      | 0     | 51           |
|            | AL3       | Probe 3 - Low Temperature Alarm Threshold (Oil tank exit)  | Don't modify it                                                             | -50,0 | 200,0  | -50,0   | °C   |                      | 2     | 52           |
|            | AH3       | Probe 3 - High Temperature Alarm Threshold (Oil tank exit) | Don't modify it                                                             | -50,0 | 200,0  | 200,0   | °C   |                      | 2     | 53           |
|            | Pb3       | Proportional band for PID Probe 3 (Oil tank exit)          | Proportional band for first PID regulation                                  | 0,0   | 200,0  | 60,0    |      |                      | 3     | 54           |
|            | db3       | Dead Zone for PID Probe 3 (Oil tank exit)                  | Dead zone for first PID regulation                                          | 0,0   | 20,0   | 0,0     | °C   | rE3 =1               | 3     | 55           |
|            | rt3       | Integral Time (Ti) for PID Probe 3 (Oil tank exit)         | Integral time for first PID regulation                                      | 0,0   | 1000,0 | 120,0   | s    | rE3 =1               | 3     | 56           |
|            | dt3       | DerivativeTime (Td) for PID Probe 3 (Oil tank exit)        | Derivative time for first PID regulation (~ ¼ di rt3)                       | 0,0   | 300,0  | 30,0    | s    | rE3 =1               | 3     | 57           |
|            | db3       | Dead Zone for PID Probe 3 (Oil tank exit)                  | Dead zone for first PID regulation                                          | 0,0   | 20,0   | 0,0     | °C   | rE3 =1               | 3     | 55           |

| Menu | Parameter | Description                                                    | Additional description                                                     | Min   | Max    | Default | U.M. | Visibility condition | Level | Modbus index |
|------|-----------|----------------------------------------------------------------|----------------------------------------------------------------------------|-------|--------|---------|------|----------------------|-------|--------------|
|      | pi1       | Overshooting for Integral action (Oil tank exit)               | Don't modify it                                                            | 100   | 1000   | 200     |      | rE3 =1               | 3     | 58           |
|      | pi2       | Derivative action enabling (Oil tank exit)                     | Don't modify it                                                            | 0     | 1      | 1       |      | rE3 =1               | 3     | 59           |
|      | pi3       | Filtering factor for derivative action (Oil tank exit)         | Don't modify it                                                            | 1     | 100    | 20      |      | rE3 =1               | 3     | 60           |
|      | pi4       | Duty cicle PWM for output DO3 and/or AO1 (0-10V)               | Don't modify it                                                            | 1     | 300    | 5       | s    | rE3 =1               | 3     | 61           |
|      | SL3       | Output selection DO3 and/or AO1 (0-10V)                        | Digital selection output for control thyristors; Don't modify it           | 0     | 2      | AO1     |      |                      | 3     | 62           |
|      | p21       | Proportional band for PID Probe 1 (Tank resistor)              | Proportional band for second PID regulation                                | 0,0   | 200,0  | 50,0    |      | rE3 =1               | 3     | 63           |
|      | p22       | Dead Zone for PID Probe 1 (Tank resistor)                      | Dead zone for second PID regulation                                        | 0,0   | 20,0   | 0,0     | °C   | rE3 =1               | 3     | 64           |
|      | p23       | Integral Time (Ti) for PID Probe 1 (Tank resistor)             | Integral time for second PID regulation                                    | 0,0   | 1000,0 | 110,0   | s    | rE3 =1               | 3     | 65           |
|      | p24       | DerivativeTime (Td) for PID Probe 1 (Tank resistor)            | Derivative time for second PID regulation                                  | 0,0   | 300,0  | 23,0    | s    | rE3 =1               | 3     | 66           |
|      | p25       | Overshooting for Integral action (Tank resistor)               | Don't modify it                                                            | 100   | 1000   | 200     |      | rE3 =1               | 3     | 67           |
|      | p26       | Derivative action enabling (Tank resistor)                     | Don't modify it                                                            | 0     | 1      | 1       |      | rE3 =1               | 3     | 68           |
|      | p27       | Filtering factor for derivative action (Tank resistor)         | Don't modify it                                                            | 1     | 100    | 20      |      | rE3 =1               | 3     | 69           |
|      | p28       | Min Output PID Probe 3 (Oil tank exit)                         | Minimum value tank resistor set-point (delta of 100°C above p29)           | 0,0   | 1000,0 | 80,0    | °C   | rE3 =1               | 3     | 70           |
|      | p29       | Max Output PID Probe 3 (Oil tank exit)                         | Maximum value tank resistor set-point                                      | 0,0   | 1000,0 | 180,0   | °C   | rE3 =1               | 3     | 71           |
|      | SP0       | Set-point Tank Resistor with oil pump stops (stand by)         | Set-point of maintaining resistance during stand by "Set point adjustment" | -50,0 | 200,0  | 140,0   | °C   | rE3 =1               | 0     | 72           |
| Pb4  |           | Probe 4                                                        |                                                                            |       |        |         |      |                      | 0     |              |
|      | tcn       | Setpoint Probe 4 (Oil consent)                                 | Oil consent according table "Set point adjustment"                         | -50,0 | 200,0  | 110,0   | °C   |                      | 0     | 73           |
|      | AL4       | Low Threshold Probe 4                                          |                                                                            | -50,0 | 200,0  | -50,0   | °C   |                      | 2     | 74           |
|      | trS       | Probe 4 - High Temperature Alarm Threshold (Safety Thermostat) | Tank resistor safety temperature according table "Set point adjustment"    | -50,0 | 200,0  | 190,0   | °C   |                      | 0     | 75           |
|      | d04       | Probe 4 differential                                           |                                                                            | 0,0   | 20,0   | 3,0     | °C   |                      | 2     | 76           |

### Alarms & Warning:

When the red triangle on the top left lights, one or more alarms are activated.

When the red key on the left lights, the output N05-C5 is active and the relay **KTRS** switches the resistors OFF. Check the reason, correct the failure and, as soon as the temperature is lower than **trS**, reset it through **ALA/rES**. In order to show active alarms and warnings, select the relevant menu through **ALA/Act.** and, using the **UP** and **DOWN** buttons, scroll the lines.

In order to perform the manual reset, select **ALA/rES**.

| Code | Description                      | Source                | Active simbol | Reset type |
|------|----------------------------------|-----------------------|---------------|------------|
| trS  | High temperature resistors alarm | probe Pb4 > value trS | red key       | Manual     |
| EP1  | Probe Pb1 fault                  | Probe Pb1 fault       | red triangle  | Automatic  |
| EP2  | Probe Pb2 fault                  | Probe Pb2 fault       | red triangle  | Automatic  |
| EP3  | Probe Pb3 fault                  | Probe Pb3 fault       | red triangle  | Automatic  |
| EP4  | Probe Pb4 fault                  | Probe Pb4 fault       | red triangle  | Automatic  |

### Set point adjustment:

All the parameters inside the **Par** menu are locked by a password. The user can modify only set points, without using any passwords.

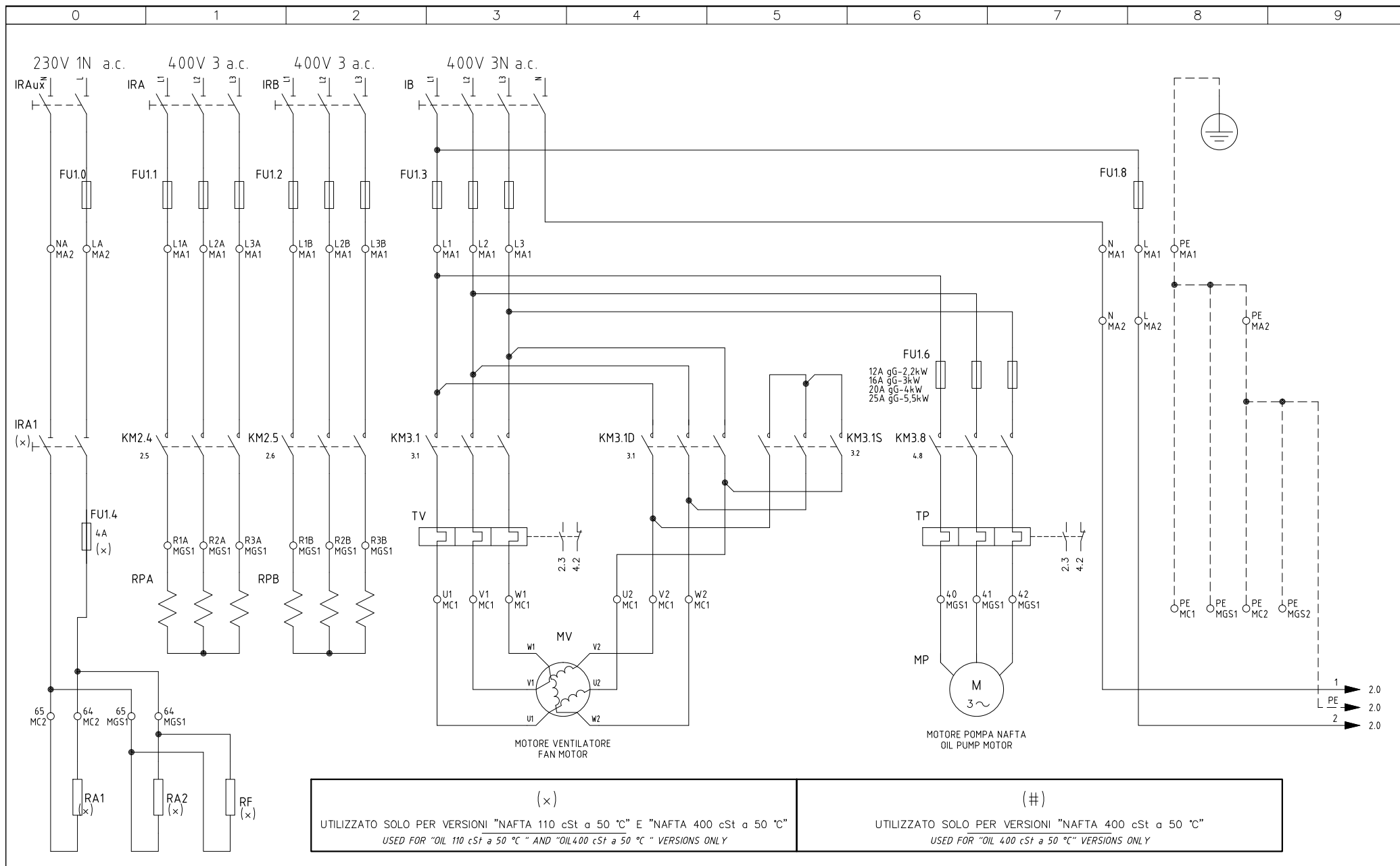
The oil viscosity at the nozzle, should be about 1,5°E, which guarantees correct and safe functioning of the burner. The temperature values in the table, guarantee the respect of that parameter and are valid when the pre heating tank is installed on the burner. For different configurations, please refer to the chapter "Recommendations to design heavy oil feeding plants" on the burner manual

Here below recommended set points:

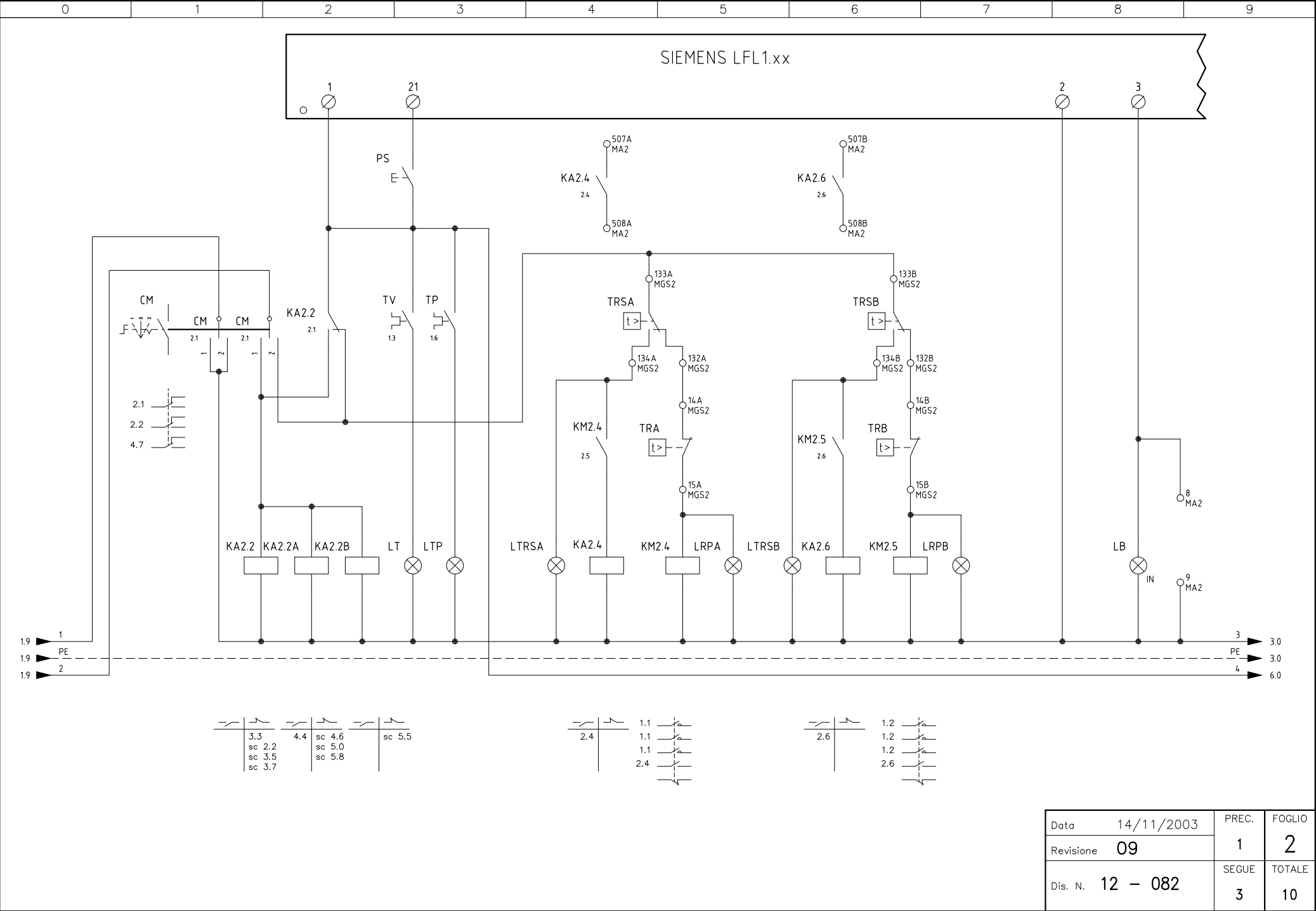
| Menu path |     |     |                                                       | Oil viscosity at 50 °C according to the letter shown in the burner model |            |                       |                        |                         |
|-----------|-----|-----|-------------------------------------------------------|--------------------------------------------------------------------------|------------|-----------------------|------------------------|-------------------------|
|           |     |     |                                                       | P                                                                        | N          | E                     | D                      | H                       |
|           |     |     |                                                       | 89 cSt                                                                   | < 50 cSt   | > 50 cSt<br>< 110 cSt | > 110 cSt<br>< 400 cSt | > 400 cSt<br>< 4000 cSt |
|           |     |     |                                                       | 12 °E                                                                    | < 7°E      | > 7 °E<br>< 15 °E     | > 15 °E<br>< 50 °E     | > 50 °E<br>< 530 °E     |
| Par       |     |     |                                                       |                                                                          |            |                       |                        |                         |
| rEG       | Pb1 | tr  | Oil heater temperature probe                          | parameter not visible                                                    |            |                       |                        |                         |
|           | Pb2 | tCl | Plant consent temperature probe (when installed)      | 20 °C                                                                    | 70 °C      | 70 °C                 | 70 °C                  | ---                     |
|           | Pb3 | Oil | oil heater output temperature probe (PID regulation); | 60-70 °C                                                                 | 110-120 °C | 120-130 °C            | 130-140 °C             | 140-150 °C              |
|           |     | SP0 | Set-point oil heater with oil pump stopped (stand-by) | 45 °C                                                                    | 120 °C     | 130 °C                | 140 °C                 | 150 °C                  |
|           | Pb4 | tcn | Oil heater consent temperature probe                  | 40 °C                                                                    | 100 °C     | 100 °C                | 110 °C                 | 120 °C                  |
|           |     | trS | Safety temperature tank resistors (manual reset)      | 120 °C                                                                   | 190-200 °C | 190-200 °C            | 190-200 °C             | 190-200 °C              |

The above temperature values are suggested and refer to a plant designed according to the prescriptions in the burner user manual.

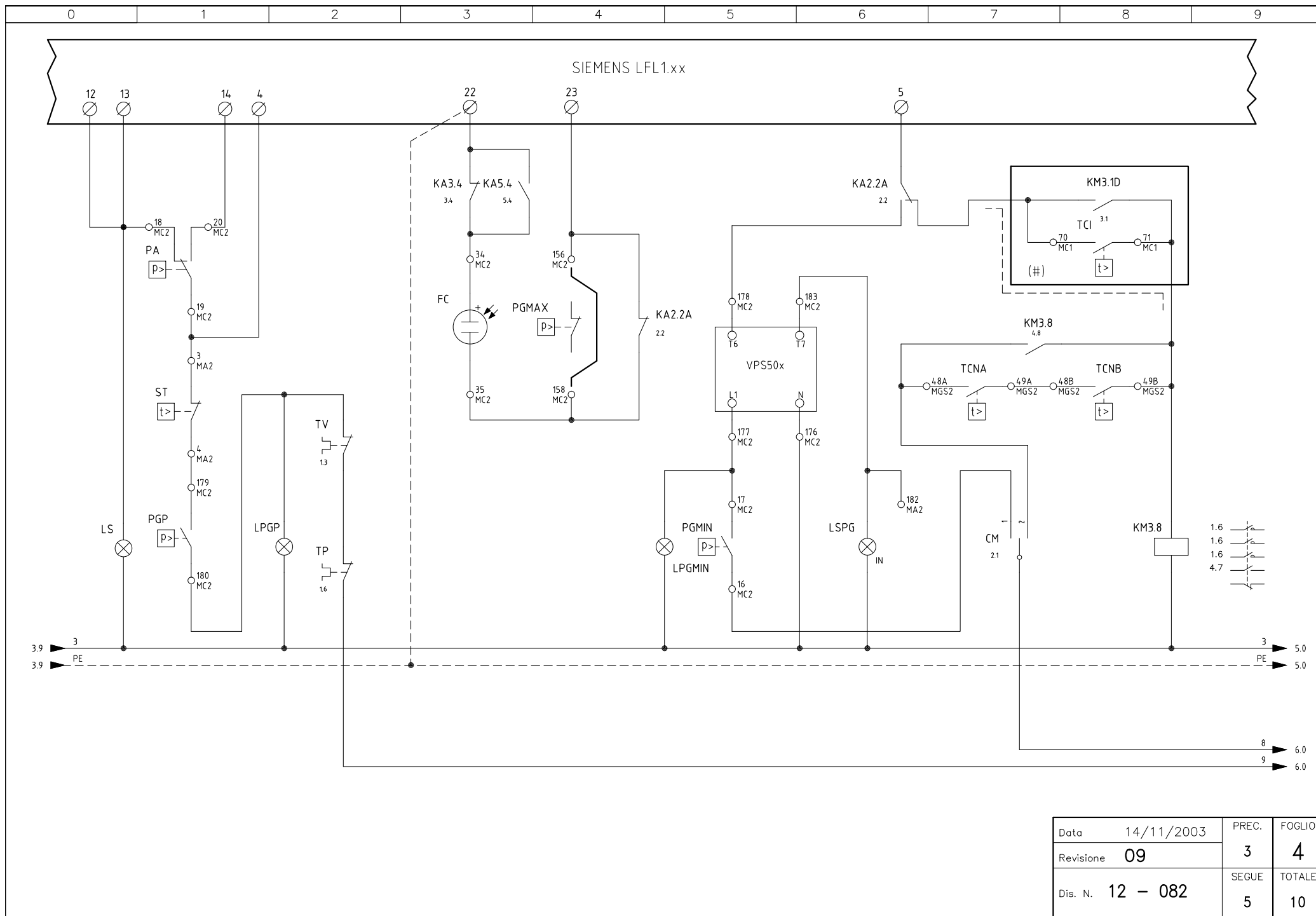
The suggested values can change in reference to the fuel oil specifications.

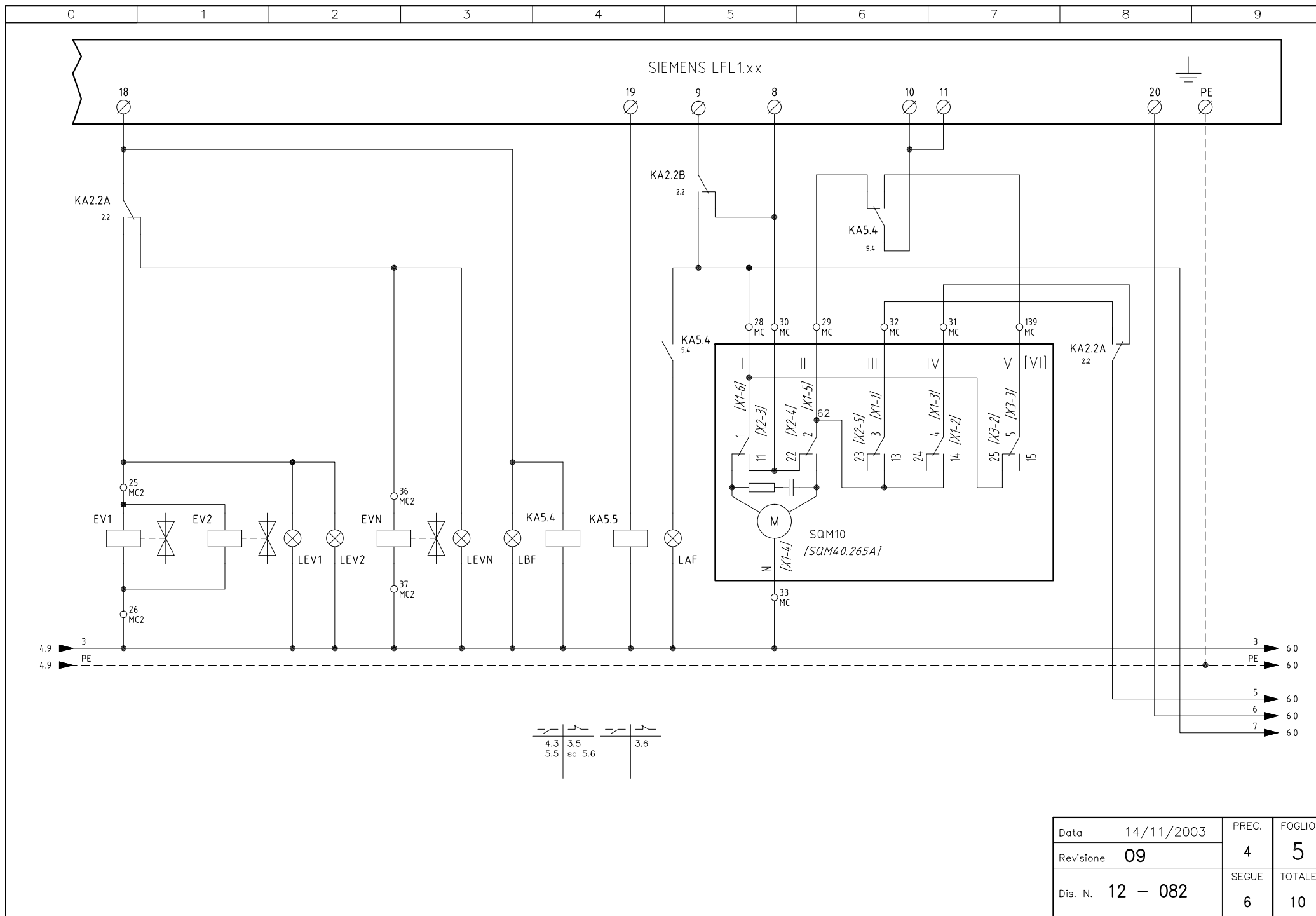


|      |                             |          |           |                                                                                     |                                                                    |             |                  |              |            |       |        |
|------|-----------------------------|----------|-----------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------|-------------|------------------|--------------|------------|-------|--------|
| 05   | AGGIUNTO/ADDED RF,TL,TR     | 29/04/09 | U. PINTON |  | Impianto                                                           | Ordine      |                  | Data         | 14/11/2003 | PREC. | FOGLIO |
| 09   | AGGIUNTO/ADDED "RWF50.2"    | 04/10/11 | U. PINTON |                                                                                     | TIPI/TYPES KR1025/KR1030/KR1040<br>MODELLO/MODEL Mx.MD.S.xx.A.1.xx | Commissa    | Data Controllato | Revisione    | 09         |       |        |
| 08   | AGGIUNTO/ADDED "KA2.2B"     | 28/04/11 | U. PINTON |                                                                                     |                                                                    | Descrizione |                  | 04/10/2011   |            | SEQUE | TOTALE |
| 07   | MODIFICATO/MODIFIED "PGMAX" | 21/01/11 | U. PINTON |                                                                                     |                                                                    |             | Esecutore        | Controllato  | Dis. N.    |       |        |
| 06   | AGGIUNTO/ADDED SQM40.265A   | 10/11/09 | U. PINTON |                                                                                     |                                                                    |             | U. PINTON        | S. MARCHETTI | 12 - 082   |       |        |
| REV. | MODIFICA                    | DATA     | FIRME     |                                                                                     |                                                                    |             |                  |              |            | 2     | 10     |







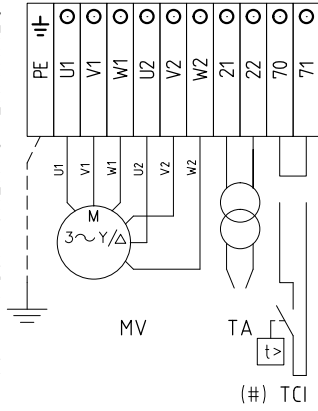


|           |            |       |        |
|-----------|------------|-------|--------|
| Data      | 14/11/2003 | PREC. | FOGLIO |
| Revisione | 09         | 4     | 5      |
| Dis. N.   | 12 - 082   | SEGUE | TOTALE |
|           |            | 6     | 10     |



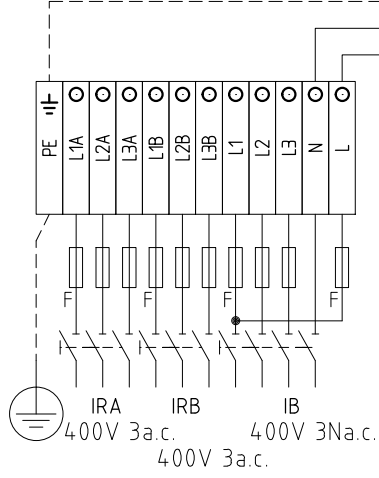
# QG - MC1

MORSETTIERA COMPONENTI BRUCIATORE - PIASTRA 1  
BURNER COMPONENTS TERMINALS - PLATE 1



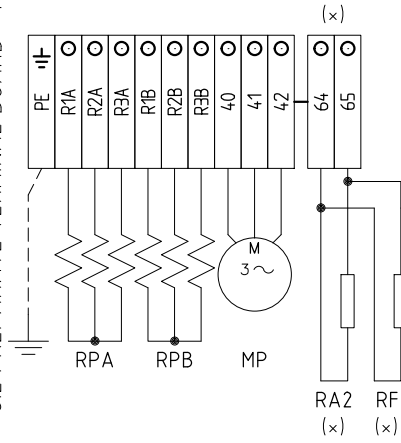
# QG - MA1

MORSETTIERA ALIMENTAZIONE - PIASTRA 1  
SUPPLY TERMINALS - PLATE 1



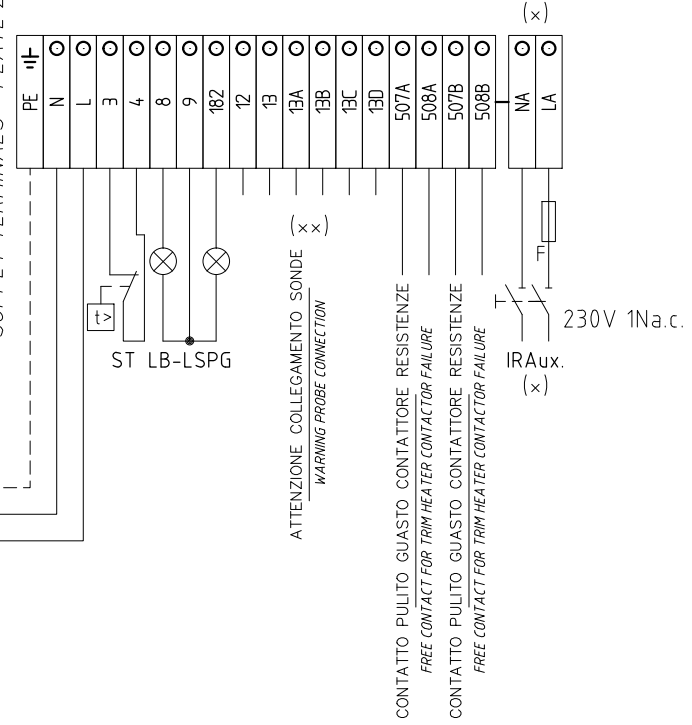
# QG - MGS1

MORSETTIERA GRUPPO SPINTA - PIASTRA 1  
OIL PREPARETE TERMINAL BOARD - PLATE 1



# QG - MA2

MORSETTIERA ALIMENTAZIONE - PIASTRA 2  
SUPPLY TERMINALS - PLATE 2

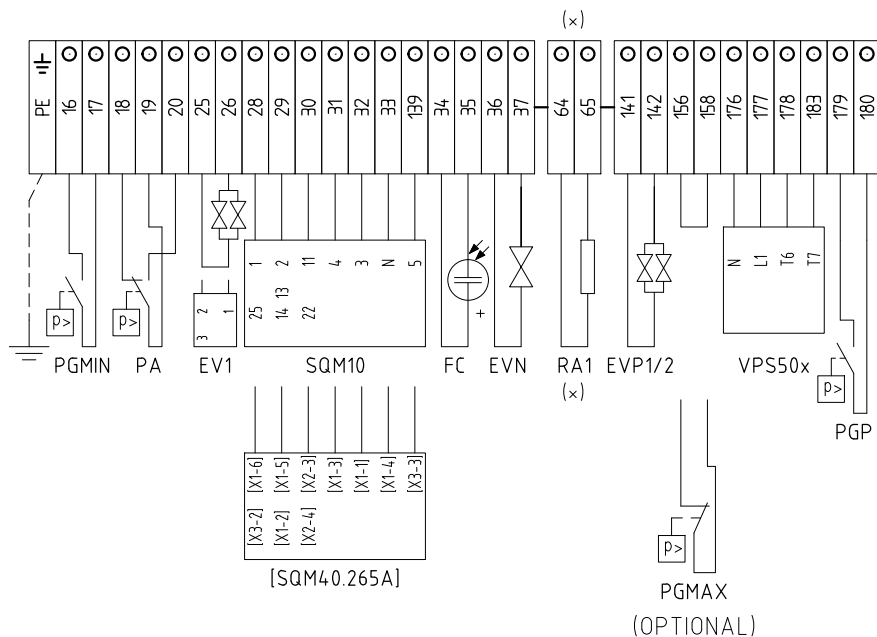


(x)  
UTILIZZATO SOLO PER VERSIONI "NAFTA 110 cSt a 50 °C" E "NAFTA 400 cSt a 50 °C"  
USED FOR "OIL 110 cSt a 50 °C" AND "OIL 400 cSt a 50 °C" VERSIONS ONLY

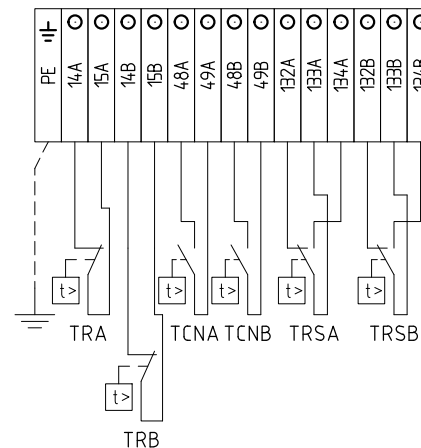
(#)  
UTILIZZATO SOLO PER VERSIONI "NAFTA 400 cSt a 50 °C"  
USED FOR "OIL 400 cSt a 50 °C" VERSIONS ONLY

|           |            |       |        |
|-----------|------------|-------|--------|
| Data      | 14/11/2003 | PREC. | FOGLIO |
| Revisione | 09         | 6     | 7      |
| Dis. N.   | 12 - 082   | SEGUE | TOTALE |
|           |            | 8     | 10     |

QG - MC2  
MORSETTIERA COMPONENTI BRUCIATORE - PIASTRA 2



QG - MGS2  
MORSETTIERA GRUPPO SPINTA - PIASTRA 2



SERVOCOMANDO SERRANDA ARIA  
AIR DAMPER ACTUATOR  
SQM10

- I ALTA FIAMMA  
HIGH FLAME
- II SOSTA E ACCENSIONE  
STAND-BY AND IGNITION
- III BASSA FIAMMA GAS  
GAS LOW FLAME
- IV BASSA FIAMMA NAFTA  
OIL LOW FLAME
- V LIMITAZIONE CORSA ANTICIPO SERVOCOMANDO  
SERVO CONTROL AUTOMATIC ADVANCE RESTRICTION

SERVOCOMANDO SERRANDA ARIA  
AIR DAMPER ACTUATOR  
[SQM40.265A]

- I ALTA FIAMMA  
HIGH FLAME
- II SOSTA E ACCENSIONE  
STAND-BY AND IGNITION
- III BASSA FIAMMA GAS  
GAS LOW FLAME
- IV BASSA FIAMMA NAFTA  
OIL LOW FLAME
- VI LIMITAZIONE CORSA ANTICIPO SERVOCOMANDO  
SERVO CONTROL AUTOMATIC ADVANCE RESTRICTION

(x)

UTILIZZATO SOLO PER VERSIONI "NAFTA 110 cSt a 50 °C" E "NAFTA 400 cSt a 50 °C"  
USED FOR "OIL 110 cSt a 50 °C" AND "OIL 400 cSt a 50 °C" VERSIONS ONLY

(#)

UTILIZZATO SOLO PER VERSIONI "NAFTA 400 cSt a 50 °C"  
USED FOR "OIL 400 cSt a 50 °C" VERSIONS ONLY

|           |            |       |        |
|-----------|------------|-------|--------|
| Data      | 14/11/2003 | PREC. | FOGLIO |
| Revisione | 09         | 7     | 8      |
| Dis. N.   | 12 - 082   | SEGUE | TOTALE |
|           |            | 9     | 10     |

|     |            |              |                                                                         |                                                          |   |   |   |   |   |   |
|-----|------------|--------------|-------------------------------------------------------------------------|----------------------------------------------------------|---|---|---|---|---|---|
|     | 0          | 1            | 2                                                                       | 3                                                        | 4 | 5 | 6 | 7 | 8 | 9 |
| (x) | SIGLA/ITEM | FOGLIO/SHEET | FUNZIONE                                                                | FUNCTION                                                 |   |   |   |   |   |   |
|     | CM         | 2            | COMMUTATORE FUNZIONAMENTO 1)GAS 0)SPENTO 2)NAFTA                        | MANUAL OPERATION SWITCH 1)GAS 0)SPENTO 2)OIL             |   |   |   |   |   |   |
|     | CMF        | 6            | COMMUT. MANUALE FUNZ. 0)FERMO 1)ALTA FIAMMA 2)BASSA FIAMMA 3)AUTOMATICO | MANUAL SWITCH 0)OFF 1)HIGH FLAME 2)LOW FLAME 3)AUTOMATIC |   |   |   |   |   |   |
|     | EV1        | 5            | ELETTROVALVOLA GAS LATO RETE (O GRUPPO VALVOLE)                         | UPSTREAM GAS SOLENOID VALVE (OR VALVES GROUP)            |   |   |   |   |   |   |
|     | EV2        | 5            | ELETTROVALVOLA GAS LATO BRUCIATORE (O GRUPPO VALVOLE)                   | DOWNSTREAM GAS SOLENOID VALVE (OR VALVES GROUP)          |   |   |   |   |   |   |
|     | EVN        | 5            | ELETTROVALVOLA NAFTA                                                    | OIL SOLENOID VALVE                                       |   |   |   |   |   |   |
|     | EVP1/2     | 3            | ELETTROVALVOLE PILOTA GAS                                               | PILOT GAS ELECTRO-VALVES                                 |   |   |   |   |   |   |
|     | FC         | 4            | SONDA UV RILEVAZIONE FIAMMA                                             | UV FLAME DETECTOR                                        |   |   |   |   |   |   |
|     | FU         | 6            | FUSIBILE                                                                | FUUSE                                                    |   |   |   |   |   |   |
|     | FU1.0      | 1            | FUSIBILE DI LINEA                                                       | LINE FUSE                                                |   |   |   |   |   |   |
|     | FU1.1      | 1            | FUSIBILI LINEA PRERISCALDATORE [RPA]                                    | LINE PRE-HEATING [RPA] FUSES                             |   |   |   |   |   |   |
|     | FU1.2      | 1            | FUSIBILI LINEA PRERISCALDATORE [RPB]                                    | LINE PRE-HEATING [RPB] FUSES                             |   |   |   |   |   |   |
| (x) | FU1.3      | 1            | FUSIBILI LINEA MOTORE VENTILATORE                                       | FAN MOTOR LINE FUSES                                     |   |   |   |   |   |   |
|     | FU1.4      | 1            | FUSIBILE RESISTENZE AUSILIARIE                                          | AUXILIARY RESISTORS FUUSE                                |   |   |   |   |   |   |
|     | FU1.6      | 1            | FUSIBILI LINEA POMPA                                                    | PUMP LINE FUSES                                          |   |   |   |   |   |   |
|     | FU1.8      | 1            | FUSIBILE LINEA AUSILIARI                                                | AUXILIARY LINE FUSE                                      |   |   |   |   |   |   |
|     | IB         | 1            | INTERRUTTORE LINEA BRUCIATORE                                           | BURNER LINE SWITCH                                       |   |   |   |   |   |   |
| (x) | IRA        | 1            | INTERRUTTORE LINEA RESISTENZE PRERISCALDATORE [RPA]                     | PRE-HEATING RESISTORS [RPA] LINE SWITCH                  |   |   |   |   |   |   |
|     | IRA1       | 1            | INTERRUTTORE RESISTENZE AUSILIARIE                                      | AUXILIARY RESISTORS SWITCH                               |   |   |   |   |   |   |
| (x) | IRAUux     | 1            | INTERRUTTORE RESISTENZE AUSILIARIE                                      | AUXILIARY RESISTORS SWITCH                               |   |   |   |   |   |   |
|     | IRB        | 1            | INTERRUTTORE LINEA RESISTENZE PRERISCALDATORE [RPB]                     | PRE-HEATING RESISTORS [RPB] LINE SWITCH                  |   |   |   |   |   |   |
|     | KA2.2      | 2            | RELE' AUSILIARIO                                                        | AUXILIARY RELAY                                          |   |   |   |   |   |   |
|     | KA2.2A     | 2            | RELE' AUSILIARIO                                                        | AUXILIARY RELAY                                          |   |   |   |   |   |   |
|     | KA2.2B     | 2            | RELE' AUSILIARIO                                                        |                                                          |   |   |   |   |   |   |
|     | KA2.4      | 2            | RELE' AUSILIARIO SEGNALAZIONE GUASTO CONTATTORE RESISTENZE              | AUXILIARY RELAY FOR TRIM HEATER CONTACTOR FAILURE        |   |   |   |   |   |   |
|     | KA2.6      | 2            | RELE' AUSILIARIO SEGNALAZIONE GUASTO CONTATTORE RESISTENZE              | AUXILIARY RELAY FOR TRIM HEATER CONTACTOR FAILURE        |   |   |   |   |   |   |
|     | KA3.4      | 3            | RELE' AUSILIARIO                                                        | AUXILIARY RELAY                                          |   |   |   |   |   |   |
|     | KA5.4      | 5            | RELE' AUSILIARIO                                                        | AUXILIARY RELAY                                          |   |   |   |   |   |   |
|     | KA5.5      | 5            | RELE' AUSILIARIO                                                        | AUXILIARY RELAY                                          |   |   |   |   |   |   |
|     | KM2.4      | 2            | CONTATTORE RESISTENZE PRERISCALDATORE [RPA]                             | PRE-HEATING RESISTORS [RPA] CONTACTOR                    |   |   |   |   |   |   |
|     | KM2.5      | 2            | CONTATTORE RESISTENZE PRERISCALDATORE [RPB]                             | PRE-HEATING RESISTORS [RPB] CONTACTOR                    |   |   |   |   |   |   |
|     | KM3.1      | 3            | CONTATTORE MOTORE VENTILATORE (LINEA)                                   | FAN MOTOR CONTACTOR (LINE)                               |   |   |   |   |   |   |
|     | KM3.1D     | 3            | CONTATTORE MOTORE VENTILATORE (TRIANGOLO)                               | FAN MOTOR CONTACTOR (DELTA)                              |   |   |   |   |   |   |
|     | KM3.1S     | 3            | CONTATTORE MOTORE VENTILATORE (STELLA)                                  | FAN MOTOR CONTACTOR (STAR)                               |   |   |   |   |   |   |
|     | KM3.8      | 4            | CONTATTORE MOTORE POMPA GASOLIO                                         | LIGHT OIL PUMP MOTOR CONTACTOR                           |   |   |   |   |   |   |
|     | KT3.2      | 3            | TEMPORIZZATORE STELLA/TRIANGOLO                                         | STAR/DELTA DELAYED RELAY                                 |   |   |   |   |   |   |
|     | KT3.3      | 3            | RELE' TEMPORIZZATORE                                                    | DELAYED RELAY                                            |   |   |   |   |   |   |
|     | LAF        | 5            | LAMPADA SEGNALAZIONE ALTA FIAMMA BRUCIATORE                             | BURNER IN HIGH FLAME INDICATOR LIGHT                     |   |   |   |   |   |   |
|     | LB         | 2            | LAMPADA SEGNALAZIONE BLOCCO BRUCIATORE                                  | INDICATOR LIGHT FOR BURNER LOCK-OUT                      |   |   |   |   |   |   |
|     | LBF        | 5            | LAMPADA SEGNALAZIONE BASSA FIAMMA BRUCIATORE                            | BURNER IN LOW FLAME INDICATOR LIGHT                      |   |   |   |   |   |   |
|     | LEV1       | 5            | LAMPADA SEGNALAZIONE APERTURA [EV1]                                     | INDICATOR LIGHT FOR OPENING OF ELECTRO-VALVE [EV1]       |   |   |   |   |   |   |
|     | LEV2       | 5            | LAMPADA SEGNALAZIONE APERTURA [EV2]                                     | INDICATOR LIGHT FOR OPENING OF ELECTRO-VALVE [EV2]       |   |   |   |   |   |   |
|     | LEVN       | 5            | LAMPADA SEGNALAZIONE APERTURA EVN                                       | INDICATOR LIGHT FOR OPENING OF ELECTRO-VALVE EVN         |   |   |   |   |   |   |
|     | LEVP       | 3            | LAMPADA SEGNALAZIONE APERTURA EVP1/2                                    | INDICATOR LIGHT FOR OPENING OF ELECTRO-VALVES EVP1/2     |   |   |   |   |   |   |
|     | LPGMIN     | 4            | LAMPADA SEGNALAZIONE PRESENZA GAS IN RETE                               | INDICATOR LIGHT FOR PRESENCE OF GAS IN THE NETWORK       |   |   |   |   |   |   |

(x)  
UTILIZZATO SOLO PER VERSIONI "NAFTA 110 cSt α 50 °C" E "NAFTA 400 cSt α 50 °C"  
USED FOR "OIL 110 cSt α 50 °C" AND "OIL400 cSt α 50 °C" VERSIONS ONLY

(#)  
UTILIZZATO SOLO PER VERSIONI "NAFTA 400 cSt α 50 °C"  
USED FOR "OIL 400 cSt α 50 °C" VERSIONS ONLY

|                   |                  |             |             |
|-------------------|------------------|-------------|-------------|
| Data<br>Revisione | 14/11/2003<br>09 | PREC.<br>8  | FOGLIO<br>9 |
| Dis. N.           | 12 - 082         | SEGUE<br>10 | TOTAL<br>10 |

|     |                   |              |                                                                            |   |   |   |                                                          |   |   |   |
|-----|-------------------|--------------|----------------------------------------------------------------------------|---|---|---|----------------------------------------------------------|---|---|---|
|     | 0                 | 1            | 2                                                                          | 3 | 4 | 5 | 6                                                        | 7 | 8 | 9 |
|     | SIGLA/ITEM        | FOGLIO/SHEET | FUNZIONE                                                                   |   |   |   | FUNCTION                                                 |   |   |   |
|     | LPGP              | 4            | LAMPADA SEGNALAZIONE PRESSOSTATO GAS PILOTA                                |   |   |   | INDICATOR LIGHT FOR PRESENCE OF GAS IN THE PILOT NETWORK |   |   |   |
|     | LRPA              | 2            | LAMPADA SEGNALAZIONE FUNZIONAMENTO PRERISCALDATORE [RPA]                   |   |   |   | INDICATOR LIGHT FOR PRE-HEATING RESISTOR [RPA] OPERATION |   |   |   |
|     | LRPB              | 2            | LAMPADA SEGNALAZIONE FUNZIONAMENTO PRERISCALDATORE [RPB]                   |   |   |   | INDICATOR LIGHT FOR PRE-HEATING RESISTOR [RPB] OPERATION |   |   |   |
|     | LS                | 4            | LAMPADA SEGNALAZIONE SOSTA BRUCIATORE                                      |   |   |   | INDICATOR LIGHT FOR BURNER STAND-BY                      |   |   |   |
|     | LSPG              | 4            | LAMPADA SEGNALAZIONE BLOCCO CONTROLLO TENUTA VALVOLE                       |   |   |   | INDICATOR LIGHT FOR LEAKAGE OF VALVES                    |   |   |   |
|     | LT                | 2            | LAMPADA SEGNALAZIONE BLOCCO TERMICO MOTORE VENTILATORE                     |   |   |   | INDICATOR LIGHT FOR FAN OVERLOAD TRIPPED                 |   |   |   |
|     | LTA               | 3            | LAMPADA SEGNALAZIONE TRASFORMATORE DI ACCENSIONE                           |   |   |   | IGNITION TRANSFORMER INDICATOR LIGHT                     |   |   |   |
|     | LTP               | 2            | LAMPADA SEGNALAZIONE BLOCCO TERMICO POMPA                                  |   |   |   | INDICATOR LIGHT FOR PUMP OVERLOAD TRIPPED                |   |   |   |
|     | LTRSA             | 2            | LAMPADA SEGNALAZIONE BLOCCO TERMOSTATO DI SICUREZZA PRERISCALDATORE [TRSA] |   |   |   | INDICATOR LIGHT FOR SAFETY THERMOSTAT [TRSA] PRE-HEATING |   |   |   |
|     | LTRSB             | 2            | LAMPADA SEGNALAZIONE BLOCCO TERMOSTATO DI SICUREZZA PRERISCALDATORE [RPB]  |   |   |   | INDICATOR LIGHT FOR SAFETY THERMOSTAT [RPB] PRE-HEATING  |   |   |   |
|     | MP                | 1            | MOTORE POMPA NAFTA                                                         |   |   |   | OIL PUMP MOTOR                                           |   |   |   |
|     | MV                | 1            | MOTORE VENTILATORE                                                         |   |   |   | FAN MOTOR                                                |   |   |   |
|     | PA                | 4            | PRESSOSTATO ARIA                                                           |   |   |   | AIR PRESSURE SWITCH                                      |   |   |   |
|     | PGMAX             | 4            | PRESSOSTATO GAS DI MASSIMA PRESSIONE (OPTIONAL)                            |   |   |   | MAXIMUM PRESSURE GAS SWITCH (OPTIONAL)                   |   |   |   |
|     | PGMIN             | 4            | PRESSOSTATO GAS DI MINIMA PRESSIONE                                        |   |   |   | MINIMUM GAS PRESSURE SWITCH                              |   |   |   |
|     | PGP               | 4            | PRESSOSTATO PILOTA GAS                                                     |   |   |   | PILOT MINIMUM GAS PRESSURE SWITCH                        |   |   |   |
|     | PS                | 2            | PULSANTE SBLOCCO FIAMMA                                                    |   |   |   | LOCK-OUT RESET BUTTON                                    |   |   |   |
|     | PT100             | 6            | SONDA DI TEMPERATURA                                                       |   |   |   | TEMPERATURE PROBE                                        |   |   |   |
| (x) | RA1               | 1            | RESISTENZE AUSILIARIE                                                      |   |   |   | AUXILIARY RESISTORS                                      |   |   |   |
| (x) | RA2               | 1            | RESISTENZE AUSILIARIE                                                      |   |   |   | AUXILIARY RESISTORS                                      |   |   |   |
| (x) | RF                | 1            | RESISTENZA AUSILIARIA FILTRO NAFTA                                         |   |   |   | OIL FILTER AUXILIARY RESISTOR                            |   |   |   |
|     | RPA               | 1            | RESISTENZE PRERISCALDATORE NAFTA                                           |   |   |   | PRE-HEATING TANK RESISTORS                               |   |   |   |
|     | RPB               | 1            | RESISTENZE PRERISCALDATORE NAFTA                                           |   |   |   | PRE-HEATING TANK RESISTORS                               |   |   |   |
|     | SD-PRESS          | 6            | SONDA DI PRESSIONE                                                         |   |   |   | PRESSURE PROBE                                           |   |   |   |
|     | SD-PRESS          | 6            | SONDA DI PRESSIONE                                                         |   |   |   | PRESSURE PROBE                                           |   |   |   |
|     | SD-TEMP.          | 6            | SONDA DI TEMPERATURA                                                       |   |   |   | TEMPERATURE PROBE                                        |   |   |   |
|     | SD - 4÷20mA       | 6            | TRASDUTTORE USCITA IN CORRENTE                                             |   |   |   | TRANSDUCER CURRENT OUTPUT                                |   |   |   |
|     | SIEMENS LFL1.xx   | 2            | APPARECCHIATURA CONTROLLO FIAMMA                                           |   |   |   | CONTROL BOX                                              |   |   |   |
|     | SIEMENS RWF40.0x0 | 6            | REGOLATORE MODULANTE                                                       |   |   |   | BURNER MODULATOR                                         |   |   |   |
|     | SIEMENS RWF50.2   | 6            | REGOLATORE MODULANTE (ALTERNATIVO)                                         |   |   |   | BURNER MODULATOR (ALTERNATIVE)                           |   |   |   |
|     | SQM10             | 5            | SERVOCOMANDO SERRANDA ARIA                                                 |   |   |   | ??????????? ???? ?????                                   |   |   |   |
|     | ST                | 4            | SERIE TERMOSTATI/PRESSOSTATI                                               |   |   |   | SERIES OF THERMOSTATS OR PRESSURE SWITCHES               |   |   |   |
|     | TA                | 3            | TRASFORMATORE DI ACCENSIONE                                                |   |   |   | IGNITION TRANSFORMER                                     |   |   |   |
| (#) | TCI               | 4            | TERMOSTATO CONSENSO IMPIANTO                                               |   |   |   | PLANT CONSENT THERMOSTAT                                 |   |   |   |
|     | TCNA              | 4            | TERMOSTATO CONSENSO NAFTA PRERISCALDATORE [RPA]                            |   |   |   | OIL CONSENT THERMOSTAT FOR PRE- HEATING [RPA] RESISTORS  |   |   |   |
|     | TCNB              | 4            | TERMOSTATO CONSENSO NAFTA PRERISCALDATORE [RPB]                            |   |   |   | OIL CONSENT THERMOSTAT FOR PRE- HEATING [RPB] RESISTORS  |   |   |   |
|     | TP                | 1            | TERMICO MOTORE POMPA                                                       |   |   |   | PUMP MOTOR THERMAL                                       |   |   |   |
|     | TRA               | 2            | TERMOSTATO DI REGOLAZIONE PRERISCALDATORE [RPA]                            |   |   |   | REGULATION THERMOSTAT FOR PRE-HEATING [RPA] RESISTORS    |   |   |   |
|     | TRB               | 2            | TERMOSTATO DI REGOLAZIONE PRERISCALDATORE [RPB]                            |   |   |   | REGULATION THERMOSTAT FOR PRE-HEATING [RPB] RESISTORS    |   |   |   |
|     | TRSA              | 2            | TERMOSTATO DI SICUREZZA PRERISCALDATORE [RPA]                              |   |   |   | PRE-HEATING [RPA] A SAFETY THERMOSTAT                    |   |   |   |
|     | TRSB              | 2            | TERMOSTATO DI SICUREZZA PRERISCALDATORE [RPB]                              |   |   |   | PRE-HEATING [RPB] A SAFETY THERMOSTAT                    |   |   |   |
|     | TV                | 1            | TERMICO MOTORE VENTILATORE                                                 |   |   |   | FAN MOTOR THERMAL                                        |   |   |   |
|     | VPS50x            | 4            | CONTROLLO DI TENUTA VALVOLE GAS (OPTIONAL)                                 |   |   |   | GAS PROVING SYSTEM (OPTIONAL)                            |   |   |   |
|     | [SQM40.265A]      | 5            | SERVOCOMANDO SERRANDA ARIA (ALTERNATIVO)                                   |   |   |   |                                                          |   |   |   |

|                                                                                                                                                           |  |                                                                                                      |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------|--|------------------------------------------------------------------------------------------------------|--|
| (x)                                                                                                                                                       |  | (#)                                                                                                  |  |
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|           |            |       |        |
|-----------|------------|-------|--------|
| Data      | 14/11/2003 | PREC. | FOGLIO |
| Revisione | 09         | 9     | 10     |
| Dis. N.   | 12 - 082   | SEGUE | TOTALE |
|           |            | /     | 10     |