

***TN1030***

***TN1050***

***Heavy oil  
Industrial Burners***

MANUAL OF INSTALLATION - USE - MAINTENANCE

***CIB UNIGAS***

BURNERS - BRUCIATORI - BRULERS - BRENNER - QUEMADORES - ГОРЕЛКИ

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## WARNINGS

**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.

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.
- For all the units that have been modified or have options fitted then original accessory equipment only shall be used.
- 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.

### 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 firebox.
- 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 repeated burner shut-downs, do not continue re-setting the unit manually. Contact qualified personnel to take care of such defects.
- 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:

- Directive 90/396/CEE - Gas Appliances;
- Directive 2006/95/EC on low voltage;
- Directive 2004/108/CEE on electromagnetic compatibility

#### Harmonised standards :

- UNI EN 676 (Gas Burners;
- CEI EN 60335-1(Household and similar electrical appliances - Safety. Part 1: General requirements;
- EN 50165 (Electrical equipment of non-electric appliances for household and similar purposes. Safety requirements.

### *Light oil burners*

#### European directives:

- Directive 2006/95/EC on low voltage;
- Directive 2004/108/CEE on electromagnetic compatibility

#### Harmonised standards :

- CEI EN 60335-1(Household and similar electrical appliances - Safety. Part 1: General requirements;
- EN 50165 (Electrical equipment of non-electric appliances for household and similar purposes. Safety requirements.

#### National standards :

- UNI 7824: Monobloc nebulizer burners for liquid fuels. Characteristics and test methods

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- Directive 2006/95/EC on low voltage;
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#### Harmonised standards :

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### *Gas - Light oil burners*

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- Directive 90/396/CEE Gas Appliances;
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## PART I: INSTALLATION MANUAL

### GENERAL FEATURES

This series of industrial burners is designed for all those applications that require big-sized air fans or air-flue heat exchangers to be installed in sound-proof areas to reduce noise. They can be provided with built-in or separately-mounted control panel (console or wall-mounted).

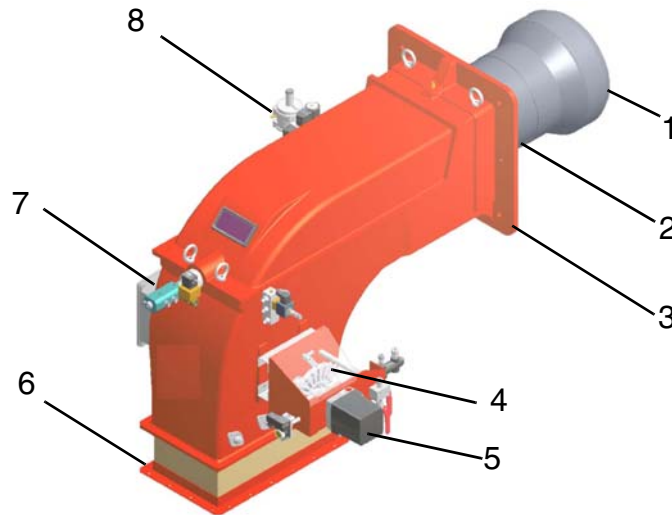


Fig. 1

- 1 Combustion head
- 2 Blast tube
- 3 Burner flange
- 4 Adjusting cam
- 5 Actuator
- 6 Air inlet flange
- 7 Oil gun
- 8 Ignitor gas train

The fuel coming from the supply line, is pushed by the pump to the nozzle and then into the combustion chamber, where the mixture between fuel and air takes place and consequently the flame.

In the burners, the mixture between fuel and air, to perform clean and efficient combustion, is activated by atomisation of oil into very small particles. This process is achieved making pressurised oil passing through the nozzle.

The pump main function is to transfer oil from the tank to the nozzle in the desired quantity and pressure. To adjust this pressure, pumps are provided with a pressure regulator (except for some models for which a separate regulating valve is provided). Other pumps are provided with two pressure regulators: one for the high and one for low pressure (in double-stage systems with one nozzle).

In the double-stage burners, the electric actuator (5), that moves the air damper, allows the optimisation of the gas flue values, as to get an efficient combustion. The position of the combustion head determines the burner's output. The air (comburent) and fuel (light oil) are forced into the combustion chamber, as to let the flame light up.

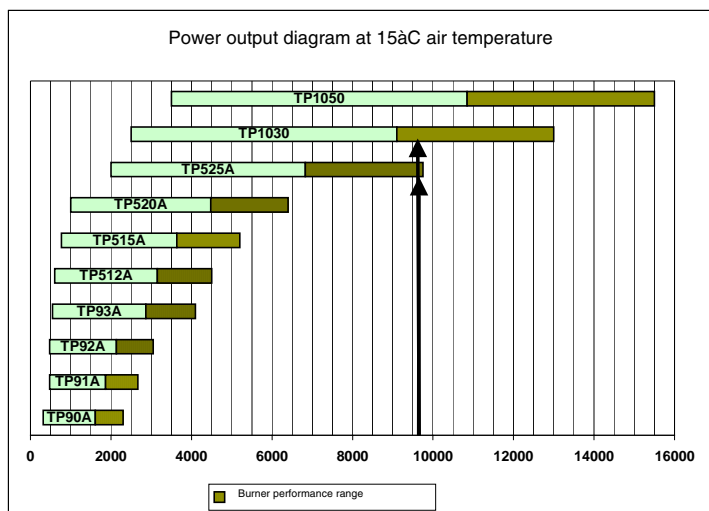
### How to choose the burner

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

- fuel
- furnace input, in kW or kcal/h ( $\text{kW} = \text{kcal/h} / 860$ );
- boiler type;
- combustion head type (reverse flame or three phase)
- temperature or pressure of the thermal carrier fluid
- Comburent air temperature
- Air duct positioning
- Pressure in the combustion chamber
- Elevation (altitude) of burner installation
- Gas train (only for gas burners)
- Pumping unit (only for light-oil or heavy-oil burners)
- Air fan
- Built-in or separated control panel

- backpressure (data are available on the boiler ID plate or in the user's manual).

Burners provided with built-in control panel are designed for IP40 index of protection. For other values of IP, please contact the CIB UNIGAS Technical Dpt.



#### Data requested:

- furnace input;
- air temperature
- altitude
- generator pressure or temperature

#### Example:

- furnace input: 9600kW
- air temperature: 15°C
- altitude: 0m

Fig. 2

See the diagram in Fig. 2, as to find the burners that better suite the power range requested in the exmple (9600kW). Once the models are founded out, the choice regards technical and economical features. Technical features can be summarised in a higher modulation ratio (fewer start-ups, less consumption, fewer swigings in the generator temperature and pressure values).

#### Burner model identification

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

| Type                    | TN1030  | Model | N.  | PR. | S.  | *.  | G. |
|-------------------------|---|-------|-----|-----|-----|-----|----|
|                         | (1)   | (2)   | (3) | (4) | (5) | (6) |    |
| (1) BURNER TYPE         | TN1030  |       |     |     |     |     |    |
| (2) FUEL                | N - Heavy oil, standard viscosity <= 7° E @ 50° C<br>D - Heavy oil, high viscosity <= 50° E @ 50° C<br>E - Ecological heavy oil, viscosity between 7°E and 15°E @ 50° C |       |     |     |     |     |    |
| (3) OPERATION           | PR - Progressive<br>MD - Fully-modulating   |       |     |     |     |     |    |
| (4) BLAST TUBE          | S - standard  |       |     |     |     |     |    |
| (5) DESTINATION COUNTRY | * - see data plate  |       |     |     |     |     |    |
| (6) BURNER VERSION      | G - Control panel and junction box  |       |     |     |     |     |    |

## Specifications

**Note:** Output values are valid for comburent air temperature lower than 50°C.

|                              |           | TN 1030                        | TN 1050      |
|------------------------------|-----------|--------------------------------|--------------|
| Output                       | kW        | 2550 - 13300                   | 3500 - 15500 |
| Fuel                         |           | Heavy oil                      |              |
| Oil viscosity                | °E, 50 °C | 50                             |              |
| Flow rate                    | kg/h      | 227 - 1158                     | 312 - 1381   |
| Power supply                 |           | 400V 3Na.c. 50Hz               |              |
| Electrical power consumption | kW        | 54                             |              |
| Pump motor                   | kW        | 5.5                            |              |
| Pre-heater resistors         | kW        | 24 + 24                        |              |
| Index of protection          |           | IP40                           |              |
| Approx. weight               | kg        | 200                            |              |
| Operation                    |           | Progressive - Fully modulating |              |
| Operating temperature        | °C        | -10 / +50                      |              |
| Storage temperature          | °C        | -20 / +60                      |              |
| Working service *            |           | Intermittent                   |              |

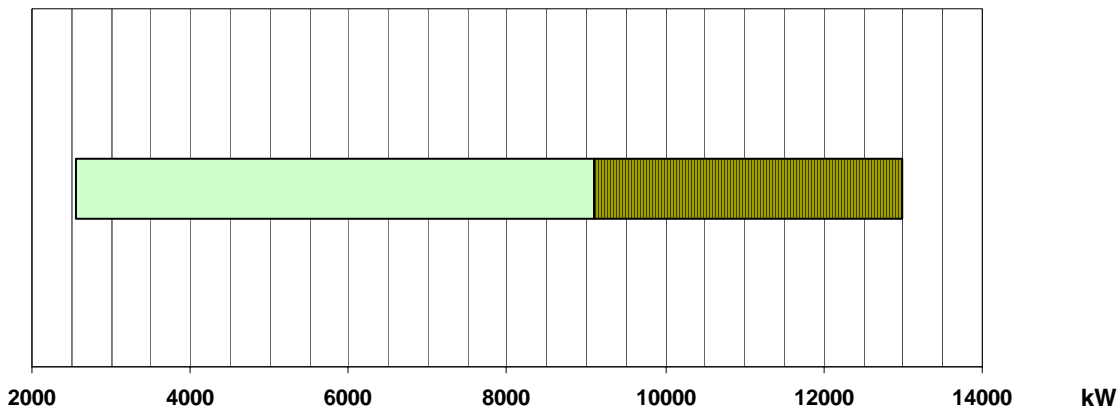
**\* NOTE ON THE BURNER WORKING SERVICE:** for safety reasons, one controlled shutdown must be performed every 24 hours of continuous operation.



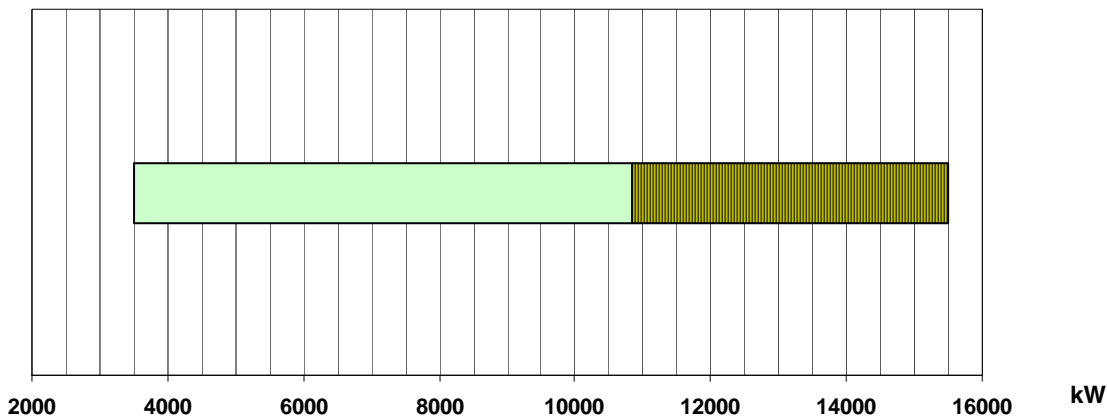
**WARNING:** the ignitor operates with natural gas or LPG and its working service is intermittent. For further information, see paragraph "Ignitor gas train".

## Performance Curves

### TN1030



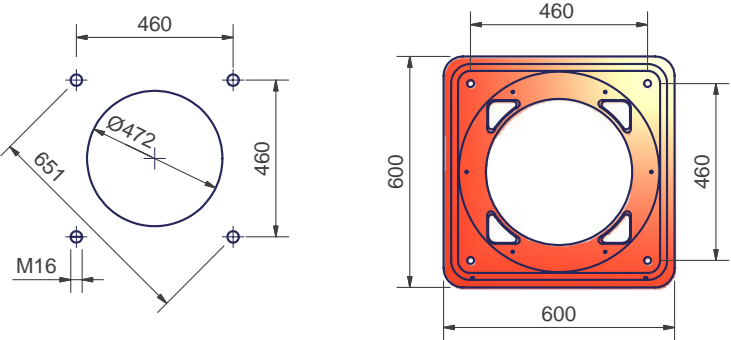
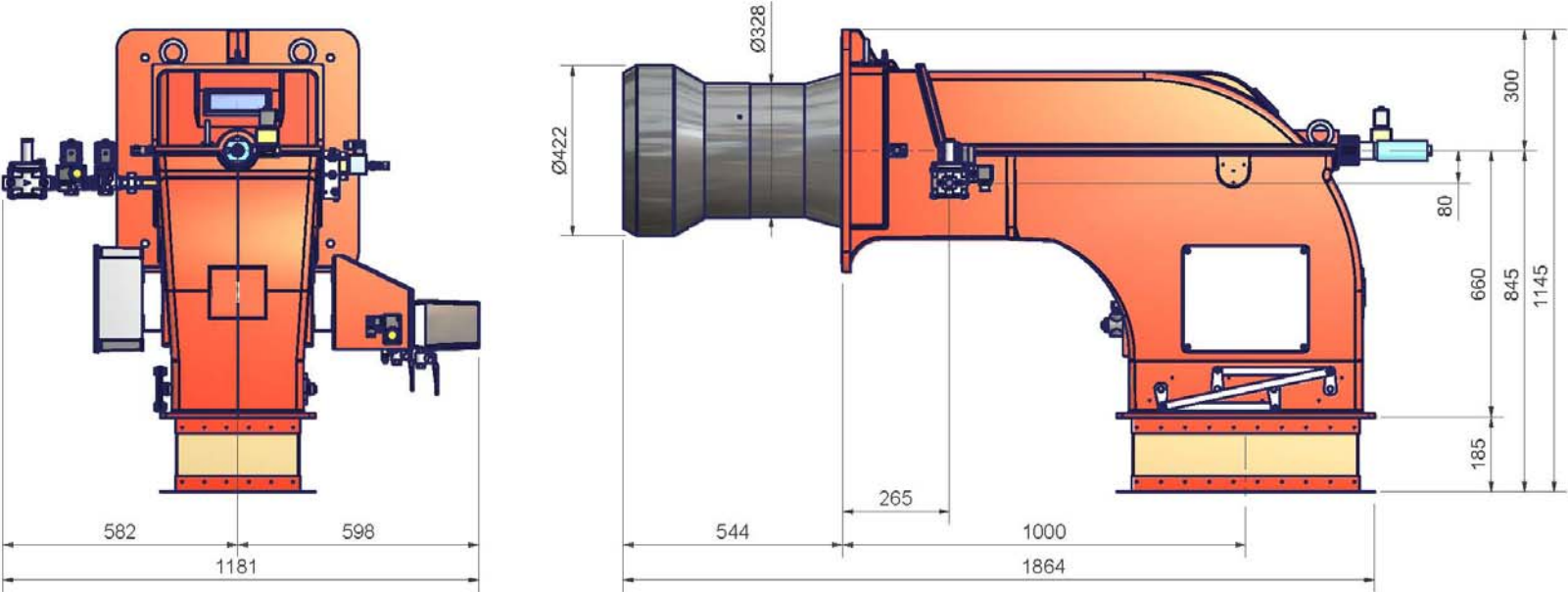
### TN1050



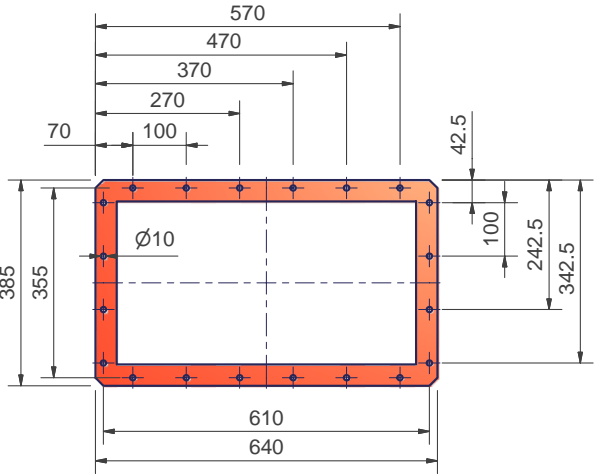
Performance range

To get the input in kcal/h, multiply value in kW by 860. Data are referred to standard conditions: 1013mbar, 15°C

Overall dimensions (mm) (TN1030)



Boiler drilling plate and burner flange



Air inlet flange



## MOUNTING AND CONNECTING THE BURNER

### Packing

The burners are despatched in wooden crates whose dimensions are:

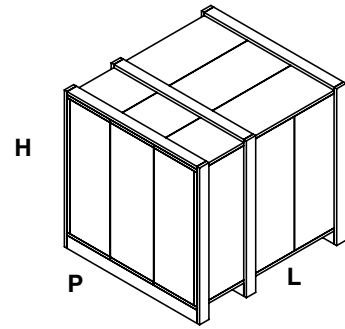
**2280 x 1730 x 1360mm (L x P x H)**

Packing cases of this kind are affected by humidity and are not suitable for stacking. In each packing case, you will find:

- 1 burner;
- 2 flexible hoses;
- 1 light oil filter;
- 1 gasket to be inserted between the burner and the boiler;
- 1 envelope containing this manual.

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

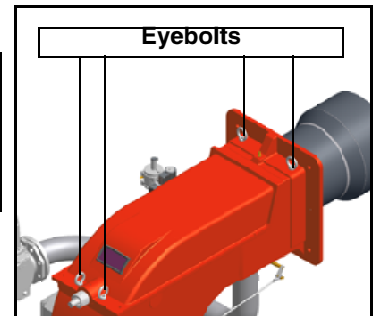
The following are placed in each packing case:



### Handling the burner

|  |  |
|--|--|
|  | <b>ATTENTION!</b> 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").   |

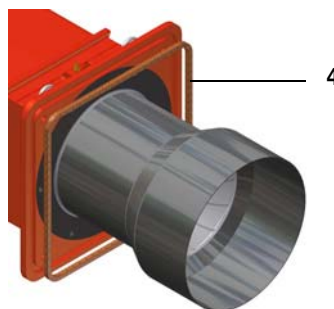
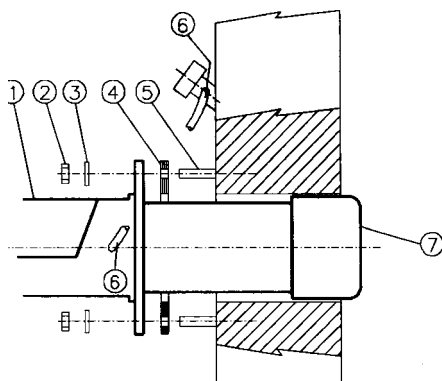
The burner is provided with eyebolts, for handling operations.



### 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 gasket on the burner's 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

### Installing the fan

Pay attention when designing the air duct: dimensioning must be performed according to the flow rate, the temperature, the distance between the fan and the burner and according to the fan features as well.

|  |  |
|--|--|
|  | <b>ATTENTION!</b> The bellows unit provided is made of canvas and is provided with blocking spacers to avoid breaking it during installation: <b>first</b> place the bellows unit between flanges, <b>then</b> remove the spacers. |
|--|--|

### Matching the burner to the boiler

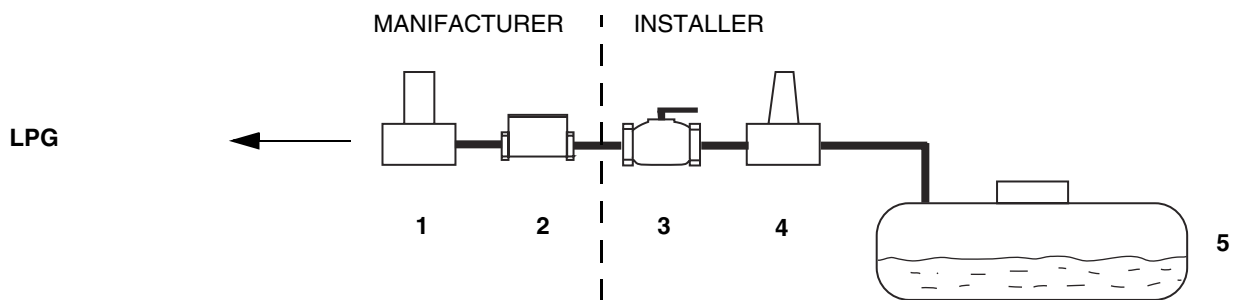
The burners described in this manual have been tested with combustion chambers that comply with EN676 regulation and whose dimensions are described in the diagram. In case the burner must be coupled with boilers with a combustion chamber smaller in diameter or shorter than those described in the diagram, 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 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 100 mm into the combustion chamber.
- Pressurised boilers with flame reversal: in this case the blast tube must penetrate at least 50 - 100 mm into combustion chamber in respect to the tube bundle plate.

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).

### Burner ignitor

Execute the burner ignitor connections as follows:



#### Legenda

- 1 Gas valve
- 2 Gas filter
- 3 Manual cutoff valve
- 4 Pressure reducer
- 5 Tank

**Gas supply:** LPG

**Gas pressure:** 100 mbar

Once the gas train is installed, execute the electrical connections for all its items (gas valves group, pressure switch).



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

## 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-pipe systems. They can be suited for single-pipe system (recommended in the case of gravity feed) as described before.

The bypass plug inserted between high pressure and shaft seal is only intended to change the pump rotation, check the presence of this plug with a 4 mm Allen key in the pressure outlet of the pump.

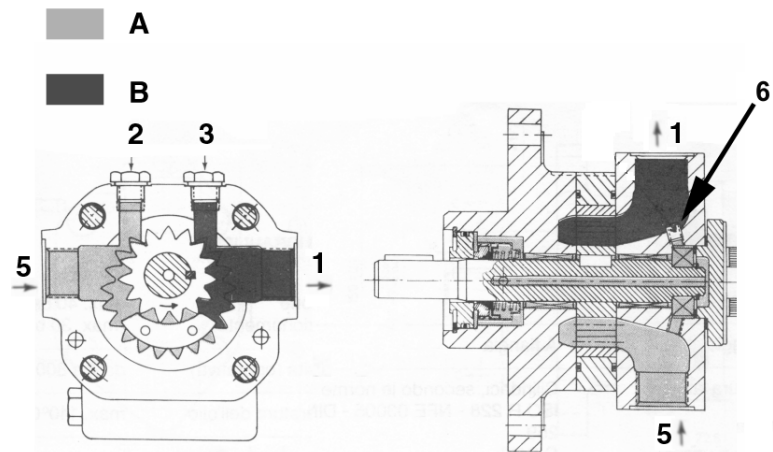
**Caution:** changing the direction of pump rotation involves changing of all pump connections.

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.  
pipeline length in meters.

### Key

- A Oil under suction
- B Oil under pressure
- 1 To the pressure adjustment valve
- 2 Vacuum gauge port
- 3 Pressure gauge port
- 5 Suction (from the tank)
- 6 By-pass plug inserted



### Bleed

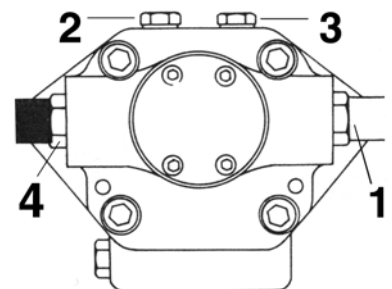
Bleeding in two-pipe operation is automatic : it is assured by a bleed flat on the piston. In one-pipe operation, the plug of a pressure gauge port must be loosened until the air is evacuated from the system.

### Suntec T pump

|                          |                             |
|--------------------------|-----------------------------|
| Viscosity                | 4 - 800 cSt                 |
| Oil temperature          | 0 - 140 °C                  |
| Minimum suction pressure | - 0,45bar to prevent gasing |
| Maximum suction pressure | 5 bar                       |
| Rated speed              | 3600 rpm max.               |

### Key

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



## 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.

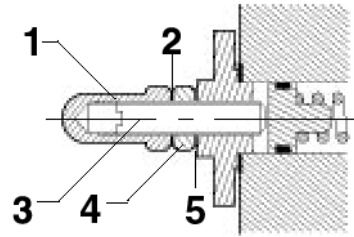
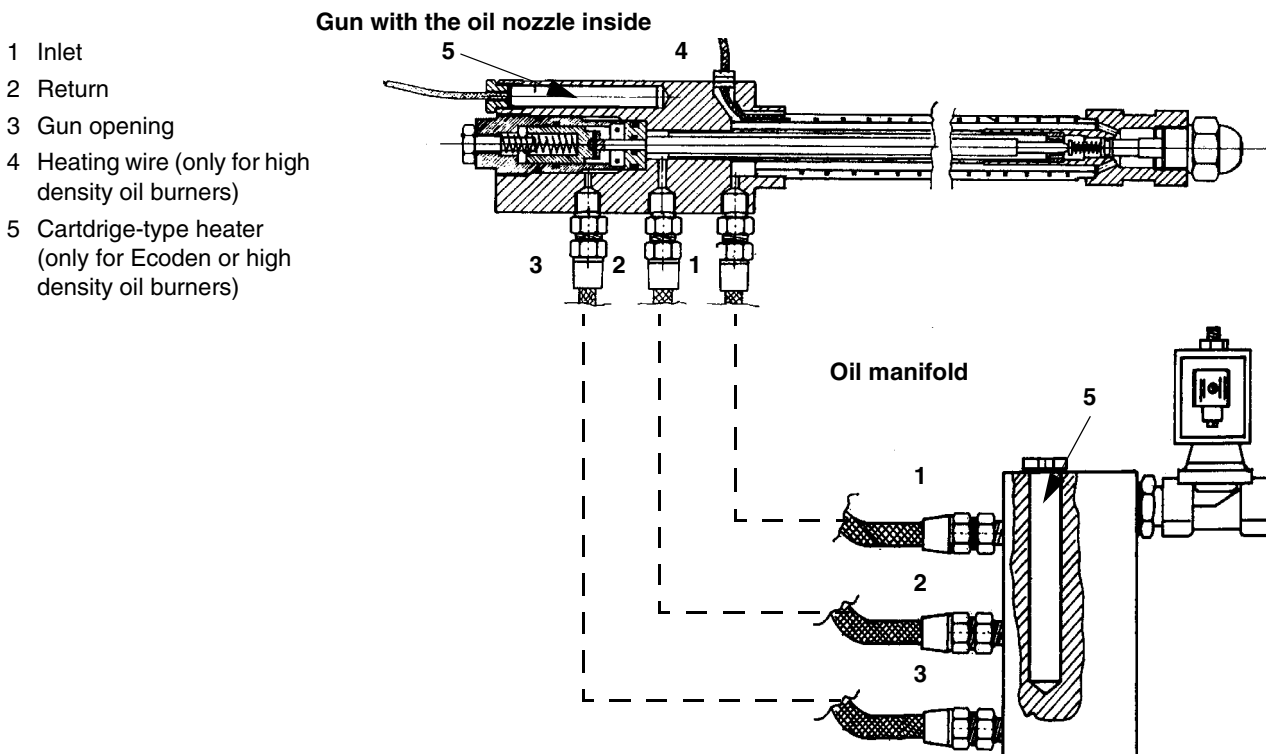


Fig. 3

### Key

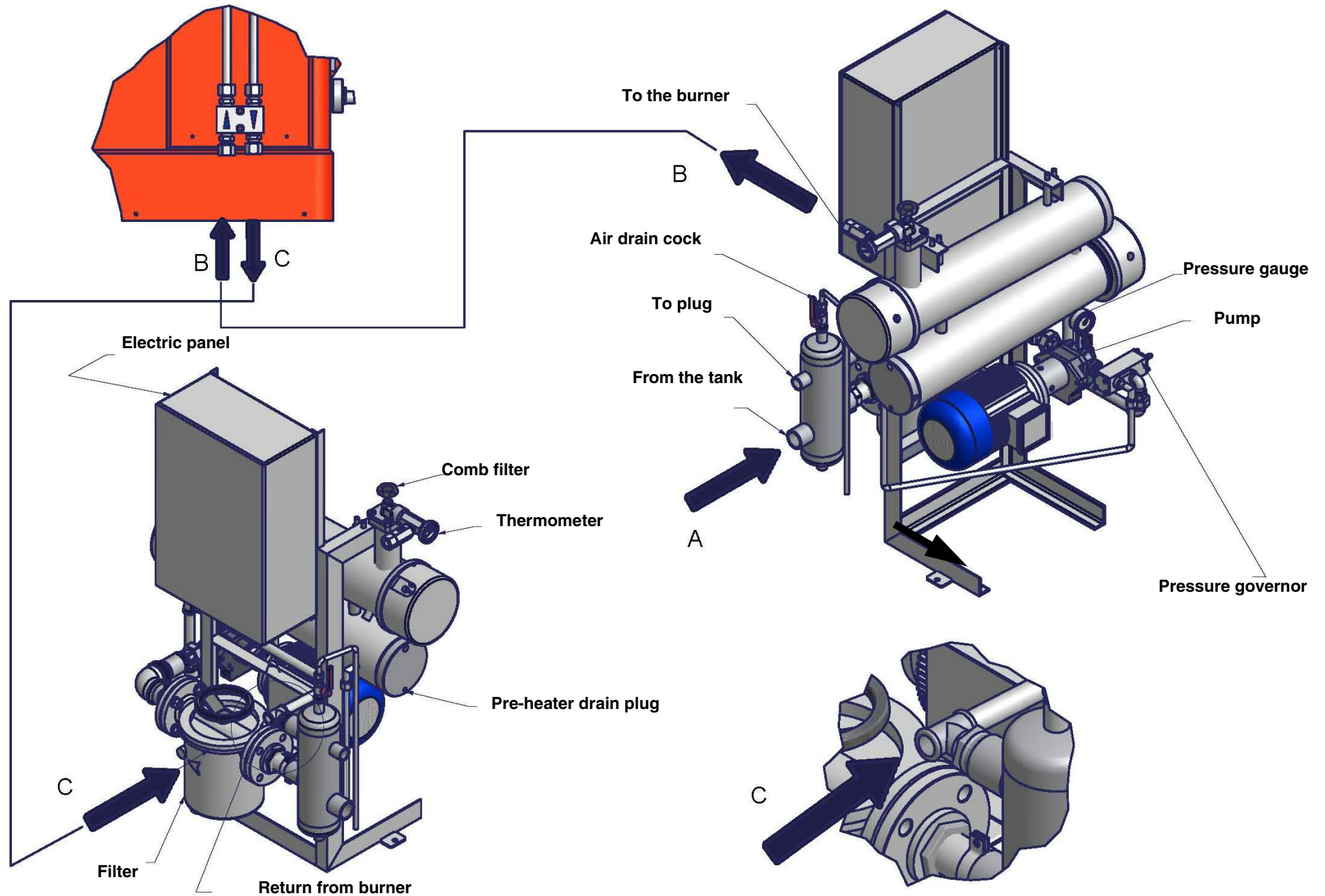
- 1 Cap nut
- 2 Gasket
- 3 Adjusting screw
- 4 Lock nut
- 5 Gasket

### Connections to the oil gun



### Connecting the burner to the light 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.



### About the use of fuel pumps

- Make sure that the by-pass plug is not used in a single pipe installation, because the fuel unit will not function properly and damage to the pump and burner motor could result.
- 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 of the fuel unit.

### Electrical connections



**RESPECT THE BASIC SAFETY RULES. MAKE SURE OF THE CONNECTION TO THE EARTHING SYSTEM. DO NOT REVERSE THE PHASE AND NEUTRAL CONNECTIONS. FIT A DIFFERENTIAL THERMAL MAGNET SWITCH ADEQUATE FOR CONNECTION TO THE MAINS. STRICTLY OBSERVE THE DATA PLATE.**

As far as electrical connections, see the "ELECTRICAL WIRING DIAGRAMS" chapter.

Once the burner electrical connection is accomplished, remember to check the rotation of the motors.

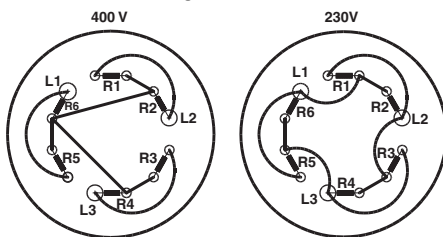
Motors must rotate in the direction showed on their casing. In the event of wrong rotation, reverse the three-phase supply and check again the motor rotation.

#### Rotation of fan motor and pump motor

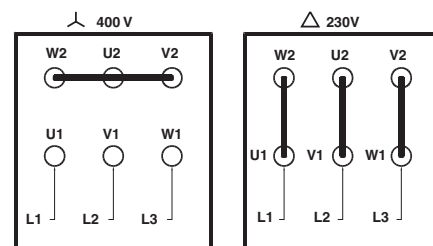
Once the electrical connection of the burner is executed, remember to check the rotation of the motors. The motor should rotate according to the indication on the body. In the event of wrong rotation, reverse the three-phase supply and check again the rotation of the motor.

Connecting the oil heating resistors

**18 - 24 kW**



#### PUMP MOTOR CONNECTION



#### Connecting the fan motor

In case of star-delta start-up, connect all the 6 wires, according to the sequence shown in the "Electrical wiring diagrams" chapter. If the start-up is performed by means of inverter, follow the instructions on the related manual.



## Guidelines for the appropriate use of heavy oil

For a correct operation of heavy oil or dual fuel burners (gas - heavy oil), the supply plant must be correctly build and it must ensure two fundamental conditions:

- CONSTANT PRESSURE
- CONSTANT TEMPERATURE

Here below we explain why it is essential to heat the oil and keep it under pressure.

Consider, as an example, a fuel oil with the following properties:

- Fuel oil BTZ (low sulphur rate)
- Viscosity from 3 to 5 °E at 50 °C

Such a fuel (see curve n. 3 in Fig. 4), at a temperature of 20° C, changes its viscosity from 3 - 5 °E to 15-20 °E and, at 10° C the viscosity exceeds 40° E.

In such conditions, obviously, the fuel couldn't be carried from the tank to the burner.

Once the oil has been heated, it can't be sucked by the burner pump, unless you keep it in pressure. In fact, as per drawing in Fig. 6, the pump manufacturer states that the minimum feeding pressure must be 1 bar at 40 °C temperature.

Should you try to suck the heated oil directly from the tank, you could get cavitation. The burner pump would constantly loose pressure as long as you heat the fuel. In this way you bring the nozzle pressure to values different from the one stated by the nozzle manufacturer. In such way the atomization would result incorrect.

From the diagram in Fig. 5, you get the pre-heating temperature of the oil according to viscosity and, from diagram in Fig. 6, you get the pump feeding pressure according to temperature.

Therefore, it is necessary in order to set up a suitable oil circuit, look at the diagrams in Fig. 8 and Fig. 9, taken from UNI 9248 "FEEDING LINES FOR LIQUID FUELS TRANSPORT FROM TANK TO BURNER".

In any case, whatever is the choosen solution to realise the oil circuit, you must act according to what is mentioned here above (constant pressure and constant temperature).

After setting up the feeding circuit, you have to decide the temperature and pressure values to be set up in the components of the feeding pipeline and of the burner.

Please find here below, a set up table regarding several types of fuels.

| FUEL                           | VISCOSITY<br>AT 50 °C |    | PIPELINE<br>PRESSURE | PIPELINE<br>TEMPERATURE* | PUMP SUPPLY<br>TEMPERATURE<br>(DIAGRAM IN Fig. 12) |
|--------------------------------|-----------------------|----|----------------------|--------------------------|--|
|                                | °E                    |    | bar                  | °C                       | °C   |
| Fluid BTZ<br>(ecoflu)          | 3                     | 7  | 1- 2                 | 20                       | 30   |
| High viscosity BTZ<br>(Ecoden) | 7                     | 15 | 1- 2                 | 50                       | 50   |
| High viscosity                 | 15                    | 50 | 1- 2                 | 65                       | 80   |

Tab. 1 - Supply pipeline

| FUEL                                 | VISCOSITY<br>AT 50 °C |    | NOZZLE<br>PRESSURE<br>MEASURED IN<br>THE GUN | RETURN<br>NOZZLE<br>PRESSURE |      | TEMPERATURE ON<br>THE PRE-HEATING<br>RESISTORS<br>THERMOSTAT<br>TR* |      | TEMPERATURE<br>OF THE<br>RESISTORS<br>SAFETY<br>THERMOSTAT<br>TRS | TEMPERATURE<br>ON THE OIL<br>ENABLING<br>THERMOSTAT<br>TCN | TEMPERATURE<br>ON THE PLANT<br>ENABLING<br>THERMOSTAT<br>TCI |
|--------------------------------------|-----------------------|----|--|------------------------------|------|---|------|---|--|--|
|                                      |                       |    |  | min.                         | max. | min.  | max. |   |  |  |
|                                      | °E                    |    | bar  | bar                          |      | °C  |      | °C  | °C   | °C   |
| Fluid BTZ<br>(ecoflu)                | 3                     | 7  | 25   | 7-97                         | 20   | 100   | 115  | 170   | 80   | 50 - 60  |
| High<br>viscosity<br>BTZ<br>(Ecoden) | 7                     | 15 | 25   | 7-9                          | 20   | 125   | 140  | 190   | 100  | 60 - 80  |
| High<br>viscosity                    | 15                    | 50 | 25   | 7-9                          | 20   | 145   | 160  | 190   | 110  | 70 - 90  |

Tab. 2 - Burner

\* The temperature in the pre-heater must be set to get a viscosity in the nozzle from 1.4 to 1.6 °E.

| VISCOSITY UNITS CONVERSION TABLE     |                                    |                                    |   |   |                                    |                                     |
|--------------------------------------|------------------------------------|------------------------------------|---|---|------------------------------------|-------------------------------------|
| Cinemetics<br>Engler<br>(Degrees) °E | Cinemetics<br>(Centistokes)<br>cSt | Cinemetics<br>(Centipoises)<br>cps | Saybolt<br>Universal<br>(Seconds)<br>S.S.U. | Saybolt<br>Furoi<br>(Seconds)<br>S.S.F. | Redwood n. 1<br>(Seconds)<br>R.S.I | Redwood n. 2<br>(Seconds)<br>R.S.II |
| 2.95                                 | 20.60                              | 20.60                              | 100   |   | 88.4                               |                                     |
| 3.21                                 | 23.00                              | 23.00                              | 110   |   | 97.1                               |                                     |
| 3.49                                 | 25.3                               | 25.3                               | 120   |   | 105.9                              |                                     |
| 3.77                                 | 27.5                               | 27.5                               | 130   |   | 114.8                              |                                     |
| 4.04                                 | 29.8                               | 29.8                               | 140   |   | 123.6                              |                                     |
| 4.32                                 | 32.1                               | 32.1                               | 150   |   | 132.4                              |                                     |
| 4.59                                 | 34.3                               | 34.3                               | 160   |   | 141.1                              |                                     |
| 4.88                                 | 36.5                               | 36.5                               | 170   |   | 150.0                              |                                     |
| 5.15                                 | 38.7                               | 38.7                               | 180   |   | 158.8                              |                                     |
| 5.44                                 | 41.0                               | 41.0                               | 190   |   | 167.5                              |                                     |
| 5.72                                 | 43.2                               | 43.2                               | 200   | 23                                      | 176.4                              |                                     |
| 6.28                                 | 47.5                               | 47.5                               | 220   | 25.3                                    | 194.0                              |                                     |
| 6.85                                 | 51.9                               | 51.9                               | 240   | 27.0                                    | 212                                |                                     |
| 7.38                                 | 56.2                               | 56.2                               | 260   | 28.7                                    | 229                                |                                     |
| 7.95                                 | 60.6                               | 60.6                               | 280   | 30.5                                    | 247                                |                                     |
| 8.51                                 | 64.9                               | 64.9                               | 300   | 32.5                                    | 265                                |                                     |
| 9.24                                 | 70.4                               | 70.4                               | 325   | 35.0                                    | 287                                |                                     |
| 9.95                                 | 75.8                               | 75.8                               | 350   | 37.2                                    | 309                                |                                     |
| 10.7                                 | 81.2                               | 81.2                               | 375   | 39.5                                    | 331                                |                                     |
| 11.4                                 | 86.6                               | 86.6                               | 400   | 42.0                                    | 353                                |                                     |
| 12.1                                 | 92.0                               | 92.0                               | 425   | 44.2                                    | 375                                |                                     |
| 12.8                                 | 97.4                               | 97.4                               | 450   | 47.0                                    | 397                                |                                     |
| 13.5                                 | 102.8                              | 102.8                              | 475   | 49                                      | 419                                |                                     |
| 14.2                                 | 108.2                              | 108.2                              | 500   | 51                                      | 441                                |                                     |
| 15.6                                 | 119.2                              | 119.2                              | 550   | 56                                      | 485                                |                                     |
| 17.0                                 | 120.9                              | 120.9                              | 600   | 61                                      | 529                                |                                     |
| 18.5                                 | 140.7                              | 140.7                              | 650   | 66                                      | 573                                |                                     |
| 19.9                                 | 151.3                              | 151.3                              | 700   | 71                                      | 617                                |                                     |
| 21.3                                 | 162.3                              | 162.3                              | 750   | 76                                      | 661                                |                                     |
| 22.7                                 | 173.2                              | 173.2                              | 800   | 81                                      | 705                                |                                     |
| 24.2                                 | 184.0                              | 184.0                              | 850   | 86                                      | 749                                |                                     |
| 25.6                                 | 194.8                              | 194.8                              | 900   | 91                                      | 793                                |                                     |
| 27.0                                 | 206                                | 206                                | 950   | 96                                      | 837                                |                                     |
| 28.4                                 | 216                                | 216                                | 1000  | 100                                     | 882                                |                                     |
| 34.1                                 | 260                                | 260                                | 1200  | 212                                     | 1058                               | 104                                 |
| 39.8                                 | 303                                | 303                                | 1400  | 141                                     | 1234                               | 122                                 |
| 45.5                                 | 346                                | 346                                | 1600  | 160                                     | 1411                               | 138                                 |
| 51                                   | 390                                | 390                                | 1800  | 180                                     | 1587                               | 153                                 |
| 57                                   | 433                                | 433                                | 2000  | 200                                     | 1703                               | 170                                 |
| 71                                   | 541                                | 541                                | 2500  | 250                                     | 2204                               | 215                                 |
| 85                                   | 650                                | 650                                | 3000  | 300                                     | 2646                               | 255                                 |
| 99                                   | 758                                | 758                                | 3500  | 350                                     | 3087                               | 300                                 |

Tab. 3



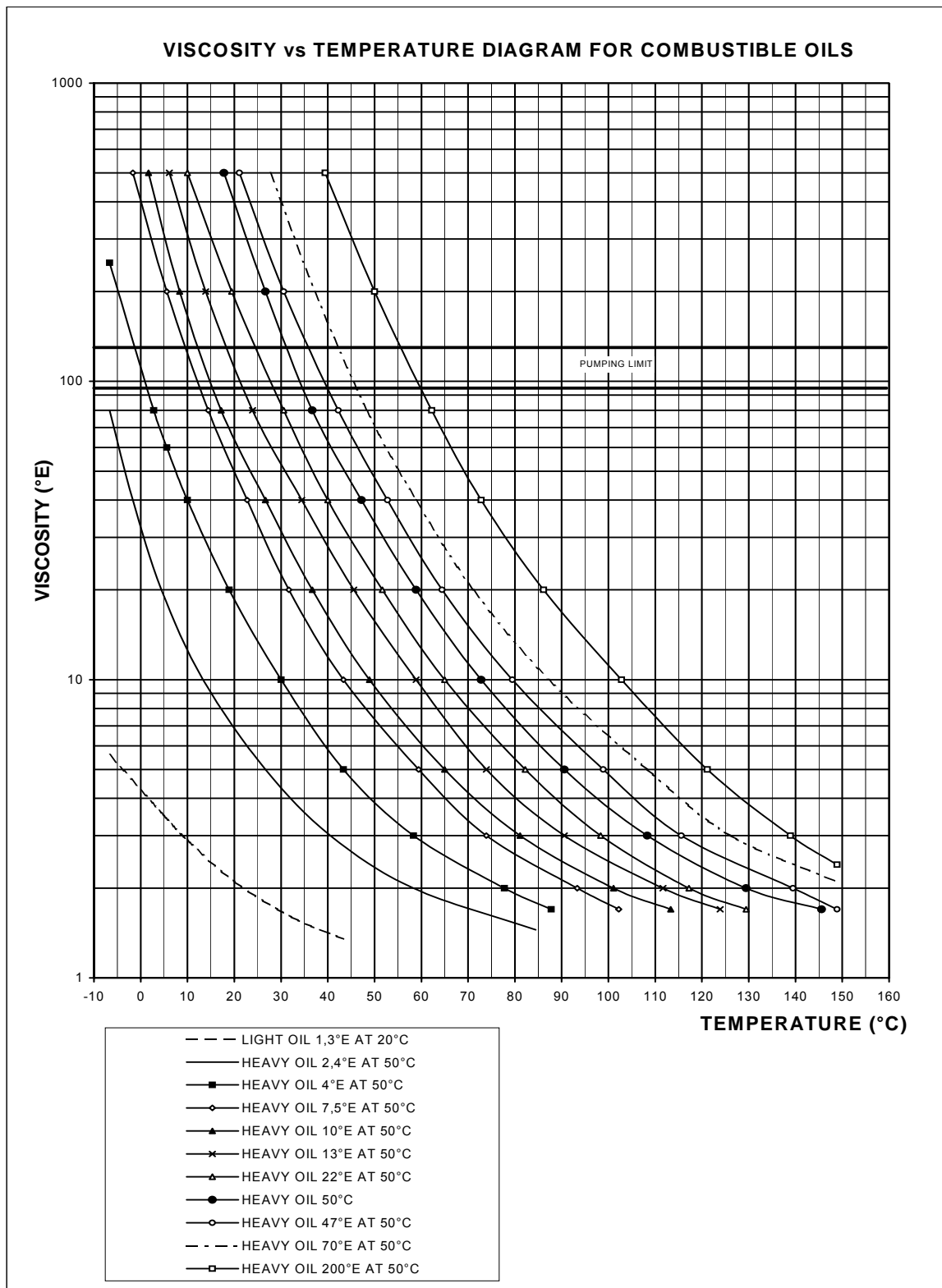


Fig. 4

The burners must be fed with fuel with a minimum temperature at the pump inlet, as a function of the oil viscosity, as showed on diagrams in Fig. 4, Fig. 5 and Fig. 7.

## Minimum feeding temperature vs. oil viscosity

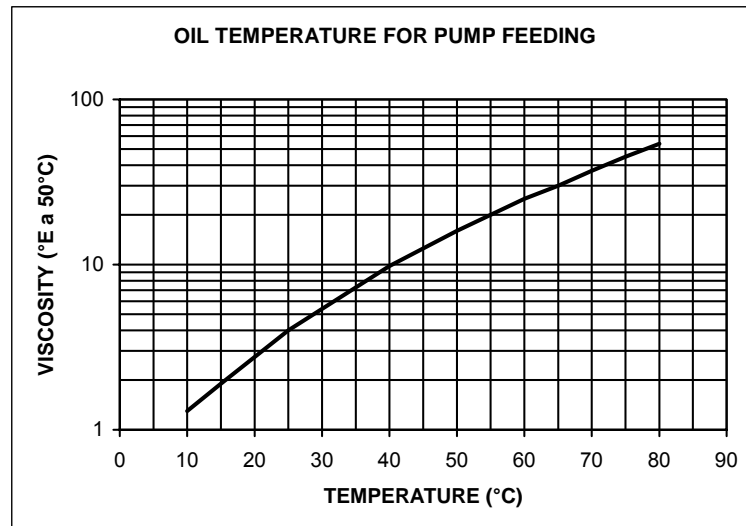


Fig. 5

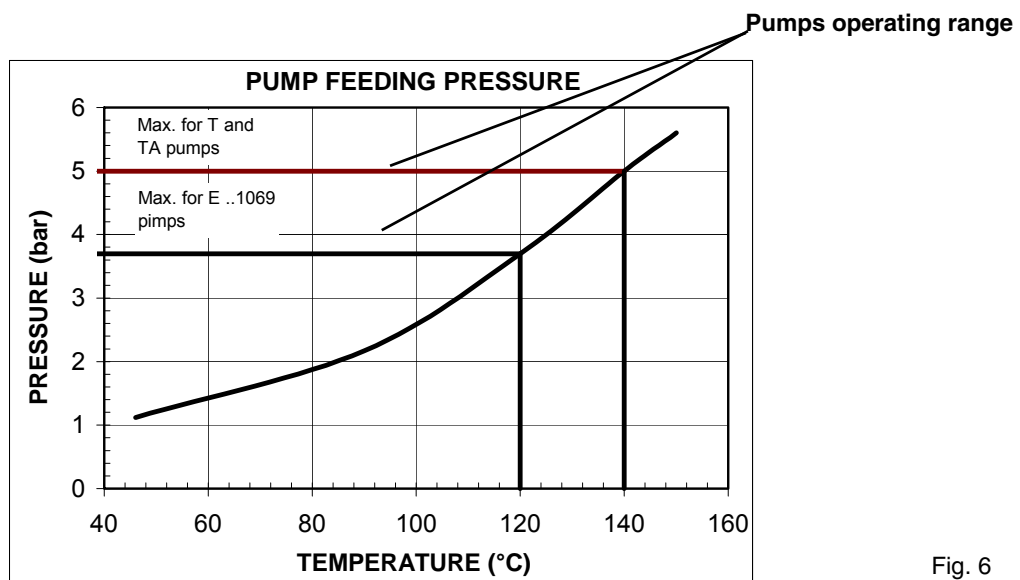


Fig. 6

The use of heavy oil forces to feed the burner to a pressure strictly related to the oil temperature. This avoids damage to the pump caused by gassification.

## VISCOSITY vs. TEMPERATURE DIAGRAM

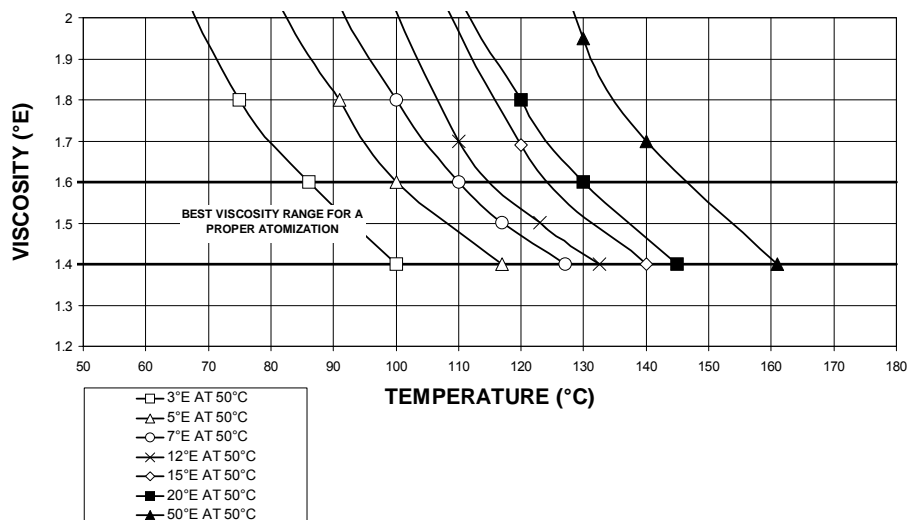


Fig. 7

## HYDRAULIC DIAGRAMS

**Fig. 8 - Hydraulic diagram 3ID0023 - Single burner configuration**

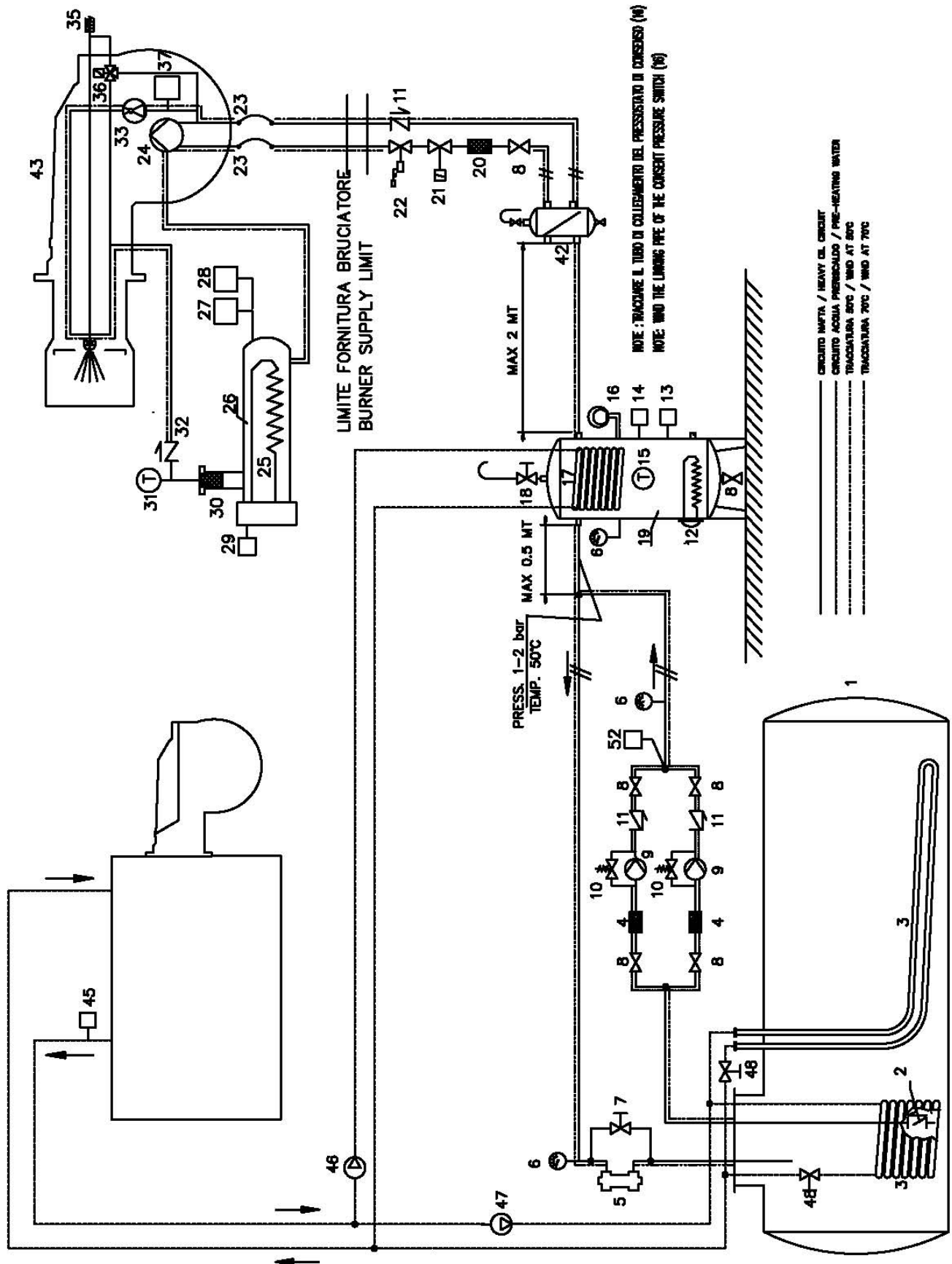
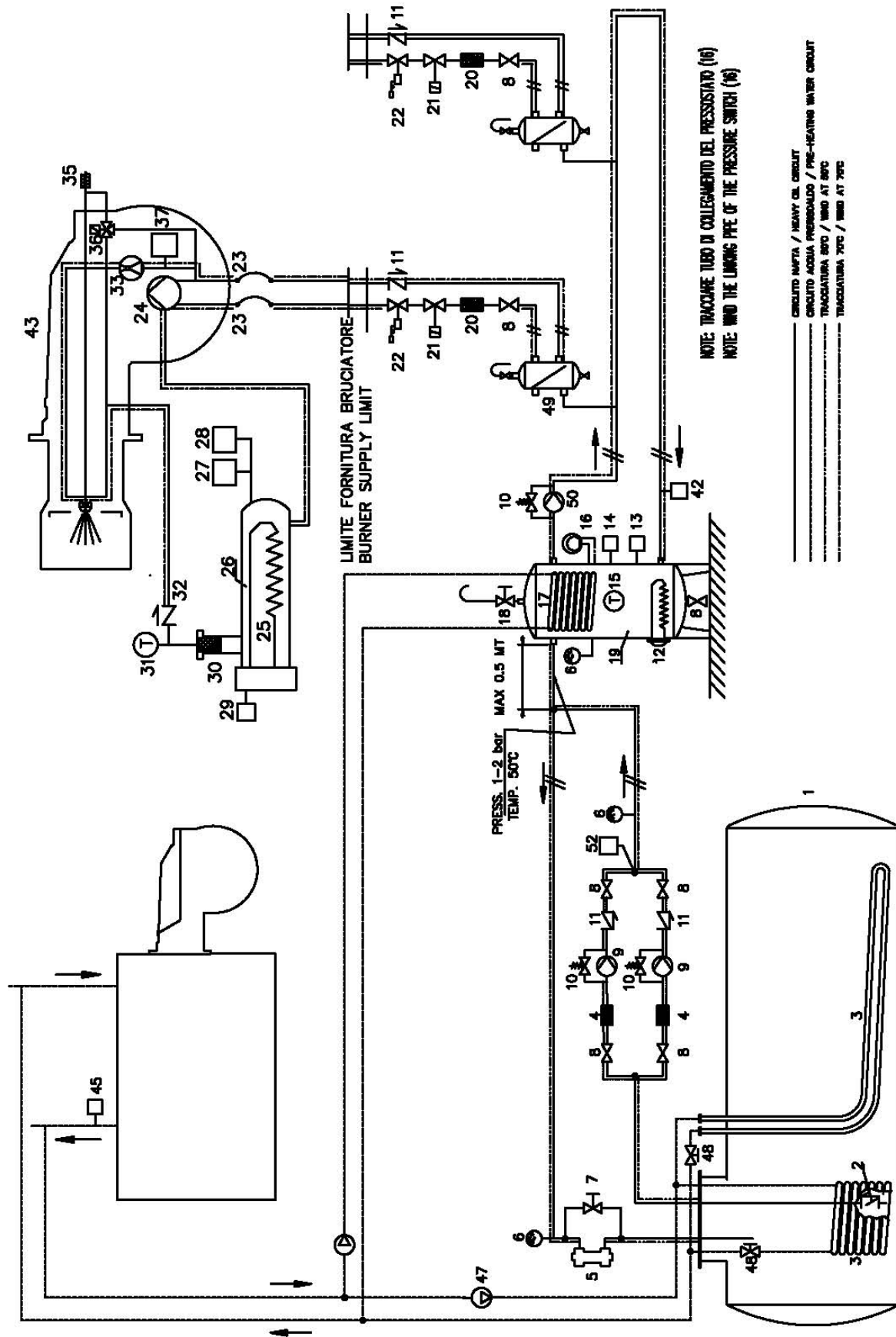


Fig. 9 - Hydraulic diagram 3ID0014 - Two or more burners configuration



**Hydraulic Diagram 3ID0014**

- 1 Main tank
- 2 Bottom valve
- 3 Main tank pre-heating pipe
- 4 Oil filter (filtration, 1mm)
- 5 Circuit pressure regulator
- 6 Manometer
- 7 Pressure regulation by-pass valve
- 8 Manual valve
- 9 Oil pump
- 10 Pump pressure regulator
- 11 Unidirectional valve
- 12 Service tank pre-heating resistor
- 13 Service tank pre-heating thermostat
- 14 Burner consent thermostat
- 15 Thermometer
- 16 Consent pressure switch for service tank resistor
- 17 Service tank heating pipe
- 18 Service tank air drain valve
- 19 Service tank
- 20 Oil filter
- 21 Fuel solenoid valve
- 22 Fuel valve
- 23 Burner pump flexible hoses
- 24 Burner oil pump
- 25 Pre-heating tank resistor
- 26 Pre heating tank
- 27 Oil consent thermostat
- 28 Heather safety thermostat
- 29 Thermostat for oil temperature setting
- 30 Tank filter
- 31 Thermometer
- 32 Check valve
- 35 Oil needle drive piston
- 36 Oil rate regulator
- 37 Burner consent thermostat
- 42 Burner start consent thermostat
- 43 Burner
- 45 Thermostat for pipes pre-heating pumps
- 46 Water pump for service tank pre-heating (1)
- 47 Water pump for main tank pre-heating (19)
- 48 Water pre-heating balance setting valve
- 50 Oil circulation pump
- 52 Oil ring max. pressure switch

**Hydraulic Diagram 3ID0023**

- 1 Main tank
- 2 Bottom valve
- 3 Main tank pre-heating pipe
- 4 Oil filter
- 5 Circuit pressure regulator
- 6 Manometer
- 7 Pressure regulation by-pass valve
- 8 Manual valve
- 9 Oil pump
- 10 Pump pressure regulator
- 11 Unidirectional valve
- 12 Service tank pre-heating resistor
- 13 Service tank pre-heating thermostat
- 14 Burner consent thermostat
- 15 Thermometer
- 16 Consent pressure switch for service tank resistor
- 17 Service tank heating pipe
- 18 Service tank air drain valve
- 19 Service tank
- 20 Oil filter
- 21 Fuel solenoid valve
- 22 Fuel valve
- 23 Burner pump flexible hoses
- 24 Burner oil pump
- 25 Pre-heating tank resistor
- 26 Pre heating tank
- 27 Oil consent thermostat
- 28 Pre-heating tank resistors safety thermostat
- 29 Thermostat for oil temperature setting
- 30 Pre-heating tank filter
- 31 Thermometer
- 32 Check valve
- 33 Return pressure regulator
- 35 Oil needle drive piston
- 36 Three way valve for piston drive
- 37 Burner consent thermostat
- 42 Air separation bottle
- 43 Burner
- 45 Thermostat for pipes pre-heating pumps
- 46 Water pump for service tank pre-heating (1)
- 47 Water pump for main tank pre-heating (19)
- 48 Valves for setting of pre-heating water balance
- 52 Oil ring max. pressure switch

## OIL NOZZLES

The light oil flow rate can be adjusted choosing a by-pass nozzle that suits the boiler/utilisation output and setting the delivery and return pressure values according to the ones quoted on the chart below and the diagrams (as far as reading the pressure values, see next paragraphs).

| NOZZLE       | NOZZLE SUPPLY PRESSURE<br>bar | HIGH FLAME RETURN PRESSURE<br>bar | LOW FLAME RETURN PRESSURE<br>bar |
|--------------|-------------------------------|-----------------------------------|----------------------------------|
| FLUIDICS WR2 | 25                            | 20                                | 7 (recommended)                  |
| BERGONZO B   | 25                            | 20                                | 7 (recommended)                  |
| BERGONZO C   | 25                            | 20                                | 7 (recommended)                  |

### ● FLUIDICS nozzles

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

Tab. 4

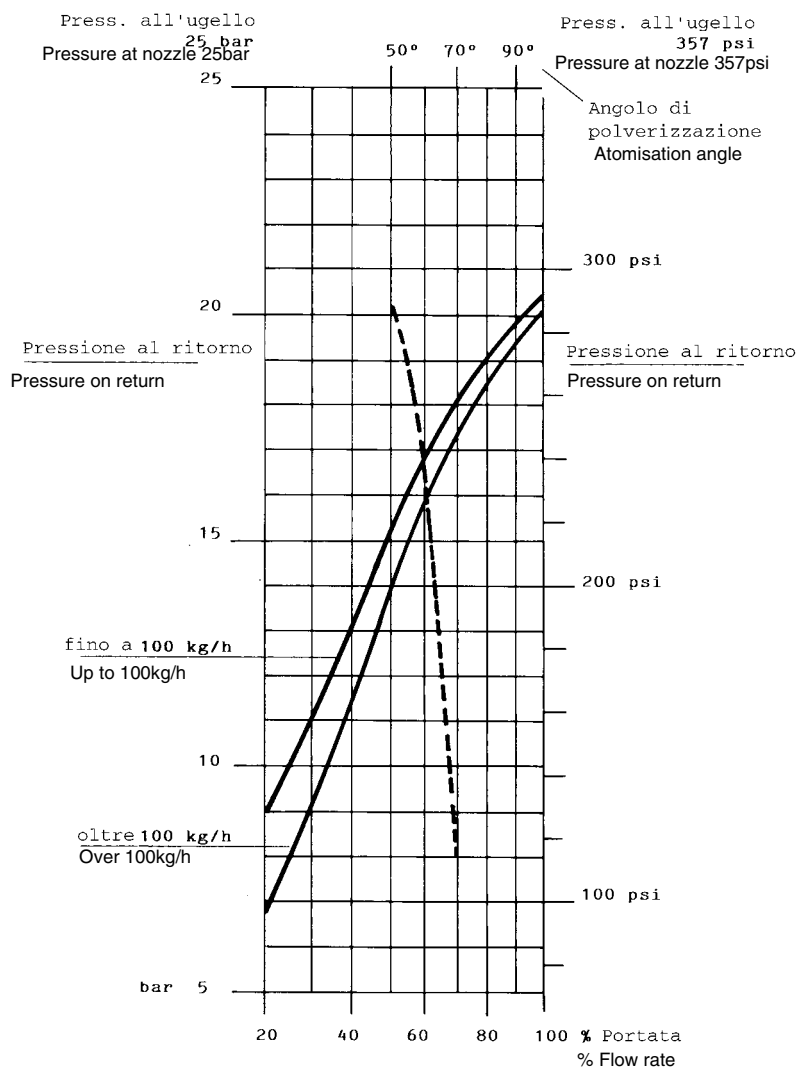


Fig. 10

-----Atomisation angle according to the return pressure  
 \_\_\_\_\_ % Flow rate

**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. 10).

## ● BERGONZO NOZZLES

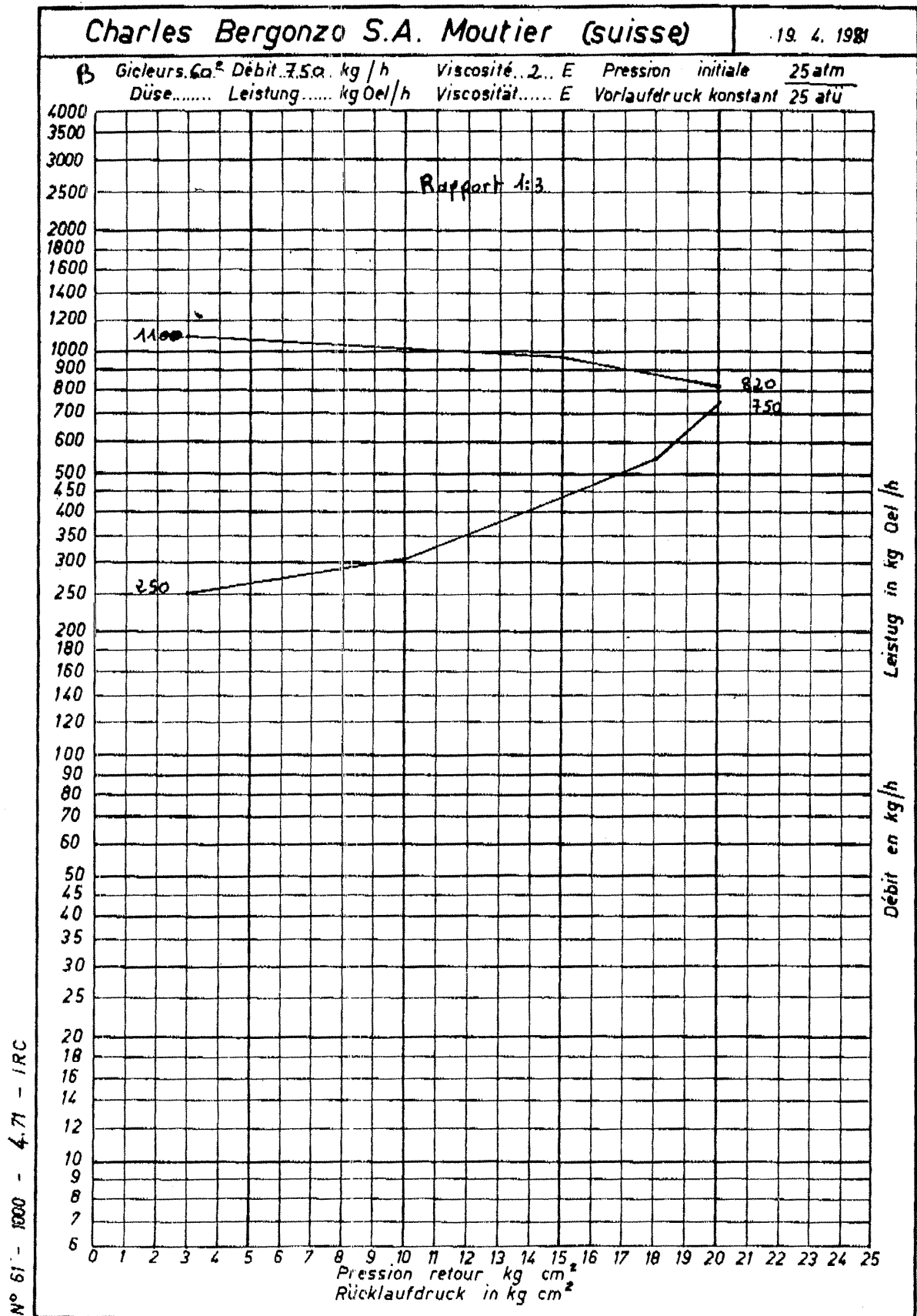


Fig. 11



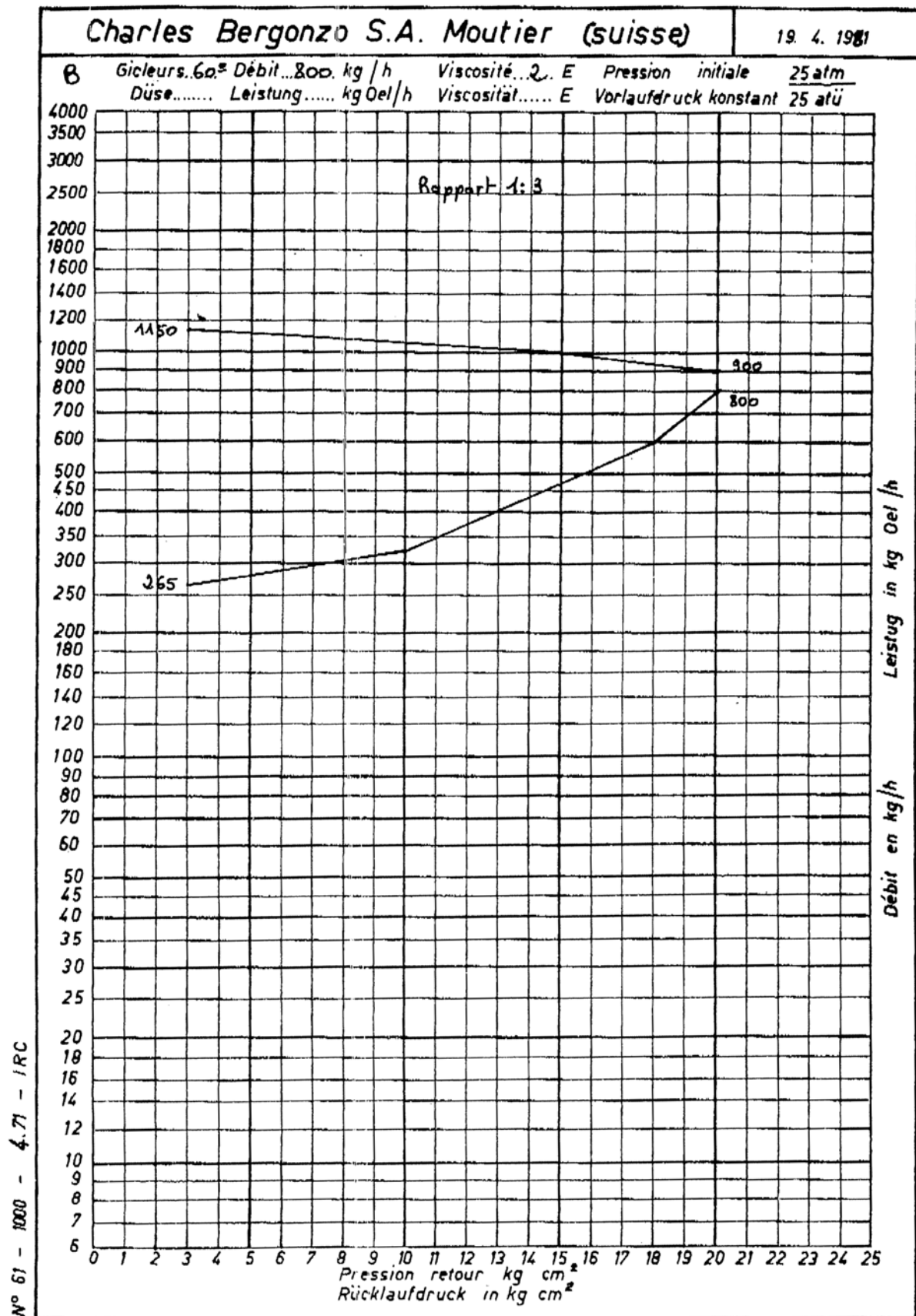


Fig. 12



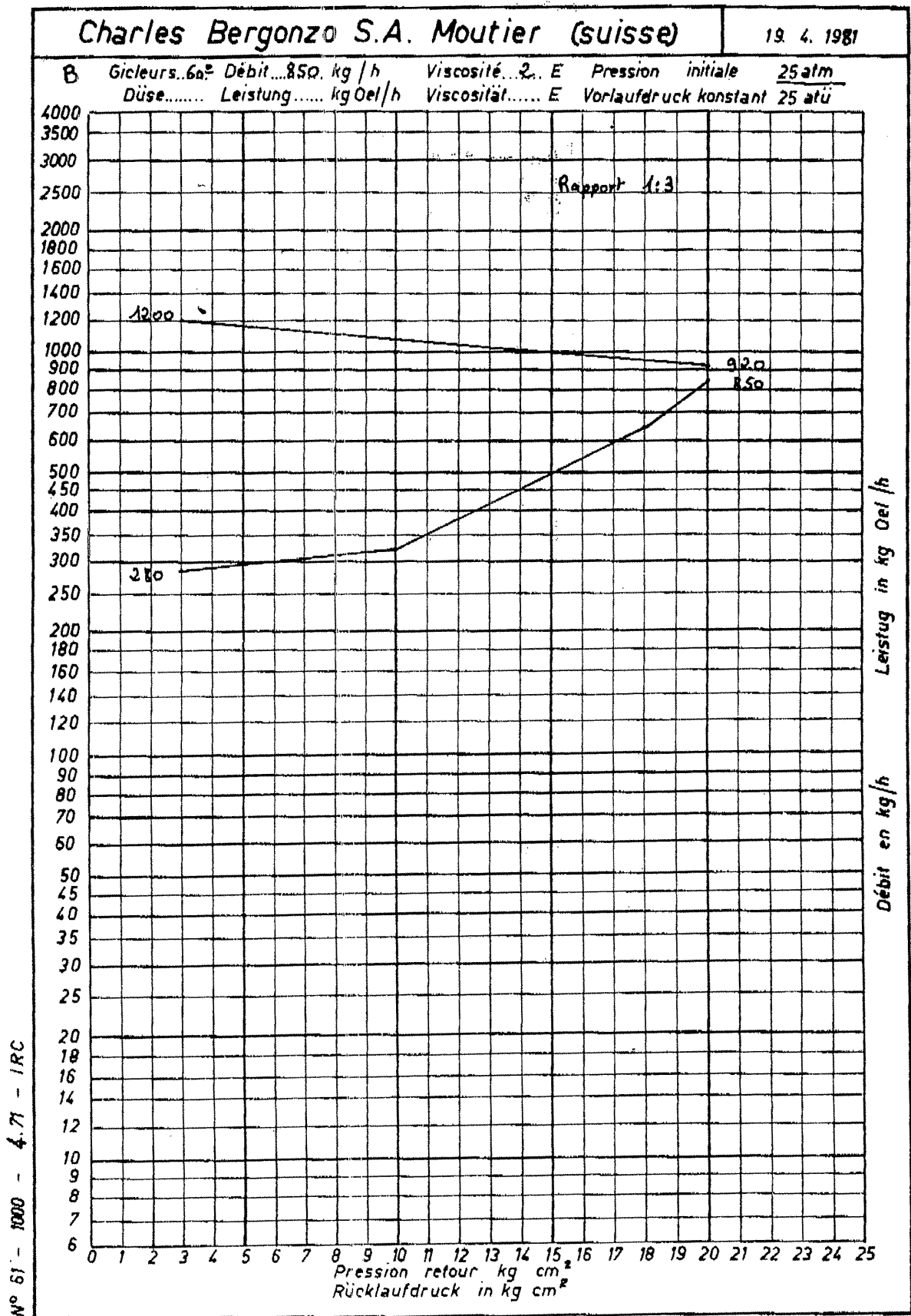


Fig. 13

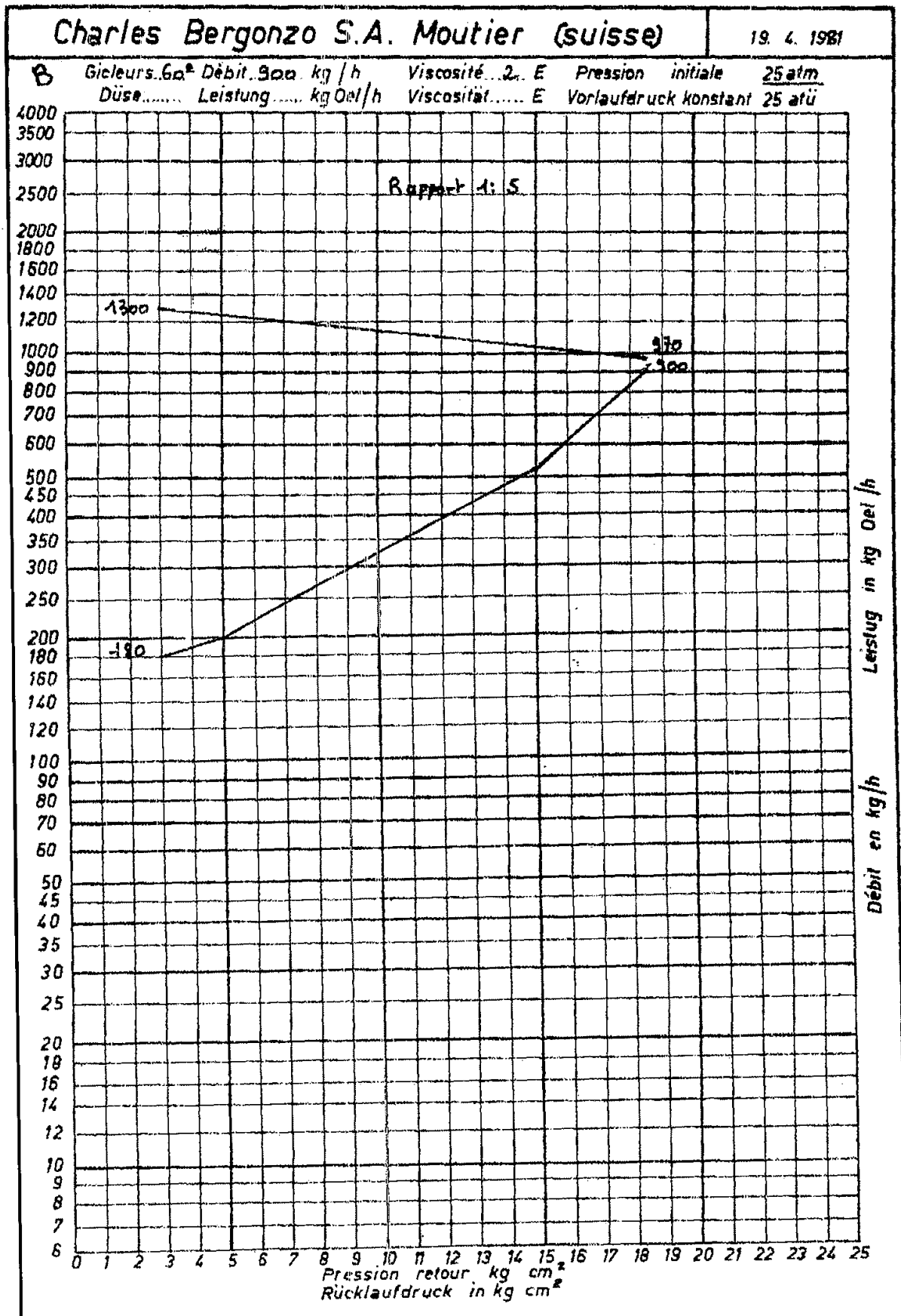


Fig. 14

### Oil thermostat adjustment

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

**NOTE:** thermostat **TCI** is provided on burners fired with fuel oil having a 50° E at 50° C viscosity only.

#### TCN - Oil enabling thermostat (Fig. 15)

Adjust this thermostat to a value 10% lower than that showed in the viscosity-temperature diagram (Fig. 4).

#### TRS - Resistor safety thermostat (Fig. 15)

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.

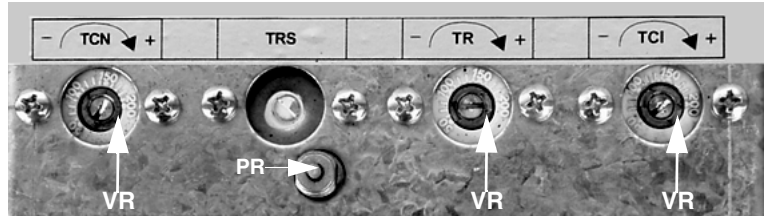


Fig. 15


#### TR - Resistor thermostat (Fig. 15)


Adjust this thermostat to the correct value according to the viscosity-temperature diagram (Fig. 4) and check the temperature by using a thermometer with a scale of up to 200° C mounted on the pre-heating tank.

#### TCI - Installation enabling thermostat (Fig. 15)

This thermostat is fitted on burners fired with oil at a viscosity of 50° E at 50° C only. Set the thermostat to a temperature about 40° C lower than the TR.

## ADJUSTMENTS

|   |  |
|---|--|
|  | <b>ATTENTION:</b> 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. |
|   | Before starting up the burner, make sure that the return pipe to the tank is not obstructed. Any obstruction would cause the pump seal to break.   |
|   | <b>ATTENTION:</b> 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.     |

|   |   |
|---|---|
|  | <b>IMPORTANT!</b> 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> |
| Heavy oil ≤7°C a 50 °C            | 11 ÷ 12                         | 4.2 ÷ 6.2                      |
| Heavy oil ≥7°C a 50 °C            | 11 ÷ 12.5                       | 4.7 ÷ 6.7                      |

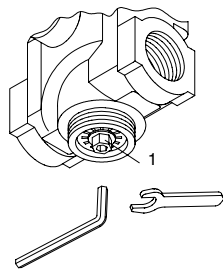
**Adjusting the gas ignitor**

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

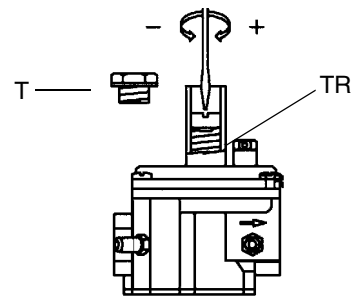
- 1 remove the protection on the bottom of the valve, moving it counterclockwise (see next figure);
- 2 rotate clockwise the nut 1 as shown in to close the valve or counterclockwise to open.

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

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



**Brahma gas valve EGR\*12**



**Pressure stabiliser**

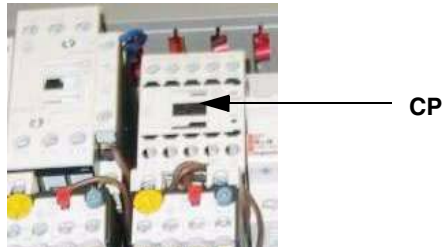
### Adjustments - brief description

Adjust the air and fuel 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 nozzle flow rate.
- 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/fuel ratio in those points, regulating the opening-closing of the fuel governor.
- 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.

### Adjustment procedure

- 1 Check the fan motor rotation.
- 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 pressed for some seconds until the oil circuit is charged;



- 3 bleed the air from the **M** pressure gauge port (Fig. 16) by loosening the cap without removing it, then release the contactor.

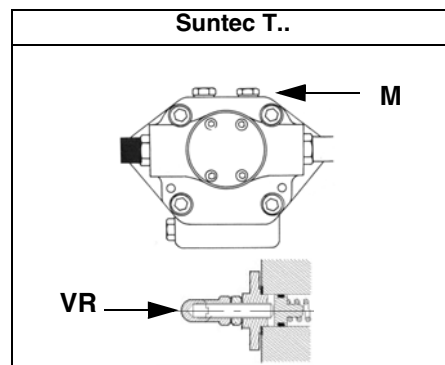
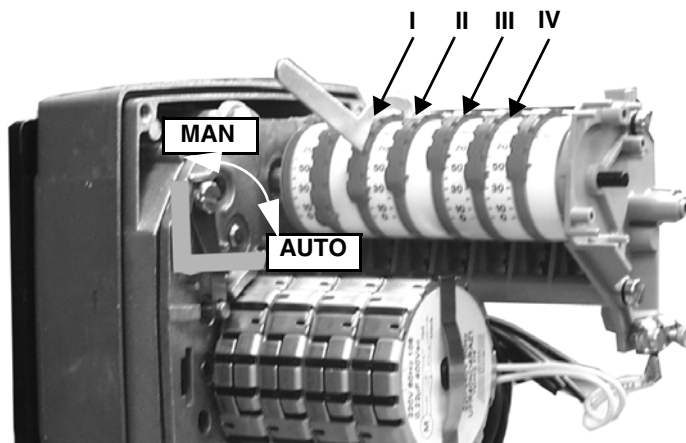


Fig. 16

- 1 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;
- 2 cam IV (stroke limitation cam) must be set a little higher than the cam III to limit the output during the first seconds the flame appears;  
**NOTE:** cam IV must shift according to cam III.
- 3 Turn the burner on by means of its main switch: if the burner locks press the RESET button on the control panel - see chapter "OPERATION" on page 25.
- 4 start the burner up by means of the thermostat series and wait until the pre-purge time comes to an end and the burner starts up;
- 5 drive the burner to high flame stage, by means of the thermostat **TAB**.
- 6 Then move progressively the microswitch to higher values until it reaches the high flame position; always check the combustion values and eventually adjust the oil pressure (see next step).



Actuator cams

- I High flame
- II Stand-by and Ignition
- III Low flame
- IV Stroke limitation

- 7 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 showed on Fig. 17 and act on on the pump adjusting screw **VR** (see Fig. 16 and page 11) as to get the nozzle pressure at 25bar (Fluidics/Bergonzo nozzles - see diagram on page 22).

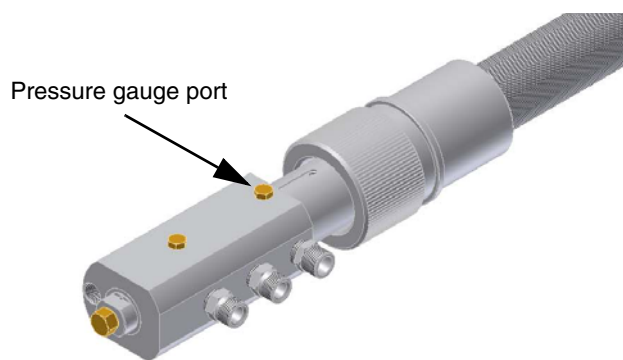


Fig. 17

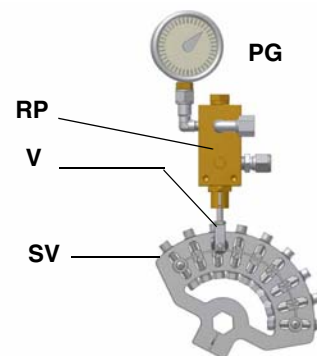
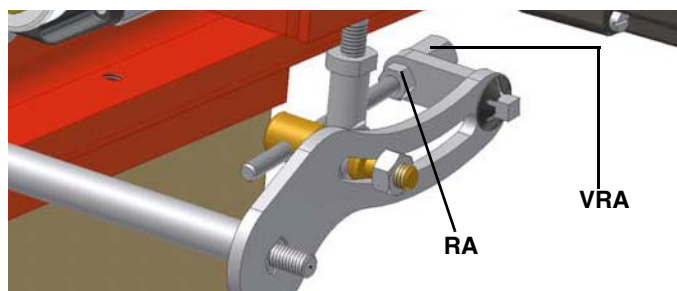


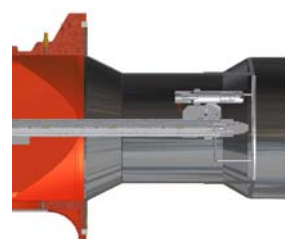
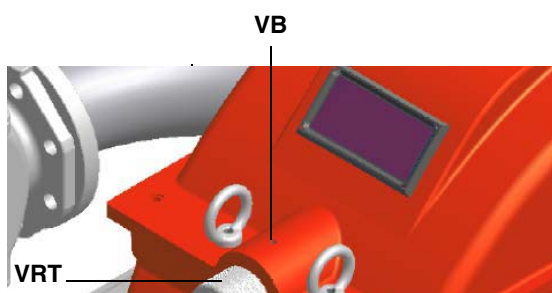
Fig. 18

- 8 In order to get the maximum oil flow rate, adjust the pressure (reading its value on the **PG** pressure gauge (see picture above): always checking the combustion parameters, the adjustment is to be performed by means of the **SV** adjusting cam screw (see picture above) when the cam has reached the high flame position.
- 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.

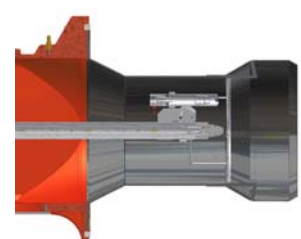
**Note:** once the procedure is performed, be sure that the blocking nut **RA** is fasten. Do not change the position of the air damper rods.



- 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.



"MAX" head position



"MIN" head position

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



- 11 the air and oil rate are now adjusted at the maximum output stage, go on with the point to point adjustment on the **SV** (Fig. 18) adjusting cam as to reach the minimum output point.
- 12 As for the point-to-point regulation in order to set the cam foil shape, move the 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 (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 **V** to increase the rate, unscrew to decrease, in order to get the pressure as showed on diagrams on page 16, according to the nozzle provided and the requested rate.
- 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.  
**NOTE:** remember that cam IV must shift according to cam III (see step 2).
- 16 The low flame position must never match the ignition position that is why cam **III** must be set 20°- 30° more than the ignition position.
- 17 Turn the burner off; then start it up again. If the adjustment is not correct, repeat the previous steps.
- 18 Now adjust the air pressure switch (see next paragraph).

### 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.



### Fully modulating burners

To adjust the fully-modulating burners, use the **CMF** switch on the burner control panel (see chapter "ELECTRICAL WIRING DIAGRAMS"), 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=2; to drive it to the low-flame stage, set CMF=1.

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

- CMF = 0 stop
- CMF = 1 low flame operation
- CMF = 2 high flame operation
- CMF = 3 automatic operation

For further details, see the burner modulator reference guide.

## 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 THE EVENT OF REPEATED LOCKOUTS, DO NOT PERSIST WITH THE RESET BUTTON AND CONTACT QUALIFIED PERSONNEL WHO WILL PROCEED TO ELIMINATE THE MALFUNCTION.

**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".

- 1 Set to the ON position the main switch on the burner control panel.
- 2 Check the control box is not in the lockout position; in such a case reset it by the reset pushbutton.
- 3 Check that the series of thermostats (or pressure switches) enable the burner to operate.
- 4 The startup sequence begins: the control box ignites the fan and pump motors and energises the ignition transformer as well.
- 5 At the end of the pre-purge stage, the light oil solenoid valve EVG is energised and the burner is on.
- 6 The ignition transformer is energized for few seconds after the ignition of the flame (post-ignition time) and at the end of this time is de-energised.
- 7 After the ignition the actuator moves to the high flame position for some seconds, then the operation begins and the burner switches to high flame or to low flame, according to the plant demand.



## 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.



**WARNING: ALL OPERATIONS ON THE BURNER MUST BE CARRIED OUT WITH THE MAINS DISCONNECTED AND THE FUEL MANUAL CUTOFF VALVES CLOSED!**

**ATTENTION: READ CAREFULLY THE "WARNINGS" CHAPTER AT THE BEGINNING OF THIS MANUAL.**

### ROUTINE MAINTENANCE

- Check and clean the ignitor gas filter cartridge, replace if necessary.
- Check and clean the fuel filter cartridge, replace if necessary.
- Check and clean the filter inside the light oil pump: filter must be thoroughly cleaned at least once in a season to ensure correct working of the fuel unit. To remove the filter, unscrew the four screws on the cover. When reassemble, make sure that the filter is mounted with the feet toward the pump body. If the gasket between cover and pump housing should be damaged, it must be replaced. An external filter should always be installed in the suction line upstream of the fuel unit.
- Check the fuel hoses for possible leaks.
- Remove, clean and check the combustion head (see Fig. 21).
- Check and clean the ignition electrode on the pilot burner, adjust and, if necessary, replace it (page 35).
- Check and clean the detection photoresistor, adjust and, if necessary, replace it (Fig. 23).
- Remove and clean the fuel nozzle (**Important: cleaning must be performed using solvent, not metal tools!**). At the end of maintenance operations after the burner reassembly, light the flame and check its shape, replacing the nozzle whenever a questionable flame shape appears. Whenever the burner is used intensely, we recommend preventively replacing the nozzle at the start of each heating season.
- Clean and grease levers and rotating parts.

### Maintenance of the governor with filter (ignitor gas train)

Before disassembling the device, be sure that there is no pressurised gas inside it.

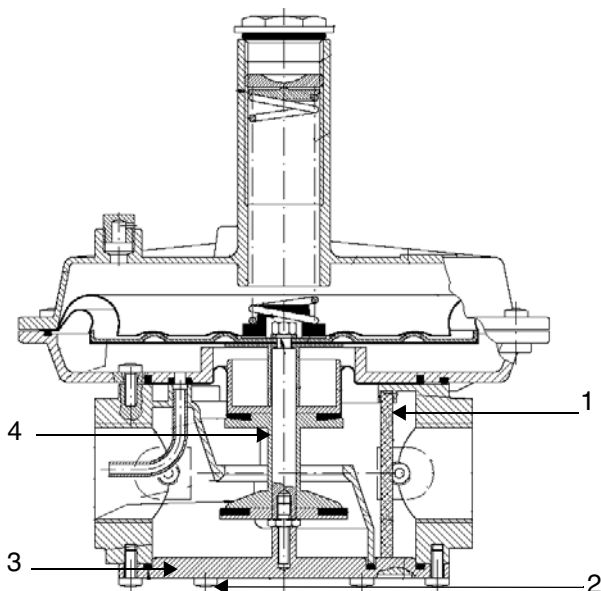
To check the filtering part (1) on threaded bodies (see ):

- remove the bottom cover, unscrewing the fixing screws;
- remove the filtering part (1), clean it with water and soap, blow it with compressed air or replace it if necessary;
- reassemble the filtering part in its initial position checking that it is placed in its own slots (see );
- reassemble the bottom cover (3), being sure that the main bolt is centered in the bottom cover slot.

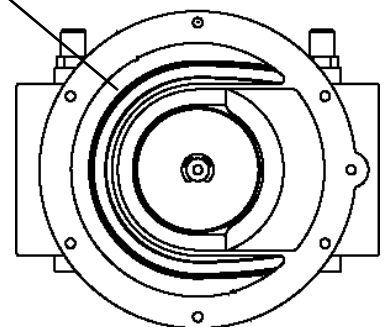
To check the filtering part (1) on flanged bodies (see ):

- remove the bottom cover, unscrewing the fixing screws;
- remove the filtering part (1), clean it with water and soap, blow it with compressed air or replace it if necessary;
- reassemble the filtering part in its initial position checking that it is placed in its own slots (see );

**NOTE:** pay attention that the teflon ring (5): while reassembling the cover (3), it must be placed inside the proper bell/slot (6).



filter slots



### Light oil filter maintenance

For correct and proper servicing, proceed as follows:

- 1 shut off fuel in the line section being serviced;
- 2 unscrew the tray;
- 3 remove the filter cartridge from its support and wash it with petrol or replace if necessary; check seal O-Ring, replace if necessary;
- 4 reassemble the tray and restore fuel flow.



### Removing the combustion head

- Remove the top cover C;
- remove the photoresistor from its seat;
- unscrew the revolving connectors (E in Fig. 20) on the fuel pipes (use 2 spanners to avoid loosening the connections attached to the distributor block);
- loosen the screw VRT to free the threaded rod AR, then screw out the 2 screws V holding the washer R and the screw VRT in position;
- remove the whole assembly as shown in Fig. 19.

Note: to replace the combustion head reverse the procedure described above.

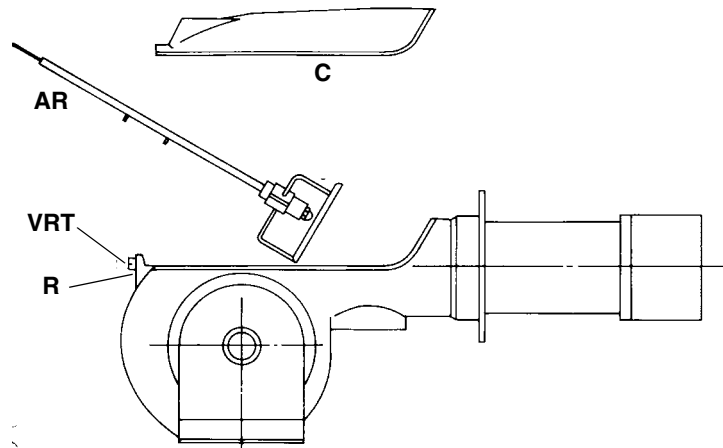


Fig. 19

### Removing the gun

- 1 Remove the combustion head, as described on the previous paragraph;
- 2 slacken the screw VB
- 3 remove the lance with the nozzle holder
- 4 to replace the combustion head reverse the procedure described above.

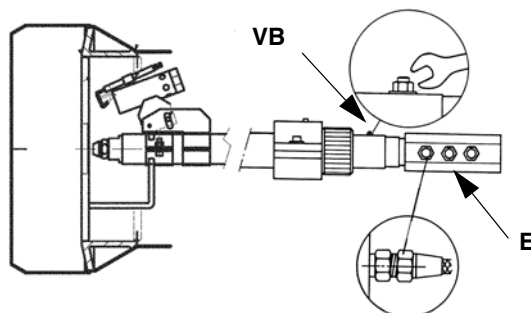


Fig. 20

## Electrode position setting



**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 guarantee a good ignition, the measures below (in mm) must be observed (Fig. 21).

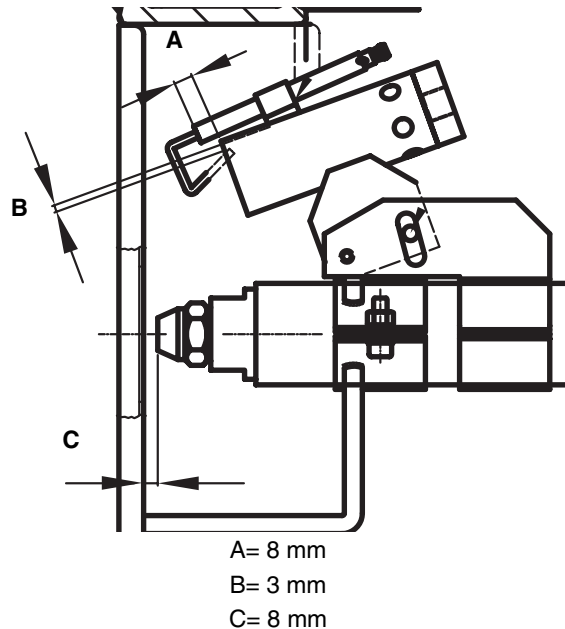


Fig. 21

## 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 cable
- 3 remove the combustion head (see par. "Removing the combustion head");
- 4 loose the screw that fasten the ignition electrode to the burner pilot;
- 5 remove the electrode and replace it, referring to the values quoted on Fig. 21;

## Cleaning and replacing the detection photoresistor

To clean/replace the detection photoresistor proceed as follows:

- 1 Disconnect the system from the electrical power supply.
- 2 Shut off the fuel supply
- 3 remove the photoresistor from its slot;
- 4 clean it using a clean cloth;
- 5 if necessary, replace it;
- 6 insert the photoresistor into its slot.

### Checking the detection current

To measure the detection signal follow the diagram in Fig. 22 - Fig. 23.

If the signal is not in the advised range, check the electrical contacts, the cleaning of the combustion head, the position of the photoreistor and if necessary replace it.

|             |   |
|-------------|---|
| Control box | Minimum current intensity with flame-<br>Minimum detection signal |
| Siemens LAL | 6.5 $\mu$ A   |

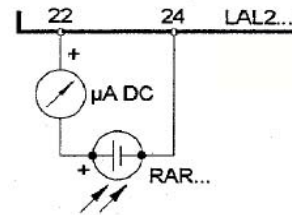


Fig. 22

|                      |                          |
|----------------------|--------------------------|
| Flame detector       | Minimum detection signal |
| Krom Schroeder IFW15 | 1 $\mu$ A                |

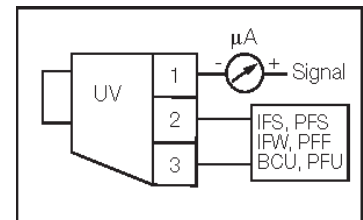


Fig. 23

### Seasonal stop

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

- 1 turn the burner's main switch to 0 (Off position)
- 2 disconnect the power mains
- 3 close the fuel cock 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".

## TROUBLESHOOTING

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

**SPARE PARTS**

| <b>Desription</b>   | <b>TN1030</b> |
|---|---------------|
| FLAME DETECTOR mod.KROM-SCHROEDER IFW15                       | 2020114       |
| CONTROL BOX mod.SIEMENS LAL2..                                | 2020420       |
| PILOT DETECTION ELECTRODE                                     | 2080115       |
| PILOT IGNITION ELECTRODE                                      | 2080258       |
| OIL FILTER  | 2090209       |
| AIR PRESSURE SWITCH   | 2160085       |
| IGNITOR GAS PRESSURE SWITCH                                   | 2160086       |
| IGNITION TRANSFORMER  | 2170136       |
| PUMP MOTOR  | 2180257       |
| 3-WAYS SOLENOID VALVE mod. SIRAI                              | 2190437       |
| GAS SOLENOID VALVE mod. BRAHMA EG*R12                         | 2190502       |
| OIL FLEXIBLE HOSES L = 600                                    | 2340059       |
| OIL FLEXIBLE HOSES 3/8" L=385                                 | 2340088       |
| GAS FLEXIBLE HOSES 1/2"M                                      | 234FX07       |
| OIL FLEXIBLE HOSES L=347                                      | 234FX24       |
| OIL FLEXIBLE HOSES L=485                                      | 234FX31       |
| ADJUSTING CAM FOIL  | 2440014       |
| ACTUATOR (SIEMENS SQM10)                                      | 2480004       |
| DETECTION PHOTORESISTOR (SIEMENS RAR)                         | 2510009       |
| PRESSURE GOVERNOR   | 2570008       |
| PRESSURE GOVERNOR (SUNTEC TV40)                               | 2570036       |
| MODULATOR (SIEMENS RWF40)                                     | 2570112       |
| PUMP (SUNTEC T4)  | 2590148       |
| NOZZLE (specify angle and rate when ordering) mod. BERGONZO B | 2610210       |
| GAS GOVERNOR WITH FILTER                                      | 2800085       |
| COMBUSTION HEAD   | 30601A5       |
| BLAST TUBE  | 30910L5       |
| OIL RESISTOR (24kW)   | 6060008       |
| IGNITION CABLE  | 6050157       |
| OIL RESISTOR CARTRIDGE (80W)                                  | 6060010       |

## SIEMENS LAL.. CONTROL BOX

### Use

- Control and supervision of oil atomization burners
- For burners of medium to high capacity
- For intermittent operation (at least one controlled shutdown every 24 hours)
- Universally applicable for multistage or modulating burners

### Housing and plug-in base

- Made of impact-proof and heat-resistance black plastic
- Lockout reset button with viewing window; located behind it:
- Lockout warning lamp
- Lockout indicator coupled to the spindle of the sequence switch and visible in the transparent lockout reset button
- uses easy-to-remember symbols to indicate the type of fault and the point in time lockout occurred

Base and plug-in section of the LAL... are designed such that only burner controls of the LAL... family can be plugged in.

- 24 connection terminals
- Auxiliary terminals «31» and «32»
- 3 earth terminals terminating in a lug for earthing the burner
- 3 neutral conductor terminals prewired to terminal 2
- 14 knockout holes for cable entry by means of cable glands
- 8 at the side
- 6 in the bottom of the base
- 6 lateral threaded knockout holes for cable entry glands Pg11 or M20

### Operation

Flame detector and flame simulation test are made automatically during burner off times and the prepurge time «t1». If loss of flame occurs during operation, the burner control will initiate lockout. If automatic repetition of the startup sequence is required, the clearly marked wire link on the plug-in section of the LAL... must be cut away.

### Pre-conditions for burner startup

- Burner control is not in the lockout position
- Sequence switch is in its start position (with LAL2 voltage is present at terminals 11 and 12.
- Air damper is closed; end switch «Z» for the CLOSED position must feed power from terminal 11 to terminal 8.
- Contact of the limit thermostat or pressure switch «W» and the contacts of any other switching devices in the control loop between terminals 4 and 5 must be closed e.g. a control contact for the oil preheater's temperature
- Normally closed contact of the air pressure switch must be closed.

### Startup sequence

Start command by «R»:

- «R» closes the start control loop between terminals 4 and 5
- The sequence switch starts to run
- Only prepurging, fan motor at terminal 6 receives power
- Pre- and postpurging, fan motor or flue gas fan at terminal 7 receives power on completion of «t7»
- On completion of «t16», the control command for opening the air damper is delivered via terminal 9
- Terminal 8 receives no power during the positioning time
- The sequence switch continues to run only after the air damper has fully closed.

t1 Prepurge time with air damper fully open:

- The correct functioning of the flame supervision circuit is checked during «t1»
- The burner control will initiate lockout if correct functioning is not ensured.

With LAL2:

Shortly after the beginning of «t1», the air pressure switch must change over from terminal 13 to terminal 14 otherwise, the burner control will initiate lockout start of the air pressure check.

t3 Short preignition time:

«Z» must be connected to terminal 16, release of fuel via terminal 18.

t3' Long preignition time: «Z» connected to terminal 15.

t3n Postignition time:

- «Z» must be connected to terminal 15

- With short preignition, «Z» remains on until «TSA» has elapsed connection to terminal 16.

t4 Interval «BV1 – BV2» or «BV1 - LR»: On completion of «t4», voltage is present at terminal 19. The voltage is required to power «BV2» connected to auxiliary switch «v» in the actuator.

t5 Interval: On completion of «t5», terminal 20 receives power. At the same time, control outputs 9 to 11 and input 8 are galvanically separated from the LAL... control section.

LAL... is now protected against reverse voltages from the load control circuit. With the release of «LR» at terminal 20, the startup sequence of the LAL... ends. After a few idle steps (steps with no contact position changes), the sequence switch switches itself off.

B Operating position of the burner

B-C Burner operation: during burner operation, «LR» drives the air damper to the nominal load or low-fire position, depending on heat demand; the release of the nominal load takes place via auxiliary switch «v» in the actuator and in the event of loss of flame during operation, the LAL... will initiate lockout. For automatic start repetition, the clearly marked wire link «B» on the plugin section of the LAL... must be cut away.

C Controlled shutdown: in the case of controlled shutdown, «BV...» will immediately be closed. At the same time, the sequence switch is started to program «t6»

C-D Sequence switch travels to start position «A»

t6 Postpurge time: fan «M2» connected to terminal 7. Shortly after the start of «t6», terminal 10 receives power and the air damper is driven to the MIN position. Full closing of the air damper starts only shortly before «t6» has elapsed initiated by the control signal at terminal 11. During the following burner off time, terminal 11 is live.

t13 Permissible afterburn time: during «t13», the flame signal input may still receive a flame signal.

D-A End of control program: start position

As soon as the sequence switch has reached the start position – having thereby switched itself off – the flame detector and flame simulation test will start again.

During burner off times, the flame supervision circuit is live.

### Lockout and indication of the stop position

Whenever a fault occurs, the sequence switch stops and with it the lockout indicator. The symbol appearing above the reading mark indicates the type of fault:

◀ No start. One of the contacts is not closed (also refer to «Preconditions for burner startup»):

Extraneous light:

Lockout during or after completion of the control program

Examples: nonextinguished flame, leaking fuel valves faulty flame supervision circuit.

▲ Interruption of startup. No OPEN signal at terminal 8 from the changeover end switch «a». Terminals 6, 7 and 15 are live until fault has been corrected

P Lockout. No air pressure indication at the beginning of the air pressure check. Air pressure failure after the air pressure check.

■ Defect in the flame supervision circuit.

▼ Interruption of the startup sequence. No positioning signal at terminal 8 from the auxiliary switch «m» for the low-fire position. Terminals 6, 7 and 15 are live until fault has been corrected.

1 Lockout. No flame signal at the end of the safety time.

I Flame signal has been lost during operation.

A Consenso all'avviamento (ad esempio tramite il termostato o il pressostato R dell'impianto)

B Operating position of the burner

B-C Burner operation: during burner operation, «LR» drives the air damper to the nominal load or low-fire position, depending on heat demand; the release of the nominal load takes place via auxiliary switch «v» in the actuator and in the event of loss of flame during operation, the LAL... will initiate lockout. For automatic start repetition, the clearly marked wire link «B» on the plugin section of the LAL... must be cut away.

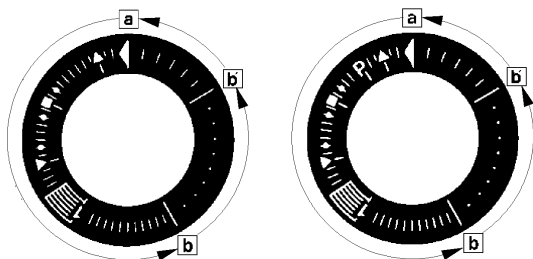
C Controlled shutdown: in the case of controlled shutdown, «BV...» will immediately be closed. At the same time, the sequence switch is started to program «t6»

C-D Sequence switch travels to start position «A».



During burner off times, the flame supervision circuit is live.

### Lockout indication



- a-b Startup sequence
- b-b' Idle step (with no contact confirmation)
- b(b')-a Postpurge program

Burner control can immediately be reset after lockout:

Do not press the lockout reset button for more than 10 seconds

The sequence switch always travels to the start position first

After resetting

After rectification of a fault that led to shutdown

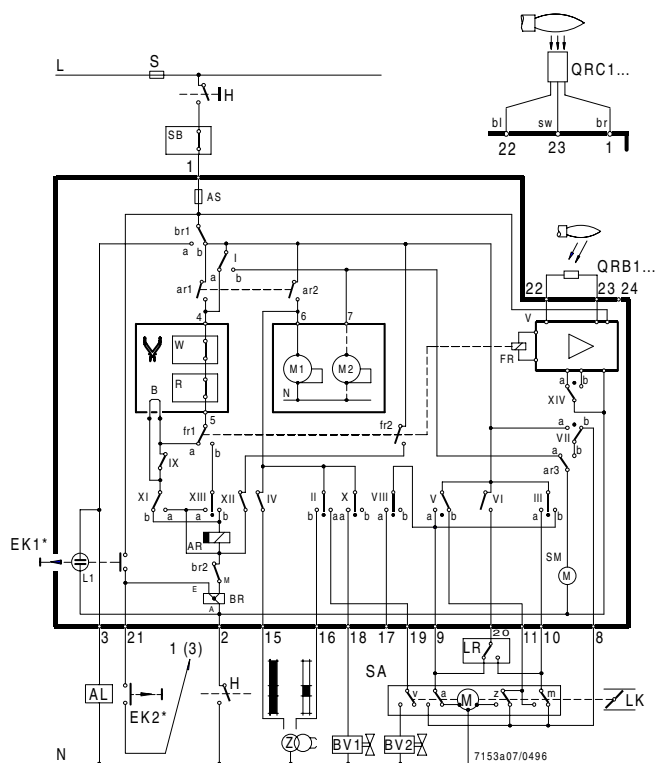
After each power failure

During this period of time, power is only fed to terminals 7 and 9...11.

Then, the LAL... will program a new burner startup sequence

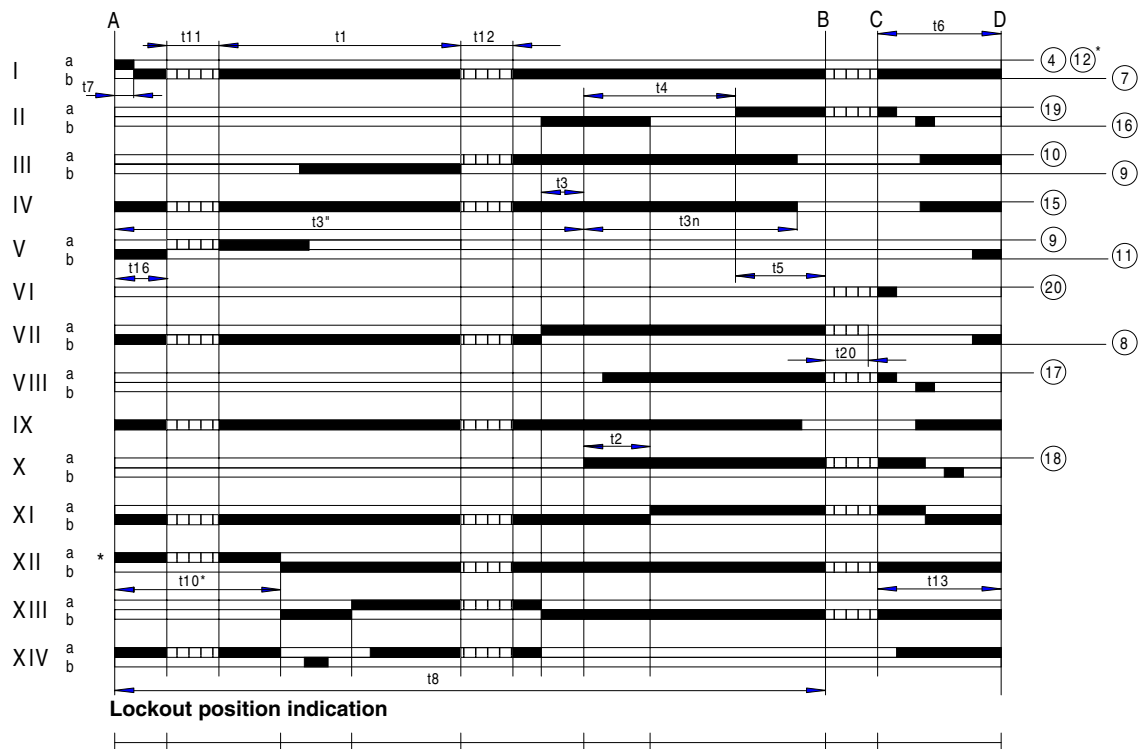
### Specifications

|  |                                     |
|--|-------------------------------------|
| Power supply   | AC 230 V -15 / +10 %                |
| for LAL2... on request   | AC 100 V -15 %...AC 110 V +10 %     |
| Frequency  | 50 Hz -6 %...60 Hz +6 %             |
| Absorption   | AC 3.5 VA                           |
| Mounting position  | optional                            |
| Protection   | IP 40                               |
| Perm. input current at terminal 1                                  | AC 5 A max., 20 A peak              |
| Perm. current rating of control terminals 3, 6, 7, 9...11, 15...20 | 4 A max., 20 A peak                 |
| Internal fuse  | T6,3H250V according to IEC 127      |
| External fuse  | max. 10 A                           |
| Weight   | Device 1000 g<br>Plug-in base 165 g |



## Sequence diagram

### Control output at terminal



### Key

- t1 Prepurge time with air damper fully open
- t2 Safety time
- t3 Preignition time, short («Z» connected to terminal 16)
- T3' Preignition time, long («Z» connected to terminal 15)
- t3n Postignition time («Z» connected to terminal 15)
- t4 Interval between voltage at terminals 18 and 19 («BV1-BV2»)
- t5 Interval between voltage at terminals 19 and 20 («BV2» load controller)
- t6 Postpurge time (with «M2»)
- t7 Interval between start command and voltage at terminal 7 (start delay time for «M2»)
- t8 Duration of startup sequence (excluding «t11» and «t12»)
- t10 Interval from startup to the beginning of the air pressure check
- t11 Air damper running time to the OPEN position
- t12 Air damper running time to the low-fire position (MIN)
- t13 Permissible afterburn time
- t16 Interval to the OPEN command for the air damper
- t20 For self-shutdown of the sequence switch

## KROM-SCHROEDER IFW15 FLAME DETECTOR

- For flame detection
- For multi-flame control for intermittent
- operation in conjunction with the
- flame control units IFS
- Ionisation or UV control
- Potential-free change-over contacts
- Integrated flame control signal

### APPLICATION

For the detection and signalling of the presence of a flame by means of ionisation or UV control. The flame detector is intended for use in conjunction with the flame control units IFS 110 IM, IFS 111 IM, IFS 410 or IFS 414. It can also be used where there is no fully automatic control required.

### FEATURES

- Flame control with ionisation electrode or UV probe
- For intermittent operation
- Potential-free contacts for flame detection (1 normally closed, 1 normally open)

### Function

The flame detector is ready for operation as soon as the mains voltage is applied to it. When the flame is established, the d.c. current energises a relay. The contacts of this relay can be used for control functions according to the application.

In a **multi-flame control system** (Fig. 2), several burners may be controlled at the same time. A flame control unit (e.g. IFS 110 IM) is used for the entire control functions and this also controls the first burner (only in the case of ionisation control). All remaining burners of this group are each controlled by an IFW 15 flame detector.

Should the flame controlled by a flame detector be extinguished during operation, the flame signal to the control unit is interrupted and an emergency cut-off occurs. This also occurs if a flame is simulated prior to ignition.

### Technical data

Mains voltage:

IFW 15: 220/240 VAC -15/+10%, 50/60 Hz for earthed mains

IFW 15T: 110/120 VAC -15/+10%, 50/60 Hz or

220/240 VAC -15/+10%, 50/60 Hz for earthed or non-earthed mains

Consumption: 12 VA

Output voltage for ionisation electrode: 230 VAC

Ionisation current: > 1  $\mu$ A

Output signal:

Potential-free contacts (1 normally closed, 1 normally open)

Contact load: max. 2 A

Connection terminals: 2 x 1.5 mm<sup>2</sup>

Flame detection: Lamp in the device

Ambient temperature: 20 °C to +60 °C

Fitting position: Arbitrary

Weight: 370 g

Construction: Housing made of impact-resistant plastic.

Plug-in upper housing with amplifying stage and green lamp for flame detection.

Plug socket with terminals, earthing strip and neutral bar 5 openings for Pg 9 cable gland provided.

### Project planning information

**Multi-flame control:** No more than 5 flame detectors should be used per flame control unit since it must be guaranteed that all burners are ignited within the flame control unit's safety period (3 s, 5 s or 10 s).

Very long gas pipes may possibly lead to delayed ignition of a burner and to switchoff of the entire system. This is why the pilot gas valves should be installed directly on the burners. In the case of ionisation control, one of the burners can be monitored by the flame control unit.

In the case of UV control, one IFW 15 flame detector must be used per burner. A diode of type EM 513 must be fitted as shown on the wiring diagram (Fig. 4).

Load of the flame control unit per output: 1 A, total current: 2 A.

Decoupling relays must be provided if the currents exceed these values.

Ionisation line: Max. 50 m; condition: well away from mains cable and sources of radiated noise - no electrical interference.

Several ionisation lines may be laid together in one plastic conduit. Avoid metal conduits wherever possible. Use high-voltage cables, non-screened.

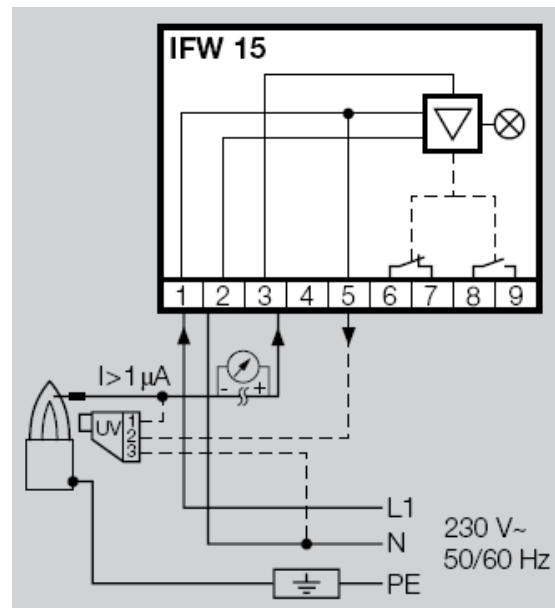
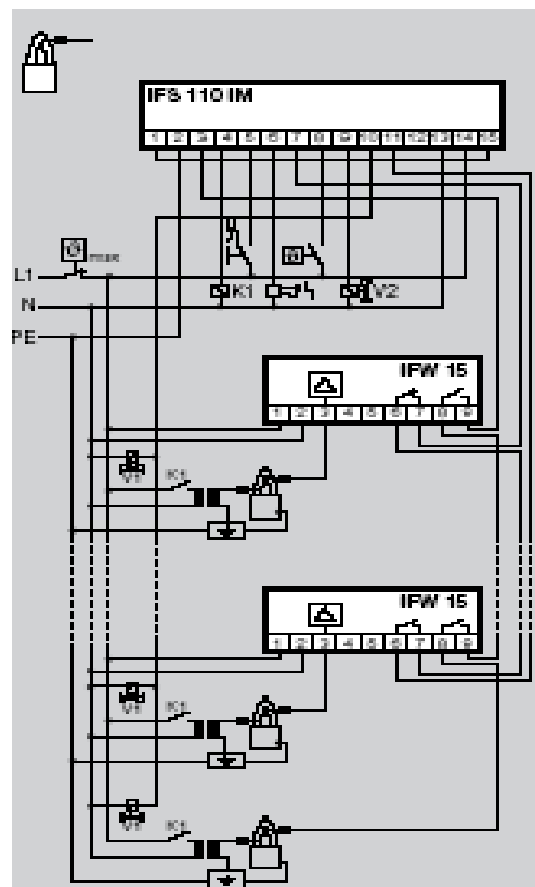


Fig. 1



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web site: [www.cibunigas.it](http://www.cibunigas.it) - e-mail: [cibunigas@cibunigas.it](mailto:cibunigas@cibunigas.it)

Note: specifications and data subject to change without notice. Errors and omissions excepted.



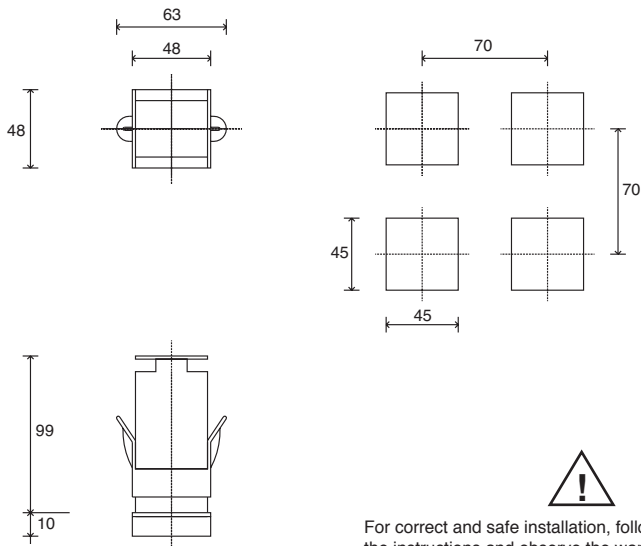
## USER'S MANUAL

COD. M12925CA Rel 1.2 08/2014

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

## 1 • INSTALLATION

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



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

#### Panel mounting:

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

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

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

Cut power to the device before accessing internal parts.

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

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

EMC conformity has been tested with the following connections

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

## 2 • TECHNICAL SPECIFICATIONS

|  |   |
|--|---|
| Display  | 2x4 digit green, high display 10 and 7mm  |
| Keys   | 4 of mechanical type (Man/Aut, INC, DEC, F)   |
| Accuracy   | 0.2% f.s. $\pm 1$ digit ambient temperature 25°C  |
| Main input (settable digital filter)   | TC, RTD, PTC, NTC<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

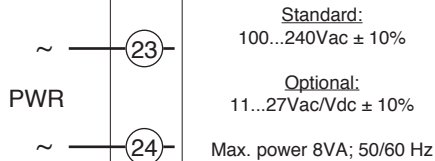
Gives access to the various configuration phases • Confirms change of set parameters and browses next or previous parameter (if Auto/Man key is pressed)

### 4 • CONNECTIONS

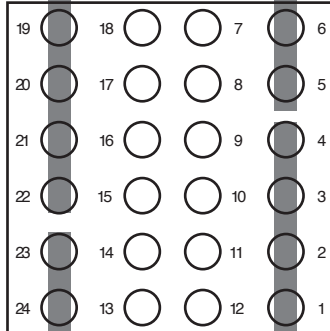
#### • Outputs



#### • Power Supply



TOP



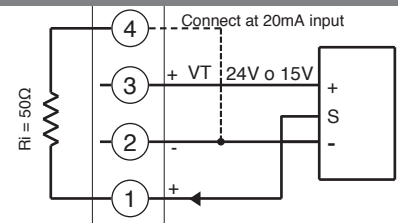
#### • Inputs

##### • TC Input

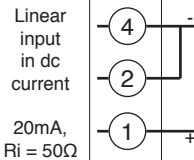
Available thermocouples:  
 J, K, R, S, T  
 (B, E, N, L, U, G, D, C custom linearization is available)  
 - Observe polarities  
 - For extensions, use the correct compensating cable for the type of TC used



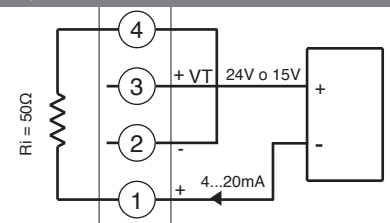
##### • Linear input with 3-wire transmitter



##### • Linear input (I)

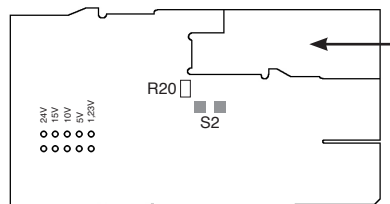


##### • Input 1 linear with transmitter 2 wires



#### • Identification of boards

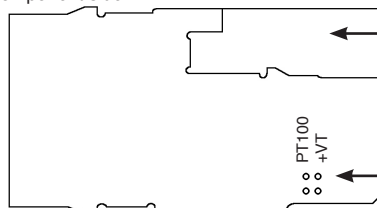
Power board - Solder side



Select transmitter voltage

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

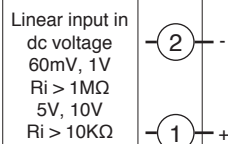
CPU board - Component side



IN/OUT boards (see appendix)

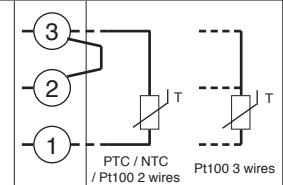
Select signal at contact 3

##### • Linear input (V)



##### • Pt100 / PTC / NTC

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



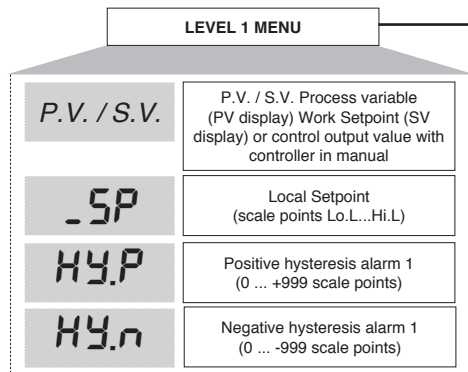
#### • Device structure





## 5 • “EASY” PROGRAMMING and CONFIGURATION

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



S4 Jumper (CPU) ON

PAS

Password

PAS = 99

Pro

Protection code

• Prot

12

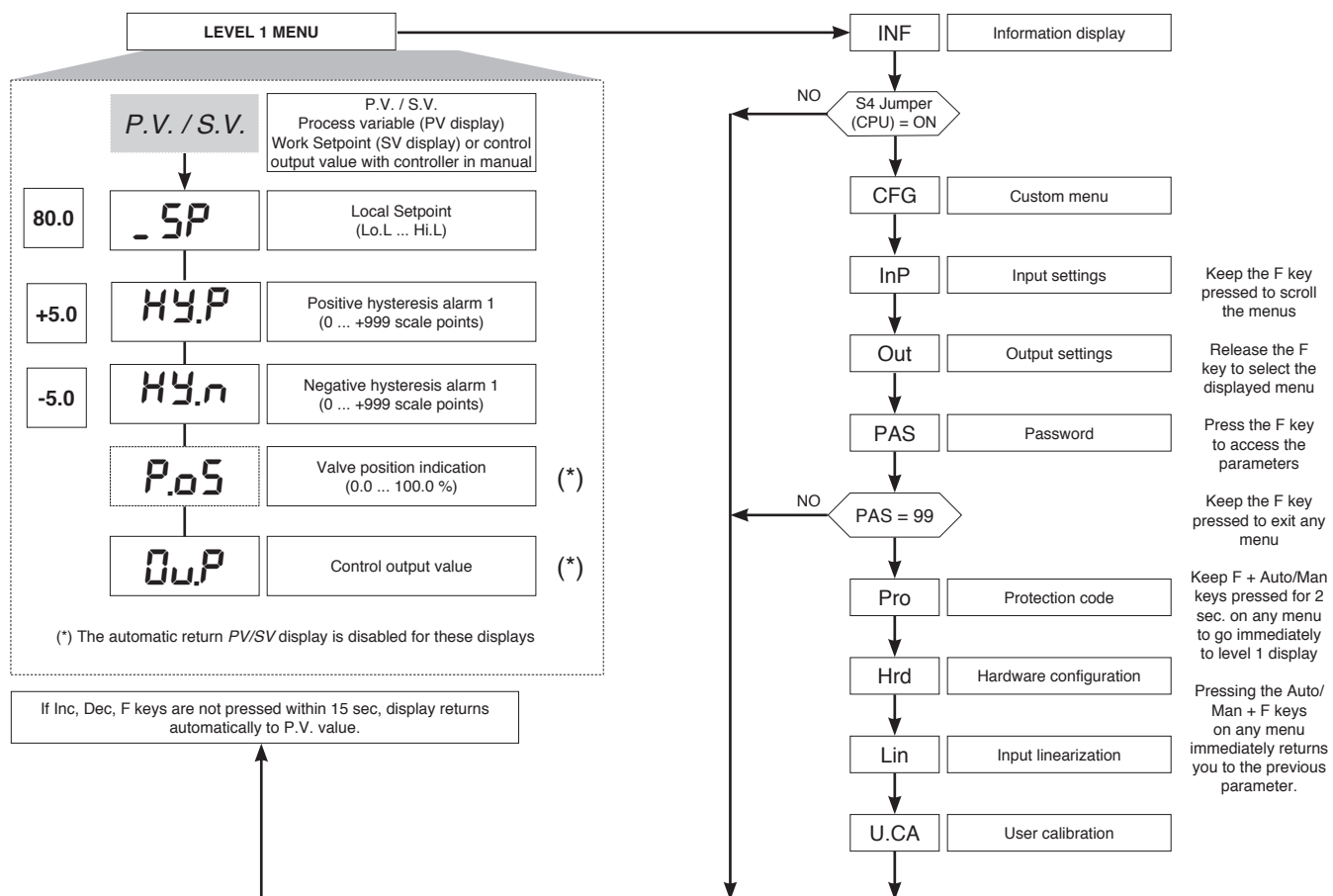
Pro

Protection code

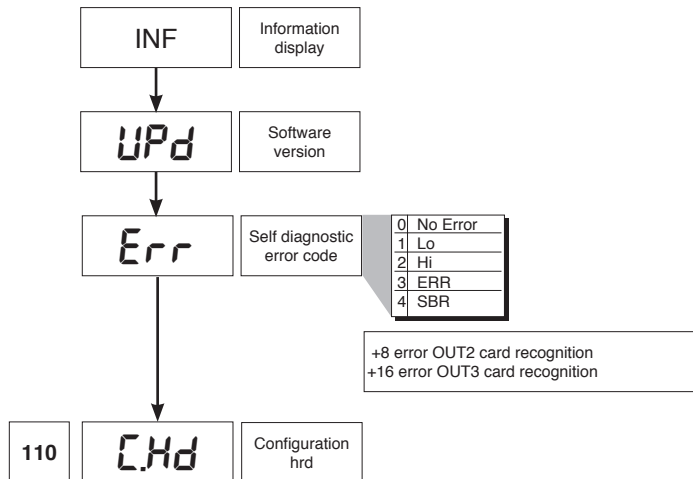
| Prot | Display        | Modification   |
|------|----------------|----------------|
| 0    | SP, Hy.P, Hy.n | SP, Hy.P, Hy.n |
| 1    | SP, Hy.P, Hy.n | SP             |
| 2    | SP             |                |

+ 4 to disable InP, Out  
+ 8 to disable CFG

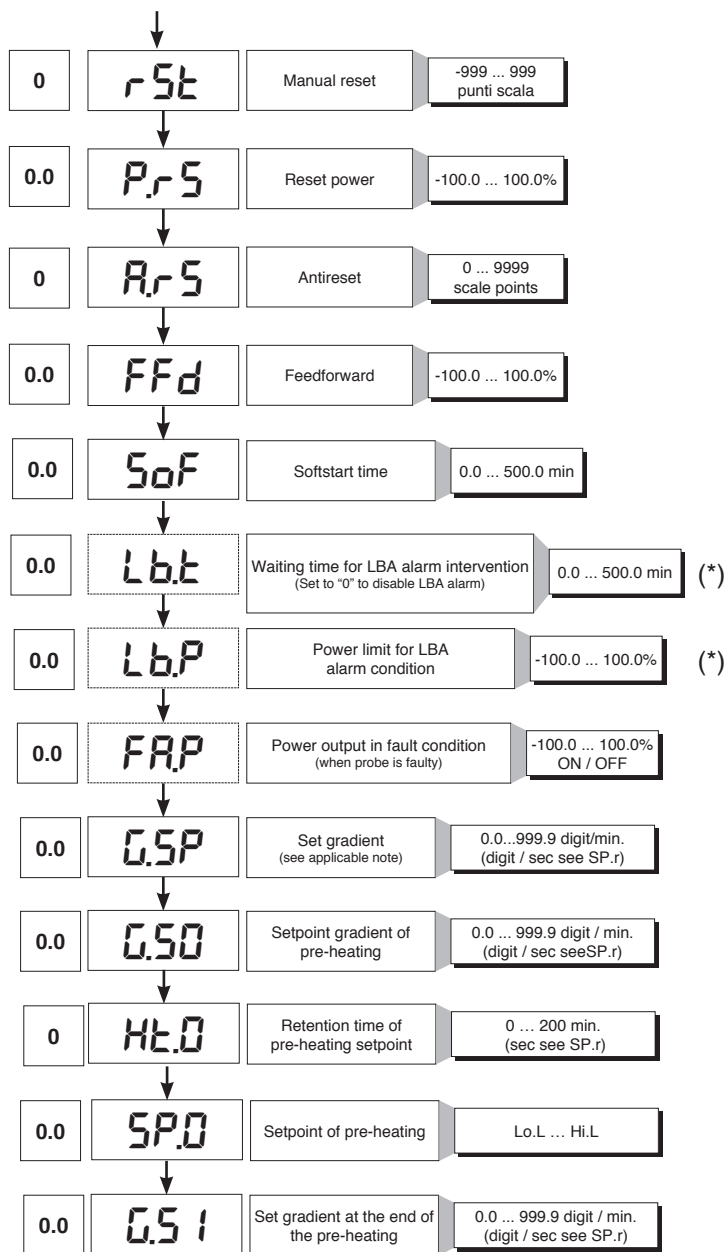
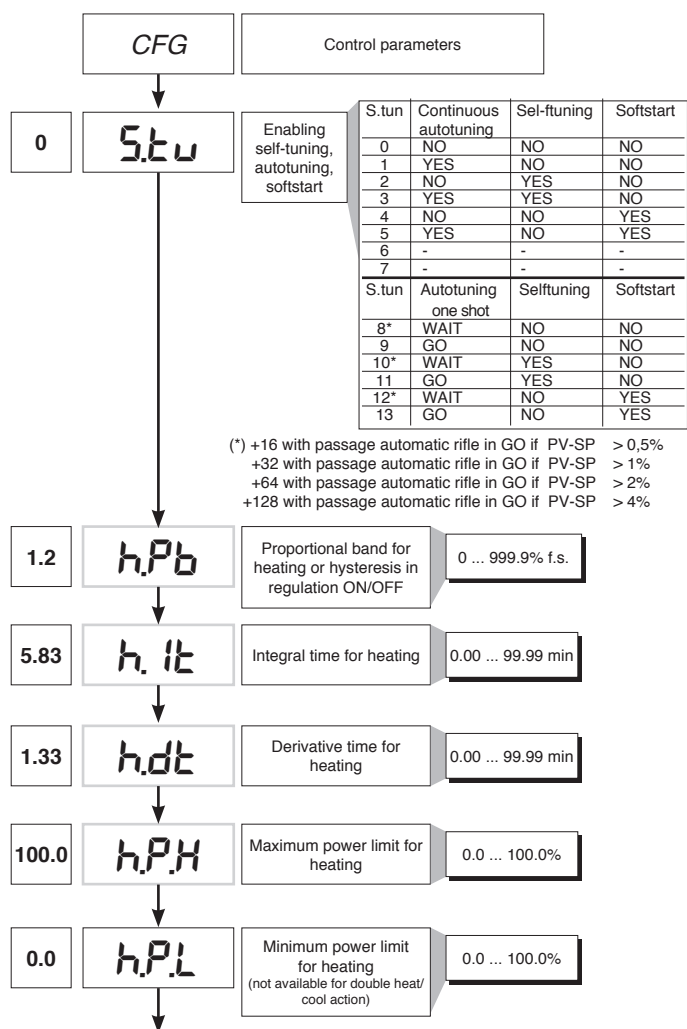
## 6 • PROGRAMMING and CONFIGURATION



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



• CFG



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



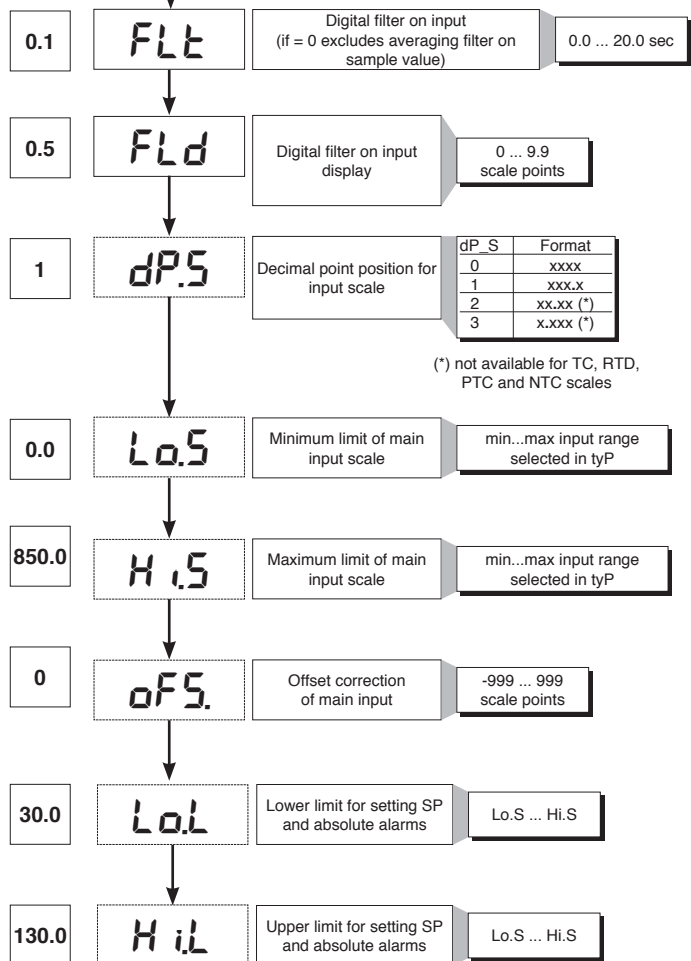
| Type | Probe type    | without decimal point | with decimal point |
|------|---------------|-----------------------|--------------------|
|      | Sensore:      | TC                    |                    |
| 0    | TC J °C       | 0/1000                | 0.0/999.9          |
| 1    | TC J °F    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

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

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

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

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





## • Prot

12

*Pro*

Protection code

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

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

Note: OuP and INF only display configuration extended

## • Hrd

*Hrd*

Hardware configuration

0

*hd.1*

Enable multiset instrument control by serial

6

*Ctrl*

Control type

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

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

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

1

*AL.n*

Select number of enabled alarms

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

1

*but.*

Function of M/A keys

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

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

0

*dSP*

Defining SV display function

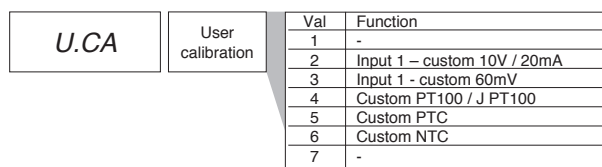
| diSP | Lower display (SV) function |
|------|-----------------------------|
| 0    | SSP - setpoint enabled      |
| 1    | PoS - valve position        |
| 2    | Control output value        |
| 3    | Deviation (SSP - PV)        |



## • Lin



## • U.CAL



## 7 • CONSENT FOR BURNER AL1



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

## 8 • PRE-HEATING FUNCTION

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

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

### - Ramp 0 phase

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

### - Maintenance phase

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

### - Ramp 1 phase

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

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





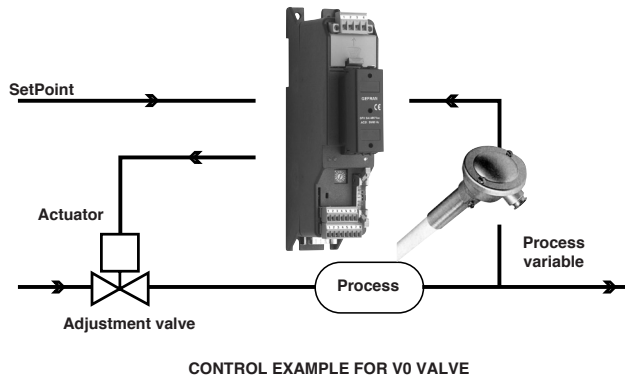
## 9 • ADJUSTMENT WITH MOTORIZED VALVE

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

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

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

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



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

### Characteristic parameters for valves control

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

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

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

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

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

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

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

You can choose between 2 types of control:

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

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

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

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

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

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

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



## Valve control modes

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

**V0** - for floating valve without potentiometer

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

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

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

*Non-movement behavior*

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

*Movement behavior*

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



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

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

## 10 • CONTROL ACTIONS

*Proportional Action:*

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

*Derivative Action:*

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

*Integral Action:*

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

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

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

Contact GEFRA for more information on control actions.

## 11 • MANUAL TUNING

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



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

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

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

Integral time:  $I_t = 1.5 \times T$

Derivative time:  $d_t = I_t/4$

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

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

## 12 • SET GRADIENT

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

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

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

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

## 13 • SOFTWARE ON / OFF SWITCHING FUNCTION

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

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

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

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

## 14 • SELF-TUNING

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

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

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

**How to activate self-tuning:**

### A. Activation at power-on

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

### B. Activation from keyboard

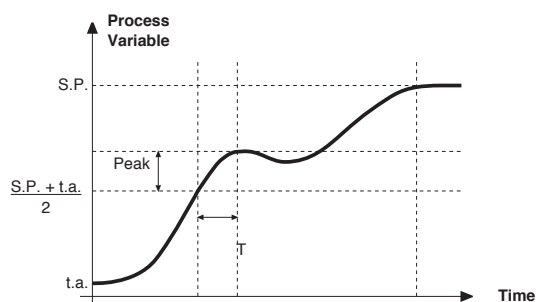
1. Make sure that key M/A is enabled for Start/Stop selftuning (code but = 6 Hrd menu)
2. Bring the temperature near room temperature
3. Set the setpoint to the required value
4. Press key M/A to activate selftuning (Attention: selftuning interrupts if the key is pressed again)

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

### Notes :

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

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



## 15 • ACCESSORIES

### • Interface for instrument configuration

KIT PC USB / RS485 o TTL



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

Lets you read or write all of the parameters

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

Component Kit:

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

### • ORDERING CODE

GF\_eXK-2-0-0

cod F049095

## 16 • ORDER CODE



### • WARNINGS

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

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

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

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

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

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

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

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

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

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

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

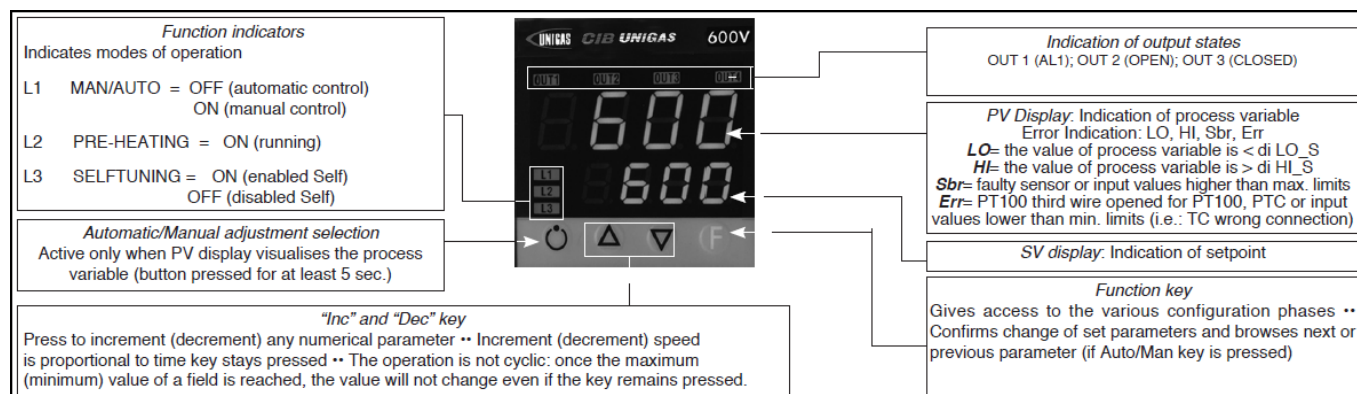


## Set-up for 600V RRR0-1-T73 regulator

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

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

Verify wiring of the sensor



Regulation of the set-point = 80

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

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

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

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

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

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

| Out  |  |
|------|--|
| A1.r | 0  |
| ...  |  |
| A1.t | 3 (operating mode AL1 =inverse-relative-normal)                        |
| ...  |  |
| rL.1 | 2 (AL1)  |
| rL.2 | 18 (open)  |
| rL.3 | 19 (close)   |
| rEL  | 0  |
| A.ty | 9 (type of servocontrol command)                                       |
| Ac.t | 12 (servocontrol running time: SQN72.4.../STA12..=12;<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.

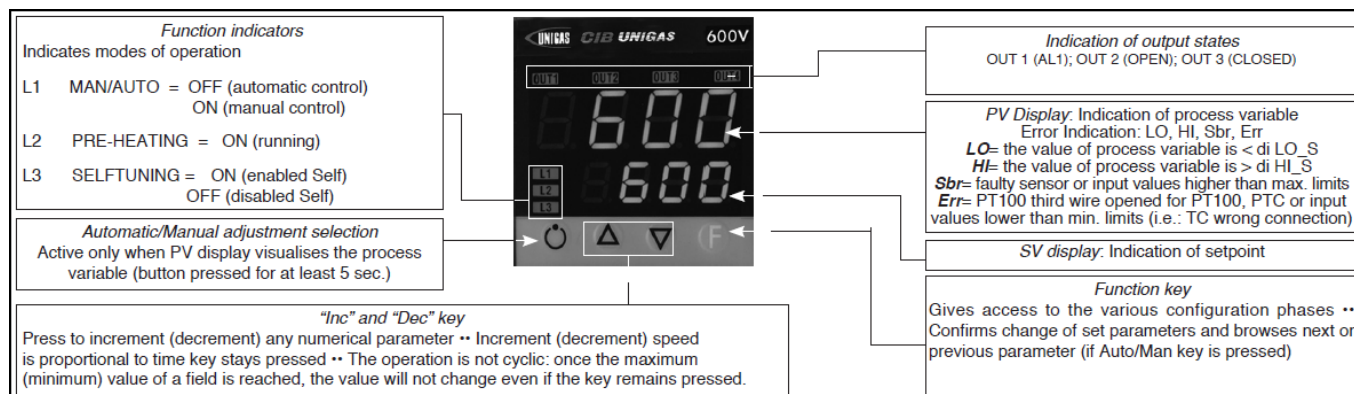
#### Software switch off :

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***

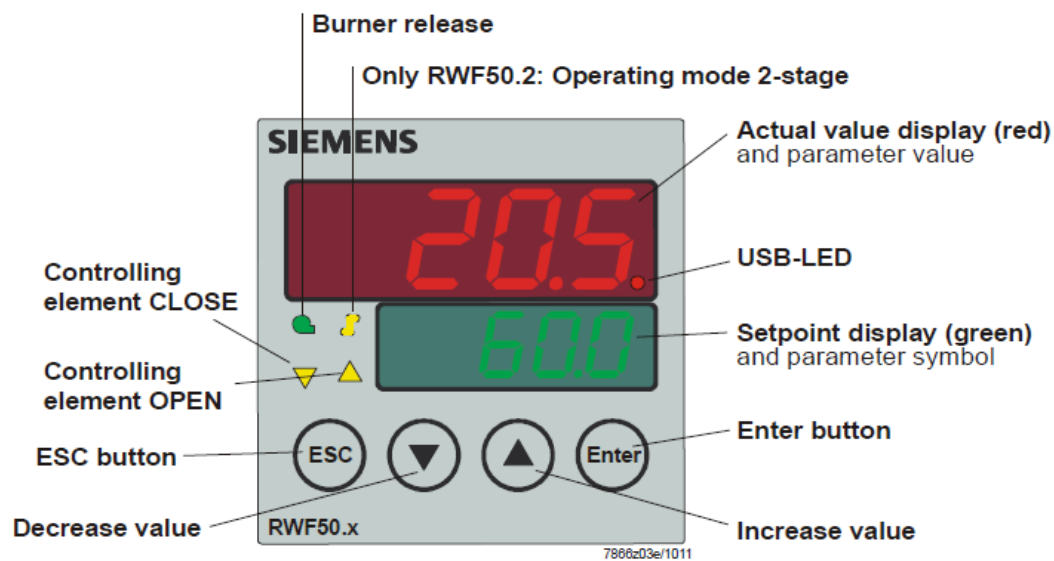
## DEVICE INSTALLATION

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

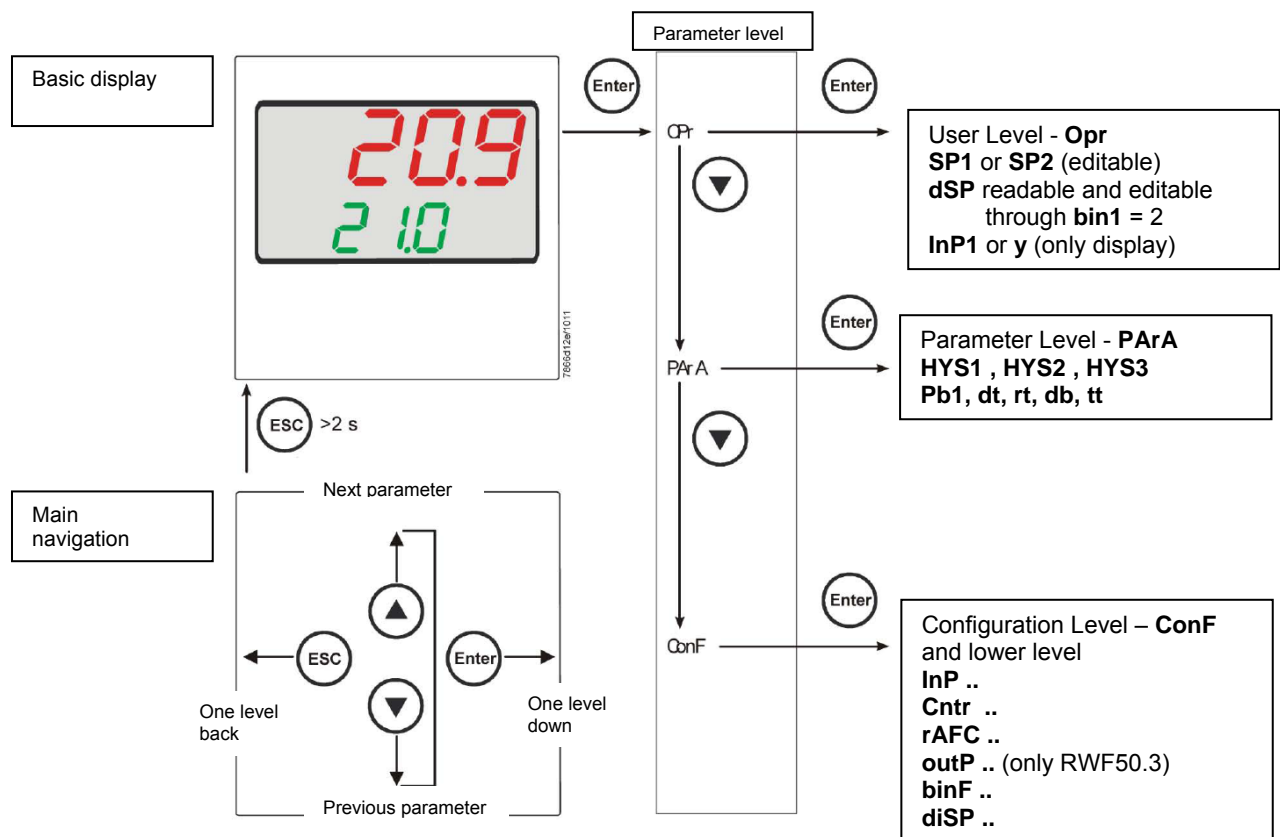
To wire the device and sensors, follow the instructions on the burner wiring diagram.



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



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.



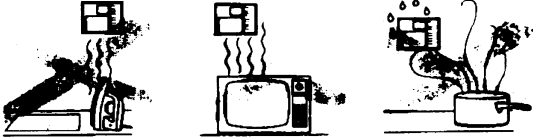
### Outside probes (weather)

#### 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

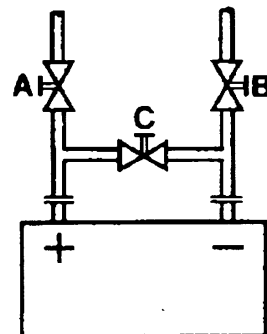
Start disable

1=open C1=open C

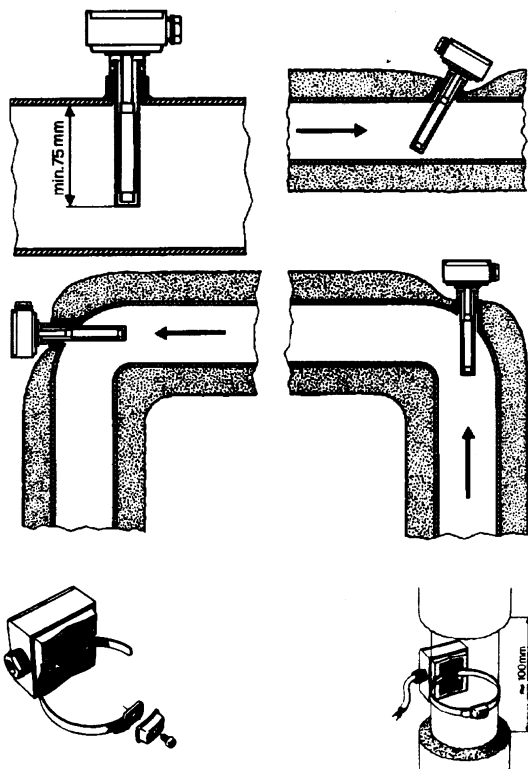
2=open A2=close B

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



## 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.

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.

## Duct pressure switches and sensors

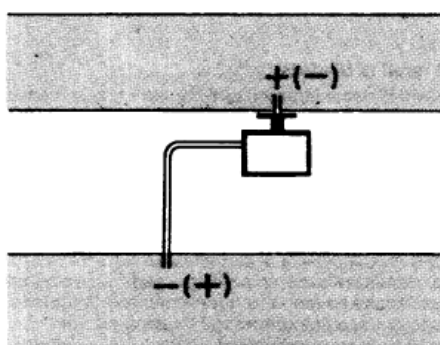
### Installing differential pressure probes for air



A - Control a filter (clogging)



B - Control a fan (upstream/downstream)



C - Measurement of difference in pressure between two ducts



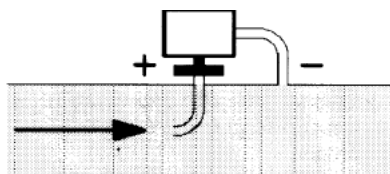
D - Measurement of difference in pressure between two rooms or of inside of duct and outside

### Basic principles

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



### Measuring dynamic pressure

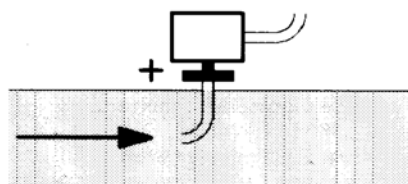


$$Pd = \frac{\gamma v^2}{2g}$$

### 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<br>(***)  |
| 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 / 0-1,6bar Pressure 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".

# 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.

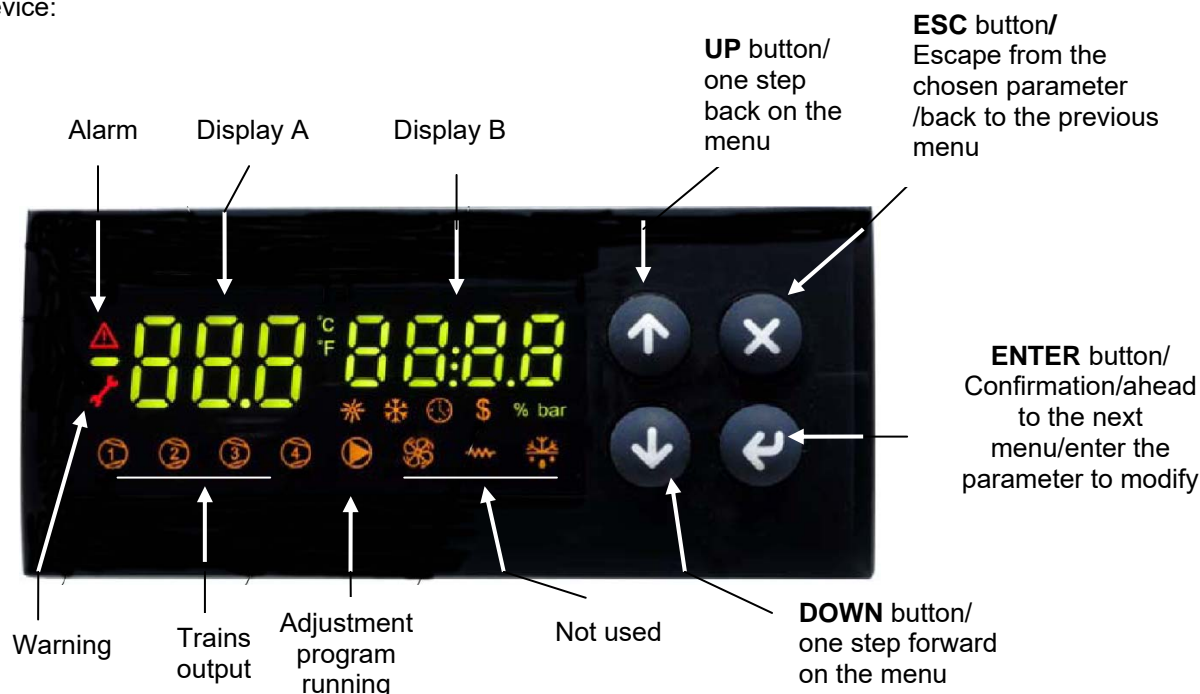
When set-point **trS** is got to, output number 5 is ON (terminals C5-NO5) linked to the relais KTRS. It switches the resistors off and activates an alarm on the device.

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:

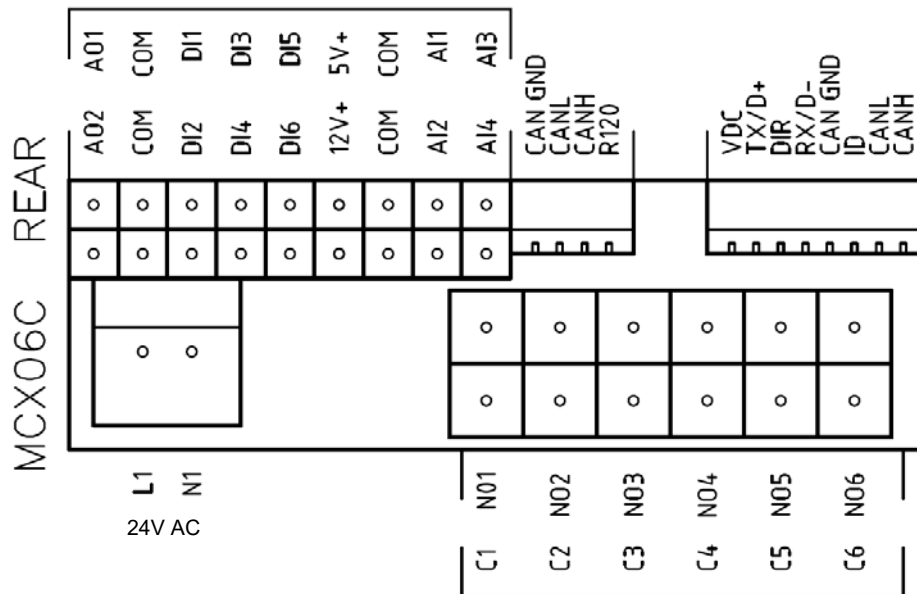


#### Note :

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

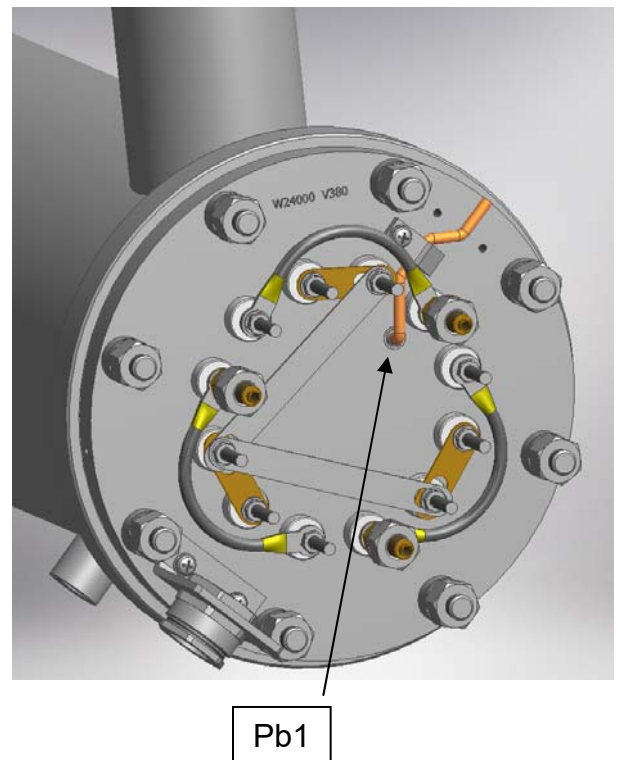
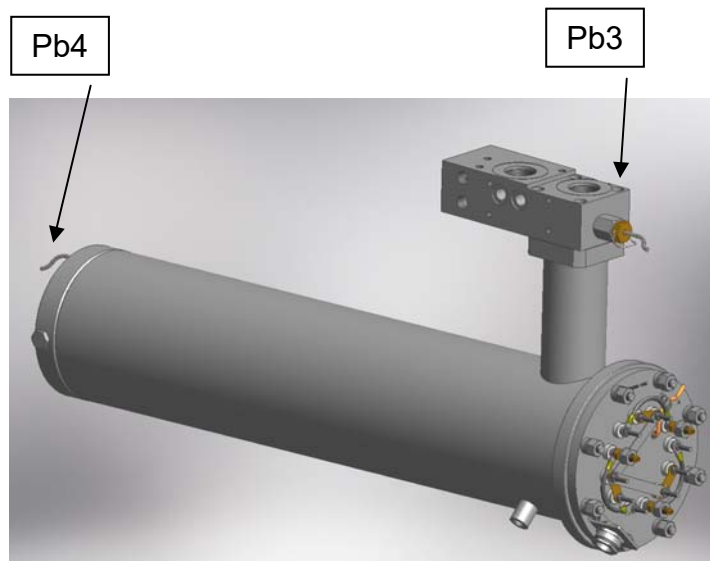
In normal operation, the display B shows the oil output temperature (probe Pb3).

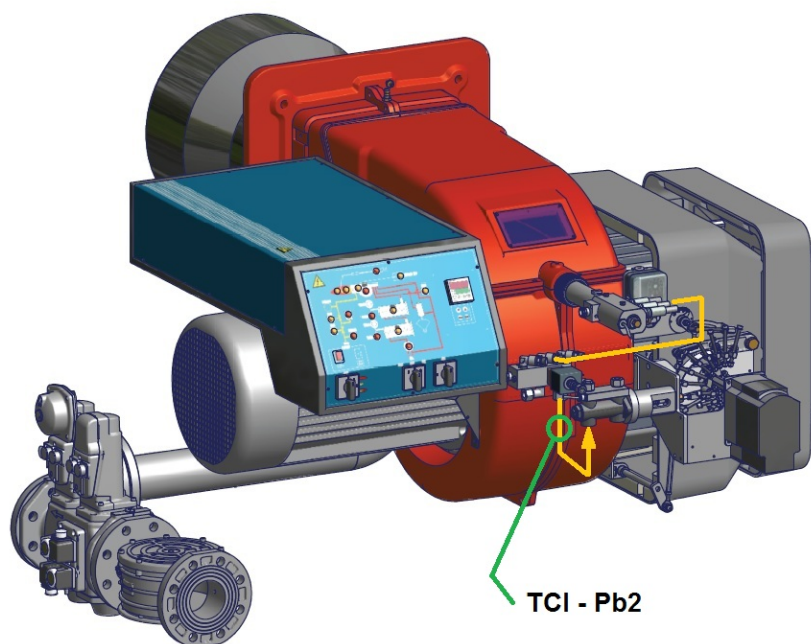
## Connections from terminal side :



## 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.

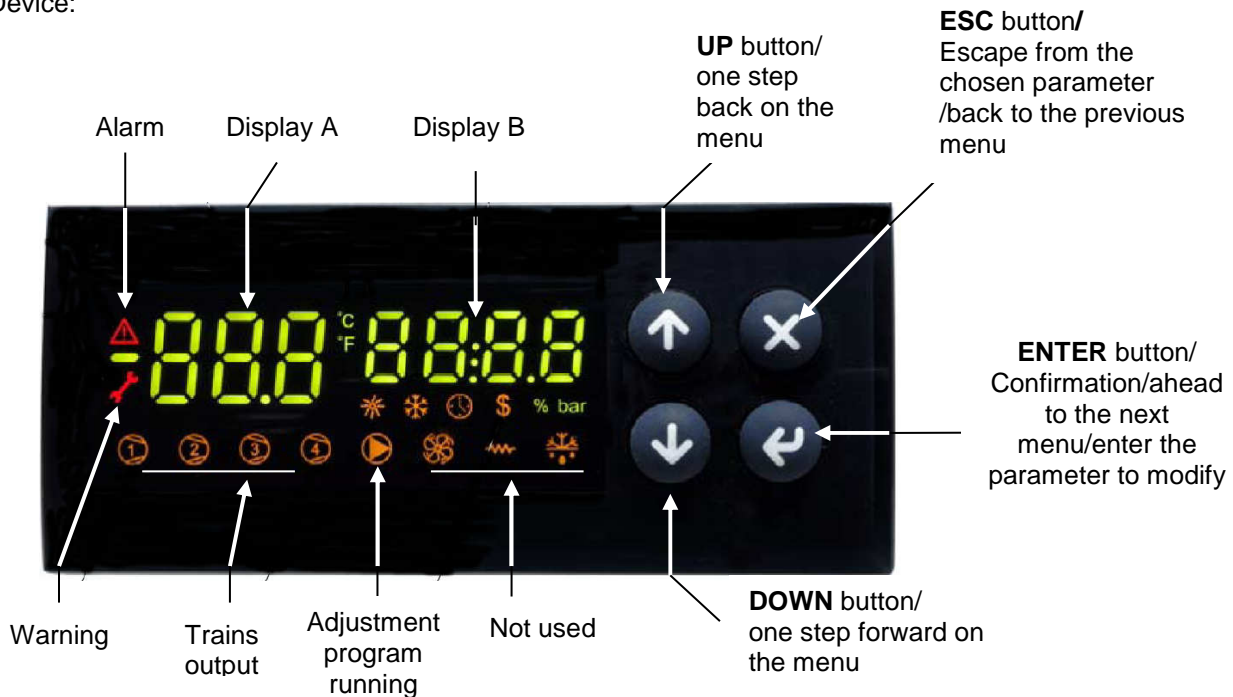
The suggested values can change in reference to the fuel oil specifications.

# 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:

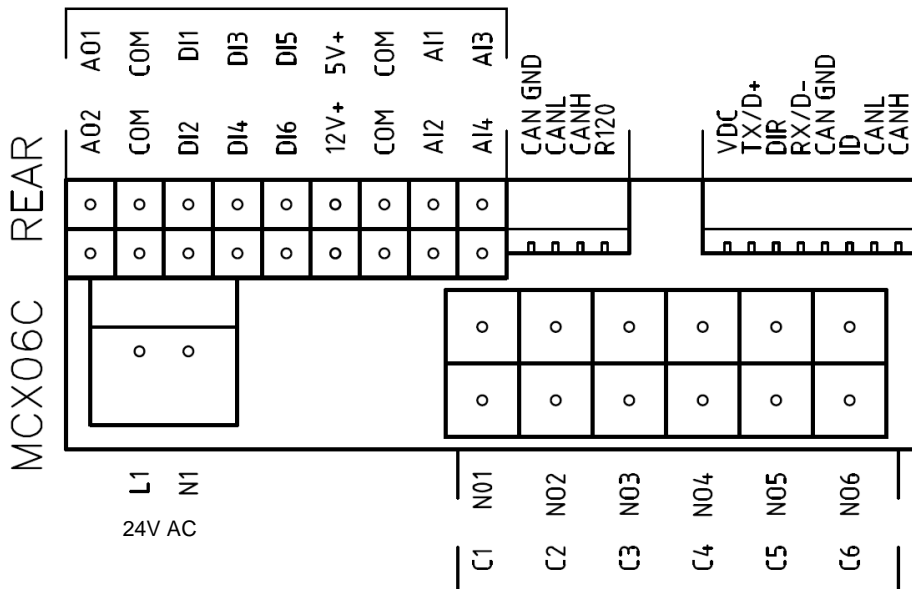
Device:



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:

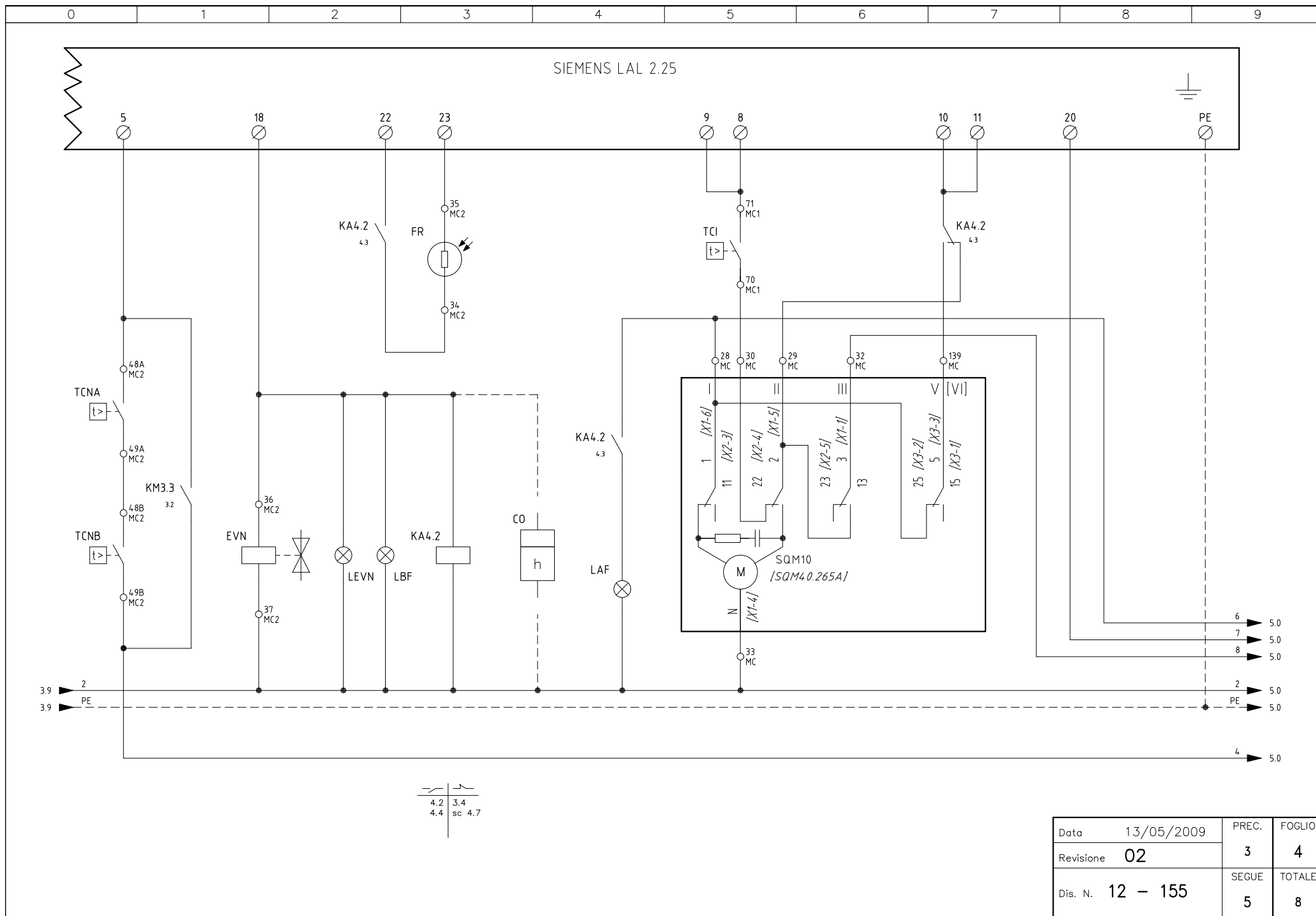
| Menu path |     |     |   | Oil viscosity at 50 °C according to the letter shown in the burner model |            |                       |                        |                         |
|-----------|-----|-----|---|--|------------|-----------------------|------------------------|-------------------------|
|           |     |     |   | <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.





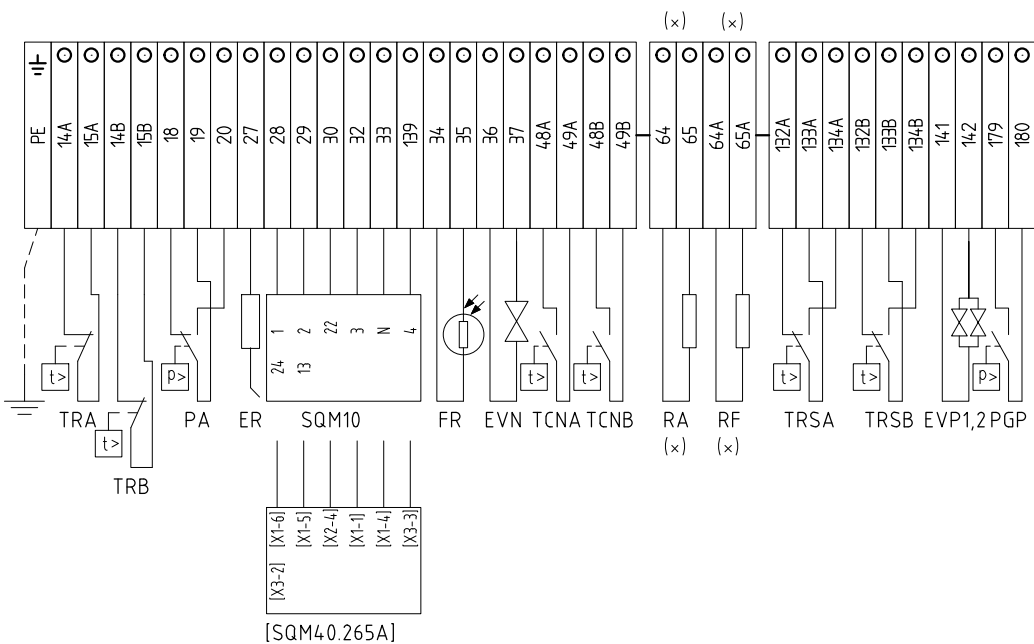
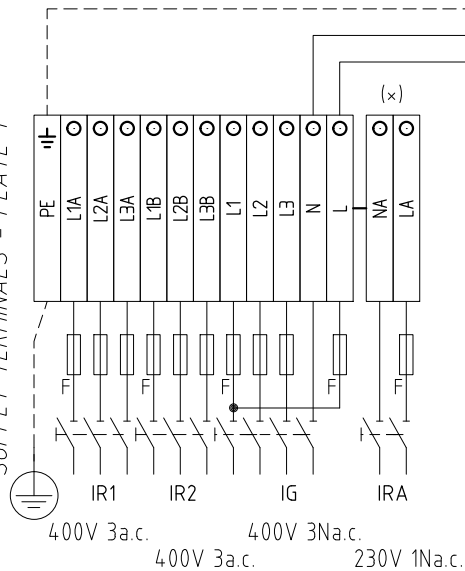




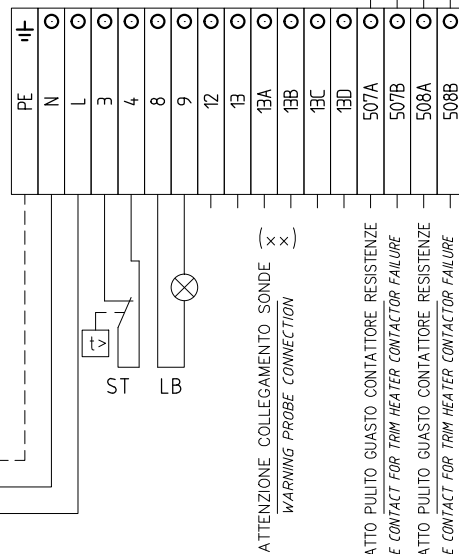




**QUADRO QG - MORSETTIERA MC2**  
MORSETTIERA COMPONENTI BRUCIATORE - PIASTRA 2  
BURNER COMPONENTS TERMINALS - PLATE 2



|      |     |     |
|------|-----|-----|
| TCNB | 48B | (x) |
|      | 49B | (x) |
|      | 64  | (x) |
|      | 65  | (x) |
|      | 64A | (x) |
|      | 65A | (x) |

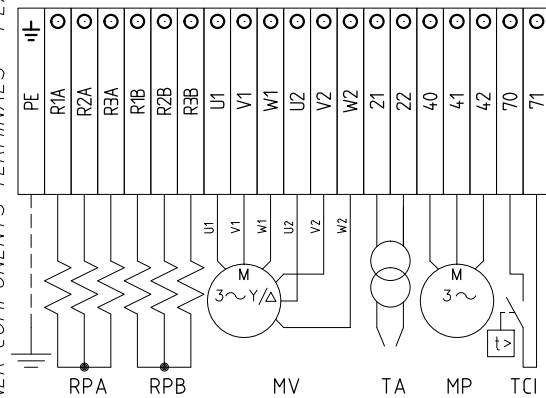


ATTENZIONE COLLEGAMENTO SONDE  
WARNING PROBE CONNECTION

KA2.3KA2.5

CONTATTO PULITO GUASTO CONTATTORE RESISTENZE  
FREE CONTACT FOR TRIM HEATER CONTACTOR FAILURE

**QUADRO QG - MORSETTIERA MC1**  
MORSETTIERA COMPONENTI BRUCIATORE - PIASTRA 1  
*BURNER COMPONENTS TERMINALS - PLATE 1*



(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 "OIL400 cSt a 50 °C " VERSIONS ONLY

SERVOCOMANDO SERRANDA ARIA  
AIR DAMPER ACTUATOR  
SQM10

- |     |  |
|-----|--|
| I   | ALTA FIAMMA<br><i>HIGH FLAME</i>   |
| II  | SOSTA E ACCENSIONE<br><i>STAND-BY AND IGNITION</i>                                       |
| III | BASSA FIAMMA<br><i>LOW FLAME</i>   |
| IV  | LIMITAZIONE CORSA ANTICIPO SERVOCOMANDO<br><i>ACTUATOR AUTOMATIC ADVANCE RESTRICTION</i> |

SERVOCOMANDO SERRANDA ARIA (ALTERNATIVO)  
AIR DAMPER ACTUATOR (ALTERNATIVE)  
[SQM40.265A]

- |     |   |
|-----|---|
| I   | ALTA FIAMMA<br>HIGH FLAME   |
| II  | SOSTA E ACCENSIONE<br>STAND-BY AND IGNITION                                       |
| III | BASSA FIAMMA<br>LOW FLAME   |
| VI  | LIMITAZIONE CORSA ANTICIPO SERVOCOMANDO<br>ACTUATOR AUTOMATIC ADVANCE RESTRICTION |

|           |            |       |        |
|-----------|------------|-------|--------|
| Data      | 13/05/2009 | PREC. | FOGLIO |
| Revisione | 02         | 5     | 6      |
| Dis. N.   | 12 - 155   | SEQUE | TOTALE |
|           |            | 7     | 8      |

0

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8

9

| SIGLA/ITEM | FOGLIO/SHEET | FUNZIONE  | FUNCTION   |
|------------|--------------|---|--|
| CMF        | 5            | 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 |
| CO         | 4            | CONTAORE DI FUNZIONAMENTO (OPTIONAL)                                    | OPERATION TIME COUNTER (OPTIONAL)                        |
| ER         | 3            | ELETTRODO RILEVAZIONE FIAMMA PILOTA                                     | PILOT FLAME DETECTION ELECTRODE                          |
| EVN        | 4            | ELETTROVALVOLA NAFTA  | OIL SOLENOID VALVE                                       |
| EVP1,2     | 3            | ELETTROVALVOLE PILOTA GAS   | PILOT GAS ELECTRO-VALVES                                 |
| FR         | 4            | FOTORESISTENZA RILEVAZIONE FIAMMA                                       | PHOTORESISTOR FLAME DETECTOR                             |
| FU         | 5            | FUSIBILE  | FUSE   |
| FU1.0      | 1            | FUSIBILI LINEA PRERISCALDATORE [RPA]                                    | LINE PRE-HEATING [RPA] FUSES                             |
| FU1.1      | 1            | FUSIBILI LINEA PRERISCALDATORE [RPB]                                    | LINE PRE-HEATING [RPB] FUSES                             |
| FU1.2      | 1            | FUSIBILI LINEA BRUCIATORE   | BURNER LINE FUSES  |
| FU1.6      | 1            | FUSIBILI LINEA POMPA  | PUMP LINE FUSES  |
| FU1.7      | 1            | FUSIBILE LINEA AUSILIARI  | AUXILIARY LINE FUSE                                      |
| (x) FU1.8  | 1            | FUSIBILE LINEA RESISTENZE AUSILIARIE                                    | LINE AUXILIARY RESISTORS FUSE                            |
| (x) FU1.9  | 1            | FUSIBILE RESISTENZE AUSILIARIE  | AUXILIARY RESISTORS FUSE                                 |
| FU4.2      | 3            | FUSIBILE AUSILIARIO   | AUXILIARY FUSE   |
| IFW15 T    | 3            | RELE' RILEVAZIONE FIAMMA  | FLAME DETECTOR RELAY                                     |
| IG         | 1            | INTERRUTTORE LINEA BRUCIATORE   | BURNER LINE SWITCH                                       |
| IL         | 1            | INTERRUTTORE LINEA AUSILIARI  | AUXILIARY LINE SWITCH                                    |
| IR1        | 1            | INTERRUTTORE LINEA RESISTENZE PRERISCALDATORE                           | PRE-HEATING RESISTORS LINE SWITCH                        |
| IR2        | 1            | INTERRUTTORE LINEA RESISTENZE PRERISCALDATORE                           | PRE-HEATING RESISTORS LINE SWITCH                        |
| (x) IRA    | 1            | INTERRUTTORE RESISTENZE AUSILIARIE                                      | AUXILIARY RESISTORS SWITCH                               |
| (x) IRAux. | 1            | INTERRUTTORE RESISTENZE AUSILIARIE                                      | AUXILIARY RESISTORS SWITCH                               |
| KA2.3      | 2            | RELE' AUSILIARIO SEGNALAZIONE GUASTO CONTATTORE RESISTENZE              | AUXILIARY RELAY FOR TRIM HEATER CONTACTOR FAILURE        |
| KA2.5      | 2            | RELE' AUSILIARIO SEGNALAZIONE GUASTO CONTATTORE RESISTENZE              | AUXILIARY RELAY FOR TRIM HEATER CONTACTOR FAILURE        |
| KA4.2      | 4            | RELE' AUSILIARIO  | AUXILIARY RELAY  |
| KM2.2      | 2            | CONTATTORE RESISTENZE PRERISCALDATORE [RPA]                             | PRE-HEATING RESISTORS [RPA] CONTACTOR                    |
| KM2.4      | 2            | CONTATTORE RESISTENZE PRERISCALDATORE [RPB]                             | PRE-HEATING RESISTORS [RPB] CONTACTOR                    |
| KM3.2      | 3            | CONTATTORE MOTORE POMPA NAFTA   | OIL PUMP MOTOR CONTACTOR                                 |
| KM3.3      | 3            | CONTATTORE MOTORE VENTILATORE (LINEA)                                   | FAN MOTOR CONTACTOR (LINE)                               |
| KM3.4S     | 3            | CONTATTORE MOTORE VENTILATORE (STELLA)                                  | FAN MOTOR CONTACTOR (STAR)                               |
| KM3.4T     | 3            | CONTATTORE MOTORE VENTILATORE (TRIANGOLO)                               | FAN MOTOR CONTACTOR (DELTA)                              |
| KT3.5      | 3            | TEMPORIZZATORE STELLA/TRIANGOLO   | STAR/DELTA DELAYED RELAY                                 |
| KT3.6      | 3            | RELE' TEMPORIZZATORE  | DELAYED RELAY  |
| KT3.8      | 3            | TEMPORIZZATORE  | TIMER  |
| KT3.9      | 3            | TEMPORIZZATORE  | TIMER  |
| LAF        | 4            | LAMPADA SEGNALAZIONE ALTA FIAMMA BRUCIATORE                             | BURNER IN HIGH FLAME INDICATOR LIGHT                     |
| LB         | 3            | LAMPADA SEGNALAZIONE BLOCCO BRUCIATORE                                  | INDICATOR LIGHT FOR BURNER LOCK-OUT                      |
| LBF        | 4            | LAMPADA SEGNALAZIONE BASSA FIAMMA BRUCIATORE                            | BURNER IN LOW FLAME INDICATOR LIGHT                      |
| LEVN       | 4            | LAMPADA SEGNALAZIONE APERTURA EVN                                       | INDICATOR LIGHT FOR OPENING OF ELECTRO-VALVE EVN         |
| LEVP       | 3            | LAMPADA SEGNALAZIONE APERTURA EVP                                       | INDICATOR LIGHT FOR OPENING OF ELECTRO-VALVE EVP         |

(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

|           |            |       |        |
|-----------|------------|-------|--------|
| Data      | 13/05/2009 | PREC. | FOGLIO |
| Revisione | 02         | 6     | 7      |
| Dis. N.   | 12 – 155   | SEQUE | TOTAL  |
|           |            | 8     | 8      |

|            |                   |              |  |   |   |  |   |   |   |   |
|------------|-------------------|--------------|--|---|---|--|---|---|---|---|
|            | 0                 | 1            | 2  | 3 | 4 | 5  | 6 | 7 | 8 | 9 |
| (x)<br>(x) | SIGLA/ITEM        | FOGLIO/SHEET | FUNZIONE   |   |   | FUNCTION   |   |   |   |   |
|            | LPGP              | 2            | 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                | 2            | LAMPADA SEGNALAZIONE SOSTA BRUCIATORE                      |   |   | INDICATOR LIGHT FOR BURNER STAND-BY                      |   |   |   |   |
|            | LT                | 2            | LAMPADA SEGNALAZIONE BLOCCO TERMICO                        |   |   | INDICATOR LIGHT FOR MOTOR THERMAL CUTOUT                 |   |   |   |   |
|            | 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 [TRSA] |   |   | INDICATOR LIGHT FOR [TRSA] SAFETY THERMOSTAT             |   |   |   |   |
|            | LTRSB             | 2            | LAMPADA SEGNALAZIONE BLOCCO TERMOSTATO DI SICUREZZA [TRSB] |   |   | INDICATOR LIGHT FOR [TRSB] SAFETY THERMOSTAT             |   |   |   |   |
|            | MP                | 1            | MOTORE POMPA NAFTA   |   |   | OIL PUMP MOTOR   |   |   |   |   |
|            | MV                | 1            | MOTORE VENTILATORE   |   |   | FAN MOTOR  |   |   |   |   |
|            | PA                | 2            | PRESSOSTATO ARIA   |   |   | AIR PRESSURE SWITCH                                      |   |   |   |   |
|            | PGP               | 2            | PRESSOSTATO PILOTA GAS                                     |   |   | PILOT MINIMUM GAS PRESSURE SWITCH                        |   |   |   |   |
|            | PS                | 2            | PULSANTE SBLOCCO FIAMMA                                    |   |   | LOCK-OUT RESET BUTTON                                    |   |   |   |   |
|            | PT100             | 5            | SONDA DI TEMPERATURA                                       |   |   | TEMPERATURE PROBE  |   |   |   |   |
|            | RA                | 1            | RESISTENZE AUSILIARIE                                      |   |   | AUXILIARY RESISTORS                                      |   |   |   |   |
|            | 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          | 5            | SONDA DI PRESSIONE   |   |   | PRESSURE PROBE   |   |   |   |   |
|            | SD-PRESS          | 5            | SONDA DI PRESSIONE   |   |   | PRESSURE PROBE   |   |   |   |   |
|            | SD-TEMP.          | 5            | SONDA DI TEMPERATURA                                       |   |   | TEMPERATURE PROBE  |   |   |   |   |
|            | SD - 4÷20mA       | 5            | TRASDUTTORE USCITA IN CORRENTE                             |   |   | TRANSDUCER CURRENT OUTPUT                                |   |   |   |   |
|            | SIEMENS LAL 2.25  | 2            | APPARECCHIATURA CONTROLLO FIAMMA                           |   |   | CONTROL BOX  |   |   |   |   |
|            | SIEMENS RWF40.0x0 | 5            | REGOLATORE MODULANTE                                       |   |   | BURNER MODULATOR   |   |   |   |   |
|            | SIEMENS RWF50.2   | 5            | REGOLATORE MODULANTE (ALTERNATIVO)                         |   |   | BURNER MODULATOR (ALTERNATIVE)                           |   |   |   |   |
|            | SQM10             | 4            | SERVOCOMANDO SERRANDA ARIA                                 |   |   | AIR DAMPER ACTUATOR                                      |   |   |   |   |
|            | ST                | 2            | 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  |   |   |   |   |
|            | [SQM40.265A]      | 4            | SERVOCOMANDO SERRANDA ARIA (ALTERNATIVO)                   |   |   | AIR DAMPER ACTUATOR (ALTERNATIVE)                        |   |   |   |   |

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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 "OIL400 cSt a 50 °C " VERSIONS ONLY

|           |            |       |        |
|-----------|------------|-------|--------|
| Data      | 13/05/2009 | PREC. | FOGLIO |
| Revisione | 02         | 7     | 8      |
| Dis. N.   | 12 - 155   | SEGUE | TOTALE |
|           |            | /     | 8      |