

***PN91 - PN92 - PN93***  
***PN510 - PN515***  
***PN520 - PN525***

***Progressive, Fully-modulating***

***Heavy oil Burners***

MANUAL OF INSTALLATION - USE - MAINTENANCE

***CIB UNIGAS***

BURNERS - BRUCIATORI - BRULERS - BRENNER - QUEMADORES - ГОРЕЛКИ

## DANGERS, WARNINGS AND NOTES OF CAUTION

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

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

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

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

### 1) GENERAL INTRODUCTION

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

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

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

Contact qualified personnel only.

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

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

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

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

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

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

### 2) SPECIAL INSTRUCTIONS FOR BURNERS

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

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

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

### Special warnings

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

### 3) GENERAL INSTRUCTIONS DEPENDING ON FUEL USED

#### 3a) ELECTRICAL CONNECTION

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

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

#### GENERAL

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

#### SPECIAL INSTRUCTIONS FOR USING GAS

Have qualified personnel inspect the installation to ensure that:

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

#### Precautions if you can smell gas

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

### DIRECTIVES AND STANDARDS

#### *Gas burners*

##### European directives

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

##### Harmonized standards

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

#### *Light oil burners*

##### European directives

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

##### Harmonized standards

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

#### *Heavy oil burners*

##### European Directives

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

##### Harmonized standards

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

### Gas - Light oil burners

#### European Directives

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

#### Harmonized standards

- UNI EN 676 (Automatic forced draught burners for gaseous fuels)
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- UNI EN ISO 12100:2010 (Safety of machinery - General principles for design - Risk assessment and risk reduction);

### Gas - Heavy oil burners

#### European directives:

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

#### Harmonized standards

- UNI EN 676 (Automatic forced draught burners for gaseous fuels)
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- UNI EN ISO 12100:2010 (Safety of machinery - General principles for design - Risk assessment and risk reduction);

### Industrial burners

#### European directives

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

#### Harmonized standards

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

### Burner data plate

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

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

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

### SYMBOLS USED



#### WARNING!

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



#### DANGER!

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



#### WARNING!

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

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

### BURNER SAFETY

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



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

### Residual risks deriving from misuse and prohibitions

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



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



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



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

## PART I: INSTALLATION

**Burner model identification**

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

| Type<br>(1)                        | Model<br>(2) | N-<br>(3) | PR.<br>(4) | S.<br>(5) | *.<br>(6) | A.<br>(6)                                                                                                                                                |
|------------------------------------|--------------|-----------|------------|-----------|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| (1) BURNER TYPE                    |              |           |            |           |           | <b>PN91 - PN92 - PN93 - PN510 - PN515 - PN520 - PN525</b>                                                                                                |
| (2) FUEL                           |              |           |            |           |           | N - Heavy oil, viscosity <= 50cSt (7° E) @ 50° C<br>D - Heavy oil, viscosity <= 400cSt (50° E) @ 50° C<br>P - Petroleum, viscosity 89cSt (12° E) @ 50° C |
| (3) OPERATION (Available versions) |              |           |            |           |           | PR - Progressive MD - Fully modulating                                                                                                                   |
| (4) BLAST TUBE                     |              |           |            |           |           | S - Standard L - Extended                                                                                                                                |
| (5) DESTINATION COUNTRY            |              |           |            |           |           | * - see data plate                                                                                                                                       |
| (6) BURNER VERSION                 |              |           |            |           |           | A - Standard<br>Y - Special                                                                                                                              |

**Technical Specifications**

| BURNER                              |              | PN91                                    | PN92       | PN93       |
|-------------------------------------|--------------|-----------------------------------------|------------|------------|
| Output                              | min-max kW   | 698 - 2093                              | 849 - 2558 | 550 - 4100 |
| Fuel                                |              | Heavy oil                               |            |            |
| Oil viscosity                       |              | See "Burner model identification" table |            |            |
| Heavy oil rate                      | min-max kg/h | 62 - 187                                | 76- 228    | 49- 365    |
| Power supply                        |              | 230/400V 3N a.c. 50Hz                   |            |            |
| Total power consumption (Heavy oil) | kW           | 22,5                                    | 24         | 32         |
| Total power consumption (Petroleum) | kW           | 10,5                                    | 12         | 16         |
| Fan motor                           | kW           | 4                                       | 5,5        | 7,5        |
| Pre-heater resistors (heavy oil)    | kW           | 18                                      | 18         | 24         |
| Pre-heater resistors (Petroleum)    | kW           | 6                                       | 6          | 8          |
| Protection                          |              | IP40                                    |            |            |
| Approx. weight                      | kg           | 240                                     | 280        | 290        |
| Operation                           |              | Progressive - Fully modulating          |            |            |
| Operating temperature               | °C           | -10 ÷ +50                               |            |            |
| Storage Temperature                 | °C           | -20 ÷ +60                               |            |            |
| Working service*                    |              | Intermittent                            |            |            |

Heavy oil net calorific value (Hi): 40.4 MJ/kg (average value).

- Burners provided with Siemens LMO44 control box: the control box automatically stops after 24h of continuous working. The control box immediately starts up, automatically.
- Burners provided with Siemens LAL25 control box: for safety reasons, one controlled shutdown must take place every 24 hours of continuous working.

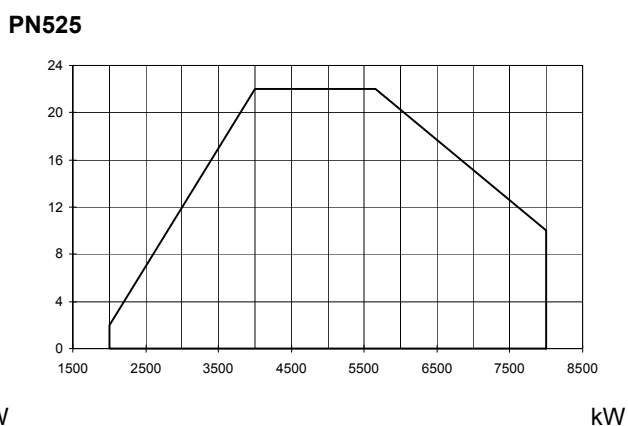
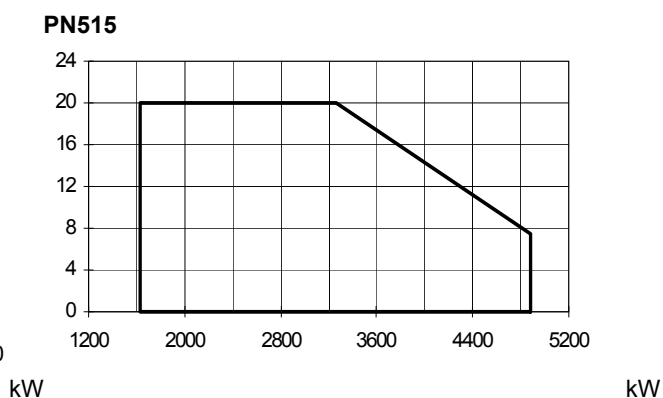
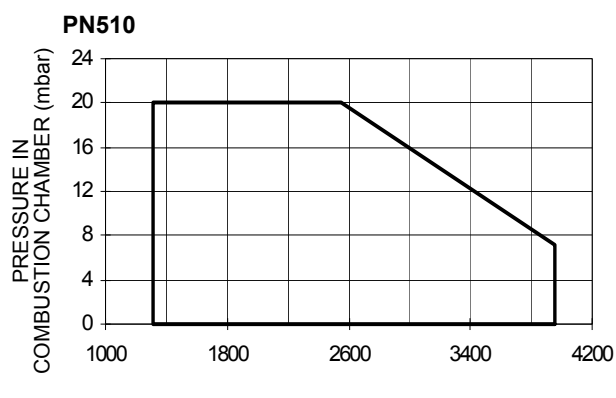
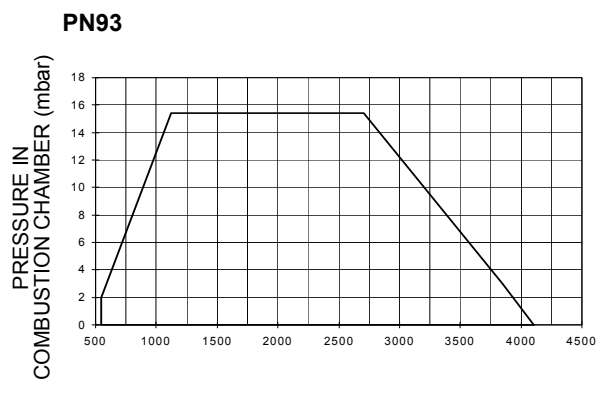
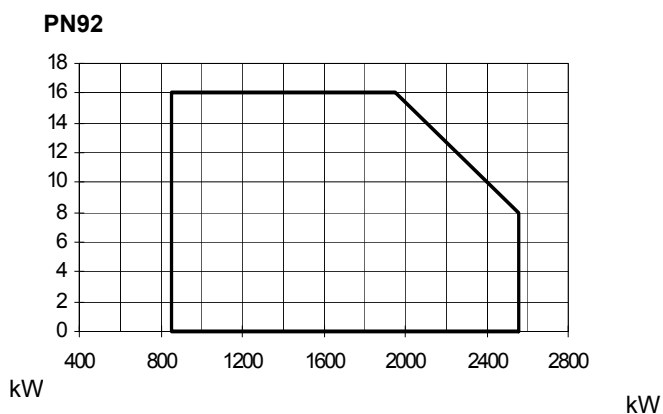
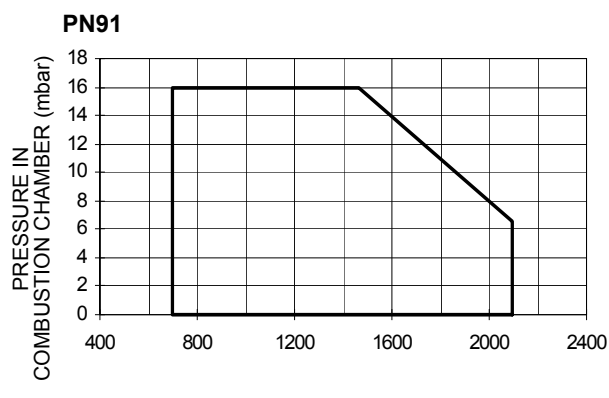
| <b>BURNER</b>                       |              | <b>PN510</b>                            | <b>PN515</b> | <b>PN520</b> | <b>PN525</b>      |
|-------------------------------------|--------------|-----------------------------------------|--------------|--------------|-------------------|
| Output                              | min-max kW   | 1314 - 3953                             | 1628 - 4884  | 2326 - 6977  | 2000 - 8000       |
| Fuel                                |              | Heavy oil                               |              |              |                   |
| Oil viscosity                       |              | See "Burner model identification" table |              |              |                   |
| Heavy oil rate                      | min-max kg/h | 117 - 352                               | 145 - 435    | 207 - 622    | 178 - 713         |
| Power supply                        |              | 230/400V 3N a.c. 50Hz                   |              |              | 400V 3N a.c. 50Hz |
| Total power consumption (Heavy oil) | kW           | 37,2                                    | 43,2         | 62,7         | 73,5              |
| Fan-pump motor                      | kW           | 7.5                                     | 11           | -            | -                 |
| Fan motor                           | kW           | 11                                      | 11           | 18,5         | 22                |
| Pump motor                          | kW           | 2,2                                     | 2,2          | 2,2          | 3                 |
| Pre-heater resistors (heavy oil)    | kW           | 24                                      | 30           | 42           | 48                |
| Protection                          |              | IP40                                    |              |              |                   |
| Approx. weight                      | kg           | 320                                     | 370          | 415          | 430               |
| Operation                           |              | Progressive - Fully modulating          |              |              |                   |
| Operating temperature               | °C           | -10 ÷ +50                               |              |              |                   |
| Storage Temperature                 | °C           | -20 ÷ +60                               |              |              |                   |
| Working service*                    |              | Intermittent                            |              |              |                   |

Heavy oil net calorific value (Hi): 40.4 MJ/kg (average value).

- Burners provided with Siemens LMO44 control box: the control box automatically stops after 24h of continuous working. The control box immediately starts up, automatically.

Burners provided with Siemens LAL25 control box: for safety reasons, one controlled shutdown must take place every 24 hours of continuous working.

## Performance Curves

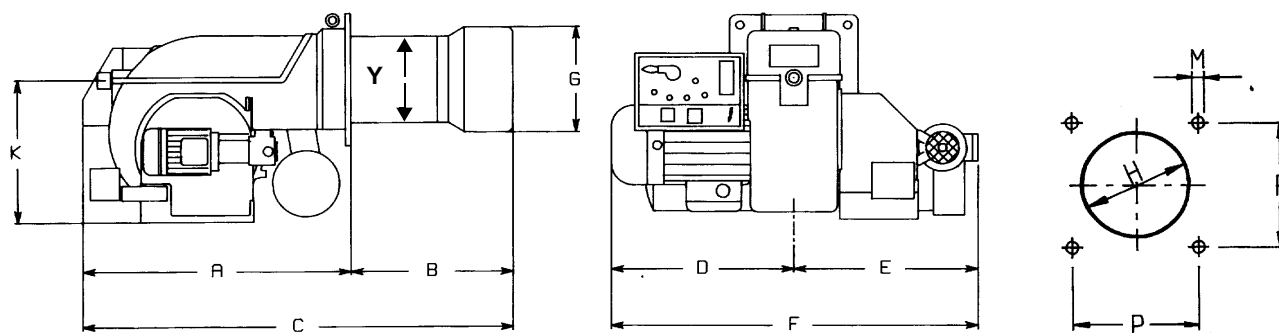


To get the input in kcal/h, multiply value in kW by 860.

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

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

## Overall dimensions (mm)



| Type  | A    | B   | BL  | C    | CL   | D   | E   | F    | G   | K   | H   | M   | P   | Y   |
|-------|------|-----|-----|------|------|-----|-----|------|-----|-----|-----|-----|-----|-----|
| PN91  | 1017 | 298 | 488 | 1315 | 1505 | 532 | 520 | 1052 | 262 | 464 | 292 | M12 | 295 | 196 |
| PN92  | 1017 | 301 | 491 | 1318 | 1508 | 532 | 520 | 1052 | 292 | 464 | 322 | M12 | 295 | 213 |
| PN93  | 1017 | 301 | 491 | 1318 | 1508 | 532 | 520 | 1052 | 292 | 464 | 322 | M12 | 295 | 213 |
| PN510 | 1050 | 340 | 520 | 1390 | 1570 | 550 | 560 | 1110 | 345 | 650 | 385 | M14 | 390 | 245 |
| PN515 | 1050 | 340 | 520 | 1390 | 1570 | 550 | 560 | 1110 | 384 | 650 | 424 | M14 | 390 | 246 |
| PN520 | 1050 | 340 | 520 | 1390 | 1570 | 650 | 670 | 1320 | 422 | 650 | 472 | M14 | 390 | 300 |
| PN525 | 1050 | 340 | 520 | 1390 | 1600 | 650 | 670 | 1320 | 434 | 650 | 484 | M14 | 390 | 328 |

B = standard blast tube

BL = extended blast tube

## INSTALLING THE BURNER

### Packing

Burners are despatched in wooden crates whose dimensions are:

**PN91-92-93** 1730mm x 1280mm x 1020mm (L x P x H)

**PN510-515-520-525** 1730mm x 1430mm x 1130mm (L x P x H)

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

The following are placed in each packing case:

- gasket or ceramic fibre plait (according to burner type) to be inserted between the burner and the boiler;
- envelope containing this manual and other documents.
- oil flexible hoses;
- oil filter
- 

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

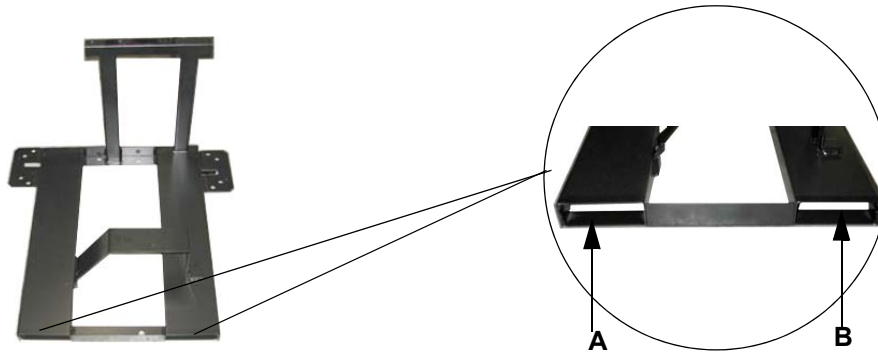
### Handling the burner



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

The burner is mounted on a stirrup provided for handling the burner by means of a fork lift truck: the forks must be inserted into the A

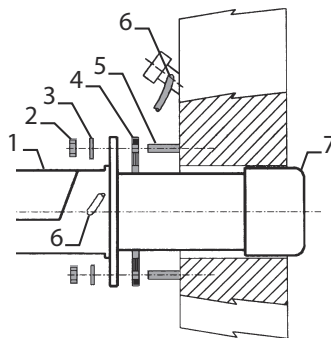
and B ways. Remove the stirrup only once the burner is installed to the boiler.



### **Fitting the burner to the boiler**

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

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



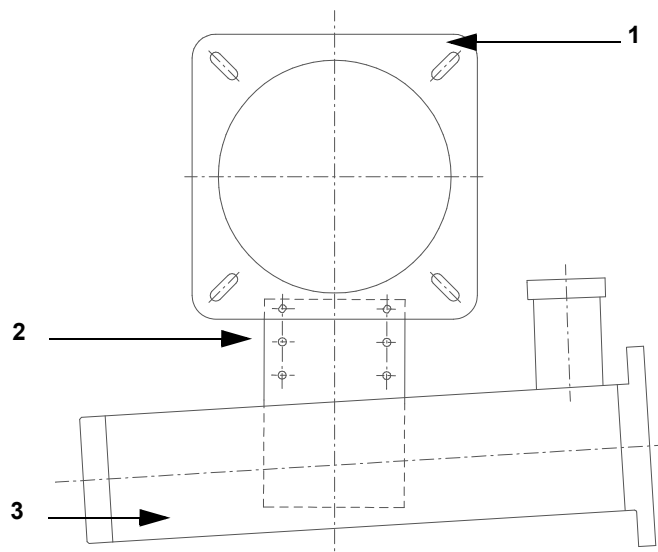
#### **Keys**

- 9
- 1 Burner
- 2 Fixing nut
- 3 Washer
- 4 Ceramic fibre plait
- 5 Stud bolt
- Blast tube

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

#### **Key**

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



## Electrical connections

|                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p><b>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.</b></p> <p><b>ATTENTION:</b> before executing the electrical connections, pay attention to turn the plant's switch to OFF and be sure that the burner's main switch is in 0 position (OFF) too. Read carefully the chapter "WARNINGS", and the "Electrical connections" section.</p>                                                                                                            |
|  | <p><b>WARNING:</b> The burner is provided with an electrical bridge between terminals 6 and 7; when connecting the high/low flame thermostat, remove this bridge before connecting the thermostat.</p> <p><b>IMPORTANT:</b> Connecting electrical supply wires to the burner terminal block MA, be sure that the ground wire is longer than phase and neutral ones.</p> <p><b>CAUTION:</b> auxiliary contacts are provided (terminals no. 507 and no. 508 of the MA terminal block) to connect an intervention system (alarm/power supply cutoff) in case of fault of the oil resistor contactor (see Fig. 2- Fig. 3).</p> |

To execute the electrical connections, proceed as follows:

- 1 remove the cover from the electrical board, unscrewing the fixing screws;
- 2 execute the electrical connections to the supply terminal board as shown in the following diagrams,
- 3 check the direction of the fan-pump motor (see next paragraph)
- 4 refit the panel cover.

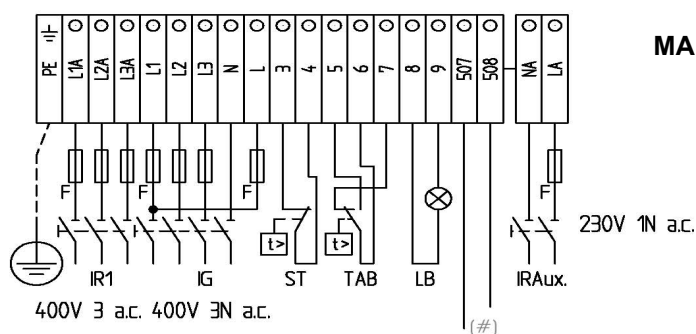


Fig. 1 - Fully modulating burners  
Fig. 2 Progressive burners

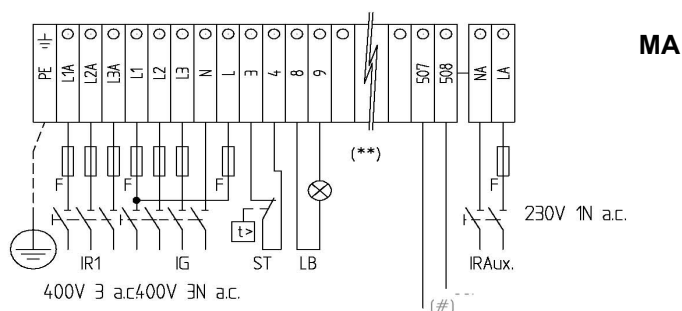


Fig. 3 - Fully modulating burners

(#) Free contact for "Faulty heater resistor contactor"

(\*\*) Probes connection (see Fig. 4)

Probes connection oby means of the 7-pins plug (Fig. 5) - see Fig. 4 for connections.

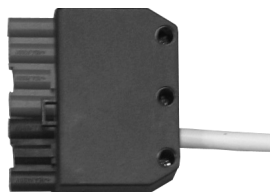


Fig. 5

### Probes connection

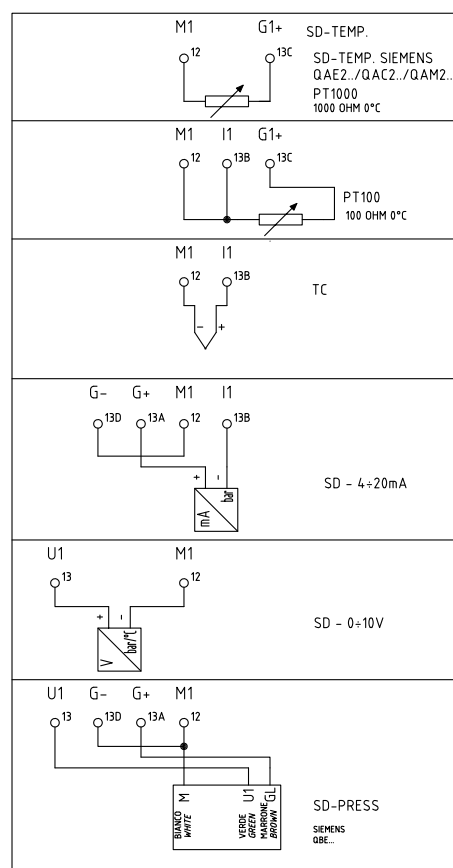


Fig. 4

## Fan motor direction ( and pump motor direction only for PN520 - PN525)

Once the electrical connection of the burner is performed, remember to check the rotation of the motor. The motor should rotate in an counterclockwise direction looking at cooling fan. In the event of incorrect rotation reverse the three-phase supply and check again the rotation of the motor.

## Connecting the oil heating resistors

2.4 - 4.5 kW

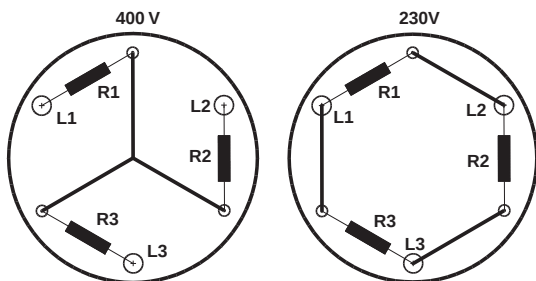


Fig. 6

8 - 12 kW

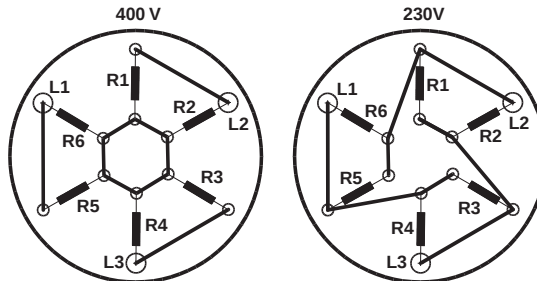


Fig. 7

18 - 24 kW

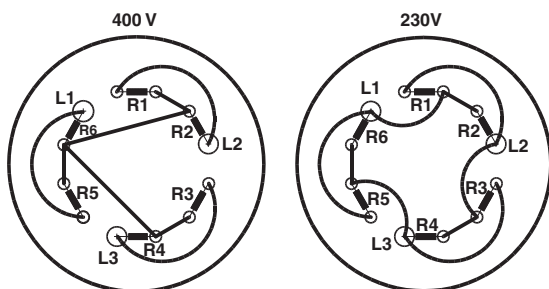


Fig. 8

ELECTRIC MOTOR CONNECTION

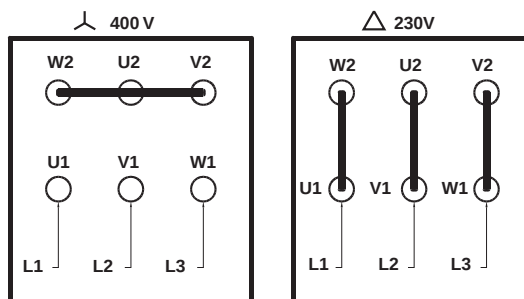


Fig. 9

## About the use of fuel pumps

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



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

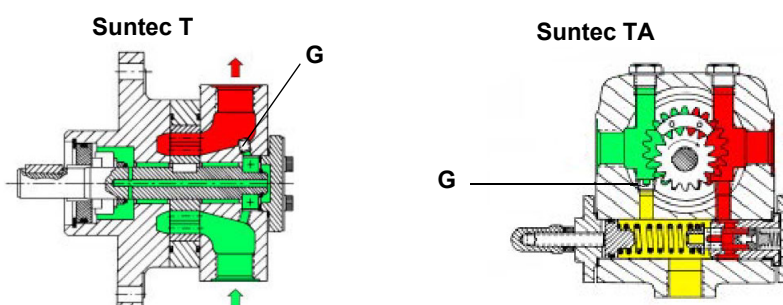
Depending on the installed pump, it is possible to design the plant for single or double pipe feeding line

**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. 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. **HP UHE series pumps:** a kit (Art.-Nr.: 0841211) is required for the transition from 2-pipe to 1-pipe system

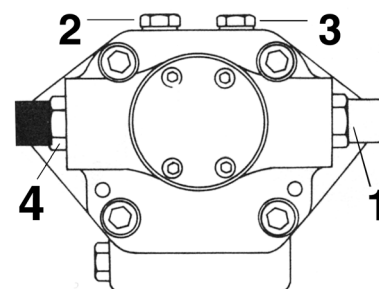


## Oil pumps

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

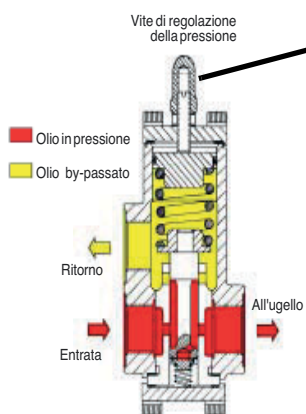
### Key

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



"Note: pump with "C" rotation.

## Suntec TV Pressure governor



### Pressure adjustment

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

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

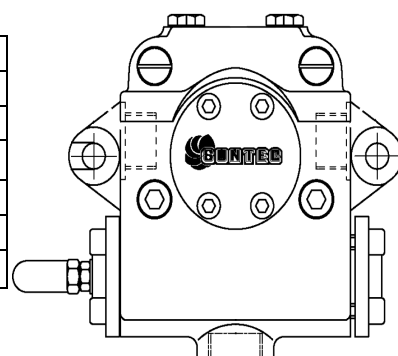
### Key

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

### Suntec TA..

|                       |                            |
|-----------------------|----------------------------|
| Oil viscosity         | 3 ÷ 75 cSt                 |
| Oil temperature       | 0 ÷ 150°C                  |
| Min. suction pressure | - 0.45 bar to avoid gasing |
| Max. suction pressure | 5 bar                      |
| Max. return pressure  | 5 bar                      |
| Rotation speed        | 3600 rpm max.              |

- 1 Inlet G1/2
- 2 To the nozzle G1/2
- 3 Return G1/2
- 4 Pressure gauge port G1/4
- 5 Vacuum gauge port G1/4
- 6 Pressure governor



### Connecting the oil flexible hoses to the pump

To connect the flexible oil hoses to the pump, proceed as follows, according to the pump provided:

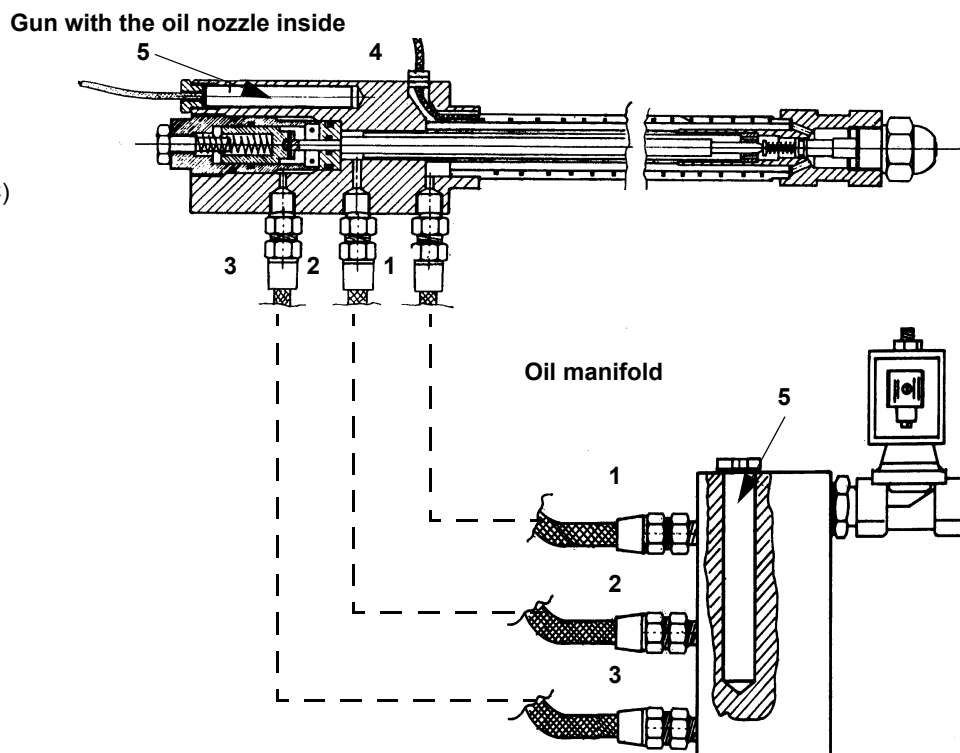
- remove the closing nuts A and R on the inlet and return connections of the pump;
- screw the rotating nut of the two flexible hoses on the pump **being careful to avoid exchanging the lines**: see the arrows marked on the pump.

For further information, refer to the technical documentation of the pump.

| Suntec T+TV | Suntec TA |
|-------------|-----------|
|             |           |

## Connections to the oil gun

- 1 Inlet
- 2 Return
- 3 Gun opening
- 4 Heating wire (only for oil viscosity > 50Cst @ 50°C)
- 5 Cartridge-type heater (only for oil viscosity > 50Cst @ 50°C)

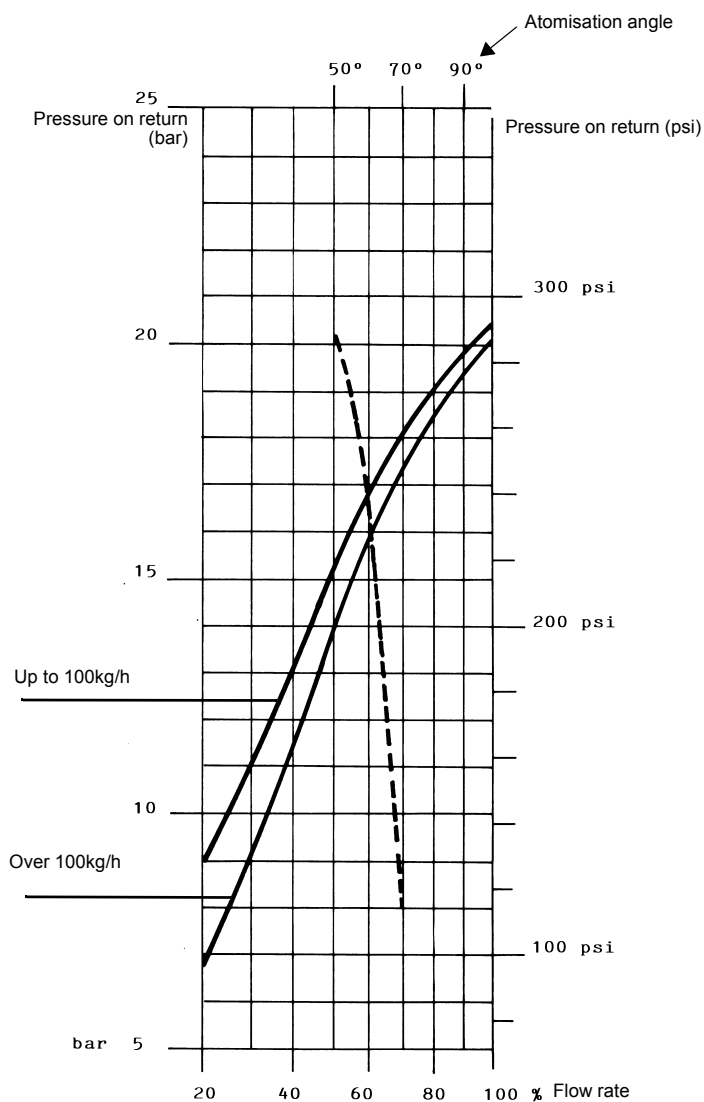


The oil flow rate can be adjusted choosing a nozzle that suits the boiler/utilisation output and setting the delivery and return pressure values according to the ones quoted on the following charts.

## FLUIDICS NOZZLE: REFERENCE DIAGRAM (INDICATIVE ONLY)

| DIMENSIONS | FLOW RATE kg/h |     | Indicative pressure on return (bar) |
|------------|----------------|-----|-------------------------------------|
|            | Min            | Max |                                     |
| 40         | 13             | 40  | 19                                  |
| 50         | 16             | 50  | 22                                  |
| 60         | 20             | 60  | 20                                  |
| 70         | 23             | 70  | 23                                  |
| 80         | 26             | 80  | 23                                  |
| 90         | 30             | 90  | 22                                  |
| 100        | 33             | 100 | 22                                  |
| 115        | 38             | 115 | 21                                  |
| 130        | 43             | 130 | 22                                  |
| 145        | 48             | 145 | 21                                  |
| 160        | 53             | 160 | 21                                  |
| 180        | 59             | 180 | 22                                  |
| 200        | 66             | 200 | 21                                  |
| 225        | 74             | 225 | 22                                  |
| 250        | 82             | 250 | 22                                  |
| 275        | 91             | 275 | 22                                  |
| 300        | 99             | 300 | 23                                  |
| 330        | 109            | 330 | 23                                  |
| 360        | 119            | 360 | 22                                  |
| 400        | 132            | 400 | 22                                  |
| 450        | 148            | 450 | 22                                  |
| 500        | 165            | 500 | 22                                  |
| 550        | 181            | 550 | 22                                  |
| 600        | 198            | 600 | 23                                  |
| 650        | 214            | 650 | 23                                  |
| 700        | 231            | 700 | 23                                  |
| 750        | 250            | 750 | 23                                  |
| 800        | 267            | 800 | 22                                  |
| 850        | 284            | 850 | 22                                  |

Tab. 1



**NOZZLE SUPPLY PRESSURE = 25 bar**

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

———— % Flow rate

viscosity at nozzle = 5 cSt



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

## Oil thermostat adjustment

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



Fig. 10 - Danfoss MCX

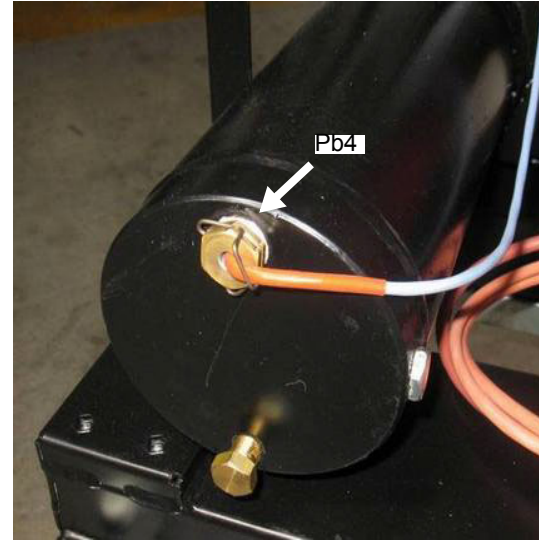
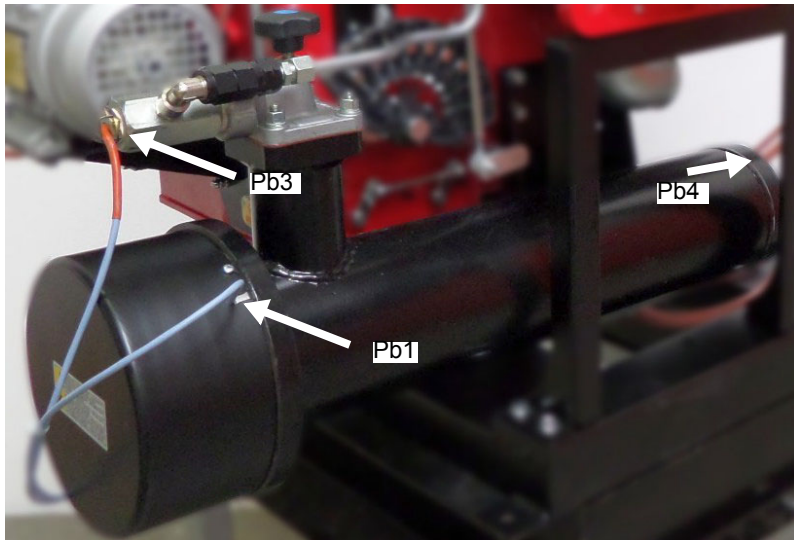


Fig. 11 - Probe connections (Danfoss MCX)

## Burners equipped with double tank

The first oil tank resistance is controlled by menas thermostats according to the below scheme. All thermostats are located inside the control panel. To set the temperature use a small screwdriver. The second oil tank is controlled by "MCX" electronic thermostat. Such temperature must be set during burner operation, checking temperature in the thermometer mounted on the pre-heating tank. We suggest a thermometer with scale up to 200° C.

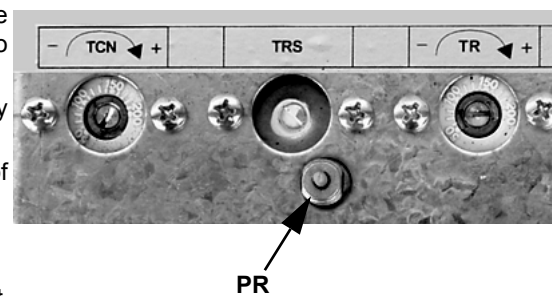
Adjust this thermostat to the correct value according to the viscosity-temperature diagram and check the temperature by using a thermometer with a scale of up to 200° C mounted on the pre-heating tank.

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

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

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

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



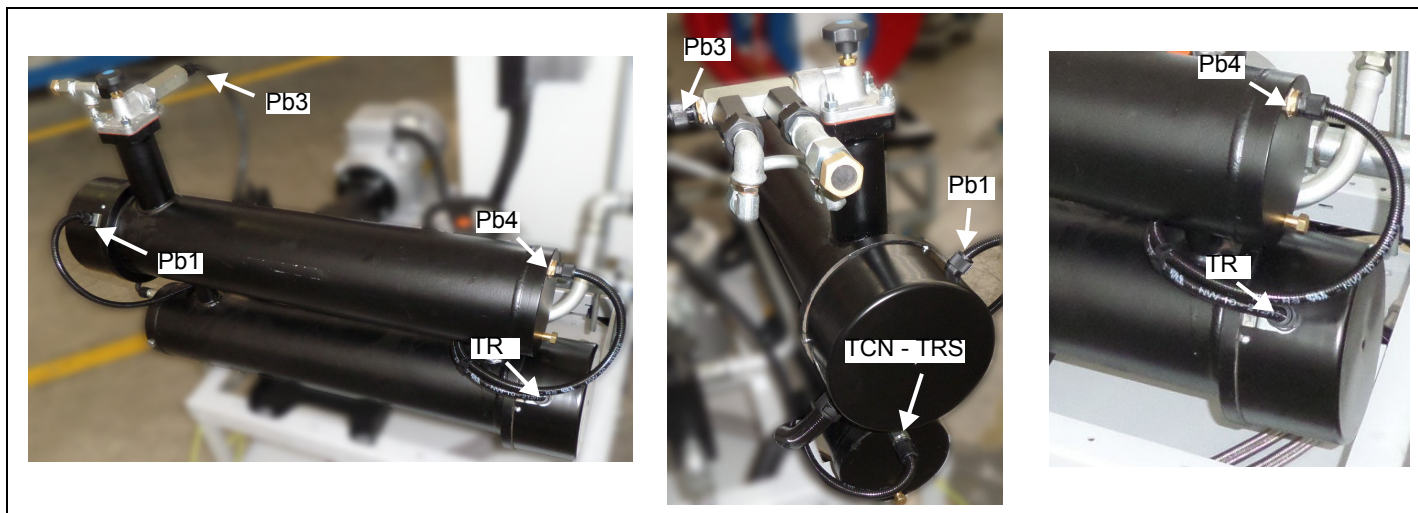


Fig. 12 - Probe connections (Danfoss MCX) and thermostats connections (Burners equipped with double tank)

| 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                  | ---                     |
|           | Pb3 | Oil | Oil heater output temperature probe (PID regulation);                    |          | 60-70 °C              | 110-120 °C             | 120-130 °C              |
|           |     | SP0 | Set-point oil heater with oil pump stopped (stand-by)                    |          | 45 °C                 | 120 °C                 | 130 °C                  |
|           | Pb4 | tcn | Oil heater consent temperature probe                                     |          | 40 °C                 | 100 °C                 | 100 °C                  |
|           |     | trS | Safety temperature tank resistors (manual reset)                         |          | 120 °C                | 190-200 °C             | 190-200 °C              |

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

## ADJUSTING AIR AND FUEL RATE

|                                                                                   |                                                                                                                                                                                                                                                             |
|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>ATTENTION:</b> before starting the burner up, be sure that the manual cutoff valves are open. Be sure that the mains switch is closed.                                                                                                                   |
|                                                                                   | <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 fuel decrease slowly until the normal combustion values are achieved. |
|  | 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>IMPORTANT!</b> the combustion air excess must be adjusted according to the values in the following chart.                                                                                                                                                |

| Recommended combustion parameters |                                       |                                      |
|-----------------------------------|---------------------------------------|--------------------------------------|
| <i>Fuel</i>                       | <i>Recommended (%) CO<sub>2</sub></i> | <i>Recommended (%) O<sub>2</sub></i> |
| Heavy oil                         | 11 ÷ 12.5                             | 4.7 ÷ 6.7                            |

### Adjustments - brief description

- Adjust the air and oil 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.
- 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.
- Now set 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 the flues temperature getting too low to cause condensation in the chimney.

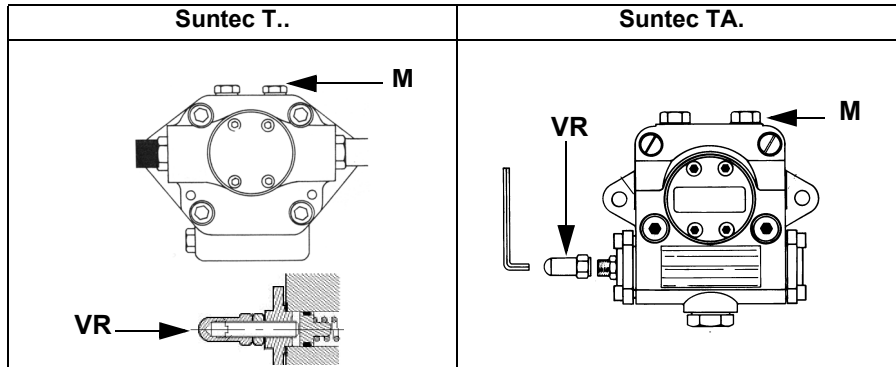
Now, adjust the burner according to the actuator model provided.

## Oil Flow Rate Settings by means of Berger STM30../Siemens SQM40.. actuator

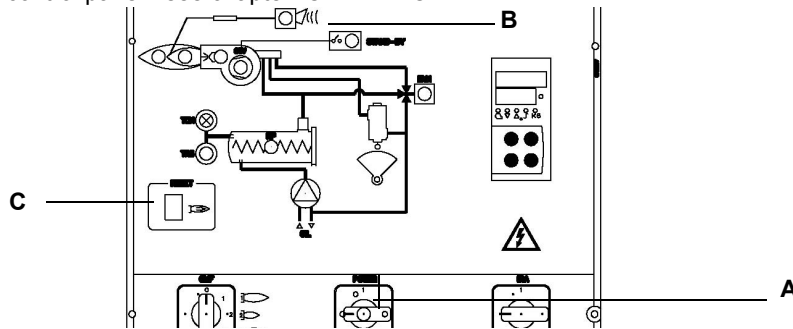
- 1 with the electrical panel open, prime the oil pump acting on the related contactor (see next picture): check the pump motor rotation (page 11) and keep pressing for some seconds until the oil circuit is charged;



- 2 bleed the air from the **M** pressure gauge port ( ) by loosening the cap without removing it, then release the solenoid starter.



- 3 Before starting the burner up, drive the high flame actuator microswitch matching the low flame one (in order to let the burner operates at the lowest output) to safely achieve the high flame stage.
- 4 Turn the burner on by means of its main switch **A** (see next picture): if the burner locks (LED **B** on in the control panel) press the RESET button (**C**) on the control panel - see chapter "OPERATION".



- 5 Start the burner up by means of the thermostat series and wait until the pre-purge phase comes to end and that burner starts up;
- 6 drive the burner to high flame stage, by means of the thermostat **TAB**.

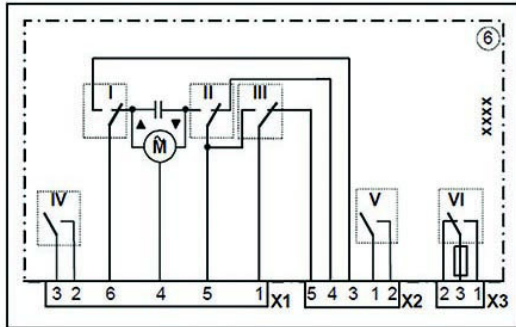
Then move progressively the microswitch to higher values until it reaches the high flame position; always check the combustion values (see next steps). the nozzle supply pressure is already factory-set and must not be changed. Only if necessary, adjust the supply pressure as follows (see related paragraph); insert a pressure gauge into the port shown on Fig. 13 and act on on the pump adjusting screw **VR** (see ) as to get the nozzle pressure at 25 bar (Fluidics nozzles).

## SQM40.265 Actuator cams

### Version with flame control LMO 24.255 / 44.255

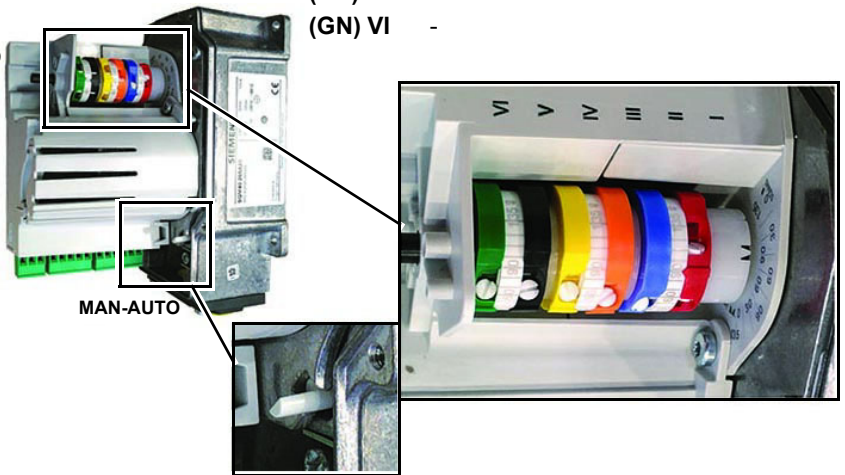
- (RD) I High flame  
(BU) II Stand-by  
(OG) III Low flame  
(YE) IV -  
(BK) V -  
(GN) VI -

Advance stroke limitation cam - set +5° to cam (BU) II



### Version with flame control LAL 2.25

- (RD) I High flame  
(BU) II Stand-by  
(OG) III Low flame  
(YE) IV -  
(BK) V -  
(GN) VI -



Pressure gauge port

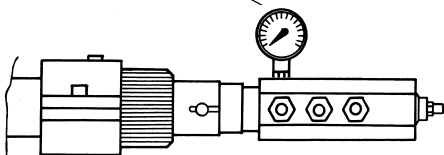


Fig. 13

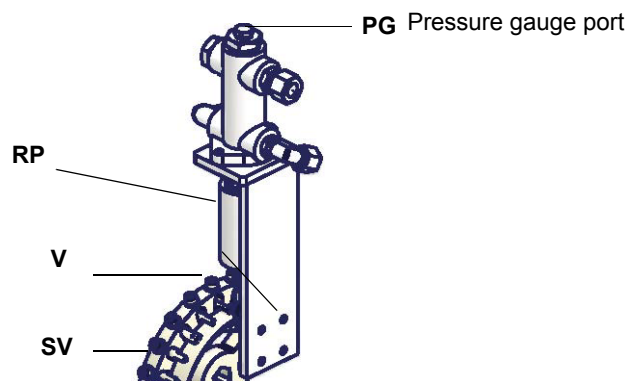
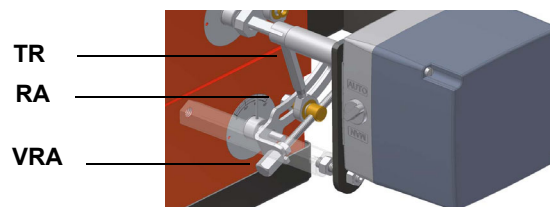


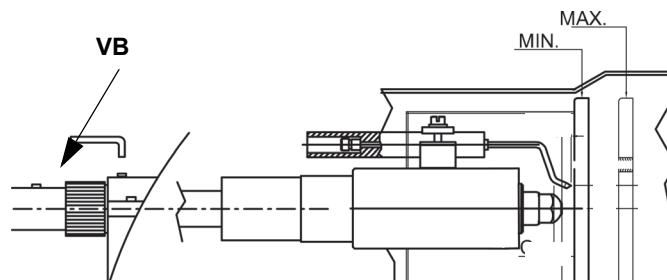
Fig. 15

- 7 in order to get the maximum oil flow rate, adjust the pressure (reading its value on the **PG** pressure gauge): checking always the combustion parameters, the adjustment is to be performed by means of the **SV** adjusting cam screw **V** (see picture) when the cam has reached the high flame position.
- 8 To adjust the **air flow rate in the high flame stage**, loose the **RA** nut and screw **VRA** as to get the desired air flow rate: moving the rod **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.



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



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

- 10 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°);
- 11 set the **TAB** thermostat to the minimum in order that the actuator moves progressively towards the low flame position;
- 12 move cam III towards the minimum to make the actuator move 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, according to the requested rate.
- 13 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.
- 14 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.

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

### Calibration of air pressure switch (only for PN515 - PN520 - PN525)

To calibrate the air pressure switch, proceed as follows:

- Remove the transparent plastic cap.
- Once air and heavy oil 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 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.

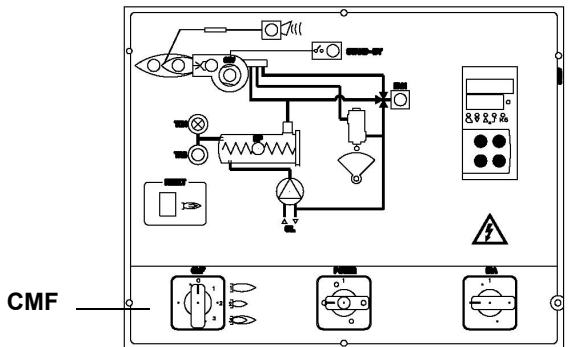


### Fully-modulating burners

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

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

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



- CMF = 0 stop at the current position
- CMF = 1 high flame operation
- CMF = 2 low flame operation
- CMF = 3 automatic operation

## Oil circuit

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

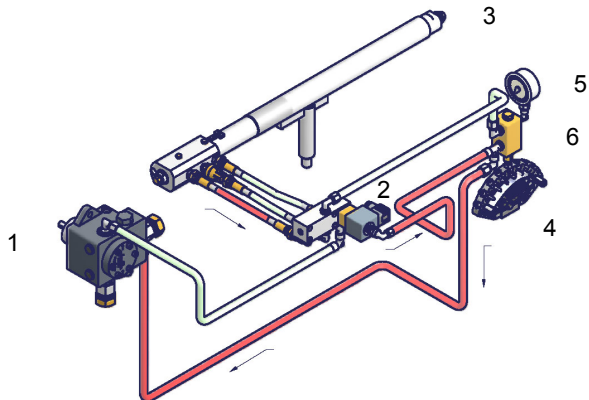


Fig. 16 - Stand-by

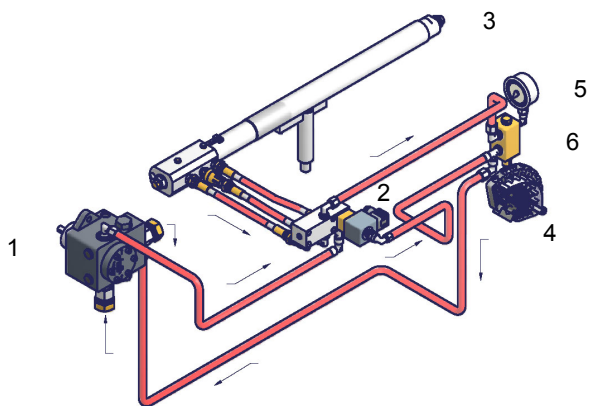


Fig. 17 - Prepurge

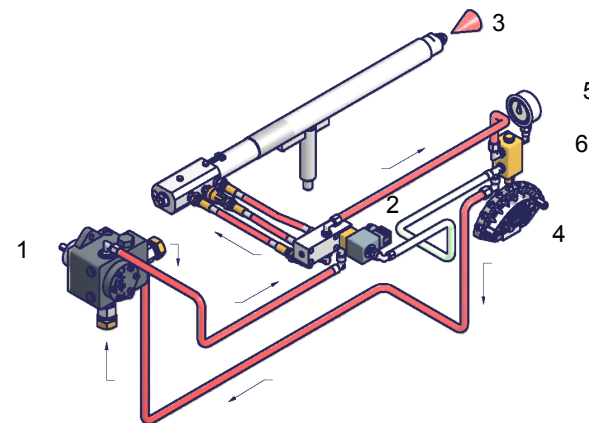


Fig. 18 - Low flame

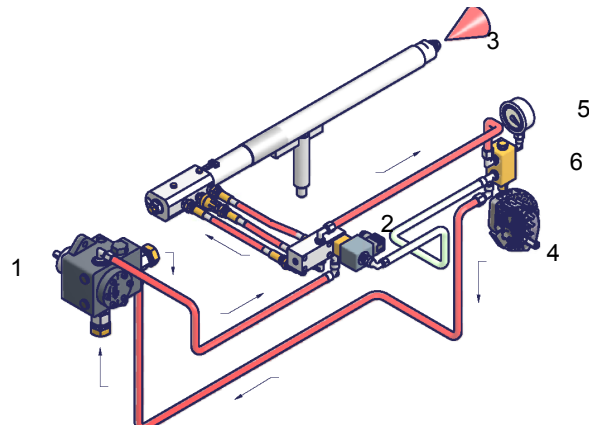


Fig. 19 - High flame

### Key

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

## PART II: OPERATION

## LIMITATIONS OF USE

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

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

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

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

NEVER OPEN OR DISMANTLE ANY COMPONENT OF THE MACHINE.

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

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

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

## OPERATION



**ATTENTION:** before starting the burner up, be sure that the manual cutoff valves are open and check that the pressure upstream the gas train complies the value quoted on paragraph "Technical specifications".

**N.B. be sure the cutoff valves on the delivery and return pipes are OPEN.**

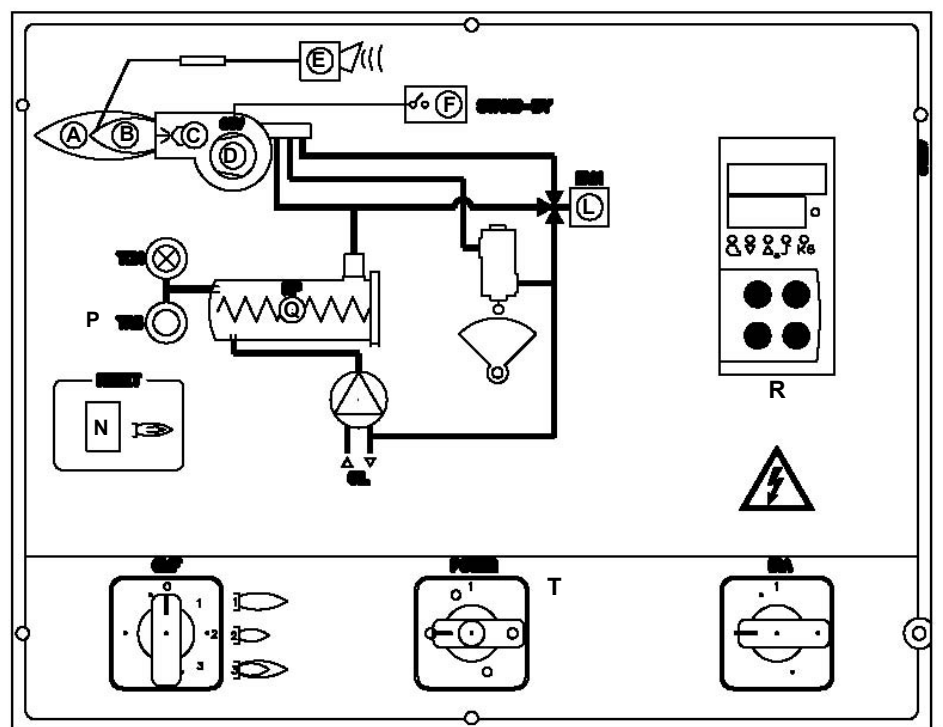
- Turn the burner on by means of its main switch **A** (see next pictures).
- Check that the burner is not locked (LED **E** lights up); if so, reset it by pressing the reset button **N**.
- Check that the series of thermostats (or pressure switches) enable the burner to start up.
- At the beginning of the start-up cycle the servo control drives the air damper to the maximum opening, the fan motor starts and the pre-purge phase begins. During the pre-purge phase the complete opening of the air damper is signalled by the indicator light **F** on the front panel.
- At the end of the pre-purge the ignition transformer is energised (signalled by the indicator light **C** on the panel). Two seconds later, the oil valve opens and the ignition transformer is de-energised (light **C** off).

The burner is now into operation, the servocontrol begins the opening, after few seconds the burner goes to two stages operation and eventually switches to the high flame operation, depending on the needs of the plant (light **A**, on) or continues with low flame operation (light **B**, on).

As far as fully-modulating burners, see the Siemens RWF40 burner modulator manual.

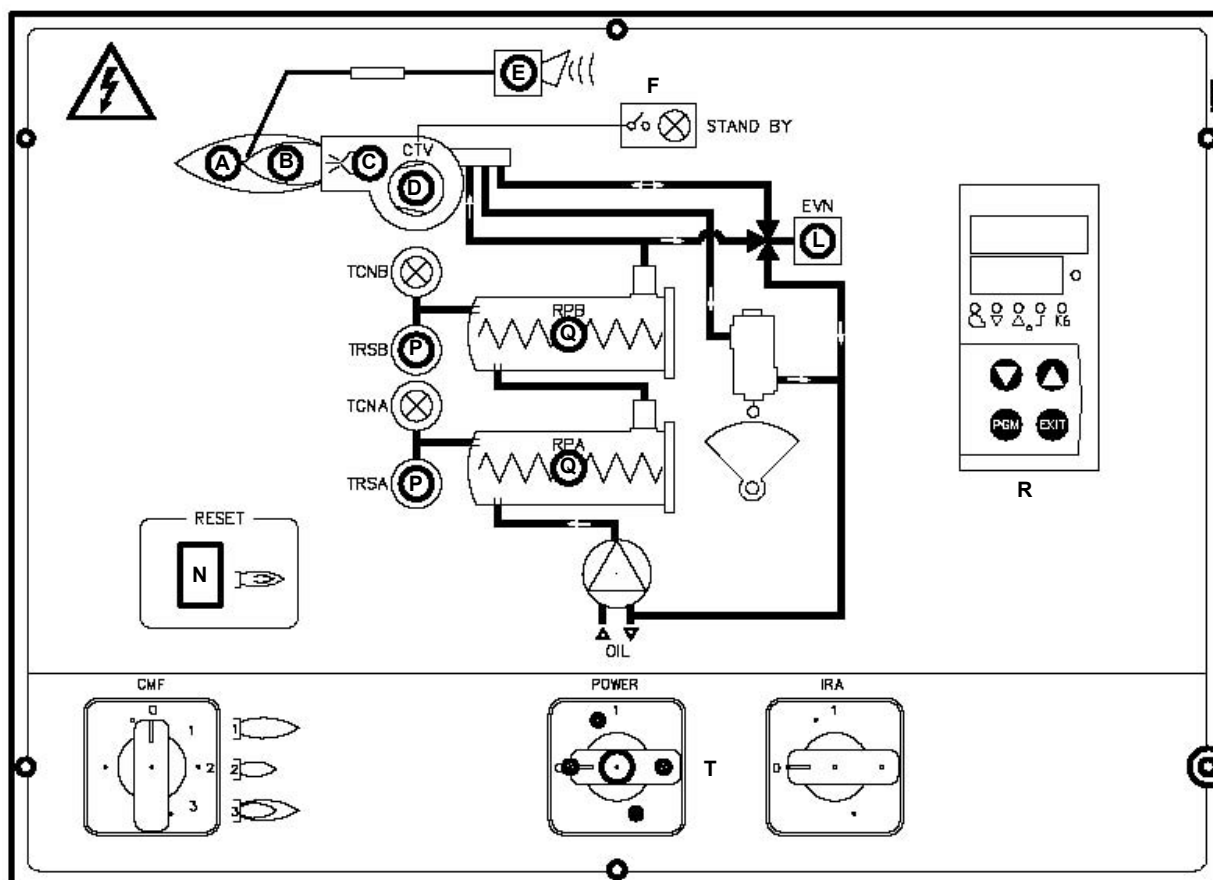
**Control panel**

PN91 - PN92 - PN93 - PN510



- A High flame lamp
- B Low flame lamp
- C Ignition transformer operation
- CMF Manual operation switch
  - 0= Off      1= High flame
  - 2= Low flame    3= Automatic
- D Fan motor thermal cutout intervention
- E Burner lockout
- F Burner in stand-by
- IRA Auxiliary resistors switch
- L Heavy oil solenoid lamp operation
- N Control box reset pushbutton
- P Heating resistors safety thermostat
- Q Pre-heating tank
- R Modulator
- T Main switch

PN515 - PN520 - PN525



## 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

- Clean and examine the oil filter cartridge and replace it if necessary.
- Examine the condition of the oil flexible tubing and check for possible leaks.
- Check and clean if necessary the oil heaters and the tank, according to the fuel type and its use; remove the heaters flange fixing nuts and remove the heaters from the tank: clean by using steam or solvents and not metallic things.
- Clean and examine the filter inside the 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.
- Remove and clean the combustion head (page 26).
- Examine and clean the ignition electrodes, adjust and replace if necessary (see page 27).
- Examine and clean the detection probe, adjust and replace if necessary (see page 28).
- Examine the detection current (see page 28).
- Remove and clean (page 28) the heavy oil nozzle (**Important: use solvents for cleaning, not metallic tools**) and at the end of the maintenance procedures, after replacing the burner, turn it on and check the shape of the flame; if in doubt replace the nozzle. Where the burner is used intensively it is recommended to replace the nozzle as a preventive measure, at the begin of the operating season.
- Clean and grease joints and rotating parts.

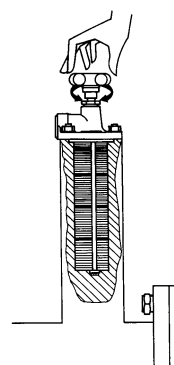
**IMPORTANT: Remove the combustion head before checking the ignition electrodes.**



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

### Self-cleaning filter

Fitted only for oil viscosity >110 cSt @ 50 °C. Periodically turn the knob to clean the filter.



### Removing the combustion head

- Remove the cover H.
- Slide the UV photoelectric cell out of its housing.
- Unscrew the oil connections E (Fig. 20) connecting the flexible pipes to the lance L and remove the whole assembly as shown in Fig. 20-Fig. 21.
- clean the combustion head by means of a vacuum cleaner; to scrape off the scale use a metallic brush.

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

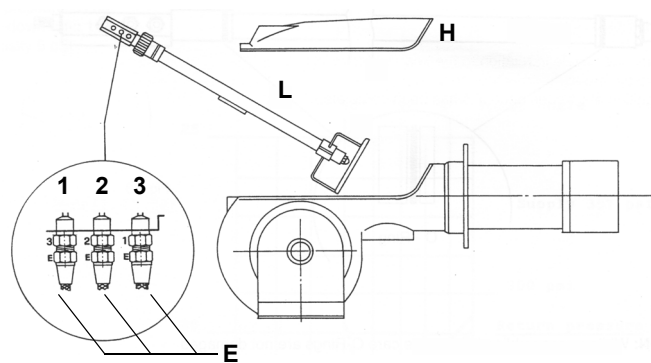


Fig. 20

**Key**

- 1 Inlet
- 2 Return
- 3 Lance opening
- 4 Heating wire (only for oil viscosity > 110 cSt @ 50 °C)
- 5 Cartridge-type heater
- H Cover
- L Oil lance
- E Oil piping connections

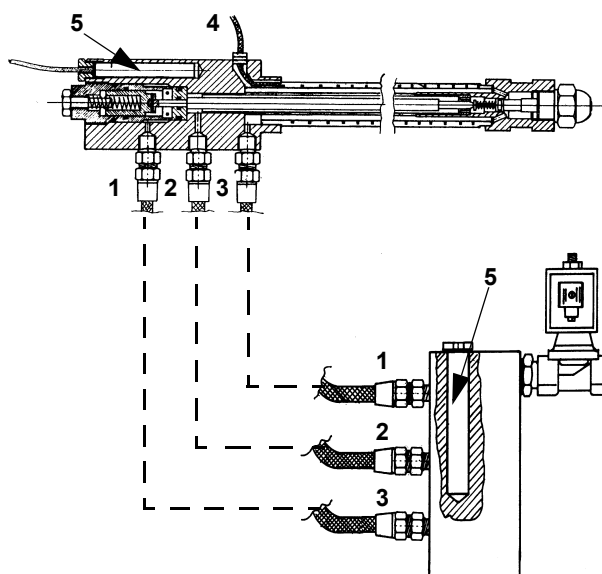


Fig. 21

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

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

To remove the oil gun, proceed as follows:

- 1 remove the combustion head as described on the previous paragraph;
- 2 loosen the **VU** screw and remove the oil gun: check the oil gun, replace it if necessary;
- 3 after removing the oil gun, unscrew the nozzle and replace it if necessary;
- 4 in order to replace the electrodes, unscrew the **VB** fixing screws and remove them: place the new electrodes being careful to observe the measures shown on next paragraph: reassemble following the reversed procedure.

**Caution:** adjust the nozzle position, by means of the **VU** screw.

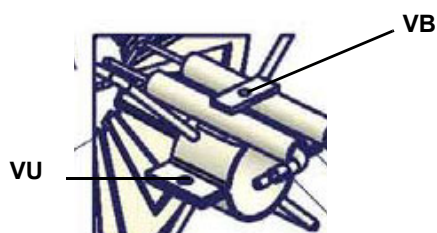


Fig. 22

### Nozzle and electrodes correct position

.Place the nozzle according to the combustion head; unscrew **VB** and move the combustion head. Check the ignition electrodes at the end of the procedure. Quotes are referred in mm.

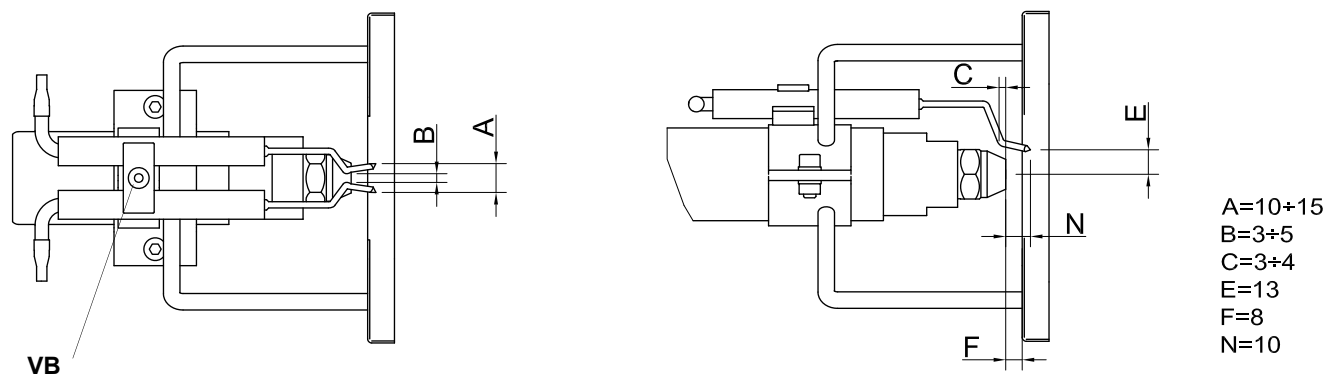


Fig. 23

### Checking the detection current

To check the flame intensity signal, follow the diagram shown on the next picture. If the measured value is lower than the suggested one, check the photoresistor position, the electrical contacts. Replace the photoresistor if necessary.

PN91-PN92 - PN93: LMO44

PN510-PN515-PN520-PN525: LAL2.

| Control box | Minimum detection signal |
|-------------|--------------------------|
| LMO44       | 45 $\mu$ A               |
| LAL2..      | 95 $\mu$ A               |

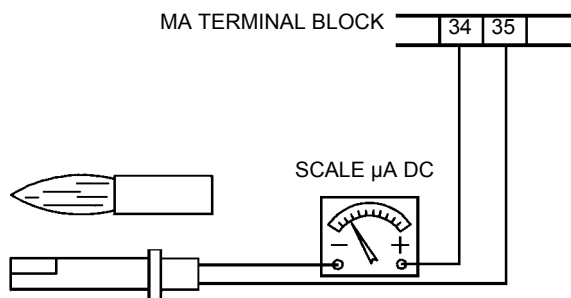


Fig. 24

### Cleaning and replacing the detection photoresistor

When cleaning the photoresistive detector, always use a clean cloth. If necessary, remove it from its slot to replace it.

### Seasonal stop

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

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

### Burner disposal

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

## TROUBLESHOOTING

| CAUSES/TROUBLES                        | DOES NOT START UP | CONTINUES PRE-PURGE | BURNER STARTS UP WITH COLD OIL | DOES NOT IGNITE AND GOES TO SHUT DOWN | DOES NOT PASS TO HIGH FLAME | GOES TO SHUT DOWN DURING OPERATION | GOES OFF AND REPEATS THE CYCLE DURING OPERATION |
|----------------------------------------|-------------------|---------------------|--------------------------------|---------------------------------------|-----------------------------|------------------------------------|-------------------------------------------------|
| MAIN SWITCH OFF                        | ●                 |                     |                                |                                       |                             |                                    |                                                 |
| LINE FUSES BLOWN                       | ●                 |                     |                                |                                       |                             |                                    |                                                 |
| MAXIMUM THERMOSTAT MALFUNCTION         | ●                 |                     |                                |                                       |                             |                                    |                                                 |
| FAN THERMAL CUTOFF TRIPPED             | ●                 |                     |                                |                                       |                             |                                    |                                                 |
| AUXILIARY FUSE BLOWN                   | ●                 |                     |                                |                                       |                             |                                    |                                                 |
| OIL RESISTOR FAULTY                    | ●                 |                     | ●                              |                                       |                             |                                    |                                                 |
| OIL ENABLING THERMOSTAT TRIPPED        | ●                 |                     | ●                              |                                       |                             |                                    |                                                 |
| CONTROL UNIT MALFUNCTION               | ●                 | ●                   |                                | ●                                     | ●                           | ●                                  | ●                                               |
| AIR SERVOCONTROL MALFUNCTION           |                   |                     |                                |                                       | ●                           |                                    |                                                 |
| CIRCUIT ENABLING THERMOSTAT            |                   | ●                   |                                |                                       | ●                           |                                    |                                                 |
| SMOKY FLAME                            |                   |                     |                                |                                       |                             | ●                                  | ●                                               |
| IGNITION TRANSFORMER FAULTY            |                   |                     |                                | ●                                     |                             |                                    |                                                 |
| IGNITION ELECTRODES WRONGLY POSITIONED |                   |                     |                                | ●                                     |                             |                                    |                                                 |
| DIRTY NOZZLE                           |                   |                     |                                | ●                                     |                             | ●                                  |                                                 |
| FAULTY OIL VALVE                       |                   |                     |                                | ●                                     |                             |                                    | ●                                               |
| FAULTY OR DIRTY PHOTORESISTOR          |                   |                     |                                |                                       |                             |                                    | ●                                               |
| FAULTY RESISTOR THERMOSTAT             | ●                 |                     |                                |                                       |                             |                                    |                                                 |
| FAULTY HIGH-LOW FLAME THERMOSTAT       |                   |                     |                                |                                       | ●                           |                                    |                                                 |
| ACTUATOR CAM NOT CALIBRATED            |                   |                     |                                |                                       | ●                           |                                    |                                                 |
| LOW OIL PRESSURE                       |                   |                     |                                | ●                                     |                             | ●                                  | ●                                               |

## ELECTRICAL WIRING DIAGRAMS

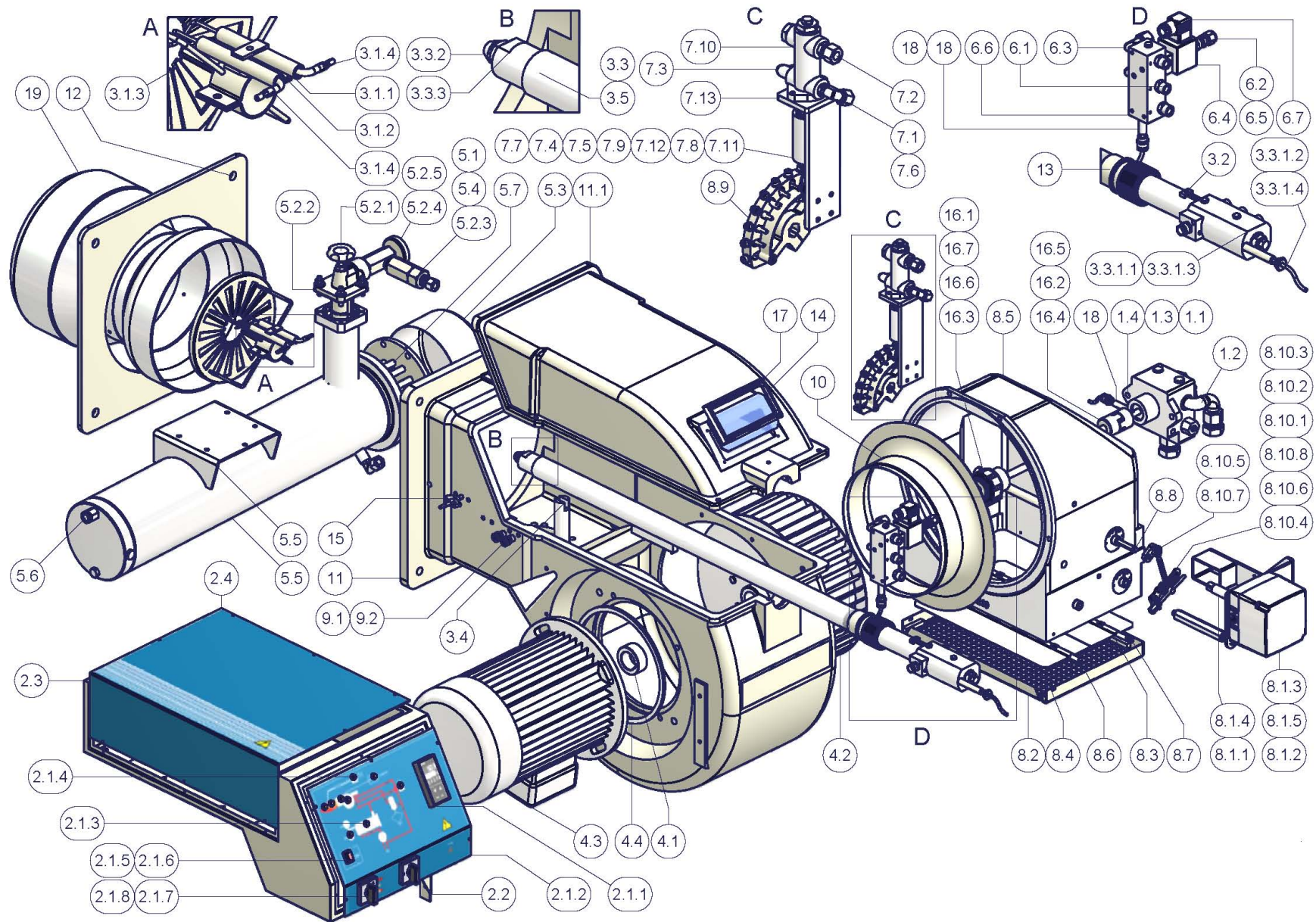
See attached wiring diagram.

## BURNER EXPLODED VIEW

| ITEM    | DESCRIPTION                    |
|---------|--------------------------------|
| 1.1     | NIPPLE                         |
| 1.2     | ELBOW                          |
| 1.3     | NIPPLE                         |
| 1.4     | PUMP                           |
| 2.1.1   | POWER CONTROLLER               |
| 2.1.2   | FRONT CONTROL PANEL            |
| 2.1.3   | LIGHT                          |
| 2.1.4   | LIGHT                          |
| 2.1.5   | LOCK-OUT RESET BUTTON          |
| 2.1.6   | PROTECTION                     |
| 2.1.7   | SWITCH                         |
| 2.1.8   | SWITCH                         |
| 2.2     | BRACKET                        |
| 2.3     | BOARD                          |
| 2.4     | COVER                          |
| 3.1.1   | LONG IGNITION ELECTRODE        |
| 3.1.2   | LONG IGNITION ELECTRODE        |
| 3.1.3   | COMBUSTION HEAD                |
| 3.1.4   | IGNITION CABLE                 |
| 3.2     | GUN TERMINAL                   |
| 3.3     | STANDARD COMPLETE OIL GUN      |
| 3.3.1.1 | NIPPLE                         |
| 3.3.1.2 | RESISTOR FIXING SCREW          |
| 3.3.1.3 | OIL MANIFOLD                   |
| 3.3.1.4 | RESISTOR                       |
| 3.3.2   | NOZZLE                         |
| 3.3.3   | NOZZLE HOLDER                  |
| 3.4     | OIL GUN HOLDER                 |
| 3.5     | COMBUSTION HEAD ADJUSTING PIPE |
| 4.1     | SPACER                         |
| 4.2     | FAN WHEEL                      |
| 4.3     | MOTOR                          |
| 4.4     | GAUGE RING                     |
| 5.1     | STRAIGHT UNION                 |
| 5.2.1   | OIL FILTER                     |

| ITEM  | DESCRIPTION        |
|-------|--------------------|
| 5.2.2 | GASKET             |
| 5.2.3 | GAS BLEEDING VALVE |
| 5.2.4 | THERMOMETER        |
| 5.2.5 | MUFF               |
| 5.3   | COVER              |
| 5.4   | REDUCTION          |
| 5.5   | OIL PRE-HEATER     |
| 5.6   | SHEATH             |
| 5.7   | RESISTOR           |
| 6.1   | NIPPLE             |
| 6.2   | STRAIGHT JOINT     |
| 6.3   | UNION ELBOW        |
| 6.4   | OIL SOLENOID VALVE |
| 6.5   | REDUCTION          |
| 6.6   | OIL MANIFOLD       |
| 6.7   | CONNECTOR          |
| 7.1   | UNION ELBOW        |
| 7.2   | STRAIGHT UNION     |
| 7.3   | UNION ELBOW        |
| 7.4   | SCREW              |
| 7.5   | ADJUSTING ROD      |
| 7.6   | REDUCTION          |
| 7.7   | WASHER             |
| 7.8   | BUSH               |
| 7.9   | BEARING            |
| 7.10  | PRESSURE GOVERNOR  |
| 7.11  |                    |
| 7.12  | BRACKET            |
| 7.13  | BRACKET            |
| 8.1.1 | SPACER             |
| 8.1.2 | BUSH               |
| 8.1.3 | ACTUATOR           |
| 8.1.4 | ACTUATOR SHAFT     |
| 8.1.5 | BRACKET            |
| 8.2   | NET                |

| ITEM   | DESCRIPTION         |
|--------|---------------------|
| 8.3    | AIR INTAKE DAMPER   |
| 8.4    | AIR INTAKE DAMPER   |
| 8.5    | AIR INTAKE          |
| 8.6    | LOUVER SHAFT        |
| 8.7    | LOUVER SHAFT        |
| 8.8    | ADJUSTING CAM SHAFT |
| 8.9    | ADJUSTING CAM       |
| 8.10.1 | SCREW               |
| 8.10.2 | SCREW               |
| 8.10.3 | SPACER              |
| 8.10.4 | CAM                 |
| 8.10.5 | LEVERAGE            |
| 8.10.6 | ROD                 |
| 8.10.7 | JOINT               |
| 8.10.8 | JOINT               |
| 9.1    | FAIRLEAD            |
| 9.2    | FAIRLEAD            |
| 10     | AIR INLET CONE      |
| 11     | BURNER HOUSING      |
| 11.1   | COVER               |
| 12     | GENERATOR GASKET    |
| 13     | RING NUT            |
| 14     | INSPECTION GLASS    |
| 15     | PHOTORESISTOR       |
| 16.1   | PIN                 |
| 16.2   | ELASTIC RING        |
| 16.3   | ELASTIC RING        |
| 16.4   | HALF-COUPLING       |
| 16.5   | HALF-COUPLING       |
| 16.6   | HALF-COUPLING       |
| 16.7   | HALF-COUPLING       |
| 17     | BRACKET             |
| 18     | RESISTOR            |
| 19     | STANDARD BLAST TUBE |
|        |                     |



**SPARE PARTS**

| DESCRIPTION                                           | PN91    | PN92    | PN93    |
|-------------------------------------------------------|---------|---------|---------|
| CONTROL BOX SIEMENS LMO                               | 2020455 | 2020455 | 2020420 |
| RIGHT ELECTRODE                                       | 2080250 | 2080250 | 2080250 |
| LEFT ELECTRODE                                        | 2080251 | 2080251 | 2080251 |
| FILTER FOR OIL VISCOSITY > 50 cSt @ 50°C              | 2090207 | 2090207 | 2090207 |
| SELF-CLEANING PRE-HEATER FILTER                       | 2090212 | 2090212 | 2090212 |
| GASKET                                                | 2110048 | 2110048 | 2110047 |
| FAN WHEEL                                             | 2150031 | 2150033 | 2150032 |
| IGNITION TRANSFORMER                                  | 2170005 | 2170005 | 2170005 |
| ELECTRIC MOTOR                                        | 2180276 | 2180277 | 2180206 |
| SOLENOID VALVE                                        | 2190437 | 2190437 | 2190437 |
| OIL HOSES                                             | 2340004 | 2340004 | 2340004 |
| OIL GUN HOSES                                         | 2340087 | 2340087 | 2340087 |
| OIL GUN HOSES                                         | 2340088 | 2340088 | 2340088 |
| OIL GUN HOSES                                         | 2340091 | 2340091 | 2340091 |
| ADJUSTING CAM FOIL                                    | 2440013 | 2440013 | 2440013 |
| ACTUATOR mod. SIEMENS SQL..                           | 2480007 | 2480007 | 2480007 |
| ACTUATOR mod. BERGER STM30                            | 2480090 | 2480090 | 2480090 |
| ACTUATOR mod. SIEMENS SQM40                           | 24800A5 | 24800A5 | 24800A5 |
| PHOTORESISTOR SIEMENS                                 | 2510003 | 2510003 | 2510003 |
| COUPLING                                              | 2540121 | 2540121 | 2540134 |
| RESISTOR THERMOSTATTCN-TCI                            | 2560026 | 2560026 | 2560026 |
| THERMOSTAT TRS                                        | 2560028 | 2560028 | 2560028 |
| PRESSURE GOVERNOR FOR OIL VISCOSITY < 110 cSt @ 50 °C | 2570054 | 2570054 | 2570077 |
| PRESSURE GOVERNOR OIL VISCOSITY > 110 cSt @ 50 °C     | 25700A6 | 25700A6 | 25700A6 |
| BURNER MODULATOR (only for fully-modulating burners)  | 2570112 | 2570112 | 2570112 |
| PUMP mod. DANFOSS                                     | 2590310 | 2590310 | 2590311 |
| PUMP mod. SUNTEC                                      | 2590118 | 2590118 | 2590119 |
| NOZZLE mod. FLUIDICS WR2 50°                          | 2610203 | 2610203 | 2610203 |
| STANDARD OIL GUN FOR OIL VISCOSITY < 110 cSt @ 50 °C  | 2700331 | 2700331 | 2700331 |
| EXTENDED OIL GUN FOR OIL VISCOSITY < 110 cSt @ 50 °C  | 2700332 | 2700332 | 2700332 |
| STANDARD OIL GUN FOR OIL VISCOSITY > 110 cSt @ 50 °C  | 2700339 | 2700339 | 2700339 |
| EXTENDED OIL GUN FOR OIL VISCOSITY > 110 cSt @ 50 °C  | 2700333 | 2700333 | 2700333 |
| COMBUSTION HEAD                                       | 3060160 | 3060161 | 3060161 |
| STANDARD BLAST TUBE                                   | 30910E2 | 30910E3 | 30910E3 |
| EXTENDED BLAST TUBE                                   | 3091091 | 30910A2 | 30910A2 |
| IGNITION CABLES                                       | 6050144 | 6050144 | 6050144 |

| DESCRIPTION                                           | PN510   | PN515   | PN520   | PN525   |
|-------------------------------------------------------|---------|---------|---------|---------|
| CONTROL BOX SIEMENS LAL                               | 2020420 | 2020420 | 2020420 | 2020420 |
| RIGHT ELECTRODE                                       | 2080250 | 2080250 | 2080250 | 2080250 |
| LEFT ELECTRODE                                        | 2080251 | 2080251 | 2080251 | 2080251 |
| FILTER FOR OIL VISCOSITY > 50 cSt @ 50°C              | 2090207 | 2090207 | 2090207 | 2090207 |
| SELF-CLEANING PRE-HEATER FILTER                       | 2090212 | 2090212 | 2090212 | 2090212 |
| GASKET                                                | 2110047 | 2110047 | 2110047 | 2110047 |
| FAN WHEEL                                             | 2150032 | 2150035 | 2150029 | 2150029 |
| IGNITION TRANSFORMER                                  | 2170005 | 2170005 | 2170005 | 2170005 |
| ELECTRIC MOTOR                                        | 2180206 | 2180209 | 2180278 | 2180289 |
| ELECTRIC MOTOR                                        | -       | -       | 2180210 | 2180210 |
| SOLENOID VALVE                                        | 2190437 | 2190437 | 2190437 | 2190437 |
| OIL HOSES                                             | 2340004 | 2340004 | 2340004 | 2340004 |
| OIL GUN HOSES                                         | 2340087 | 2340087 | 2340087 | 2340087 |
| OIL GUN HOSES                                         | 2340088 | 2340088 | 2340088 | 2340088 |
| OIL GUN HOSES                                         | 2340089 | 2340089 | 2340089 | 2340089 |
| ADJUSTING CAM FOIL                                    | 2440013 | 2440013 | 2440013 | 2440013 |
| ACTUATOR mod. SIEMENS SQL..                           | 2480007 | 2480007 | 2480007 | 2480007 |
| ACTUATOR mod. BERGER STM30                            | 2480090 | 2480090 | 2480090 | 2480090 |
| ACTUATOR mod. SIEMENS SQM40                           | 24800A5 | 24800A5 | 24800A5 | 24800A5 |
| PHOTORESISTOR SIEMENS                                 | 2510003 | 2510003 | 2510003 | 2510003 |
| COUPLING                                              | 2540122 | 2540122 | 2540126 | 2540126 |
| RESISTOR THERMOSTAT TR-TCN-TCI                        | 2560026 | 2560026 | 2560026 | 2560026 |
| THERMOSTAT TRS                                        | 2560028 | 2560028 | 2560028 | 2560028 |
| PRESSURE GOVERNOR FOR OIL VISCOSITY < 110 cSt @ 50 °C | 2570077 | 25700B2 | 25700B2 | 25700A7 |
| PRESSURE GOVERNOR OIL VISCOSITY > 110 cSt @ 50 °C     | 25700A6 | 25700A7 | 25700A7 | 25700A7 |
| BURNER MODULATOR (only for fully-modulating burners)  | 2570112 | 2570112 | 2570112 | 2570112 |
| PUMP mod. DANFOSS                                     | 2590311 | 2590312 | 2590313 | 2590313 |
| PUMP mod. SUNTEC                                      | 2590119 | 2590120 | 2590121 | 2590121 |
| NOZZLE mod. FLUIDICS WR2 50°                          | 2610203 | 2610203 | 2610203 | 2610203 |
| STANDARD OIL GUN FOR OIL VISCOSITY < 110 cSt @ 50 °C  | 2700347 | 2700347 | 2700347 | 2700244 |
| EXTENDED OIL GUN FOR OIL VISCOSITY < 110 cSt @ 50 °C  | 2700337 | 2700337 | 2700337 | -       |
| STANDARD OIL GUN FOR OIL VISCOSITY > 110 cSt @ 50 °C  | 2700348 | 2700348 | 2700348 | 2700245 |
| EXTENDED OIL GUN FOR OIL VISCOSITY > 110 cSt @ 50 °C  | 2700338 | 2700338 | 2700338 | -       |
| COMBUSTION HEAD                                       | 3060167 | 3060164 | 3060165 | 30601C9 |
| STANDARD BLAST TUBE                                   | 30910E4 | 30910E5 | 30910E6 | 30910L9 |
| EXTENDED BLAST TUBE                                   | 30910A3 | 30910A4 | 30910A5 | -       |
| IGNITION CABLES                                       | 6050144 | 6050144 | 6050144 | 6050144 |

## APPENDIX

### SIEMENS OIL BURNERS AUTOMATIC CONTROLLER SIEMENS LMO14 - LMO24 - LMO44

The LMO... burner controls are designed for the start-up and supervision of single- or 2-stage forced draught oil burners in intermittent operation. Yellow-burning flames are supervised with photoresistive detectors QRB..., blue-burning flames with blue-flame detectors QRC...

In terms of housing dimensions, electrical connections and flame detectors, the LMO... are identical to the LOA... oil burner controls.

#### Preconditions for startup

- Burner control is reset
- All contacts in the line are closed
- No undervoltage
- Flame detector is darkened, no extraneous light

#### Undervoltage

- Safety shut-down in the operating position takes place should the mains voltage drop below about AC 165 V
- Restart is initiated when the mains voltage exceeds about AC 175 V

#### Time supervision oil pre-heater

If the oil pre-heater's release contact does not close within 10 minutes, the burner control will initiate lock-out.

#### Controlled intermittent operation

After no more than 24 hours of continuous operation, the burner control will initiate an automatic safety shut-down followed by a restart.

#### Control sequence in the event of fault

If lock-out occurs, the outputs for the fuel valves and the ignition will immediately be deactivated (< 1 second).

| Cause                                                          | Response                                                       |
|----------------------------------------------------------------|----------------------------------------------------------------|
| After a mains failure                                          | Restart                                                        |
| After voltage has fallen below the undervoltage threshold      | Restart                                                        |
| In the event of a premature, faulty flame signal during «t1»   | Lock-out at the end of «t1»                                    |
| In the event of a premature, faulty flame signal during «tw»   | Prevention of start-up, lock-out after no more than 40 seconds |
| If the burner does not ignite during «TSA»                     | Lock-out at the end of TSA                                     |
| In the event the flame is lost during operation                | Max. 3 repetitions, followed by lock-out                       |
| Oil pre-heater's release contact does not close within 10 min. | Lock-out                                                       |

#### Lock-out

In the event of lock-out, the LMO... remains locked (lock-out cannot be changed), and the red signal lamp will light up. This status is also maintained in the case of a mains failure.

#### Resetting the burner

Whenever lock-out occurs, the burner control can immediately be reset. To do this, keep control the lock-out reset button depressed for about 1 second (< 3 seconds).

#### Ignition program with LMO24.113A2

If the flame is lost during «TSA», the burner will be reignited, but not later than at the end of «TSAmx.». This means that several ignition attempts can be made during TSA (refer to «Program sequence»).

#### Limitation of repetitions

If the flame is lost during operation, a maximum of 3 repetitions can be made. If the flame is lost for the 4th time during operation, the burner will initiate lock-out. The repetition count is restarted each time controlled switching on by «R-W-SB» takes place.

#### Operation

Lock-out reset button «EK...» is the key operating element for resetting the burner control and for activating / deactivating the diagnostic functions.



The multicolour «LED» is the key indicating element for both visual diagnosis and interface diagnosis.

s Red  
l Yellow  
o Green

| Colour code table                                |              |                   |
|--------------------------------------------------|--------------|-------------------|
| Status                                           | Colour code  | Colour            |
| Oil pre-heater heats, waiting time «tw»          | llllllll     | Yellow            |
| Ignition phase, ignition controlled              | lmlmlmlml    | Yellow-off        |
| Operation, flame o.k.                            | oooooooo     | Green             |
| Operation, flame not o.k.                        | omomomomo    | Green-off         |
| Undervoltage                                     | lsllsllsl    | Yellow-red        |
| Fault, alarm                                     | ssssssssss   | Red               |
| Output of fault code (refer to Fault code table) | smsmsmsmsm   | Red-off           |
| Extraneous light prior to burner start-up        | osososososo  | Green-red         |
| Interface diagnosis                              | ssssssssssss | Red flicker light |

#### Key

m Off  
l Yellow  
o Green  
s Red

#### Diagnosis of cause of fault

After lock-out, the red fault signal lamp remains steady on.

In that condition, the visual diagnosis of the cause of fault according to the error code table can be activated by pressing the lock-out reset button for more than 3 seconds.

| Error code table |                                                                                                                                                                                                                                                      |
|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Blink code       | Possible cause                                                                                                                                                                                                                                       |
| 2 blinks **      | No establishment of flame at the end of TSA <ul style="list-style-type: none"> <li>● Faulty or soiled fuel valves</li> <li>● Faulty or soiled flame detector</li> <li>● Poor adjustment of burner, no fuel</li> <li>● Faulty ignition</li> </ul>     |
| 3 blinks ***     | Free                                                                                                                                                                                                                                                 |
| 4 blinks ****    | Extraneous light on burner startup                                                                                                                                                                                                                   |
| 5 blinks *****   | Free                                                                                                                                                                                                                                                 |
| 6 blinks ****    | Free                                                                                                                                                                                                                                                 |
| 7 blinks *****   | Too many losses of flame during operation (limitation of the number of repetitions) <ul style="list-style-type: none"> <li>● Faulty or soiled fuel valves</li> <li>● Faulty or soiled flame detector</li> <li>● Poor adjustment of burner</li> </ul> |
| 8 blinks *****   | Time supervision oil pre-heater                                                                                                                                                                                                                      |
| 9 blinks *****   | Free                                                                                                                                                                                                                                                 |
| 10 blinks *****  | Wiring error or internal error, output contacts                                                                                                                                                                                                      |

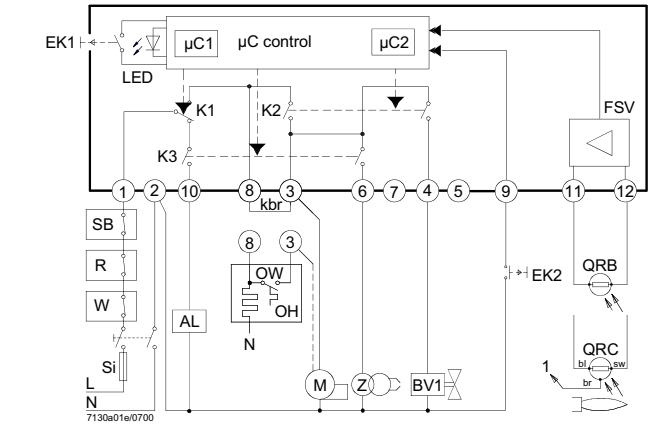
During the time the cause of fault is diagnosed, the control outputs are deactivated.

- Burner remains shut down
- Fault status signal «AL» at terminal 10 is activated

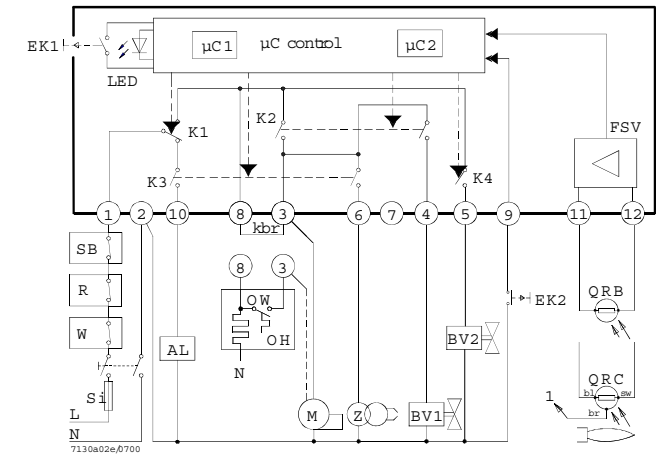
The diagnosis of the cause of fault is quit and the burner switched on again by resetting the burner control.

Press lock-out reset button for about 1 second (< 3 seconds).

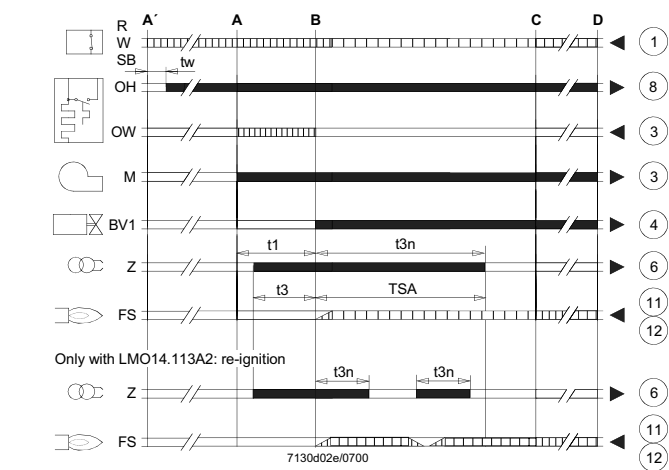
**Connection diagram and internal diagram**  
**LMO14**



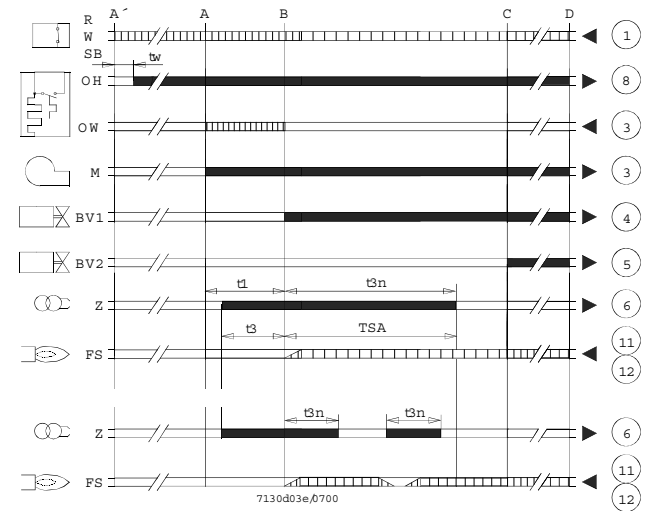
**LMO24 - LMO44**



**Control sequence**  
**LMO14**



**LMO24 - LMO44**



**Key**

- AL Alarm device
- kbr... Cable link (required only when no oil pre-heater is used)
- BV... Fuel valve
- EK1 Lock-out reset button
- EK2 Remote lock-out reset button
- FS Flame signal
- FSV Flame signal amplifier
- K... Contacts of control relay
- LED 3-colour signal lamps
- M Burner motor
- OW Release contact of oil pre-heater
- t1 Pre-purge time
- t3 Pre-ignition time
- t3n Post-ignition time
- A' Beginning of start-up sequence with burners using an oil pre-heater
- A Beginning of start-up sequence with burners using no oil pre-heater
- Controller output signals (represented by a white box)
- Required input signals (represented by a black box)
- OH Oil pre-heater
- QRB Photoresistive detector
- QRC Blue-flame detector
- bl = blue
- br = brown
- sw = black
- R Control thermostat or pressurestat
- SB Safety limit thermostat
- Si External primary fuse
- W Limit thermostat or pressure switch
- Z Ignition transformer
- t4 Interval from flame signal to release «BV2»
- TSA Ignition safety time
- tw Waiting time for oil pre-heating
- B Time of flame establishment
- C Operating position
- D Controlled shut-down by «R»
- μC1 Microcontroller 1
- μC2 Microcontroller 2

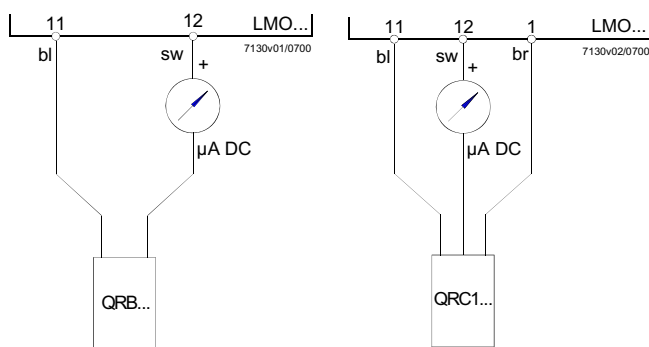
## General unit data

|                                              |                                                  |     |
|----------------------------------------------|--------------------------------------------------|-----|
| Mains voltage                                | AC 230 V +10 % / -15 %<br>AC 110 V +10 % / -15 % |     |
| Mains frequency                              | 50...60 Hz $\pm 6$ %                             |     |
| External primary fuse                        | (Si) 5 A (slow)                                  |     |
| Power consumption                            | 12 VA                                            |     |
| Mounting orientation                         | optional                                         |     |
| Weight                                       | approx. 200 g                                    |     |
| Degree of protection                         | IP 40                                            |     |
| Perm. cable lengths                          | max. 3 m at a line capacitance of 100 pF/m       |     |
| Detector cable laid separately               | 20 m                                             |     |
| Remote reset                                 | 20m                                              |     |
| Max perm. amperage at $\cos\varphi \geq 0.6$ | LMO14                      LMO24-LMO44           |     |
| Terminal 1                                   | 5 A                                              | 5 A |
| Terminals 3 and 8                            | 3 A                                              | 5 A |
| Terminals 4, 5, 6 and 10                     | 1 A                                              | 1 A |

## Flame supervision with QRB and QRC

|                                                |             |             |
|------------------------------------------------|-------------|-------------|
|                                                | <b>QRB</b>  | <b>QRC</b>  |
| Min. detector current required (with flame)    | 45 $\mu$ A  | 70 $\mu$ A  |
| Min detector current permitted (without flame) | 5.5 $\mu$ A | 5.5 $\mu$ A |
| Max. possible with flame (typically)           | 100 $\mu$ A | 100 $\mu$ A |

## Measurement circuit for detector current



## Key

|            |                                                                      |
|------------|----------------------------------------------------------------------|
| $\mu$ A DC | DC microamperometer with an internal resistance of 5 k $\Omega$ max. |
| bl         | Blue                                                                 |
| sw         | Black                                                                |
| br         | Brown                                                                |

## 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...s 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.

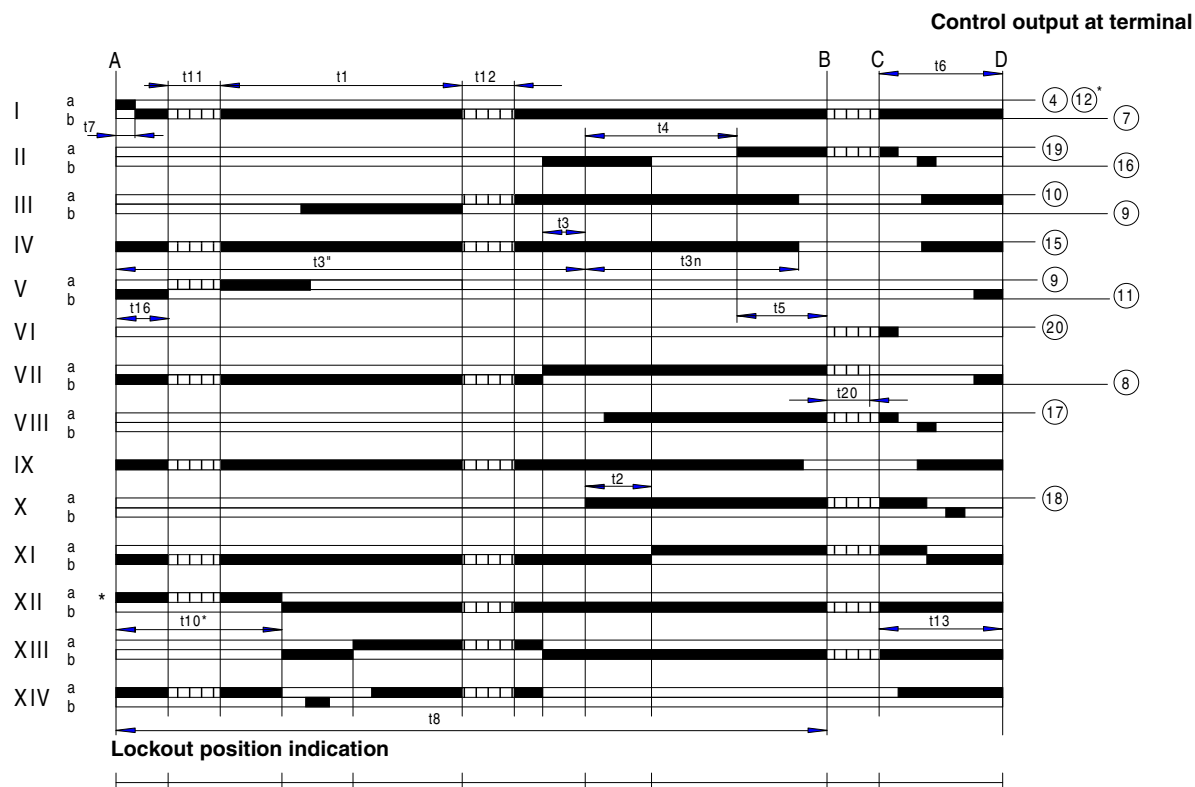
C Controlled shutdown: in the case of controlled shutdown, «BV...» will immediately be closed. At the same time, the sequence switch is started to program «t6»

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



## Sequence diagram



### Key

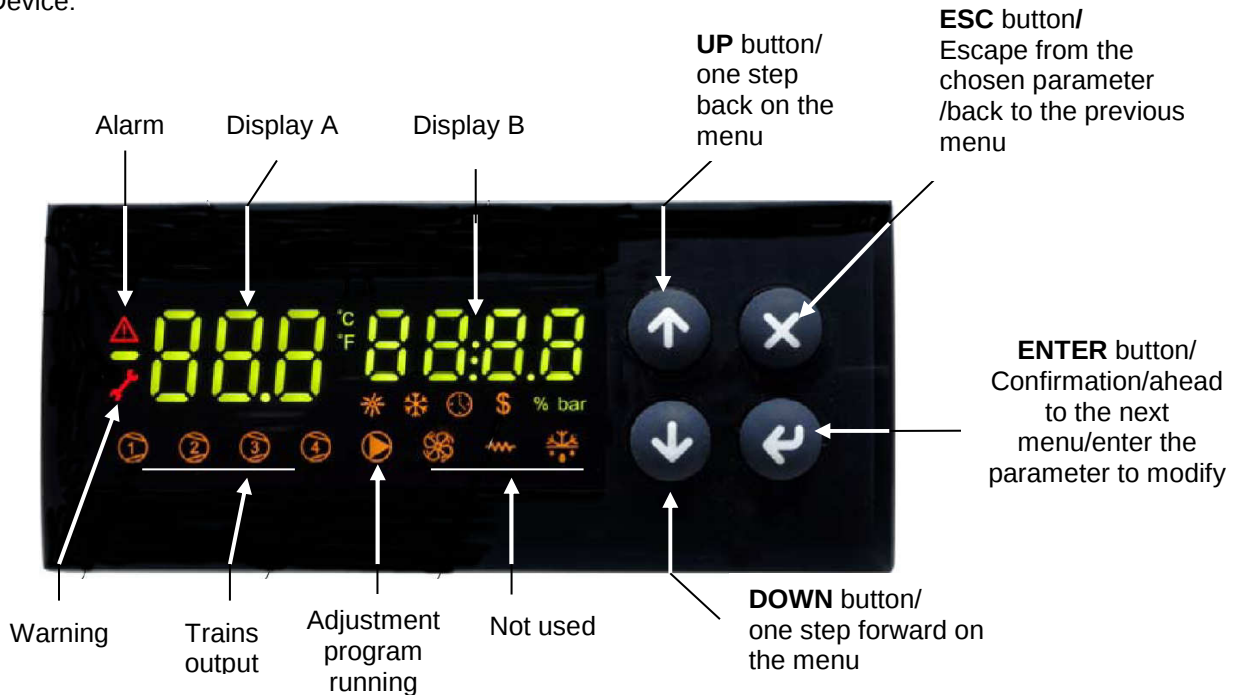
- t1 Prepurge time with air damper fully open
- t2 Safety time
- t3 Preignition time, short («Z» connected to terminal 16)
- T3' Preignition time, long («Z» connected to terminal 15)
- t3n Postignition time («Z» connected to terminal 15)
- t4 Interval between voltage at terminals 18 and 19 («BV1-BV2»)
- 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

# 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:

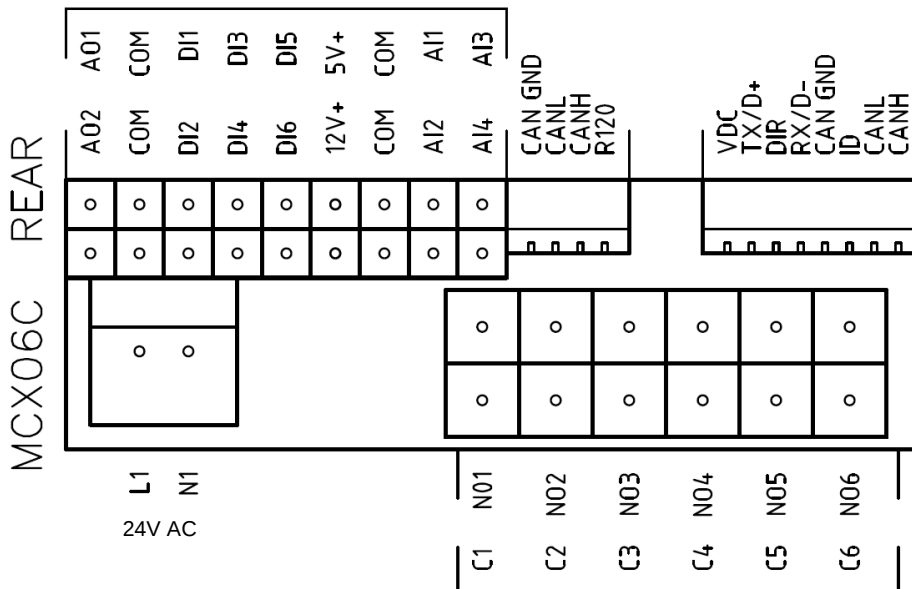
Device:



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.







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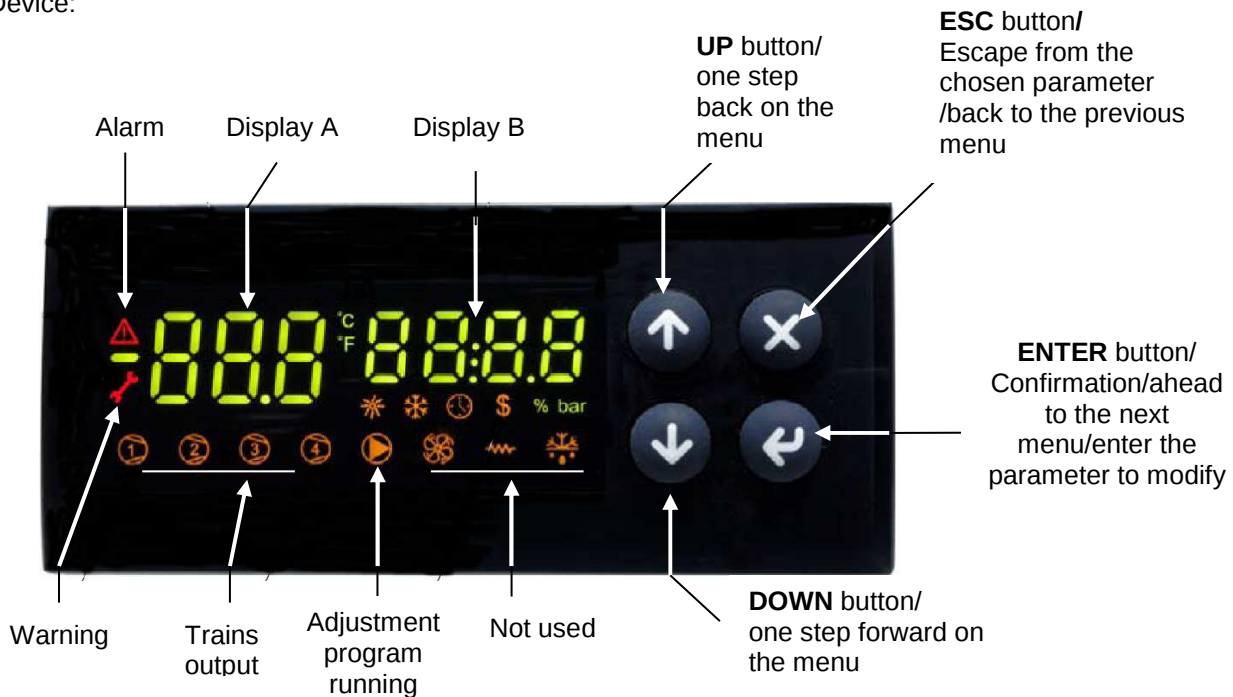
Note: specifications and data subject to change. Errors and omissions excepted.

# USER MANUAL OF MULTI-THERMOSTAT MCX06C

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

## User interface:

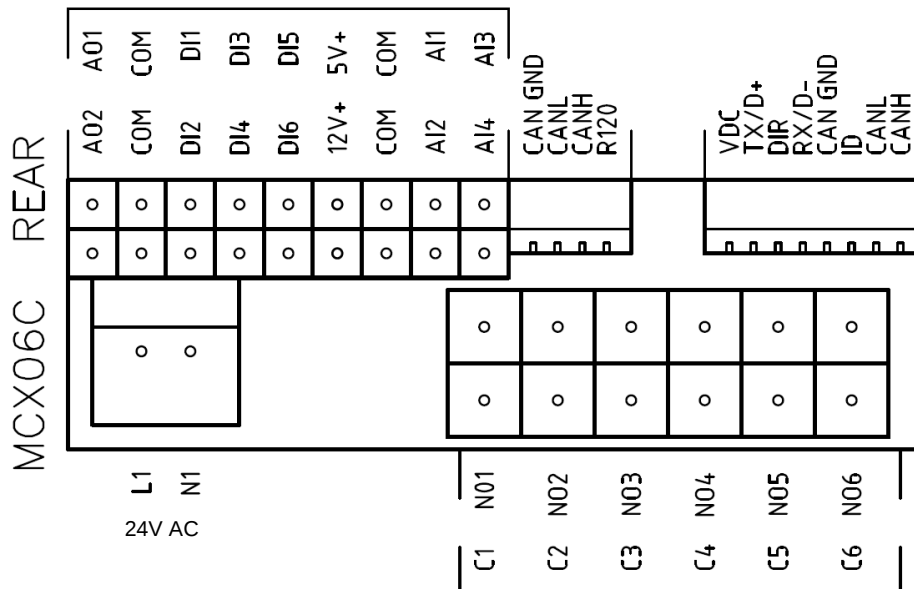
Device:



Note :

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

## Connections from terminal side:



## Probe connection:

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

**Menu:**

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| 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**.

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

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| 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.

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

Here below recommended set points:

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

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



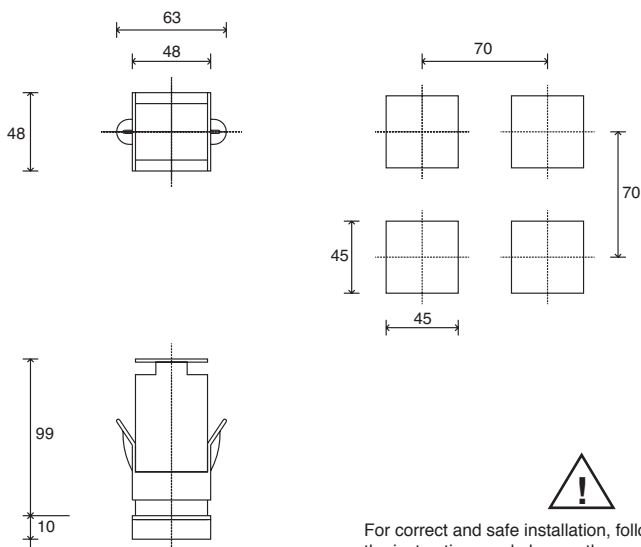
## USER'S MANUAL

COD. M12925CA Rel 1.2 08/2014

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

## 1 • INSTALLATION

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



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

#### Panel mounting:

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

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

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

Cut power to the device before accessing internal parts.

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

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

EMC conformity has been tested with the following connections

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

## 2 • TECHNICAL SPECIFICATIONS

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

### 3 • DESCRIPTION OF FACEPLATE

#### Function indicators

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

#### Automatic/Manual adjustment selection

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

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

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



#### Indication of output states

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

#### PV Display: Indication of process variable

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

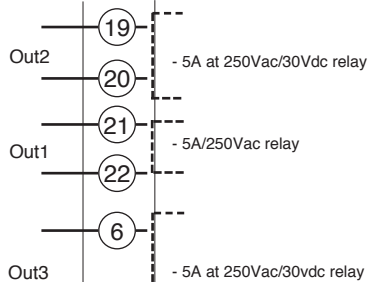
#### SV display: Indication of setpoint

#### Function key

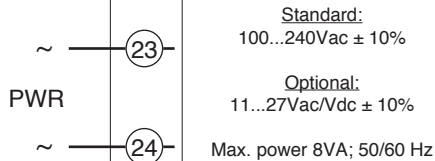
Gives access to the various configuration phases • Confirms change of set parameters and browses next or previous parameter (if Auto/Man key is pressed)

### 4 • CONNECTIONS

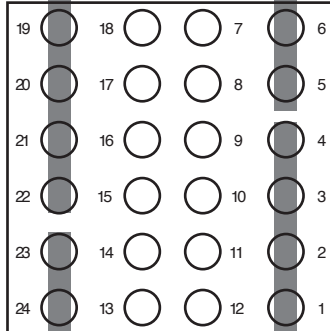
#### • Outputs



#### • Power Supply



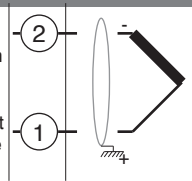
TOP



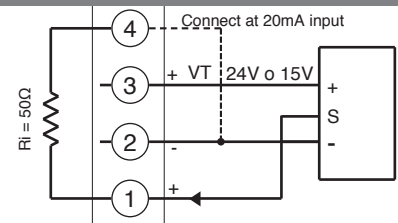
#### • Inputs

##### • TC Input

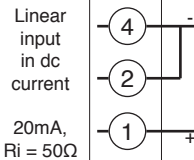
Available thermocouples:  
 J, K, R, S, T  
 (B, E, N, L, U, G, D, C custom linearization is available)  
 - Observe polarities  
 - For extensions, use the correct compensating cable for the type of TC used



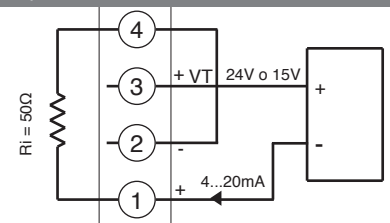
##### • Linear input with 3-wire transmitter



##### • Linear input (I)

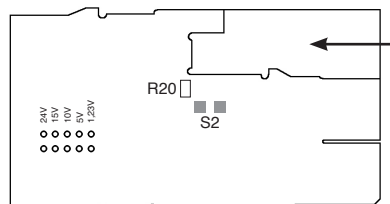


##### • Input 1 linear with transmitter 2 wires



#### • Identification of boards

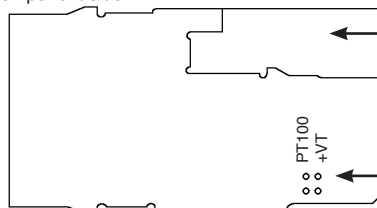
Power board - Solder side



Select transmitter voltage

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

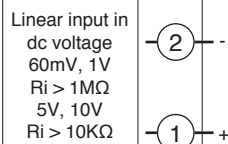
CPU board - Component side



IN/OUT boards (see appendix)

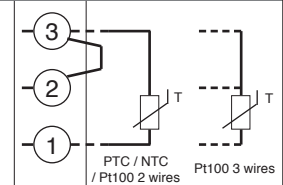
Select signal at contact 3

##### • Linear input (V)

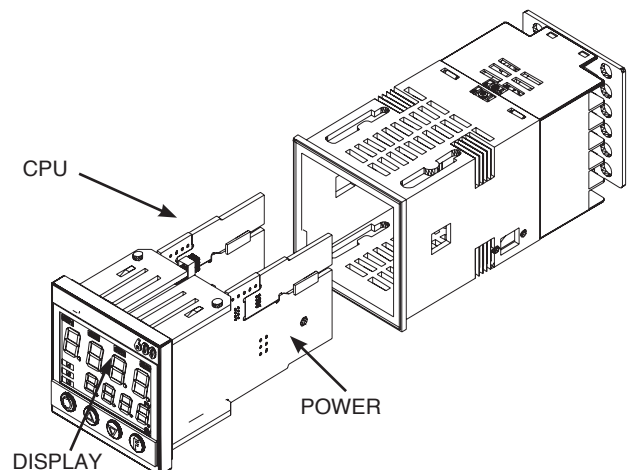


##### • Pt100 / PTC / NTC

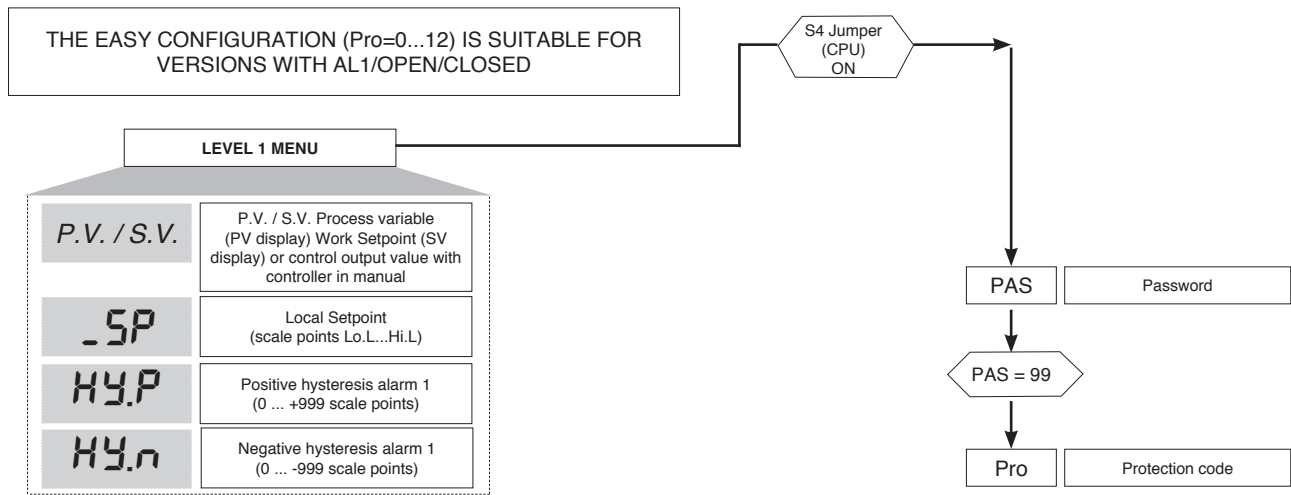
Use wires of adequate diameter (min. 1mm²)  
 PT100, JPT100, PTC, NTC



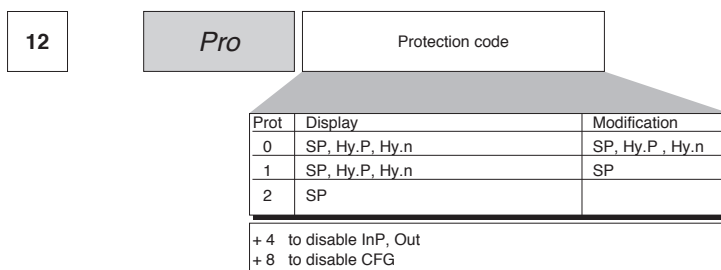
#### • Device structure



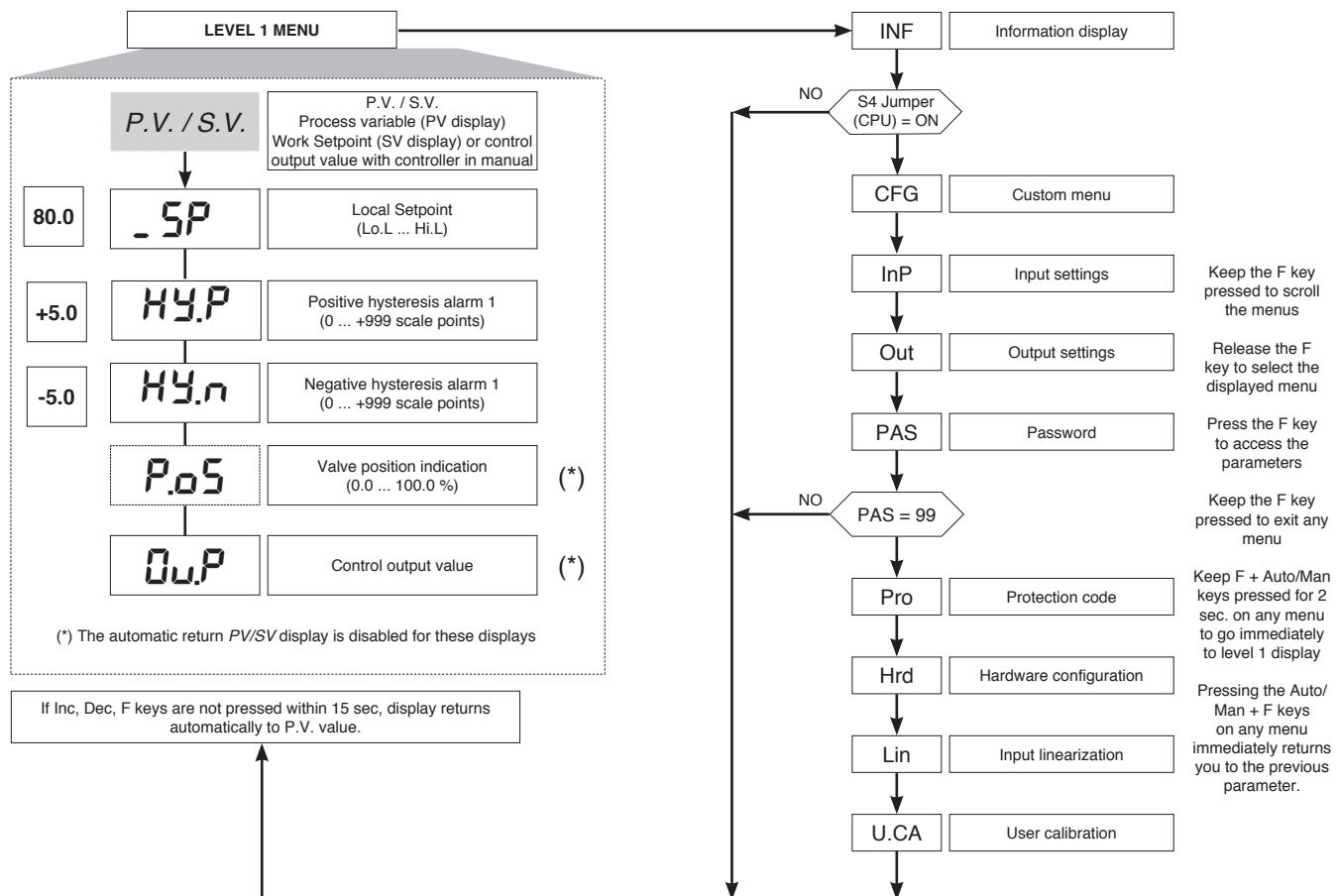
## 5 • “EASY” PROGRAMMING and CONFIGURATION



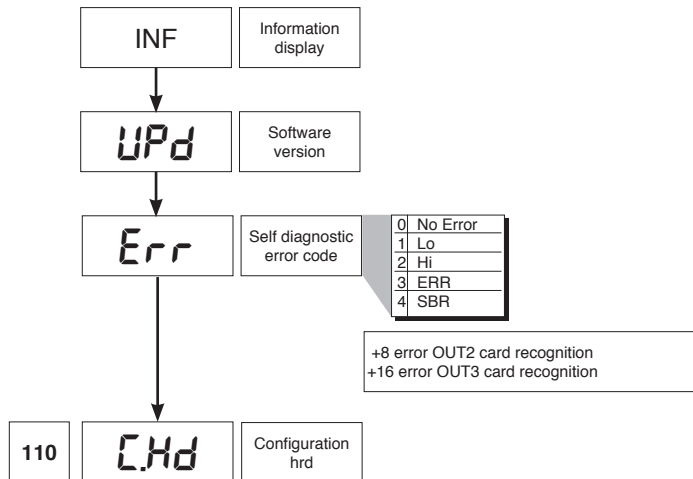
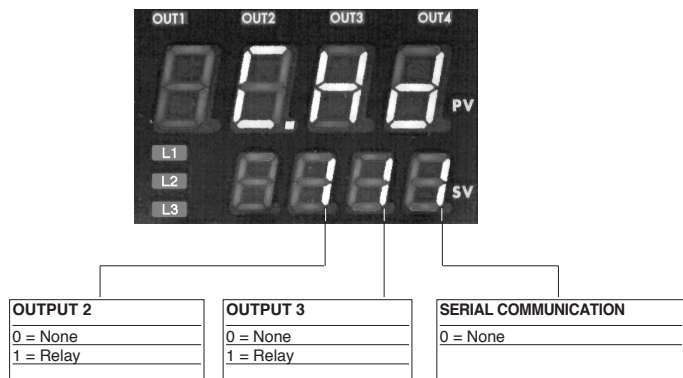
### • Prot



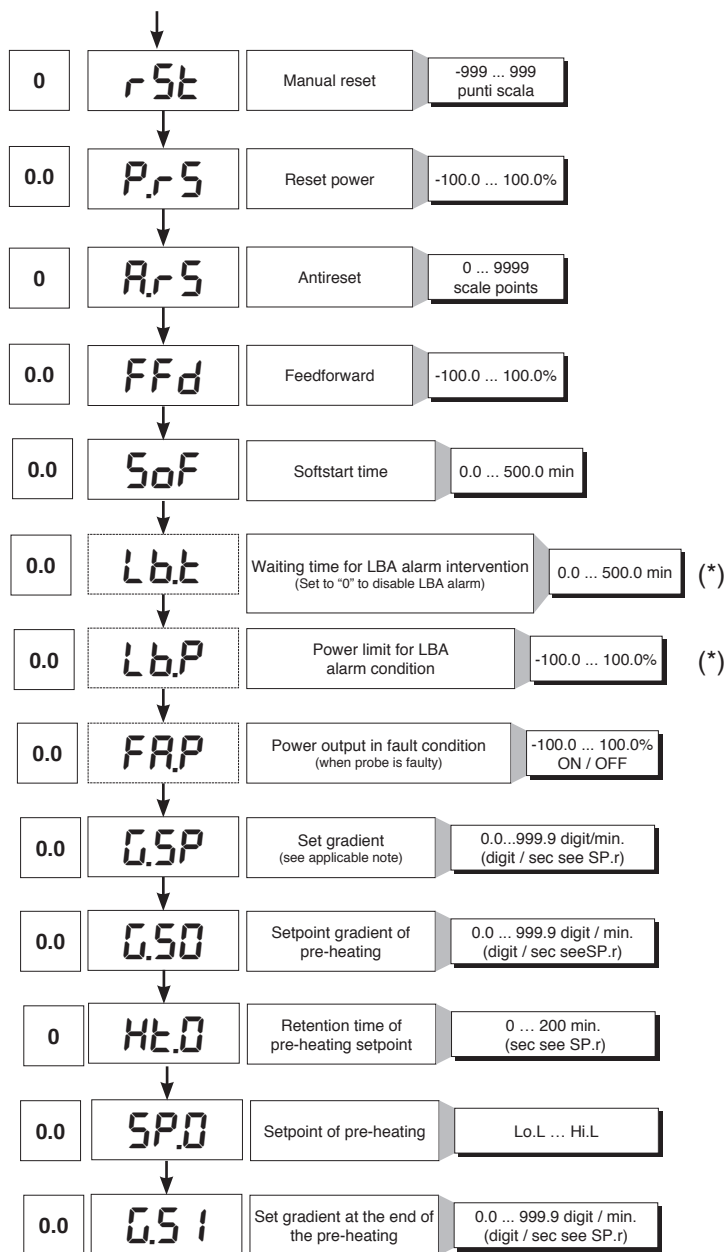
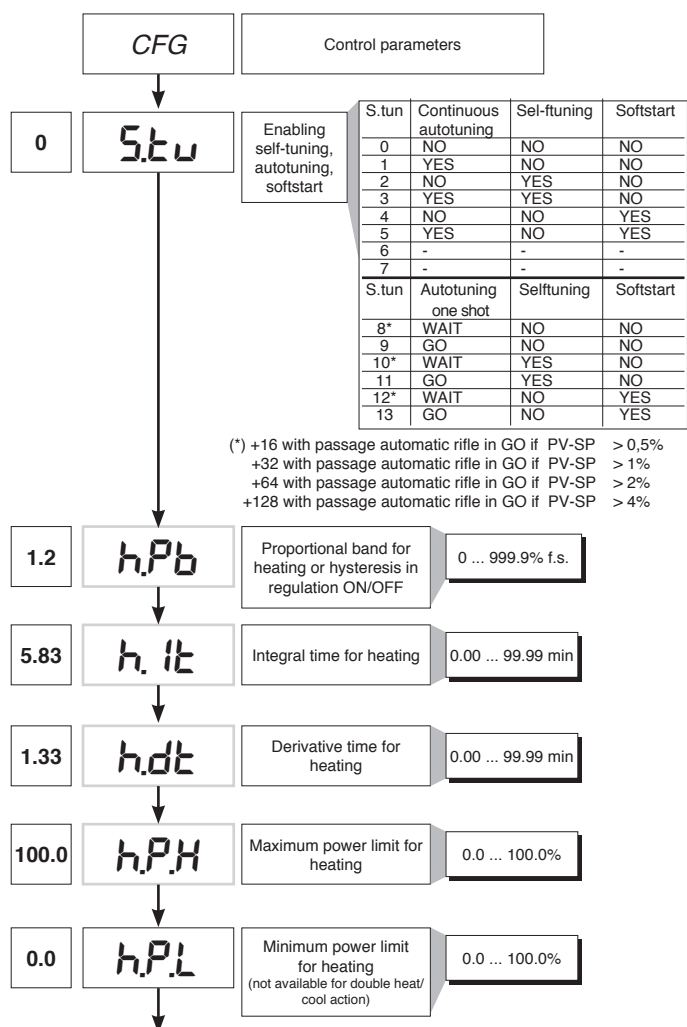
## 6 • PROGRAMMING and CONFIGURATION



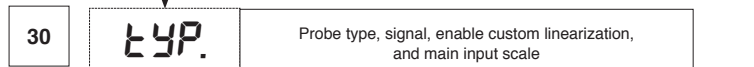
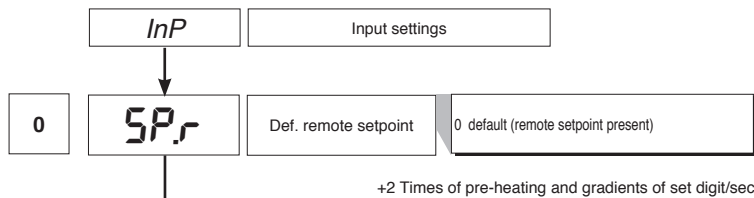
**N.B.:** Once a particular configuration is entered, all unnecessary parameters are no longer displayed



• CFG



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



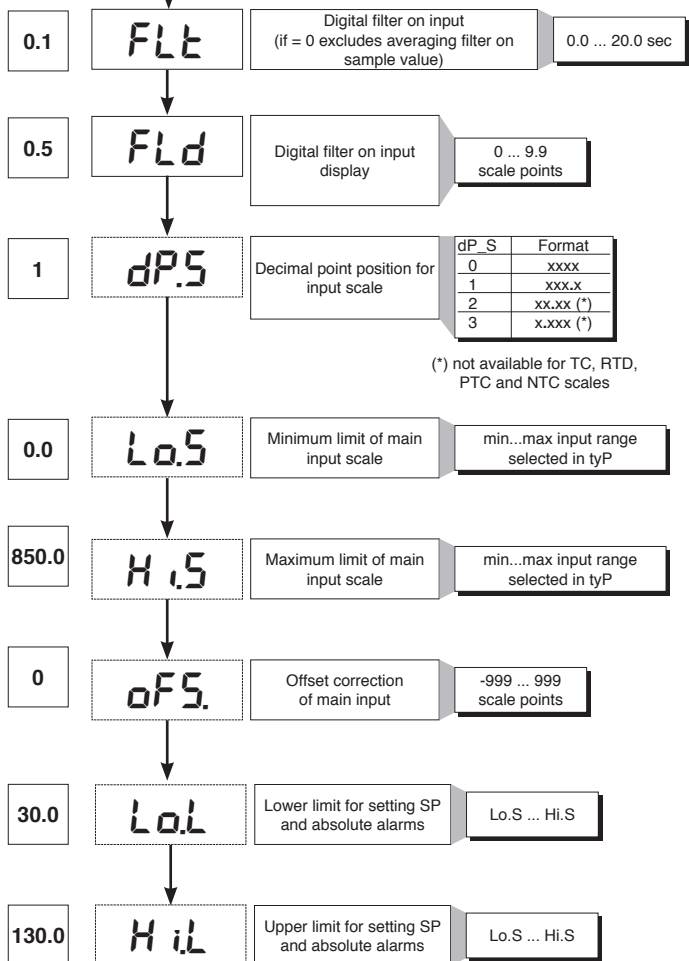
| Type | Probe type    | without decimal point | with decimal point |
|------|---------------|-----------------------|--------------------|
|      | Sensore:      | TC                    |                    |
| 0    | TC J °C       | 0/1000                | 0.0/999.9          |
| 1    | TC J °F    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

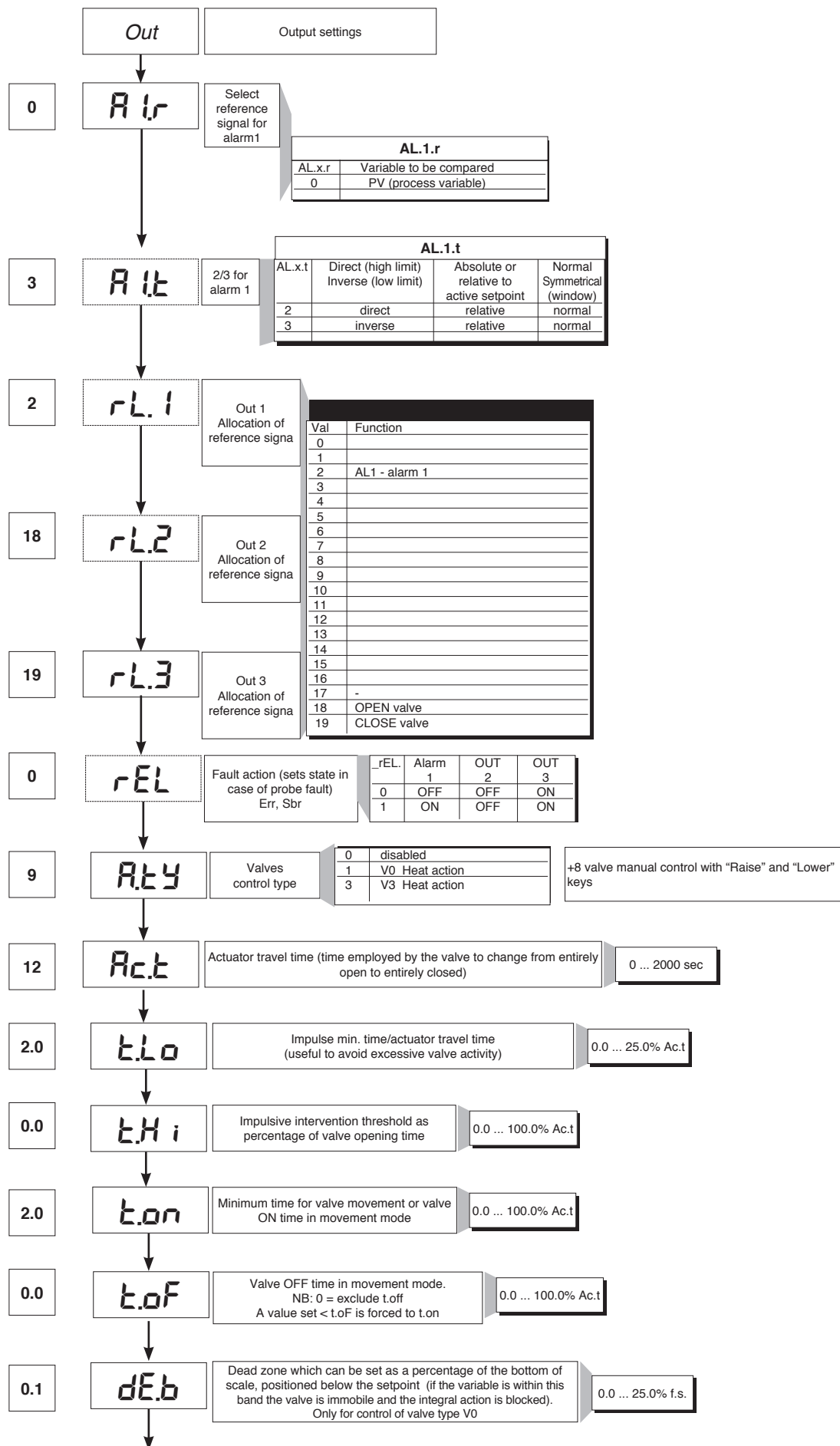
For custom linearization:  
 - LO signal is generated with variable below Lo.S or at minimum calibration value  
 - HI signal is generated with variable above Lo.S or at maximum calibration value

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

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

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





## • Prot

12

*Pro*

Protection code

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

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

Note: OuP and INF only display configuration extended

## • Hrd

*Hrd*

Hardware configuration

0

*hd.1*

Enable multiset instrument control by serial

6

*Ctrl*

Control type

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

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

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

1

*AL.n*

Select number of enabled alarms

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

1

*but.*

Function of M/A keys

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

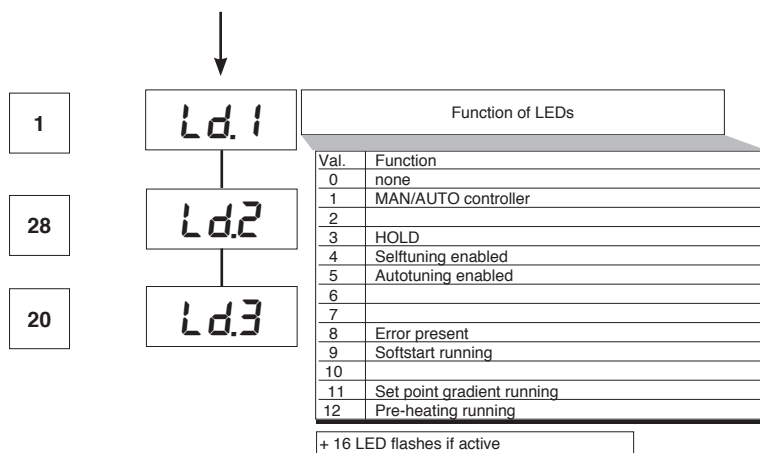
+ 16 disables the "back menu" function (Auto/Man + F keys) in the configuration menus

0

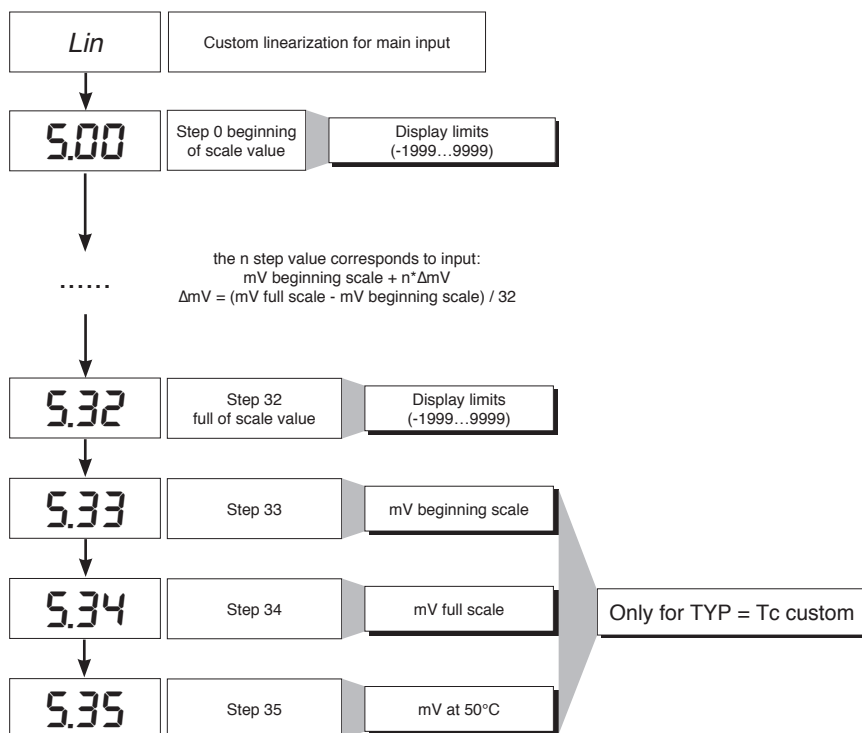
*dSP*

Defining SV display function

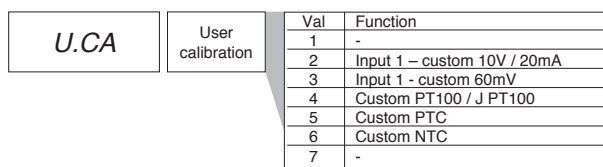
| diSP | Lower display (SV) function |
|------|-----------------------------|
| 0    | SSP - setpoint enabled      |
| 1    | PoS - valve position        |
| 2    | Control output value        |
| 3    | Deviation (SSP - PV)        |



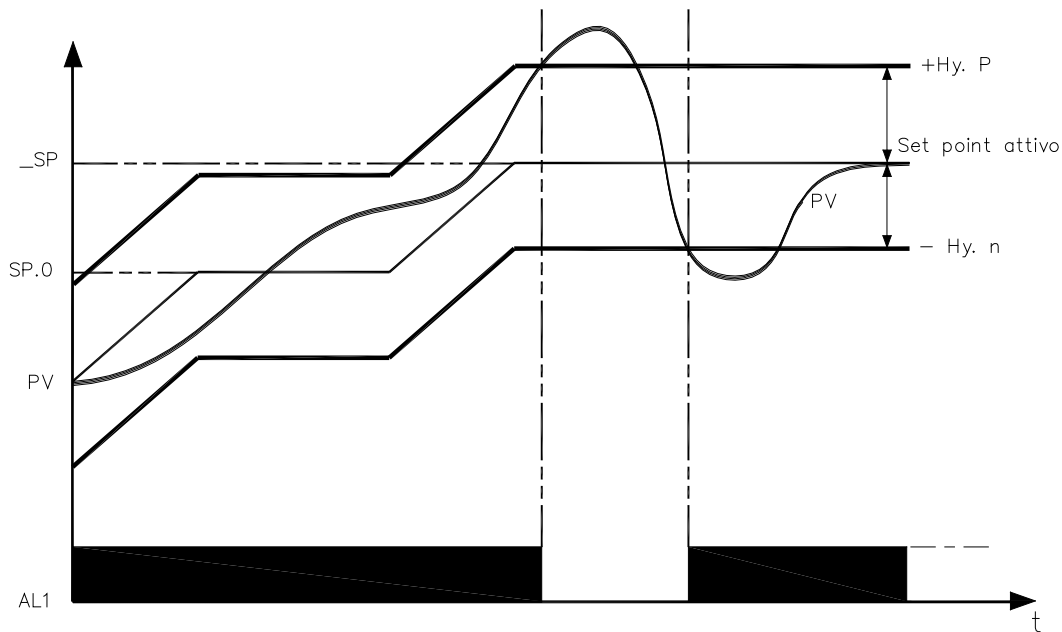
## • Lin



## • U.CAL



## 7 • CONSENT FOR BURNER AL1



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

## 8 • PRE-HEATING FUNCTION

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

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

### - Ramp 0 phase

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

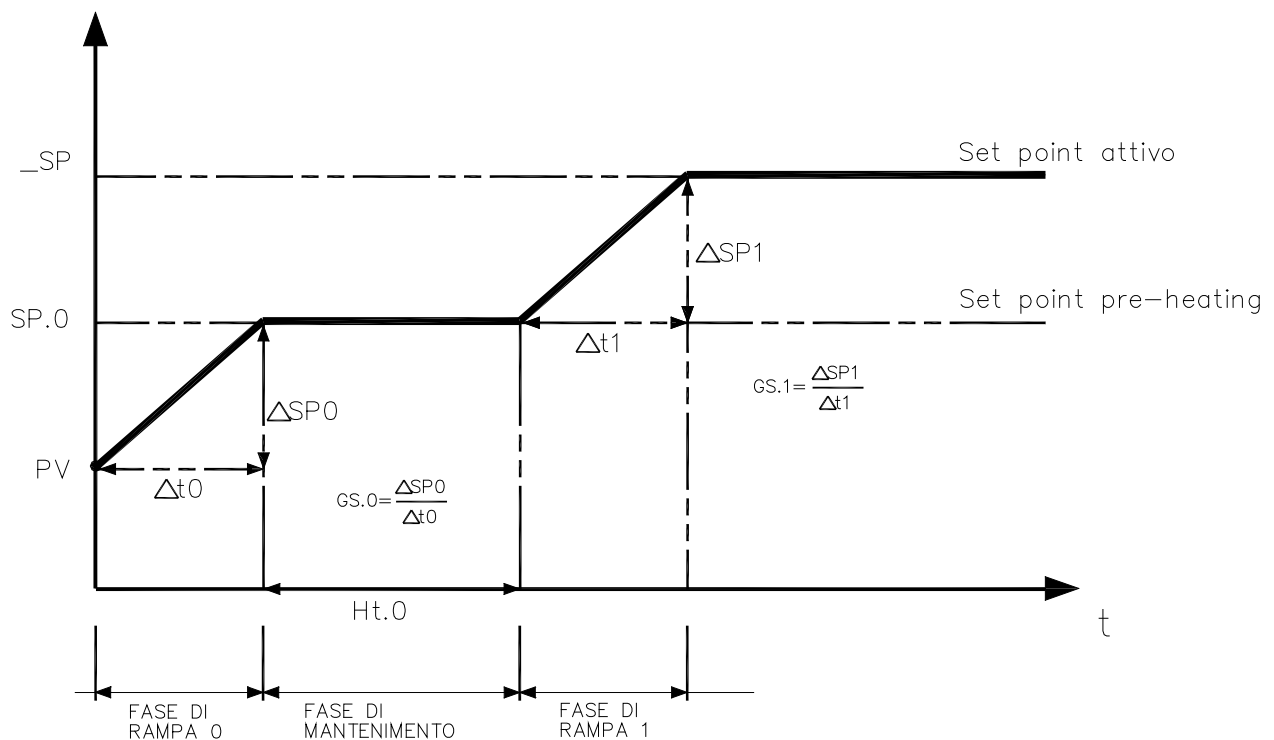
### - Maintenance phase

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

### - Ramp 1 phase

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

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



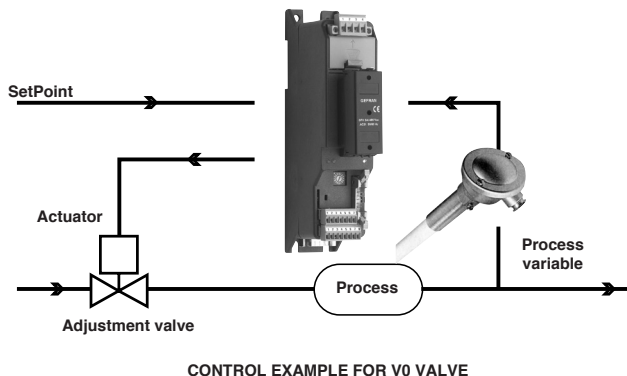
## 9 • ADJUSTMENT WITH MOTORIZED VALVE

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

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

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

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



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

### Characteristic parameters for valves control

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

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

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

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

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

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

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

You can choose between 2 types of control:

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

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

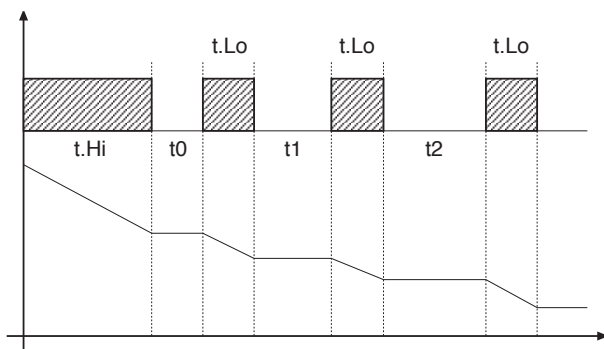
The type of movement approach allows fine control of the reverse drive valve (from potentiometer or not), especially useful in cases of high mechanical inertia.

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

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

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

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



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

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

$t0 = t.Lo$

## Valve control modes

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

**V0** - for floating valve without potentiometer

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

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

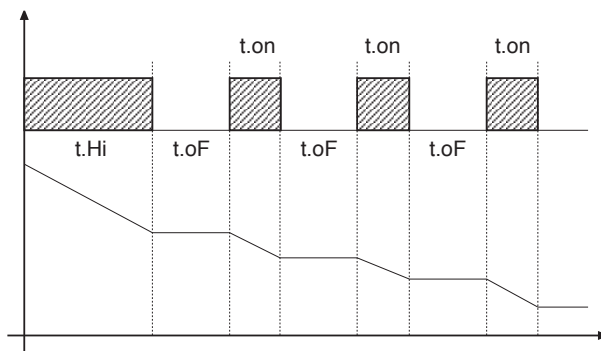
When the difference between the position calculated by the controller and the only proportional component exceeds the value corresponding to the minimum impulse t.Lo the controller provides an OPEN or CLOSE command of the duration of the minimum impulse itself t.Lo. At each delivery the integral component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

*Non-movement behavior*

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

*Movement behavior*

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



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

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

## 10 • CONTROL ACTIONS

*Proportional Action:*

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

*Derivative Action:*

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

*Integral Action:*

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

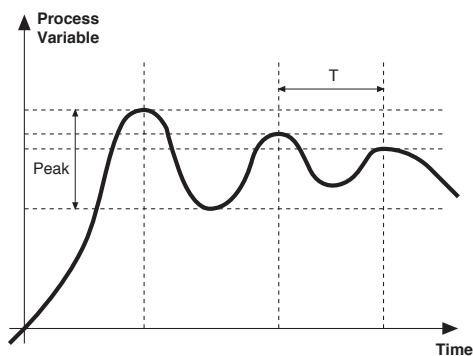
### Influence of Proportional, Derivative and Integral actions on response of process under control

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

Contact GEFRA for more information on control actions.

## 11 • MANUAL TUNING

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



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

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

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

Integral time:  $I_t = 1.5 \times T$

Derivative time:  $d_t = I_t/4$

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

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

## 12 • SET GRADIENT

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

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

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

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

## 13 • SOFTWARE ON / OFF SWITCHING FUNCTION

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

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

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

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

## 14 • SELF-TUNING

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

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

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

**How to activate self-tuning:**

### A. Activation at power-on

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

### B. Activation from keyboard

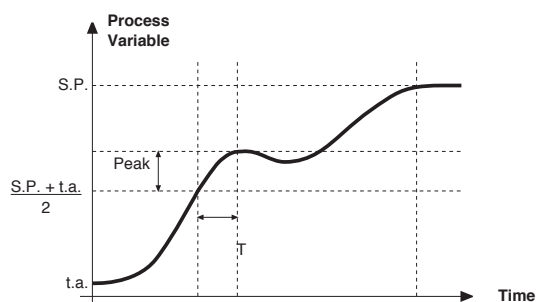
1. Make sure that key M/A is enabled for Start/Stop selftuning (code but = 6 Hrd menu)
2. Bring the temperature near room temperature
3. Set the setpoint to the required value
4. Press key M/A to activate selftuning (Attention: selftuning interrupts if the key is pressed again)

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

### Notes :

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

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



## 15 • ACCESSORIES

### • Interface for instrument configuration

KIT PC USB / RS485 o TTL



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

Lets you read or write all of the parameters

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

Component Kit:

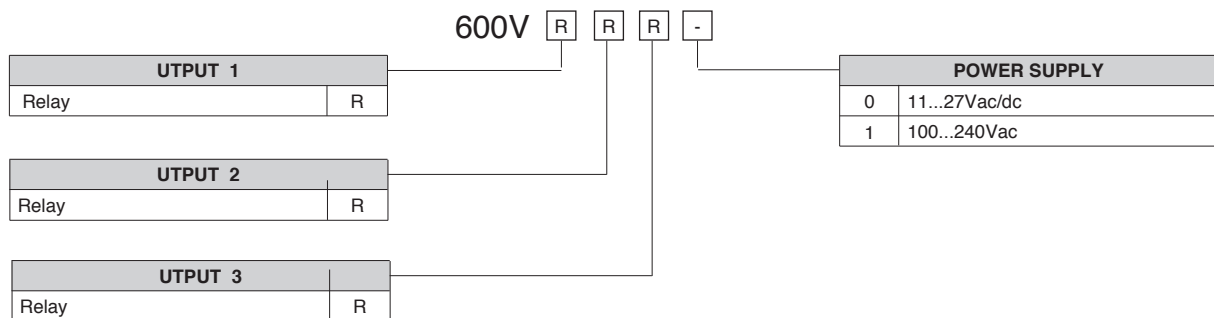
- Connection cable PC USB ... port TTL
- Connection cable PC USB ... RS485 port
- Serial line converter
- CD SW GF Express installation

### • ORDERING CODE

GF\_eXK-2-0-0

cod F049095

## 16 • ORDER CODE



### • WARNINGS

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

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

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

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

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

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

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

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

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

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

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

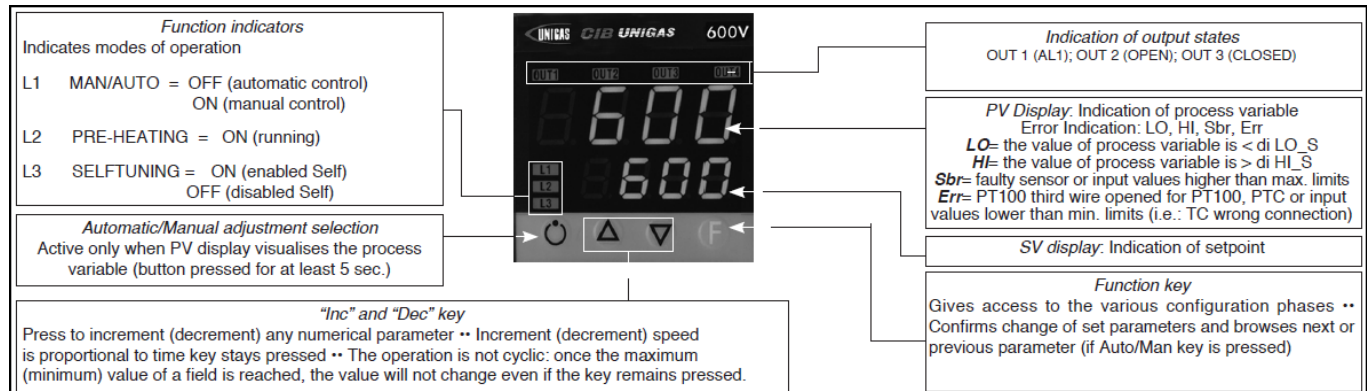


## Set-up for 600V RRR0-1-T73 regulator

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

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

Verify wiring of the sensor



Regulation of the set-point = 80

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

By pushing F you go to parameters:

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

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

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

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

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

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

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

#### Manual operation :

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

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

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

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

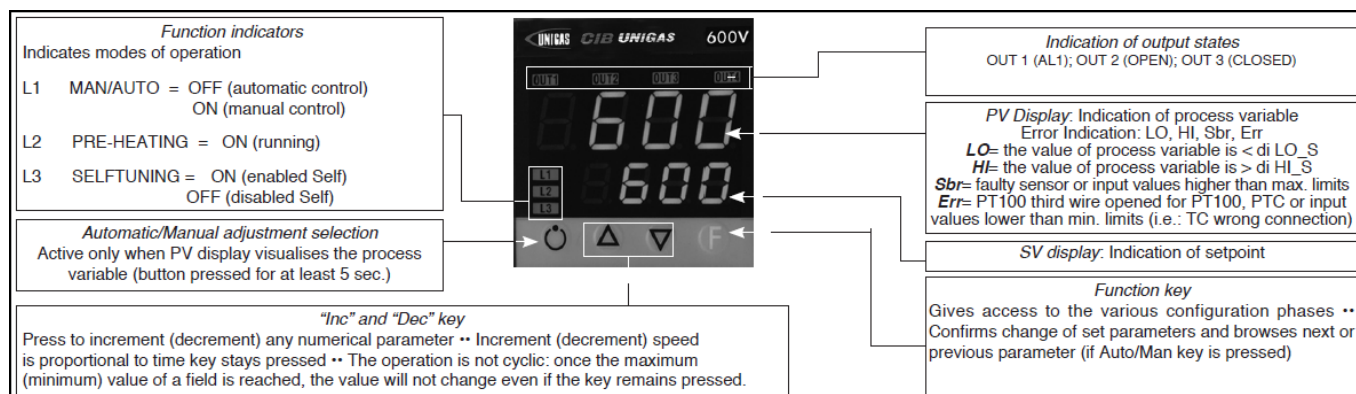
#### Software switch off :

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

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

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

Verify wiring of the sensor



Regulation of the set-point = 80

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

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

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

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

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

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

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

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

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

#### Manual operation:

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

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

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

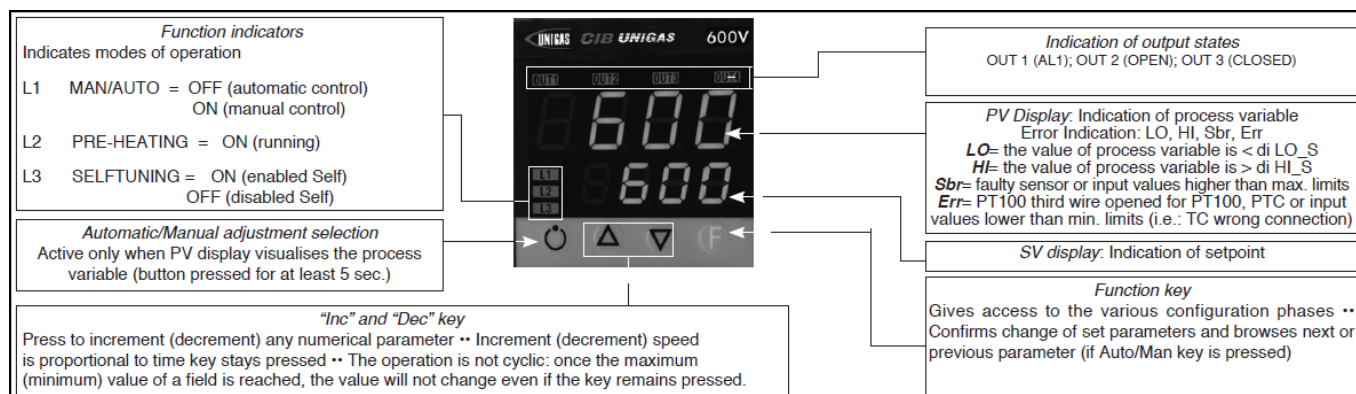
To come back to normal working keep the lower left key pushed for at least 5 sec.

#### Software switch off :

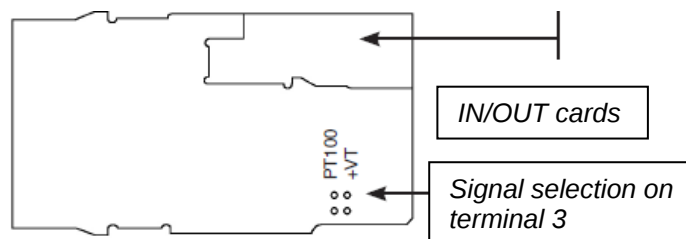
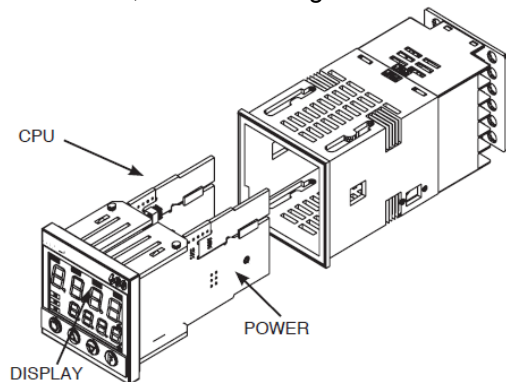
By keeping pushed keys **Arrow up** + **F** for more than 5 sec. the instrument switches off the software, does not command the outputs and visualize only the variable of process measured by the probe.

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

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



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



Verify wiring of the sensor

Impostazione set-point

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

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

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

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

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

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

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

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

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

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

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

#### Manual operation:

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

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

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

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

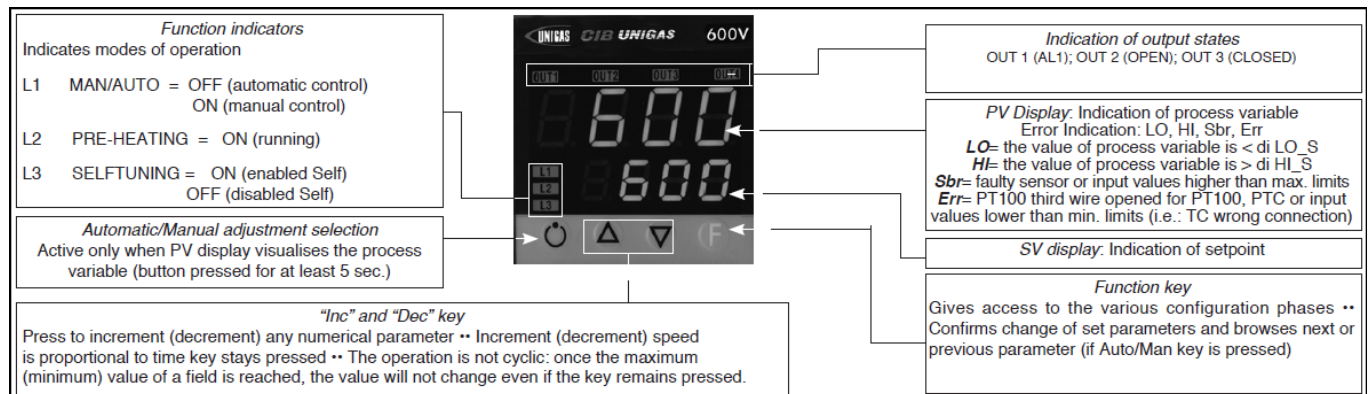
#### Software switch off :

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

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

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

Verify wiring of the sensor



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

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

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

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

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

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

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

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

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

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

#### Manual operation:

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

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

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

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

#### Software switch off :

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

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





# **MANUAL FOR OPERATION AND CALIBRATION**

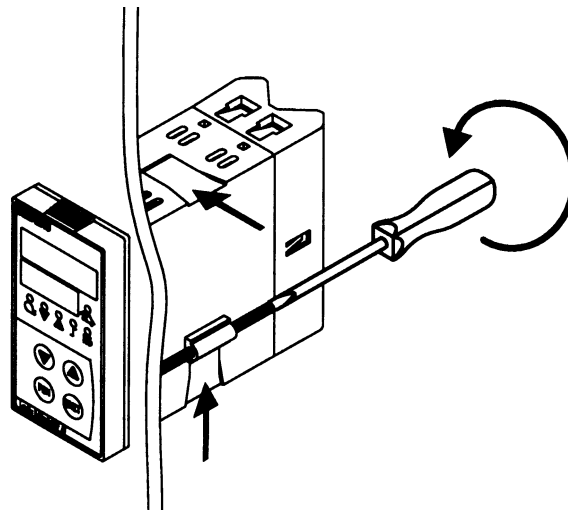
## **MODULATOR**

### **SIEMENS RWF 40....**

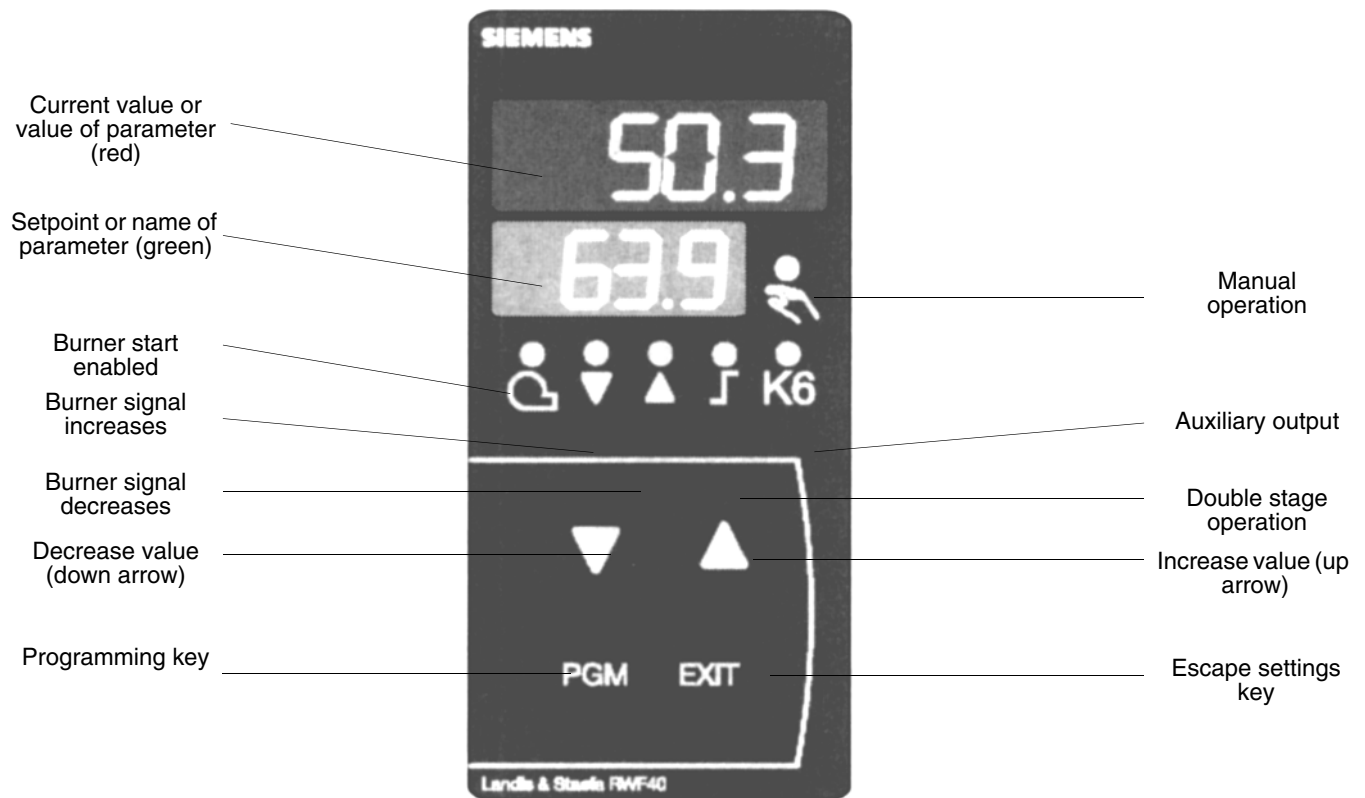
## INSTRUMENT MOUNTING

Mount the instrument using the relevant mounts as illustrated in the figure.

To wire the instrument and sensors, follow the instructions given on the burner's wiring diagrams.



## INSTRUMENT FRONTAL PANEL



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## INSTRUMENT SETTINGS

The instrument comes with a number of factory settings that are good for 90% of cases. However, you can set or edit parameters proceeding as follows

### 1. Setting or editing of setpoint value

With the burner switched off (thermostat/pressure switch series contacts open, i.e. terminals 3-4 open), press the PGM key, holding it down for less than 2 sec.. The display at the bottom (green) reads SP1: use the up and down arrows to set the setpoint value on the display at the top (red).

To confirm the value, press the **PGM** key, then press **EXIT** to return to normal operation.

### 2. Checking or editing the instrument's PID parameters (table 1 attached)

- Press the PGM key, holding it down for longer than 2 sec.. The code AL appears on the green display whilst the red display reads 0
- reads **0**.
- To change, use the up and down arrows to change the value on the red display.
- To confirm, press PGM and the green display moves on to the next parameter.
- Repeat the previous operations for all parameters.
- To stop, press the EXIT key.
- For a list of PID parameters, see table (1) attached.

### 3. Setting the kind of sensor to be connected to the instrument (table 2 attached)

- With the instrument in normal operating mode, press the **PGM** key, holding it down for 2 sec.. The instrument enters PID parameter configuration mode, hence press the **PGM** key for another 2 sec.
- The green display features the code **C111** whilst the red display gives the code **9030**.
- Each digit of the code corresponds to a settable parameter
- When the down arrow is pressed, the first digit on the left (n°9) on the red display starts flashing. Pressing the up arrow while the digit is flashing, you can change the value according to table (2) attached .
- Once you have edited the value, press the down arrow again and the second digit from the left (n°0) starts flashing and so on for all four digits. Press **PGM** to confirm and **EXIT** to exit.

Example: temperature sensor, set **9030**; pressure sensor, set **G030**.

### 4. C112 and C113 configurations (tables 3 & 4 attached) :

Configurations **C112** and **C113** enable use of an auxiliary contact (terminals Q63-Q64 and LED K6 on the front panel), which is fully configurable.

It also allows you to choose between degrees Celsius °C or Fahrenheit °F and to lock the instrument's keys.

With the instrument in normal operating mode, press the **PGM** key, holding it down for 2 sec.. The instrument enters PID parameter configuration mode, hence press the **PGM** key for another 2 sec..

The code **C111** appears on the green display whilst the red display reads **9030**. If you press **PGM** again, the green display reads **C112** and the red display reads **0110**.

For the instrument to work as standard, the **C112** configuration should never be altered, whilst the **C113** configuration should be changed when using pressure sensors or 0-10V / 0.4-20mA signals (see table (5) attached).

### 5. Configuring process values:

With the instrument in normal operating mode, press the **PGM** key for 2 sec.. The instrument enters PID parameter configuration mode. The code **C111** appears on the green display, whilst the code 9030 (or different code depending on settings made previously) appears on the red display. If you press **PGM** again, the code becomes **C112** and the red display reads 0010. When you next press **PGM**, the code becomes **C113** and the red display reads 0110. When you next press **PGM**, the green display reads **SCL** (=lower limit [instrument range start] for analogue input 1, valid for signals 0-10V, 0-20mA, 4-20mA, 0-100ohms etc.). Use the up arrow or down arrow to set the chosen value (see table (5) attached).

If you press the **PGM** key again, the green display reads **SCH** (=upper limit [instrument range end] for analogue input 1, valid for input signals 0-10V, 0-20mA, 4-20mA, 0-100ohms etc.). Use the up and down arrow to set the chosen value (see table (5) attached).

Example: for SIEMENS pressure sensor QBE2.. P25 (25bar), the input signal used is 0-10V: set **SCL** to 0 and **SCH** to 2500. That way the instrument's scale ranges from 0 to 2500 kPa (25 bar).

Pressing the **PGM** key repeatedly calls up the following parameters in sequence. These parameters can be edited with the up and down arrows:

---

**SCL2**: lower limit for analogue input 2 (same as SCL but for input 2 - factory setting 0);

**SCH2**: upper limit for analogue input 2 (same as SCH but for input 2 - factory setting 100);

**SPL**: lower setpoint limit (same as SCL but for setpoint - factory setting 0);

**SPH**: upper setpoint limit (same as SCH but for setpoint - factory setting 100);

Example: for SIEMENS pressure sensor QBE2.. P25 (25bar), the input signal used is 0-10V: if you want to work between 5 and 19 bar, set **SPL** to 500 and **SPH** to 1900 (kPa). That way the setpoint scale can be set between 500 and 1900 kPa (5 and 19 bar).

**OFF1**: correction for analogue input 1 (factory setting 0)

**OFF2**: correction for analogue input 2 (factory setting 0)

**OFF3**: correction for analogue input 3 (factory setting 0)

**HYST**: "K6" auxiliary contact differential (factory setting 1)

**dF1**: delay applied to sensor signal to prevent transients (range 0-100sec.; factory setting 1 sec.)

## 6. Manual control

- To control burner output manually, press the **EXIT** key for 5 sec. with the burner operating - the LED with the hand symbol lights.
- At this point, use the up arrow and down arrow to increase or decrease burner output.
- To exit manual mode, press the **EXIT** key.
- NB: Every time the controller switches the burner off (start enabled LED off - Q13-Q14 contact open), manual mode is disabled when the burner is switched back on.

## 7. Instrument self-setting (auto-tuning)

- If the burner in the steady state does not respond properly to heat generator requests, you can activate the instrument's self-setting function, which recalculates PID values for its operation, deciding which are most suitable for the specific kind of request
- To activate this function, proceed as follows:
- Press the **PGM** key and down arrow at the same time.
- The green display reads tunE and the instrument forces the burner to increase and decrease output.
- During these output oscillations, the instrument calculates the PID parameters (proportional band, integral time, derivative time).
- At the end of calculations, the tunE function switches off automatically and the instrument has stored the new parameters.
- If you want to disable the self-setting function, press the up arrow once it has started.
- PID parameters calculated by the instrument can be edited at any time following the procedure illustrated earlier in point 2.

### Note:

If no key is pressed for ~10sec. during the instrument's setting, the instrument automatically exits setting mode and returns to normal operating mode.

**TABLE 1 - "PID" PARAMETERS AND RELEVANT FACTORY SETTINGS**

| Parameter                                     | Display | Values range             | Factory setting | Remarks                                                                       |
|-----------------------------------------------|---------|--------------------------|-----------------|-------------------------------------------------------------------------------|
| Limit value for auxiliary contact (*)         | AL      | from -1999 to 9999 digit | 0               | Do not alter                                                                  |
| Auxiliary contact switching differential (*)  | HYST    | from 0 to 999.9 digit    | 1               | Do not alter                                                                  |
| Proportional band (*)                         | PB.1    | from 0.1 to 9999 digit   | 10              | Typical value for temperature                                                 |
| Derivative action                             | dt      | from 0 to 9999 sec.      | 80              | Typical value for temperature                                                 |
| Integral action                               | rt      | from 0 to 9999 sec.      | 350             | Typical value for temperature                                                 |
| Dead band (*)                                 | db      | from 0 to 999.9 digit    | 1               | Typical value                                                                 |
| Servocontrol running time                     | tt      | from 10 to 3000 sec.     | 15              | Set servocontrol running time                                                 |
| Switch-on differential (*)                    | HYS1    | from 0.0 to -199.9 digit | -5              | Value under setpoint below which the burner switches back on (Q13-Q14 closes) |
| Lower switch-off differential (*)             | HYS2    | from 0.0 to HYS3         | 3               | Do not alter                                                                  |
| Upper switch-off differential (*)             | HYS3    | from 0.0 to 999.9 digit  | 5               | Value over setpoint above which the burner switches off (Q13-Q14 opens)       |
| Modulating response threshold                 | q       | from 0.0 to 999.9        | 0               | Do not alter                                                                  |
| Weather compensation gradient                 | H       | from 0.0 to 4            | 1               | Do not alter                                                                  |
| Ambient temperature parallel displacement (*) | P       | from -90 to +90          | 0               | Do not alter                                                                  |

(\*) Parameters affected by setting of decimal place (C113 configuration 01X0)

**TABLE 2 - INPUTS CONFIGURATION C111**

| Red display                                         |          |          |          |          |
|-----------------------------------------------------|----------|----------|----------|----------|
| Analog input 1                                      | 1^ digit | 2^ digit | 3^ digit | 4^ digit |
| Pt100 3 wires                                       | 0        |          |          |          |
| Pt100 22 wires                                      | 1        |          |          |          |
| Ni100 3 wires                                       | 2        |          |          |          |
| Ni100 22 wires                                      | 3        |          |          |          |
| Pt1000 3 wires                                      | 4        |          |          |          |
| Pt 1000 22 wires                                    | 5        |          |          |          |
| Ni1000 3 wires DIN 43760                            | 6        |          |          |          |
| Ni1000 22 wires DIN 43760                           | 7        |          |          |          |
| Ni1000 3 wires Siemens                              | 8        |          |          |          |
| Ni1000 22 wires Siemens                             | 9        |          |          |          |
| Thermocoupling K NiCr-Ni                            | A        |          |          |          |
| Thermocoupling T Cu-Con                             | b        |          |          |          |
| Thermocoupling N NiCrSiI-NiSiI                      | C        |          |          |          |
| Thermocoupling J Fe-Con                             | d        |          |          |          |
| Signal 0 ÷ 20 mA                                    | E        |          |          |          |
| Signal 4 ÷ 20 mA                                    | F        |          |          |          |
| Signal 0 ÷ 10 V                                     | G        |          |          |          |
| Signal 0 ÷ 1 V                                      | H        |          |          |          |
| Analog input 2                                      |          |          |          |          |
| none                                                |          | 0        |          |          |
| external set point WFG                              |          | 1        |          |          |
| external set point 0 ÷ 20 mA                        |          | 2        |          |          |
| external set point 4 ÷ 20 mA                        |          | 3        |          |          |
| external set point 0 ÷ 10 V                         |          | 4        |          |          |
| external set point 0 ÷ 1 V                          |          | 5        |          |          |
| analog shift set-point WFG                          |          | 6        |          |          |
| analog shift set-point 0 ÷ 20 mA                    |          | 7        |          |          |
| analog shift set-point 4 ÷ 20 mA                    |          | 8        |          |          |
| analog shift set-point 0 ÷ 10 V                     |          | 9        |          |          |
| analog shift set-point 0 ÷ 1 V                      |          | A        |          |          |
| Analog input 3                                      |          |          |          |          |
| none                                                |          |          | 0        |          |
| external temperature sensor Pt 1000 22 wires        |          |          | 1        |          |
| external temperature sensor Ni1000 22 wires DIN     |          |          | 2        |          |
| external temperature sensor Ni1000 22 wires Siemens |          |          | 3        |          |
| Input D2 - Logic functions                          |          |          |          |          |
| none                                                |          |          |          | 0        |
| changeover set-point                                |          |          |          | 1        |
| V shift set-point                                   |          |          |          | 2        |
| Typical settings                                    |          |          |          |          |
| Siemens sensors QAE2../QAC2../QAM2..                | 9        | 0        | 3        | 0        |
| Factory sensors Pt1000 30÷130 °C                    | 5        | 0        | 3        | 0        |
| Factory sensors Pt1000 0 ÷ 350 °C                   | 5        | 0        | 3        | 0        |
| Pressure probes QBE... 3 wires (signal 0 ÷ 10 V)    | G        | 0        | 3        | 0        |
| Pressure probes MBS... 2 wires (signal 4 ÷ 20 mA)   | F        | 0        | 3        | 0        |
| Probes Pt100 3 wires                                | 0        | 0        | 3        | 0        |
| Thermocouplings K type                              | A        | 0        | 3        | 0        |
| Signal 4 ÷ 20 mA                                    | F        | 0        | 3        | 0        |

**TABLE 3 - CONFIGURATION C112**

| Red display                                                                  | 1 ^ digit | 2 ^ digit | 3 ^ digit | 4 ^ digit |
|------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|
| <b>Auxiliary limit switch K6</b>                                             |           |           |           |           |
| <b>none</b>                                                                  | <b>0</b>  |           |           |           |
| Ik1 function for input 1                                                     | 1         |           |           |           |
| Ik2 function for input 1                                                     | 2         |           |           |           |
| Ik3 function for input 1                                                     | 3         |           |           |           |
| Ik4 function for input 1                                                     | 4         |           |           |           |
| Ik5 function for input 1                                                     | 5         |           |           |           |
| Ik6 function for input1                                                      | 6         |           |           |           |
| Ik7 function for input 1                                                     | 7         |           |           |           |
| Ik8 function for input 2                                                     | 8         |           |           |           |
| Ik7 function for input 2                                                     | 9         |           |           |           |
| Ik8 function for input 2                                                     | A         |           |           |           |
| Ik7 function for input 3                                                     | b         |           |           |           |
| Ik8 function for input 3                                                     | C         |           |           |           |
| <b>Type of instrumentoutput control</b>                                      |           |           |           |           |
| 3 points (relay type)                                                        |           | <b>0</b>  |           |           |
| DC 0 ÷ 20 mA (*)                                                             |           | 1         |           |           |
| DC 4 ÷ 20 mA (*)                                                             |           | 2         |           |           |
| DC 0 ÷ 10 V (*)                                                              |           | 3         |           |           |
| <b>Set-point SP1</b>                                                         |           |           |           |           |
| SP1set with keys                                                             |           |           | 0         |           |
| <b>SP1 dependent on outside sensor (analogue input 3 must be configured)</b> |           |           | 1         |           |
| <b>Parameter lock</b>                                                        |           |           |           |           |
| no keyboard lock                                                             |           |           |           | <b>0</b>  |
| configuration level block                                                    |           |           |           | 1         |
| parameters level block PID                                                   |           |           |           | 2         |
| total block                                                                  |           |           |           | 3         |
| <b>Factory settings</b>                                                      | <b>0</b>  | <b>0</b>  | <b>1</b>  | <b>0</b>  |

**Note: (\*) for RWF 40.002 only**

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**TABLE 4 - CONFIGURATION C113**

| <b>Red display</b>                               | <b>1^ digit</b> | <b>2^ digit</b> | <b>3^ digit</b> | <b>4^ digit</b> |
|--------------------------------------------------|-----------------|-----------------|-----------------|-----------------|
| <b>Instrument addresses (for RWF 40.003 only</b> |                 |                 |                 |                 |
| <b>address 0</b>                                 | <b>0</b>        |                 |                 |                 |
| <b>address 1</b>                                 | <b>0</b>        | <b>1</b>        |                 |                 |
| address...                                       | ...             | ...             |                 |                 |
| address 99                                       | 9               | 9               |                 |                 |
| <b>Unit of measurement and decimal place</b>     |                 |                 |                 |                 |
| °C without decimal                               |                 |                 | 0               |                 |
| <b>°C and 1 decimal</b>                          |                 |                 | <b>1</b>        |                 |
| °F without decimal                               |                 |                 | 2               |                 |
| °F and 1 decimal                                 |                 |                 | 3               |                 |
| <b>Activation of “K6”</b>                        |                 |                 |                 |                 |
| <b>limit contact OFF</b>                         |                 |                 |                 | <b>0</b>        |
| limit contact ON                                 |                 |                 |                 | 1               |
| <b>Factory settings</b>                          | <b>0</b>        | <b>1</b>        | <b>1</b>        | <b>0</b>        |

**TABLE 5 - SUMMARY OF STANDARD PARAMETER SETTINGS**

|                                  | PARAMETERS TO BE EDITED |                                                                                                          |             |             |             |             |             |             |       |    |     |             |
|----------------------------------|-------------------------|----------------------------------------------------------------------------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------|----|-----|-------------|
| SENSORS/PROBES                   | C111                    | C113                                                                                                     | SCL         | SCH         | SPL         | SPH         | HYS1 (*)    | HYS3 (*)    | Pb. 1 | dt | rt  | SP1 (*)     |
| Siemens QAE2120.010              | 9030                    | 0110                                                                                                     | -           | -           | 30          | 95          | -5          | 5           | 10    | 80 | 350 | 80°C        |
| Siemens QAM2120.040              | 9030                    | 0110                                                                                                     | -           | -           | 0           | 80          | -2,5        | 2,5         | 10    | 80 | 350 | 40°C        |
| Pt1000 (130°C max.)              | 5030                    | 0110                                                                                                     | -           | -           | 30          | 95          | -5          | 5           | 10    | 80 | 350 | 80°C        |
| Pt1000 (350°C max.)              | 5030                    | 0110                                                                                                     | -           | -           | 0           | 350         | -5          | 10          | 10    | 80 | 350 | 80°C        |
| Pt100 (130°C max.)               | 0030                    | 0110                                                                                                     | -           | -           | 0           | 95          | -5          | 5           | 10    | 80 | 350 | 80°C        |
| Pt100 (350°C max)                | 0030                    | 0110                                                                                                     | -           | -           | 0           | 350         | -5          | 10          | 10    | 80 | 350 | 80°C        |
| Termocouple K                    | A030                    | 0110                                                                                                     | -           | -           | 0           | 1200        | -5          | 20          | 10    | 80 | 350 | 80°C        |
| Danfoss/Siemens 4÷20mA p 1,6 bar | F030                    | 0100                                                                                                     | 0           | 160         | 0           | 160         | 0           | 20          | 5     | 20 | 80  | 100kPa      |
| Danfoss/Siemens 4÷20mA p 10 bar  | F030                    | 0100                                                                                                     | 0           | 1000        | 0           | 1000        | 0           | 50          | 5     | 20 | 80  | 600kPa      |
| Danfoss/Siemens 4÷20mA p 16 bar  | F030                    | 0100                                                                                                     | 0           | 1600        | 0           | 1600        | 0           | 80          | 5     | 20 | 80  | 600kPa      |
| Danfoss/Siemens 4÷20mA p 25 bar  | F030                    | 0100                                                                                                     | 0           | 2500        | 0           | 2500        | 0           | 125         | 5     | 20 | 80  | 600kPa      |
| Danfoss/Siemens 4÷20mA p 40 bar  | F030                    | 0100                                                                                                     | 0           | 4000        | 0           | 4000        | 0           | 200         | 5     | 20 | 80  | 600kPa      |
| Siemens QBE2.. P4                | G030                    | 0100                                                                                                     | 0           | 400         | 0           | 400         | 0           | 20          | 5     | 20 | 80  | 200kPa      |
| Siemens QBE2.. P10               | G030                    | 0100                                                                                                     | 0           | 1000        | 0           | 1000        | 0           | 50          | 5     | 20 | 80  | 600kPa      |
| Siemens QBE2.. P16               | G030                    | 0100                                                                                                     | 0           | 1600        | 0           | 1600        | 0           | 80          | 5     | 20 | 80  | 600kPa      |
| Siemens QBE2.. P25               | G030                    | 0100                                                                                                     | 0           | 2500        | 0           | 2500        | 0           | 125         | 5     | 20 | 80  | 600kPa      |
| Siemens QBE2.. P40               | G030                    | 0100                                                                                                     | 0           | 4000        | 0           | 4000        | 0           | 200         | 5     | 20 | 80  | 600kPa      |
| Signal 0÷10V                     | G030                    | to be fixed                                                                                              | to be fixed | to be fixed | to be fixed | to be fixed | to be fixed | to be fixed | 5     | 20 | 80  | to be fixed |
| Signal 4÷20mA                    | F030                    | to be fixed                                                                                              | to be fixed | to be fixed | to be fixed | to be fixed | to be fixed | to be fixed | 5     | 20 | 80  | to be fixed |
| tt - servocontrol run            | 12 sec.                 | Servocontrol Berger STA12B.../Siemens SQN30.251/Siemens SQN72.4A4A20                                     |             |             |             |             |             |             |       |    |     |             |
| tt - servocontrol run            | 13 sec.                 | Servocontrol Berger STA13B...                                                                            |             |             |             |             |             |             |       |    |     |             |
| tt - servocontrol run            | 15 sec.                 | Servocontrol Berger STA15B...                                                                            |             |             |             |             |             |             |       |    |     |             |
| tt - servocontrol run            | 30 sec.                 | Servocontrol Siemens SQL33.03/Siemens SQM10/Siemens SQM50/Siemens SQM54/Berger STM30../Siemens SQM40.265 |             |             |             |             |             |             |       |    |     |             |

## NOTES

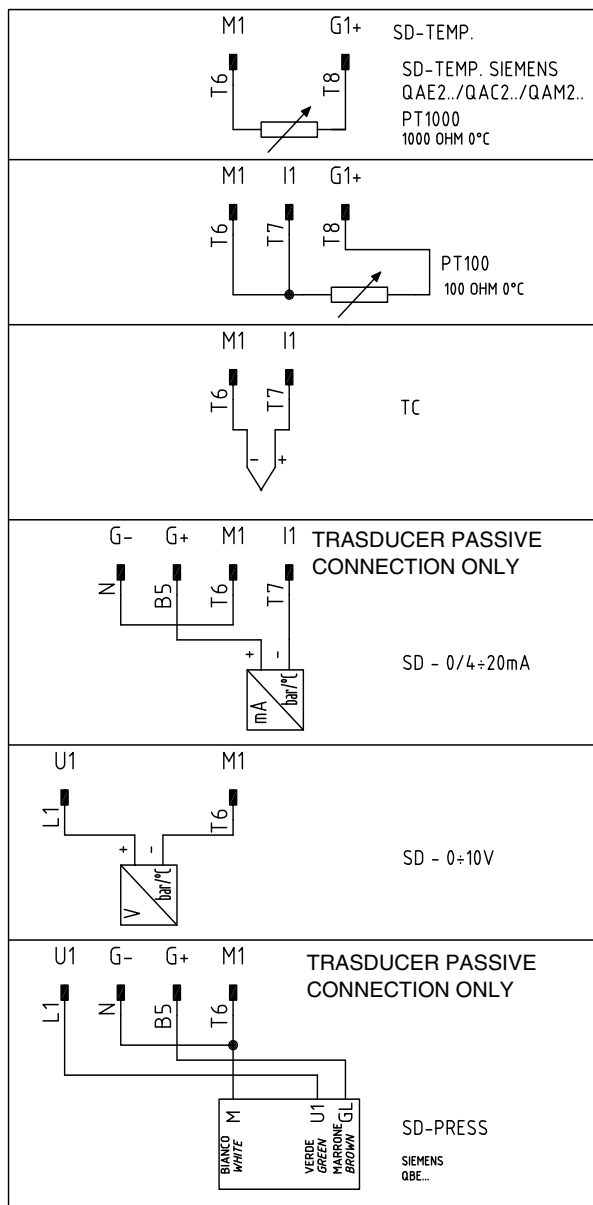
(\*) These values are factory set - values must be set during operation at the plant based on the real working temperature/pressure value.

## WARNING

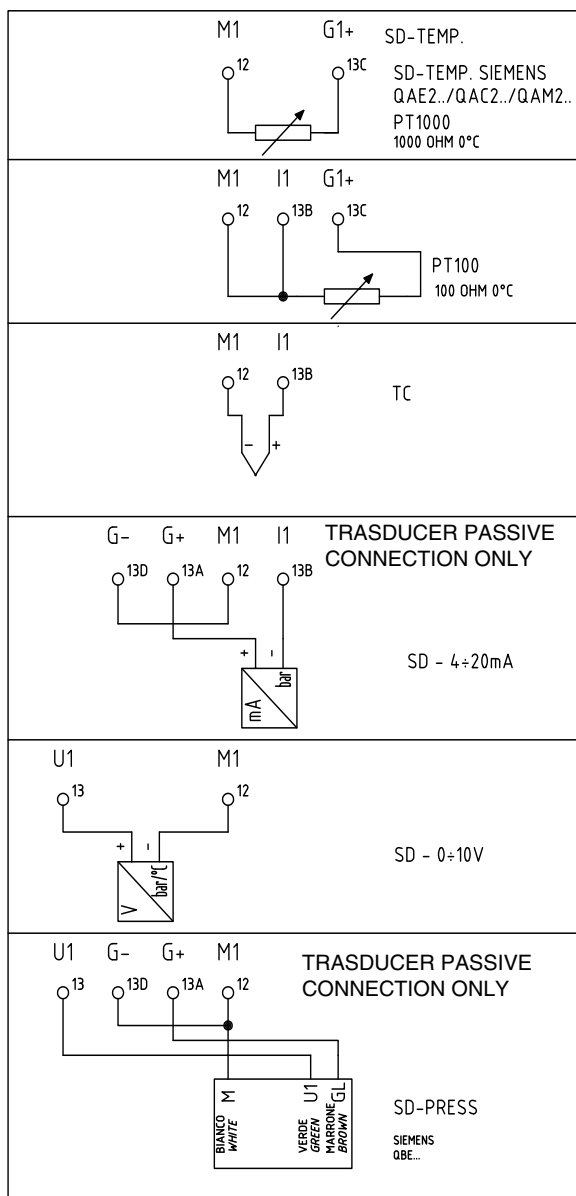
With pressure sensors, parameters SP1, SCH, SCL, HYS1, HYS3 must be selected and displayed in kPa (kilo Pascal).  
(1bar = 100,000Pa = 100kPa)

**Probe electric connection :**

With 7 pins connector version

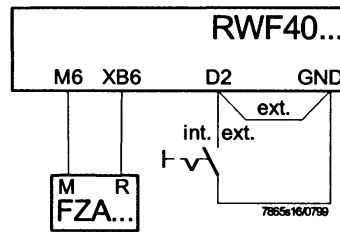


With terminals version



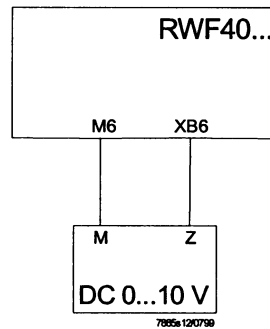
---

### With external setpoint



C111 configuration code = X1X1

### With setpoint modified by independent management system



C111 configuration code = X9XX

$$SCH2 = 0.5 \times (SPH - SPL)$$

$$SCL2 = -0.5 \times (SPH - SPL)$$

Example:

SPH = max. 130° C

SPL = min. 30° C

$$SCH2 = 0.5 \times (130 - 30) = 50$$

$$SCL2 = -0.5 \times (130 - 30) = -50$$

## 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.

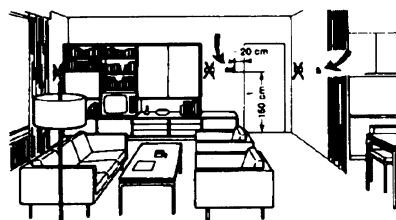
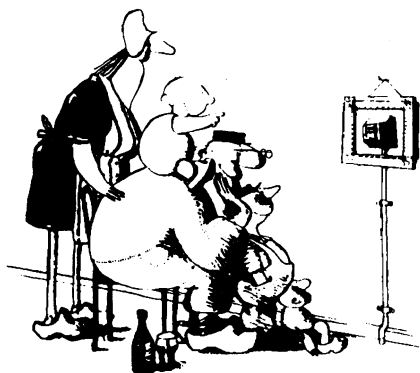
Measurement is taken based on design features (time constant) and according to specific operating conditions.

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.



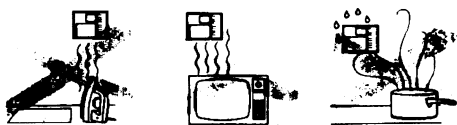
### Outside probes (weather)

#### 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

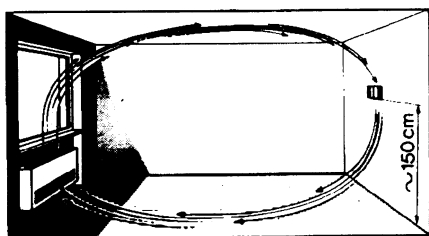
Heating systems: the room sensor must not be installed in rooms with heating units complete with thermostatic valves. Avoid all sources of heat foreign to the system.



**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

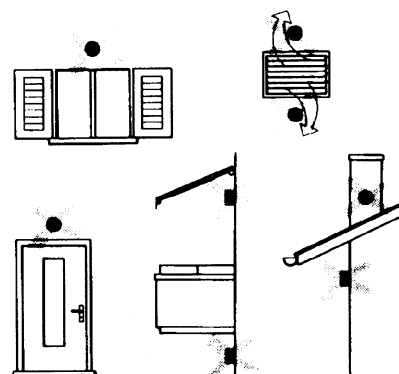
On an inner wall on the other side of the room to heating units height above floor 1.5 m, at least 1.5 m away from external sources of heat (or cold)



#### 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

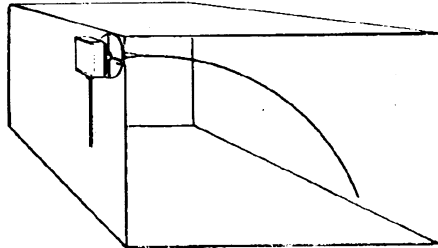
### Installing temperature sensors

For measuring outlet air:

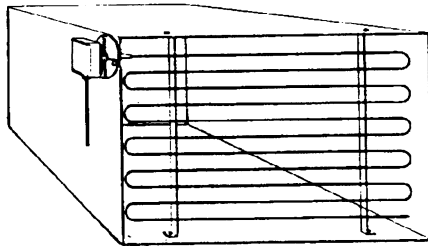
- after delivery fan or
- after coil to be controlled, at a distance of at least 0,5 m

For measuring room temperature:

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



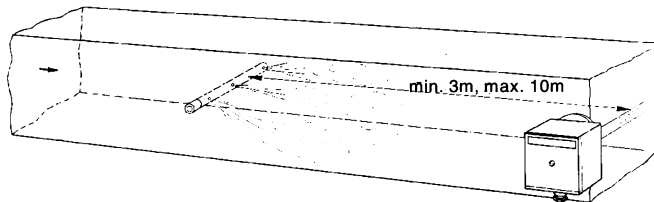
Bend 0.4m sensor by hand (never use tools) as illustrated.



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).



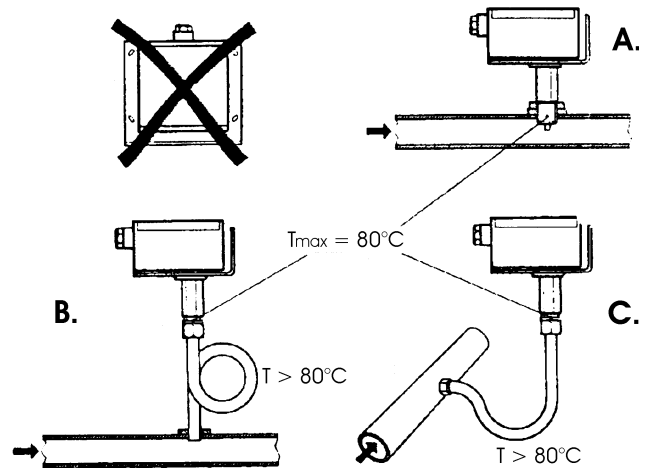
### Installing pressure sensors

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

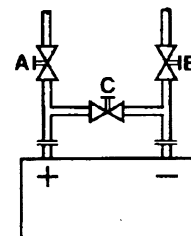
start disable

1=open C1=open C

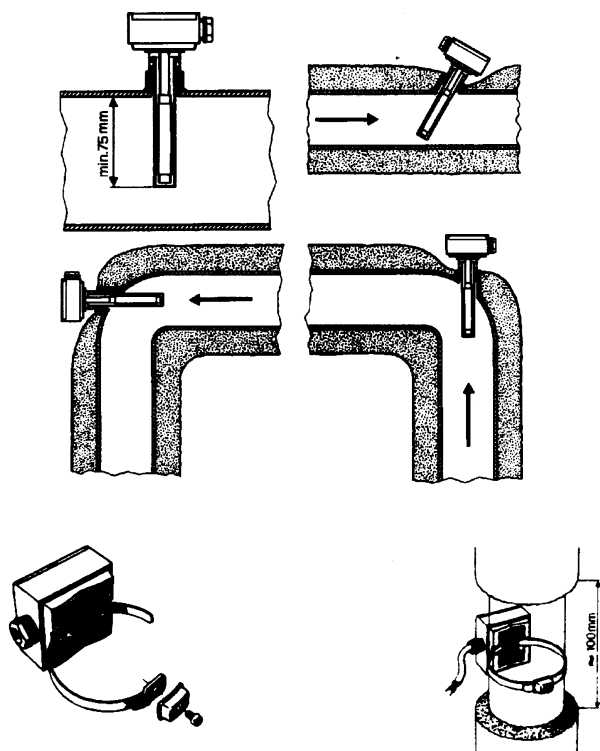
2=open A2=close B

3=open B3=close A

4= close C



## Immersion or strap-on sensors



### Immersion probes mounting

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

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

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

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

### Installing QAD2.. strap-on sensors

Make sure fluid is circulating in the chosen location.

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

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

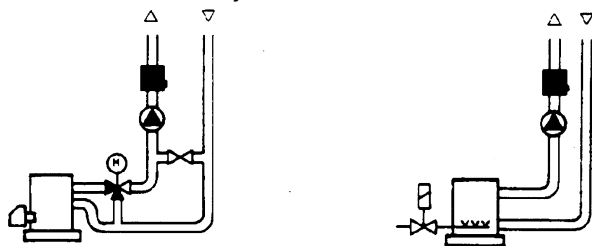
## Placing the probes (QAD22.../QAE21.../QAP21.../RCA...)

### With pumps on outlet

with 3 ways valves / with 4 ways valves



Panel system / burner control



### With pumps on return

with 3 ways valves / with 4 ways valves



### Strap-on or immersion sensors?

#### QAD2.. strap-on sensors

Advantages

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

Limits:

Suitable for pipe diameters max. 100 mm

- Can be affected by currents of air etc.

#### QAE2... immersion sensors

Advantages

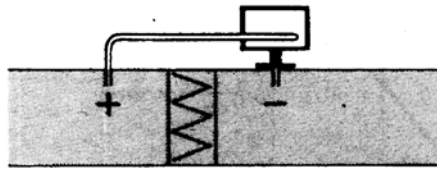
- Measure "mean" fluid temperature
- No external influence on measurement such as: currents of air, nearby pipes etc.

Limits

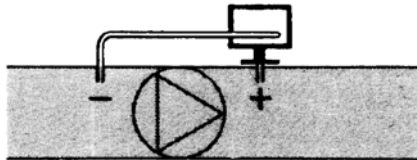
- Time constant with sheath: 20 sec.
- Hard to change installation position if it proves incorrect.

## Duct pressure switches and sensors

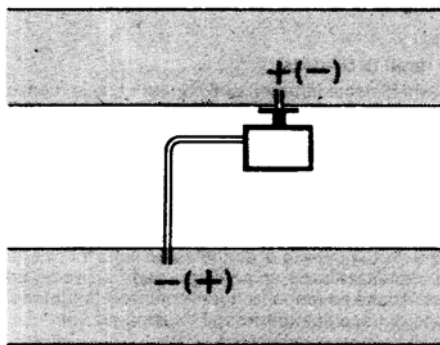
Installing differential pressure probes for air



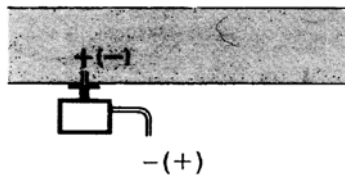
A - Control a filter (clogging)



B - Control a fan (upstream/downstream)



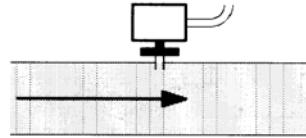
C - Measurement of difference in pressure between two ducts



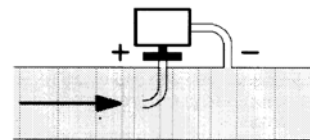
D - Measurement of difference in pressure between two rooms or of inside of duct and outside

## Basic principles

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



Measuring dynamic pressure

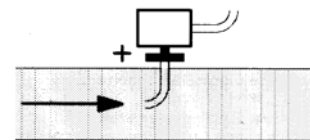


$$P_d = \frac{\gamma q^2}{2g}$$

## Key

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

Measuring total pressure



Pressure probes connection Siemens QBE 2...P... to burner's terminal block

SONDA DI PRESSIONE  
 PRESSURE SENSOR  
 SONDE DE PRESSION  
 QBE 2...P...

MORSETTIERA BRUCIATORE  
 BURNER TERMINAL BLOCK  
 BORNIER DU BRÛLEUR

BLANC - BIANCO  
 WHITE  
 VERT - VERDE  
 GREEN  
 BRUN - MARRONE  
 BROWN

|    |     |
|----|-----|
| M  | 12  |
| U1 | 13  |
| GL | 13A |

---

**Spare parts**

| Description                                                           | Code    |
|-----------------------------------------------------------------------|---------|
| Modulator RWF40.000                                                   | 2570112 |
| Adapting frame Siemens ARG40 from RWF32.. to RWF40..                  | 2570113 |
| Temperature probe Siemens QAE2120.010A (30÷130°C)                     | 2560101 |
| Temperature probe Siemens QAM2120.040 (-15÷+50°C)                     | 2560135 |
| Thermoresistor Pt1000 $\varnothing$ = 6mm L = 100mm (30÷130°C)        | 2560188 |
| Thermoresistor Pt1000 $\varnothing$ = 10mm L = 200mm (0÷350°C)        | 2560103 |
| Pressure probe Siemens QBE2.. P4 (0÷4bar)                             | 2560159 |
| Pressure probe Siemens QBE2.. P10 (0÷10bar / signal 0÷10V)            | 2560160 |
| Pressure probe Siemens QBE2.. P16 (0÷16bar / signal 0÷10V)            | 2560167 |
| Pressure probe Siemens QBE2.. P25 (0÷25bar / signal 0÷10V)            | 2560161 |
| Pressure probe Siemens QBE2.. P40 (0÷40bar / signal 0÷10V)            | 2560162 |
| Pressure probe Danfoss MBS3200 p 1,6 (0÷1,6bar / segnale 4÷20mA)      | 2560189 |
| Pressure probe Danfoss MBS3200 p 10 (0÷10bar / segnale 4÷20mA)        | 2560190 |
| Pressure probe Danfoss MBS3200 p 16 (0÷16bar / segnale 4÷20mA)        | 2560191 |
| Pressure probe Danfoss MBS3200 p 25 (0÷25bar / segnale 4÷20mA)        | 2560192 |
| Pressure probe Danfoss MBS3200 p 40 (0÷40bar / segnale 4÷20mA)        | 2560193 |
| Pressure probe Siemens 7MF1564-3BB00-1AA1 (0÷1,6bar / segnale 4÷20mA) | 25601A3 |
| Pressure probe Siemens 7MF1564-3CA00-1AA1 (0÷10bar / segnale 4÷20mA)  | 25601A4 |
| Pressure probe Siemens 7MF1564-3CB00-1AA1 (0÷16bar / segnale 4÷20mA)  | 25601A5 |
| Pressure probe Siemens 7MF1564-3CD00-1AA1 (0÷25bar / segnale 4÷20mA)  | 25601A6 |
| Pressure probe Siemens 7MF1564-3CE00-1AA1 (0÷40bar / segnale 4÷20mA)  | 25601A7 |
| Thermocoupling type K $\varnothing$ = 10mm L = 200mm (0÷1200°C)       | 2560142 |
| Thermoresistor Pt100 $\varnothing$ = 10mm L = 200mm (0÷350°C)         | 2560145 |

# RWF50.2x & RWF50.3x

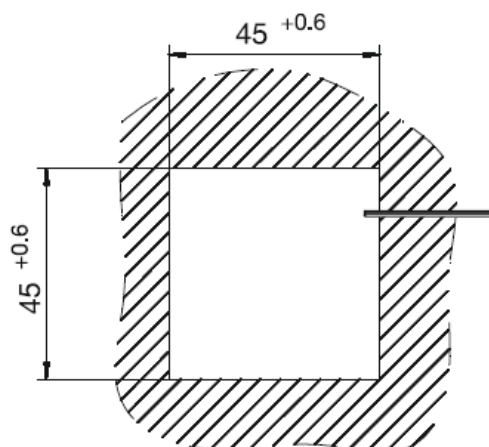
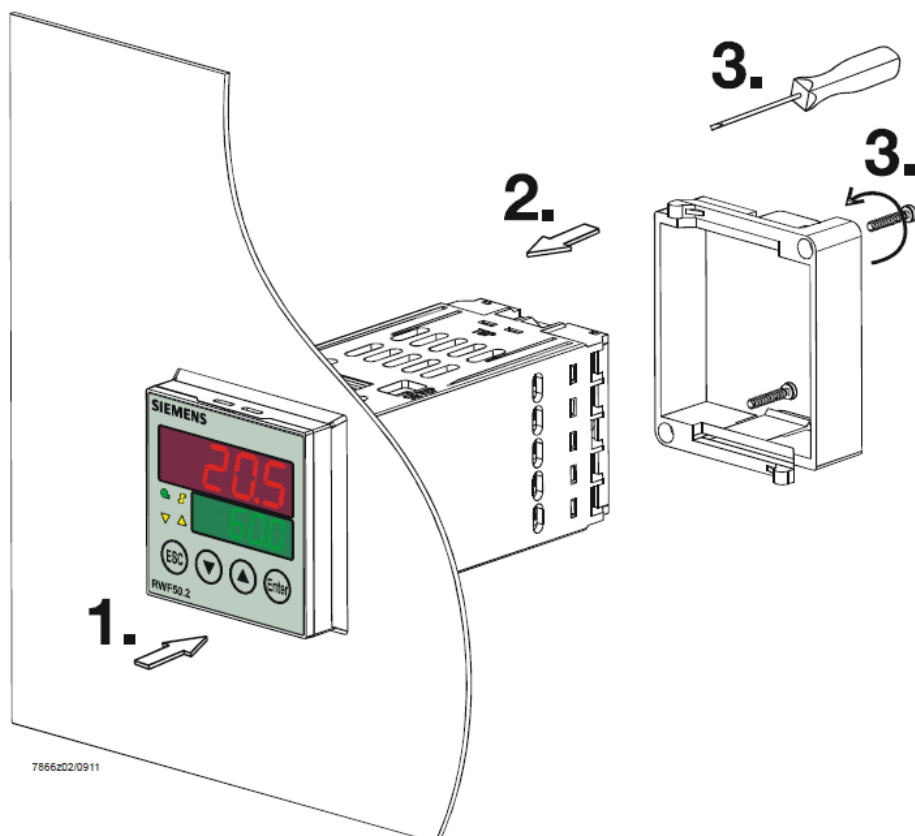


*User manual*

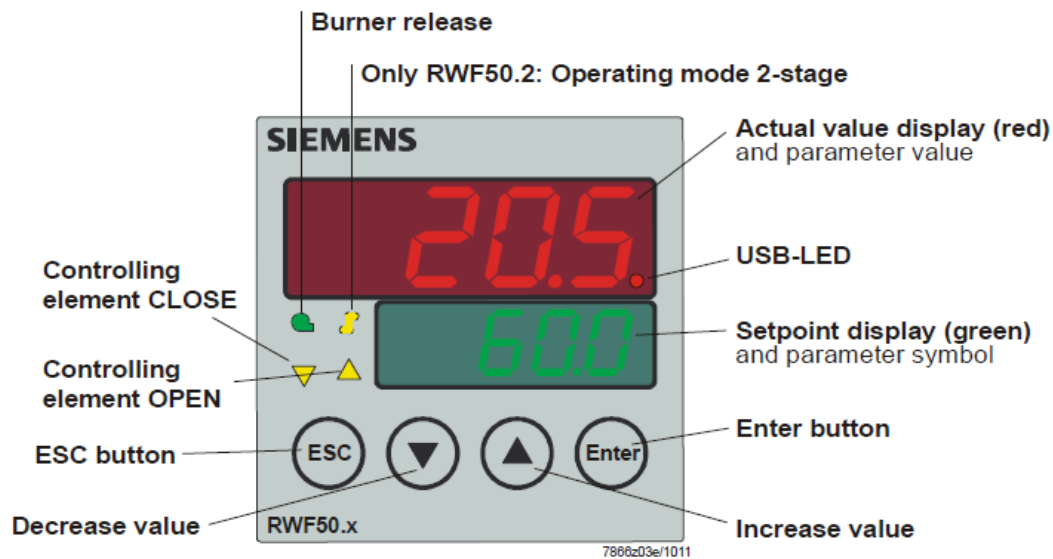
## DEVICE INSTALLATION

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

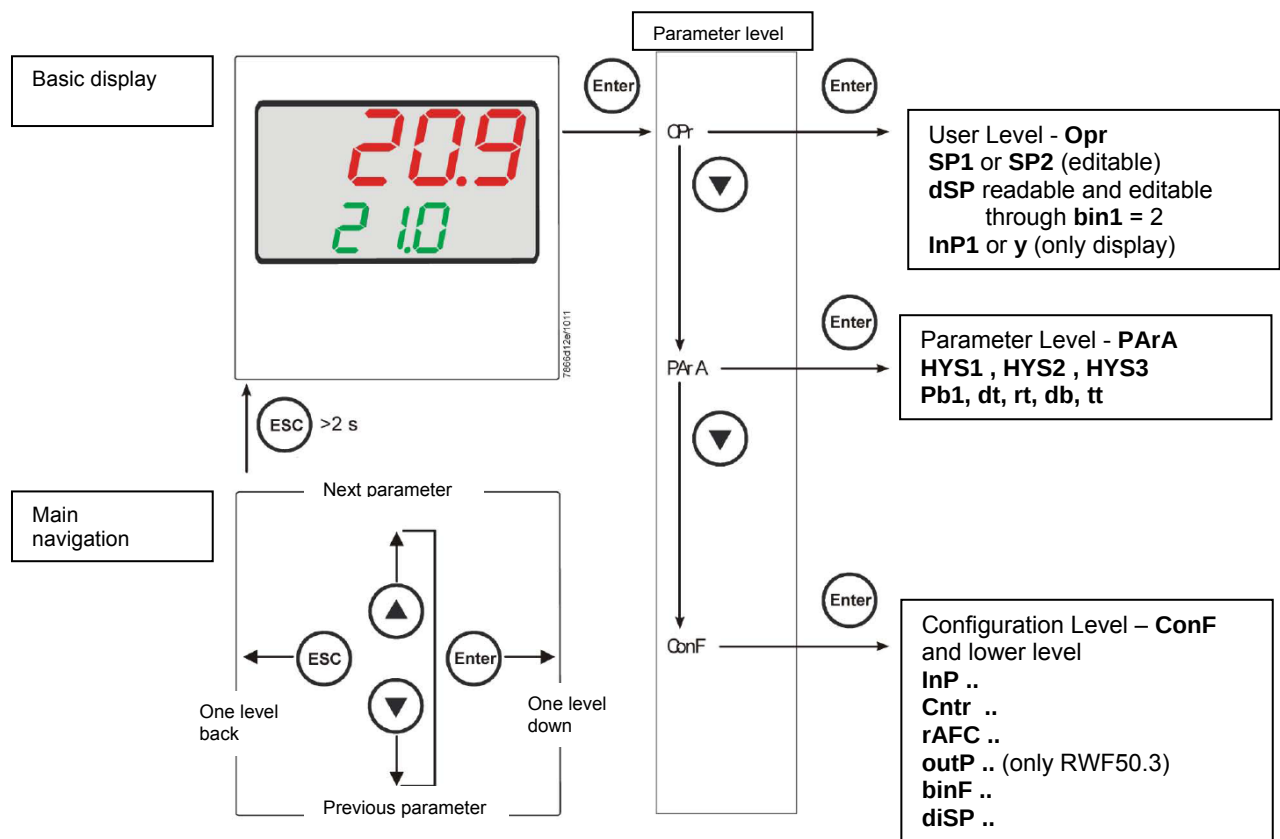
To wire the device and sensors, follow the instructions on the burner wiring diagram.



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

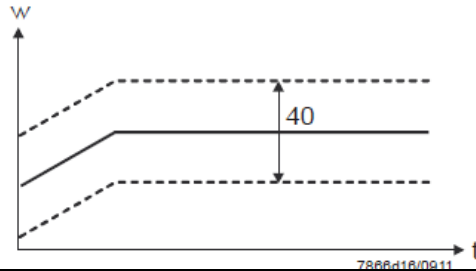
| Parameter                                               | Value                      | Description                                                                                                          |
|---------------------------------------------------------|----------------------------|----------------------------------------------------------------------------------------------------------------------|
| 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                                                   |

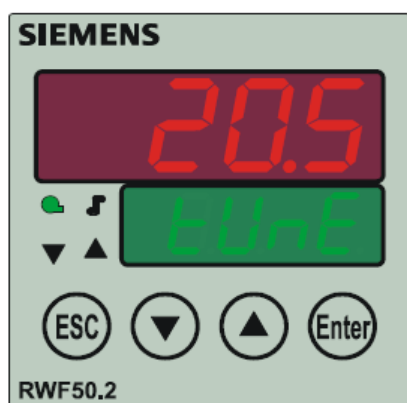
(**bold** = factory settings)

#### 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.

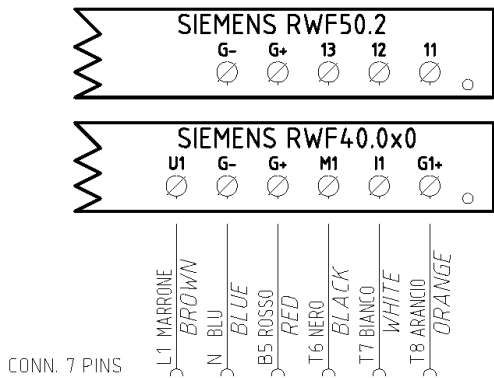
#### Display of software version :



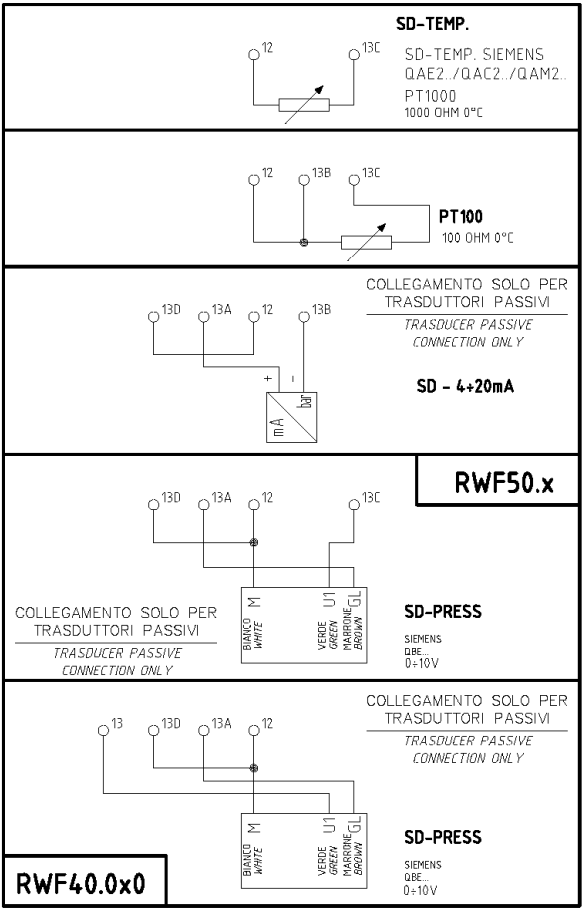
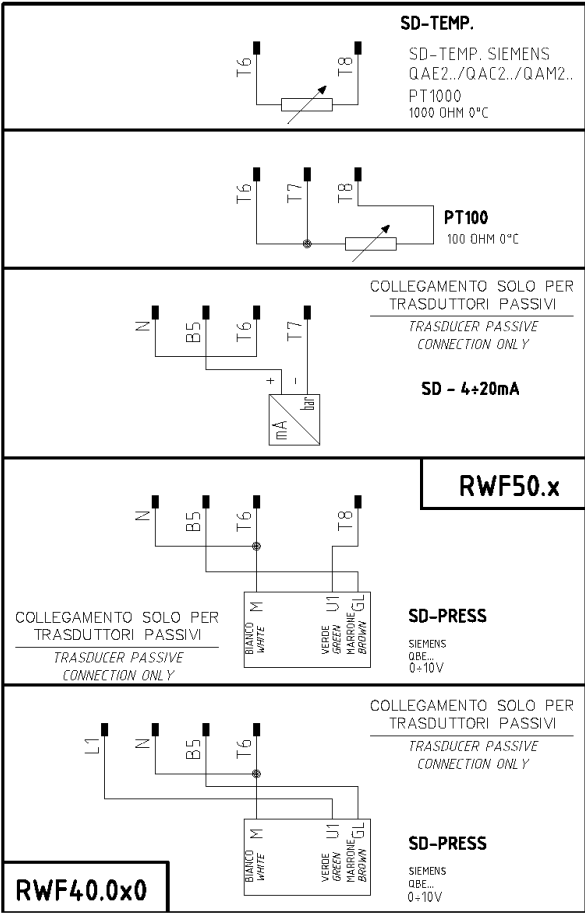
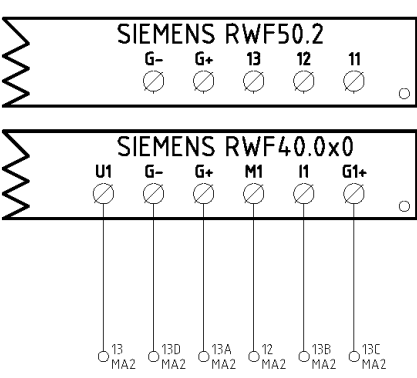
The software version is shown by pushing **Enter + UP arrow** on the upper display

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<br>OutP |            |      |      |     |
|-----------------|--------------|------------|------|------|-----|
|                 | FnCt         | SiGn       | rOut | OPnt | End |
| Parameter       | 4            | 1 (4÷20mA) | 0    | 0    | 100 |

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

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

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

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

**WARNING :** With pressure probes in bar, parameters SP1, SCH, SCL, HYS1, HYS3 must be set, and displayed in kPa (kilo Pascal); 1bar = 100,000Pa = 100kPa.  
With pressure probes in PSI the parameters SP1, SCH, SCL, HYS1, HYS3 must be set, and displayed in PSI x10 (example : 150PSI > display 1500).

## APPENDIX: PROBES CONNECTION

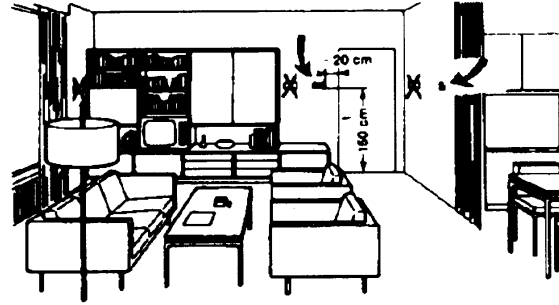
To assure the utmost comfort, the control system needs reliable information, which can be obtained provided the sensors have been installed correctly. Sensors measure and transmit all variations encountered at their location.

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

### Ambient probes (or ambient thermostats)

#### Installation

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



### Outside probes (weather)

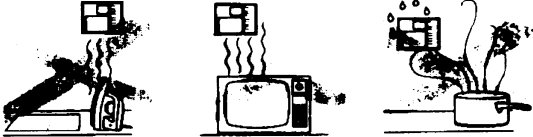
#### Installation

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



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

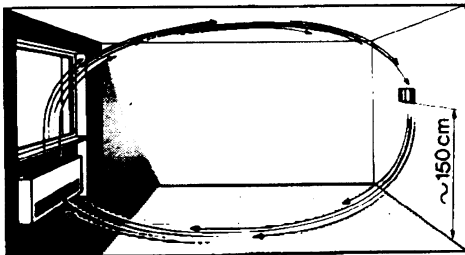
Heating systems: the room sensor must not be installed in rooms with heating units complete with thermostatic valves. Avoid all sources of heat foreign to the system.



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

### Location

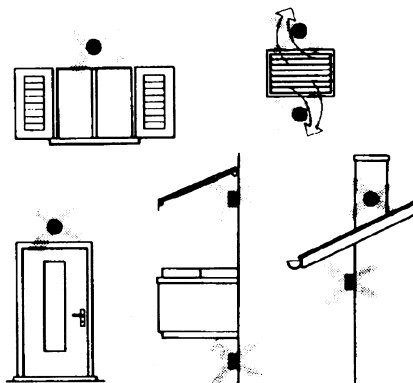
On an inner wall on the other side of the room to heating units height above floor 1.5 m, at least 1.5 m away from external sources of heat (or cold).



### Installation position to be avoided

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

### Positions to be avoided



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

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

## Duct or pipe sensors

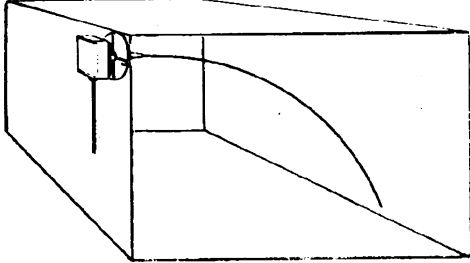
### Installing temperature sensors

For measuring outlet air:

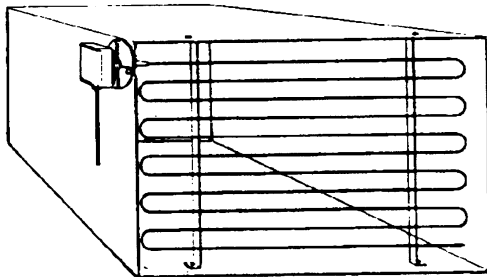
- after delivery fan or
- after coil to be controlled, at a distance of at least 0,5 m

For measuring room temperature:

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



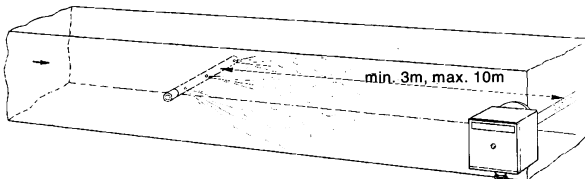
Bend 0.4m sensor by hand (never use tools) as illustrated.



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

### Installing combined humidity sensors

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



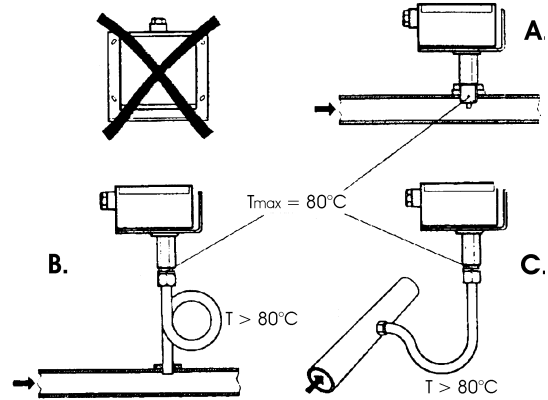
## Installing pressure sensors

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

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

C - installation on ducts at high temperatures:

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



## Installing differential pressure sensors for water

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

### when installing:

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

## Putting into operation

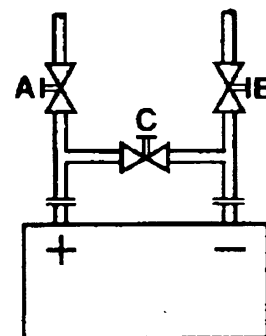
Start disable

1=open C1=open C

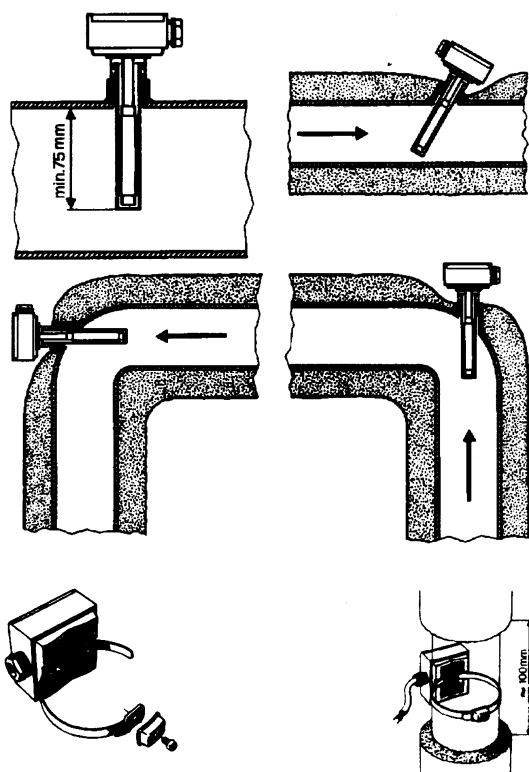
2=open A2=close B

3=open B3=close A

4= close C



## Immersion or strap-on sensors



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

## Immersion probes installation

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

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

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

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

## Installing QAD2.. strap-on sensors

Make sure fluid is circulating in the chosen location.

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

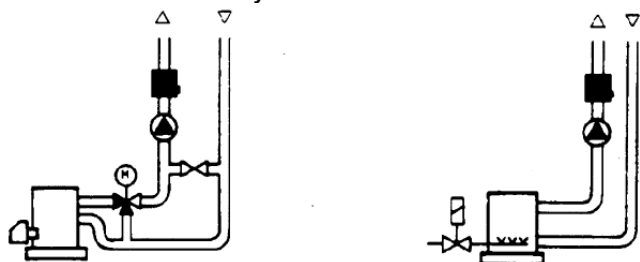
Sensors come with straps for pipes up to 100 mm in diameter

## With pumps on outlet

with 3 ways valves / with 4 ways valves



Panel system / burner control



## Strap-on or immersion sensors?

### QAD2.. strap-on sensors

Advantages :

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

Limits:

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

### QAE2... immersion sensors

Advantages:

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

Limits:

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

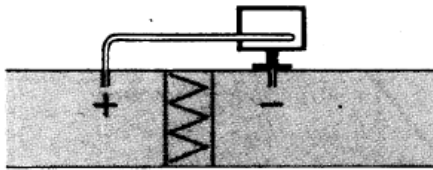
## With pumps on return

with 3 ways valves / with 4 ways valves

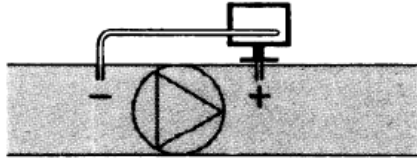


## Duct pressure switches and sensors

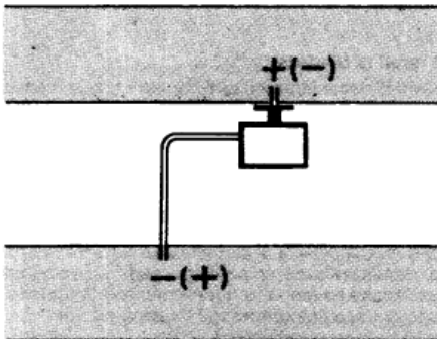
### Installing differential pressure probes for air



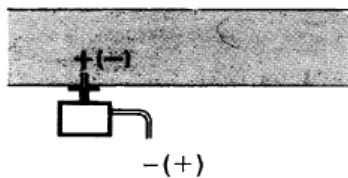
A - Control a filter (clogging)



B - Control a fan (upstream/downstream)



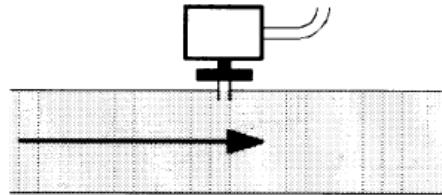
C - Measurement of difference in pressure between two ducts



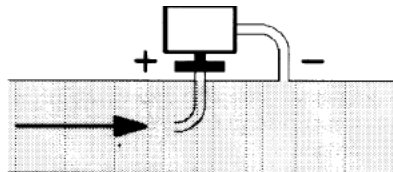
D - Measurement of difference in pressure between two rooms or of inside of duct and outside

### Basic principles

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



### Measuring dynamic pressure

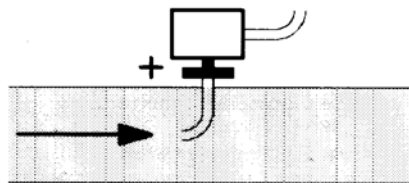


$$Pd = \frac{\gamma v^2}{2g}$$

### Key

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

### Measuring total pressure



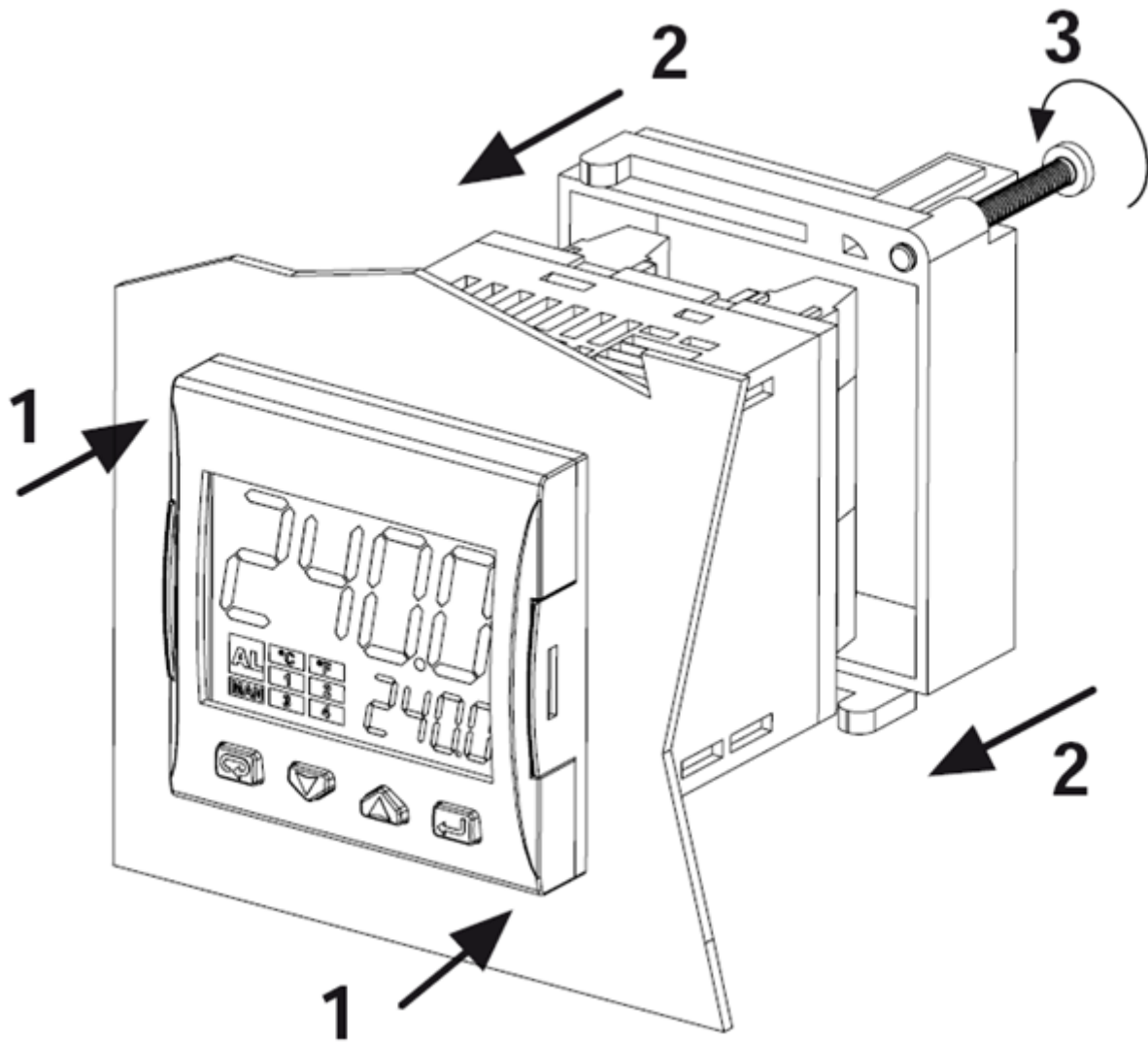
## Spare parts

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

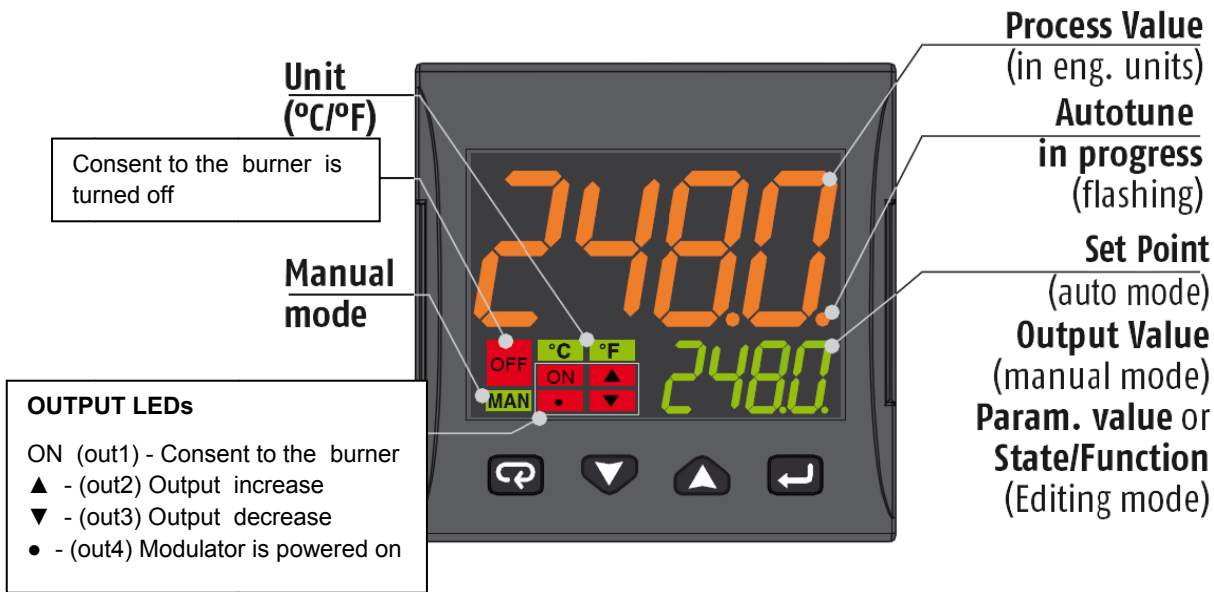
Note: Specifications and data subject to change. Errors and omissions excepted.

# **KM3 Modulator**

## **USER MANUAL**

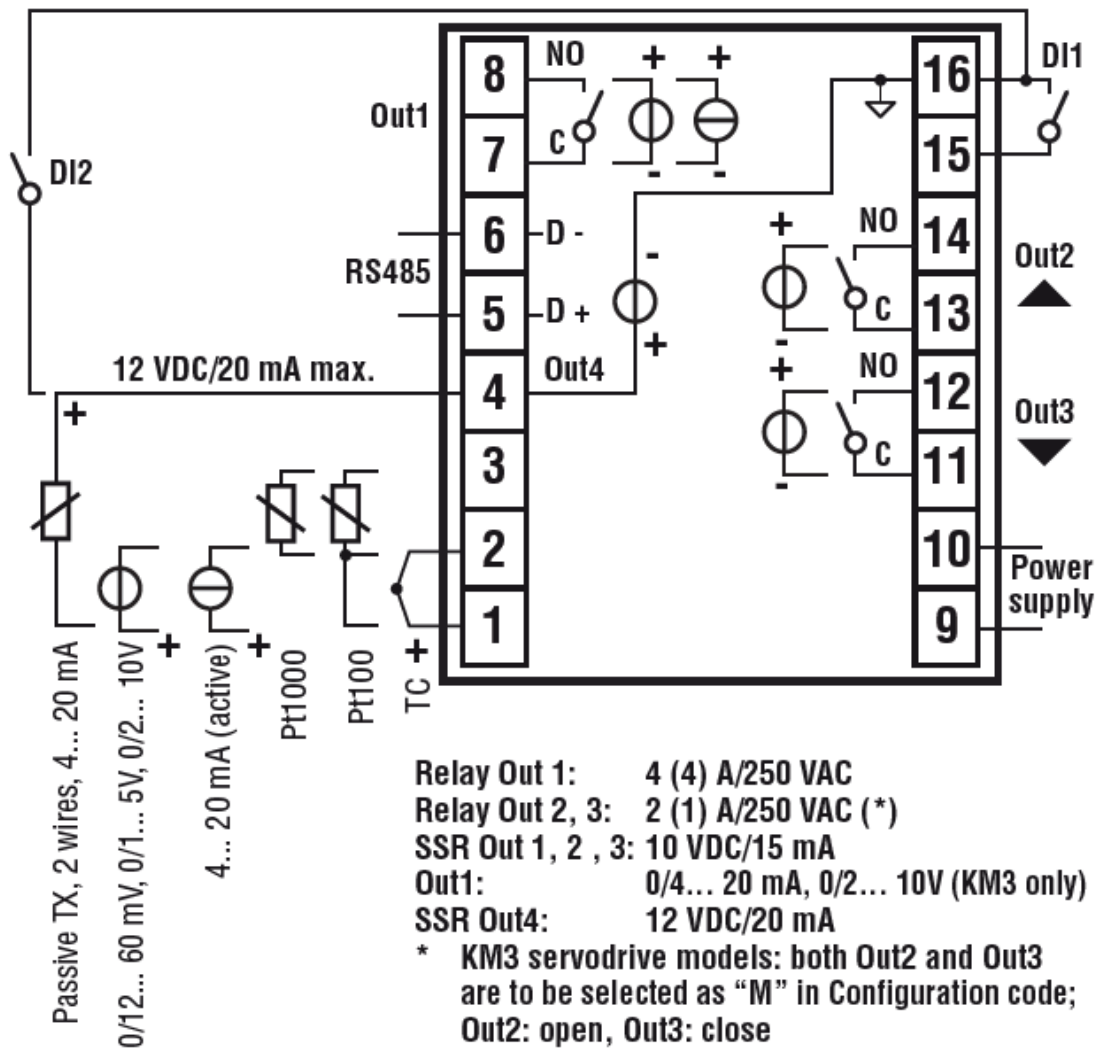
**MOUNTING**

## DISPLAY AND KEYS



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

## CONNECTIONS DIAGRAM



### Probe connection:

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

### Power supply connection:

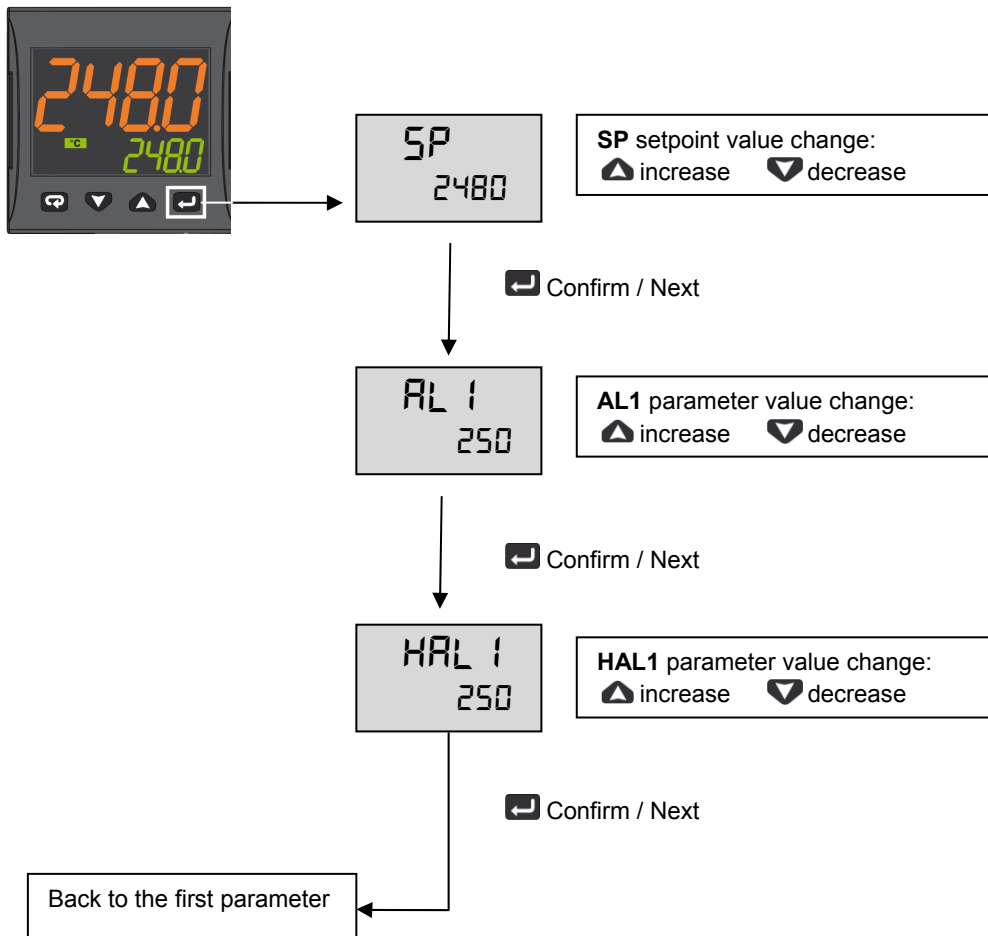
- **Neutral wire:** terminal 9
- **Phase:** terminal 10 ( 100...240 Vac )
- Close terminals 15-16 to switch to the set point 2

### Output connection:

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

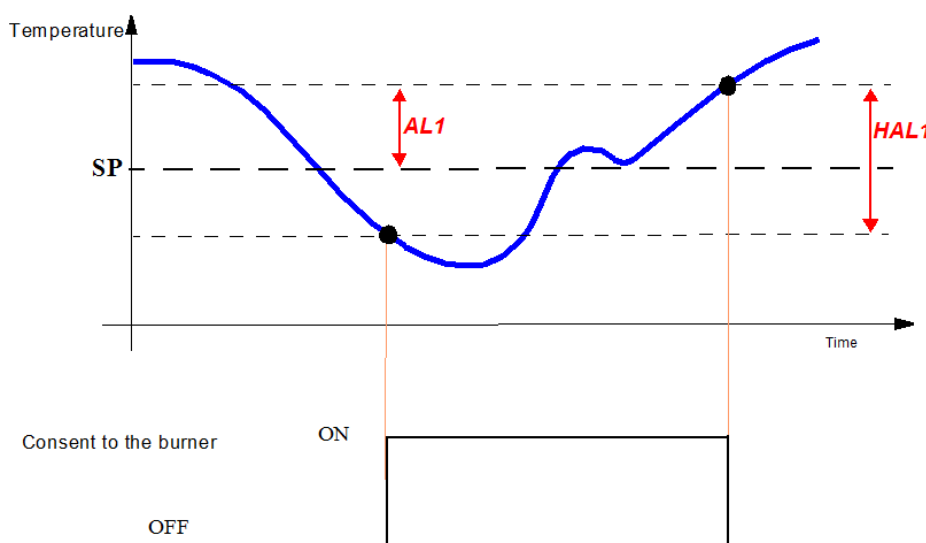
## SETPOINT AND HYSTERESIS CONFIGURATION (SP, AL1, HAL1 parameters)

Push the  button to enter into the setpoint configuration:



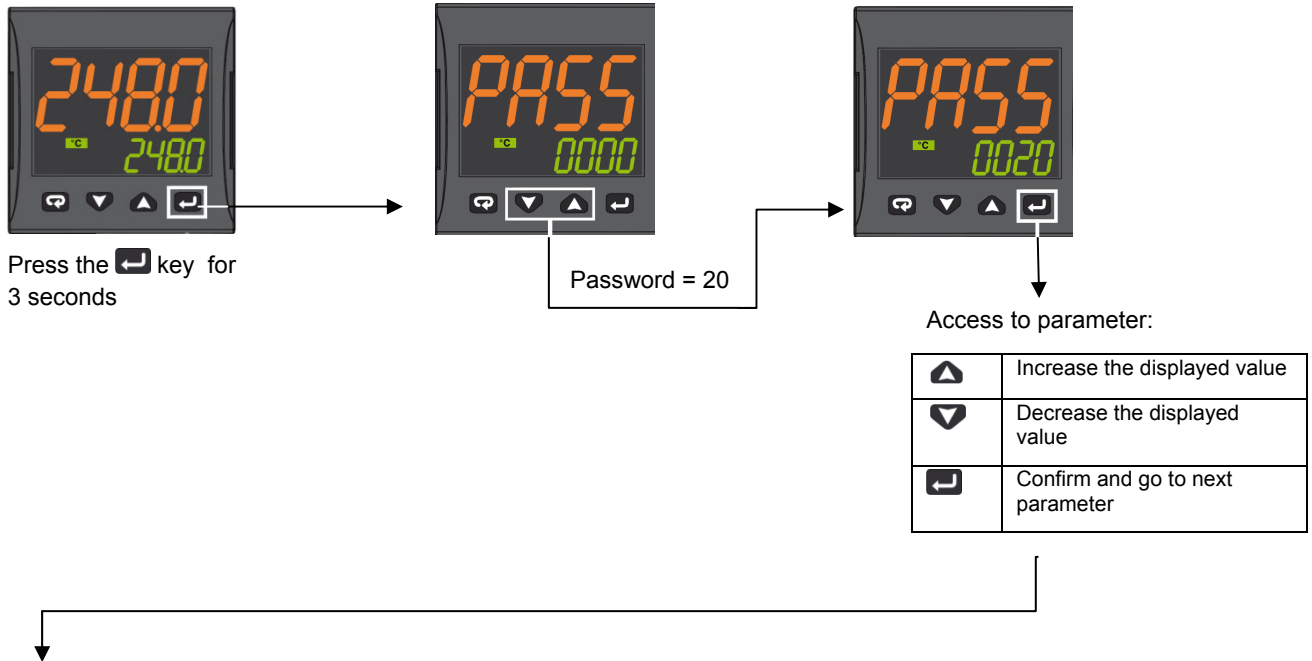
To return to normal mode, press the  key for 3 seconds or wait the 10s timeout

### Operation example



## LIMITED ACCESS LEVEL

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



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

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

### Probe parameters configuration MODULATORE ASCON KM3

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

Note:

(\*) Str.t - Servomotor stroke time

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

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

**(\*\*) Out 4 ... on Display led °4 must be switched on, otherwise change the io4.F parameter value from "on" to "out4", confirm the value, quit the configuration mode then change again the io4.F parameter value from "out4" to "on".**

(\*\*\*) Factory settings. These values must be adapted to machine conditions

N.B. For pressure probe, SP, SPHL, SPLL parameters values are expressed in Kpa (1 bar = 100 Kpa).

## CONFIGURATION

### How to access configuration level

The configuration parameters are collected in various groups. Every group defines all parameters related with a specific function (e.g.: control, alarms, output functions).

1. Push the  button for more than 5 seconds. The upper display will show PASS while the lower display will show 0.
2. Using  and  buttons set the programmed password.  
According to the entered password, it is possible to see a part of the parameters listed in the "configuration parameters" section.
  - a. Enter "30" as password to view all the configuration parameters
  - b. Enter "20" as password to view the parameters of the "limited access level". At this point, only the parameters with attribute **Liv = A** or **Liv = O** will be editable.
  - c. Leave the password blank to edit "user level" parameters, that are identified by attribute **Liv = O**
3. Push the  button. If the password is correct the display will show the acronym of the first parameter group preceded by the symbol: . In other words the upper display will show:  inP (group of the **Input parameters**).

The instrument is in configuration mode. To press  for more than 5 seconds, the instrument will return to the "standard display".

### Keyboard functions during parameter changing:

| Operator Mode                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                          | When the upper display is showing a group and the lower display is blank, this key allows to enter in the selected group. When the upper display is showing a parameter and the lower display is showing its value, this key allows to store the selected value for the current parameter and access the next parameter within the same group. |
|                                                                                         | Allows to increase the value of the selected parameter.                                                                                                                                                                                                                                                                                        |
|                                                                                        | Allows to decrease the value of the selected parameter.                                                                                                                                                                                                                                                                                        |
|                                                                                        | Short presses allow you to exit the current group of parameters and select a new group. A long press terminates the configuration procedure (the instrument returns to the normal display).                                                                                                                                                    |
|  +  | These two keys allow to return to the previous group. Proceed as follows:<br>Push the  button and maintaining the pressure, then push the  ; release both the buttons. |

### Configuration Parameters

| inP GROUP - input configuration |    |       |                                                                                                                       |                                                                                                                                                   |                      |
|---------------------------------|----|-------|-----------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| Liv                             | N° | Param | Description                                                                                                           | Values                                                                                                                                            | Default              |
| A                               | 1  | SEnS  | Input type                                                                                                            | Pt1 = RTD Pt100<br>Pt10 = RTD Pt1000<br>0.20 = 0..20mA<br>4.20 = 4..20mA Pressure probe<br>0.10 = 0..10V<br>2.10 = 2..10V<br>crAL= Thermocouple K | Depends on the probe |
| A                               | 2  | dp    | Decimal point position                                                                                                | 0... 3                                                                                                                                            | See page 7           |
| A                               | 3  | SSc   | Initial scale read-out for linear inputs (available only if SEnS parameter is not equal to Pt1, Pt10, crAL values)    | -1999... 9999                                                                                                                                     | 0                    |
| C                               | 4  | FSc   | Full scale read-out for linear input inputs (available only if SEnS parameter is not equal to Pt1, Pt10, crAL values) | -1999... 9999                                                                                                                                     | Depends on the probe |
| C                               | 5  | unit  | Unit of measure (present only in the case of temperature probe)                                                       | °C/°F                                                                                                                                             | °C                   |
| C                               | 6  | Fil   | Digital filter on the measured value                                                                                  | 0 (= OFF)... 20.0 s                                                                                                                               | 1.0                  |
| C                               | 7  | inE   | Selection of the Sensor Out of Range type that will enable the safety output value                                    | or = Over range<br>ou = Under range<br>our = over e under range                                                                                   | or                   |

|   |    |       |                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |    |
|---|----|-------|------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| C | 8  | oPE   | Safety output value                            | -100... 100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0  |
| C | 9  | io4.F | I/O4 function selection                        | on = Out4 will be ever ON (used as a transmitter power supply) ,out4 = Uscita 4 (Used as digital output 4), dG2c = Digital input 2 for contact closure, dG2U = Digital input 2 driven by 12... 24 VDC                                                                                                                                                                                                                                                                                                                                                                                                          | on |
| C | 10 | diF1  | Digital input 1 function                       | oFF = Not used,<br>1 = Alarm reset,<br>2 = Alarm acknowledge (ACK),<br>3 = Hold of the measured value,<br>4 = Stand by mode,<br>5 = Manual mode,<br>6 = HEAt with SP1 and Cool with SP2,<br>7 = Timer RUN/Hold/Reset,<br>8 = Timer Run,<br>9 = Timer Reset,<br>10 = Timer Run/Hold,<br>11 = Timer Run/Reset,<br>12 = Timer Run/Reset with lock,<br>13 = Program Start,<br>14 = Program Reset,<br>15 = Program Hold,<br>16 = Program Run/Hold,<br>17 = Program Run/Reset,<br>18 = Sequential SP selection,<br>19 = SP1 - SP2 selection,<br>20 = SP1... SP4 binary selection,<br>21 = Digital inputs in parallel | 19 |
| C | 12 | di.A  | Digital Inputs Action (DI2 only if configured) | 0 = DI1 direct action, DI2 direct action<br>1 = DI1 reverse action, DI2 direct action<br>2 = DI1 direct action, DI2 reverse action<br>3 = DI1 reverse action, DI2 reverse action                                                                                                                                                                                                                                                                                                                                                                                                                               | 0  |

**Out GROUP- Output parameters**

| Liv | N° | Param | Description                                      | Values                                                                                                               | Default |
|-----|----|-------|--------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|---------|
| C   | 14 | o1F   | Out 1 function                                   | AL = Alarm output                                                                                                    | AL      |
| C   | 15 | o1AL  | Initial scale value of the analog retransmission | -1999 ... Ao1H                                                                                                       | 1       |
| C   | 18 | o1Ac  | Out 1 action                                     | dir = Direct action<br>rEU = Reverse action<br>dir.r = Direct with reversed LED<br>ReU.r = Reverse with reversed LED | rEU.r   |
| C   | 19 | o2F   | Out 2 function                                   | H.rEG = Heating output                                                                                               | H.rEG   |
| C   | 21 | o2Ac  | Out 2 action                                     | dir = Direct action<br>rEU = Reverse action<br>dir.r = Direct with reversed LED<br>ReU.r = Reverse with reversed LED | dir     |
| C   | 22 | o3F   | Out 3 function                                   | H.rEG = Heating output                                                                                               | H.rEG   |
| C   | 24 | o3Ac  | Out 3 action                                     | dir = Direct action<br>rEU = Reverse action<br>dir.r = Direct with reversed LED<br>ReU.r = Reverse with reversed LED | dir     |

**AL1 GROUP - Alarm 1 parameters**

| Liv | N° | Param | Descrizione      | Values                                                                                                                                                                            | Default |
|-----|----|-------|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| C   | 28 | AL1t  | Tipo allarme AL1 | nonE = Alarm not used<br>LoAb = Absolute low alarm<br>HiAb = Absolute high alarm<br>LHAo = Windows alarm in alarm outside the windows<br>LHAI = Windows alarm in alarm inside the | HidE    |

|   |    |      |                                                                                                                         |                                                                                                                                                                                                                                  |            |
|---|----|------|-------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
|   |    |      |                                                                                                                         | windows<br>SE.br = Sensor Break<br>LoDE = Deviation low alarm (relative)<br>HiDE = Deviation high alarm (relative)<br>LHdo = Relative band alarm in alarm out of the band<br>LHdi = Relative band alarm in alarm inside the band |            |
| C | 29 | Ab1  | Alarm 1 function                                                                                                        | 0... 15<br>+1 = Not active at power up<br>+2 = Latched alarm (manual reset)<br>+4 = Acknowledgeable alarm<br>+8 = Relative alarm not active at set point change                                                                  | 0          |
| C | 30 | AL1L | -- For High and low alarms, it is the low limit of the AL1 threshold;<br>-- For band alarm, it is low alarm threshold   | -1999... AL1H (E.U.)                                                                                                                                                                                                             | -199.9     |
| C | 31 | AL1H | -- For High and low alarms, it is the high limit of the AL1 threshold;<br>-- For band alarm, it is high alarm threshold | AL1L... 9999 (E.U.)                                                                                                                                                                                                              | 999.9      |
| O | 32 | AL1  | AL1 threshold                                                                                                           | AL1L... AL1H (E.U.)                                                                                                                                                                                                              | See page 7 |
| O | 33 | HAL1 | AL1 hysteresis                                                                                                          | 1... 9999 (E.U.)                                                                                                                                                                                                                 | See page 7 |
| C | 34 | AL1d | AL1 delay                                                                                                               | 0 (oFF)... 9999 (s)                                                                                                                                                                                                              | oFF        |
| C | 35 | AL1o | Alarm 1 enabling during Stand-by mode and out of range conditions                                                       | 0 = Alarm 1 disabled during Stand by and out of range<br>1 = Alarm 1 enabled in stand by mode<br>2 = Alarm 1 enabled in out of range condition<br>3 = Alarm 1 enabled in stand by mode and in overrange condition                | 1          |

**GRUPPO AL2 - parametri allarme 2**

| Liv | N° | Param | Description                                                       | Values                                                                                                                                                                                                                                                                                                                                                                                                             | Default |
|-----|----|-------|-------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| C   | 36 | AL2t  | Alarm 2 type                                                      | nonE = Alarm not used<br>LoAb = Absolute low alarm<br>HiAb = Absolute high alarm<br>LHAo = Windows alarm in alarm outside the windows<br>LHAi = Windows alarm in alarm inside the windows<br>SE.br = Sensor Break<br>LoDE = Deviation low alarm (relative)<br>HiDE = Deviation high alarm (relative)<br>LHdo = Relative band alarm in alarm out of the band<br>LHdi = Relative band alarm in alarm inside the band | SE.br   |
| C   | 37 | Ab2   | Alarm 2 function                                                  | 0... 15<br>+1 = Not active at power up<br>+2 = Latched alarm (manual reset)<br>+4 = Acknowledgeable alarm<br>+8 = Relative alarm not active at set point change                                                                                                                                                                                                                                                    | 0       |
| C   | 42 | AL2d  | AL2 hysteresis                                                    | 0 (oFF)... 9999 (s)                                                                                                                                                                                                                                                                                                                                                                                                | oFF     |
| C   | 43 | AL2o  | Alarm 2 enabling during Stand-by mode and out of range conditions | 0 = Alarm 2 disabled during Stand by and out of range<br>1 = Alarm 2 enabled in stand by mode<br>2 = Alarm 2 enabled in out of range condition<br>3 = Alarm 2 enabled in stand by mode and in overrange condition                                                                                                                                                                                                  | 0       |

| AL3 Group - alarm 3 parameters |    |       |              |                                                                                                                                                                                                                                                                                                                                                                                                                    |         |
|--------------------------------|----|-------|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| Liv                            | N° | Param | Description  | Values                                                                                                                                                                                                                                                                                                                                                                                                             | Default |
|                                | 44 | AL3t  | Alarm 3 type | nonE = Alarm not used<br>LoAb = Absolute low alarm<br>HiAb = Absolute high alarm<br>LHAo = Windows alarm in alarm outside the windows<br>LHAI = Windows alarm in alarm inside the windows<br>SE.br = Sensor Break<br>LoDE = Deviation low alarm (relative)<br>HiDE = Deviation high alarm (relative)<br>LHdo = Relative band alarm in alarm out of the band<br>LHdi = Relative band alarm in alarm inside the band | nonE    |

| LbA Group - Loop break alarm |    |       |             |                       |         |
|------------------------------|----|-------|-------------|-----------------------|---------|
| Liv                          | N° | Param | Descrizione | Values                | Default |
| C                            | 52 | LbAt  | LBA time    | Da 0 (oFF) a 9999 (s) | oFF     |

| rEG Group - Control parameters |    |       |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |         |
|--------------------------------|----|-------|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| Liv                            | N° | Param | Description                    | Values                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Default |
| C                              | 56 | cont  | Control type                   | Pid = PID (heat and/or)<br>On.FA = ON/OFF asymmetric hysteresis<br>On.FS = ON/OFF symmetric hysteresis<br>nr = Heat/Cool ON/OFF control with neutral zone<br>3Pt = Servomotor control (available only when Output 2 and Output 3 have been ordered as "M")                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3pt     |
| C                              | 57 | Auto  | Autotuning selection           | -4 = Oscillating auto-tune with automatic restart at power up and after all point change<br>-3 = Oscillating auto-tune with manual start<br>-2 = Oscillating -tune with auto-matic start at the first power up only<br>-1 = Oscillating auto-tune with auto-matic restart at every power up<br>0 = Not used<br>1 = Fast auto tuning with automatic restart at every power up<br>2 = Fast auto-tune with automatic start the first power up only<br>3 = FAST auto-tune with manual start<br>4 = FAST auto-tune with automatic restart at power up and after set point change<br>5 = Evo-tune with automatic restart at every power up<br>6 = Evo-tune with automatic start the first power up only<br>7 = Evo-tune with manual start<br>8 = Evo-tune with automatic restart at power up and after a set point change | 7       |
| C                              | 58 | tunE  | Manual start of the Autotuning | oFF = Not active<br>on = Active                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | oFF     |

|   |    |       |                                  |                                                                                                            |            |
|---|----|-------|----------------------------------|------------------------------------------------------------------------------------------------------------|------------|
| C | 59 | SELF  | Self tuning enabling             | no = The instrument does not perform the self-tuning<br>YES = The instrument is performing the self-tuning | No         |
| A | 62 | Pb    | Proportional band                | 1... 9999 (E.U.)                                                                                           | See page 7 |
| A | 63 | ti    | Integral time                    | 0 (oFF) ... 9999 (s)                                                                                       | See page 7 |
| A | 64 | td    | Derivative time                  | 0 (oFF) ... 9999 (s)                                                                                       | See page 7 |
| C | 65 | Fuoc  | Fuzzy overshoot control          | 0.00... 2.00                                                                                               | 1          |
| C | 69 | rS    | Manual reset (Integral pre-load) | -100.0... +100.0 (%)                                                                                       | 0.0        |
| A | 70 | Str.t | Servomotor stroke time           | 5...1000 seconds                                                                                           | See page 7 |
| A | 71 | db.S  | Servomotor dead band             | 0...100%                                                                                                   | 5          |
| C | 72 | od    | Delay at power up                | 0.00 (oFF) ... 99.59 (hh.mm)                                                                               | oFF        |

**SP Group - Set point parameters**

| Liv | N° | Param | Description                                            | Values                                                                                                                                                                                                                                                                                   | Default    |
|-----|----|-------|--------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| C   | 76 | nSP   | Number of used set points                              | 1... 4                                                                                                                                                                                                                                                                                   | 2          |
| A   | 77 | SPLL  | Minimum set point value                                | -1999 ... SPHL                                                                                                                                                                                                                                                                           | See page 7 |
| A   | 78 | SPHL  | Maximum set point value                                | SPLL ... 9999                                                                                                                                                                                                                                                                            | See page 7 |
| O   | 79 | SP    | Set point 1                                            | SPLL ... SPLH                                                                                                                                                                                                                                                                            | See page 7 |
| C   | 80 | SP 2  | Set point 2                                            | SPLL ... SPLH                                                                                                                                                                                                                                                                            | 60         |
|     | 83 | A.SP  | Selection of the active set point                      | "SP" ... "nSP"                                                                                                                                                                                                                                                                           | SP         |
| C   | 84 | SP.rt | Remote set point type                                  | RSP = The value coming from serial link is used as remote set point<br>trin = The value will be added to the local set point selected by A.SP and the sum becomes the operative set point<br>PERC = The value will be scaled on the input range and this value will be used as remote SP | trin       |
| C   | 85 | SPLr  | Local/remote set point selection                       | Loc = Local<br>rEn = Remote                                                                                                                                                                                                                                                              | Loc        |
| C   | 86 | SP.u  | Rate of rise for POSITIVE set point change (ramp UP)   | 0.01... 99.99 (inF) Eng. units per minute                                                                                                                                                                                                                                                | inF        |
| C   | 87 | SP.d  | Rate of rise for NEGATIVE set point change (ramp DOWN) | 0.01... 99.99 (inF) Eng. units per minute                                                                                                                                                                                                                                                | inF        |

**PAn Group - Operator HMI**

| Liv | N°  | Param | Description                                        | Values                                                                                                                                                                                                                                                        | Default |
|-----|-----|-------|----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| C   | 118 | PAS2  | Level 2 password (limited access level)            | oFF (Level 2 not protected by password)<br>1... 200                                                                                                                                                                                                           | 20      |
| C   | 119 | PAS3  | Level 3 password (complete configuration level)    | 3... 300                                                                                                                                                                                                                                                      | 30      |
| C   | 120 | PAS4  | Password livello (livello configurazione a codice) | 201... 400                                                                                                                                                                                                                                                    | 300     |
| C   | 121 | uSrb  | button function during RUN TIME                    | nonE = No function<br>tunE = Auto-tune/self-tune enabling. A single press (longer than 1 second) starts the auto-tune<br>oPLo = Manual mode. The first pressure puts the instrument in manual mode (OPLO) while a second one puts the instrument in Auto mode | tunE    |

|   |     |       |                               |                                                                                                                                                                                                                                                                                                                                               |      |
|---|-----|-------|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
|   |     |       |                               | AAC = Alarm reset<br>ASi = Alarm acknowledge<br>chSP = Sequential set point selection<br>St.by = Stand by mode. The first press puts the instrument in stand by mode while a second one puts the instrument in Auto mode.<br>Str.t = Timer run/hold/reset<br>P.run = Program run<br>P.rES = Program reset<br>P.r.H.r = Program run/hold/reset |      |
| C | 122 | diSP  | Display management            | Spo = Operative set point                                                                                                                                                                                                                                                                                                                     | SPo  |
| C | 123 | di.cL | Display colour                | 0 = The display colour is used to show the actual deviation (PV - SP)<br>1 = Display red (fix)<br>2 = Display green (fix)<br>3 = Display orange (fix)                                                                                                                                                                                         | 2    |
|   | 125 | diS.t | Display Timeout               | -- oFF (display always ON)<br>-- 0.1... 99.59 (mm.ss)                                                                                                                                                                                                                                                                                         | oFF  |
| C | 126 | fiLd  | Filter on the displayed value | -- oFF (filter disabled)<br>-- From 0.0 (oFF) to 20.0 (E.U.)                                                                                                                                                                                                                                                                                  | oFF  |
| C | 128 | dSPu  | Instrument status at power ON | AS.Pr = Starts in the same way it was prior to the power down<br>Auto = Starts in Auto mode<br>oP.0 = Starts in manual mode with a power output equal to zero<br>St.bY = Starts in stand-by mode                                                                                                                                              | Auto |
| C | 129 | oPr.E | Operative modes enabling      | ALL = All modes will be selectable by the next parameter<br>Au.oP = Auto and manual (OPLO) mode only will be selectable by the next parameter<br>Au.Sb = Auto and Stand-by modes only will be selectable by the next parameter                                                                                                                | ALL  |
| C | 130 | oPEr  | Operative mode selection      | If oPr.E = ALL: - Auto = Auto mode<br>- oPLo = Manual mode<br>- St.bY = Stand by mode<br>If oPr.E = Au.oP: - Auto = Auto mode<br>- oPLo = Manual mode<br>If oPr.E = Au.Sb: - Auto = Auto mode<br>- St.bY = Stand by mode                                                                                                                      | Auto |

**SEr Group - Serial link parameter**

| Liv | N°  | Param | Description                                         | Values                                                                                                                                                                                                                   | Default |
|-----|-----|-------|-----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| C   | 131 | Add   | Instrument address                                  | -- oFF<br>-- 1... 254                                                                                                                                                                                                    | 1       |
| C   | 132 | bAud  | baud rate                                           | 1200 = 1200 baud<br>2400 = 2400 baud<br>9600 = 9600 baud<br>19.2 = 19200 baud<br>38.4 = 38400 baud                                                                                                                       | 9600    |
| C   | 133 | trSP  | Selection of the value to be retransmitted (Master) | nonE = Retransmission not used (the instrument is a slave)<br>rSP = The instrument becomes a Master and retransmits the operative set point<br>PErc = The instrument become a Master and it retransmits the power output | nonE    |

| con Group - Consumption parameters |     |       |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |         |
|------------------------------------|-----|-------|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| Liv                                | N°  | Param | Description                  | Values                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Default |
| C                                  | 134 | Co.tY | Count type                   | oFF = Not used<br>1 = Instantaneous power (kW)<br>2 = Power consumption (kW/h)<br>3 = Energy used during program execution. This measure starts from zero when a program runs end stops at the end of the program. A new program execution will reset the value<br>4 = Total worked days: number of hours the instrument is turned ON divided by 24.<br>5 = Total worked hours: number of hours the instrument is turned ON.<br>6 = Total worked days with threshold: number of hours the instrument is turned ON divided by 24, the controller is forced in stand-by when Co.ty value reaches the threshold set in [137] h.Job.<br>7 = Total worked hours with threshold: number of hours the instrument is turned ON, the controller is forced in stand-by when Co.ty value reaches the threshold set in [137] h.Job.<br>8 = Totalizer of control relay worked days: number of hours the control relay has been in ON condition, divided by 24.<br>9 = Totalizer of control relay worked hours: number of hours the control relay has been in ON condition.<br>10 = Totalizer of control relay worked days with threshold: number of hours the control relay has been in ON condition divided by 24, the controller is forced in stand-by when Co.ty value reaches the threshold set in [137] h.Job.<br>11 = Totalizer of control relay worked hours with threshold: number of hours the control relay has been in ON condition, the controller is forced in stand-by when Co.ty value reaches the threshold set in [137] h.Job. | oFF     |
| C                                  | 138 | t.Job | Worked time (not resettable) | 0... 9999 days                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0       |

| cAL Group - User calibration group |     |       |                    |                                                |         |
|------------------------------------|-----|-------|--------------------|------------------------------------------------|---------|
| Liv                                | N°  | Param | Description        | Values                                         | Default |
| C                                  | 139 | AL.P  | Adjust Low Point   | From -1999 to (AH.P - 10) in engineering units | 0       |
| C                                  | 140 | AL.o  | Adjust Low Offset  | -300... +300 (E.U.)                            | 0       |
| C                                  | 141 | AH.P  | Adjust High Point  | From (AL.P + 10) to 9999 engineering units     | 999.9   |
| C                                  | 142 | AH.o  | Adjust High Offset | -300... +300                                   | 0       |

## OPERATIVE MODES

When the instrument is powered, it starts immediately to work according to the parameters values loaded in its memory. The instrument behaviour and its performance are governed by the value of the stored parameters.

At power ON the instrument can start in one of the following mode depending on its configuration:

**Automatic Mode** In Automatic mode the instrument drives automatically the control output according to the parameter value set and the set point/measured value.

**Manual Mode (OPLO):** In Manual mode the the upper display shows the measured value while the lower display shows the power output The lower display shows the power output [preceded by H (for heating) or C (for cooling)], MAN is lit and the instrument allows you to set manually the control output power. No Automatic action will be made.

**Stand by Mode (St.bY):** In stand-by mode the instrument operates as an indicator. It will show on the upper display the measured value and on the lower display the set point alternately to the "St.bY" messages and forces the control outputs to zero.

We define all the above described conditions as "Standard Display".

As we have seen, it is always possible to modify the value assigned to a parameter independently from the operative modes selected.

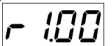
## AUTOMATIC MODE

Keyboard function when the instrument is in Auto mode:

|                                                                                     | Modo Operatore                                                                                                                                                                |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | Allows entry into parameter modification procedures                                                                                                                           |
|  | Allows you to start the "Direct set point modification" function (see below).                                                                                                 |
|  | Allows you to display the "additional informations" (see below).                                                                                                              |
|  | Performs the action programmed by [121] uSrb (  button function during RUN TIME) parameter |

### Additional information

This instrument is able to show you some additional informations that can help you to manage your system. The additional informations are related to how the instrument is programmed, hence in many cases, only part of this information is available.

1. When the instrument is showing the "standard display" push  button. The lower display will show H or c followed by a number. This value is the current power output applied to the process. The H show you that the action is a Heating action while the "c" show you that the action is a Cooling action
2. Push  button again. When the programmer is running the lower display will show the segment currently performed and the Event status as shown below:  
 where the first character can be r for a ramp or S for a soak, the next digit show the number of the segment (e.g. S3 means Soak number 3) and the twoless significant digits (LSD) show you the status of the two event (the LSD is the Event 2)..
3. Push  button again. When the programmer is running the lower display will show the theoretical remaining time to the end of the program preceded by a "P" letter:  

4. Push  button again. When the wattmeter function is running the lower display will show U followed by the measured energy..
5. Push  button. When the "Worked time count" is running the lower display will show "d" for days or "h" for hours followed by the measured time.
6. Push  button. The instrument returns to the "standard display".

Note: The additional information visualization is subject to a time out. If no button is pressed for more than 10 second the instrument comes automatically back to the Standard display..

**Direct set point modification**

This function allows to modify rapidly the set point value selected by [83] A.SP (selection of the active Set point) or to the set point of the segment group (of the programmer) currently in progress.

1. Push  button. The upper display shows the acronym of the selected set point (e.g. SP2) and the lower display will show its value.
2. By  and  buttons, assign to this parameter the desired value
3. Do not push any button for more than 5 second or push the  button. In both cases the instrument memorize the new value and come back to the “standard display”.

**Manual mode**

This operative mode allows you to deactivate automatic control and manually program the percentage power output to the process. When the instrument is in manual mode, the upper display shows the measured value while the lower display shows the power output [preceded by H (for heating action) or C (for cooling action)] The MAN LED is lit. When manual control is selected, the instrument will start to operate with the same power output as the last one supplied by automatic mode and can be modified using the  and  buttons.

In case of ON/OFF control, 0% corresponds to the deactivated output while any value different from 0 corresponds to the activated output. As in the case of visualization, the programmable values range from H100 (100% output power with reverse action) to C100 (100% output power with direct action).

**Notes:**

- During manual mode, the alarms are operative.
- If you set manual modes during program execution, the program will be frozen and it will restart when the instrument will come back to Auto mode.
- If you set manual modes during self-tune execution, the self- tune function will be aborted.
- During manual mode, all functions not related with the control (wattmeter, independent timer, “worked time”, etc) continue to operate normally..

**STAND-BY MODE**

This operative mode also deactivates the automatic control but forces the control output to zero. In this mode the instrument operates as an indicator. When the instrument is in stand by mode the upper display will show the measured value while the lower display will show alternately the set point and the message “St.bY”.

**Notes:**

- During stand by mode, the relative alarms are disabled while the absolute alarms are operative or not according to the ALxo (Alarm x enabling during Stand-by mode) parameter setting.
- If you set stand by mode during program execution, the program will be aborted.
- If you set stand by mode during self-tune execution, the self- tune function will be aborted.
- During stand by mode, all functions not related with the control (wattmeter, independent timer, “worked time”, etc) continue to operate normally.
- When the instrument is swapped from stand by to auto modes, the instrument will start automatically the alarm masking, the soft start functions and the auto-tune (if programmed).

**AUTOTUNE (EVOTUNE)**

Evotune is a fast and fully automatic procedure that can be started in any condition, regardless the deviation from SP. The controller selects automatically the best tune method and computes the optimum PID parameters. To activate Evotune press  button for 3 seconds.

## ERROR MESSAGES

The upper display shows the OVER-RANGE and UNDERRANGE conditions with the following indications:

Over-range: 

Under-range 

The sensor break will be signalled as an out of range: - - - -

Note: When an over-range or an under-range is detected, the alarms operate as in presence of the maximum or the minimum measurable value respectively.

To check the out of span Error condition, proceed as follows:

1. Check the input signal source and the connecting line.
2. Make sure that the input signal is in accordance with the instrument configuration. Otherwise, modify the input configuration.
3. If no error is detected, send the instrument to your supplier to be checked.

### List of possible errors

**ErAT** Fast Auto-tune cannot start. The measure value is too close to the set point. Push the button in order to delete the error message.

**ouLd** Overload on the out 4. The messages shows that a short circuit is present on the Out 4 when it is used as output or as a transmitter power supply. When the short circuit disappears the output restart to operate..

**NoAt** Auto-tune not finished within 12 hours.

**ErEP** Possible problem of the instrument memory. The messages disappears automatically. When the error continues, send the instrument to your supplier.

**RonE** Possible problem of the firmware memory. When this error is detected, send the instrument to your supplier.

**Errt** Possible problem of the calibration memory. When this error is detected, send the instrument to your supplier.

## FACTORY RESET

Sometime, e.g. when you re-configure an instrument previously used for other works or from other people or when you have made too many errors during configuration and you decided to re-configure the instrument, it is possible to restore the factory configuration. This action allows to put the instrument in a defined condition (the same it was at the first power ON).

The default data are those typical values loaded in the instrument prior to ship it from factory. To load the factory default parameter set, proceed as follows:

1. Press the  button for more than 5 seconds. The upper display will show PASS while the lower display shows 0;
2. Using  and  buttons set the value -481;
3. Push  button;
4. The instrument will turn OFF all LEDs for a few seconds, then the upper display will show dFLt (default) and then all LEDs are turned ON for 2 seconds. At this point the instrument restarts as for a new power ON.

The procedure is complete.

Note: The complete list of the default parameters is available in Chapter "Configuration".

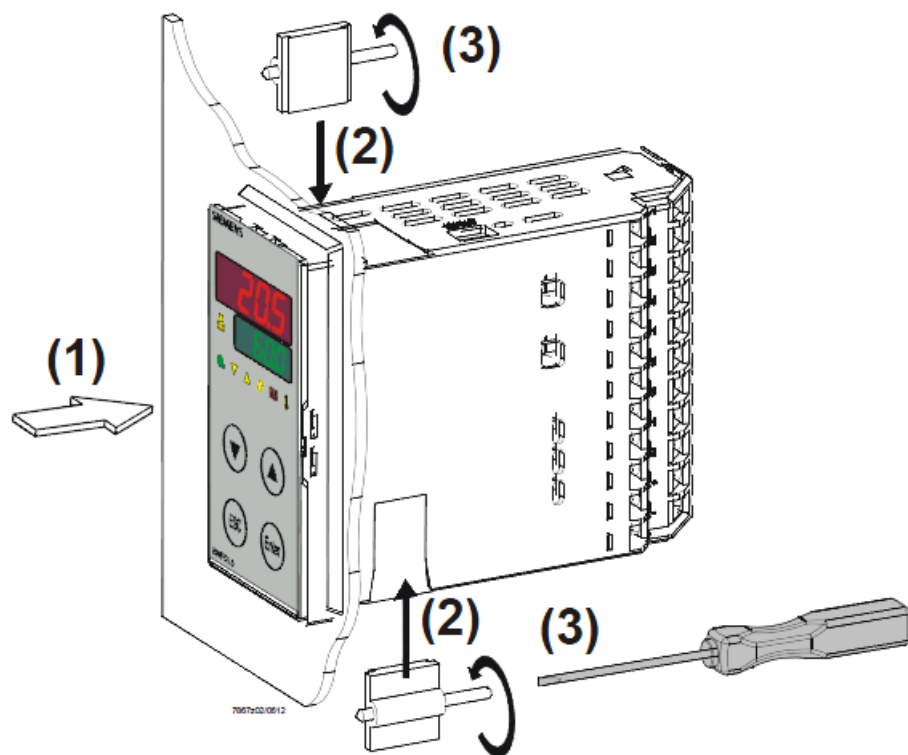
# RWF55.5X & RWF55.6X



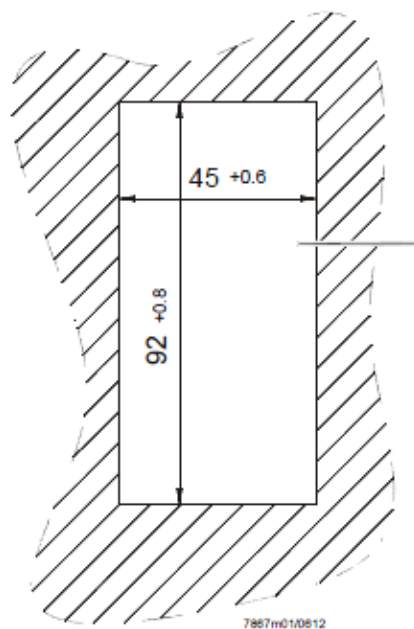
*User manual*

## DEVICE INSTALLATION

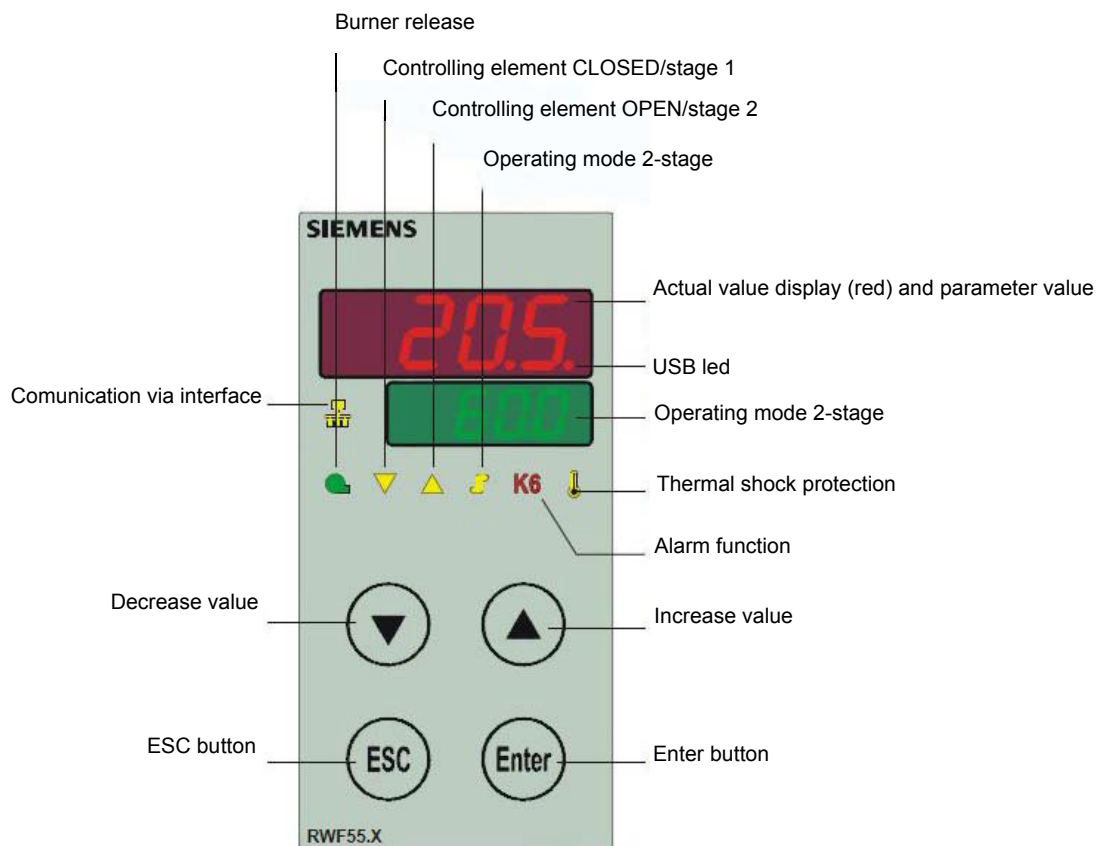
### Fixing system

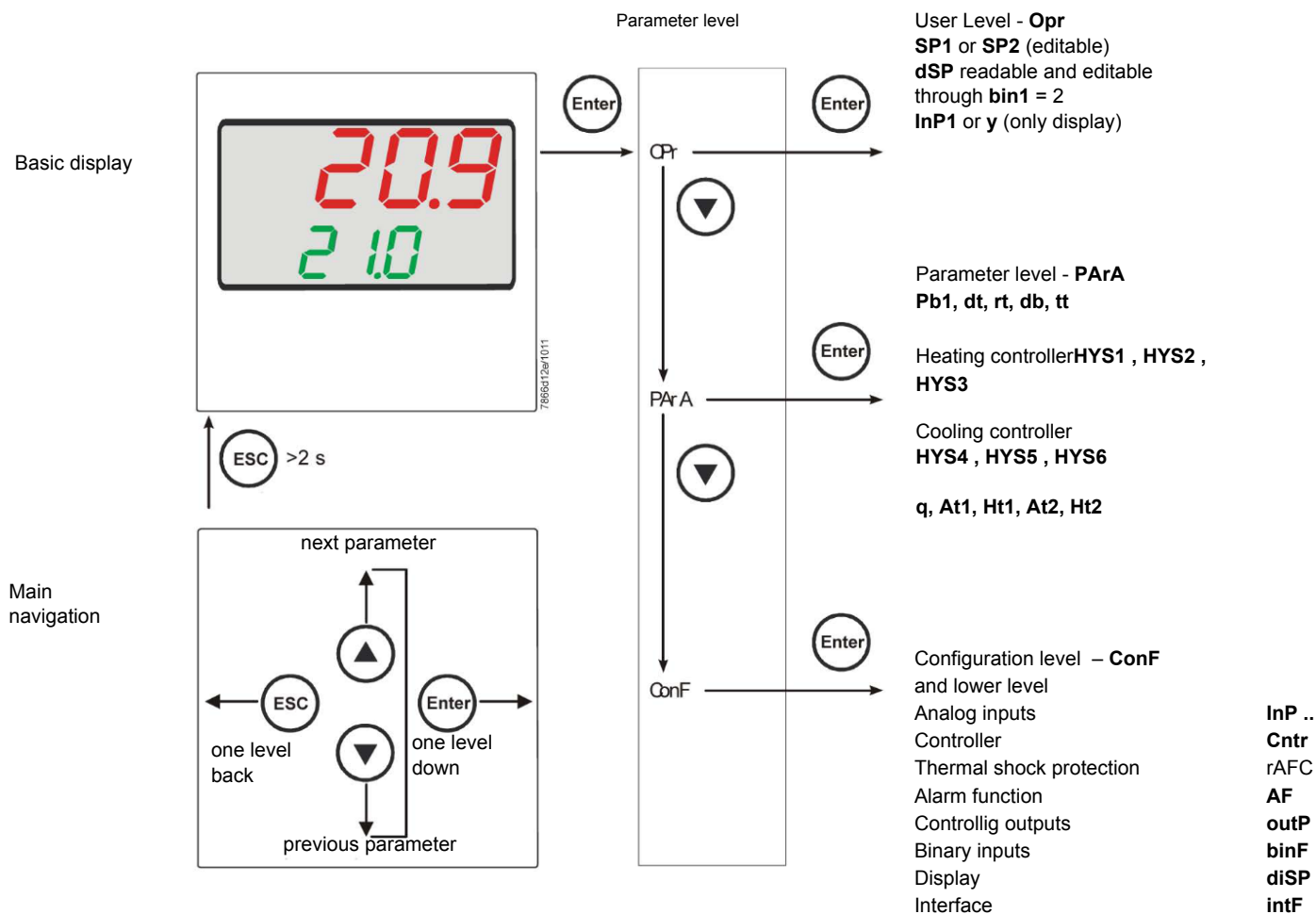


### Drilling dimensions:



## FRONT PANEL





RWF55 is preset good for 90% of applications. However, you can set or edit parameters as follow:

### Set-point: set or modification:

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

### PID parameters set and modifications (PARA):

Push **Enter** button, on the green display **Op** appears; using the **down arrow**, scroll until group **PARA** is reached and push **Enter**.

On the green display **Pb1** appears and on the red one the set parameter. Push is sequence the **down or up** arrow the menu is scrolled.

Push **Enter** to select and the **arrows** to choose the desired value. **Enter** to confirm

| Parameter                                                  | Display | Range              | Factory setting | Remarks                                                                                  |
|------------------------------------------------------------|---------|--------------------|-----------------|------------------------------------------------------------------------------------------|
| Proportional band                                          | Pb1     | 1... 9999 digit    | 10              | Typical value for temperature                                                            |
| Derivative action                                          | dt      | 0... 9999 sec.     | 80              | Typical value for temperature                                                            |
| Integral action                                            | rt      | 0... 9999 sec.     | 350             | Typical value for temperature                                                            |
| Dead band (*)                                              | db      | 0... 999,9 digit   | 1               | Typical value                                                                            |
| Servocontrol running time                                  | tt      | 10... 3000 sec.    | 15              | Set servocontrol running time                                                            |
| Switch-on differential (*)                                 | HYS1    | 0,0... -1999 digit | -5              | Value under setpoint below which the burner switches back on (1N-1P closes)              |
| Switch-off differential 2° stage (*)                       | HYS2    | 0,0 ... HYS3       | 3               | (enable only with parameter bin1 = 4)                                                    |
| Upper switch-off differential (*)                          | HYS3    | 0,0... 9999 digit  | 5               | Value over setpoint above which the burner switches off (1N-1P opens)                    |
| Switch-on differential on cooling controller (*)           | HYS4    | 0,0... 9999 digit  | 5               | Do not used<br>(enable only with parameter <b>CACT</b> = 0)                              |
| Switch-off differential 2° stage on cooling controller (*) | HYS5    | HYS6...0,0 digit   | 5               | Do not used<br>(enable only with parameter <b>CACT</b> = 0 and parameter <b>bin1</b> =0) |
| Upper switch-off differential on cooling controller (*)    | HYS6    | 0,0... -1999 digit | 5               | Do not used<br>(enable only with parameter <b>CACT</b> = 0)                              |
| Delay modulation                                           | q       | 0,0... 999,9 digit | 0               | Do not alter                                                                             |
| Outside temperature Curve point 1 (*)                      | At1     | -40 ...120 digit   | -10             | First point of external temperature for climatic curve                                   |
| Boiler temperature Curve point 1 (*)                       | Ht1     | SPL...SPH          | 60              | Set-point temperature for the external temperature<br>1                                  |
| Outside temperature Curve point 2 (*)                      | At2     | -40 ...120 digit   | 20              | Second point of external temperature for climatic curve                                  |
| Boiler temperature Curve point 2 (*)                       | Ht2     | SPL...SPH          | 50              | Set-point temperature for the external temperature<br>2                                  |

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

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

Push the **Enter** button: on the lower display (green) **Opr** appears. Using the **up and down arrows** find **ConF**. Push **Enter** to confirm. Now on the green display the group **InP** appears. Push **Enter** and **InP1** is displayed. Enter to confirm. You are inside **InP1**; the green display shows **Sen1 (sensor type)**, while the red display shows the chosen sensor code. Push **Enter** to enter the **Sen1** parameter, then choose the desired sensor using the **arrows**. Push **Enter** to confirm and **ESC** to escape.

Once selected the sensor, you can modify all the other parameters using **up and down arrows** according to the tables here below :

#### ConF > InP > InP1

| Parameter                                    | Value              | Description                                                                       |
|----------------------------------------------|--------------------|-----------------------------------------------------------------------------------|
| SEn1<br>type of sensor for analog<br>input 1 | 1                  | Pt100 3 wire                                                                      |
|                                              | 2                  | Pt100 2 wire                                                                      |
|                                              | 3                  | Pt1000 3 wire                                                                     |
|                                              | 4                  | Pt1000 2 wire                                                                     |
|                                              | 5                  | Ni1000 3 wire                                                                     |
|                                              | 6                  | Ni1000 2 wire                                                                     |
|                                              | 7                  | 0 ÷ 135 ohm                                                                       |
|                                              | 8                  | Cu-CuNi T                                                                         |
|                                              | 9                  | Fe-CuNi J                                                                         |
|                                              | 10                 | NiCr-Ni K                                                                         |
|                                              | 11                 | NiCrSi-NiSi N                                                                     |
|                                              | 12                 | Pt10Rh-Pt S                                                                       |
|                                              | 13                 | Pt13Rh-Pt R                                                                       |
|                                              | 14                 | Pt30Rh-Pt6Rh B                                                                    |
|                                              | 15                 | 0 ÷ 20mA                                                                          |
|                                              | 16                 | 4 ÷ 20mA                                                                          |
|                                              | 17                 | 0 ÷ 10V                                                                           |
|                                              | 18                 | 0 ÷ 5V                                                                            |
|                                              | 19                 | 1 ÷ 5V                                                                            |
| OFF1<br>Sensor offset                        | -1999..0.. +9999   | Correction value measured by the sensor                                           |
| SCL1<br>scale low level                      | -1999..0.. +9999   | minimum scale value(for input ohm, mA, V)                                         |
| SCH1<br>scale high level                     | -1999..100.. +9999 | maximum scale value(for input ohm, mA, V)                                         |
| dF1<br>digital filter                        | 0...0,6...100      | Is used to adapt the digital 2nd order input filter (time in s; 0 s = filter off) |
| Unit<br>temperature unit                     | 1                  | 1 = <b>degrees</b> Celsius                                                        |
|                                              | 2                  | 2 = degrees Fahrenheit                                                            |

(**bold** = factory settings)

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### ConF > InP > InP2

Input 2 : this input can be used to specify an external setpoint or carry out setpoint shifting

| Parameter                   | Value                       | Description                                                                       |
|-----------------------------|-----------------------------|-----------------------------------------------------------------------------------|
| FnC2                        | 0                           | 0= <b>no function</b>                                                             |
|                             | 1                           | 1= external setpoint (display <b>SPE</b> )                                        |
|                             | 2                           | 2 =setpoint shifting (display <b>dSP</b> )                                        |
|                             | 3                           | 3 = angular positioning feedback                                                  |
| SEn2<br>sensor type input 2 | 1                           | 0 ÷ 20mA                                                                          |
|                             | 2                           | 4 ÷ 20mA                                                                          |
|                             | 3                           | 0 ÷ 10V                                                                           |
|                             | 4                           | 0 ÷ 5V                                                                            |
|                             | 5                           | 1 ÷ 5V                                                                            |
|                             | 1                           | 0 ÷ 20mA                                                                          |
| OFF2<br>Sensor offset       | -1999.. <b>0</b> .. +9999   | Correction value measured by the sensor                                           |
| SCL2<br>scale low level     | -1999.. <b>0</b> .. +9999   | minimum scale value(for input ohm, mA, V)                                         |
| SCH2<br>scale high level    | -1999.. <b>100</b> .. +9999 | maximum scale value(for input ohm, mA, V)                                         |
| dF2<br>digital filter       | 0... <b>2</b> ...100        | Is used to adapt the digital 2nd order input filter (time in s; 0 s = filter off) |

(**bold** = factory settings)

### ConF > InP > InP3

Input 3: this input is used to acquire the outside temperature

| Parameter                                          | Value                     | Description                                                                       |
|----------------------------------------------------|---------------------------|-----------------------------------------------------------------------------------|
| SEn3<br>sensor type input 3<br>sensor type input 2 | 0                         | 0 =                                                                               |
|                                                    | 1                         | 1 = wire                                                                          |
|                                                    | 2                         | 2 = wire                                                                          |
| OFF3<br>Sensor offset                              | -1999.. <b>0</b> .. +9999 | Correction value measured by the sensor                                           |
| dF3<br>digital filter                              | 0... <b>1278</b> ...1500  | Is used to adapt the digital 2nd order input filter (time in s; 0 s = filter off) |

(**bold** = factory settings)

## ConF > Cntr

Here, the type of controller, operating action, setpoint limits and presets for self-optimization are selected

| Parameter                                               | Value                     | Description                                                                                                                                                                               |
|---------------------------------------------------------|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CtYP<br>controller type                                 | 1<br>2                    | <b>1 = 3-position controller (open-stop-close)</b><br>2 = continuative action controller (0 ÷ 10V or 4 ÷ 20mA)                                                                            |
| CACt<br>control action                                  | 1<br>0                    | <b>1 = heating controller</b><br>0 = cooling controller                                                                                                                                   |
| SPL<br>least value of the set-point range               | -1999.. <b>0</b> ..+9999  | minimum set-point scale                                                                                                                                                                   |
| SPH<br>maximum value of the set-point range             | -1999.. <b>100</b> ..+999 | maximum set-point scale                                                                                                                                                                   |
| Self-optimization                                       | 0<br>1                    | <b>0 = Free</b><br>1 = Locked<br>Self-optimization can only be disabled or enabled via the ACS411 setup program.<br>Self-optimization is also disabled when the parameter level is locked |
| pLLo<br>set-point limitation start, operation limit low | -1999.... +9999           | lower working range limit                                                                                                                                                                 |
| pLHi<br>set-point limitation end, operation limit high  | -1999.... <b>+9999</b>    | upper working range limit                                                                                                                                                                 |

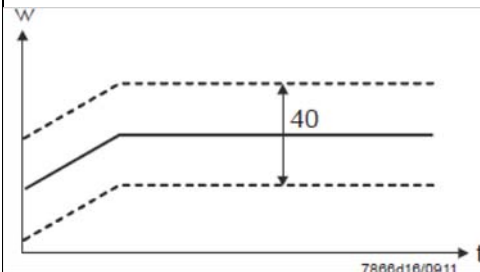
(**bold** = factory settings)

## ConF > rAFC

Activation boiler shock termic protetion:

RWF55.. can activate the thermal shock protection only on sites where the set-point is lower than 250°C and according to **rAL** parameter

| Parameter                   | Value                          | Description                                                                                                                                                                                                                                    |
|-----------------------------|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FnCT<br>type of control     | <b>0</b><br>1<br>2             | choose type of range degrees/time<br><b>0 = deactivated</b><br>1 = Kelvin degrees/minute<br>2 = Kelvin degrees/hour                                                                                                                            |
| rASL<br>ramp rate           | <b>0,0</b> ... 999,9           | Slope of thermal shock protection (only with functions 1 and 2)                                                                                                                                                                                |
| tolP<br>tolerance band ramp | <b>2 x (HYS1) = 10</b> ...9999 | width of tolerance band (in K) about the set-point<br><b>0 = tolerance band inactive</b>                                                                                                                                                       |
| rAL<br>ramp limit           | <b>0</b> ...250                | Ramp limit. When this value is lower than the temperature set-point, the RWF controls the output increasing the temp set point step by step according to <b>rASL</b> . If this is over the temp set point, the control is performed in cooling |



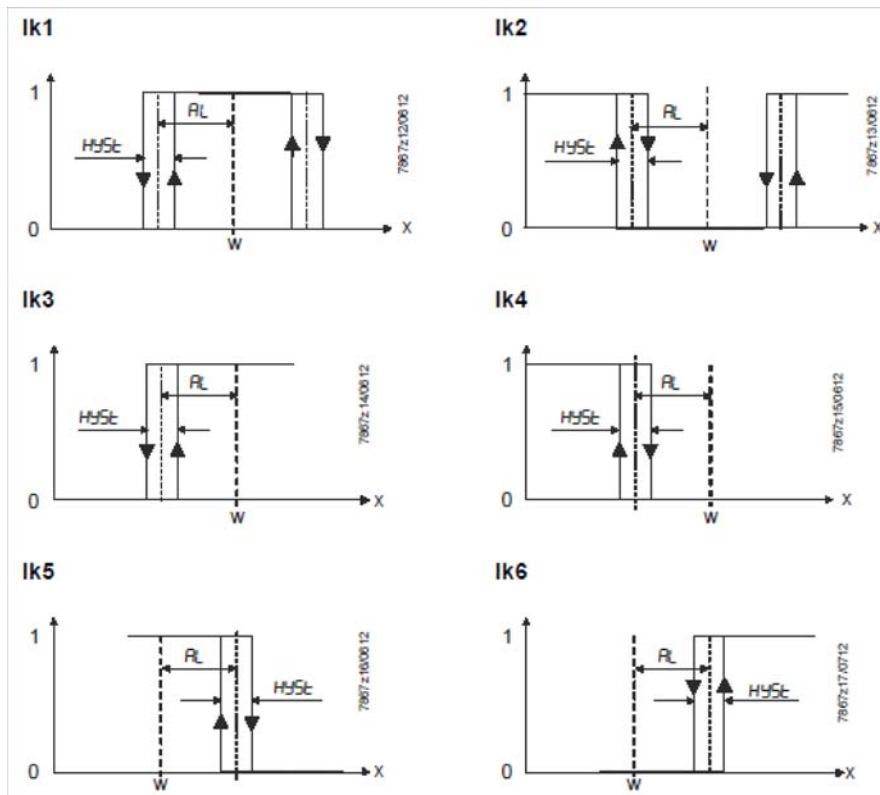
(**bold** = factory settings)

## Alarm functionAF

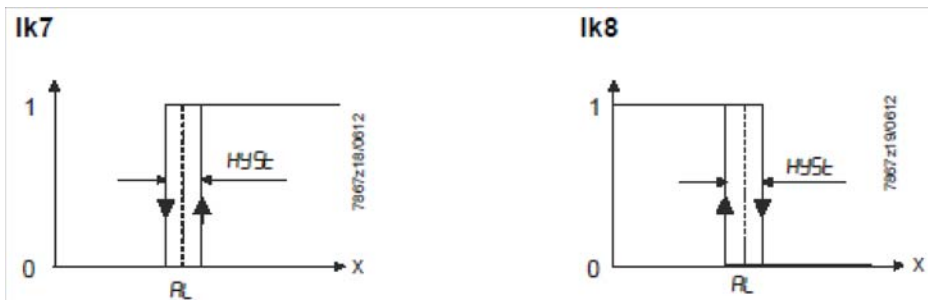
The alarm function can be used to monitor the analog inputs. If the limit value is exceeded, multifunctional relay K6 (terminals **6N** and **6P**) is activated (depending on the switching characteristic)

The alarm function can have different switching functions (Ik1 to Ik8) and can be set to a deviation from the active setpoint or to a fixed limit value

Limit value **AL** relative to setpoint (x)



Fixed limit value **AL**



## ConF > AF

| Parameter                        | Value                                                            | Description                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------------------------|------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FnCt<br>type of control          | 0<br>1<br>2<br>3<br>4<br>5<br>6<br>7<br>8<br>9<br>10<br>11<br>12 | 0 = <b>Without function</b><br>Ik1 = monitored input InP1<br>Ik2 = monitored input InP1<br>Ik3 = monitored input InP1<br>Ik4 = monitored input InP1<br>Ik5 = monitored input InP1<br>Ik6 = monitored input InP1<br>Ik7 = monitored input InP1<br>Ik8 = monitored input InP1<br>Ik7 = monitored input InP2<br>Ik8 = monitored input InP2<br>Ik7 = monitored input InP3<br>Ik8 = monitored input InP3 |
| Alarm value<br>AL                | -1999 ...<br><b>0</b><br>1999                                    | Limit value or deviation from setpoint to be monitored (see alarm functions<br><b>Ik1 to Ik8</b> : limit value <b>AL</b> )<br>Limit value range for <b>Ik1</b> and <b>Ik20</b> ...9999                                                                                                                                                                                                              |
| HySt<br>switching differential   | 0...<br>1...<br>9999                                             | Switching differential for limit value <b>AL</b>                                                                                                                                                                                                                                                                                                                                                    |
| ACrA<br>response by out of range | <b>0</b><br>1                                                    | <b>Switched-off</b><br>ON<br>Switching state in the case of measuring range overshoot or undershoot (Out of Range)                                                                                                                                                                                                                                                                                  |

(**bold** = factory settings)

## ConF > OutP

For fuel-air ratio control purposes, the RWF55 has the binary outputs K2, K3 (terminals KQ,K2, K3) and the analog output (terminals A+, A-). The burner is released via relay K1 (terminals 1N, 1P) .

The binary outputs of the RWF55 offer no setting choices

The RWF55 has an analog output.

The analog output offers the following setting choices:

| Parameter                             | Value                        | Description                                                                                                                                                                                                                                                       |
|---------------------------------------|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FnCt<br>type of control               | 1<br>2<br>3<br><b>4</b>      | 1 = analog input 1 doubling with possibility to convert<br>2 = analog input 2 doubling with possibility to convert<br>3 = analog input 3 doubling with possibility to convert<br><b>4 = Controller's angular positioning is delivered (modulating controller)</b> |
| SiGn<br>type of output signal         | <b>0</b><br>1<br>2           | physical output signal (terminals A+, A-)<br><b>0 = 0÷20mA</b><br>1 = 4÷20mA<br>2 = 0÷10V DC                                                                                                                                                                      |
| rOut<br>value when out of input range | <b>0</b> ...101              | signal (in percent) when measurement range is crossed                                                                                                                                                                                                             |
| oPnt<br>zero point                    | -1999... <b>0</b> ...+9999   | A value range of the output variable is assigned to a physical output signal (for <b>FnCt</b> = 1, 2, 3)                                                                                                                                                          |
| End<br>end point                      | -1999... <b>100</b> ...+9999 | A value range of the output variable is assigned to a physical output signal (for <b>FnCt</b> = 1, 2, 3)                                                                                                                                                          |

(**bold** = factory settings)

## ConF > binF

This setting decides on the use of the binary inputs **D1**, **D2**, **DG**

b

| Parameter                                                 | Value                   | Description                                                                                                                                                      |
|-----------------------------------------------------------|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| bin1<br>binary input 1 (terminals <b>DG</b> – <b>D1</b> ) | <b>0</b><br>1<br>2<br>3 | <b>0 = without function</b><br>1 = set-point changeover (SP1 / SP2)<br>2 = lset-point shift (Opr > dSP parameter = value of set-point modify)<br>3 = input alarm |
| bin2<br>binary input 2 (terminals <b>DG</b> – <b>D2</b> ) | <b>4</b>                | <b>changeover of operating mode</b><br>DG-D2 open = modulating operation<br>DG-D2 close = 2 stage operation                                                      |

(**bold** = factory settings)

## ConF > dISP

.Both displays can be customized to suit your needs by configuring the displayed value, decimal, time out and blocking

| Parameter                     | Value                                  | Description                                                                                                                                                                                                                                                                              |
|-------------------------------|----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| diSU<br>upper display (red)   | <b>0</b><br>1<br>2<br>3<br>4<br>6<br>7 | Display value for upper display:<br>0 = display power-off<br><b>1 = analog input 1 (InP1) value</b><br>2 = analog input 2 (InP2) value<br>3 = analog input 3 (InP3) value<br>4 = controller's angular positioning<br>6 = set-point values<br>7 = end value with thermal shock protection |
| diSL<br>lower display (green) | <b>0</b><br>1<br>2<br>3<br>4<br>6<br>7 | Display value for lower display:<br>0 = display power-off<br>1 = analog input 2 (InP2) value<br>2 = analog input 2 (InP2) value<br>3 = analog input 2 (InP2) value<br>4 = controller's angular positioning<br><b>6 = set-point values</b><br>7 = end value with thermal shock protection |
| tout<br>timeout               | 0.. <b>180</b> ..250                   | time (s) on completion of which the controller returns automatically to the basic display, if no button is pressed                                                                                                                                                                       |
| dECP<br>decimal point         | <b>0</b><br>1<br>2                     | <b>0 = no decimal place</b><br>1 = one decimal place<br>2 = two decimal place                                                                                                                                                                                                            |
| CodE<br>level lockout         | <b>0</b><br>1<br>2<br>3                | <b>0 = no lockout</b><br>1 = configuration level lockout ( <b>ConF</b> )<br>2 = parameter and configuration level lockout ( <b>PARa</b> & <b>ConF</b> )<br>3 = keyboard lockout                                                                                                          |

(**bold** = factory settings)

## ConF > IntF

The controller can be integrated into a data network using an optional RS-485 (terminals R+ and R-) interface or an optional Profibus DP interface(only model **RWF55.6x** terminals C1-C2-C3-C4)

| Parameter                     | Value                        | Description                                                               |
|-------------------------------|------------------------------|---------------------------------------------------------------------------|
| bdr<br>baudrate               | <b>0</b><br>1<br>2<br>3      | <b>0 = 4800 baud</b><br>1 = 9600 baud<br>2 = 19200 baud<br>3 = 38400 baud |
| Adr<br>Device address Modbus  | 0..<br><b>1</b> ..<br>254    | Address in the data network                                               |
| dP<br>Device address Profibus | 0.. <b>125</b>               | only with RWF55.6x                                                        |
| dt<br>Remote detection time   | 0..<br><b>30</b> ..<br>7200s | 0 = switched-off                                                          |

(**bold** = factory settings)

## Manual control :

In order to manual change the burner load, while firing keep pushing the **ESC** button for more than 5 s; on the lower green display **Hand** appears.

using the **UP** and **DOWN** arrows, the load varies.

Keep pushing the **ESC** button for getting the normal operation again.

NB: every time the device shuts the burner down (start led switched off - contact 1N-1P open), the manual control is not active.

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

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



Follow the below instructions:

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

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

### Display of software version :

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



### Weather-compensated setpoint shifting(climatic regulation):

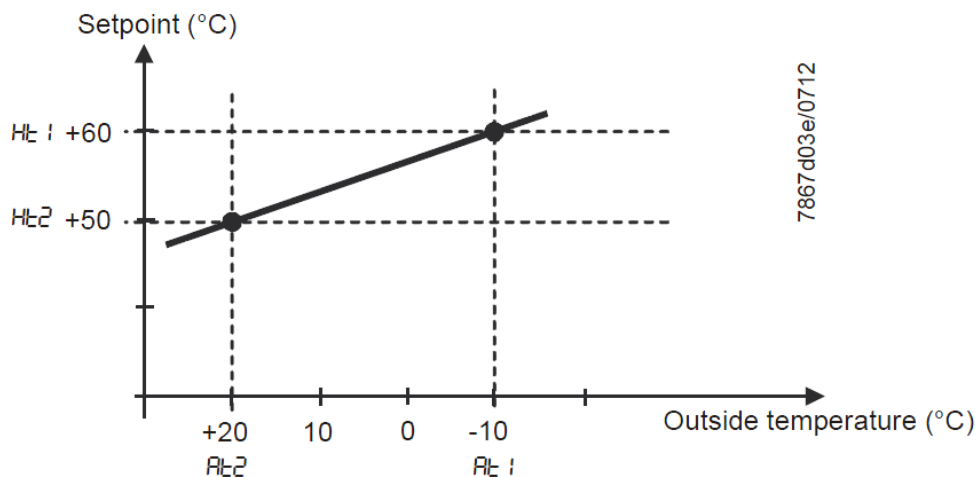
The RWF55 can be configured so that weather-compensated setpoint shifting is activated when an LG-Ni1000 outside sensor or a Pt1000 is connected (see parameter **InP3**).

To take into account the time response of a building, weather-compensated setpoint shifting uses the attenuated outside temperature rather than the current outside temperature

The minimum and maximum setpoints can be set using the lower setpoint limit **SPL** and the upper setpoint limit **SPH** of the menu **Crtr**.

The system also prevents the lower working range limit **oLLo** and upper working range limit **oLHi** from exceeding/dropping below the system temperature limits.

The heating curve describes the relationship between the boiler temperature setpoint and the outside temperature. It is defined by 2 curve points. For 2 outside temperatures, the user defines the boiler temperature setpoint that is required in each case. The heating curve for the weather-compensated setpoint is calculated on this basis. The effective boiler temperature setpoint is limited by the upper setpoint limit **SPH** and the lower setpoint limit **SPL**.



For setting climatic regulation function set:

**PArA** > parameters **At1**, **Ht1**, **At2**, **Ht2**

**ConF** > **InP** > **InP3** parameters **SEn3**, **FnC3** = 1 (Weather-compensated setpoint).

---

## Modbus interface

The tables that follow in this chapter specify the addresses of the readable and writable words that the customer is able to access. The customer may read and/or write the values using SCADA programs, PLCs, or similar.

The entries under Access have the following meanings:

**R/O** Read Only, value can only be read

**R/W** Read/Write, value can be read and written

The number of characters specified under Data type in the case of character strings includes the final \0.

Char10 means that the text is up to 9 characters long. The final \0 character is then added to this

### User level

| Address | Access | Data type | Signal reference | Parameter                      |
|---------|--------|-----------|------------------|--------------------------------|
| 0x0000  | R/O    | Float     | X1               | Analog input InP1              |
| 0x0002  | R/O    | Float     | X2               | Analog input InP2              |
| 0x0004  | R/O    | Float     | X3               | Analog input InP2              |
| 0x0006  | R/O    | Float     | WR               | Actual setpoint                |
| 0x0008  | R/W    | Float     | SP1              | Setpoint 1                     |
| 0x000A  | R/W    | Float     | SP2 (= dSP)      | Setpoint 2                     |
| 0x1035  | R/O    | Float     | ---              | Analog input InP3 (unfiltered) |
| 0x1043  | R/O    | Float     | ---              | Actual angular positioning     |
| 0x1058  | R/O    | Word      | B1               | Burner alarm                   |

### Parameter level

| Address | Access | Data type | Signal reference | Parameter                           |
|---------|--------|-----------|------------------|-------------------------------------|
| 0x3000  | R/W    | Float     | Pb1              | Proportional range 1                |
| 0x3004  | R/W    | Float     | dt               | Derivative action time              |
| 0x3006  | R/W    | Float     | rt               | Integral action time                |
| 0x300C  | R/W    | Float     | db               | Dead band                           |
| 0x3012  | R/W    | Word      | tt               | Controlling element running time    |
|         |        |           |                  |                                     |
| 0x3016  | R/W    | Float     | HYS1             | Switch-on threshold                 |
| 0x3018  | R/W    | Float     | HYS2             | Switch-off threshold down           |
| 0x301A  | R/W    | Float     | HYS3             | Switch-off threshold up             |
| 0x301C  | R/W    | Float     | HYS4             | Switch-on threshold (cooling)       |
| 0x301E  | R/W    | Float     | HYS5             | Switch-off threshold down (cooling) |
| 0x3020  | R/W    | Float     | HYS6             | Switch-off threshold up (cooling)   |
| 0x3022  | R/W    | Float     | q                | Reaction threshold                  |
|         |        |           |                  |                                     |
| 0x3080  | R/W    | Float     | At1              | Outside temperature 1               |
| 0x3082  | R/W    | Float     | Ht2              | Boiler temperature 1                |
| 0x3084  | R/W    | Float     | At2              | Outside temperature 2               |
| 0x3086  | R/W    | Float     | Ht2              | Boiler temperature 2                |

## Configuration level

| Address | Access | Data type | Signal reference | Parameter                                   |
|---------|--------|-----------|------------------|---------------------------------------------|
| 0x3426  | R/W    | Float     | SCL1             | Start of display input 1                    |
| 0x3428  | R/W    | Float     | SCH1             | End of display input 1                      |
| 0x3432  | R/W    | Float     | SCL2             | Start value input 2                         |
| 0x3434  | R/W    | Float     | SCH2             | End value input 2                           |
| 0x3486  | R/W    | Float     | SPL              | Start of setpoint limitation                |
| 0x3488  | R/W    | Float     | SPH              | End of setpoint limitation                  |
| 0x342A  | R/W    | Float     | OFFS1            | Offset input E1                             |
| 0x3436  | R/W    | Float     | OFFS2            | Offset input E2                             |
| 0x343A  | R/W    | Float     | OFFS3            | Offset input E3                             |
|         |        |           |                  |                                             |
| 0x1063  | R/W    | Word      | FnCt             | Ramp function                               |
| 0x1065  | R/W    | Float     | rASL             | Ramp slope                                  |
| 0x1067  | R/W    | Float     | toLP             | Tolerance band ramp                         |
| 0x1069  | R/W    | Float     | rAL              | Limit value                                 |
| 0x1075  | R/W    | Float     | dtT              | Remote Detection Timer                      |
|         |        |           |                  |                                             |
| 0x1077  | R/W    | Float     | dF1              | Filter constant input 1                     |
| 0x1079  | R/W    | Float     | dF2              | Filter constant input 2                     |
| 0x107B  | R/W    | Float     | dF3              | Filter constant input 3                     |
| 0x107D  | R/O    | Float     | oLLo             | Lower working range limit                   |
| 0x107F  | R/O    | Float     | oLHi             | Upper working range limit                   |
|         |        |           |                  |                                             |
| 0x106D  | R/W    | Word      | FnCt             | Alarm relay function                        |
| 0x106F  | R/W    | Float     | AL               | Alarm relay limit value (limit value alarm) |
| 0x1071  | R/W    | Float     | HYSt             | Alarm relay hysteresis                      |

## Remote operation

| Address | Access | Data type | Signal reference | Parameter                                   |
|---------|--------|-----------|------------------|---------------------------------------------|
| 0x0500  | R/W    | Word      | REM              | Activation remote operation *               |
| 0x0501  | R/W    | Word      | rOFF             | Controller OFF in remote setpoint **        |
| 0x0502  | R/W    | Float     | rHYS1            | Switch-on threshold remote                  |
| 0x0504  | R/W    | Float     | rHYS2            | Switch-off threshold down remote            |
| 0x0506  | R/W    | Float     | rHYS3            | Switch-off threshold up remote              |
| 0x0508  | R/W    | Float     | SPr              | Setpoint remote                             |
|         |        |           |                  |                                             |
| 0x050A  | R/W    | Word      | RK1              | Burner release remote operation             |
| 0x050B  | R/W    | Word      | RK2              | Relay K2 remote operation                   |
| 0x050C  | R/W    | Word      | RK3              | Relay K3 remote operation                   |
| 0x050D  | R/W    | Word      | RK6              | Relay K6 remote operation                   |
| 0x050E  | R/W    | Word      | rStEP            | Step-by-step control remote operation       |
| 0x050F  | R/W    | Float     | rY               | Angular positioning output remote operation |
| 0x0511  | R/W    | Float     | rHYS4            | Switch-on threshold remote (cooling)        |
| 0x0513  | R/W    | Float     | rHYS5            | Switch-off threshold down remote (cooling)  |
| 0x0515  | R/W    | Float     | rHYS6            | Switch-off threshold up remote (cooling)    |

### Legend

\* = Local

\*\* = Controller OFF

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**Dati dell'apparecchio**

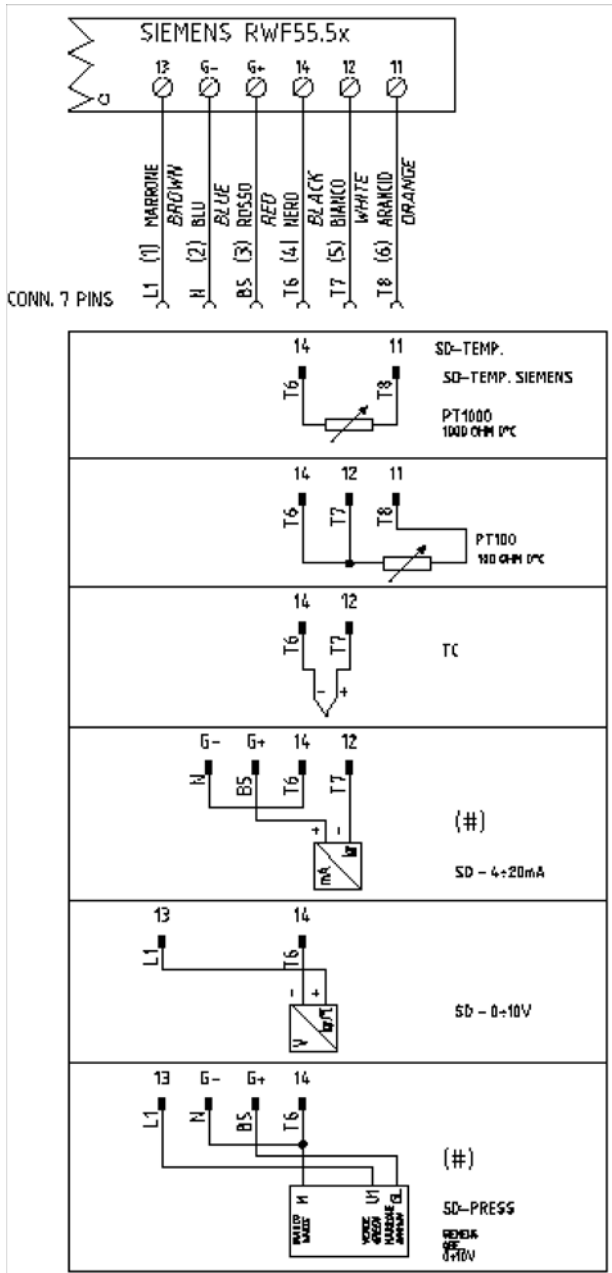
| Address | Access | Data type | Signal reference | Parameter        |
|---------|--------|-----------|------------------|------------------|
| 0x8000  | R/O    | Char12    | ---              | Software version |
| 0x8006  | R/O    | Char14    | ---              | VdN number       |

**Stato dell'apparecchio**

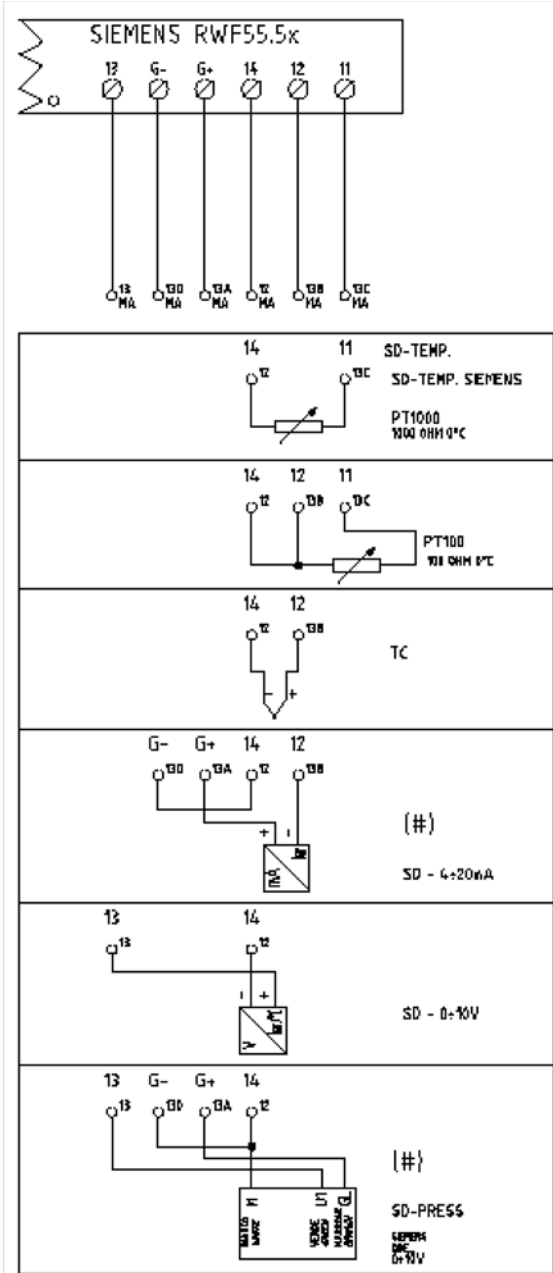
| Address | Access | Data type | Signal reference | Parameter                             |
|---------|--------|-----------|------------------|---------------------------------------|
| 0x0200  | R/O    | Word      | ---              | Outputs and states                    |
|         |        |           | Bit 0            | Output 1                              |
|         |        |           | Bit 1            | Output 3                              |
|         |        |           | Bit 2            | Output 2                              |
|         |        |           | Bit 3            | Output 4                              |
|         |        |           | Bit 8            | Hysteresis limitation                 |
|         |        |           | Bit 9            | Control system                        |
|         |        |           | Bit 10           | Self-optimization                     |
|         |        |           | Bit 11           | Second setpoint                       |
|         |        |           | Bit 12           | Measuring range overshoot InP1        |
|         |        |           | Bit 13           | Measuring range overshoot InP2        |
|         |        |           | Bit 14           | Measuring range overshoot InP3        |
|         |        |           | Bit 15           | Calibration mode                      |
|         |        |           |                  |                                       |
| 0x0201  | R/O    | Word      | ---              | Binary signals and hardware detection |
|         |        |           | Bit 0            | Operation mode 2-stage                |
|         |        |           | Bit 1            | Manual mode                           |
|         |        |           | Bit 2            | Binary input D1                       |
|         |        |           | Bit 3            | Binary input D2                       |
|         |        |           | Bit 4            | Thermostat function                   |
|         |        |           | Bit 5            | First controller output               |
|         |        |           | Bit 6            | Second controller output              |
|         |        |           | Bit 7            | Alarm relay                           |
|         |        |           | Bit 13           | Analog output available               |
|         |        |           | Bit 14           | Interface available                   |

Electric connections :

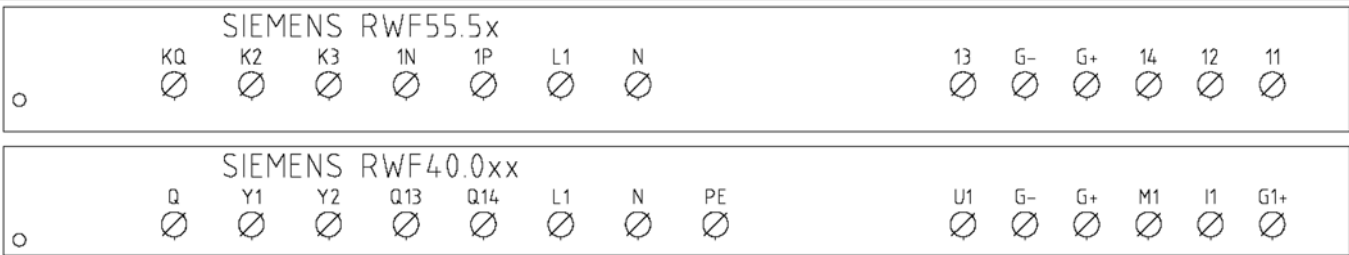
With 7 pins connector version



With terminals version



Correspondences bornes entre RWF55.5x y RWF40.0x0Matches terminals betweenRWF55.5x and RWF40.0x0



## Parameters summarising for RWF55.xx :

| Navigation menù        | ConF           |      |          |          |          | ConF     |          |          |      |       |      |     |      |          | Opr         |
|------------------------|----------------|------|----------|----------|----------|----------|----------|----------|------|-------|------|-----|------|----------|-------------|
|                        | Inp            |      |          |          |          |          |          | diSP     |      |       |      |     |      |          |             |
|                        | Inp1           |      |          |          |          |          |          |          | Cntr |       | PArA |     |      |          |             |
|                        | Types of probe | SEn1 | OFF1     | SCL      | SCH      | Unit     | SPL      | SPH      | dECP | Pb. 1 | dt   | rt  | tt   | HYS1 (*) |             |
| Siemens QAE2120...     | 6              | 0    | needless | needless | 1        | 30       | 95       | 1        | 10   | 80    | 350  | (#) | -5   | 5        | 80 °C       |
| Siemens QAM2120..      | 6              | 0    | needless | needless | 1        | 0        | 80       | 1        | 10   | 80    | 350  | (#) | -2,5 | 2,5      | 40°C        |
| Pt1000 (130°C max.)    | 4              | 0    | needless | needless | 1        | 30       | 95       | 1        | 10   | 80    | 350  | (#) | -5   | 5        | 80°C        |
| Pt1000 (350°C max.)    | 4              | 0    | needless | needless | 1        | 0        | 350      | 1        | 10   | 80    | 350  | (#) | -5   | 10       | 80°C        |
| Pt100 (130°C max.)     | 1              | 0    | needless | needless | 1        | 0        | 95       | 1        | 10   | 80    | 350  | (#) | -5   | 5        | 80°C        |
| Pt100 (350°C max)      | 1              | 0    | needless | needless | 1        | 0        | 350      | 1        | 10   | 80    | 350  | (#) | -5   | 10       | 80°C        |
| Probe4÷20mA / 0÷1,6bar | 16             | 0    | 0        | 160      | needless | 0        | 160      | 0        | 5    | 20    | 80   | (#) | 0    | 20       | 100 kPa     |
| Probe4÷20mA / 0÷3bar   | 16             | 0    | 0        | 300      | needless | 0        | 300      | 0        | 5    | 20    | 80   | (#) | 0    | 20       | 200 kPa     |
| Probe 4÷20mA / 0÷10bar | 16             | 0    | 0        | 1000     | needless | 0        | 1000     | 0        | 5    | 20    | 80   | (#) | 0    | 50       | 600 kPa     |
| Probe 4÷20mA / 0÷16bar | 16             | 0    | 0        | 1600     | needless | 0        | 1600     | 0        | 5    | 20    | 80   | (#) | 0    | 80       | 600 kPa     |
| Probe 4÷20mA / 0÷25bar | 16             | 0    | 0        | 2500     | needless | 0        | 2500     | 0        | 5    | 20    | 80   | (#) | 0    | 125      | 600 kPa     |
| Probe 4÷20mA / 0÷40bar | 16             | 0    | 0        | 4000     | needless | 0        | 4000     | 0        | 5    | 20    | 80   | (#) | 0    | 200      | 600 kPa     |
| Probe 4÷20mA / 0÷60PSI | 16             | 0    | 0        | 600      | needless | 0        | 600      | 0        | 5    | 20    | 80   | (#) | 0    | 30       | 300 (30PSI) |
| Probe4÷20mA / 0÷200PSI | 16             | 0    | 0        | 2000     | needless | 0        | 2000     | 0        | 5    | 20    | 80   | (#) | 0    | 75       | 600 (60PSI) |
| Probe4÷20mA / 0÷300PSI | 16             | 0    | 0        | 3000     | needless | 0        | 3000     | 0        | 5    | 20    | 80   | (#) | 0    | 120      | 600 (60PSI) |
| Siemens QBE2002 P4     | 17             | 0    | 0        | 400      | needless | 0        | 400      | 0        | 5    | 20    | 80   | (#) | 0    | 20       | 200 kPa     |
| Siemens QBE2002 P10    | 17             | 0    | 0        | 1000     | needless | 0        | 1000     | 0        | 5    | 20    | 80   | (#) | 0    | 50       | 600 kPa     |
| Siemens QBE2002 P16    | 17             | 0    | 0        | 1600     | needless | 0        | 1600     | 0        | 5    | 20    | 80   | (#) | 0    | 80       | 600 kPa     |
| Siemens QBE2002 P25    | 17             | 0    | 0        | 2500     | needless | 0        | 2500     | 0        | 5    | 20    | 80   | (#) | 0    | 125      | 600 kPa     |
| Siemens QBE2002 P40    | 17             | 0    | 0        | 4000     | needless | 0        | 4000     | 0        | 5    | 20    | 80   | (#) | 0    | 200      | 600 kPa     |
| Signal 0÷10V           | 17             | 0    | needless | needless | needless | needless | needless | needless | 5    | 20    | 80   | (#) |      |          |             |
| Signal 4÷20mA          | 16             | 0    | needless | needless | needless | needless | needless | needless | 5    | 20    | 80   | (#) |      |          |             |

### NOTE:

(#) tt – servo control run time

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

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

### WARNING :

With pressure probes in bar the parameters SP1, SCH, SCL, HYS1, HYS3 must be set and displayed in kPa (kilo Pascal); 1bar = 100,000Pa = 100kPa.

With pressure probes in PSI the parameters SP1, SCH, SCL, HYS1, HYS3 must be set and displayed in PSI x10 (example: 150PSI > I display 1500).

## APPENDIX: PROBES CONNECTION

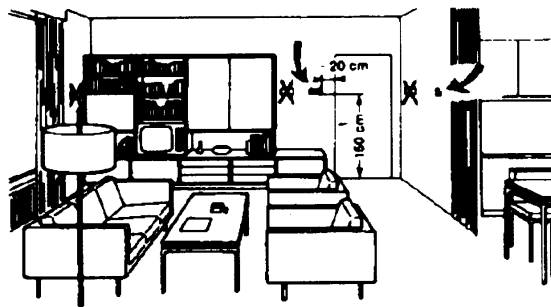
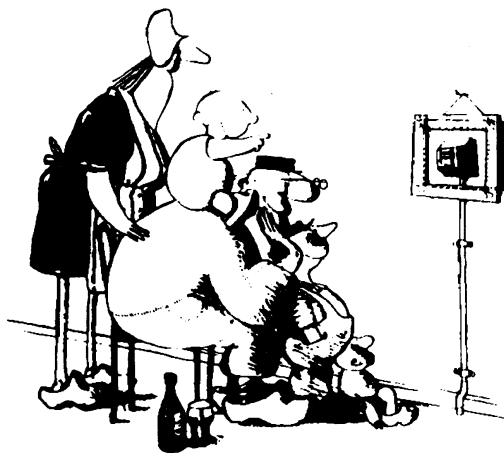
To assure the utmost comfort, the control system needs reliable information, which can be obtained provided the sensors have been installed correctly. Sensors measure and transmit all variations encountered at their location.

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

### Ambient probes (or ambient thermostats)

#### Installation

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

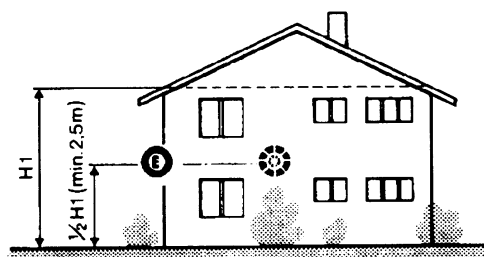
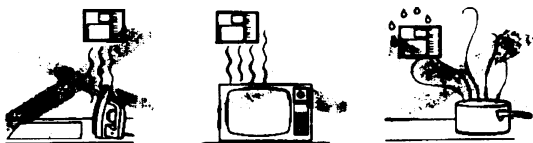


#### Outside probes (weather) Installation

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

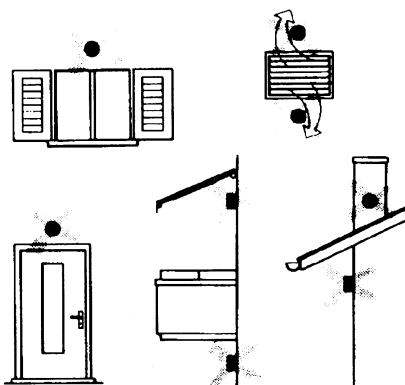
#### It's good to be admired ...even better to be effective

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



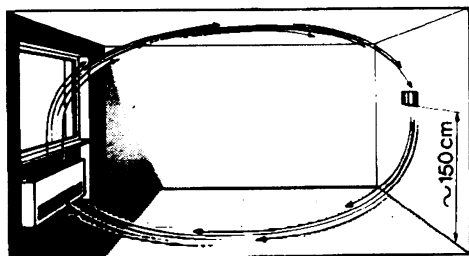
**General rule:** en on the outer wall of the building where the living rooms are, never on the south-facing wall or in a position where they will be affected by morning sun. If in any doubt, place them on the north or north-east façade.

#### Positions to be avoided



#### Location

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



#### Installation position to be avoided

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

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

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

## Duct or pipe sensors

### Installing temperature sensors

For measuring outlet air:

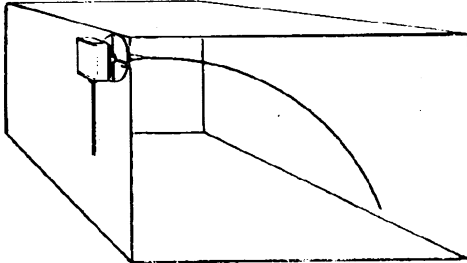
"after delivery fan or

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

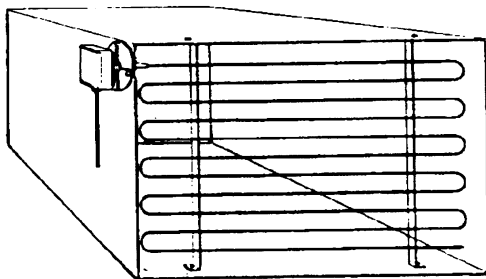
For measuring room temperature:

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

For measuring saturation temperature: after mist eliminator.



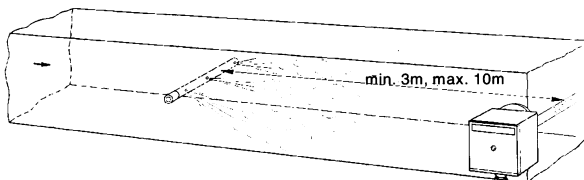
Bend 0.4m sensor by hand (never use tools) as illustrated .



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

### Installing combined humidity sensors

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



### Installing pressure sensors

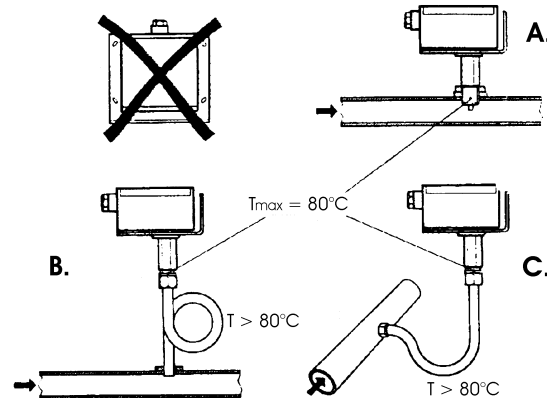
A - installation on ducts carrying fluids at max. temperature 80°C

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

C - installation on ducts at high temperatures :

· "increase length of siphon

"place sensor at side to prevent it being hit by hot air coming from the pipe.



### Installing differential pressure sensors for water

Installation with casing facing down not allowed.

With temperature over 80°C, siphons are needed.

To avoid damaging the sensor, you must comply with the following instructions :

when installing: make sure pressure difference is not greater than the value permitted by the sensor

when there are high static pressures, make sure you insert shutoff valves A-B-C.

### Putting into operation

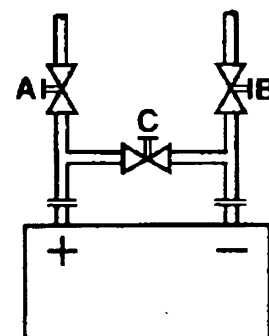
Start disable

1=open C1=open C

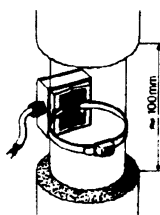
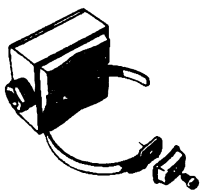
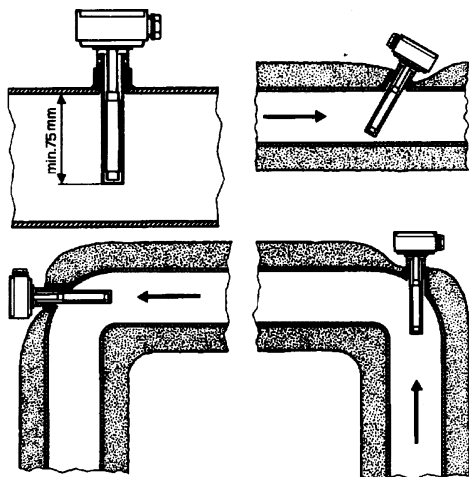
2=open A2=close B

3=open B3=close A

4= close C



## Immersion or strap-on sensors



### Immersion probes installation

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

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

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

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

### Installing QAD2.. strap-on sensors

Make sure fluid is circulating in the chosen location.

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

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

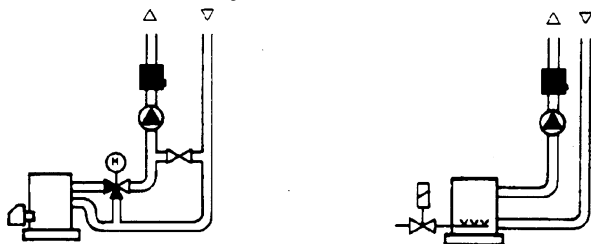
## Placing the probes (QAD22.../QAE21.../QAP21.../RCA...)

### With pumps on outlet

with 3 ways valves / with 4 ways valves



Panel system / burner control



### With pumps on return

with 3 ways valves / with 4 ways valves



### Strap-on or immersion sensors?

#### QAD2.. strap-on sensors

Advantages :

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

ΠLimits:

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

#### QAE2... immersion sensors

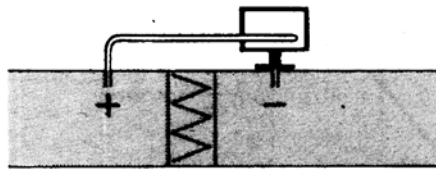
Advantages:

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

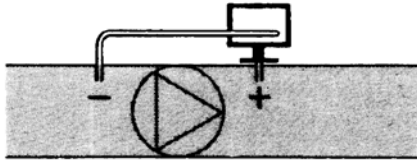
Limits:

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

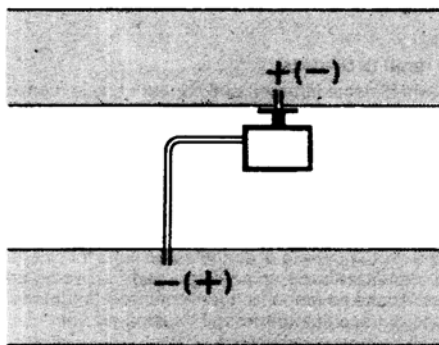
Installing differential pressure probes for air



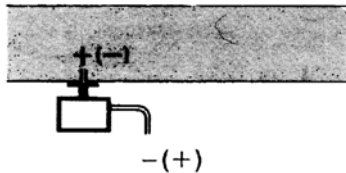
A - Control a filter (clogging)



B - Control a fan (upstream/downstream)



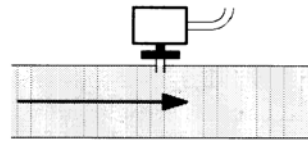
C - Measurement of difference in pressure between two ducts



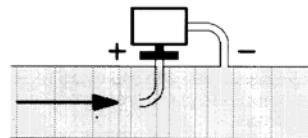
D - Measurement of difference in pressure between two rooms or of inside of duct and outside

Basic principles

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



Measuring dynamic pressure

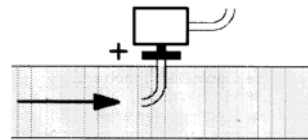


$$P_d = \frac{\gamma q^2}{2g}$$

Legend

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

Measuring total pressure





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