

**TPBY1030**  
**TPBY1050**  
**TPBY1080**

***Heavy oil Burners  
with pneumatic atomization  
with LMV5 micro-processor control***

**MANUAL OF INSTALLATION - USE - MAINTENANCE**



**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.**

*The following:*

- Entails the customer's acknowledgement and acceptance of the company's general terms and conditions of sale, in force at the date of order confirmation and available in the appendix to the current price lists.
- Is intended exclusively for specialised, experienced and trained users able to operate in conditions that are safe for people, the device and the environment, and in full compliance with the requirements set out on the following pages and with current health and safety regulations.

Information regarding assembly/installation, maintenance, replacement and repair is always and exclusively intended for (and therefore only to be carried out by) specialised personnel and/or directly by the Authorised Technical Service

### IMPORTANT :

The supply has been made at the best conditions on the basis of the customer's order and technical indications concerning the state of the places and the installation systems, as well as the need to prepare certain certifications and / or additional adaptations with respect to the standard observed and transmitted for each product. In this respect, the manufacturer declines any responsibility for complaints, malfunctions, criticalities, damages and/or anything else consequent to incomplete, inaccurate and/or missing information, as well as failure to comply with the technical requirements and installation regulations, initial start-up, operational management and maintenance.

For proper operation of the device, it is necessary to ensure the readability and conservation of the manual, also for future reference. In case of deterioration or more simply for reasons of technical and operational insight, contact the manufacturer directly. Text, descriptions, images, examples and anything else contained in this document are the exclusive property of the manufacturer. Any reproduction is prohibited.

## RISK ANALYSIS

### Instruction manual delivered with the device:

This is an integral and essential part of the product and must not be separated from it. It must therefore be kept carefully for any necessary consultation and must accompany the burner even if it is transferred to another owner or user, or to another system. In the event of damage or loss, another copy must be requested from the local customer service centre;

### Delivery of the system and instruction manual

The supplier of the system is obliged to accurately inform the user about:-  
Use of the system;

- any further testing that may be necessary before activating the system;
- maintenance and the requirement to have the system checked at least once a year by a contractor or other specialised technician.

To ensure periodic monitoring, the manufacturer recommends drawing up a Maintenance Agreement.

## WARRANTY AND LIABILITY

In particular, warranty and liability claims will no longer be valid in the event of damage to persons and/or property if such damage is due to any of the following causes:

- Incorrect installation, start-up, use and maintenance of the burner;
- Improper, incorrect or unreasonable use of the burner;
- Operation by unqualified personnel;
- Carrying out of unauthorised changes to the device;
- Use of the burner with safety devices that are faulty, incorrectly applied and/or not working;
- Installation of untested supplementary components on the burner;
- Powering of the burner with unsuitable fuels;
- Faults in the fuel supply system;
- Use of the burner even after an error and/or fault has occurred;
- Repairs and/or overhauls incorrectly carried out;

- Modification of the combustion chamber with inserts that prevent the regular development of the structurally established flame;
- Insufficient and inappropriate supervision and care of the burner components most subject to wear and tear;
- Use of non-original components, whether spare parts, kits, accessories and optionals;
- Force majeure.

**Furthermore, the manufacturer declines all responsibility for non-compliance with this manual.**



**WARNING!** Failure to comply with this manual, operational negligence, incorrect installation and unauthorised modifications will result in the manufacturer's warranty for the burner being voided.

### Personnel training

The user is the person, organisation or company that has acquired the appliance and intends to use it for the specific purpose. The user is responsible for the appliance and for training the personnel that operate it.

### The user:

- Undertakes to entrust the machine to suitably trained and qualified personnel;
- Must take all measures necessary to prevent unauthorised people gaining access to the appliance;
- Undertakes to adequately inform personnel about application and observance of the safety requirements, and therefore ensure that they are familiar with the operating instructions and safety requirements;
- Must inform the manufacturer if any faults or malfunctions of the accident prevention systems occur, and if there is any suspected danger;
- Personnel must always use the personal protective equipment required by law and follow the instructions provided in this manual;
- Personnel must observe all danger and caution notices on the appliance;
- Personnel must not carry out, on their own initiative, operations or interventions outside their area of expertise;
- Personnel must inform their superiors of any problem and danger that may arise;
- The assembly of parts of other makes, or any modifications made, may alter the characteristics of the appliance and may therefore compromise operational safety. The manufacturer therefore declines all responsibility for damages arising from the use of non-original parts.

## 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 cutout 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 **WARNING!** Failure to observe the information given in this manual, ope-

rating negligence, incorrect installation and carrying out of non authorised modifications will result in the annulment by the manufacturer of the guarantee that it supplies with the burner.

The 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

### SPECIAL INSTRUCTIONS FOR BURNERS

a Make the following checks:

- 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:

- remove the power supply by disconnecting the power cord from the mains;
- disconnect the fuel supply by means of the hand-operated shutoff 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:
  - set the burner fuel flow rate depending on the heat input of the appliance;
  - 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;
  - 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;
  - make sure that control and safety devices are operating properly;
  - make sure that exhaust ducts intended to discharge the products of combustion are operating properly;
  - on completion of setting and adjustment operations, make sure that all mechanical locking devices of controls have been duly tightened;
  - 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.

### GENERAL INSTRUCTIONS DEPENDING ON FUEL USED

#### 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 should be switched off.

### FIRING WITH GAS, LIGHT OIL OR OTHER FUELS GENERAL

#### General Warnings

- 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:
  - the fuel supply system, for proper sealing;
  - the fuel flow rate, to make sure that it has been set based on the firing rate required of the burner;
  - the burner firing system, to make sure that it is supplied for the designed fuel type;
  - the fuel supply pressure, to make sure that it is included in the range shown on the rating plate;
  - 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:

- the gas delivery line and train are in compliance with the regulations and provisions in force;
  - all gas connections are tight;
  - 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

- do not operate electric switches, the telephone, or any other item likely to generate sparks;
  - immediately open doors and windows to create an air flow to purge the room;
  - close the gas valves;
  - 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.

#### Using oil pressure gauges

Generally, pressure gauges are equipped with a manual valve. Open the valve only to take the reading and close it immediately afterwards.

#### Safety and prevention

- Opening or tampering with the burner components is not allowed, apart from the parts requiring maintenance.
- Only those parts envisaged by the manufacturer can be replaced.

## SYMBOLS USED

|  |                |                                                                                                                                                         |
|--|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>WARNING</b> | Failure to observe the warning may result in irreparable damage (electrical or mechanical source respectively) to the unit or damage to the environment |
|  | <b>DANGER!</b> | Failure to observe the warning may result in serious injuries or death (electrical or mechanical source respectively).                                  |
|  | <b>NOTE</b>    | This symbol distinguishes warnings of an annotative, reminder, general nature                                                                           |

## 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.

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.

## DIRECTIVES AND STANDARDS

### Heavy oil burners

#### European directives

**2014/35/UE** (Low Tension Directive)

**2014/30/UE** (Electromagnetic compatibility Directive)

**2006/42/CE** (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);

**UNI EN ISO 12100:2010** (Safety of machinery - General principles for design - Risk assessment and risk reduction);

### Industrial burners

#### European directives

**2006/42/CE** (Machinery Directive)

**2014/35/UE** (Low Tension Directive)

**2014/30/UE** (Electromagnetic compatibility Directive)

**2006/42/CE** (Machinery Directive)

#### Harmonized standards

**EN 746-2** (Industrial thermoprocessing equipment - Part 2: Safety requirements for combustion and fuel handling systems)

**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);

**UNI EN ISO 12100:2010** (Safety of machinery - General principles for design - Risk assessment and risk reduction);

## BURER 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

### Consump

|              |    |
|--------------|----|
| 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.       | -- |

## PART I: SPECIFICATIONS

### 1.0 GENERAL FEATURES

This particular burner series has been studied to use compressed air or alternatively steam, to atomize heavy oil. In this way we have achieved higher efficiency compared to mechanical atomization. These burners are equipped with a low pressure nozzle which permits to save fuel and, above all, to preserve the whole system. All burners are progressive type, complete with electrical panel, with self cleaning nozzle system and oil pump motor to be separately installed by the final user. A supplying system of compressed air and steam at 8 bar must be provided on the site. All burners are ignited by means of a pilot flame burning LPG or Natural gas. The standard version of the burner uses compressed air to atomize oil fuel. If compressed air is not available on site, it is possible to use steam to atomize oil fuel by using a special kit. In any case compressed air is essential: to ignite the burner when steam is not available, to control valves and for self cleaning nozzle.

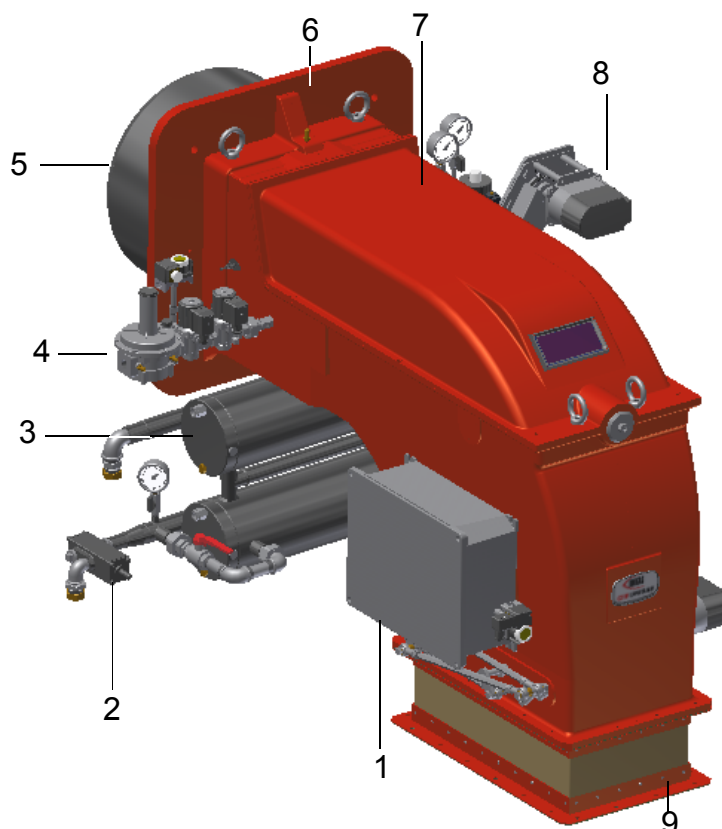


Fig. 1

Note: the figure is indicative only.

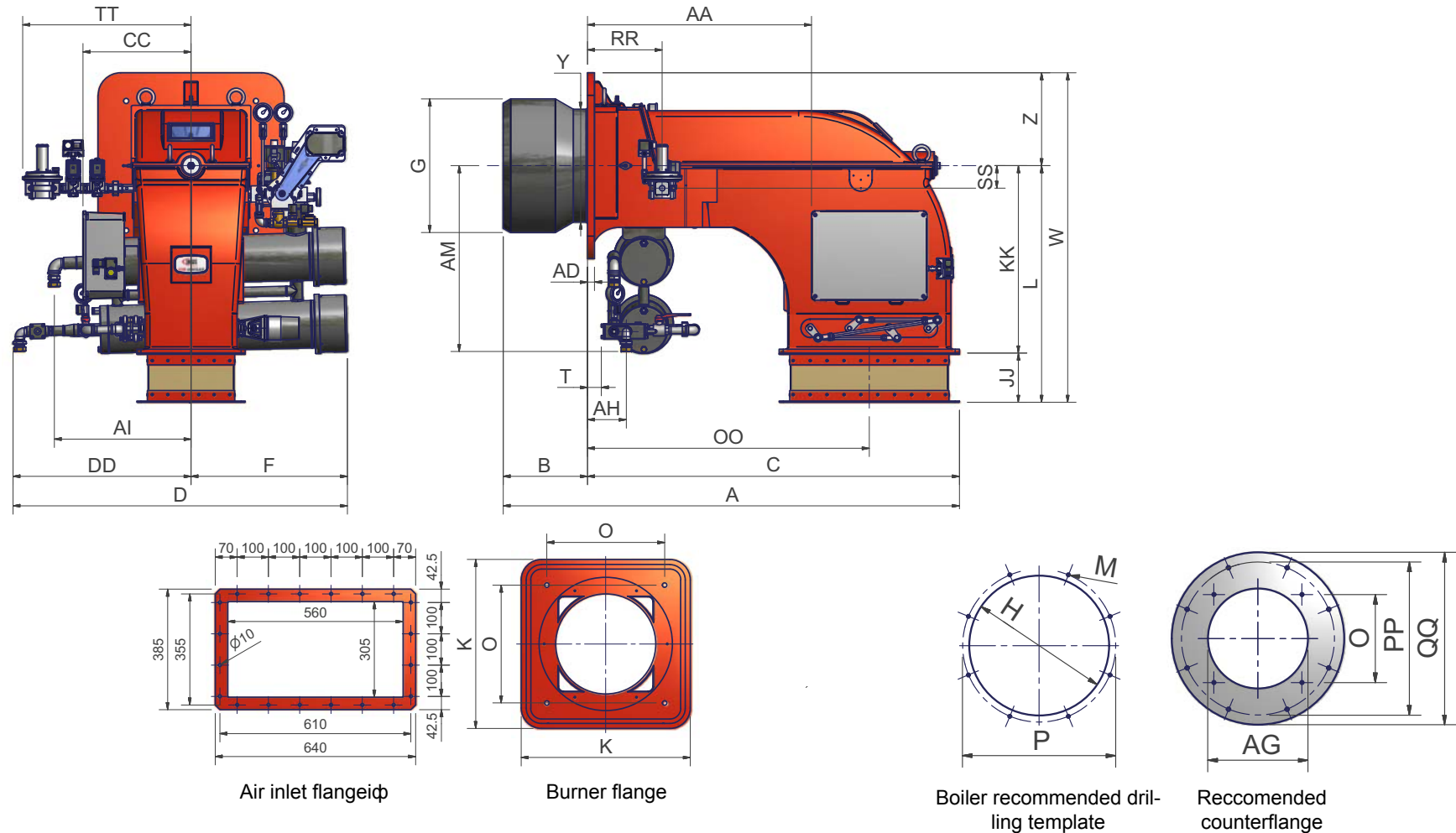
- 1 Burner junction box
- 2 Pressure governor
- 3 Oil pre-heater tank
- 4 Pilot gas train
- 5 Blast tube-combustion head
- 6 Burner flange
- 7 Burner cover
- 8 Oil train
- 9 Air inlet flange

| Type | TPBY1030 | Model | H-  | MD. | S.  | .   | A.  | ES. |
|------|----------|-------|-----|-----|-----|-----|-----|-----|
|      | (1)      |       | (2) | (3) | (4) | (5) | (6) | (7) |

|                                    |                                                                                                                                                                                                                                                      |
|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (1) BURNER TYPE                    | <b>TPBY1030 – TPBY1050 - TPBY1080</b>                                                                                                                                                                                                                |
| (2) FUEL                           | H - heavy oil, max viscosity 4000cSt (530°E) @ 50°C                                                                                                                                                                                                  |
| (3) OPERATION (Available versions) | MD - Fully modulating                                                                                                                                                                                                                                |
| (4) BLAST TUBE                     | S - Standard                                  L - Extended                                                                                                                                                                                           |
| (5) DESTINATION COUNTRY            | * - see data plate                                                                                                                                                                                                                                   |
| (6) BURNER VERSION                 | A - Standard<br>Y - Special<br>E- Junction box<br>G - Control panel and junction box                                                                                                                                                                 |
| (6) MICRO-PROCESSOR CONTROL        | ES = with no O <sub>2</sub> trim control, with no VSD control<br>EO = with O <sub>2</sub> trim control, with no VSD control<br>EI = with no O <sub>2</sub> trim control, with VSD control<br>EK = with O <sub>2</sub> trim control, with VSD control |

| BURNER                                     |                  | TPBY1030                                | TPBY1050     | TPBY1080     |
|--------------------------------------------|------------------|-----------------------------------------|--------------|--------------|
| Output                                     | min ÷ max kW     | 2550 - 13300                            | 3100 - 15500 | 3800 - 19000 |
| Fuel                                       |                  | Heavy oil                               |              |              |
| Oil viscosity                              |                  | See "Burner model identification" table |              |              |
| Heavy oil rate                             | min. ÷ max. kg/h | 222 - 1160                              | 270 - 1351   | 331 - 1656   |
| Gas pressure                               | max. mbar        | 500                                     |              |              |
| Gas pressure after gas governor            | mbar             | 100                                     |              |              |
| Compressed air pressure                    | min. ÷ max. bar  | 4 - 10                                  |              |              |
| Power supply                               |                  | 400V 3N a.c. 50Hz                       |              |              |
| Total power consumption (with Cucchi Pump) | kW               | 37,6                                    | 50           | 50           |
| Total power consumption (with Kral Pump)   | kW               | 37,6                                    | 45,5         | 5            |
| Pump motor (Cucchi)                        | kW               | 1,1                                     | 1,5          | 1,5          |
| Pump motor (Kral)                          | kW               | 1,1                                     | 1,1          | 1,5          |
| Pre-heater resistors                       | kW               | 36                                      | 48           | 48           |
| Protection                                 |                  | IP40                                    |              |              |
| Approx. weight                             | kg               | 165                                     | 175          | 185          |
| Operation                                  |                  | Fully modulating                        |              |              |
| Operating temperature                      | °C               | -10 ÷ +50                               |              |              |
| Storage Temperature                        | °C               | -20 ÷ +60                               |              |              |
| Working service*                           |                  | Continuous                              |              |              |

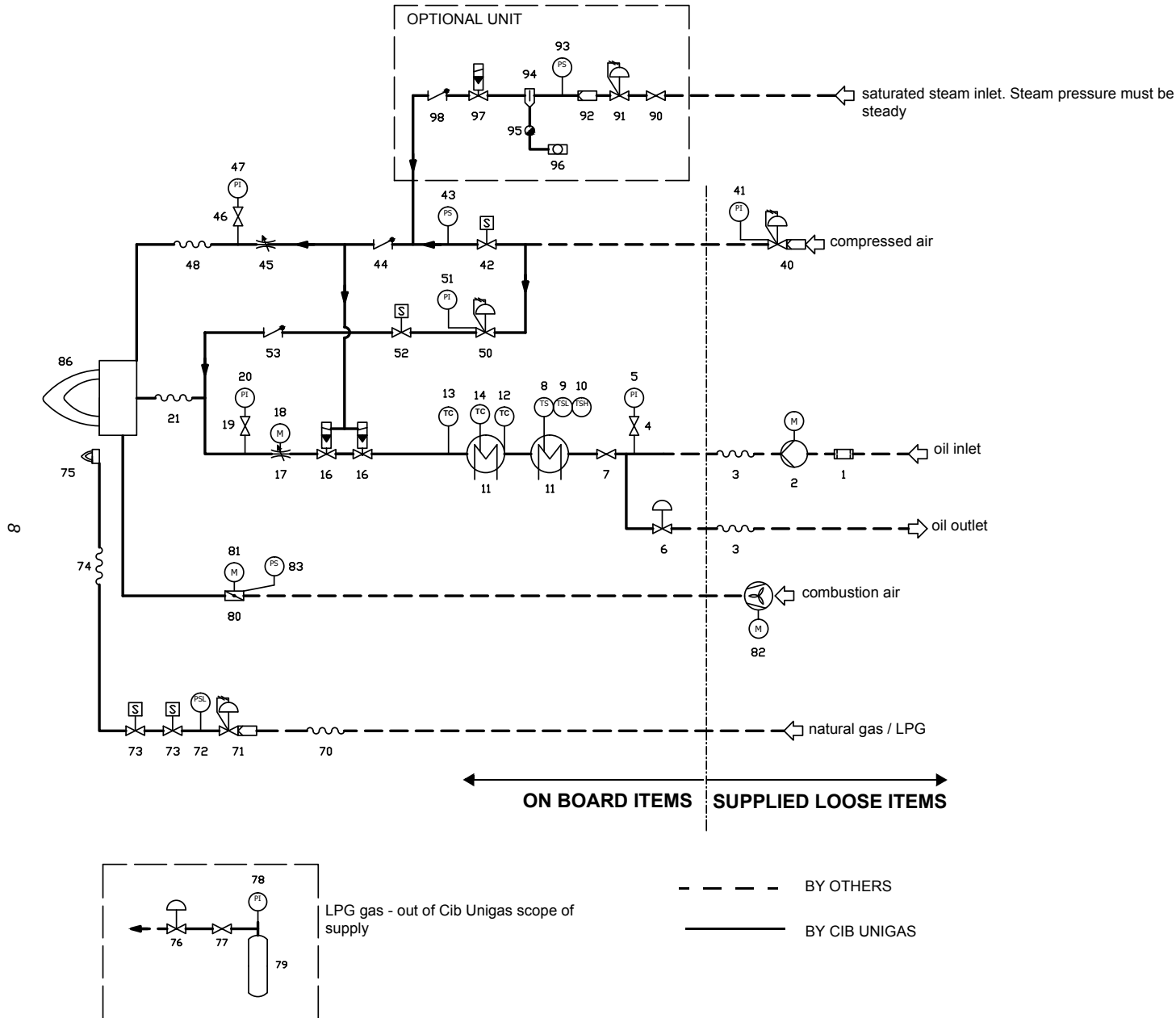
1.3 Overall dimensions (mm)



|          | A <sub>S</sub> * | A <sub>L</sub> | AA  | AD | AG  | AH  | AI  | AM  | B <sub>S</sub> * | B <sub>L</sub> * | C    | CC  | D    | DD  | F   | G   | H   | JJ  | K   | KK  | L   | M   | N   | O   | OO   | P   | PP  | QQ  | R   | RR  | SS | T  | TT  | W    | Y   | Z   |
|----------|------------------|----------------|-----|----|-----|-----|-----|-----|------------------|------------------|------|-----|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|-----|-----|-----|-----|-----|----|----|-----|------|-----|-----|
| TPBY1030 | 1673             | -              | 795 | 25 | 523 | 138 | 485 | 589 | 353              | -                | 1320 | 383 | 1187 | 632 | 555 | 633 | 693 | 175 | 660 | 665 | 840 | M16 | 651 | 460 | 1000 | 800 | 800 | 900 | 200 | 265 | 80 | 49 | 598 | 1170 | 400 | 330 |
| TPBY1050 | 1681             | 1900           | 795 | 25 | 523 | 138 | 485 | 589 | 361              | 580              | 1320 | 383 | 1156 | 632 | 558 | 671 | 731 | 175 | 660 | 665 | 840 | M16 | 651 | 460 | 1000 | 800 | 800 | 900 | 200 | 265 | 80 | 49 | 598 | 1170 | 412 | 330 |

(\*) S = standard blast tube    L = long blast tube

Fig. 2 - (3I2D-50 v3) Hydraulic diagram



NOTE: The following items are optional: 76, 77, 78, 79, 82, 90, 91, 92, 93, 94, 95, 96, 97, 98

| POS                                       | OIL TRAIN                            |
|-------------------------------------------|--------------------------------------|
| 1                                         | Filter                               |
| 2                                         | Pump with electromotor               |
| 3                                         | Flexible hose                        |
| 4                                         | Maual valve                          |
| 5                                         | Pressure gauge                       |
| 6                                         | Pressure governor                    |
| 7                                         | Maual valve                          |
| 8                                         | Thermostat                           |
| 9                                         | Low thermostat                       |
| 10                                        | High thermostat                      |
| 11                                        | Electrical preheater tank            |
| 12                                        | Temperature probe                    |
| 13                                        | Temperature probe                    |
| 14                                        | Temperature probe                    |
| 16                                        | Pneumatic valve                      |
| 17                                        | Metering valve with servomotor       |
| 18                                        | Actuator                             |
| 19                                        | Maual valve                          |
| 20                                        | Pressure gauge                       |
| 21                                        | Flexible hose                        |
| <b>COMPRESSED AIR TRAIN (ATOMIZATION)</b> |                                      |
| 40                                        | Pressure governor with filter        |
| 41                                        | Pressure gauge                       |
| 42                                        | Solenoid valve                       |
| 43                                        | Pressure switch                      |
| 44                                        | One-way valve                        |
| 45                                        | Metering valve                       |
| 46                                        | Manual valve                         |
| 47                                        | Pressure gauge                       |
| 48                                        | Flexible hose                        |
| <b>COMPRESSED AIR TRAIN (PURGE)</b>       |                                      |
| 50                                        | Pressure governor with filter        |
| 51                                        | Pressure gauge                       |
| 52                                        | Solenoid valve                       |
| 53                                        | One-way valve                        |
| <b>PILOT GAS TRAIN</b>                    |                                      |
| 71                                        | Pressure governor with filter        |
| 72                                        | Pressure switch                      |
| 73                                        | Solenoid valve                       |
| 74                                        | Flexible hose                        |
| 75                                        | Pilot burner                         |
| 76                                        | Pressure governor for L.P.G. tank    |
| 77                                        | Manual valve                         |
| 78                                        | Pressure gauge                       |
| 79                                        | L.P.G. tank                          |
| <b>COMBUSTION AIR TRAIN</b>               |                                      |
| 80                                        | Air damper                           |
| 81                                        | Actuator                             |
| 82                                        | Remote draught fan with electromotor |
| 83                                        | Pressure switch - PA                 |
| 86                                        | Burner                               |
| <b>STEAM TRAIN (OPTIONAL)</b>             |                                      |
| 90                                        | Manual valve                         |
| 91                                        | Regolatore di pressione              |
| 92                                        | Filter                               |
| 93                                        | Pressure switch                      |
| 94                                        | Water separator                      |
| 95                                        | Water drainage                       |
| 96                                        | Flow indicator                       |
| 97                                        | Pneumatic valve                      |
| 98                                        | One-way valve                        |

## PART II: INSTALLATION

### 2.0 MOUNTING AND CONNECTING THE BURNER

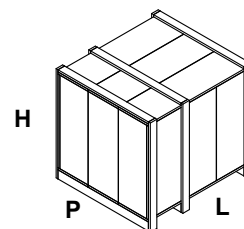
#### 2.1 Packing

Burners are despatched in wooden crates whose dimensions are:

- 2270 mm x 1720 mm x 1410 mm(L x P x H)

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

- burner;
- gasket/ceramic fiber plait to be inserted between the burner and the boiler;
- oil flexible hoses;
- oil filter;
- envelope containing this manual.



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

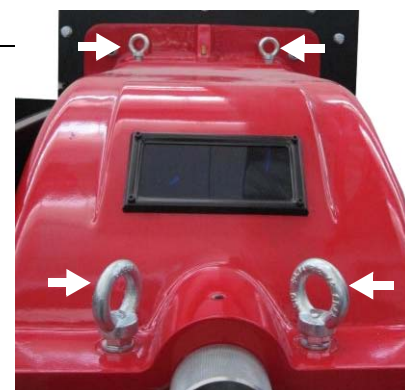
#### 2.2 Handling the burner



**WARNING!** The handling operations must be carried out by specialised and trained personnel. If these operations are not carried out correctly, the residual risk for the burner to overturn and fall down still persists.

To move the burner, use means suitable to support its weight (see paragraph "Technical specifications").

The burner is provided with eyebolts, for handling operations.

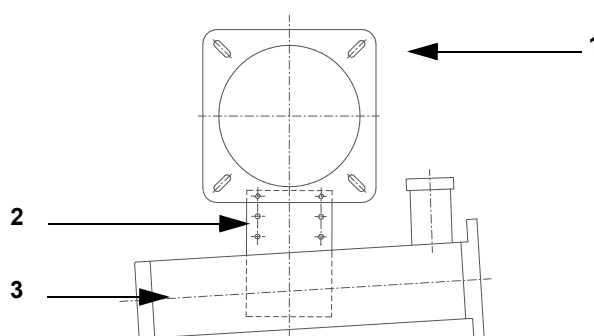


**Eyebolts**

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

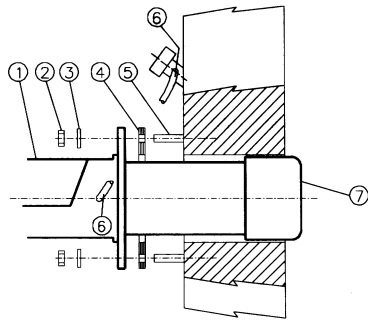
- 1 Burner flange (upper side indicated)
- 2 Bracket
- 3 Pre-heating tank on the burner



## 2.3 Fitting the burner to the boiler

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

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



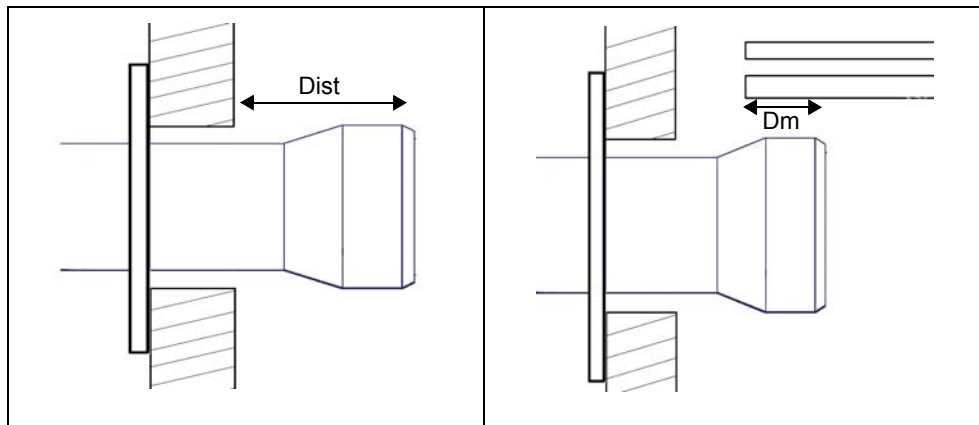
### Keys

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

## 2.4 Matching the burner to the boiler

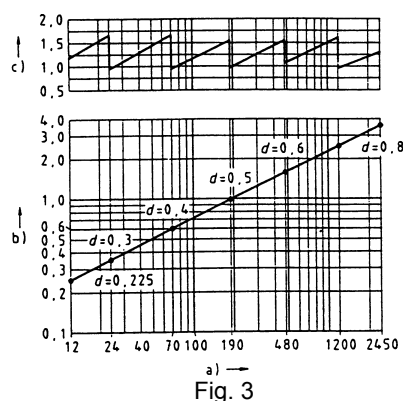
The burners described in this manual have been tested with combustion chambers that comply with EN676 regulation and whose dimensions are described in the diagram. In case the burner must be coupled with boilers with a combustion chamber smaller in diameter or shorter than those described in the diagram, please contact the supplier, to verify that a correct matching is possible, with respect of the application involved. To correctly match the burner to the boiler verify the type of the blast tube. Verify the necessary input and the pressure in combustion chamber are included in the burner performance curve; otherwise the choice of the burner must be revised consulting the burner manufacturer. To choose the blast tube length follow the instructions of the boiler manufacturer. In absence of these consider the following:

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



The length of the blast tubes does not always allow this requirement to be met, and thus it may be necessary to use a suitably-sized

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

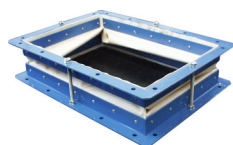


### Key

- a) Heat output in kW
- b) Length of the flame tube in meters
- c) Flame tube firing intensity in MW/m³
- d) Combustion chamber diameter (m)

Fig. 3 - Firing intensity, diameter and length of the test flame tube as a function of the heat input in kW.

## Fan installation



Connect the air duct to the burner by means of the bellows unit provided together with the burner (see the picture below).

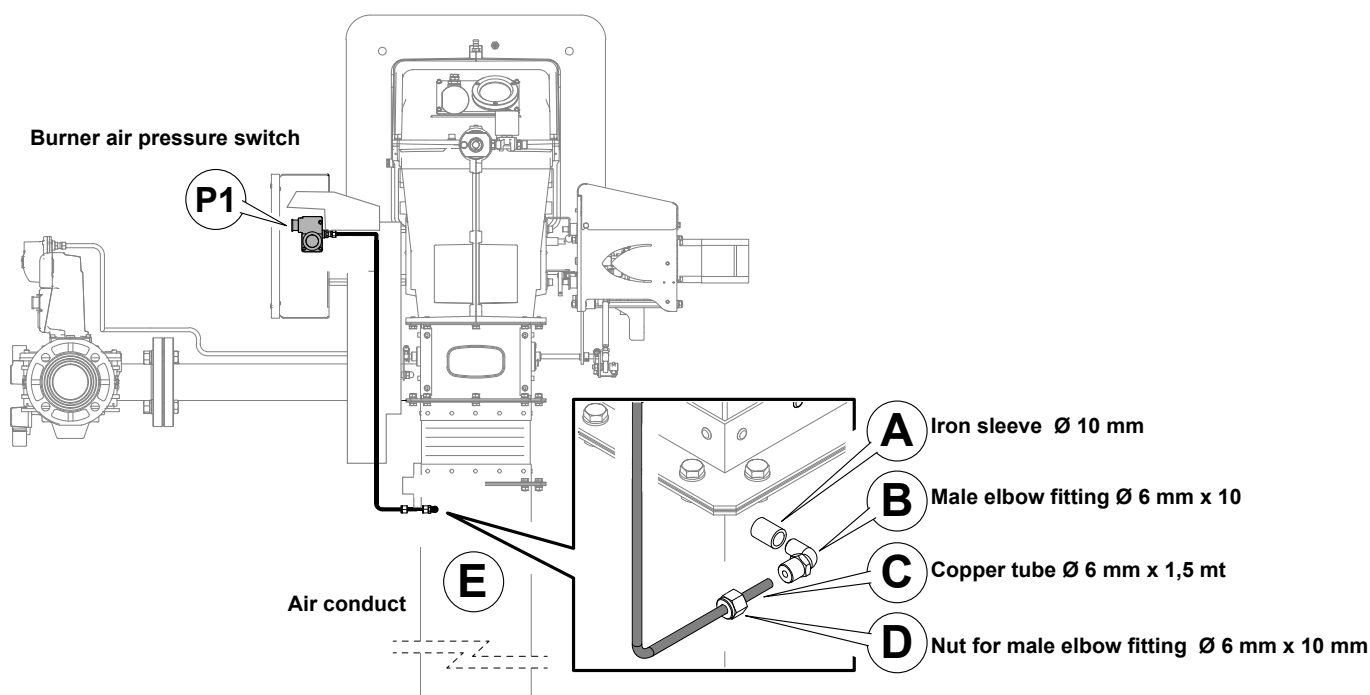


**ATTENTION!** The bellows unit provided is made of canvas and is provided with blocking spacers to avoid breaking it during installation: first place the bellows unit between flanges, then remove the spacers. Canvas has to be stretched after the installation, but not stressed.

**ATTENTION!** the air duct dimensioning must be performed according to the flow rate, the temperature, the distance between the fan and the burner and according to the fan features as well..

**ATTENTION!** It is suggested to install the fan on vibration-damping supports in order to reduce vibration propagation.

## Connection diagram of the air pressure switch to the burner air conduct



### Copper tube connection Ø 6 mm:

- Drill the air duct (with hole from Ø 10 mm);
- Fit sleeve A (Ø 10 mm) and weld it on channel E;
- Assemble in sequence the B-D details on the tube (Ø 6 mm) C appropriately shaped up to the connection on the air pressure switch (P1).

### 3.0 OIL TRAIN CONNECTIONS

#### 3.1 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.

#### 3.2 Connecting the pump

According to the pump provided, proceed as follows:

- 1 remove the closing nuts **A** (on the pump inlet) and **B** (from pump to the burner);
- 2 connect 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.

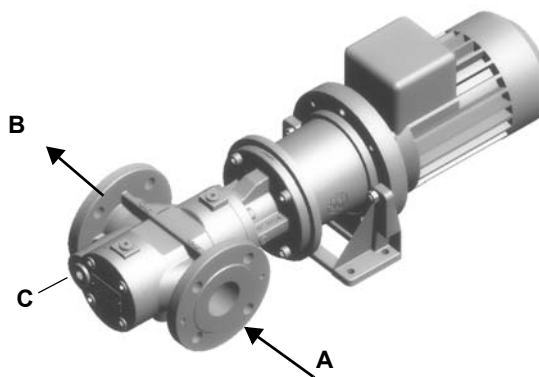


Fig. 4 - Kral

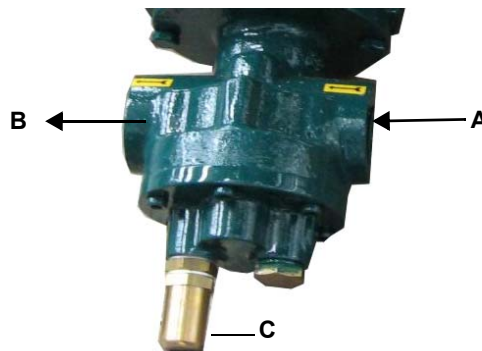


Fig. 5 - Cucchi

#### Legend

- A - Inlet
- B - Outlet
- C - Overflow pressure adjusting screw

The pump provided with the burner must be installed according to the hydraulic diagram.

| Pumps          | capacity [l/h] | power [kW] | speed [rpm] | connection | max outlet pressure [bar] | max inlet pressure (bar) |
|----------------|----------------|------------|-------------|------------|---------------------------|--------------------------|
| Kral KF 32 BCB | 1800           | 1,1        | 1500        | DN32       | 10                        | 2                        |
| Kral KF 42 BCB | 2300           | 1,1        | 1500        | DN32       | 10                        | 2                        |
| Kral KF 55 BCB | 3300           | 1,5        | 1500        | DN50       | 10                        | 2                        |
| Cucchi FMG40   | 2500           | 1,1        | 1400        | 1"         | 10                        | 2                        |
| Cucchi FMG50   | 3000           | 1,5        | 1400        | 1"         | 10                        | 2                        |

For further details see the manufacturer documentation.

### 3.3 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

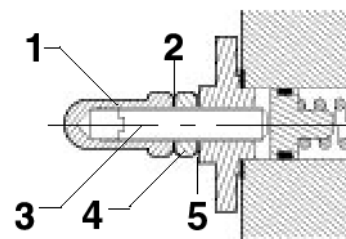


Fig. 6

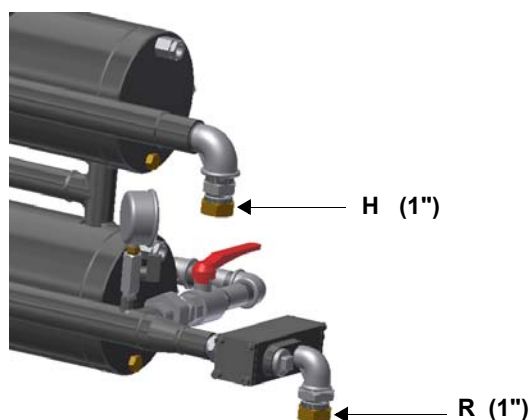
### Fuel Oil filters

|                                                                                  |   | Item     | Note                                       | Connection | Max. operating pressure | Max. operating temperature | Filtering degree | Protection |
|----------------------------------------------------------------------------------|---|----------|--------------------------------------------|------------|-------------------------|----------------------------|------------------|------------|
|  | 1 | 51000/05 | Self-cleaning filter with heating elements | 2" - DN50  | 4 bar                   | 150 °C                     | 500 μ            | IP54       |

### 3.4 Connecting the oil flexible hoses to the burner

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

- 1 remove the closing nuts **H** (on the heater) and **R** (on the oil pressure governor) of the inlet and return connections;
- 2 screw the rotating nut of the two flexible hoses on the burner **being careful to avoid exchanging the inlet and return lines**: see the arrows marked that show the inlet and the return.



## Hydraulic connections

### Key

- G Gas
- A Compressed Air
- O Oil

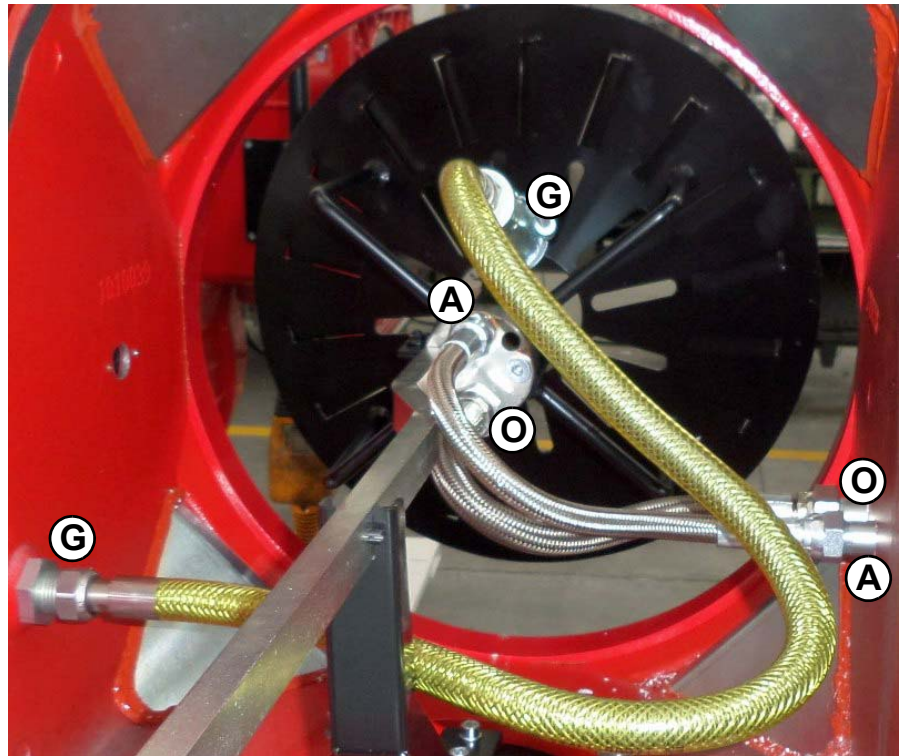


Fig. 7

### 3.5 Connecting the compressed air hoses

To connect the compressed air supply, refer to the following pictures



Compressor



Flow governor with filter



### 3.6 Pilot gas train

The connection to the pilot gas train must be done according to the following scheme, valid for LPG. In case of natural gas, connect the

pressure governor (pos. 3) to the natural gas line (maximum input pressure = 1 bar).

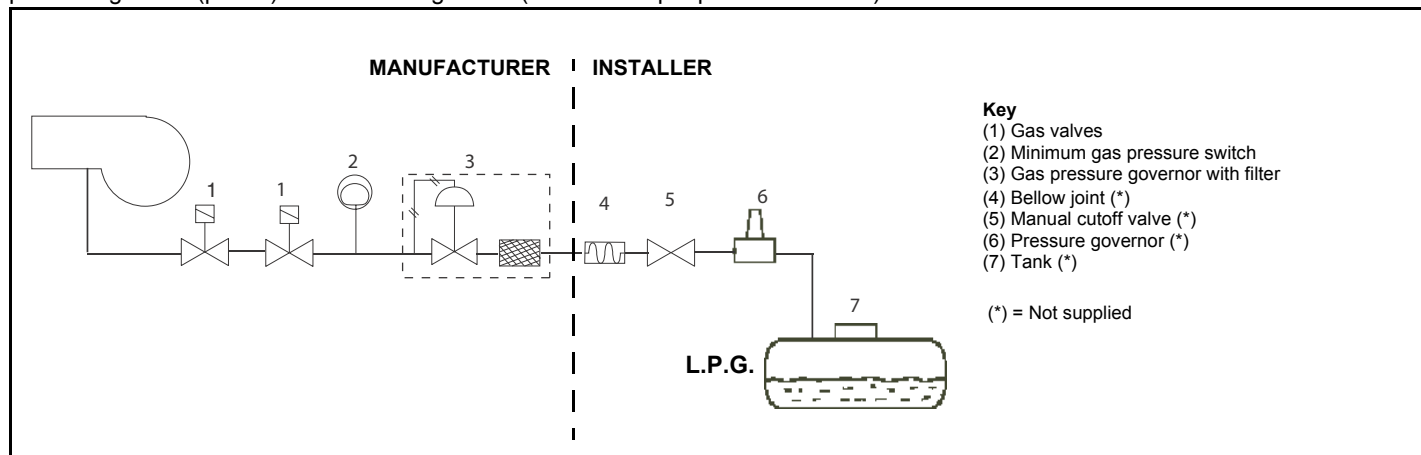


Fig. 8

The pilot gas train is already installed into the burner, the connection from the filter with stabiliser to the gas supply network must be carried out.



connection to the gas supply network 1/2"

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



**ATTENTION:** once the gas train is mounted according to the diagram on Fig. 8, the gas proving test must be performed, according to the procedure set by the laws in force.

## 4.0 ELECTRICAL CONNECTIONS



**Respect the basic safety rules. make sure of the connection to the earthing system. do not reverse the phase and neutral connections. fit a differential thermal magnet switch adequate for connection to the mains.**

**ATTENTION:** 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.

**IMPORTANT:** Connecting electrical supply wires to the burner terminal block MA, be sure that the ground wire is longer than phase and neutral ones.



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

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 attached wiring diagrams;
- 3 check the direction of the fan motor (see next paragraph);
- 4 refit the panel cover.



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

### 4.1 Note on electrical supply

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

#### Key

C - Capacitor (22nF/250V)

LME / LMV - Siemens control box

R - Resistor (1Mohm)

M - Resistor (1Mohm)

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

RC466890660 - RC Siemens filter

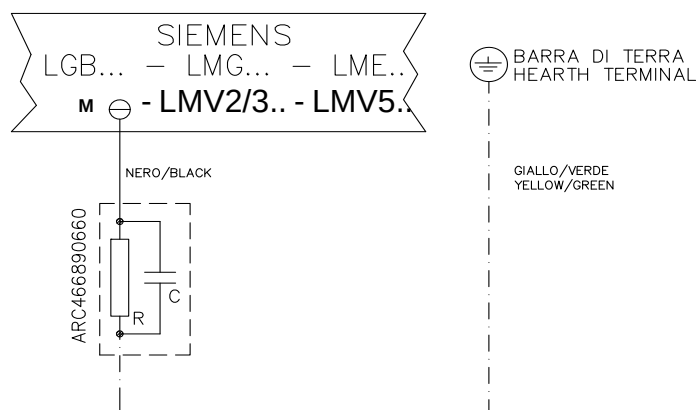


Fig. 9

## 4.2 Rotation of electric motor

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

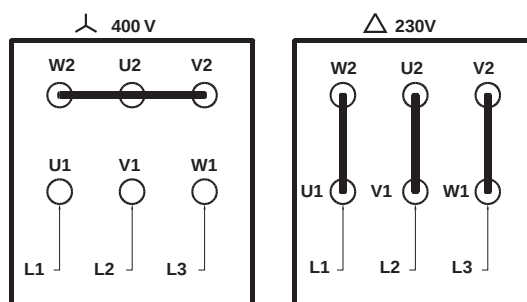


**CAUTION:** check the motor thermal cut-out adjustment

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



### ELECTRIC MOTOR CONNECTION



## 4.3 Connecting the oil heating resistors

### 2.4 - 4.5 kW

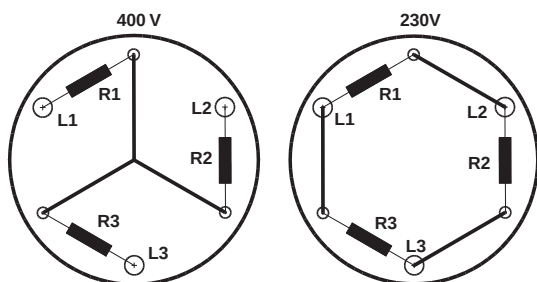


Fig. 10

### 8 - 12 kW

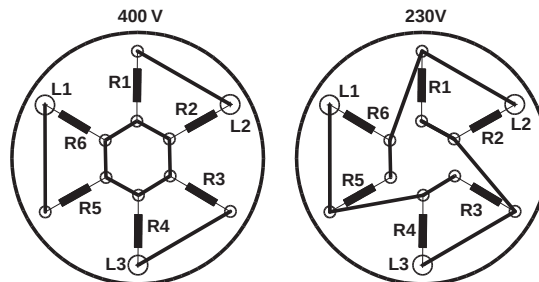


Fig. 11

### 18 - 24 kW

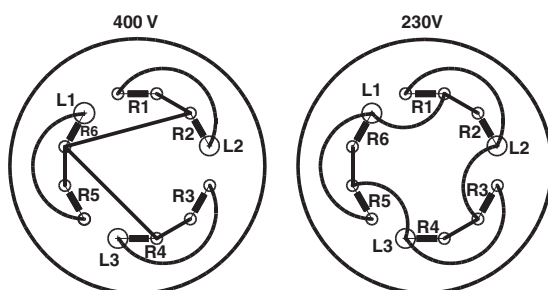


Fig. 12

## 5.0 Recommendations to design heavy oil feeding plants

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

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

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

The diagram in Fig. 13 shows how the heavy oil viscosity changes according to its temperature.

Example: an oil with 22°E viscosity at 50°C once heated to 100°C gets a 3 °E viscosity.

As far as the pumping capability, it depends on the type of the pump that pushes the oil even if on diagram in Fig. 13 a generic limit is quoted at about 100 °E, so it is recommended to refer to the specifications of the pump provided.

Usually the oil minimum temperature at the oil pump inlet increases as viscosity does, in order to make the oil easy to pump. Referring to the diagram on Fig. 14, it is possible to realise that to pump an oil with 50°E viscosity at 50°C, it must be heated at about 80°C.

### 5.1 Pipe heating system

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

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

A very low pressure leads to cavitation (signalled by its peculiar noise): the pump manufacturer declares the minimum value. Therefore, check the pump technical sheets.

By increasing the oil temperature, also the minimum inlet pressure at the pump must increase, to avoid the gassification of the oil low-boiling products and the cavitation. The cavitation compromises the burner operation, it causes the pump to break too. The diagram on Fig. 15 roughly shows the inlet pump pressure according to the oil temperature.

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

Remember that pumps and all the system components through which the oil circulates, feature an upper limit. Always read the technical documentation for each component. Schemes on Fig. 16 are taken from UNI 9248 "liquid fuel feeding lines from tank to burner" standard and show how a feeding line should be designed. For other countries, see related laws in force. The pipe dimensioning, the execution and the winding dimensioning and other constructive details must be provided by the installer.

### 5.4 Adjusting the supplying oil ring

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

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

| HEAVY OIL VISCOSITY AT 50 °C |              | PIPELINE PRESSURE | PIPELINE TEMPERATURE |
|------------------------------|--------------|-------------------|----------------------|
| cSt (°E)                     |              | bar               | °C                   |
|                              | < 50 (7)     | 1- 2              | 20                   |
| > 50 (7)                     | < 110 (15)   | 1- 2              | 50                   |
| > 110 (15)                   | < 400 (50)   | 1- 2              | 65                   |
| > 400 (50)                   | < 4000 (530) | 1- 2              | 100                  |

Tab. 1 - Supply pipeline hydraulic scheme 3ID0024, pump n.4



**ATTENTION:** Atomizing air pressure is typically set at 1 bar lower than oil pressure.

Viscosity units conversion table

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

Tab. 6

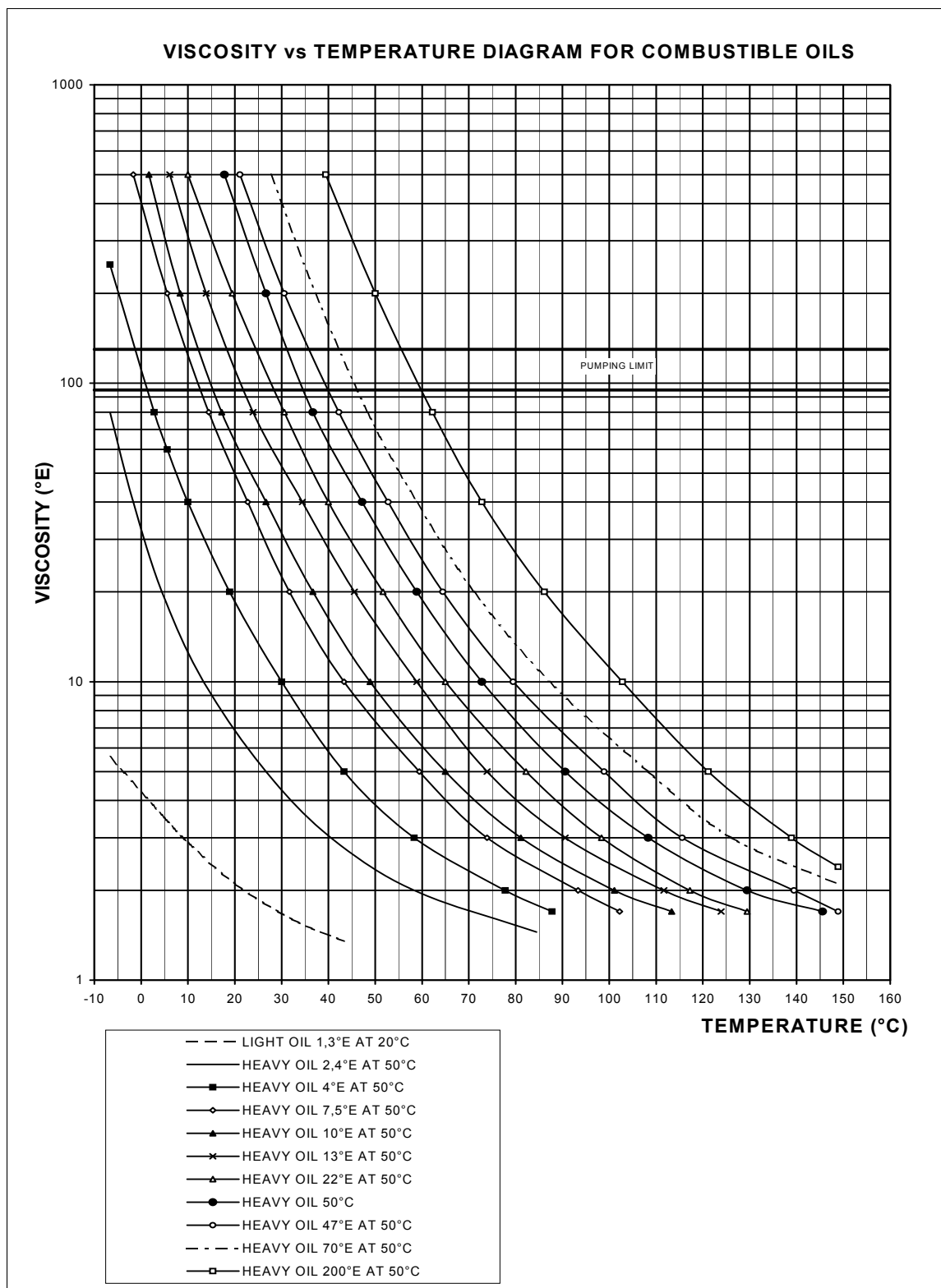


Fig. 13

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

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

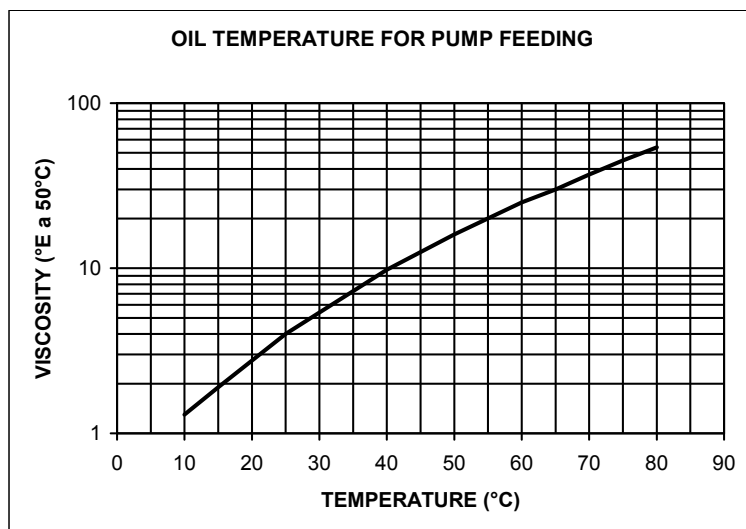


Fig. 14

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

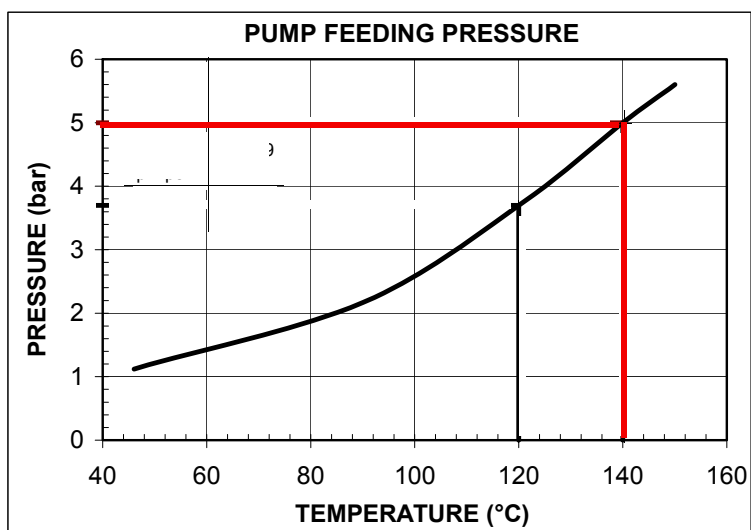
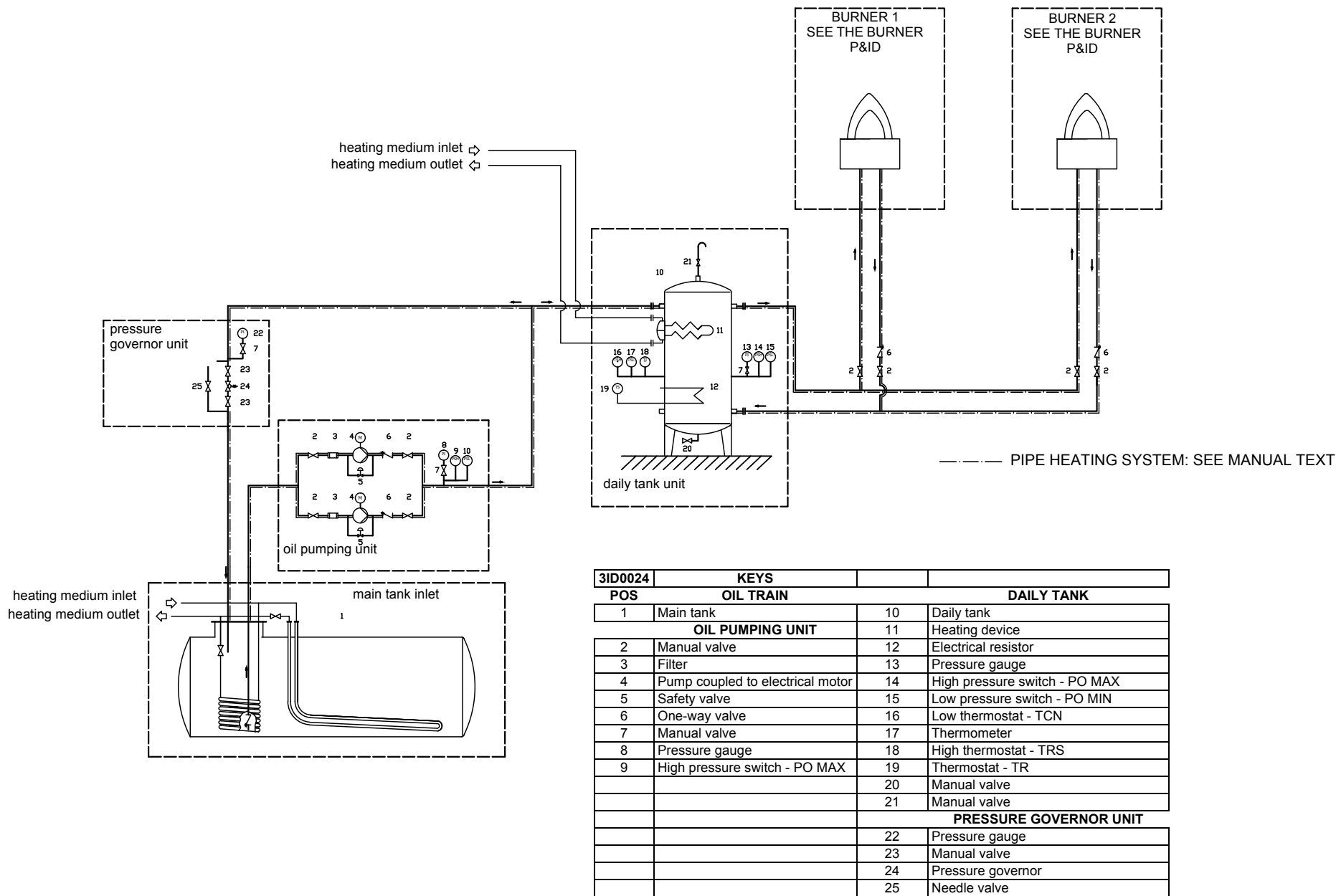


Fig. 15

6.1 HYDRAULIC DIAGRAMS

Fig. 16 - Hydraulic diagram 3ID0024



## PART III: OPERATION

### LIMITATIONS OF USE

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

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

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

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

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

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

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

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

## 7.0 ADJUSTMENT FOR OIL OPERATIONS

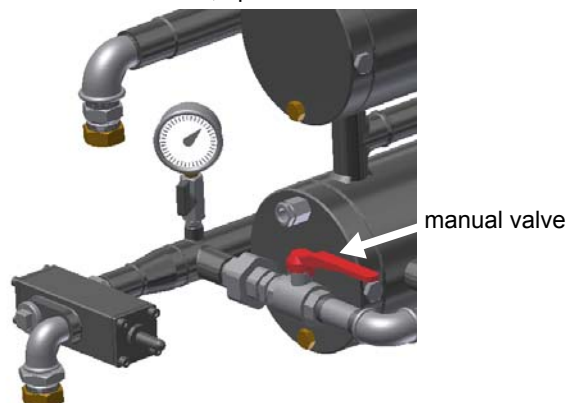


Before starting up the burner, make sure that the return pipe to the tank is not obstructed. Any obstruction would cause the pump seal to break.



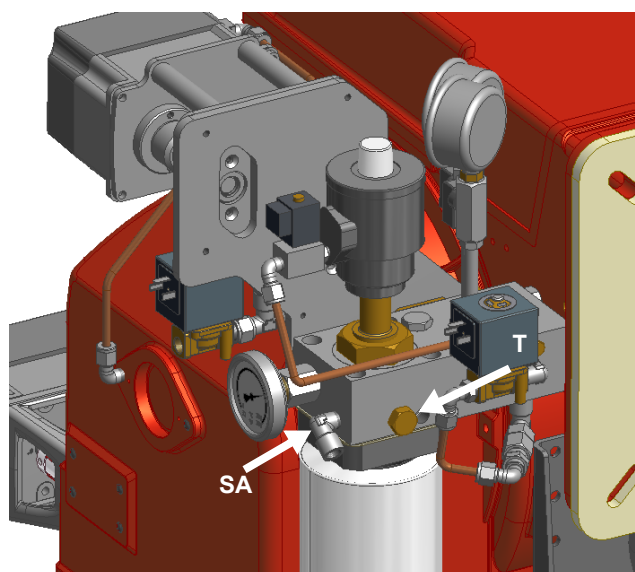
**ATTENTION:** before starting the burner up, be sure that the manual cutoff valves are open. Be sure that the mains switch is closed.

The figure below shows nozzle flow valve. Before turn on the burner, open the manual valve.



### 7.1 Air vent

Before to give tension to the electrical resistance, release the air inside the heaters through the SA connection acting on the T cap.



### 7.2 Oil Flow Rate Settings

The light 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 table.

| VISCOSITY<br>AT 50 °C |              | OIL PRESSURE<br>AFTER<br>BURNER PUMP |     | OIL PRESSURE<br>AFTER OIL<br>METERING VALVE |     |
|-----------------------|--------------|--------------------------------------|-----|---------------------------------------------|-----|
|                       |              | min                                  | max | min                                         | max |
| °E                    |              | bar                                  |     | bar                                         |     |
|                       | < 50 (7)     | 6                                    | 10  | 1                                           | 6   |
| > 50 (7)              | < 110 (15)   | 6                                    | 10  | 1                                           | 6   |
| > 110 (15)            | < 400 (50)   | 6                                    | 10  | 1                                           | 6   |
| > 400 (50)            | < 4000 (530) | 6                                    | 10  | 1                                           | 6   |

The pressure values shown in the table are intended as working range. In order to obtain a more accurate indication, please refer to the nozzle pressure-flow diagrams.

### 7.3 Compressed air adjustment



**ATTENTION:** set the pressure value about 1 bar, at the pressure gauge 47 (see Fig. 18). check it before open valve 16!

To start the burner set the oil and atomisation medium pressure at about 1 bar, as first trial. then, regulate the burner checking the combustion values at the chimney, according to the paragraph "operation", and adjust the starting point according to the regulation.

40



Fig. 17

47

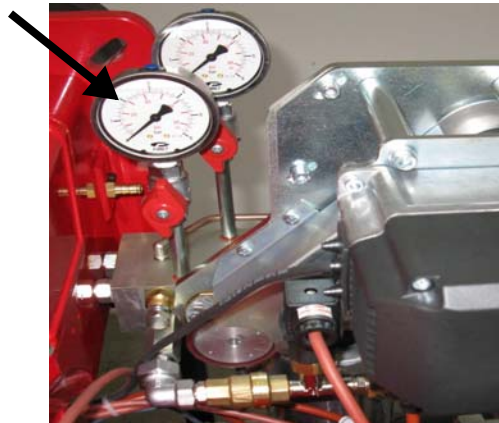


Fig. 18



**ATTENTION:** set the pressure value about 5-10 bar, at the pressure gauge on the governor 40 (see hydraulic diagram and Fig. 2)

### 7.4 Air valve for gun cleaning

As the flame is off, the purge valve 52 opens automatically the compressed air to clean the gun. With this operation, the oil between the valves and the nozzle is drained. The air pressure value for the gun cleaning must be setted to the pressure value of the atomization medium, regulated in low flame (generally 1 bar), and should be adjusted throught the item 50. (see hydraulic diagram of the burner)

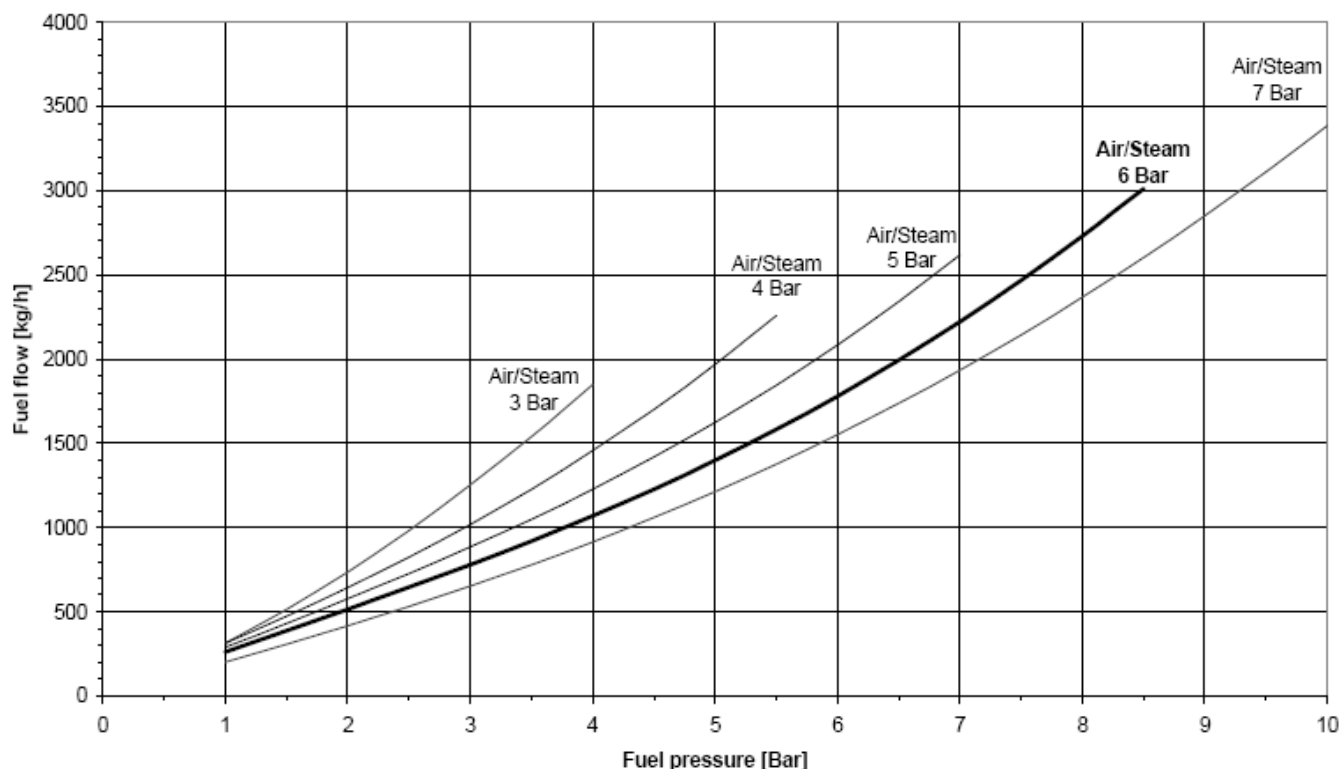
50



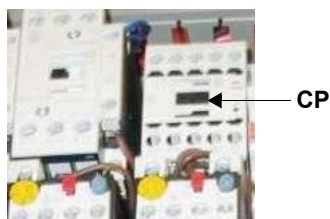
Fig. 19

### 7.5 Oil Flow Rate Settings

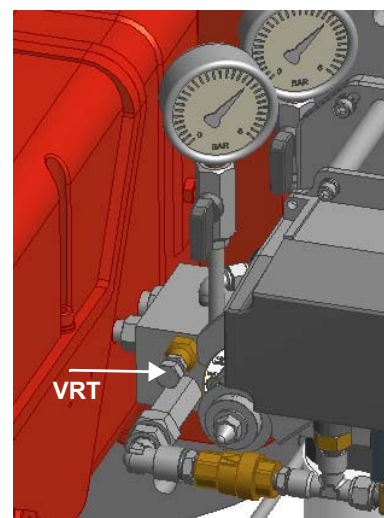
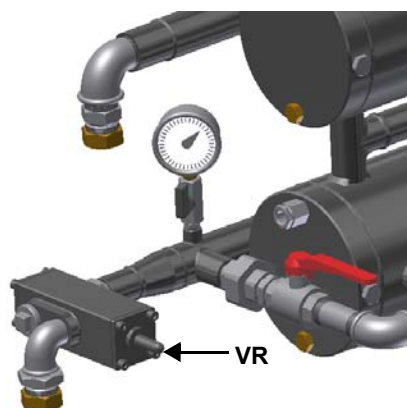
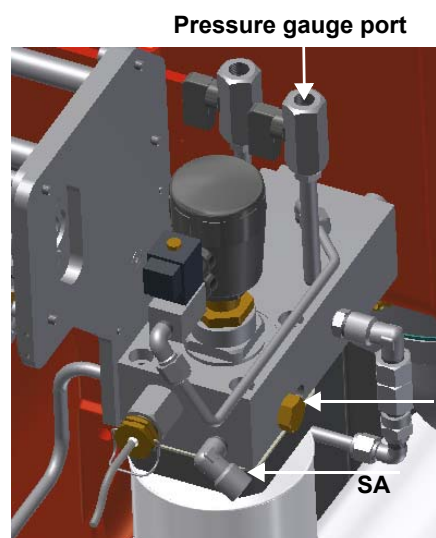
The light oil flow rate can be adjusted choosing a nozzle that suits the boiler/utilisation output and setting the delivery and return pressure values according to the ones quoted on the following table.

**Atomizer 32-Y-A°-14-7 with reverse disc****7.6 Oil Flow Rate Settings actuator**

- 1 Turn the burner on by means of the main switch on the burner control panel (see chapter "Operation");
- 2 with the electrical panel open, prime the oil pump acting directly on the related contactor **CP** (see next picture): check the pump motor rotation and keep pressing for some seconds until the oil circuit is charged;



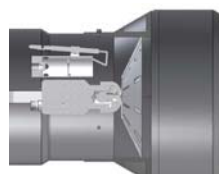
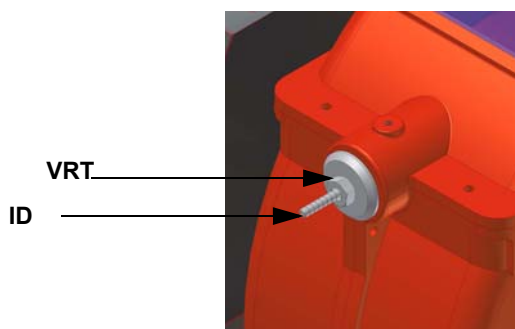
- 3 bleed the air from the **SA** port by loosening the cap **T** without removing it, then release the contactor and fasten cap **T**.



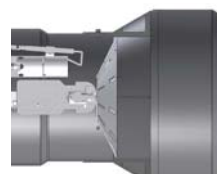
- 4 As for setting the fuel/air ratio curve, see the LMV related manual.
- 5 The nozzle supply pressure is already factory-set and must not be changed. Only if necessary, adjust the supply pressure as fol-

lows (see related paragraph); read the pressure on the oil pressure gauge on picture below and act on the Suntec TV governor adjusting screw **VR** as to get the nozzle pressure at 2 bar . If the required flow rate is not reached, increase the feeding pressure by means of the Suntec TV governor; if it is too high, reduce it.

- 6 Set the atomisation air according to the data in the nozzle diagram attached, by means of the RB knob (see picture).
- 7 If necessary, change the combustion head position: to let the burner operate at a lower output, move progressively back the combustion head towards the MIN position, by turning clockwise the **VRT** ring nut. The graduated index **ID** shows the combustion head shifting (each mark refers to 5mm).



"MAX" position



"MIN" position

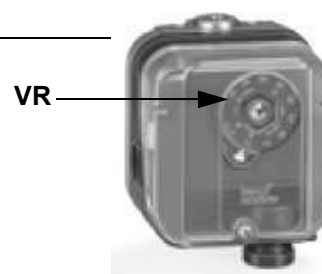
**Attention!** if it is necessary to change the head position, repeat the air and gas adjustments described above.

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

## 7.7 Calibration of air pressure switch

To calibrate the air pressure switch, proceed as follows:

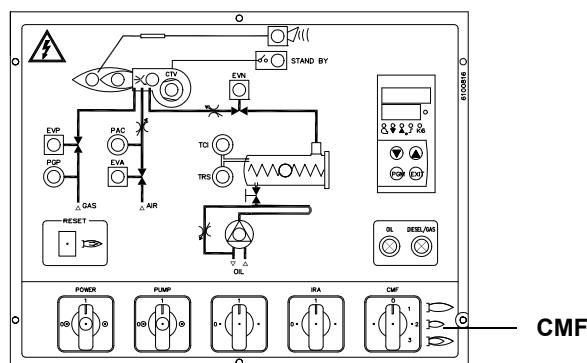
- Remove the transparent plastic cap.
- Once air and heavy oil setting have been accomplished, startup the burner.
- During the pre-purge phase of the operation, turn slowly the adjusting ring nut **VR** in the clockwise direction until the burner lockout, then read the value on the pressure switch scale 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.



## 7.8 Fully-modulating burners

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

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



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

## 7.9 Oil thermostat adjustment

All thermostats are located inside the control panel. To set the temperature use a small screwdriver.

Such temperature must be set during burner operation, checking temperature in the thermometer mounted on the pre-heating tank. We

suggest a thermometer with scale up to 200° C.

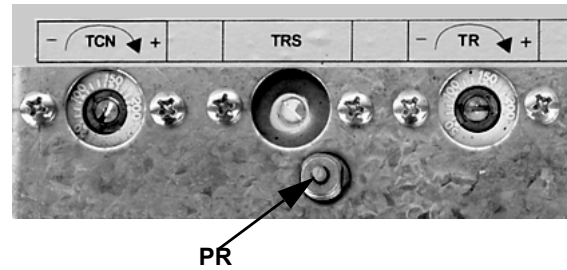
Adjust this thermostat to the correct value according to the viscosity-temperature diagram and check the temperature by using a thermometer with a scale of up to 200° C mounted on the pre-heating tank.

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

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

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

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



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. 20 - Danfoss MCX

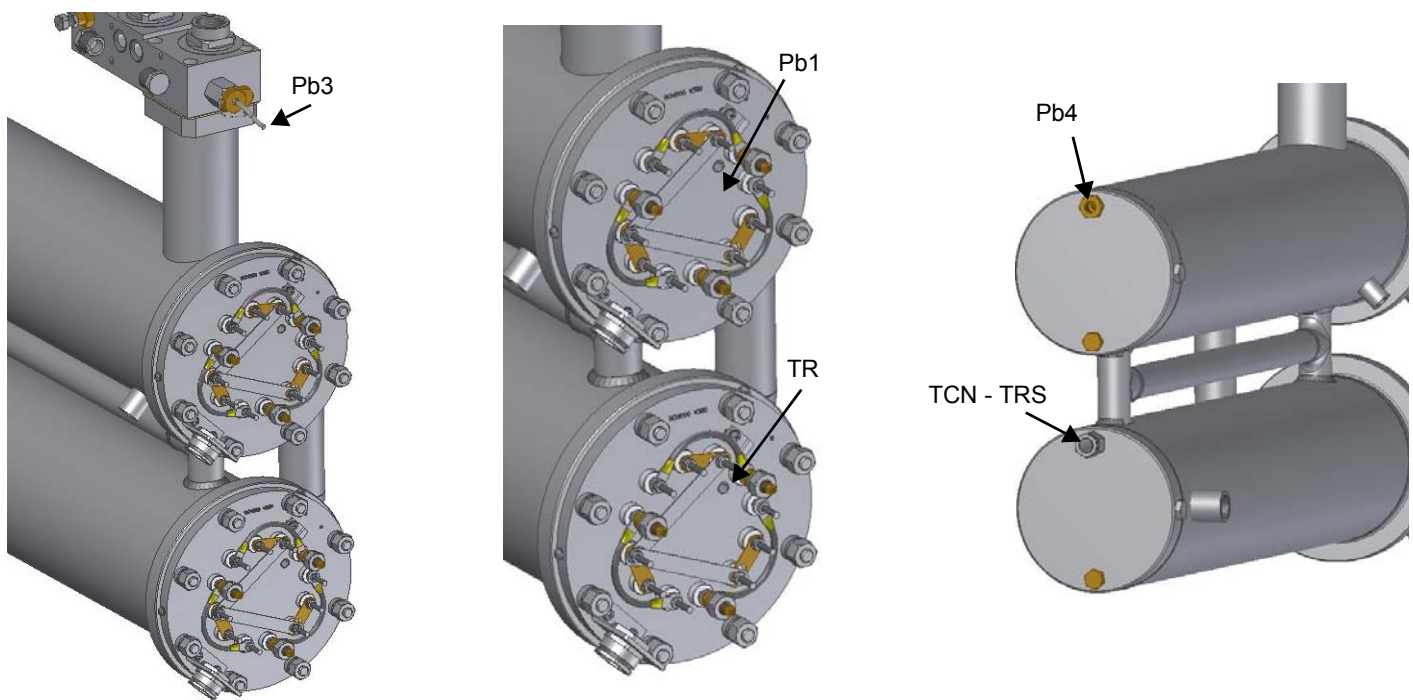


Fig. 21 - Probe connections (Danfoss MCX)

| 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   | > 110 cSt  | > 400 cSt  |
|           |     |     |                                                       |                                                                          |            | < 110 cSt  | < 400 cSt  | < 4000 cSt |
|           |     |     |                                                       | 12 °E                                                                    | < 7°E      | > 7 °E     | > 15 °E    | > 50 °E    |
|           |     |     |                                                       |                                                                          |            | < 15 °E    | < 50 °E    | < 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.

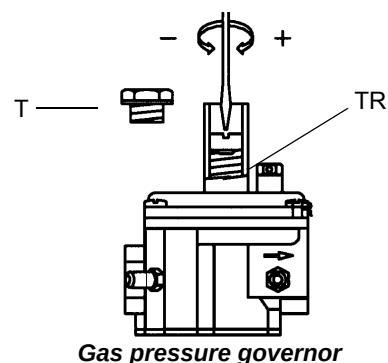
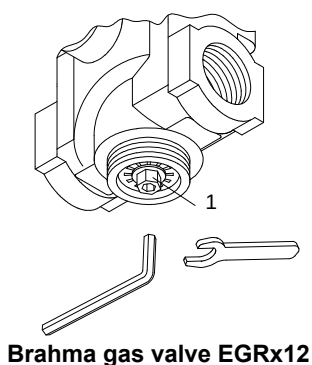
### 7.10 Adjusting the pilot gas flow rate: gas valve Brahma EG12xR and pressure governor

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

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

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

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



## 8.0 ADJUSTING AIR AND FUEL RATE

### 8.1 Adjustments - brief description

The air and fuel rates adjustments must be performed at the maximum output first ("high flame"): see the LMV5.. related manual..

- Check that the combustion parameters are in the suggested limits.
- Then, adjust the combustion values by setting the "fuel/air" ratio" curvepoints (see the LMV5.. related manual).
- Set, now, the low flame output, in order to avoid the low flame output increasing too much or that the flues temperature gets too low to cause condensation in the chimney.



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



**IMPORTANT!** 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                               | 4.2 ÷ 6.2                            |

### 8.2 Start-up procedure

- 1 Turn the burner on.
- 2 the LMV control box starts the system test cycle: the AZL display shows the **System Test** message; at the end of the test, it shows the main page and the system stops (the safety chain is open) waiting for the startup enabling signal (standby - Program phase no. 12)

|           |      |
|-----------|------|
| Setpoint  | 80°C |
| Act.value | 78°C |
| Fuel      | GAS  |
| Standby   | 12   |

Main page

- 3 check the fan motor rotation (see related paragraph).
- 4 make the safety chain enabling the system to start up
- 5 the combustion cycle starts: the system will show the operating stages
  - **Prepurging** (program phase no.30)
  - **Driving to ignition position** (program phase no.36)
  - **Ignition position** (program phase no.38)
  - **Fuel** (the fuel solenoid valves open)
  - **Flame** (the flame lights up)
  - **Driving to low flame** (the actuator drives to low flame).

**NOTE:** the **C** and **A**, on the .

Once the ignition cycle ends, the main page is shown:

|           |      |
|-----------|------|
| Setpoint  | 80°C |
| Act.value | 78°C |
| Load      | 24%  |
| Flame     | 60%  |

Main page

**Set point:** temperature set-point

**Act value:** actual temperature value

**Load:** load percentage (burner output)

**Flame:** percentage of flame detection current.

By pressing the ENTER key the display shows the second page:

|      |     |     |     |
|------|-----|-----|-----|
| Fuel | 0.0 | Air | 1.8 |
| Ax1  |     | VSD | 0.0 |
| Ax2  |     | O2  |     |
| Ax3  |     | Ld. | 0.0 |

Second page

**Fuel:** it shows (in degrees) the fuel actuator position.

**Air:** it shows (in degrees) the air actuator position.

**Ax1..3:** auxiliaries.

**VSD:** % value on the inverter maximum frequency

**O2:** oxygen percentage

**Ld:** load percentage (burner output).

Press the ENTER key to go back to the main page.

To access the **main menu**, from the main page, press the ESC key twice:

|                             |
|-----------------------------|
| OperationalStat             |
| Operation                   |
| ManualOperation             |
| <b>Params &amp; Display</b> |

Main menu

By pressing the ESC key once, the **Operational Status** (first item in the main menu) menu is directly shown:

|                  |
|------------------|
| Normal operation |
| Status/Reset     |
| Fault History    |
| Lockout History  |

the **Operational Status** menu provides the following items:

**Normal operation:** by selecting this item and pressing the ENTER key, the main page is showed; press ESC to go back to the main menu.

**Status/Reset:** it shows system errors or faults occurring / it represents the lockout reset function.

**Fault History:** by selecting this item and pressing the ENTER key, the Lockout History will be showed about the last 21 faults occurred.

**Lockout History:** by selecting this item and pressing the ENTER key, the Lockout History will be showed about the last 9 lockouts occurred, and the related date and hour.

**Alarm act/deact:** enable/disable the horn in case of alarm.

### **Fault History**

To visualise the **Fault History**, select it and press the ENTER key. The message will be as:

|           |    |        |       |
|-----------|----|--------|-------|
| 1 Class:  |    |        | 05Gas |
| code      | BF | Phase: | 10    |
| Diag.:    | 00 | Lod:   | 0.0   |
| Start No. |    |        | 88    |

alternating by an error message as:

|                                                  |
|--------------------------------------------------|
| O2 control and<br>limiter automat<br>deactivated |
|--------------------------------------------------|

To see the other Fault History pages, press the arrow keys.

To exit the Fault History pages, press ESC.

### **Lockout History**

To visualise the **Lockout History**, choose the related item and press ENTER. The message will be:

|           |          |       |
|-----------|----------|-------|
| 1         | 10.08.07 | 13.47 |
| C:71      | D:00     | F: 12 |
| Start No. |          | 88    |
| Load      | 0.0      | Gas   |

alternating by an error message as:k

|                                   |
|-----------------------------------|
| No flame at end<br>of safety time |
|-----------------------------------|

To see the other Lockout History pages, press the arrow keys.

To exit the Lockout History pages, press ESC.

### **Setting the temperature/pressure set-point value**

To set the temperature/pressure set-point value, that is the generator operating temperature/pressure; proceed as follows.

From the main page, enter the main menu by pressing the ESC key twice:

|                             |
|-----------------------------|
| OperationalStat             |
| Operation                   |
| ManualOperation             |
| <b>Params &amp; Display</b> |

by means of the arrow keys, select "Params&Display", press ENTER: the system will ask you to enter the proper password

|                 |
|-----------------|
| Access w-out PW |
| Access Serv     |
| Access OEM      |
| Access LS       |

by means of the arrow keys, select "Access w-out pass" (access without password - user level), confirm by pressing ENTER.

The other levels require password reserved to the Technical Service, to the Manufacturer, etc.

The menu shown accessing without password is the following:

|                       |
|-----------------------|
| BurnerControl         |
| RatioControl          |
| O2Contr./Guard.       |
| <b>LoadController</b> |

Choose "LoadController" and press ENTER: the following menu is shown:

|                 |
|-----------------|
| ControllerParam |
| Configuration   |
| Adaption        |
| SW Version      |

Choose “ControllerParam” and press ENTER: the following menu is shown:

|                 |
|-----------------|
| ContrlParamList |
| MinActuatorStep |
| SW_FilterTmeCon |
| SetPointW1      |

Choose “SetPointW1” and press ENTER:

|            |     |
|------------|-----|
| SetpointW1 |     |
| Curr:      | 90° |
| New:       | 90° |

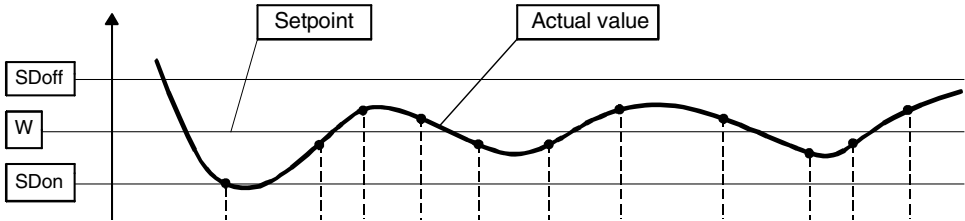
**Curr:** it shows the current set-point; use the arrows keys to change.

**NOTE:** the availabel range for this parameter depends on the probe provided; the unit measure of the detected value and its limits are bound up with parameters set at the “Service” level.

Once the new set-point is set, confirm by pressing ENTER, otherwise exit without changings by pressing ESC.

Press ESC to exit the set-point programming mode.

Once the temperature set-point W1 is imposed, set the Switch-on (SDon) and the Switch-off (SDoff) point of the 2-position controller:



To set these values, select the item SD\_ModOn (SDOn), by scrolling down the “Load controller” menu with the arrow keys and press ENTER:

|            |
|------------|
| SetpointW1 |
| SetpointW2 |
| SD_ModOn   |
| SD_ModOff  |

the display will show:

|          |      |
|----------|------|
| SD_ModOn |      |
| Curr::   | 1.0% |
| New:     | 1.0% |

The deaault value for this parameter is1% that is, the burner will light again at a temperature 1% lower than the set-point. Change value, if needed, by means of the arrow keys; press ENTER to confirm and the press ESC to exit. Press only ESC to exit without changing. Now choose SD\_ModOff always scrolling down theLoad Controller menu, by menas of the arrow keys, and press ENTER.

|            |
|------------|
| SetpointW1 |
| SetpointW2 |
| SD_ModOn   |
| SD_ModOff  |

the display will show:

|           |       |
|-----------|-------|
| SD_ModOff |       |
| Curr::    | 10.0% |
| New:      | 10.0% |

The default value for this parameter is 10% that is, the burner will turn off at a temperature 1% higher than the set-point.

Change value, if needed, by means of the arrow keys; press ENTER to confirm and the press ESC to exit. Press only ESC to exit without changing. Press the ESC key until the following menu is shown:

|                 |
|-----------------|
| BurnerControl   |
| RatioControl    |
| O2Contr./Guard. |
| LoadController  |

scroll this menu down until the item "AZL" is reached

|                |
|----------------|
| LoadController |
| AZL            |
| Actuators      |
| VSD Module     |

confirm by pressing ENTER:

|               |
|---------------|
| Times         |
| Languages     |
| DateFormat    |
| PhysicalUnits |

**Times:** it sets the "Summer (SUM) Time / Winter (WIN) Time" operation and the continent (EU - Europe; US - United States)

|                 |
|-----------------|
| Sum/Winter Time |
| Time EU/US      |

choose the Summertime/Wintertime mode desired and confirm by pressing ENTER; press ESC to exit. Set the time zone (Time EU/US) in the same way.

**Languages:** it allows setting the current language

|          |          |
|----------|----------|
| Language |          |
| Curr::   | Italiano |
| New:     | English  |

choose the desired language and confirm by pressing ENTER; press ESC to exit.

**DateFormat:** it allows setting the date format as DD-MM-YY (day-month-year) or MM-DD-YY (month-day-year)

|            |          |
|------------|----------|
| DateFormat |          |
| Curr::     | DD-MM-YY |
| New:       | MM-DD-YY |

choose the desired format and confirm by pressing ENTER; press ESC to exit.

**PhysicalUnits:** it allows setting the measuring units for temperature and pressure

|                 |
|-----------------|
| UnitTemperature |
| UnitPressure    |

Settable temperature units: °C or °F

Settable pressure units: bar or psi.

- choose the desired unit and confirm by pressing ENTER; press ESC to exit.
- choose the temperature and pressure unit and confirm by pressing ENTER; press ESC to exit.

### System lockout

If the system locks out, the following message will appear:

|           |          |       |
|-----------|----------|-------|
| 1         | 10.08.07 | 13.47 |
| C:71      | D:00     | F: 12 |
| Start No. |          | 88    |
| Load      | 0.0      | Gas   |

call the Technical Service and tell the message data.

### Cold start thermal shock (CSTP)

If the generator cannot suffer thermal shocks, the CSTP (Cold Start Thermal Shock) function can be enabled. This function is already set by the Technical service (access by reserved password).

if this function is enabled, when the burner starts up the "Thermal shock protection activated" message will be showed.

If this function is not enabled, after startup, the burner will rapidly increase the load according to the requested value and, if necessary, to the maximum output.

### Manual mode

To by-pass the thermal protection or not to let the burner operate in high flame stage (maximum output) after ignition, the manual mode is provided.

To choose the manual mode (Manual Operation), use the SELECT arrow keys

|                             |
|-----------------------------|
| OperationalStat             |
| Operation                   |
| ManualOperation             |
| <b>Params &amp; Display</b> |

Items to be set are the following:

|                  |
|------------------|
| SetLoad          |
| Autom/Manual/Off |

**SetLoad:** to set the required load percentage

|         |       |
|---------|-------|
| SetLoad |       |
| Curr::  | 0.0%  |
| New:    | 20.0% |

set the required percentage and confirm by pressing ENTER; press ESC to exit.  
choose "Autom/Manual/Off:

|                  |
|------------------|
| SetLoad          |
| Autom/Manual/Off |

|                  |           |
|------------------|-----------|
| Autom/Manual/Off |           |
| Curr::           | Automatic |
| New:             | Burner On |

three modes are provided:  
**Automatic:** automatic operation  
**Burner on:** manual operation  
**Burner off:** burner in stand-by

If the BurnerOn mode is choosen,the burner does not follow the modulator and probe settings, but operates at the set load.

|                                                                                     |                                                                                               |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
|  | <b>Caution:</b> if BurnerOff mode is selected, the burner stays in stand-by.                  |
|                                                                                     | <b>Caution:</b> in the BurnerOn mode, the safety thresholds are set by the Technical Service. |

For further details, see the LMV5x annexed manuals.

## PART IV: MAINTENANCE

### 9.0

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 gas filter and replace it if necessary.
- Clean and examine the oil filter cartridge and replace it if necessary.
- Examine the flexible hoses and check for possible leaks.
- Check and clean if necessary the oil heaters and the tank, according to the fuel type and its use; remove the heaters flange fixing nuts and remove the heaters from the tank: clean by using steam or solvents and not metallic things.
- Remove and clean the combustion head (page 38).
- Examine and clean the ignition electrode, adjust and replace if necessary (see page 38).
- Examine and clean the detection probe, adjust and replace if necessary.
- Examine the detection current.
- Remove and clean the heavy oil nozzle (**Important: use solvents for cleaning, not metallic tools**) and at the end of the maintenance procedures, after replacing the burner, turn it on and check the shape of the flame; if in doubt replace the nozzle. Where the burner is used intensively it is recommended to replace the nozzle as a preventive measure, at the begin of the operating season.
- Clean and grease joints and rotating parts.

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



**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.**

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

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

To check the filtering part (1) on threaded bodies (see picture Fig. 22):

- remove the bottom cover, unscrewing the fixing screws;
- remove the filtering part (1), clean it with water and soap, blow it with compressed air or replace it if necessary;
- reassemble the filtering part in its initial position checking that it is placed in its own slots (see picture Fig. 22);
- reassemble the bottom cover (3), being sure that the main bolt is centered in the bottom cover slot.

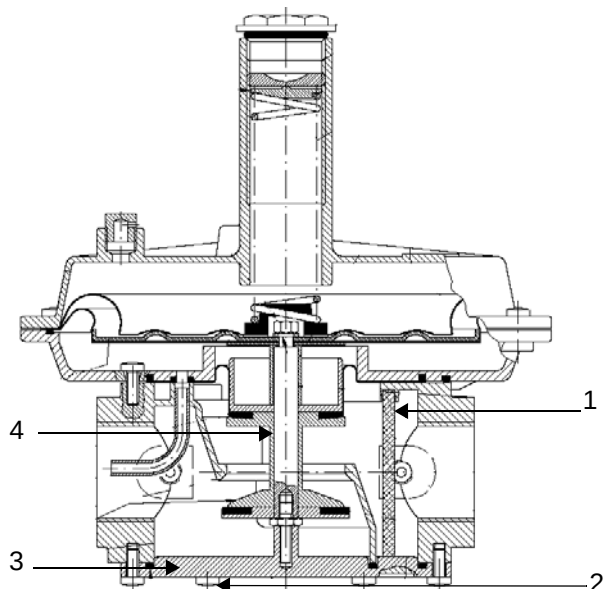


Fig. 22 - threaded body

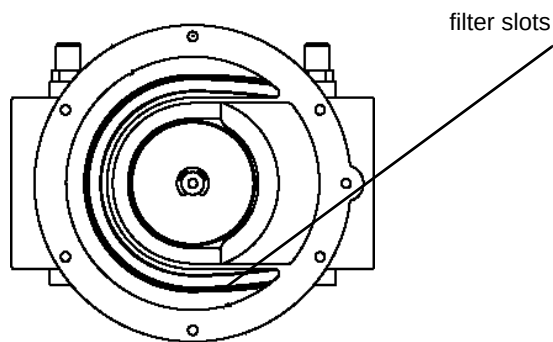


Fig. 23 - threaded body without bottom cover

## 9.2 Removing the combustion head

- Remove the cover **H**.
- Slide the photoresistor out of its housing.
- Unscrew the flexible hoses from the gun (burner side) and remove the whole assembly as shown on Fig. 24.

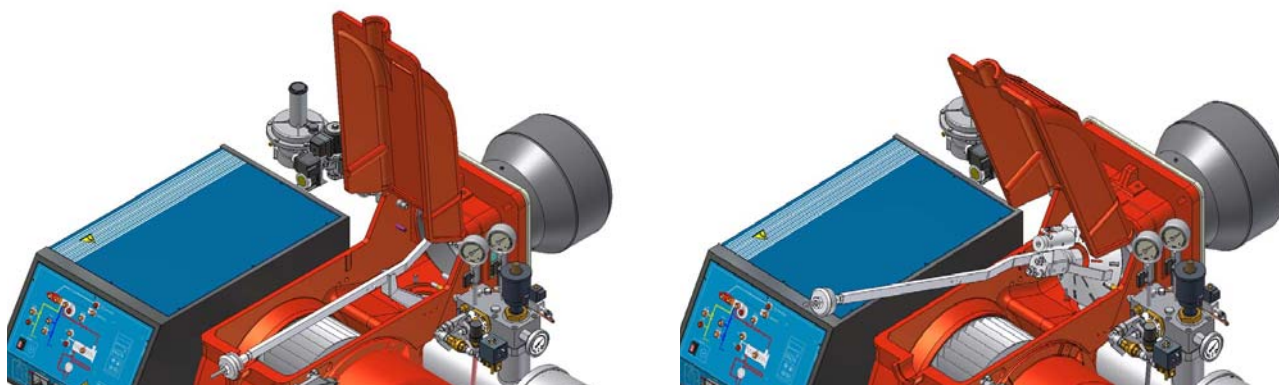


Fig. 24

## 9.3 Removing the oil gun, replacing/adjusting the nozzle and the ignition electrode



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

To remove the oil gun, proceed as follows:

- 1 remove the combustion head as described on the previous paragraph;
- 2 after removing the oil gun, to clean the nozzle remove it from its place after unscrewing **V**;
- 3 unscrew cap **C** and clean the nozzle body **CU**; replace the nozzle if necessary;
- 4 in order to replace the electrode, unscrew the fixing screw and remove it: place the new electrode being careful to observe the measures (in mm) shown on next pictures and reassemble following the reversed procedure.
- 5 To adjust the nozzle position, unscrew the fixing screw, move the nozzle backwards or forwards, then fix the screw on the new position. In the example from "1" to "2" - see picture below.

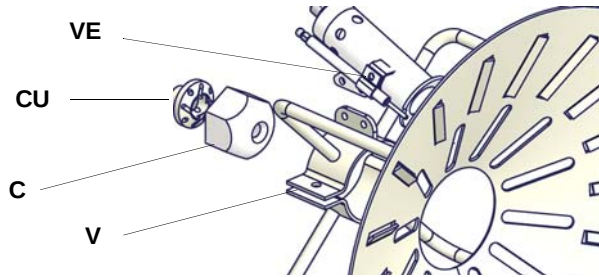
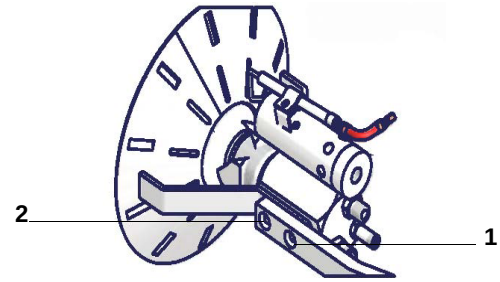
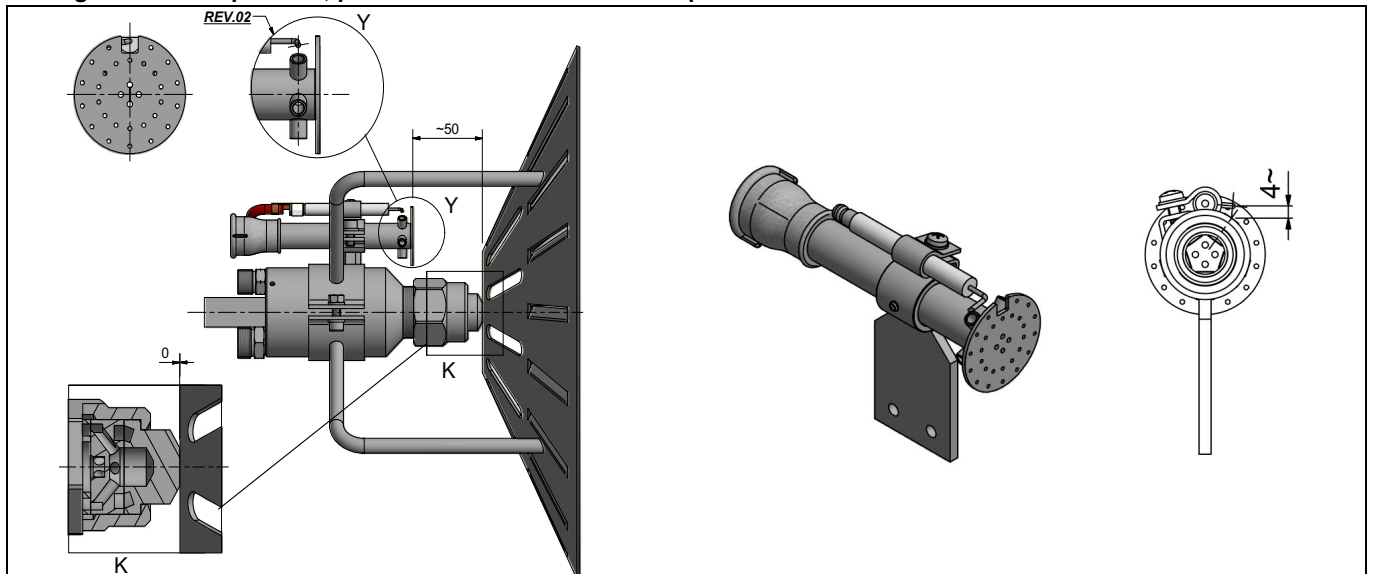


Fig. 25



To change the nozzle position, please contact the Technical Dpt.

To change the nozzle position, please contact the Technical Dpt.



## 9.4 Checking the detection current

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

Minimum detection signal: 3.5Vdc

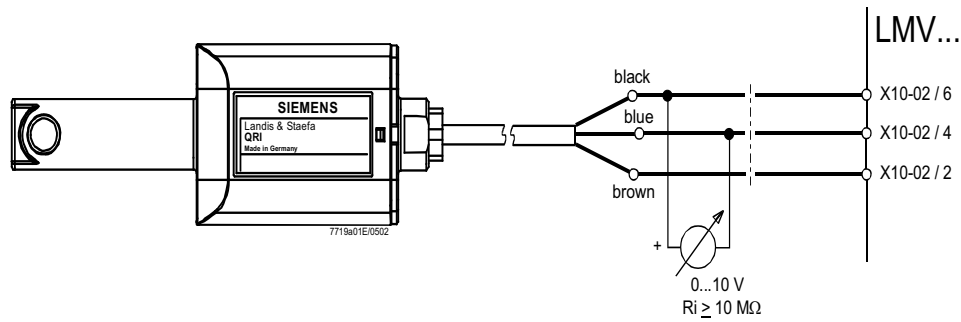


Fig. 26 Detection with detector QRI...

## 9.5 Extraneous light

Extraneous light during standby (phase 12) leads to start prevention, followed by a restart.

Extraneous light during the prepurge phase leads to immediate lockout.

If extraneous light occurs during the shutdown phase, the system switches to the safety phase.

One repetition is permitted. This means that if the error occurs again the next time the system is shut down, the unit initiates lockout.

## 9.6 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

## 9.7 Burner disposal

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

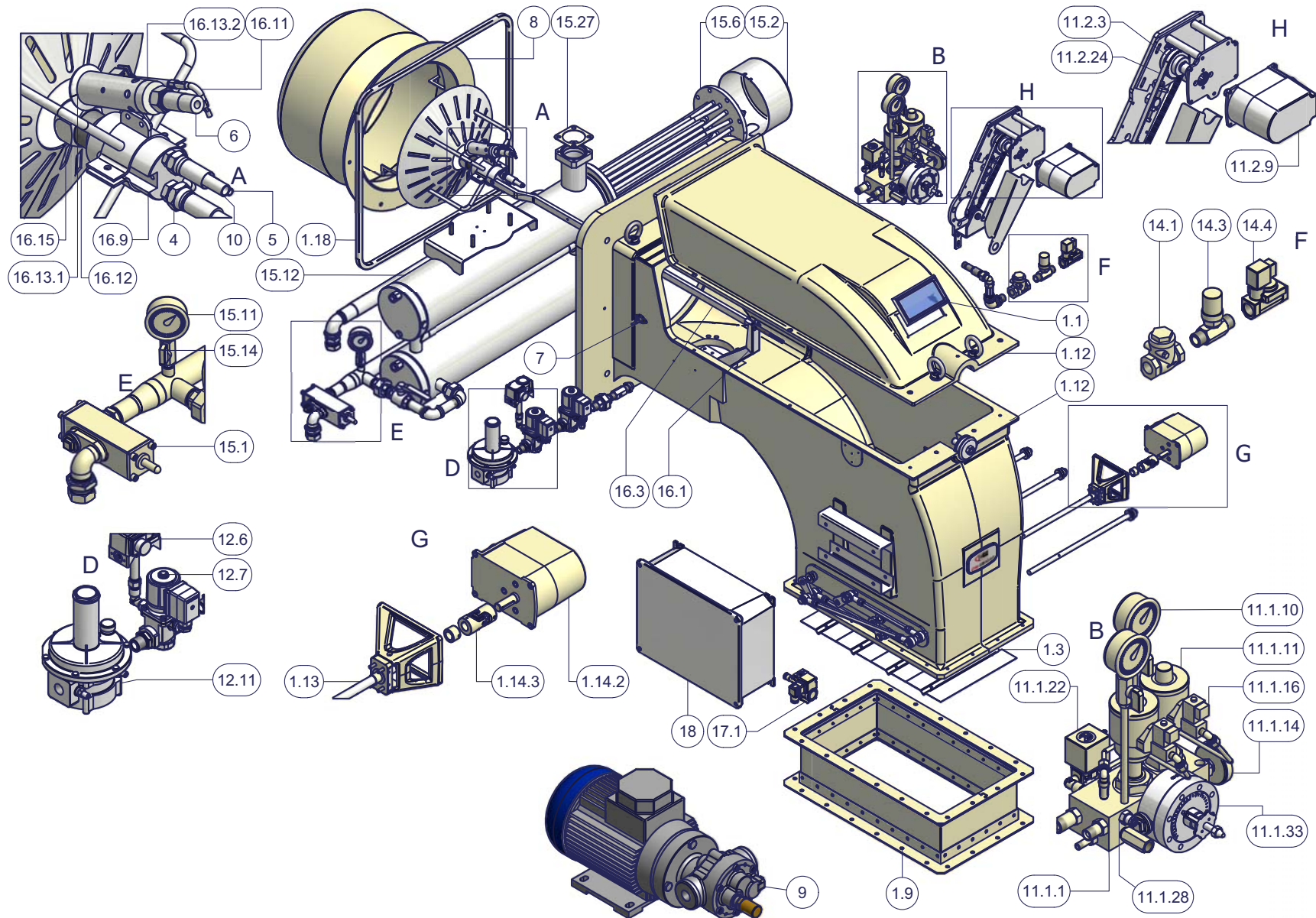
## 10.0 WIRING DIAGRAMS

---

Refer to the attached wiring diagrams.

### **WARNING**

- 1 - Electrical supply 230V 50Hz 1 a.c./400V 50Hz 3N a.c.
- 2 - Do not reverse phase with neutral
- 3 - Ensure burner is properly earthed
- 4 - Refer to the attached document "RECOMMENDATIONS FOR LMV5x CONNECTIONS"



|         |                      |         |                          |
|---------|----------------------|---------|--------------------------|
| 1.1     | BRACKET              | 12.6    | GAS PRESSURE             |
| 1.3     | AIR INTAKE DAMPER    | 12.7    | GAS SOLENOID VALVE       |
| 1.9     | BELLOWS              | 12.11   | GAS GOVERNOR WITH FILTER |
| 1.12    | DUAL-BLOCK BURNER    | 14.1    | ONE-WAY VALVE            |
| 1.13    | AIR DAMPER SHAFT     | 14.3    | AIR PRESSURE SWITCH      |
| 1.14.2  | ACTUATOR             | 14.4    | SOLENOID VALVE           |
| 1.14.3  | COUPLING             | 15.1    | PRESSURE GOVERNOR        |
| 1.18    | CERAMIC FIBER GASKET | 15.2    | COVER                    |
| 4       | OIL FLEXIBLE HOSE    | 15.6    | RESISTOR                 |
| 5       | FLEXIBLE HOSE        | 15.11   | PRESSURE GAUGE           |
| 6       | GAS FLEXIBLE HOSE    | 15.12   | TANK                     |
| 7       | PHOTORESISTOR        | 15.14   | VALVE                    |
| 8       | BLAST TUBE           | 15.27   | GASKET                   |
| 9       | PUMP                 | 16.1    | BRACKET                  |
| 10      | OIL FLEXIBLE HOSE    | 16.3    | NOZZLE HOLDER            |
| 11.1.1  | OIL MANIFOLD         | 16.9    | NOZZLE HOLDER            |
| 11.1.10 | PRESSURE GAUGE       | 16.11   | IGNITION CABLE           |
| 11.1.11 | PNEUMATIC OIL VALVE  | 16.12   | COMBUSTION HEAD          |
| 11.1.14 | THERMOMETER          | 16.13.1 | IGNITOR                  |
| 11.1.22 | SOLENOID VALVE       | 16.13.2 | IGNITION ELECTRODE       |
| 11.1.28 | AIR GOVERNOR         | 16.15   | NOZZLE                   |
| 11.1.33 | PRESSURE GOVERNOR    | 17.1    | PRESSURE SWITCH          |
| 11.2.3  | BAND WHEEL           | 18      | JUNCTION BOX             |
| 11.2.9  | ACTUATOR             |         |                          |
| 11.2.24 | BELT                 |         |                          |



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

# Siemens LMV5x



## Service Manual

**Warnings:**

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

**Qualified personal**

In the sense of this documentation, qualified personal are those who are knowledgeable and qualified to install, mount, commission, operate and service / maintain LMV5 system together with burner & boiler products.

The personal must have the appropriate qualifications to carry out these activities, for example:

Trained and authorized to energize and de-energize, ground and tag circuits and equipment according to applicable safety standards.

Trained or instructed according to the latest related standards (e.g. EN298, EN676, EN267, ..).

**Notes of caution:**

The equipment must be installed in compliance with the regulations in force, following the manufacturer's instructions, by qualified personnel.

Qualified personnel means those having technical knowledge in the field of components for civil or industrial heating systems, sanitary hot water generation and particularly service centres authorised by the manufacturer.

Improper installation may cause injury to people and animals, or damage to property, for which the manufacturer cannot be held liable.

Remove all packaging material and inspect the equipment for integrity.

In case of any doubt, do not use the unit - contact the supplier.

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

Before any cleaning or servicing operation, disconnect the unit from the mains by turning the master switch OFF, and/or through the cut- out devices that are provided.

Make sure that inlet or exhaust grilles are unobstructed.

In case of breakdown and/or defective unit operation, disconnect the unit. Make no attempt to repair the unit or take any direct action.

Contact qualified personnel only.

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

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

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

When a decision is made to discontinue the use of the equipment, those parts likely to constitute sources of danger shall be made harmless.

In case the equipment is to be sold or transferred to another user, or in case the original user should move and leave the unit behind, make sure that these instructions accompany the equipment at all times so that they can be consulted by the new owner and/or the installer.

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

This unit shall be employed exclusively for the use for which it is meant. Any other use shall be considered as improper and, therefore, dangerous.

The manufacturer shall not be held liable, by agreement or otherwise, for damages resulting from improper installation, use and failure to comply with the instructions supplied by the manufacturer.

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# 1 WIRING RECOMMENDATIONS

## 1.1 Earthing

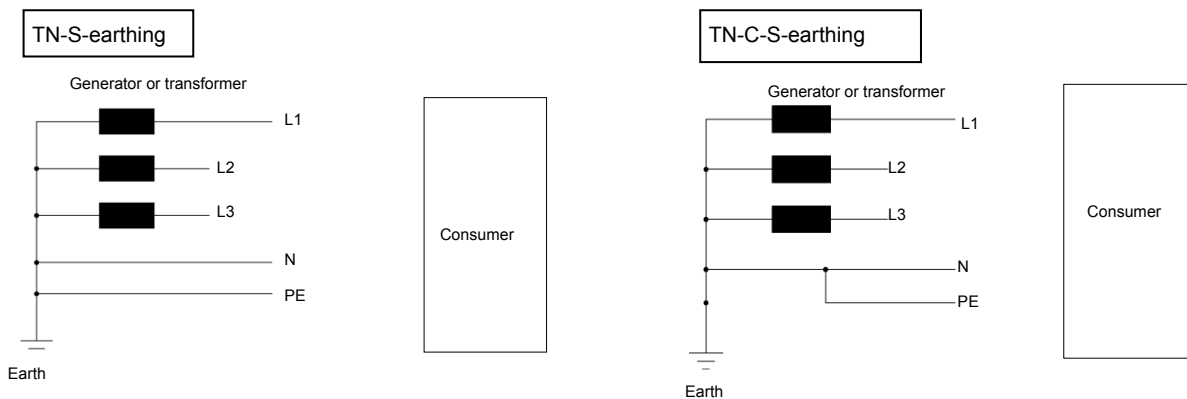
### 1.1.1 TN earthing system

For the LMV5x-System it is preconditioned that a TN earthing system is used.

In a TN earthing system, one of the points in the generator or transformer is connected with earth, usually the star point in a three-phase system.

TN-S: PE and N are separate conductors that are connected together only near the power source. This arrangement is the current standard for most residential and industrial electric systems in North America and Europe.

TN-C-S: Combined PEN conductor from transformer to building distribution point, but with separate PE and N conductors in fixed indoor wiring.



LMV system must be connected to earth (PE).  $\Delta\text{Volt}$  must be 0 V between N-PE.

NOTE: PE = protection earth, it is not FE

FE = functional earth

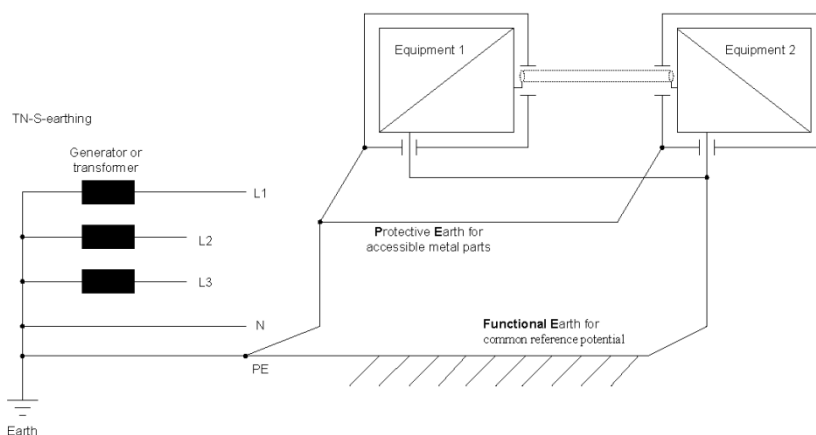
### 1.1.2 Protective Earth (PE) and Functional Earth (FE)

**Protective Earth (PE):**

Known as an equipment grounding conductor, avoids hazards by keeping the exposed conductive surfaces of a device at earth potential.

To avoid possible voltage drop no current is allowed to flow in this conductor under normal circumstances, but fault currents will usually trip or blow the fuse or circuit breaker protecting the circuit.

For example: burner body or the third wire in a 3 wire cable (N L E)



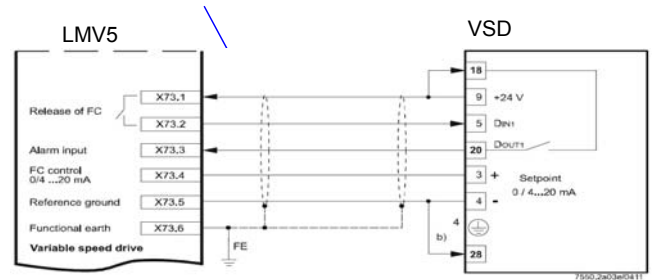
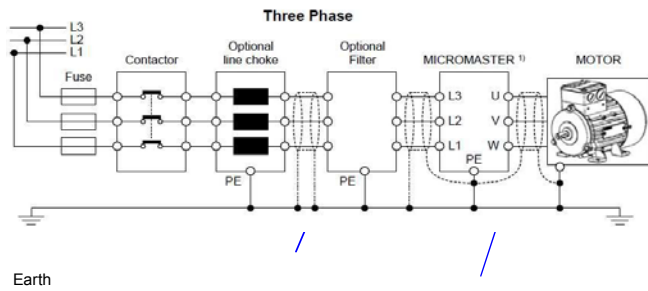
**Functional Earth (FE):**

Is not intended for shock protection. It is used for a common reference potential.

For example: cable shields.

## 1.2 .Frequency inverter / Variable Speed Drive (VSD)

A VSD is one of the strongest EMC sources in a boiler house, so the following is recommended:



**Note:** If the LMV5 is mounted in a cabinet, alternative to (X73.6 / FE), also a connection with the PE- rail in the cabinet is possible

Use only VSD with EMC- filter!

Cable from VSD to the fan motor (Line voltage)

Use a complete separate and shielded cable from the VSD to the fan motor! Connect the shield at VSD- and at the motor- side with PE.

Details and further information see related VSD- documentation.

Cable from LMV5 to VSD (Low voltage)

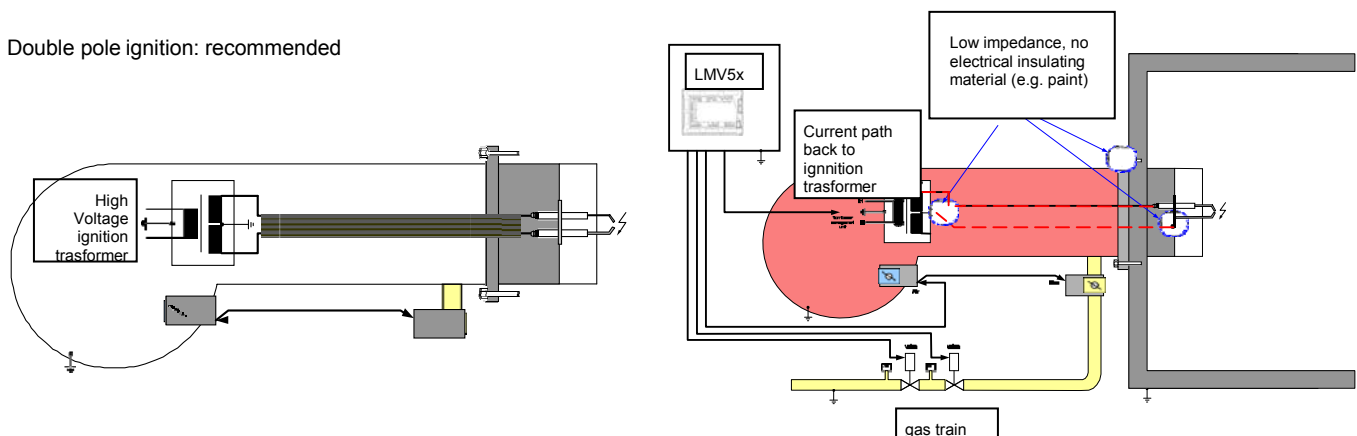
Use a shielded cable from LMV5 to VSD. The shield of this cable has to be connected only at LMV5 side with X73.6 (FE), not at the VSD side:

## 1.3 Ignition electrodes and transformers

The Ignition is also one of the strong EMC sources, so the following is recommended:

- Keep the cable loop/length in the high voltage ignition circuit as short as possible.
- Use special EMC-ignition cable
- Avoid capacitive and inductive coupling to other signalpaths.
- Use separate wiring for the ignition high voltage cable, with max. possible distance to other cables and to the burner housing.
- e.g.: use a electrical insulating conduit or distance parts (e.g. plastic material), see also Appendix "Example for wiring, earthing and shielding the LMV5-System"
- Prefer a double pole ignition (see drawings below).
- When using a double probe ignition, the cables should be run close together to ensure that the area of emissions is as small as possible.

Double pole ignition: recommended



If a **single pole ignition must be used**, it is very important to have a low impedance at the mechanical connections (no insulation material, e.g. paint), because then you get a **good** current path from the ignition spark back to the ignition transformer, that results in **low** EMC-emissions:

If you have high impedance at the mechanical connections, e.g. caused by paint, you get **bad** multiple current paths from the ignition spark back to the ignition transformer, that results in **high** EMC-emissions

### 1.3.1 Recommendations

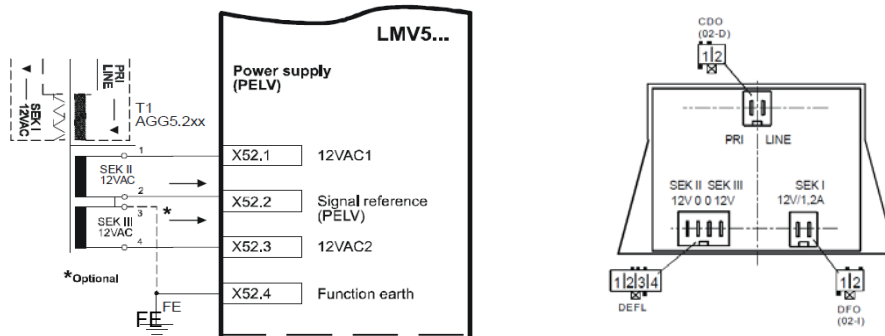
It is recommended to use a metal "mounting plate" for the LMV5 Base Unit and the Transformer AGG5.220.

Use this plate to provide the Functional Earth (FE), see also [/EARTH connection example](#)

The connection of the FE to the LMV5 has to be made by connecting the X52.4 terminal with FE!



Follow exactly the shield and earth connection in the wiring diagram



In some cases connecting the terminal X52.2 with FE results in an improved EMC- immunity of the LMV5. Make this connection and check the result, if there is no improvement, remove this connection.

The FE is wired LMV- internal to the terminals for the shields (e.g. for Temperature- & Pressure- Sensors, ...), see "4. Shielding"

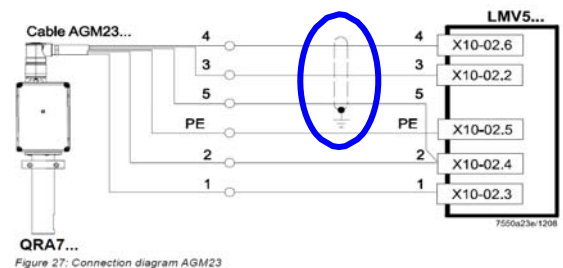
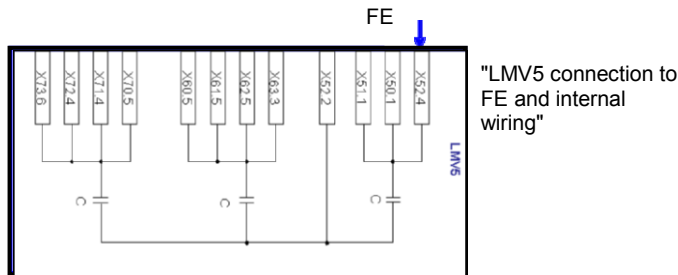
To have a good connection of FE to the actuators SQM4/9, make certain that there is a proper electrical contact between the housing of the actuators and FE.

If necessary connect the actuators SQM45/48/91 with a separate cable with the maximum possible diameter to FE, see also Appendix "Example for wiring, earthing and shielding the LMV5-System"

### 1.3.2 Shielding

The LMV5-FE-terminals for the shields are LMV5 internally connected with X52.4, this terminal must be connect external with FE!, see also "3.3".

The shield terminals for the CAN-Bus (X50.1, X51.1) are connected direct with X52.4, the other shield terminals are connected via capacitors to prevent DC- current.



For the cables listed below use shielded cables:

For the CAN-Bus cable use AGG5.631 and/or AGG5.641 together with AGG5.110 = CAN bus connection shield, for connecting the CAN bus to the basic unit. More details see page 36 "Installation Guide CC1J7550.1"

- Cables for the VSD:
- Line voltage cable VSD - Fan motor
- Low voltage cable LMV5 – VSD (terminals X73)
- Cables for Temperature or Pressure sensors, set points, load output at the LMV5 Base Unit: X60, X61, X62, X63
- Cables for the Fuel Counters at the LMV5 Bas Unit: X71, X72
- Cable for the Speed sensor: X70
- Cable for the QGO20 sensor at the PLL52: X81
- Cables for Temperature sensors at PLL52: X86, X87

(only if present) Cable for QRA7- Signal wires no. 3, 4 and 5, for cable length > 10m and < 100m; consider reinforced insulation to signal cable and connect it to PE at the cabinet PE- rail.

## 1.4 Wireway and electrical conduit

The following cables are recommended for separate wiring;

Complete separate from all other cables:

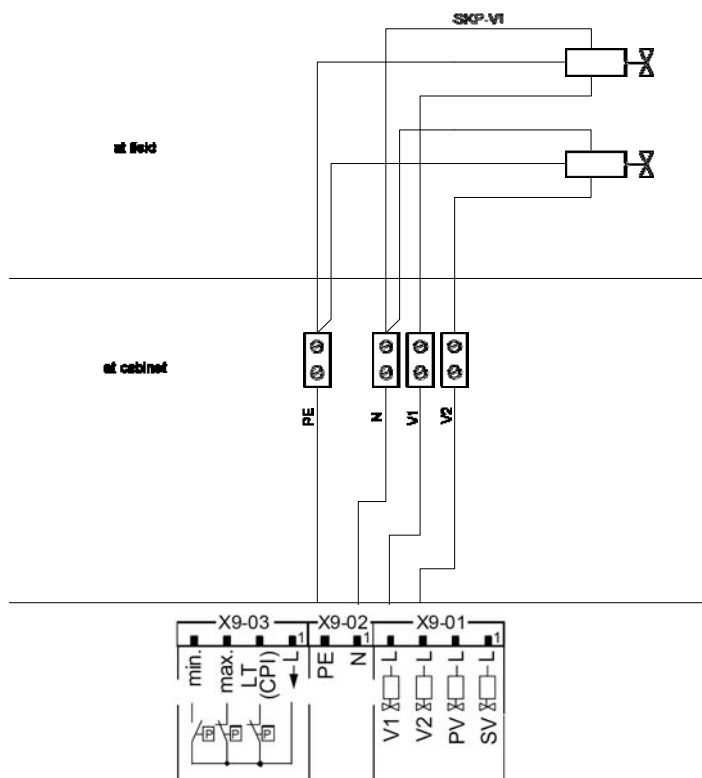
- Cable for "VSD to Fan motor" Line voltage, see also "1. Frequency inverter / Variable Speed Drive (VSD)"
- Cable for ignition high voltage, see also "2. Ignition"
- Cable for the Flame sensors

Together in cable duct 1 for Low voltage, e.g.:

- Cable for CAN-Bus
- Cable for VSD speed sensor, LMV5 X70
- Cable for VSD Release & Set point , LMV5 X73
- Cables for the Load controller: Temperature or Pressure sensor, set point, load output at the LMV5 X60, X61, X62, X63

Together in cable duct 2 for Line voltage, e.g.:

- Cable for Ignition transformer
- Cables for other Line voltage signals, e.g. Gas pressure switches, Air pressure switches, ....
- Cable for Gas valves SKP/VGD

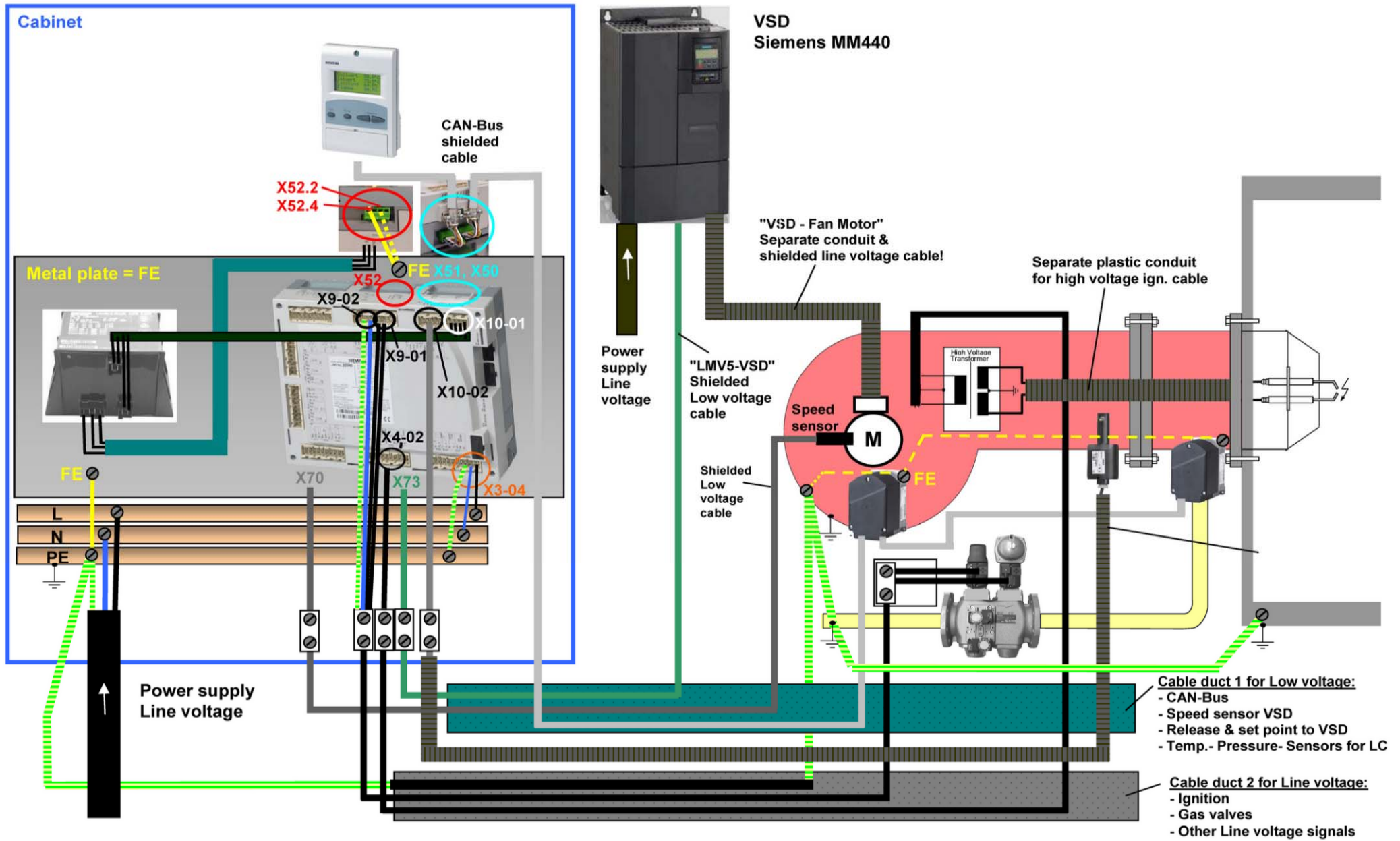


The cables from the LMV5 to the SKP/VGD -Gas vales shall be connected at the LMV5 side with X9-01: L-Valve1, L-Valve2 and with X9-02, N, PE) and connected at the SKP side separate to each SKP.

Example of wiring, see next paragraph [Wireway and electrical conduit](#)



NOTE: KEEP SEPARATE SIGNALS CABLES, OUTPUT CABLES, PHOTOCCELL CABLE AS SHOWN IN THE BELOW PICTURE



1.4.1 Servomotor wiring example



1.4.2 Bus cable wiring on LMV5x and AZL doors.

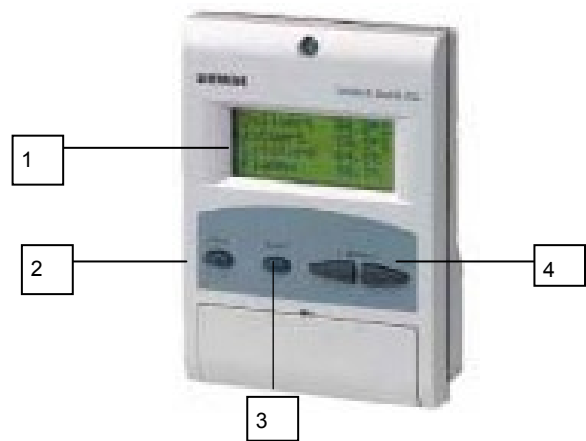


1.4.3 EARTH connection example



## 2 AZL display/programming unit

Users can set only the LMV parameters that can be accessed without password: (see “Adjusting the temperature set-point”). The Siemens AZL User Interface allows programming the Siemens LMV control box and monitoring the system data.



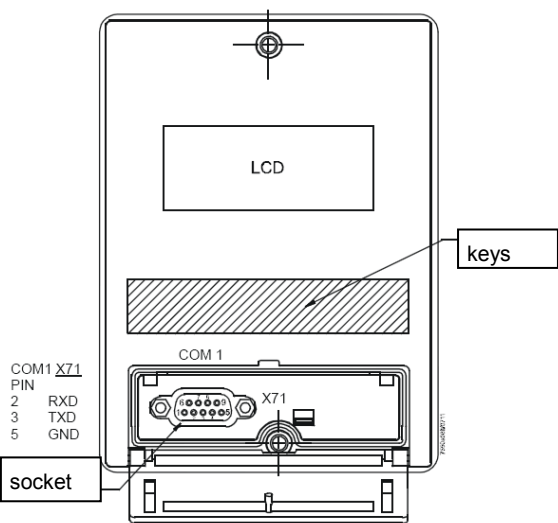
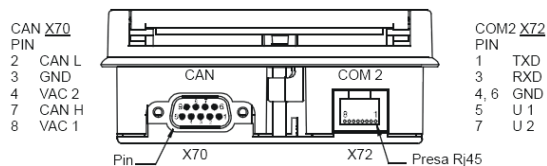
The user interface is made of:

display: it shows menus and parameters

**ESC**  key (previous level): it goes back to the previous level menu or exits the programming mode without changing data.

**ENTER**  key (next level): it confirms the data changing and jumps to the next menu/parameter.

**SELECT**  keys: they select a menu item and change the parameter values.



AZL5x provides three sockets to interface with other devices:

X70 socket for CAN bus connection: it provides power supply to display also.

COM1 (X71) for connection to PC/laptop by RS232 connector

COM2 (X72) for connection to building automation system by RJ45 connector.

Note: COM1 and COM2 ports do not work at the same time.



**Caution:** when MODBUS is active, it is not possible to execute the backup via ACS450; if backup is executed the set-point will be missing and the burner will immediately turns off.

## 2.1 LMV5x program operating phases

| Phase number | Description              | Sequence      |
|--------------|--------------------------|---------------|
| 10           |                          | Home run      |
| 12           |                          | Stand by      |
| 20,21        | Waiting to start realase | Startup       |
| 22           | Start fan on             | Startup       |
| 24           | Driving to pre-purge     | Startup       |
| 30....34     | Pre purging              | Startup       |
| 36           | Driving to ignition pos  | Startup       |
| 38           | Ingnition pos            | Startup       |
| 40,42,44     | Fuel release 1           | Startup       |
| 50,52        | Fuel release 2           | Startup       |
| 54           | Driving to low flame     | Startup       |
| 60,62        | Shut-down low fire       | Operation     |
| 70,72        | Driving to prepurge      | Shutdown      |
| 74....78     | Post-prepurging          | Shutdown      |
| 79           | Test Air PressSwitch     | Shutdown      |
| 80....83     |                          | Valve proving |
| 01           |                          | Safety Phase  |
| 00           |                          | Lockout       |

At burner startup, the AZL display shows, one by one, the various phases of the start-up program, until it reaches normal operation phase (Phase 60).

LMV5x controller is factory preset. Changing are possible according to the password input

By closing the "thermostat series" and once the start-up sequence is accomplished (from phase 12 to pahse34), the burner is driven to the factory-set ignition position (phase 38).

The burner remains in that position because this is the only one work point in memory.

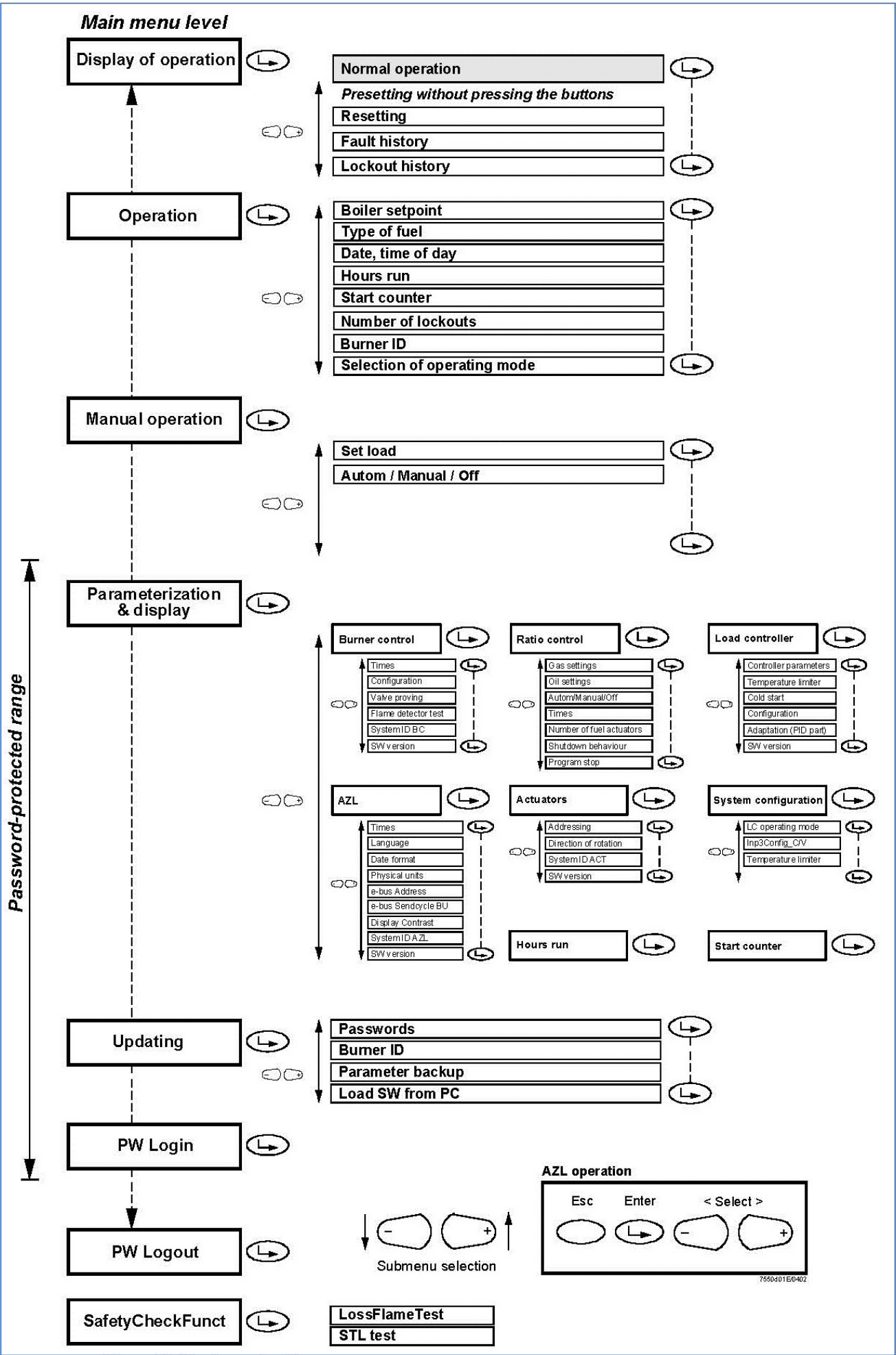
The fuel/air ratio curve must be set, until the maximum load limit (100% output).

During the setting, the actuators move according to the curve points. While the actuators move, always check the combustion analysis, point by point, and the flame stability.

The fuel/air curve points must be set during the commissioning, by a qualified operator.

|                                                                                    |                                                                                                                                                                                                                                                                                             |
|------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>CAUTION!</b> The procedure requires a password: qualified personnel only must check all changes to combustion parameters by means of the combustion analyzer. Remember that the password will elapse if no key is pressed for a certain period. The unit will ask for the password again |
|  | <b>ATTENTION!</b> During the cold start phase, it is necessary to set the burner load. Too low output values could damage the combustion head, blast tube, oil nozzle (if present). The minimum working point must be set by qualified personal.                                            |
|  | <b>CAUTION!:</b> check the combustion analysis, point by point, and the flame stability.                                                                                                                                                                                                    |
|  | <b>ATTENTION!</b> Set the real load output percentage at the corresponding curve-point on AZL during the burner regulation.                                                                                                                                                                 |

2.2 LMV5x program structure



**NOTE:**

(1) only for LMV52.400, LMV51.300 without temperature compensation

(2) only for LMV5.200 (controlling the oxygen level in the exhaust gas flue) and LMV52.400 (monitoring the oxygen level in the exhaust gas flue, a lock out occur if a limit value is overcoming)

(3) Only for LMV51.300 (in this case VSD cannot be used), LMV52.xxx



**ATTENTION: LMV51.300: HAS ONE AUX. IT CAN BE SET FOR FGR OR VSD OR "VSD AND FGR" TOGETHER**



**ATTENTION: IT IS RECOMMENDED TO NOT USE O2 MONITORING IF FGR IS INSTALLED AND ACTIVE**

## 2.3 Burner ID number

The burner ID number corresponds to the **burner serial number**.

**NOTE:** in case of call to the Service Center, always tell the burner type and serial number (see burner data plate).

**NOTE:** burner ID number must be set.

Following the below route access to the programming levels of the menu:

| 1st level       | 2nd level | 3rd level | 4th level | 5th level | 6th level | Description              |
|-----------------|-----------|-----------|-----------|-----------|-----------|--------------------------|
| OperationalStat |           |           |           |           |           |                          |
|                 | BurnerID  |           |           |           |           | Identification of burner |

the product ID number is an OEM parameter, entered by the burner manufacturer and it can not be changed; it consist of minimum 4 and maximum 15 characters.

2.4 Password

2.4.1 Access to service levels by password

Depending on password (service or OEM), different parameters are visible.

"Service" parameters, as per the actuator curves and the set-point values, are password protected. The operator must logon using the "9876" password.

"User" level doesn't need a password.

If a password shall be entered, line Enter password is selected by means of decrementing (pointer points to the first character of that line) and then finally selected by pressing Enter.

Then, the pointer jumps to the first position of the password entry line. Now, through incrementing or decrementing, a character (digit or letter) can be selected. A character is confirmed by pressing Enter. If a wrong entry has been made, the last character can be edited again by pressing Esc.

The other password positions can be selected, edited and entered in a similar way. Hence, when making an entry, only 1 character is visible. When the last character of the password is reached, the entry is to be confirmed by pressing Enter.

Display before the first password character is entered:



The example displays when entering the third password character:



If the check of the password entered is positive, the change to the next menu level takes place. Otherwise, the display returns to the main menu level.

To go back to the main menu, press "Esc"  until the first level menu is reached, then press the "right arrow"  till the first item is reached, then press "Enter" twice. 

2.4.2 Password Logout

To avoid customer changes on parameter settings and consequently changes in regulation, the password must be logged out. The "password logout" functions on the first level menu: press  to choose "PW Logout" then press "Enter".

**Note:** if no key is pressed within a settable period, the password is deactivated automatically.

**Note:** if a power supply drop occurs to the unit, the password will be automatically deactivated.

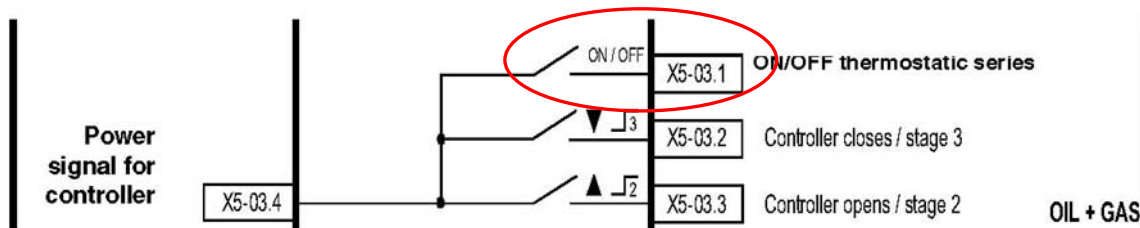
2.4.3 Changing password.

Following the below route access to the programming levels of the menu by means the Esc

| 1st level                                                                           | 2nd level                                                                           | 3rd level       | 4th level | 5th level | 6th level | Description        |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-----------------|-----------|-----------|-----------|--------------------|
| Updating                                                                            |                                                                                     |                 |           |           |           |                    |
|  | Password                                                                            |                 |           |           |           | To change password |
|                                                                                     |  | ServicePassword |           |           |           | For service only   |
|                                                                                     |  | OEM Password    |           |           |           | For OEM only       |

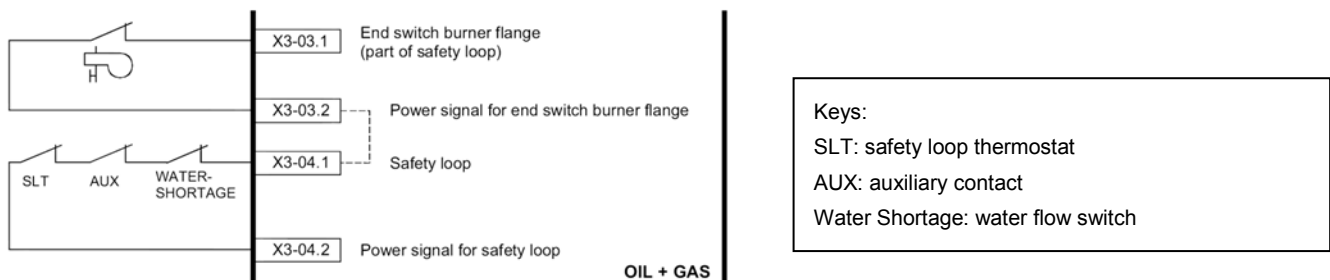
### 3 Thermostatic series and safety loop

The burner shuts down properly when the thermostatic series (X5-03.1 and X5-03.4 - terminals 3 and 4 of the burner terminal block) opens. In this way, before shut-down, the burner drives to the minimum load, then the fuel valve will close. The post-purging phase will be performed if set. By re-closing the thermostatic series, the burner will start-up again.

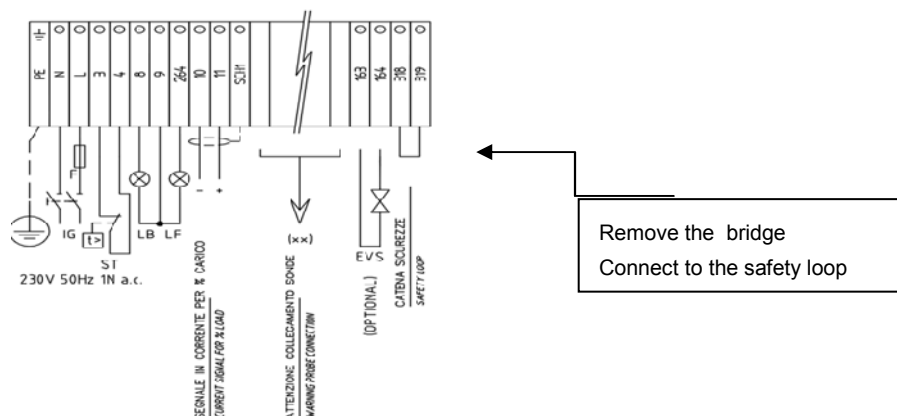


In the plant other safety devices are provided (levels, pressure switches, thermostats, air damper) . All these contacts are connected in series to the 318-319 terminals of the burner supply terminal block. When the safety loop closes, the burner is ready to restart. The actuators move to "home position" (standby position), and if terminals 3-4 are closed the start-up cycle resumes; otherwise the burner enters the standby phase.

In the plant the safety thermostat is provided as well. If this thermostat switches (terminals X3-04.1 e X3-04.2 corresponding to terminals 318 and 319 of the burner supply terminal block - see below), the system will lead to an immediate burner lockout.



In case of burner designed with automatic pull-out system from the generator, the burner flange end switch is connected to terminals X3-03.1 e X3-03.2. If the contact open, the burner automatically shuts down.



**NOTE:** When the safety loop opens, the burner will immediately turns off, skipping the low flame stage. It's important to distinguish between "safety loop" and "thermostatic series"

The maximum number of emergency shut-downs is 16. When this number is reached a lockout will occur AZL will show the message: "Open safety loop".

Following the below route access to the programming levels of the menu:

| 1st level                                                                           | 2nd level                                                                           | 3rd level                                                                           | 4th level                                                                           | 5th level  | 6th level | Description                                        |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|------------|-----------|----------------------------------------------------|
| Params & Display                                                                    |                                                                                     |                                                                                     |                                                                                     |            |           | Menu level for making the parameter settings       |
|  | BurnerControl                                                                       |                                                                                     |                                                                                     |            |           | Setting the burner control parameters              |
|                                                                                     |  | Configuration                                                                       |                                                                                     |            |           |                                                    |
|                                                                                     |                                                                                     |  | RepetitCounter                                                                      |            |           | It sets the maximum number of possible repetitions |
|                                                                                     |                                                                                     |                                                                                     |  | SafetyLoop | 1...16    | Default is set on 16                               |

# 4 Actuators

## 4.1 Addressing the actuators

The addressing assigns to each actuator its proper function. The addressing is factory set by the burner manufacturer.

If an actuator must be replaced, it is necessary to address it, otherwise the system will not work. The parameter that sets the actuator function is protected by the Service level password. Remember to check that the jumper “Bus termination” of the last actuator on the CAN bus is set to “On”, before starting addressing.

Following the below route access to the programming levels of the menu by means the Esc

| 1st level                                                                        | 2nd level                                                                         | 3rd level                                                                         | 4th level                                                                                             | 5th level | 6th level | Description                        |
|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|-----------|-----------|------------------------------------|
| Params & Display                                                                 |                                                                                   |                                                                                   |                                                                                                       |           |           |                                    |
|  | Actuators                                                                         |                                                                                   |                                                                                                       |           |           |                                    |
|                                                                                  |  | Addressing                                                                        |                                                                                                       |           |           | Addressing unad- dressed actuators |
|                                                                                  |                                                                                   |  | AirActuator<br>GasActuat (Oil)<br>OilActuator<br>AuxActuator 1<br>AuxActuator 2<br>AuxActuator 3 (**) |           |           | (**) used with FGR                 |

To address an actuator, choose the corresponding actuator and follow the instructions on display:

When the actuator green LED flashes, it means that one of the following function is set according to the number of blinks:

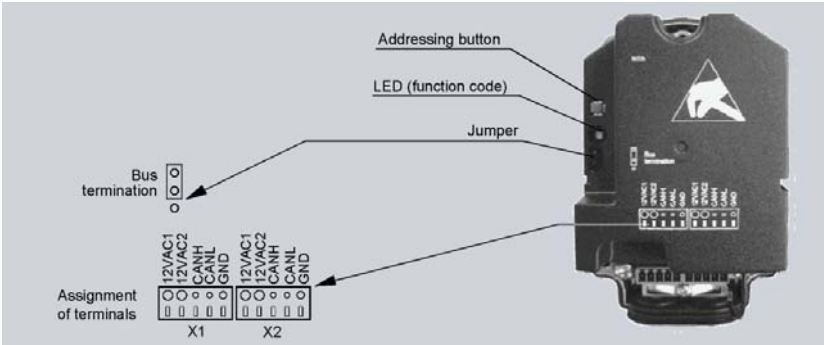
| Blinks   | Actuator function              |
|----------|--------------------------------|
| 1 blink  | air damper actuator            |
| 2 blinks | gas butterfly valve actuator   |
| 3 blinks | oil pressure governor actuator |
| 4 blinks | auxiliary actuator AUX1        |
| 5 blinks | auxiliary actuator AUX2        |
| 6 blinks | auxiliary actuator AUX3        |

If the burner is equipped with FGR, AUX3 must be used



**CAUTION:** it is recommended not to adjust the actuators. Anyway, never press the actuator red button, otherwise the fundamental parameters, necessary for the burner operation, will be cancelled. The burner will therefore continuously lock out

In case P1 was pressed for a long time, it will be necessary to perform a new addressing of the actuator.





**ATTENTION:** when the actuator LV green LED is always lit, it means that the actuator has not been addressed yet or it has been reset and needs to be addressed again.

## 4.2 Actuator doors configuration

After the addressing of the actuators, it is necessary to activate and to configure the operation way for each servomotor.

|                                                                                  |                                                                                                       |
|----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
|  | <b>ATTENTION: Activate only the actuators that are really present, otherwise an error will occur.</b> |
|----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|

| 1st level                                                                        | 2nd level                                                                         | 3rd level                                                                         | 4th level                                                                                        | Possible choices                                                                                                                                                                                                                       |
|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Params&Display                                                                   |                                                                                   |                                                                                   |                                                                                                  |                                                                                                                                                                                                                                        |
|  | RatioControl                                                                      |                                                                                   |                                                                                                  |                                                                                                                                                                                                                                        |
|                                                                                  |  | Gas/OilSetting                                                                    |                                                                                                  |                                                                                                                                                                                                                                        |
|                                                                                  |                                                                                   |  | AuxActuator<br>AirActuator<br>AuxActuator1<br>AuxActuator2<br>AuxActuator3<br>VSD<br>GasActuator | Deactivated<br>Activated<br>Air influencing (only with LMV52x if O2 control is present)<br><br>(values available Only with LMV51.300)<br>VSD = VSD only<br>AUX3 = FGR only, without temperature compensation<br>VSD+AUX3 = VSD and FGR |

|                                                                                  |                                                                                                |
|----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
|  | <b>LMV 51.300 has the possibility to operate with VGD+FGR without temperature compensation</b> |
|----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|

## 4.3 Setting the actuator speed

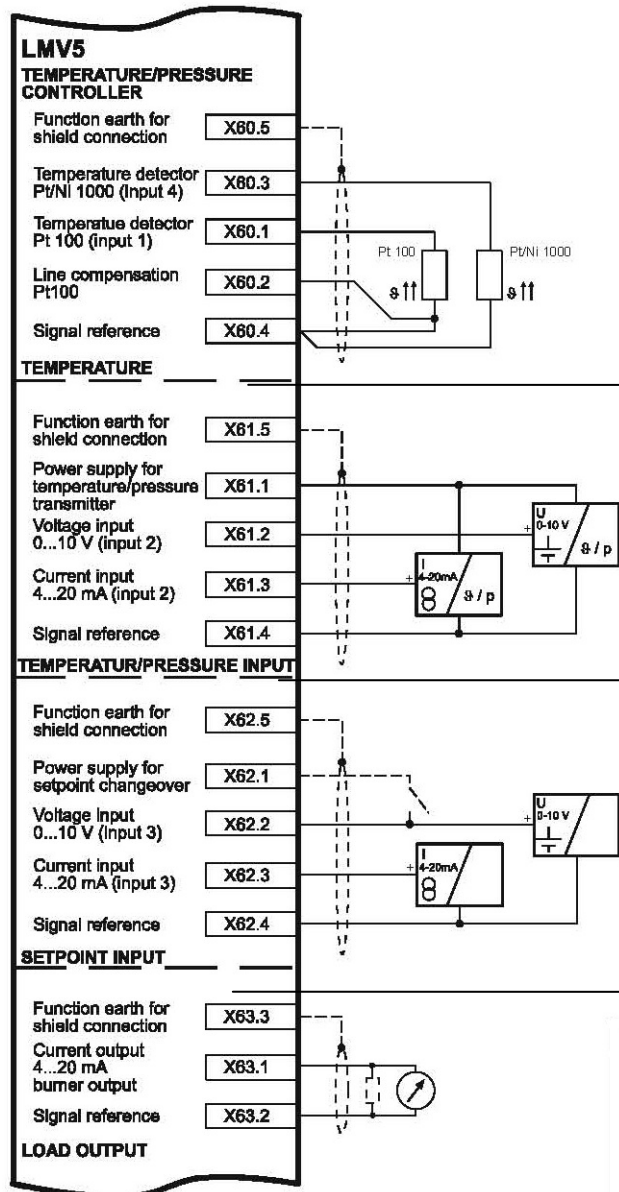
LMV sees VSD as an actuator, that's why the speed ramp up and the stop times must not be higher than the actuator stroke time. If it is necessary to increase the VSD times, change the actuator stroke time also, according to the next procedure. By following the next table, set both parameter "OperatRampMod" and "TimeNoFlame" to set the ramp up/stop times for the VSD and the actuator opening speed (from 0° to 90°).

Following the below route access to the programming levels of the menu by means the Esc

| 1st level                                                                          | 2nd level                                                                           | 3rd level                                                                           | 4th level     | 5th level | 6th level | Description                                                                                                                                                                                                                                                                                                                             |
|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------|-----------|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Params&Display                                                                     |                                                                                     |                                                                                     |               |           |           | Menu level for making the parameter settings                                                                                                                                                                                                                                                                                            |
|  | RatioControl                                                                        |                                                                                     |               |           |           | Parameter settings for fuel/ air ratio control                                                                                                                                                                                                                                                                                          |
|                                                                                    |  | Times                                                                               |               |           |           |                                                                                                                                                                                                                                                                                                                                         |
|                                                                                    |                                                                                     |  | OperatRampMod | Service   | 40 s      | Operating ramp modulating is the maximum speed of the actuators during operation (phase 60 ÷ 62).<br>A setting of 30 seconds generates a maximum speed of 90° in 30 seconds (3°/s).<br>The LMV5 calculates an individual speed for each actuator, so that all actuators reach their target positions at the same time.<br>Range 10..60s |
|                                                                                    |                                                                                     |  | TimeNo- Flame | Service   | 40 s      | Drive ramp is the speed of the actuators when traveling to the home, prepurge, ignition, and postpurge positions.<br>A setting of 10 seconds generates a maximum speed of 90° in 10 seconds (9°/s).<br>Range 10..120s                                                                                                                   |

|                                                                                    |                                                                                                                          |
|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
|  | <b>ATTENTION: It is suggested to set the ramp up and stop time to a value about 35% lower then the slowest actuator.</b> |
|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|

## 5 Setting the load controller



Door X60 is used for IntLC... choice and a temperature modulating probe is used.



**ATTENTION:** in case of FGR, it is not possible to connect a modulating temperature probe at the X60 door of the LMV5...

See the proper chapter for configuration.

Door X60 is used for IntLC.... choice and a pressure probe is used.

It can be used also if the temperature probe has an analogue exit or a converter from Ohm to mA /V is used.

In this case the right input must be set.



**ATTENTION:** in case of FGR, it is possible to connect a modulating temperature probe at the X61 door of the LMV5...

Door X62 is used for ExtLC...

The input signal come from an external load modulator.

Door X62 is also used to switch from one setpoint to another one when IntLC... is used, by means the opening and closing of the contact between X62.1 and X62.2 terminals

Door X63 is used to remote a load % signal output from the LMV to the client DCS or PLC

Output Value Selection are: Load / Load 0 / O2 / Pos Air / Pos Fuel / Pos Aux1 / Pos Aux2 / Pos Aux3 / Speed VSD / Flame / Temp Pt1000 / TempNi1000 / Temp Pt100 / Temp X61 / Press X61)

IntLC....must be set together with a modulating probe (temperature or pressure). The probe and its signal must be configured. Doors allowed are X60 for temperature probe and X61 for pressure probes or analogue output probes.

ExtLC... must be set together with an external input signal of modulation (analogue or bus) coming from an external output modulator. The input must be configured. Doors allowed are X62 for the type of signal choice.

Following the below route access to the programming levels of the menu

| 1st level        | 2nd level      | 3rd level     | 4th level   | 5th level                                                                     | 6th level | Description                                  |
|------------------|----------------|---------------|-------------|-------------------------------------------------------------------------------|-----------|----------------------------------------------|
| Params & Display |                |               |             |                                                                               |           | Menu level for making the parameter settings |
|                  | LoadController |               |             |                                                                               |           | Settings for the internal load controller    |
|                  |                | Configuration |             |                                                                               |           | General configuration of the load controller |
|                  |                |               | LC_OptgMode |                                                                               |           | Operating mode with load controller          |
|                  |                |               |             | ExtLC X5-03<br>Int LC<br>Int LC Bus<br>Int LC X62<br>Ext LC X62<br>Ext LC Bus |           | See below.                                   |

**ExtLC X5-03** = three-point external controller (X5-03 terminals)

**Int LC** = internal controller (LMV5x) (it switches between 2 set points, W1,W2 set thought AZL. the switch from W1 and W2 is realized opening/closing the LMV5x... terminals X62.1, X62.2).

**Int LC Bus** = internal controller and set point setting via bus connection

**Int LC X62** = internal controller (LMV), but set point is externally controlled by means of a voltage/current signal on X62 terminals

**Ext LC X62** = external controller, the burner output is controlled by means of a voltage/current signal on X62 terminals

**Ext LC Bus** = external controller, the burner output is controlled via bus



**ATTENTION:** in case of FGR, it is not possible to connect a modulating temperature probe at the X60 door of the LMX5...  
See the proper chapter for configuration.

## 6 Setting the probes and set-points

If the LMV5x internal load controlled is used, a temperature or pressure probe can be connected to the terminal X60 or X61. In this case, set the type of probe and its operating range.

### 6.1 Configuration of a temperature probe at X60 door



**ATTENTION:** If the external load controller is set do not connected to terminals X60 or X61.



**ATTENTION:** If the burner is equipped with FGR with temperature compensation a Pt1000 must be set.



**ATTENTION:** Depending on the sensor, the value is visualized as °C or bar.

Following the below route access to the programming levels of the menu by means the Esc

| 1st level        | 2nd level      | 3rd level     | 4th level     | 5th level                                                                                | 6th level | Description                                        |
|------------------|----------------|---------------|---------------|------------------------------------------------------------------------------------------|-----------|----------------------------------------------------|
| Params & Display |                |               |               |                                                                                          |           | Menu level for making the parameter set- tings     |
|                  | LoadController |               |               |                                                                                          |           | Settings for the internal load controller          |
|                  |                | Configuration |               |                                                                                          |           | General configuration of the load controller       |
|                  |                |               | Sensor Select |                                                                                          |           | Select actual value input                          |
|                  |                |               |               | Pt100<br>Ni1000<br>Temp sensor<br>Press sensor<br>Pt100Pt1000<br>Pt100Ni1000<br>NoSensor |           | See the table below for the meaning of the choice. |

Possible settings are:

| Probe           | Description                                                                                                                                                                                |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Pt100           | Temperature sensor Pt100 at the input X60, internal temperature limiter function = activated                                                                                               |
| Pt1000          | Temperature sensor Pt1000 at the input X60, internal temperature limiter function = activated                                                                                              |
| Ni1000          | Temperature sensor LG-Ni1000 at the input X60, internal temperature function = activated                                                                                                   |
| TempSens        | Temperature sensor at the input X61, internal temperature switch function = deactivated                                                                                                    |
| PressSens       | Pressure sensor at the input X61, internal temperature switch function = deactivated                                                                                                       |
| Pt100<br>Pt1000 | Temperature sensor Pt100 at input X60 for temperature controller and temperature limiter function and temperature sensor Pt1000 at input X60 additionally for temperature limiter function |
| Pt100<br>Ni1000 | Temperature sensor Pt100 at input X60 for temperature controller and temperature limiter function and temperature sensor LG-Ni at input X60 additionally for temperature limiter function. |
| No Sensor       | No actual value sensor (e.g. in the case of external predefined loads and without internal temperature limiter).                                                                           |



**ATTENTION:** If a boiler second probe is to be connected to terminals (1000 Ohm only), internal functions TL\_ThreshOff and DiffIntervTL\_SD\_On are activated automatically (see paragraph **SETTING FUNCTIONS "TL\_ThreshOff" AND "TL\_SD\_On"**).

## 6.2 Configuration of a pressure or a temperature probe type at X61 door



**ATTENTION:** If the external load controller is set do not connected to terminals X60 or X61.

If a modulation probe is connected to the X61 terminal, proceeding as follows:

| 1st level        | 2nd level      | 3rd level     | 4th level        | 5th level                                      | 6th level | Description                                         |
|------------------|----------------|---------------|------------------|------------------------------------------------|-----------|-----------------------------------------------------|
| Params & Display |                |               |                  |                                                |           | Menu level for making the parameter settings        |
|                  | LoadController |               |                  |                                                |           | Settings for the internal load controller           |
|                  |                | Configuration |                  |                                                |           | General configuration of the load controller        |
|                  |                |               | Ext Inp X61 U/ I |                                                |           | Configuration of external input X61                 |
|                  |                |               |                  | 4...20 mA<br>2...10 V<br>0...10 V<br>0...20 mA |           | Set the proper value according to the probe output. |

### 6.2.1 Configuration of a pressure or a temperature probe signal at X61 door

Once the pressure sensor signal type is set, the sensor range must be set as well, proceeding as follows:

| 1st level      | 2nd level      | 3rd level     | 4th level        | 5th level                   | 6th level                   | Description                                   |
|----------------|----------------|---------------|------------------|-----------------------------|-----------------------------|-----------------------------------------------|
| Params&Display |                |               |                  |                             |                             | Menu level for making the parameter settings  |
|                | LoadController |               |                  |                             |                             | Settings for the internal load controller     |
|                |                | Configuration |                  |                             |                             | General configuration of the load controller  |
|                |                |               | MRange PressSens |                             |                             | End of pressure measuring range for input X61 |
|                |                |               |                  | 0...99.9 bar<br>0...2000 °C | 0...99.9 bar<br>0...2000 °C | Set the probe value                           |

**Example:** if a max 10bar Siemens sensor is used, the voltage output signal will be 0 V at 0 bar, while the 10 V signal will correspond to its maximum pressure 10 bar. If the sensor is replaced with a max 16bar one, the 0 V output signal will correspond to 0 bar, while the 10 V output signal will correspond to 16bar pressure: the parameter "MRange Press-Sens" has to be set at 16bar.

## 6.3 Configuration of the X62 door input signal

Following the below route access to the programming levels of the menu by means the Esc

| 1st level        | 2nd level      | 3rd level     | 4th level       | 5th level                                      | 6th level | Description                                                                                      |
|------------------|----------------|---------------|-----------------|------------------------------------------------|-----------|--------------------------------------------------------------------------------------------------|
| Params & Display |                |               |                 |                                                |           | Menu level for making the parameter settings                                                     |
|                  | LoadController |               |                 |                                                |           | Settings for the internal load controller                                                        |
|                  |                | Configuration |                 |                                                |           | General configuration of the load controller                                                     |
|                  |                |               | Ext Inp X62 U/I |                                                |           | Configuration of external input X62: input signal on X62 can change setpoint or control the load |
|                  |                |               |                 | 4...20 mA<br>2...10 V<br>0...10 V<br>0...20 mA |           | According to the external modulator output.                                                      |

If a boiler second probe is to be connected to terminals (1000 Ohm only), internal functions TL\_ThreshOff and DiffIntervTL\_SD\_On are activated automatically (see paragraph SETTING FUNCTIONS "TL\_ThreshOff" AND "TL\_SD\_On").

## 6.4 Setting the setpoint and the burner and the PID operative band.

### 6.4.1 Set-point

To set the temperature set-point value, that is the generator operating temperature; proceed as follows.

| 1st level                                                                        | 2nd level                                                                         | 3rd level       | 4th level | 5th level | 6th level | Description                                  |
|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------|-----------|-----------|-----------|----------------------------------------------|
| Params & Display                                                                 |                                                                                   |                 |           |           |           | Menu level for making the parameter settings |
|  | LoadController                                                                    |                 |           |           |           | General configuration of the load controller |
|                                                                                  |  | ControllerParam |           |           |           | Controller parameters                        |

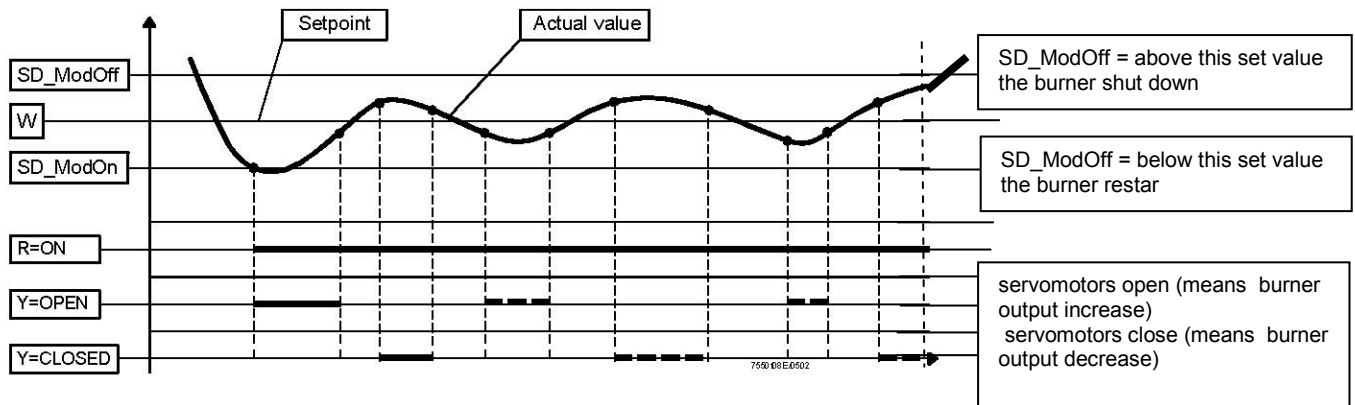
It appears the below screen:

|                                     |                                                                                                                                                                                                                                                              |
|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SetPointW1<br>Curr: 90°<br>New: 90° | <b>Curr:</b> it shows the current set-point; use the arrows keys to change it.<br><b>New:</b> it is the new set value. Enter to confirm, otherwise exit without changing by pressing ESC.<br>Press ESC one more time to exit the set-point programming mode. |
|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

After setting the set-point it is necessary to set the operation range of the burner. See paragraph SD\_ModON e SD\_Mod Off

### 6.4.2 SD\_ModON e SD\_Mod Off

Once the temperature set-point W1 is stored, set the burner switch-on (SDon) and the switch-off (SDoff) point:



To set these values, choose the item SD\_ModOn (SDOn), by scrolling down the “Load controller” menu with the arrow keys and press ENTER:

| 1st level                                                                          | 2nd level | 3rd level | 4th level | 5th level                         | 6th level                                                                            | Description |
|------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------------------------------|--------------------------------------------------------------------------------------|-------------|
| Params & Display                                                                   |           |           |           | Menu level for making the         | Params & Display                                                                     |             |
|  | SD:ModOn  |           |           | General configuration of the load |  | SD:ModOn    |
|  | SD:ModOff |           |           | General configuration of          |  | SD:ModOff   |

the display will show:

|                                     |                                        |
|-------------------------------------|----------------------------------------|
| SD_ModOn<br>Curr: 1.0%<br>New: 1.0% | SD_ModOff<br>Curr: 10.0%<br>New: 10.0% |
|-------------------------------------|----------------------------------------|

The **SD\_ModOn** default value for this parameter is 1% that is, the burner will light again at a temperature 1% lower than the set-point.

Change value, if needed, by means of the arrow keys; press ENTER to confirm and the press ESC to exit. Press only ESC to exit without changing.

Now choose **SD\_ModOff** always scrolling down the Load Controller menu, by means of the arrow keys, and press ENTER.

The default value for this parameter is 10% that is, the burner will turn off at a temperature 1% higher than the set-point.

Press the ENTER to confirm, the press ESC to exit. Otherwise press ESC to exit without changing data. Press the ESC to exit

### 6.4.3 PID control parameters

The controller's memory contains 5 standard parameter sets.

If required, 1 of these 5 PID triple values can be copied to the storage locations for the actual values so that it becomes active.

PID standard values for the following applications:

| 1st level                                                                        | 2nd level                                                                         | 3rd level                                                                         | 4th level                                                                         | 5th level     | 6th level                                                    | Description                                                   |
|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|---------------|--------------------------------------------------------------|---------------------------------------------------------------|
| Params & Display                                                                 |                                                                                   |                                                                                   |                                                                                   |               |                                                              | Menu level for making the parameter settings                  |
|  | LoadController                                                                    |                                                                                   |                                                                                   |               |                                                              | Settings for the internal load controller                     |
|                                                                                  |  | ControllerParam                                                                   |                                                                                   |               |                                                              | Settings for internal load controller                         |
|                                                                                  |                                                                                   |  | ContrlParamList                                                                   |               |                                                              | Settings of controller parameter for internal load controller |
|                                                                                  |                                                                                   |                                                                                   |  | StandardParam | Adaption<br>very fast<br>fast<br>normal<br>slow<br>very slow |                                                               |

It is possible to manually set the PID parameters to any value in the setting range shown below, to activate a PID regulation from the predefined standard values described below (and edit it further if required), or to use the adaption function (self-setting function) instead of making the settings manually. The LMV5... then acquires the PID parameters itself.

See the LMV5x Siemens manual for instructions. Generally the choice of the proper pre-set PID that LMV5x suggest (very fast / fast / normal / slow / very slow) are enough for a proper operation.

| Adaption                             | The values acquired by the LMV5... adaption function are |        |        |
|--------------------------------------|----------------------------------------------------------|--------|--------|
|                                      | Xp [%]                                                   | Tn [s] | Tv [s] |
| Very fast<br>(e.g. for small boiler) | 42,5                                                     | 68     | 12     |
| Fast                                 | 14,5                                                     | 77     | 14     |
| Normal                               | 6,4                                                      | 136    | 24     |
| Slow                                 | 4,7                                                      | 250    | 44     |
| Very slow<br>(e.g. for large boiler) | 3,4                                                      | 273    | 48     |

Table shows the pre set parameter of the PID regulator according to the internal modulator reaction choice.

The parameter Xp is the proportional band in % of the set-point

6.5 Setting functions “TL\_ThreshOff” and “TL\_SD\_On”

These functions enable the settable threshold for the immediate shutdown, if value set on TL\_ThreshOff is exceeded. The automatic restart is performed for values lower than the one set on TL\_SD\_On.

On display, values detected by temperature/pressure probe are shown at the same time.

TL\_ThreshOff turns the burner off if temperature exceeds the set value. Gas/Oil valves are suddenly closed.

TL\_SD\_On automatically restart the burner if the temperature is lower than the set value.

SD\_ModOff automatically turns the burner to low flame and then shut down the burner if temperature exceeds the set value.

SD\_ModOn automatically restart the burner if the temperature is lower than the set value.

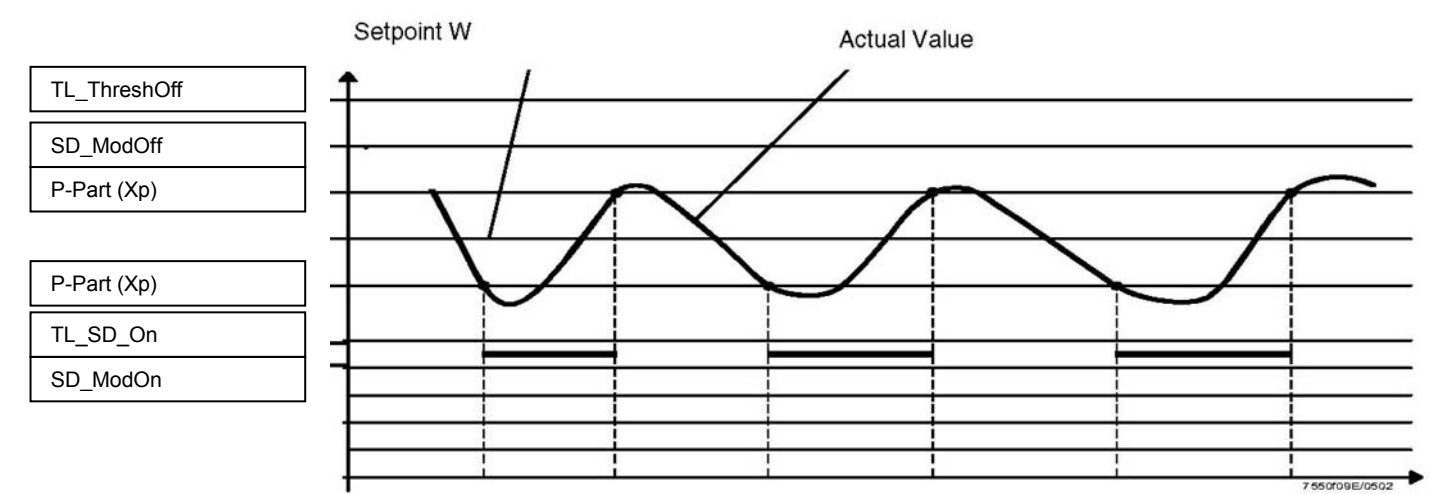
P-Part (Xp) proportional band of modulation.

**Note:** this function is available if a Pt100 Ni1000 or Pt 1000 temperature sensor is connected to X60.3 and X60.4 terminals.



**ATTENTION:** basically, these parameters provide a function similar to the safety thermostat one, but can not replace it. The boiler must **always** operate with its safety thermostat connected properly.

**NOTE:** the parameter TL\_ThreshOff for the immediate shutdown, must always be set to a value higher than the SD\_ModOff threshold for the normal shutdown. TL\_SD\_On must be set at a higher temperature than SD\_ModOn.



Following the below route access to the programming levels of the menu by means the Esc

| 1st level                                                                          | 2nd level                                                                           | 3rd level                                                                           | 4th level    | Range                     |  | Default | Description                                    |
|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------|---------------------------|--|---------|------------------------------------------------|
| Params & Display                                                                   |                                                                                     |                                                                                     |              |                           |  |         | Menu level for making the parameter set- tings |
|  | LoadController                                                                      |                                                                                     |              |                           |  |         | Settings for the internal load controller      |
|                                                                                    |  | TempLimiter                                                                         |              |                           |  |         | Settings for the temperature limiter function  |
|                                                                                    |                                                                                     |  | TL_ThreshOff | 0...2000 °C               |  | 95°C    | Temperature limiter OFF threshold, in °C       |
|                                                                                    |                                                                                     |  | TL_SD_On     | -50...0%<br>TL_Thresh_Off |  | - 5%    | Temperature limiter switching differential ON  |

## 7 VSD Standardization

Motor standardization (speed acquisition) allows the LMV unit to control the motor rounds at the maximum frequency signal coming from the VSD. A temporary standardization is factory set only for test purpose. The definite standardization must be performed on site by the Service Center (only if the fan is supplied), before the plant test.

|                                                                                  |                                                                                                                                                  |
|----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>ATTENTION:</b> To perform standardization, the burner must be in stand-by mode, not it lockout stage. The Safety loop must be closed (X3-04). |
|----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|

Following the below route access to the programming levels of the menu by means the Esc

| 1st level                                                                        | 2nd level                                                                         | 3rd level                                                                         | 4th level                                                                         | 5th level       | Range                    | Description                                  |
|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------|--------------------------|----------------------------------------------|
| Params & Display                                                                 |                                                                                   |                                                                                   |                                                                                   |                 |                          | Menu level for making the parameter settings |
|  | VSD Module                                                                        |                                                                                   |                                                                                   |                 |                          | Settings for the VSD module                  |
|                                                                                  |  | Configuration                                                                     |                                                                                   |                 |                          |                                              |
|                                                                                  |                                                                                   |  | Speed                                                                             |                 |                          |                                              |
|                                                                                  |                                                                                   |                                                                                   |  | Standardization | Deactivated<br>Activated | Standardization process for fan speed        |

By activating the standardization, without starting the burner up, the air actuator drives to its maximum opening. Then the fan motor starts and the VSD drives the motor to its maximum speed. The speed sensor, mounted on the motor, detects the rpm value. LMV stores the data and the motor stops.

|                                                                                     |                                                                                                              |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
|   | <b>ATTENTION:</b> do not enter manually the rpm value of the motor data plate on parameter "StandardizedSp". |
|  | <b>ATTENTION:</b> the power cable that connects VSD to motor must be screened.                               |

## 8 SPECIAL POSITIONS

### 8.1 Ignition position

The ignition point is independent from the other curve points of the air/fuel ratio curve.

As far as dual fuel burners, the ignition point set for the gas operation does not depend on the one set for the oil operation. LMV5x allow two different ignition position for gas mode and oil mode.

The burner is provided with a factory-set ignition point, to make easier the first ignition procedure by the Service Centre.

The air actuator at the ignition point, is factory set at a 6°/7° opening, while the gas actuator is set at 12°/15°. In case of burner provided with VSD, it is suggested to set ignition at 100% VSD frequency.

Following the below route access to the programming levels of the menu by means the Esc

| 1st level                                                                        | 2nd level                                                                         | 3rd level                                                                         | 4th level                                                                         | 5th level                                                                           | 6th level        | Description                                  |
|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|------------------|----------------------------------------------|
| Params & Display                                                                 |                                                                                   |                                                                                   |                                                                                   |                                                                                     |                  | Menu level for making the parameter settings |
|  | RatioControl                                                                      |                                                                                   |                                                                                   |                                                                                     |                  |                                              |
|                                                                                  |  | GasSettings<br>OilSettings                                                        |                                                                                   |                                                                                     |                  | Choose according to the fired fuel.          |
|                                                                                  |                                                                                   |  | Special Positions                                                                 |                                                                                     |                  |                                              |
|                                                                                  |                                                                                   |                                                                                   |  | IgnitionPos                                                                         |                  |                                              |
|                                                                                  |                                                                                   |                                                                                   |  | HomePos                                                                             |                  |                                              |
|                                                                                  |                                                                                   |                                                                                   |  | PrepurgePos                                                                         |                  |                                              |
|                                                                                  |                                                                                   |                                                                                   |  | PostpurgePos                                                                        |                  |                                              |
|                                                                                  |                                                                                   |                                                                                   |                                                                                   |   | IgnitionPosGas   | Set the proper position                      |
|                                                                                  |                                                                                   |                                                                                   |                                                                                   |  | IgnitionPosAir   | Set the proper position                      |
|                                                                                  |                                                                                   |                                                                                   |                                                                                   |  | IgnitionPosAux 1 | Set the proper position                      |
|                                                                                  |                                                                                   |                                                                                   |                                                                                   |  | IgnitionPosAux 2 | Set the proper position                      |
|                                                                                  |                                                                                   |                                                                                   |                                                                                   |  | IgnitionPosAux 3 | Set the proper position                      |
|                                                                                  |                                                                                   |                                                                                   |                                                                                   |  | IgnitionPosVSD   | Set the proper position                      |

### 8.2 Prepurge position

Following the same route up to the 4th level, choose the pre-purge position of the servomotors

### 8.3 Home position

Following the same route up to the 4th level, choose the home position of the servomotors

### 8.4 Postpurge position

Following the same route up to the 4th level, choose the postpurge position of the servomotors

## 9 ADJUSTING THE AIR/FUEL RATIO CURVES



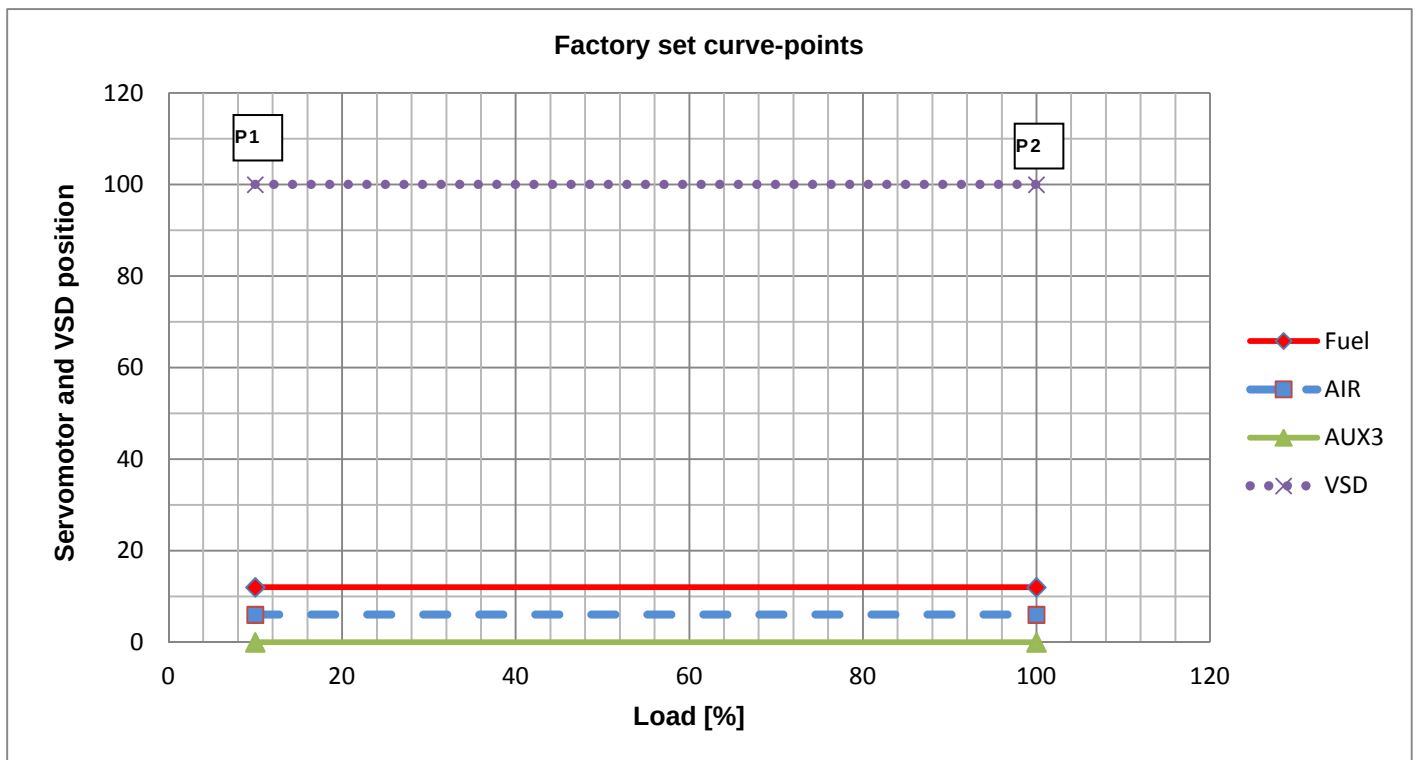
**ATTENTION:** when burners are provided with VSD, before setting the air/fuel ratio curves, the Standardization of the motor speed must be performed (see chapter "Standardization").

| 1st level                                                                        | 2nd level                                                                         | 3rd level                                                                         | 4th level   | 5th level | 6th level | Description                                    |
|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------|-----------|-----------|------------------------------------------------|
| Params & Display                                                                 |                                                                                   |                                                                                   |             |           |           | Menu level for making the parameter settings   |
|  | RatioControl                                                                      |                                                                                   |             |           |           | Parameter settings for fuel/air ratio control  |
|                                                                                  |  | GasSettings<br>OilSettings                                                        |             |           |           | Parameter settings for firing on gas or on oil |
|                                                                                  |                                                                                   |  | CurveParams |           |           |                                                |

### 9.1 Fuel burner settings - curve-points

Two curve points are factory set (default settings) corresponding to a hypothetic low flame stage

**Note:** points P1 and P2, are temporally mentioned 10% and 100% load, independently from the actual load. The operator can name the load on each point, without respecting the actual load value in that point. LMV5x will order those points automatically according to the load values set by the operator.



With this setting, by closing the thermostat series, the burner drives to minimum load position **P1**, after ignition. Then it drives to position **P2** without increasing the output, as both the points are set with actuators minimum opening.

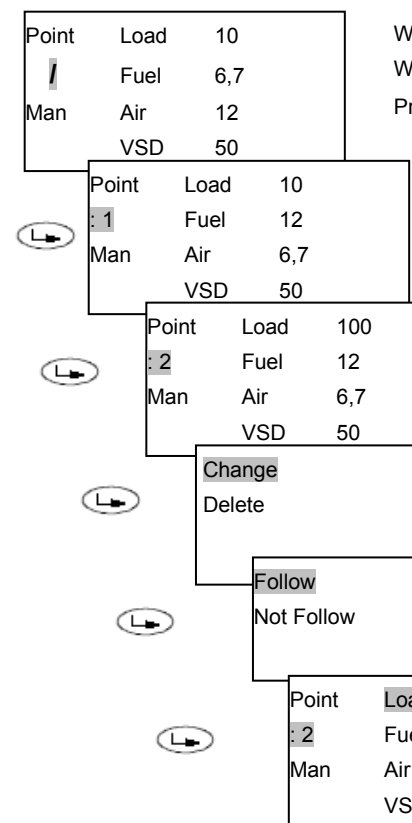


**ATTENTION:** For burners with FGR and LMV52.400, the parameter is set to "deactivated".

## 9.2 Setting the load points output (burners with no FGR)

Following the below route access to the programming levels of the menu

| 1st level                                                                        | 2nd level                                                                         | 3rd level                                                                         | 4th level   | 5th level | 6th level | Description                                                      |
|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------|-----------|-----------|------------------------------------------------------------------|
| Params & Display                                                                 |                                                                                   |                                                                                   |             |           |           |                                                                  |
|  | RatioControl                                                                      |                                                                                   |             |           |           | Parameter settings for fuel/air ratio control                    |
|                                                                                  |  | GasSettings<br>GasSettings                                                        |             |           |           | Parameter settings for firing on Gas or on Oil                   |
|                                                                                  |                                                                                   |  | CurveParams |           |           | At this level, the air/fuel ratio during operation is to be set. |



Wait until symbol “\” stops twisting. It indicates that actuators are moving to the displayed position. When the position is reached it will show the number of the point the LMV5x is at.

Press Enter  to see Point1.

Press “right arrow”  to scroll to the desired point

Press Enter  to change the curve point.

Press “right arrow”  to scroll to the desired point

Press Enter  to change the curve point.

Select "change" to change the point, or "delete" to cancel it

Press “right arrow”  to scroll to the desired point

Press Enter  on “Follow”. The actuator moves in real time as the operator change its setting

The selector will be on Load.

By means the arrow  scroll to the desired actuator

Now it is possible to change Point2 with the next procedure

Checking continuously the air excess means of the combustion analyzer, increasing by few degrees\* the air damper opening and the VSD if provided. Then increase by few degrees\* the gas butterfly valve (or the fuel actuator). Go on step by step, until the butterfly valve complete opening is reached (actuator at 90° - see diagram).

The target is to reach the gas butterfly valve maximum with a sufficient excess of air. While progressively increasing the actuator positions, besides increasing the air quantity the fuel rate must be controlled by means of the valve pressure governor, in order to not exceed the requested maximum flow rate.

Once the gas butterfly valve maximum opening is reached, adjust the fuel **rate** only acting on the gas valve pressure governor (or on the oil pressure governor in case of oil).



**ATTENTION:** as for “increasing by few degrees” it means that the increasing must be performed in order to avoid great excess of air or defect of air.

Therefore the increasing operation must be performed always checking the flue gas analysis by means of the combustion analyzer. It is recommended to make increasing while maintaining O<sub>2</sub> % between max 7,5% and min 3%.

It is recommended to save new points increasing the burner output at step of 10÷20% load. Measuring the burner output at the flow meter. In this way, if for any reason, you must interrupt the commissioning and restart it later, you would help yourself.

|       |      |     |
|-------|------|-----|
| Point | Load | 100 |
| :2    | Fuel | 12  |
| O2    | Air  | 6.7 |
|       | VSD  | 70  |

To choose the actuator to set, press the "left arrow"  and choose Air or VSD

|       |      |     |
|-------|------|-----|
| Point | Load | 100 |
| :2    | Fuel | 12  |
| O2    | Air  | 6.7 |
|       | VSD  | 70  |

Press "Enter"  to access the Air actuator value to be set.

|       |      |     |
|-------|------|-----|
| Point | Load | 100 |
| :2    | Fuel | 12  |
| O2    | Air  | 6.7 |
|       | VSD  | 70  |

Press keys   to change value.

|       |      |     |
|-------|------|-----|
| Point | Load | 100 |
| :2    | Fuel | 12  |
| O2    | Air  | 9.5 |
|       | VSD  | 70  |

Press Enter  to confirm the value and go back to Air actuator. (Do not exit by pressing Esc from the values column because data will not be stored)

|       |      |     |
|-------|------|-----|
| Point | Load | 100 |
| :2    | Fuel | 12  |
| O2    | Air  | 9.5 |
|       | VSD  | 70  |

Press arrows   to select another actuator to be set, for example, press  to choose Fuel)

|       |      |     |
|-------|------|-----|
| Point | Load | 100 |
| :2    | Fuel | 12  |
| O2    | Air  | 9.5 |
|       | VSD  | 70  |

Press keys   to change the value. Press Enter to confirm the value and go back to Fuel actuator

|       |      |     |
|-------|------|-----|
| Point | Load | 100 |
| :2    | Fuel | 12  |
| O2    | Air  | 9.5 |
|       | VSD  | 70  |

Press keys   to change value.

|       |      |     |
|-------|------|-----|
| Point | Load | 100 |
| :2    | Fuel | 15  |
| O2    | Air  | 9.5 |
|       | VSD  | 70  |

Press Enter  to confirm the value and go back to Fuel actuator. (Do not exit by pressing Esc from the values column because data will not be stored)

Checking parameters by means of the combustion analyzer go on increasing the Air (and/or VSD if provided) and the Fuel actuators.  
At the end the last point will be set.

|       |      |     |
|-------|------|-----|
| Point | Load | 100 |
| :10   | Fuel | 90  |
| O2    | Air  | 50  |
|       | VSD  | 85  |

Act on the pressure governor to adjust the fuel pressure at the proper value in order to reach the real 100% load of the generator/boiler.

Act only on the AIR or VSD actuators, to adjust the combustion.

|       |      |     |
|-------|------|-----|
| Point | Load | 100 |
| :10   | Fuel | 90  |
| O2    | Air  | 90  |
|       | VSD  | 100 |

An example of final point will be as per the display aside, imaging to set 10 curve-points.

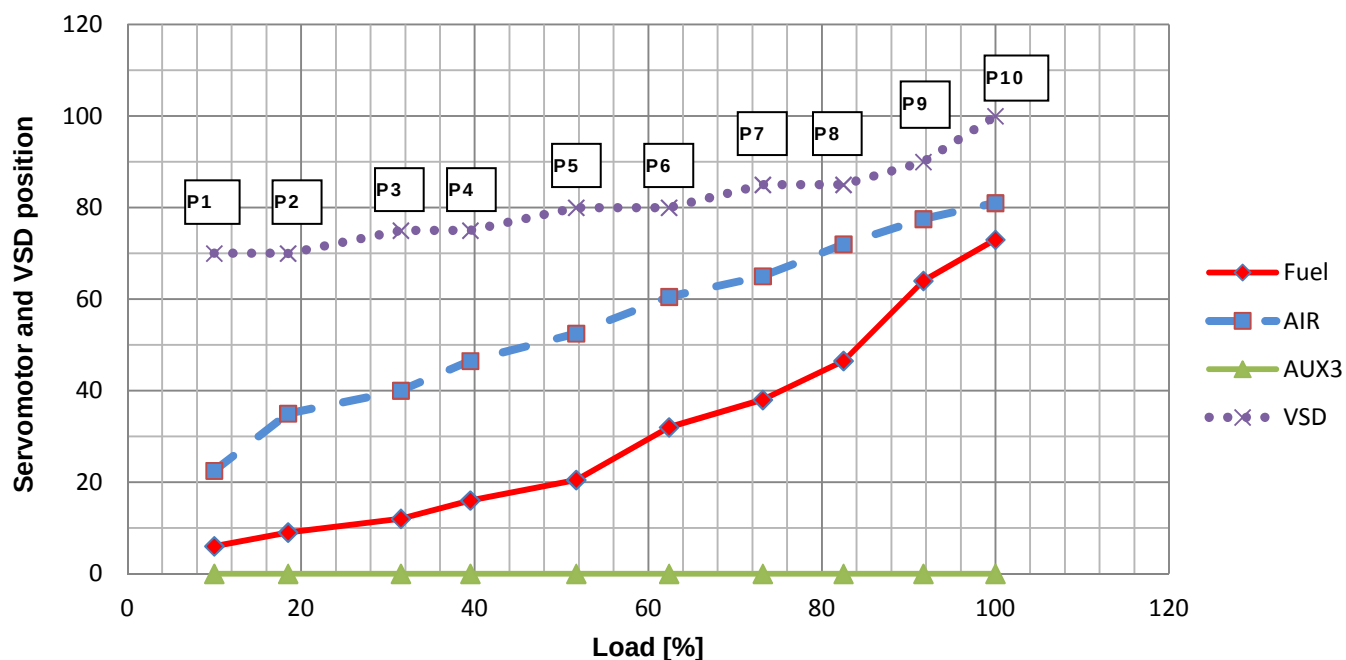
|                                                                                    |                                                                                                                                                                                                      |
|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>ATTENTION: Set the % output load values, for every curve-point</b>                                                                                                                                |
|  | <b>ATTENTION: Adjust actuators position by small changes, always checking combustion parameters.</b>                                                                                                 |
|  | <b>Caution! For safety reasons, once the maximum load point P2 is set, never go down to the minimum load point P1, without having set the other intermediate points before (see next paragraph).</b> |



Caution! In case it is necessary to immediately shut the burner down while working at high flame and the maximum load point is not already set observing the combustion parameters, decrease gas by means of the pressure governor as to drive the burner to a sufficient excess of air, then shut the burner down by the main switch.

At next start-up, start again with point P2 to the minimum load (factory-setting - see previous paragraph) and go on setting the curve points.

Commissioned curve-points - example



P1



ATTENTION: When the maximum load is reached (100%), check again the curve-points. The pressure at the governor has changed and therefore also the gas flow rate to the other points. So, it is necessary to check the adjustment of the points already set.



ATTENTION: for proper operation, it is necessary that the curve of each actuator does not reverse its slope.



ATTENTION: When % load value is changed by user, LMV recalculates all the curve-points according the new load value. It may happen that the point you are adjusting, once saved, is moved to another position.

Point Load 53,2

Point Load 70  
: 6 Fuel 53.1  
O2 Air 65.5  
VSD 90

Point Load 61,8  
: 7 Fuel 53.1  
O2 Air 65.5  
VSD 90

Point Load 53,2

Point Load 61,8  
: 6 Fuel 53.1  
O2 Air 65.5  
VSD 90

Point Load 70  
: 7 Fuel 53.1  
O2 Air 65.5  
VSD 90

new order position

# 10 Configurations for burner with FGR

## 10.1 Recommendations

|                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <p><b>Note!</b></p> <p>Reduction of maximum burner output</p> <p>Use of the flue gas recirculation (FGR) function or the flue gas mass introduced to the supply air duct might lower the burner's maximum output.</p> <p>This means that the maximum amount of combustion air that can be introduced will be reduced.</p> <p>It is recommended to consider a proper air excess during the regulation of the burner in order to have to the right O2 content in the smoke, after the flue gas recirculation.</p> <p>Hence, the amount of fuel for high-fire operation must be reduced to ensure correct combustion values.</p>                                                                                                                                                                                                           |
|    | <p><b>Caution!</b></p> <p>Temperature-compensated flue gas recirculation (FGR) can be correctly set only when selecting with <i>DriveLowfire</i> in operation!</p> <p>A change in the curve point without the corresponding flue gas recirculation temperature (e.g. <i>without driving</i> in operation or in standby) results in an incorrect <i>pairing</i> of the values <i>Flue gas recirculation position</i> and <i>Flue gas recirculation temperature</i>.</p> <p>This can lead to excessive amounts of recirculated flue gas, which might cause the flame to lift: Stability limit of flame.</p>                                                                                                                                                                                                                               |
|    | <p><b>Caution!</b></p> <p>A subsequent change of the curve point without an associated flue gas recirculation (FGR) temperature (e.g. without <i>DriveLowfire</i> in operation or standby) leads to an incorrect pairing of <i>flue gas recirculation-position</i> and <i>flue gas recirculation-temperature</i>.</p> <p>This can lead to excessive amounts of recirculated flue gas, which might cause the flame to lift: Stability limit of flame.</p>                                                                                                                                                                                                                                                                                                                                                                                |
|  | <p><b>Note!</b></p> <p>Flue gas recirculation (FGR) in combination with O2 trim control Recommendation: Do not use flue gas recirculation (FGR) in combination with O2 trim control.</p> <p>This has no impact on the use of the O2 alarm.</p> <p>The physical effects are the following:</p> <ol style="list-style-type: none"> <li>1. Pressures have reciprocal effects.</li> <li>2. The reduction of O2 can lead to a significant increase of NOx levels.</li> </ol> <p>As a result of these reciprocal effects, it is difficult, if not impossible, to adjust fuel-air ratio control, O2 trim control, and the flue gas recirculation (FGR) function.</p> <p>Even if an adjustment was possible, the flame may become unstable during operation, or the required NOx levels might not be reached.</p>                               |
|  | <p><b>Note!</b></p> <p>The full scope of setting <i>TCautoDeact</i> is possible only when the flue gas temperature is acquired via the load controller input (X60...).</p> <p>When the temperature is acquired via the PLL52... input (X86...) and the O2 trim controller / alarm is active (not <i>CtrlAutoDeac</i>), flue gas recirculation (FGR) mode <i>temperature-compensated</i> cannot be used (would lead to error C:F6 D:2).</p> <p>When operating mode <i>O2 Control</i> is deactivated (<i>man deact</i>), operating mode <i>TCautoDeact</i> can be used if the flue gas temperature is acquired via PLL52... (X86...).</p>                                                                                                                                                                                                 |
|  | <p><b>Attention!</b></p> <p>If at an dual-fuel burner the FGR function is used for only one fuel (e.g. gas operation with FGR and oil operation without FGR) pay attention to the following:</p> <p>When the fuel selection is switched over to the fuel without FGR it must be assured that the FGR actuator is closed and is supervised kept in the closed position.</p> <p>This is accomplished by making the following settings for the fuel without FGR:</p> <ul style="list-style-type: none"> <li>- Activation of the AUX3 actuator</li> <li>- Parameterization of the positions Home, Prepurge , Ignition and Postpurge to <i>closed</i></li> <li>- Parameterization of all AUX3 actuator positions at all curve points to <i>closed</i></li> <li>- Parameterization of the FGR operating mode to <i>Aux3onCurve</i></li> </ul> |

Before to activate the FGR system, it is mandatory to complete the air/fuel ratio curve for each point, up to the maximum burned output.

Check the previous chapter for instructions.

|                                                                                    |                                                                                                                                                                             |
|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p><b>WARNING:</b> Activating or increasing the FGR butterfly valve opening, it is mandatory to check the combustion by means a properly and calibrated smoke analyzer.</p> |
|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## 10.2 Address and activate the AUX3 servomotor.

Usually these operations are already set in the manufacturer factory.

They would be necessary in same cases as: the substitution of the servomotor, in case the FGR mode were not activated yet or the LMV5x were be supplied loose...



**WARNING:** for LMV52.400 device, in case of FGR servomotor addressing: the only possible choice is **AuxActuator3**. Don't set the FGR servomotor for a different one.

| 1st level        | 2nd level | 3rd level  | 4th level                                                                              | 5th level | 6th level     | Description                                    |
|------------------|-----------|------------|----------------------------------------------------------------------------------------|-----------|---------------|------------------------------------------------|
| Params & Display |           |            |                                                                                        |           |               |                                                |
|                  | Actuators |            |                                                                                        |           |               | Parameter settings for fuel/ air ratio control |
|                  |           | Addressing |                                                                                        |           |               | Parameter settings for firing on Gas or on Oil |
|                  |           |            | AirActuator<br>GasActuat<br>OilActuat<br>AuxActuator<br>AuxActuator 2<br>AuxActuator 3 |           | AuxActuator 3 | AuxActuator 3 MUST be chosen                   |

After the addressing, activate the FGR servomotor.

| 1st level        | 2nd level    | 3rd level                  | 4th level                  | 5th level                                                   | 6th level                                           | Description                                                        |
|------------------|--------------|----------------------------|----------------------------|-------------------------------------------------------------|-----------------------------------------------------|--------------------------------------------------------------------|
| Params & Display |              |                            |                            |                                                             |                                                     |                                                                    |
|                  | RatioControl |                            |                            |                                                             |                                                     | Parameter settings for fuel/ air ratio control                     |
|                  |              | GasSettings<br>OilSettings |                            |                                                             |                                                     | Parameter settings for firing on Gas or on Oil                     |
|                  |              |                            | AuxActuator                | deactivated<br>damper act<br>VSD active<br>AUX3<br>VSD+Aux3 | Deactivated for LMV52.xxx<br><br>AUX3 for LMV51.300 | Deactivated for LMV52.xxx<br>AUX3 for LMV51.300                    |
|                  |              |                            | AirActuator                | deactivated<br>activated<br>air influen                     | activated                                           |                                                                    |
|                  |              |                            | AuxActuator 1              |                                                             |                                                     |                                                                    |
|                  |              |                            | AuxActuator 2              |                                                             |                                                     |                                                                    |
|                  |              |                            | AuxActuator 3              |                                                             | Activated for LMV52.xxx                             |                                                                    |
|                  |              |                            | VSD                        |                                                             |                                                     |                                                                    |
|                  |              |                            | GasActuator<br>OilActuator |                                                             | Activated<br>Activated                              | Choice according to the Operation mode gas setting or oil setting. |

### 10.3 Setting the special positions

| 1st level                                                                        | 2nd level                                                                         | 3rd level                                                                         | 4th level       | 5th level | 6th level | Description |
|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------|-----------|-----------|-------------|
| Param & Display                                                                  |                                                                                   |                                                                                   |                 |           |           |             |
|  | RatioControl                                                                      |                                                                                   |                 |           |           |             |
|                                                                                  |  | GasSettings<br>OilSettings                                                        |                 |           |           |             |
|                                                                                  |                                                                                   |  | SpecialPosition |           |           |             |

Suggested positions are below. They can be modify during the commissioning according to right needs.

#### Special Position: AUX3 POS

- Home position 0° (Closed)
- Prepurge position 90° (Open)
- Ignition position 0° (Closed)
- Postpurge position 90° (Open)

### 10.4 Setting the load controller mode: see the previous chapter (regolazione senza FGR)

|                                                                                    |                                                                                                                                                                                                                                                                                       |
|------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   | <b>WARNING:</b> If one of the intLC (internal Load Controller) option must be choice, a temperature sensor cannot be connected to the terminal X60. A temperature sensor with analogue output or a converter Ohm → mA or V must be used. They must be connected to the terminals X61. |
|  | <b>WARNING:</b> If one of the extLC (External Load Controller) options must be used, set "no sensor", "Temperature sensor" or "Pressure Sensor" on the choice for the modulation probe.                                                                                               |
|  | <b>WARNING:</b> The X61 door must be configured in according to the used sensor or signal.                                                                                                                                                                                            |

## 10.5 FGR mode choice

| 1st level                                                                        | 2nd level                                                                         | 3rd level                                                                                     | 4th level                                                                                      | 5th level | 6th level | Description                                                     |
|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|-----------|-----------|-----------------------------------------------------------------|
| Param & Display                                                                  |                                                                                   |                                                                                               |                                                                                                |           |           |                                                                 |
|  | Flue Gas Recirc                                                                   |                                                                                               |                                                                                                |           |           |                                                                 |
|                                                                                  |  | FGR-Mode<br> | AUX3onCurve<br>time<br>temperature<br>temp. contr.<br>TCautoDeact<br>deactMinpos<br>auto deact |           |           | According to the preference and instruction in the table below. |

Description of the FGR mode.

| FGR-Mode    | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | LMV50<br>LMV51.3<br>LMV52.2 | LMV52.4.. |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-----------|
| Aux3onCurve | Flue gas recirculation (FGR) function is deactivated.<br>Auxiliary actuator 3 is driven along its parameterized ratio control curve                                                                                                                                                                                                                                                                                                                                                                     | ●                           | ●         |
| deactivated | After the ignition position, auxiliary actuator 3 is always held at the minimum position for flue gas recirculation (indicated with #) and the flue gas recirculation temperature is not evaluated (display XXX).<br><br>This ensures that the system is operated in a safe state if the flue gas recirculation setting could not be fully realized.<br><br>We recommend performing burner start-up using this setting prior to setting the flue gas recirculation curve                                |                             | ●         |
| time        | Auxiliary actuator 3 maintains the ignition position until an adjustable time is reached (parameter "DelaytimeFGR...").<br><br>During the operation, the burner regulate its load as per the set curve points, without flue gas recirculation.                                                                                                                                                                                                                                                          | ●                           | ●         |
| temperature | Auxiliary actuator 3 maintains the ignition position until an adjustable temperature is reached (parameter "FRG On Temp ...").<br><br>During the operation, the burner regulate its load as per the set curve points, without flue gas recirculation.                                                                                                                                                                                                                                                   | ●                           | ●         |
| temp.contr. | The position of auxiliary actuator 3 is determined depending on the flue gas temperature and the ratio control curve.<br><br>In addition, the actuator can maintain the ignition position until an adjustable time (parameter FGR On Time ...) is reached                                                                                                                                                                                                                                               |                             | ●         |
| TCautoDeact | Same manner of operation as temp.contr., but the function is automatically deactivated should the flue gas sensor become faulty.<br><br>The actuator is driven to the minimum flue gas recirculation (FGR) position and a warning is issued                                                                                                                                                                                                                                                             |                             | ●         |
| deactMinpos | After the ignition position, auxiliary actuator 3 always maintains the minimum flue gas recirculation (FGR) position (indicated by #) and the flue gas recirculation (FGR) temperature is not evaluated (display of XXX).<br><br>The system can thus be driven to a secure state, if it was not possible to fully complete the flue gas recirculation (FGR) settings.<br><br>It is recommended to use this setting for commissioning the burner before adjusting the flue gas recirculation (FGR) curve |                             |           |
| auto deact  | Flue gas recirculation (FGR) with temperature compensation was automatically deactivated. Same operation mode as deactMinpos, but a warning is issued                                                                                                                                                                                                                                                                                                                                                   |                             | ●         |

## 10.6 Main parameter of the FGR function

| Parameter                                                           | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | LMV50<br>LMV51.3<br>LMV52.2 | LMV52.4.. |
|---------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-----------|
| DelaytimeFGR Gas<br>DelaytimeFGR Oil                                | Setting of delay time for auxiliary actuator 3 to be kept in the ignition position after entering phase <i>OPERATION</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | ●                           | ●         |
| ThresholdFGR Gas<br>ThresholdFGR Oil                                | Setting of temperature that must not be exceeded so that auxiliary actuator 3 can be kept in the ignition position                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | ●                           |           |
| <i>FGR-sensor</i><br>(X86 PtNi1000 /<br>X60 Pt1000 /<br>X60 Ni1000) | Selection of temperature sensors for temperature-compensated flue gas recirculation (FGR)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | ●                           | ●         |
| <i>Factor FGR Gas</i><br><br><i>Factor FGR Oil</i>                  | Readjustment of calculated temperature-dependent position of auxiliary actuator 3.<br>The setting is made in steps of 1%.<br>100% means no readjustment.<br>Settings <100% reduce the amount of recirculate flue gas (moving the damper toward the fully closed position).<br>The factor has an impact only when there is a deviation from the learned flue gas recirculation (FGR) temperature.<br>This means that when reaching the initially acquired flue gas recirculation (FGR) temperature, the stored position is approached, independent of the flue gas recirculation (FGR) factor.<br>See the <i>Examples of tables showing the damper positions with FGR</i> |                             | ●         |
| <i>FGR MinPos</i>                                                   | Minimum limitation of position of auxiliary actuator 3 for <i>temp.comp.</i> and <i>TCautoDeact</i> modes.<br>The setting is made as an absolute value and ensures that flue gas recirculation (FGR) always operates with at least a minimum amount of flue gas.<br>The position is also used to ensure a defined damper position for emergency operation or automatically deactivated flue gas recirculation (FGR)                                                                                                                                                                                                                                                      |                             | ●         |
| <i>FGR MaxPos Fact</i>                                              | Maximum limitation of the required position of auxiliary actuator 3 calculated from the current temperature and the warm position.<br>The setting is made in steps of 1% and refers to the relevant curve-point.<br>Interpolation between the curve-points is linear                                                                                                                                                                                                                                                                                                                                                                                                     |                             | ●         |

The parameter are in side the AZL menu with following structure:

| 1st level       | 2nd level       | 3rd level                            | 4th level                | 5th level | 6th level | Description                       |
|-----------------|-----------------|--------------------------------------|--------------------------|-----------|-----------|-----------------------------------|
| Param & Display |                 |                                      |                          |           |           |                                   |
|                 | Flue Gas Recirc |                                      |                          |           |           |                                   |
|                 |                 | FGR-sensor                           | X60 Pt1000<br>X60 Ni1000 |           |           | According to the available probe  |
|                 |                 | ThresholdFGR Gas<br>ThresholdFGR Oil | 0...850 °C               |           |           | According to the regulation needs |
|                 |                 | DelaytimeFGR Gas<br>DelaytimeFGR Oil | 0...63 min               |           |           | According to the regulation needs |
|                 |                 | Factor FGR Gas<br>Factor FGR Oil     | 10..100%                 |           |           | According to the regulation needs |
|                 |                 | FGR MinPos                           |                          |           |           | According to the regulation needs |
|                 |                 | FGR MaxPos Fact                      | 0..100%                  |           |           | According to the regulation needs |

|                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p><b>WARNING: Only in case of FGR temperature compensation function.</b></p> <p>If the detected temperature value is lower than the value recorded during the curve setting, the AUX3 servomotor doesn't reach the set position, but it will be closer. In this condition flue gas recirculation flow could be not sufficient or too much.</p> <p>NOx value could be different from the expected or the flame could be instable. Try to reduce the correction factor ("Factor FGR Gas" or "Factor FGR Oil"). In case readjust the FGR curve. Probably the point was saved also if the flue gas temperature were too far from the regime condition.</p> |
|------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

10.7 Example of FGR factor and FGR Maps Factor on the burner regulation.

We consider to set the AUX3 for FGR with the “temp.contr.” Mode  
The curve is as per the below table.

|                 |        |        |        |        |                                                                                                               |
|-----------------|--------|--------|--------|--------|---------------------------------------------------------------------------------------------------------------|
| Point           | 1      | 2      | 3      | 4      | Note                                                                                                          |
| Load %          | 37,5 % | 62,5 % | 75 %   | 100 %  |                                                                                                               |
| AUX3 FGR Curve  | 19,3 ° | 25,0 ° | 28,5 ° | 37,0 ° |                                                                                                               |
| FGR temperature | 72 °C  | 105 °C | 121 °C | 150 °C | The flue gas value increase from low to high flame.<br>The temperature is with burner in operative condition. |

LMV52.400 will calculate a “Zero Curve” referred to flue gas 0°C temperature.  
The “Zero Curve” is calculated in reference to the effect of the temperature on the smoke density.  
If “FGR factor” is set at 100% LMV will not make any additional correction.

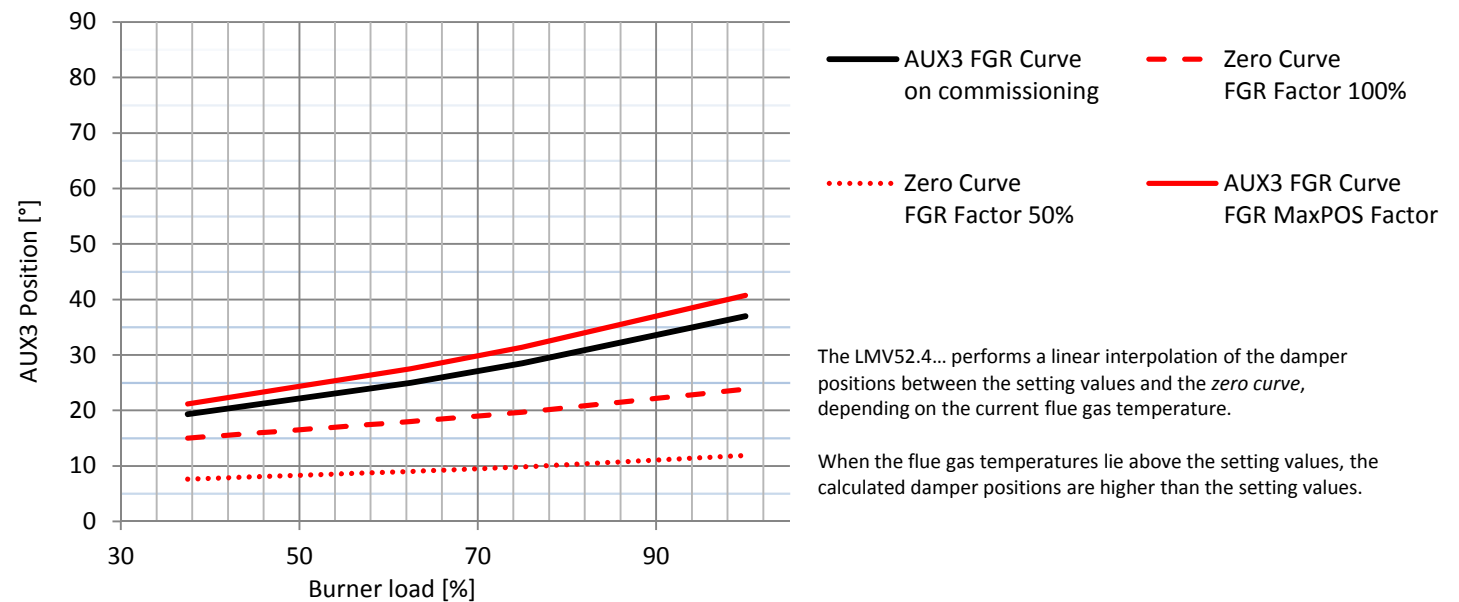
|                                  |       |       |         |         |                        |
|----------------------------------|-------|-------|---------|---------|------------------------|
| Point                            | 1     | 2     | 3       | 4       | Note                   |
| Pos. FGR con T = 0 °C zero curve | 15 °C | 18 °C | 19,7 °C | 23,8 °C | FGR Factor set on 100% |

If “FGR factor” is set at lower value than 100% LMV will apply an additional correction to calculate the “Zero Curve”.  
If “FGR factor” is 50%, the new “zero Curve” will be

|                                  |       |       |       |        |                                                                                                                                                                              |
|----------------------------------|-------|-------|-------|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Point                            | 1     | 2     | 3     | 4      | Note                                                                                                                                                                         |
| Pos. FGR con T = 0 °C zero curve | 7,6 ° | 9,0 ° | 9,8 ° | 11,9 ° | FGR Factor set on 50%<br>The above example shows that – with the zero curve – a flue gas recirculation (FGR) factor of 50% leads to a 50% reduction of the damper positions. |

If the temperature value of the smoke during the operation of the burner is higher than the temperature value during the commissioning, the AUX3 position will be bigger than the set values.  
To avoid a wide opening of the FGR butterfly valve it could be necessary to limit the automatic correction LMV52.400.  
This could be necessary if the AUX3 opening become bigger than 90°, if a flame instability happen, or the flue gas recirculation is too big...  
To limit the correction due to a higher temperature value, it become necessary to set the parameter “FGR MaxPOS Factor”.

|          |        |        |        |        |                                                                                                              |
|----------|--------|--------|--------|--------|--------------------------------------------------------------------------------------------------------------|
| Point    | 1      | 2      | 3      | 4      | Note                                                                                                         |
| Pos. FGR | 21,2 ° | 27,5 ° | 31,4 ° | 40,7 ° | FGR MaxPOS Factor set on 10%<br>I valori sono il 10% in più rispetto ai corrispondenti settati inizialmente. |



## 11 Cold start thermal shock (CSTP)

If there is a steam boiler or a boiler that must start up cold in the plant and to avoid thermal shocks a slow heating is required for the boiler by maintaining the burner at the minimum output, the automatic function "Cold start thermal shock" can be performed instead of the manual operation at minimum load.

The CSTP (Cold Start Thermal Schock) function can be enabled by the Technical service only (access by reserved password). if this function is enabled, when the burner starts up the "Thermal shock protection activated" message will be shown.

If this function is not enabled, after start-up, the burner will rapidly increase the load according to the requested value.

The CSTP function is a Service level paramter, to enable this function proceed as follows:

| 1st level                                                                        | 2nd level                                                                         | 3rd level                                                                           | 4th level            | 5th level                                | 6th level   | Description                                                                                                                                                                                             |
|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|----------------------|------------------------------------------|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Params & Display                                                                 |                                                                                   |                                                                                     |                      |                                          |             | Menu level for making the parameter settings                                                                                                                                                            |
|  | LoadController                                                                    |                                                                                     |                      |                                          |             | Settings for the internal load controller                                                                                                                                                               |
|                                                                                  |  | ColdStart                                                                           |                      |                                          |             | Settings for the cold start (thermal shock protection)                                                                                                                                                  |
|                                                                                  |                                                                                   |    | ColdStartOn          | Deactivated<br>Activated                 |             | The parameter <b>ColdStartOn</b> deactivates or activates the Cold start protection function, the other parameters are factory set and can be changed following the next programming rows (see diagram) |
|                                                                                  |                                                                                   |    | ThresholdOn          | 0...100%Wcurrent                         | 20%         |                                                                                                                                                                                                         |
|                                                                                  |                                                                                   |    | StageLoad            | 0..100%                                  | 15%         |                                                                                                                                                                                                         |
|                                                                                  |                                                                                   |    | StageSetp_M od       | 1...100% Wcurrent                        | 5%          |                                                                                                                                                                                                         |
|                                                                                  |                                                                                   |    | Stage- Setp_Stage    | 1...100% Wcurrent                        | 5%          |                                                                                                                                                                                                         |
|                                                                                  |                                                                                   |   | MaxTme- Mod          | 1...63 min                               | 3 min       |                                                                                                                                                                                                         |
|                                                                                  |                                                                                   |  | MaxTmeStage          | 1...63 min                               | 3 min       | Cold start thermal shock protection, maximum time per step (multistage)                                                                                                                                 |
|                                                                                  |                                                                                   |  | ThresholdOff         | 1...100% Wcurrent                        | 80%         | Cold start thermal shock protection deactivation level referred to the current set-point (Wcurrent)                                                                                                     |
|                                                                                  |                                                                                   |  | Additional-Sens      | Deactivated<br>Pt100<br>Pt1000<br>Ni1000 | Deactivated | Select extra sensor for cold start thermal shock protection                                                                                                                                             |
|                                                                                  |                                                                                   |  | Temp Cold- Start     | 0...2000 °C                              |             | Display of temperature acquired by extra sensor for the cold start thermal shock protection function                                                                                                    |
|                                                                                  |                                                                                   |  | Setpoint AddSensor   | 0...450 °C                               | 60°C        | Set-point for extra sensor for cold start thermal shock protection                                                                                                                                      |
|                                                                                  |                                                                                   |  | Release Stages       | no release/ release                      | release     | Cold start thermal shock protection load step stage mode (multistage operation)                                                                                                                         |
|                                                                                  |                                                                                   |  | MaxTmeStage          | 1...63 min                               | 3 min       | Cold start thermal shock protection, maximum time per step (multistage)                                                                                                                                 |
|                                                                                  |                                                                                   |  | ThresholdOff         | 1...100% Wcurrent                        | 80%         | Cold start thermal shock protection deactivation level referred to the current set-point (Wcurrent)                                                                                                     |
|                                                                                  |                                                                                   |  | AdditionalSens       | deactivated Pt100<br>Pt1000 Ni1000       | deactivated | Select extra sensor for cold start thermal shock protection                                                                                                                                             |
|                                                                                  |                                                                                   |  | Temp Cold- Start     | 0...2000 °C                              |             | Display of temperature acquired by extra sensor for the cold start thermal shock protection function                                                                                                    |
|                                                                                  |                                                                                   |  | Setpoint Add- Sensor | 0...450 °C                               | 60 °C       | Set-point for extra sensor for cold start thermal shock protection                                                                                                                                      |
|                                                                                  |                                                                                   |  | Release Stages       | no release/ release                      | release     | Cold start thermal shock protection load step stage mode (multistage operation)                                                                                                                         |



## 12 BURNER MANUAL OPERATION

The operator can decide if choosing burner manual operation at a settable fixed load or modulating operation through the automatic load controller, then can also set the burner shutdown by means of the "burner off" function.

Choose the type of operation (Au-tom / Manual / Off).

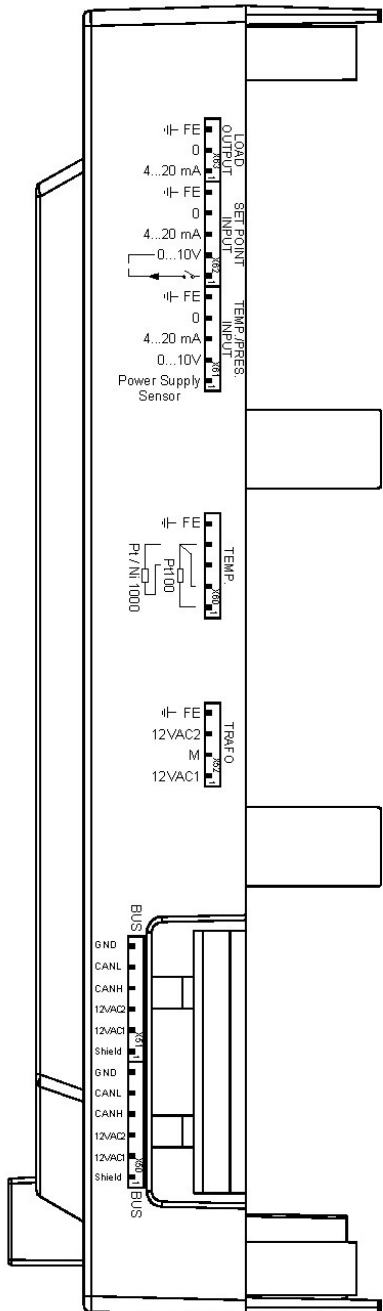
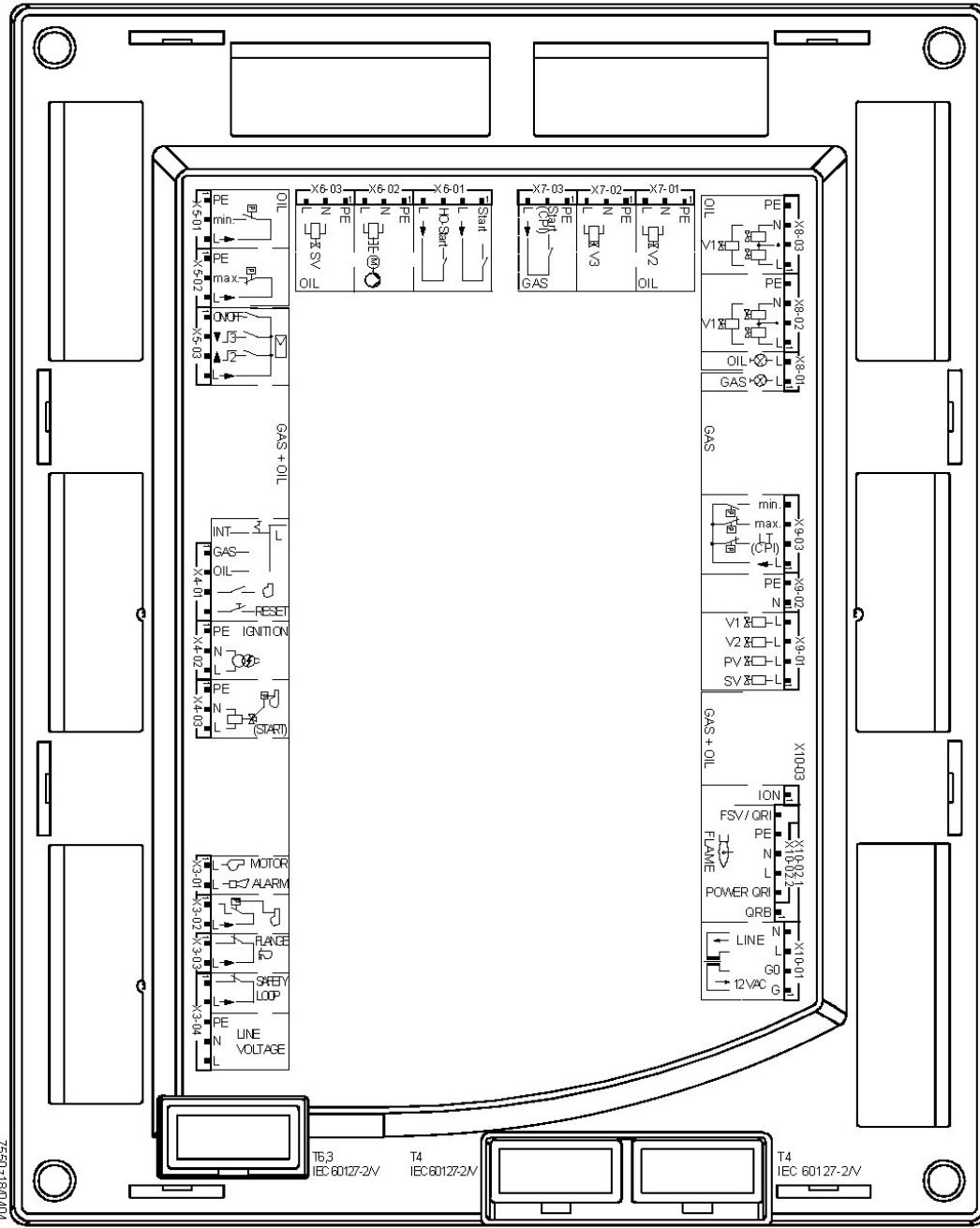
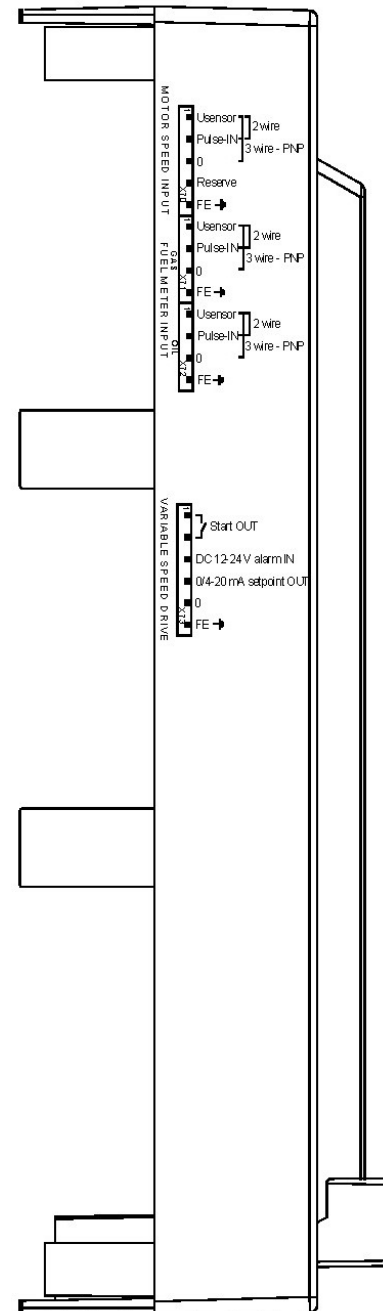
| 1st level                                                                        | 2nd level                                                                         | 3rd level                         | Password | Description                                                          |
|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------|----------|----------------------------------------------------------------------|
| ManualOpe- ration                                                                |                                                                                   |                                   |          | Menu level for activating manual operation with the preselected load |
|  | Au-tom/<br>Manual/Off                                                             |                                   |          | Selection of manual or automatic operation                           |
|                                                                                  |  | Automatic/ Burner on / Burner off | User     |                                                                      |

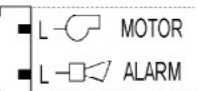
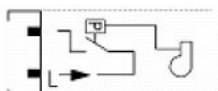
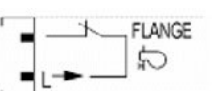
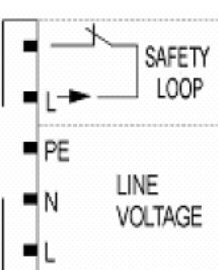
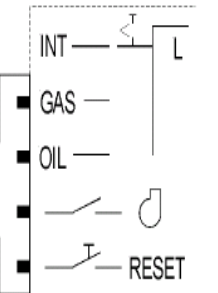
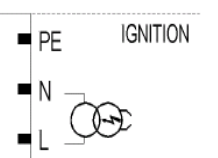
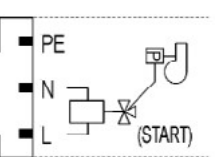
Setting the load percentage for the manual operation

To set the load percentage at which the burner must operate in manual mode, proceed as described below.

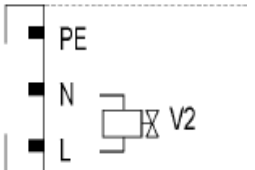
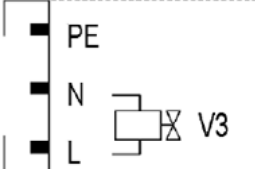
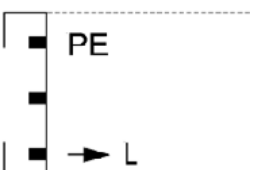
| 1st level                                                                         | 2nd level                                                                           | 3rd level | Password | Description                                                          |
|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-----------|----------|----------------------------------------------------------------------|
| ManualOpe- ration                                                                 |                                                                                     |           |          | Menu level for activating manual operation with the preselected load |
|  | SetLoad                                                                             |           |          | Set target load                                                      |
|                                                                                   |  | 0..100%   | User     |                                                                      |

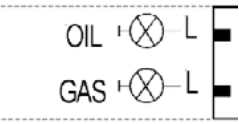
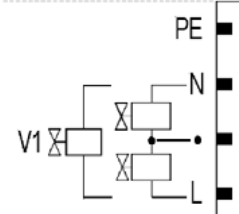
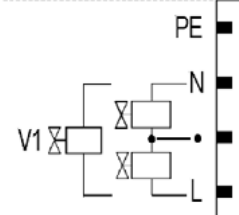
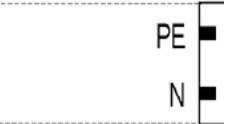
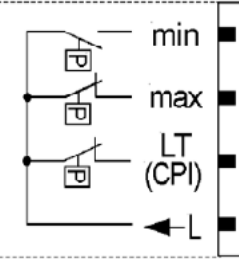
# LMV51.300B2 / LMV52.200B1 / LMV52.200B2 / LMV52.240B2



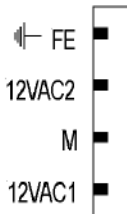
| Terminal group | Connection symbol |                                                                                     | Input | Output | Description of connection terminals                                     | Electrical rating                                                     |
|----------------|-------------------|-------------------------------------------------------------------------------------|-------|--------|-------------------------------------------------------------------------|-----------------------------------------------------------------------|
| X3-01          | PIN1              |    |       | x      | Fan motor contactor                                                     | AC 230 V +10 % / -15 %, 50...60 Hz, 1 A, cos.0.4                      |
|                | PIN2              |                                                                                     |       | x      | Alarm                                                                   | AC 230 V +10 % / -15 %, 50...60 Hz, 1 A, cos.0.4                      |
| X3-02          | PIN1              |    | x     |        | Air pressure switch (LP)                                                | AC 230 V +10 % / -15 %, 50...60 Hz, I <sub>max</sub> 1.5 mA           |
|                | PIN2              |                                                                                     |       | x      | Power signal for air pressure switch (LP)                               | AC 230 V +10 % / -15 %, 50...60 Hz, I <sub>max</sub> 500 mA           |
| X3-03          | PIN1              |    | x     |        | End switch burner flange                                                | AC 230 V +10 % / -15 %, 50...60 Hz, I <sub>max</sub> 5 A              |
|                | PIN2              |                                                                                     |       | x      | Power signal for end switch burner flange                               | AC 230 V +10 % / -15 %, 50...60 Hz, I <sub>max</sub> 5 A              |
| X3-04          | PIN1              |    | x     |        | Safety loop                                                             | AC 230 V +10 % / -15 %, 50...60 Hz, I <sub>max</sub> 5 A              |
|                | PIN2              |                                                                                     |       | x      | Power signal for safety loop                                            | AC 230 V +10 % / -15 %, 50...60 Hz, I <sub>max</sub> 5 A              |
|                | PIN3              |                                                                                     | x     |        | Protective earth (PE)                                                   |                                                                       |
|                | PIN4              |                                                                                     | x     |        | Supply voltage neutral conductor (N)                                    |                                                                       |
|                | PIN5              |                                                                                     | x     |        | Supply voltage live conductor (L)                                       | AC 230 V +10 % / -15 %, 50...60 Hz, fuse 6.3 AT (DIN EN 60 127 2 / 5) |
| X4-01          |                   |   |       |        | Fuel selection "internal" if pin 1-2 is not used                        |                                                                       |
|                | PIN1              |                                                                                     | x     |        | Fuel selection gas                                                      | AC 230 V +10 % / -15 %, 50...60 Hz, I <sub>max</sub> 1.5 mA           |
|                | PIN2              |                                                                                     | x     |        | Fuel selection oil                                                      | AC 230 V +10 % / -15 %, 50...60 Hz, I <sub>max</sub> 1.5 mA           |
|                | PIN3              |                                                                                     | x     |        | Fan contactor contact (FCC) or flue gas recirculation pressure switch   | AC 230 V +10 % / -15 %, 50...60 Hz, I <sub>max</sub> 1.5 mA           |
|                | PIN4              |                                                                                     | x     |        | Reset / manual lockout                                                  | AC 230 V +10 % / -15 %, 50...60 Hz, I <sub>max</sub> 1.5 mA           |
| X4-02          | PIN1              |  |       | x      | Protective earth (PE)                                                   |                                                                       |
|                | PIN2              |                                                                                     |       | x      | Neutral conductor (N)                                                   |                                                                       |
|                | PIN3              |                                                                                     |       | x      | Ignition                                                                | AC 230 V +10 % / -15 %, 50...60 Hz, 2 A, cos.0.2                      |
| X4-03          | PIN1              |  |       | x      | Protective earth (PE)                                                   |                                                                       |
|                | PIN2              |                                                                                     |       | x      | Neutral conductor (N)                                                   |                                                                       |
|                | PIN3              |                                                                                     |       | x      | Start signal or pressure switch relief (air pressure switch test valve) | AC 230 V +10 % / -15 %, 50...60 Hz, 0.5 A, cos.0.4                    |

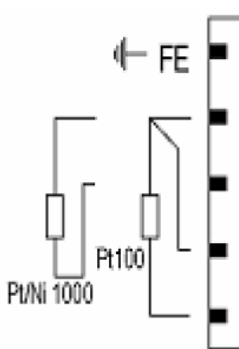
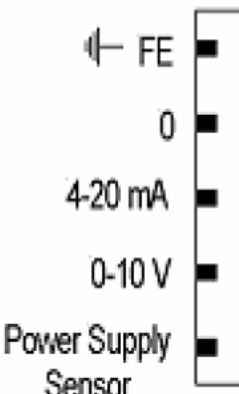
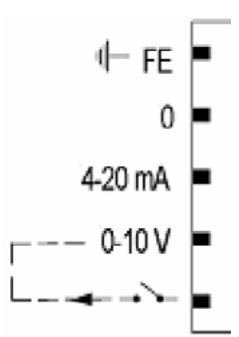
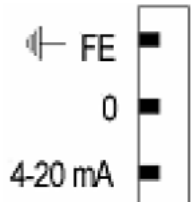
| Terminal group | Connection symbol |  | Input | Output | Description of connection terminals                  | Electrical rating                                           |
|----------------|-------------------|--|-------|--------|------------------------------------------------------|-------------------------------------------------------------|
| X5-01          | PIN1              |  |       | x      | Protective earth (PE)                                |                                                             |
|                | PIN2              |  | x     |        | Pressure switch min-oil (DWmin-oil)                  | AC 230 V +10 % / -15 %, 50...60 Hz, I <sub>max</sub> 1.5 mA |
|                | PIN3              |  |       | x      | Power signal for pressure switch-min-oil (DWmin-oil) | AC 230 V +10 % / -15 %, 50...60 Hz, I <sub>max</sub> 500 mA |
| X5-02          | PIN1              |  |       | x      | Protective earth (PE)                                |                                                             |
|                | PIN2              |  | x     |        | Pressure switch-max-oil (DWmax-oil)                  | AC 230 V +10 % / -15 %, 50...60 Hz, I <sub>max</sub> 1.5 mA |
|                | PIN3              |  |       | x      | Power signal for pressure switch-max-oil (DWmax-oil) | AC 230 V +10 % / -15 %, 50...60 Hz, I <sub>max</sub> 500 mA |
| X5-03          | PIN1              |  | x     |        | Controller (ON / OFF)                                | AC 230 V +10 % / -15 %, 50...60 Hz, I <sub>max</sub> 1.5 mA |
|                | PIN2              |  | x     |        | Controller closes / stage 3                          | AC 230 V +10 % / -15 %, 50...60 Hz, I <sub>max</sub> 1.5 mA |
|                | PIN3              |  | x     |        | Controller opens / stage 2                           | AC 230 V +10 % / -15 %, 50...60 Hz, I <sub>max</sub> 1.5 mA |
|                | PIN4              |  |       | x      | Power signal for control of controller               | AC 230 V +10 % / -15 %, 50...60 Hz, I <sub>max</sub> 500 mA |
| X6-01          | PIN1              |  | x     |        | Start release oil                                    | AC 230 V +10 % / -15 %, 50...60 Hz, I <sub>max</sub> 1.5 mA |
|                | PIN2              |  |       | x      | Power signal start release oil                       | AC 230 V +10 % / -15 %, 50...60 Hz, I <sub>max</sub> 500 mA |
|                | PIN3              |  | x     |        | Direct heavy oil start                               | AC 230 V +10 % / -15 %, 50...60 Hz, I <sub>max</sub> 1.5 mA |
|                | PIN4              |  |       | x      | Power signal direct heavy oil start                  | AC 230 V +10 % / -15 %, 50...60 Hz, I <sub>max</sub> 500 mA |
| X6-02          | PIN1              |  |       | x      | Protective earth (PE)                                |                                                             |
|                | PIN2              |  |       | x      | Neutral conductor (N)                                |                                                             |
|                | PIN3              |  |       | x      | Oil pump / magnetic coupling                         | AC 230 V +10 % / -15 %, 50...60 Hz, 2 A, cos.0.4            |
| X6-03          | PIN1              |  |       | x      | Protective earth (PE)                                |                                                             |
|                | PIN2              |  |       | x      | Neutral conductor (N)                                |                                                             |
|                | PIN3              |  |       |        | Fuel valve (shutoff valve-oil)                       | AC 230 V +10 % / -15 %, 50...60 Hz, 1 A, cos.0.4            |

| Terminal group | Connection symbol |                                                                                   | Input | Output | Description of connection terminals | Electrical rating                                           |
|----------------|-------------------|-----------------------------------------------------------------------------------|-------|--------|-------------------------------------|-------------------------------------------------------------|
| X7-01          | PIN1              |  |       | x      | Protective earth (PE)               |                                                             |
|                | PIN2              |                                                                                   |       | x      | Neutral conductor (N)               |                                                             |
|                | PIN3              |                                                                                   |       |        | Fuel valve 2 (oil)                  | AC 230 V +10 % / -15 %, 50...60 Hz, 1 A, cos.0.4            |
| X7-02          | PIN1              |  |       | x      | Protective earth (PE)               |                                                             |
|                | PIN2              |                                                                                   |       | x      | Neutral conductor (N)               |                                                             |
|                | PIN3              |                                                                                   |       |        | Fuel valve 3 (oil)                  | AC 230 V +10 % / -15 %, 50...60 Hz, 1 A, cos.0.4            |
| X7-03          | PIN1              |  |       | x      | Protective earth (PE)               |                                                             |
|                | PIN2              |                                                                                   | x     |        | Start release gas CPL (LMV52...)    | AC 230 V +10 % / -15 %, 50...60 Hz, I <sub>max</sub> 1.5 mA |
|                | PIN3              |                                                                                   |       | x      | Power signal (reserve)              | AC 230 V +10 % / -15 %, 50...60 Hz, I <sub>max</sub> 500 mA |

| Terminal group | Connection symbol                                                                   |      | Input | Output | Description of connection terminals                                             | Electrical rating                                           |
|----------------|-------------------------------------------------------------------------------------|------|-------|--------|---------------------------------------------------------------------------------|-------------------------------------------------------------|
| X8-01          |    | PIN2 |       | x      | Firing on oil                                                                   | AC 230 V +10 % / -15 %, 50...60 Hz, 1 A, cos.0.4            |
|                |                                                                                     | PIN1 |       | x      | Firing on gas                                                                   | AC 230 V +10 % / -15 %, 50...60 Hz, 1 A, cos.0.4            |
| X8-02          |    | PIN4 |       | x      | Protective earth (PE)                                                           |                                                             |
|                |                                                                                     | PIN3 |       | x      | Neutral conductor (N)                                                           |                                                             |
|                |                                                                                     | PIN2 |       | x      | Wiring point for valves connected in series                                     |                                                             |
|                |                                                                                     | PIN1 |       | x      | Fuel valve 1 (oil)                                                              | AC 230 V +10 % / -15 %, 50...60 Hz, 1 A, cos.0.4            |
| X8-03          |    | PIN4 |       | x      | Protective earth (PE)                                                           |                                                             |
|                |                                                                                     | PIN3 |       | x      | Neutral conductor (N)                                                           |                                                             |
|                |                                                                                     | PIN2 |       | x      | Wiring point for valves connected in series                                     |                                                             |
|                |                                                                                     | PIN1 |       | x      | Fuel valve 1 (oil)                                                              | AC 230 V +10 % / -15 %, 50...60 Hz, 1 A, cos.0.4            |
| X9-01          |   | PIN4 |       | x      | Fuel valve 1 (gas)                                                              | AC 230 V +10 % / -15 %, 50...60 Hz, 2 A, cos.0.4            |
|                |                                                                                     | PIN3 |       | x      | Fuel valve 2 (gas)                                                              | AC 230 V +10 % / -15 %, 50...60 Hz, 2 A, cos.0.4            |
|                |                                                                                     | PIN2 |       | x      | Fuel valve (gas)                                                                | AC 230 V +10 % / -15 %, 50...60 Hz, 2 A, cos.0.4            |
|                |                                                                                     | PIN1 |       | x      | Fuel valve (shutoff valve-(gas)                                                 | AC 230 V +10 % / -15 %, 50...60 Hz, 2 A, cos.0.4            |
| X9-02          |  | PIN2 |       | x      | Protective earth (PE)                                                           |                                                             |
|                |                                                                                     | PIN1 |       | x      | Neutral conductor (N)                                                           |                                                             |
| X9-03          |  | PIN4 | x     |        | Pressure switch-min-gas, start release gas                                      | AC 230 V +10 % / -15 %, 50...60 Hz, I <sub>max</sub> 1.5 mA |
|                |                                                                                     | PIN3 | x     |        | Pressure switch-max-gas (DWmax- gas)                                            | AC 230 V +10 % / -15 %, 50...60 Hz, I <sub>max</sub> 1.5 mA |
|                |                                                                                     | PIN2 | x     |        | Pressure switch-valve proving-gas / leakage test or valve closing contact (CPI) | AC 230 V +10 % / -15 %, 50...60 Hz, I <sub>max</sub> 1.5 mA |
|                |                                                                                     | PIN1 |       | x      | Power signal for pressure switch                                                | AC 230 V +10 % / -15 %, 50...60 Hz, I <sub>max</sub> 500 mA |

| Termi-<br>nal<br>group | Connection symbol |      | Input | Output | Description of connection termi- nals                                                                                           | Electrical rating                                           |
|------------------------|-------------------|------|-------|--------|---------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|
| X10-01                 |                   | PIN4 |       | x      | Neutral conductor (N)                                                                                                           | AC 230 V +10 % / -15 %, 50...60 Hz, max 1 mA                |
|                        |                   | PIN3 |       | x      | Power signal transformer                                                                                                        |                                                             |
|                        |                   | PIN2 | x     |        | AC power signal GO                                                                                                              | AC 12 V +10 % / -15 %, 50...60 Hz, max 1.2 mA               |
|                        |                   | PIN1 | x     |        | AC power signal fan motor (G)                                                                                                   |                                                             |
| X10-02                 |                   | PIN6 | x     |        | QRI... (IR detector) / QRA7... signal voltage                                                                                   | Umax DC 5 V                                                 |
|                        |                   | PIN5 |       | x      | Protective earth (PE)                                                                                                           |                                                             |
|                        |                   | PIN4 |       | x      | Neutral conductor (N)                                                                                                           |                                                             |
|                        |                   | PIN3 |       | x      | Power signal                                                                                                                    | AC 230 V +10 % / -15 %, 50...60 Hz, I <sub>max</sub> 500 mA |
|                        |                   | PIN2 |       | x      | QRI... (IR detector) / QRA7... power supply                                                                                     | DC 14 / 21 V <sub>DC</sub> I <sub>max</sub> 100 mA          |
|                        |                   | PIN1 | x     |        | QRB... signal voltage                                                                                                           | Max. DC 8 V                                                 |
|                        |                   |      |       |        |                                                                                                                                 |                                                             |
| X10-03                 |                   | PIN1 |       | x      | Ionization probe (ION) (alternati- vely QRA2.../ QRA4.U/QRA10..., refer to section <i>Description of inputs and out- puts</i> ) | Umax (X3-04-PINS) I <sub>max</sub> 0.5 mA                   |
| X50                    |                   | PIN6 |       | x      | Reference ground (PELV)                                                                                                         |                                                             |
|                        |                   | PIN5 |       | x      | Communication signal (CANL)                                                                                                     | DC U <5 V, R <sub>w</sub> = 120 Ω, level to ISO-DIS 11898   |
|                        |                   | PIN4 |       | x      | Communication signal (CANH)                                                                                                     |                                                             |
|                        |                   | PIN3 |       | x      | AC power supply for actuators / display and operating unit AZL5...                                                              | AC 12 V +10 % / -15 %, 50...60 Hz, Fuse max. 4 A            |
|                        |                   | PIN2 |       | x      | AC power supply for actuators / display and operating unit AZL5...                                                              |                                                             |
|                        |                   | PIN1 |       | x      | Shield connec-<br>tion (functional earth)                                                                                       |                                                             |
|                        |                   |      |       |        |                                                                                                                                 |                                                             |
| X51                    |                   | PIN6 |       | x      | Reference ground (PELV)                                                                                                         |                                                             |
|                        |                   | PIN5 |       | x      | Communication signal (CANL)                                                                                                     | DC U <5 V, R <sub>w</sub> = 120 Ω, level to ISO-DIS 11898   |
|                        |                   | PIN4 |       | x      | Communication signal (CANH)                                                                                                     |                                                             |
|                        |                   | PIN3 |       | x      | AC power supply for actuators / display and operating unit AZL5...                                                              | AC 12 V +10 % / -15 %, 50...60 Hz, Fuse max. 4 A            |
|                        |                   | PIN2 |       | x      | AC power supply for actuators / display and operating unit AZL5...                                                              |                                                             |
|                        |                   | PIN1 |       | x      | Shield connec-<br>tion (functional earth)                                                                                       |                                                             |
|                        |                   |      |       |        |                                                                                                                                 |                                                             |

|     |                                                                                   |      |   |  |                                                    |                                   |
|-----|-----------------------------------------------------------------------------------|------|---|--|----------------------------------------------------|-----------------------------------|
| X52 |  | PIN4 | x |  | (functional earth)                                 |                                   |
|     |                                                                                   | PIN3 | x |  | AC power supply from transformer to LMV5... system | AC 12 V +10 % / -15 %, 50...60 Hz |
|     |                                                                                   | PIN2 | x |  | Reference ground (PELV)                            |                                   |
|     |                                                                                   | PIN1 | x |  | AC power supply from transformer to LMV5... system | AC 12 V +10 % / -15 %, 50...60 Hz |

| Terminal group                    | Connection symbol                                                                   |      | Input | Output | Description of connection terminals                         | Electrical rating           |
|-----------------------------------|-------------------------------------------------------------------------------------|------|-------|--------|-------------------------------------------------------------|-----------------------------|
| Temperature / pressure controller |                                                                                     |      |       |        |                                                             |                             |
| X60                               |    | PIN5 | x     |        | Functional earth for shield connection                      |                             |
|                                   |                                                                                     | PIN4 | x     |        | Reference ground                                            |                             |
|                                   |                                                                                     | PIN3 | x     |        | Temperature sensor input Pt / LG- Ni 1000                   |                             |
|                                   |                                                                                     | PIN2 | x     |        | Line compensation temperature sensor PT100                  |                             |
|                                   |                                                                                     | PIN1 | x     |        | Temperature sensor input PT100                              |                             |
| X61                               |  | PIN5 | x     |        | Functional earth for shield connection                      |                             |
|                                   |                                                                                     | PIN4 | x     |        | Reference ground                                            |                             |
|                                   |                                                                                     | PIN3 | x     |        | Current input for temperature / pressure signal 0/4...20 mA | DC 0/4...20 mA              |
|                                   |                                                                                     | PIN2 | x     |        | Voltage input for temperature / pressure signal DC 0...10 V | DC 0...10 V                 |
|                                   |                                                                                     | PIN1 |       | x      | Power supply for temperature / pressure transmitter         | approx. DC 20 V Max. 25 mA  |
| X62                               |  | PIN5 | x     |        | Functional earth for shield connection                      |                             |
|                                   |                                                                                     | PIN4 | x     |        | Reference ground                                            |                             |
|                                   |                                                                                     | PIN3 | x     |        | Current input for setpoint or load                          | DC 0...20 mA                |
|                                   |                                                                                     | PIN2 | x     |        | Voltage input for setpoint or load                          | DC 0...10 V                 |
|                                   |                                                                                     | PIN1 |       | x      | Power supply for setpoint changeover                        | approx. DC 24 V Max. 2 mA   |
| X63                               |  | PIN3 | x     |        | Functional earth for shield connection                      |                             |
|                                   |                                                                                     | PIN2 |       | x      | Reference ground                                            |                             |
|                                   |                                                                                     | PIN1 |       | x      | Current output for burner (LOAD OUTPUT)                     | DC 4...20 mA, RLmax = 500 Ω |





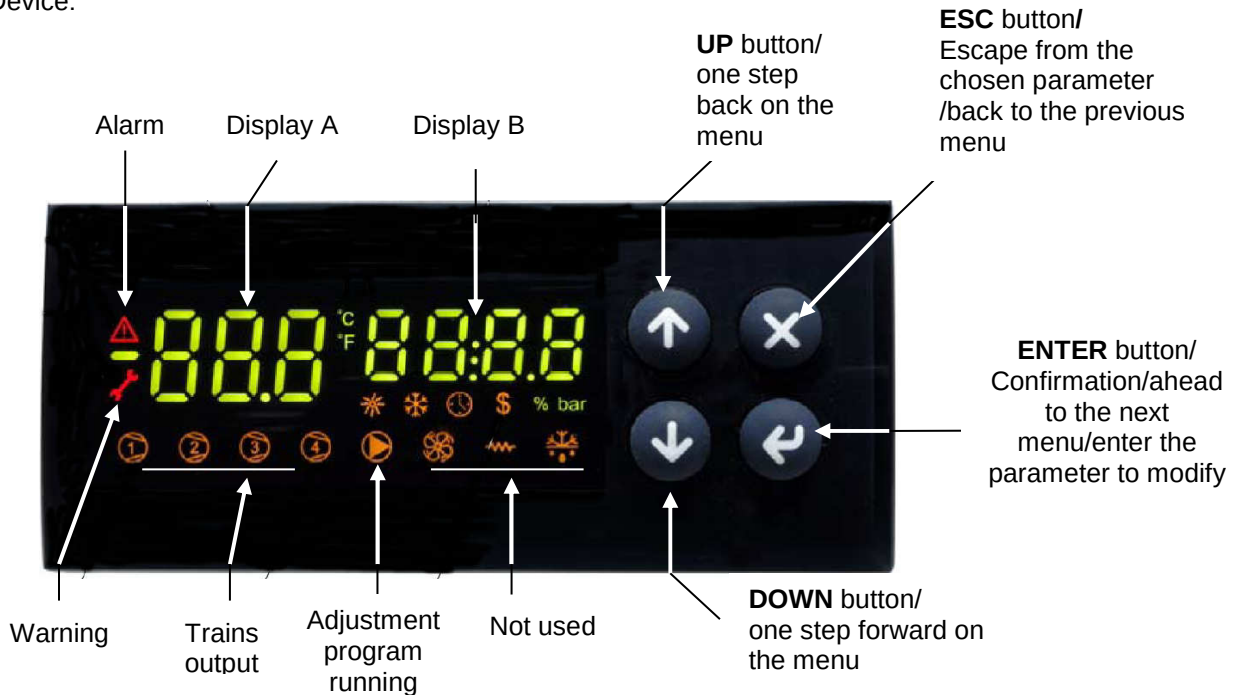
Note: Specifications and data subject to change. Errors and omissions excepted.

# USER MANUAL OF MULTI-THERMOSTAT MCX06C

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

## User interface:

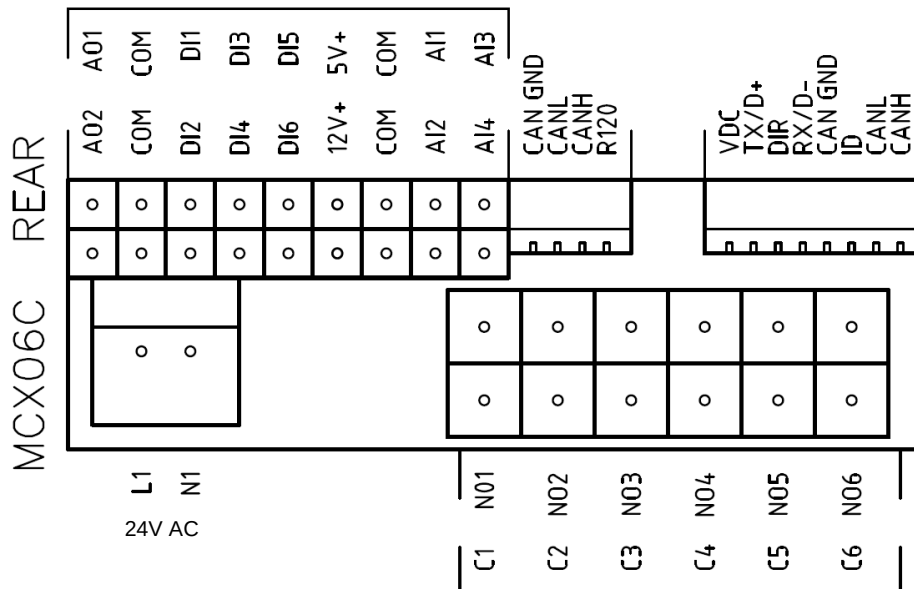
Device:



Note :

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

## Connections from terminal side:



## Probe connection:

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

**Menu:**

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

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

**Alarms & Warning:**

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

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

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

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

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

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

**Set point adjustment:**

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

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

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

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

Here below recommended set points:

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

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

## RECOMMENDATIONS FOR LMV5x CONNECTIONS

Connections affected by EMC noises are related to the bus cable (actuator line cable, PLL52), detection probe cable, speed sensor cable, 4-20mA signal cable that controls the VSD.

Input and power cables (400V e 230V) must be laid separately from the signal cables.

The bus cable between control panel and burner and between burner and PLL52 board (used when O2 trim control must be performed) must be laid separately and far from power cables.

When long cables must be provided, it is recommended to put the bus cable into a pipe or a metallic sheath: the sheath ends must be grounded with suitable rings.

Provide a shielded three-pole cable type FG7OH2R+T (see Annex 1), between VSD and motor; earth must be outside the shielding.

Shielding must get to the lower part of the VSD and get to the motor junction box. Shielding must be connected to the equipotential ground on both ends, better with suitable rings.

Otherwise, a standard cable can be used also but put inside a pipe or metallic sheath (the sheath ends must be grounded with suitable rings) and an earth external wire for the motor ground.

The cable for the 4÷20mA signal that controls the VSD, must be shielded, only LMV5x side ends connected to the equipotential terminal. If the VSD is not inside the control panel, the cable must be laid separately inside a metallic sheath earthed by means of rings.

As for the speed sensor cable and QRI detection probe cable, provide a "Ethernet " cat.5 or 6 cable, inside a metallic sheath (with ends earthed by means of rings) and laid separately from the motor cable.

As the sensor uses three wires, divide and twist the pairs to avoid noises. Alternatively, provide a 3x2x0,50 twisted cable Liycy type (see Annex 2).

In case of O2 trim control version, O2 probe and PLL52 board must be connected by means of a 3x2x0,50 twisted cable Liycy type (see Annex 2).

*NB: when a shielding has both ends wired to Earth, be sure they are at the same potential. If there is any Voltage difference, ground just one of the two ones, generally the one closest to the weakest, respect to EMC, component. Anyway give way to the burner control, that is wire to ground the end of the shielding closest to the LMV. For instance, the cable between LMV and VSD, if the shielding has only one end wired to Earth, this one has to be the one LMV side.*

## Annex1 – Example for motor cable



**FG70H2R+T 0,6/1 kV**  
A RIDOTTA EMISSIONE  
DI ALOGENI

**FG70H2R+T 0,6/1 kV**  
WITH REDUCED  
HALOGEN EMISSION

INDUSTRIA E AUTOMAZIONE



### CARATTERISTICHE TECNICHE

|                                |                                                                                                       |                                         |
|--------------------------------|-------------------------------------------------------------------------------------------------------|-----------------------------------------|
| Colore delle anime:            |                                                                                                       | UNEL 00722 / VDE 0293 (Tab. 8)          |
| Conduttori:                    | rame rosso elettrolitico                                                                              | normativa CEI EN 60228 Cl.5 (Tabella 9) |
| Isolante:                      | elastomero silanico di qualità G7                                                                     | normativa CEI 20-11 - CEI EN 50363      |
| Separatore:                    | nastro poliestere-mylar                                                                               |                                         |
| Schermatura:                   | a treccia capillari di rame rosso elettrolitico cop. > 80 %                                           |                                         |
| Guaina esterna:                | PVC di qualità TM2                                                                                    | normativa CEI 20-11 - CEI EN 50363      |
| Colore della guaina:           | Grigio RAL 7035                                                                                       |                                         |
| Prova N.P. verticale:          | su singolo conduttore o cavo isolato                                                                  | normativa CEI EN 60332-1-2              |
| Prova GAS emessi:              | durante la combustione                                                                                | normativa CEI EN 50267-2-1              |
| Resistenza agli olii:          |                                                                                                       | normativa CEI 20-34/O-1                 |
| Prova N.P.I.:                  |                                                                                                       | normativa CEI 20-22/2                   |
| Resistenza elettrica:          | relativamente alla sezione                                                                            | normativa CEI EN 60228 (Tabella 9)      |
| Tens. nominale Uo/U:           | 0,6/1 kV                                                                                              |                                         |
| Tensione di prova:             | 4000 V                                                                                                |                                         |
| Temperatura d'esercizio:       | (- 25 °C ÷ + 90 °C)                                                                                   |                                         |
| Temperatura di corto circuito: | 250 °C                                                                                                |                                         |
| Marcatura:                     | BERICA CAVI S.P.A. (VI) FG70H2R + T 0,6/1 kV O.R. CEI 20-22 II C€ Anno/Lotto - N° Anime x Sezione + T |                                         |
| Raggio di curvatura:           | minimo 15 volte diametro esterno                                                                      |                                         |

### TECHNICAL FEATURES

|                               |                                                                                                                 |                                |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------|--------------------------------|
| Cores colour code:            |                                                                                                                 | UNEL 00722 / VDE 0293 (Tab. 8) |
| Conductors :                  | fine wires stranded of bare copper                                                                              | CEI EN 60228 Cl.5 (Tab.9) rule |
| Insulation:                   | G7 quality rubber                                                                                               | CEI 20-11 - CEI EN 50363 rules |
| Assembling:                   | polyester-mylar tape                                                                                            |                                |
| Shield:                       | bare copper braid 80% covering                                                                                  |                                |
| Outer sheath:                 | TM2 quality PVC                                                                                                 | CEI 20-11 - CEI EN 50363 rules |
| Sheath colour code:           | Grey RAL 7035                                                                                                   |                                |
| Vertical fire retardant test: | on single conductor or insulated cable                                                                          | CEI EN 60332-1-2 rule          |
| Emission GAS test:            | during the combustion                                                                                           | CEI EN 50267-2-1 rule          |
| Oil resistant test:           |                                                                                                                 | CEI 20-34/O-1 rule             |
| Flame retardant test:         |                                                                                                                 | CEI 20-22/2 rule               |
| Electric resistance:          | according to                                                                                                    | CEI EN 60228 (Tab. 9)          |
| Working voltage:              | 0,6/1 kV                                                                                                        |                                |
| Testing voltage:              | 4000 V                                                                                                          |                                |
| Working temperature:          | (-25 °C ÷ +90 °C)                                                                                               |                                |
| Short circuit temperature:    | 250 °C                                                                                                          |                                |
| Outer printing:               | BERICA CAVI S.P.A. (VI) FG70H2R + T 0,6/1 kV O.R. CEI 20-22 II C€ - Year/Lot - Nr. of cond. by cross sect. + T. |                                |
| Bending radius:               | cable outer diameter x 15                                                                                       |                                |

**FG70H2R+T 0,6/1 kV**  
**WITH REDUCED**  
**HALOGEN EMISSION**

[illegible]

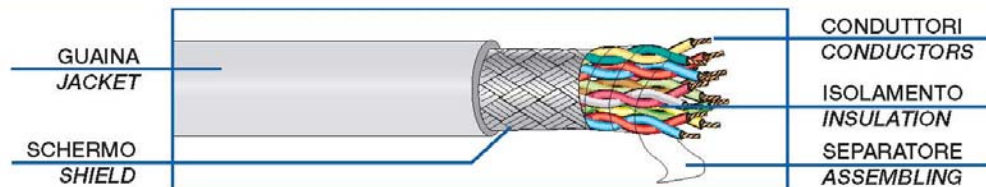
## Annex 2 – Example for sensor cable

### CAVI TIPO "Li-ICY-P" A COPPIE SCHERMATI A TRECCIA

**IMPIEGO:** Cavi schermati per segnali e trasmissione dati per applicazioni in elettronica ed informatica, efficaci contro le interferenze elettromagnetiche ed atti ad offrire una protezione contro influenze capacitive dovute a campi elettrici.

### CABLES TYPE "Li-ICY-P" TWISTED PAIRS, TINNED COPPER BRAID SHIELD

**STANDARD USE:** Signal and data transmission shielded cables for electronics and information technology applications, effective against electromagnetic interferences and suited to offer protection against capacitive influences due to electric fields.



| CARATTERISTICHE TECNICHE                                                                                                                                                                                                                                                  |  | TECHNICAL FEATURES                                                                                                                                                                                                                                                                                                                                        |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <b>CONDUTTORI:</b><br>Flessibili in rame rosso<br>sec. CEI 20-29 (IEC 228) Cl. 5, VDE 0295 Cl. 5, NF C32-013<br>(0,34 mm <sup>2</sup> : VDE 0295 Cl.2)                                                                                                                    |  |  <b>CONDUCTORS:</b><br>Flexible bare copper conductors<br>CEI 20-29 (IEC 228) Cl. 5, VDE 0295 Cl. 5,<br>NF C32-013 Ref. (0,34 mm <sup>2</sup> : VDE 0295 Cl.2)                                                                                                           |  |
| <b>ISOLANTE:</b><br>Polivinilcloruro (PVC)<br>Sec. CEI 20-11 Cl. R2, VDE 0207 Cl. Y12<br>Codici colori: a norma DIN 47100                                                                                                                                                 |  |  <b>INSULATION:</b><br>Polyvinylchloride (PVC)<br>CEI 20-11 Cl. R2, VDE 0207 Cl. Y12 Ref.<br>Colour code according to DIN 47100                                                                                                                                          |  |
| <b>SEPARATORE:</b><br>Nastro di poliestere                                                                                                                                                                                                                                |  |  <b>ASSEMBLING:</b><br>Polyester tape helically wound                                                                                                                                                                                                                  |  |
| <b>SCHERMATURA:</b><br>A treccia di rame stagnato<br>Cordina di continuità a richiesta                                                                                                                                                                                    |  |  <b>SHIELD:</b><br>Tinned copper braid<br>On request with drain wire                                                                                                                                                                                                   |  |
| <b>GUAINA ESTERNA:</b><br>Polivinilcloruro (PVC)<br>Sec. CEI 20-20 Cl. TM2, VDE 0207 Cl. YM2<br>colore: grigio (diverso a richiesta)                                                                                                                                      |  |  <b>JACKET:</b><br>Polyvinylchloride (PVC)<br>CEI 20-20 Cl. TM2, VDE 0207 Cl. YM2 Ref.<br>colour: gray or on request                                                                                                                                                   |  |
| <b>RESISTENZA ELETTRICA DEI CONDUTTORI:</b><br>0,14 mm <sup>2</sup> : <148 Ohm/Km<br>0,25 mm <sup>2</sup> : <79 Ohm/Km<br>0,34 mm <sup>2</sup> : <55 Ohm/Km<br>0,50 mm <sup>2</sup> : <39 Ohm/Km<br>0,75 mm <sup>2</sup> : <26 Ohm/Km<br>1 mm <sup>2</sup> : <19,5 Ohm/Km |  |  <b>ELECTRICAL CONDUCTOR RESISTANCE:</b><br>0,14 mm <sup>2</sup> : <148 Ohm/Km<br>0,25 mm <sup>2</sup> : <79 Ohm/Km<br>0,34 mm <sup>2</sup> : <55 Ohm/Km<br>0,50 mm <sup>2</sup> : <39 Ohm/Km<br>0,75 mm <sup>2</sup> : <26 Ohm/Km<br>1 mm <sup>2</sup> : <19,5 Ohm/Km |  |
| <b>TEMPERATURA DI ESERCIZIO:</b><br>posa fissa: -25°C + 70°C<br>posa mobile: -15°C + 70°C                                                                                                                                                                                 |  |  <b>WORKING TEMPERATURE:</b><br>fixed installation: -25°C + 70°C<br>flexing: -15°C + 70°C                                                                                                                                                                              |  |
| <b>RAGGIO DI CURVATURA:</b><br>15 volte il diametro del cavo                                                                                                                                                                                                              |  |  <b>BENDING RADIUS:</b><br>15 times overall diameter of cable                                                                                                                                                                                                          |  |
| <b>TENSIONE DI ESERCIZIO:</b><br>250 V                                                                                                                                                                                                                                    |  |  <b>WORKING VOLTAGE:</b><br>250 V                                                                                                                                                                                                                                      |  |
| <b>TENSIONE DI PROVA:</b><br>1500 V                                                                                                                                                                                                                                       |  |  <b>TEST VOLTAGE:</b><br>1500 V                                                                                                                                                                                                                                        |  |

**CAVI TIPO "Li-ICY-P"**  
A COPPIE SCHERMATI A TRECCIA

**CABLES TYPE "Li-ICY-P"**  
TWISTED PAIRS, TINNED COPPER BRAID SHIELD

**PROVA N.P. FIAMMA:**  
Standard: sec. CEI 20-35 (IEC 332.1)  
A richiesta: sec. CEI 20-22 II (IEC 332.3A)



**FLAME RETARDANT TEST:**  
Standard: CEI 20-35 (IEC 332.1) Ref.  
On request: CEI 20-22 II (IEC 332.3A) Ref.

**IMPEDENZA DI TRASFERIMENTO:**  
max 200 mohm/m ( $f < 10\text{MHz}$ )



**SURFACE TRANSFER IMPEDANCE:**  
max 200 mohm/m ( $f < 10\text{MHz}$ )

**CAPACITA' DI LAVORO:**  
cond/cond: 120 nF/km (nom.)  
cond/sch: 180 nF/km (nom.)



**CAPACITANCE:**  
cond/cond: 120 nF/km (nom.)  
cond/shield: 180 nF/km (nom.)

| CODICE            | FORMAZIONE | ø esterno medio  | Peso medio Kg/Km    |
|-------------------|------------|------------------|---------------------|
| CODE              | TYPE       | outer diameter ø | Medium weight Kg/Km |
| 28.204.1.02.1.000 | 2x2x0.14   | 5.6              | 40.0                |
| 28.204.1.03.1.000 | 3x2x0.14   | 5.9              | 47.0                |
| 28.204.1.04.1.000 | 4x2x0.14   | 6.2              | 61.0                |
| 28.204.1.05.1.000 | 5x2x0.14   | 7.2              | 68.0                |
| 28.204.1.06.1.000 | 6x2x0.14   | 7.6              | 76.0                |
| 28.204.1.07.1.000 | 7x2x0.14   | 7.6              | 82.0                |
| 28.204.1.08.1.000 | 8x2x0.14   | 8.4              | 90.0                |
| 28.204.1.10.1.000 | 10x2x0.14  | 9.8              | 118.0               |
| 28.204.1.12.1.000 | 12x2x0.14  | 10.2             | 130.0               |
| 28.204.1.16.1.000 | 16x2x0.14  | 11.2             | 160.0               |
| 28.204.1.18.1.000 | 18x2x0.14  | 11.7             | 186.0               |
| 28.204.1.20.1.000 | 20x2x0.14  | 12.4             | 200.0               |
| 28.204.1.25.1.000 | 25x2x0.14  | 14.0             | 273.0               |
| 28.204.1.02.3.000 | 2x2x0.25   | 5.8              | 54.0                |
| 28.204.1.03.3.000 | 3x2x0.25   | 7.0              | 65.0                |
| 28.204.1.04.3.000 | 4x2x0.25   | 7.3              | 89.0                |
| 28.204.1.05.3.000 | 5x2x0.25   | 8.0              | 99.0                |
| 28.204.1.06.3.000 | 6x2x0.25   | 9.0              | 114.0               |
| 28.204.1.07.3.000 | 7x2x0.25   | 9.0              | 120.0               |
| 28.204.1.08.3.000 | 8x2x0.25   | 9.6              | 126.0               |
| 28.204.1.10.3.000 | 10x2x0.25  | 10.3             | 160.0               |
| 28.204.1.12.3.000 | 12x2x0.25  | 11.4             | 171.0               |
| 28.204.1.16.3.000 | 16x2x0.25  | 13.1             | 238.0               |
| 28.204.1.18.3.000 | 18x2x0.25  | 13.6             | 248.0               |
| 28.204.1.20.3.000 | 20x2x0.25  | 14.2             | 275.0               |
| 28.204.1.25.3.000 | 25x2x0.25  | 16.4             | 340.0               |

| CODICE            | FORMAZIONE | ø esterno medio  | Peso medio Kg/Km    |
|-------------------|------------|------------------|---------------------|
| CODE              | TYPE       | outer diameter ø | Medium weight Kg/Km |
| 28.204.1.02.4.000 | 2x2x0.34   | 7.3              | 68.0                |
| 28.204.1.03.4.000 | 3x2x0.34   | 7.8              | 82.0                |
| 28.204.1.04.4.000 | 4x2x0.34   | 8.6              | 96.0                |
| 28.204.1.05.4.000 | 5x2x0.34   | 10.0             | 110.0               |
| 28.204.1.06.4.000 | 6x2x0.34   | 10.6             | 130.0               |
| 28.204.1.07.4.000 | 7x2x0.34   | 10.6             | 145.0               |
| 28.204.1.08.4.000 | 8x2x0.34   | 11.5             | 150.0               |
| 28.204.1.10.4.000 | 10x2x0.34  | 13.0             | 190.0               |
| 28.204.1.12.4.000 | 12x2x0.34  | 13.5             | 220.0               |
| 28.204.1.16.4.000 | 16x2x0.34  | 15.2             | 250.0               |
| 28.204.1.18.4.000 | 18x2x0.34  | 16.0             | 275.0               |
| 28.204.1.20.4.000 | 20x2x0.34  | 17.1             | 290.0               |
| 28.204.1.25.4.000 | 25x2x0.34  | 19.5             | 400.0               |
| 28.204.1.02.5.000 | 2x2x0.50   | 7.6              | 75.0                |
| 28.204.1.03.5.000 | 3x2x0.50   | 9.0              | 125.0               |
| 28.204.1.04.5.000 | 4x2x0.50   | 10.0             | 140.0               |
| 28.204.1.05.5.000 | 5x2x0.50   | 10.8             | 160.0               |
| 28.204.1.06.5.000 | 6x2x0.50   | 11.7             | 190.0               |
| 28.204.1.07.5.000 | 7x2x0.50   | 11.7             | 220.0               |
| 28.204.1.08.5.000 | 8x2x0.50   | 14.0             | 250.0               |
| 28.204.1.10.5.000 | 10x2x0.50  | 15.0             | 300.0               |
| 28.204.1.12.5.000 | 12x2x0.50  | 15.7             | 345.0               |
| 28.204.1.16.5.000 | 16x2x0.50  | 17.6             | 450.0               |

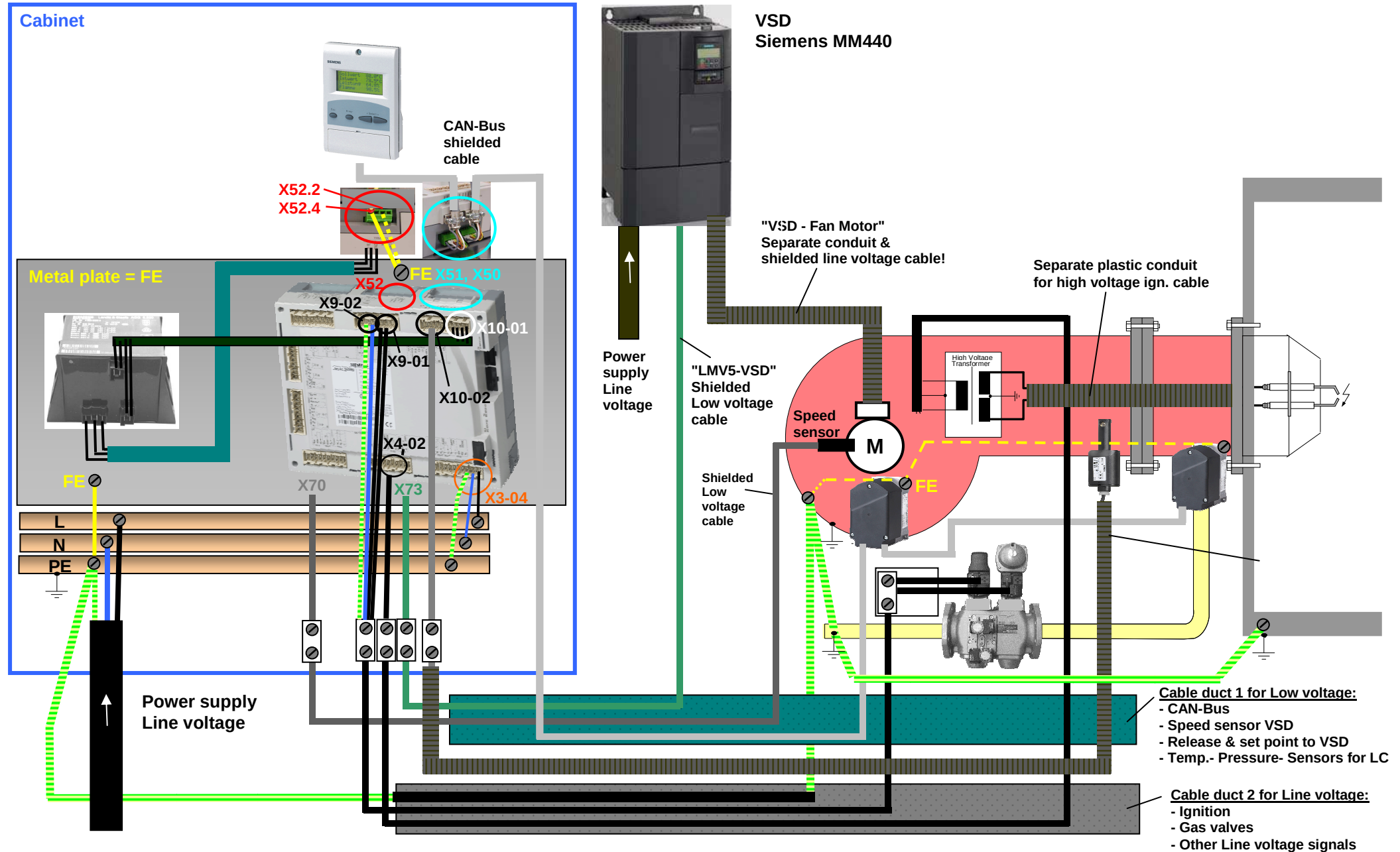
**CAVI TIPO "Li-ICY-P"**  
A COPPIE SCHERMATI A TRECCIA

**CABLES TYPE "Li-ICY-P"**  
TWISTED PAIRS, TINNED COPPER BRAID SHIELD

| CODICE            | FORMAZIONE | ø esterno<br>medio  | Peso medio<br>Kg/Km    |
|-------------------|------------|---------------------|------------------------|
| CODE              | TYPE       | outer<br>diameter ø | Medium weight<br>Kg/Km |
| 28.204.1.02.6.000 | 2x2x0.75   | 8.6                 | 103.0                  |
| 28.204.1.03.6.000 | 3x2x0.75   | 9.0                 | 128.0                  |
| 28.204.1.04.6.000 | 4x2x0.75   | 10.6                | 167.0                  |
| 28.204.1.05.6.000 | 5x2x0.75   | 12.0                | 215.0                  |
| 28.204.1.06.6.000 | 6x2x0.75   | 12.8                | 240.0                  |
| 28.204.1.07.6.000 | 7x2x0.75   | 12.8                | 265.0                  |
| 28.204.1.08.6.000 | 8x2x0.75   | 14.6                | 306.0                  |
| 28.204.1.10.6.000 | 10x2x0.75  | 16.0                | 355.0                  |
| 28.204.1.12.6.000 | 12x2x0.75  | 17.0                | 405.0                  |
| 28.204.1.16.6.000 | 16x2x0.75  | 20.5                | 565.0                  |

| CODICE            | FORMAZIONE | ø esterno<br>medio  | Peso medio<br>Kg/Km    |
|-------------------|------------|---------------------|------------------------|
| CODE              | TYPE       | outer<br>diameter ø | Medium weight<br>Kg/Km |
| 28.204.1.02.7.000 | 2x2x1      | 9.4                 | 122.0                  |
| 28.204.1.03.7.000 | 3x2x1      | 11.5                | 179.0                  |
| 28.204.1.04.7.000 | 4x2x1      | 12.8                | 237.0                  |
| 28.204.1.05.7.000 | 5x2x1      | 13.8                | 297.0                  |

## Appendix: Example for wiring, earthing and shielding the LMV5-System



# Addendum 4: LMV52... with O2 trim control and O2 module

## General

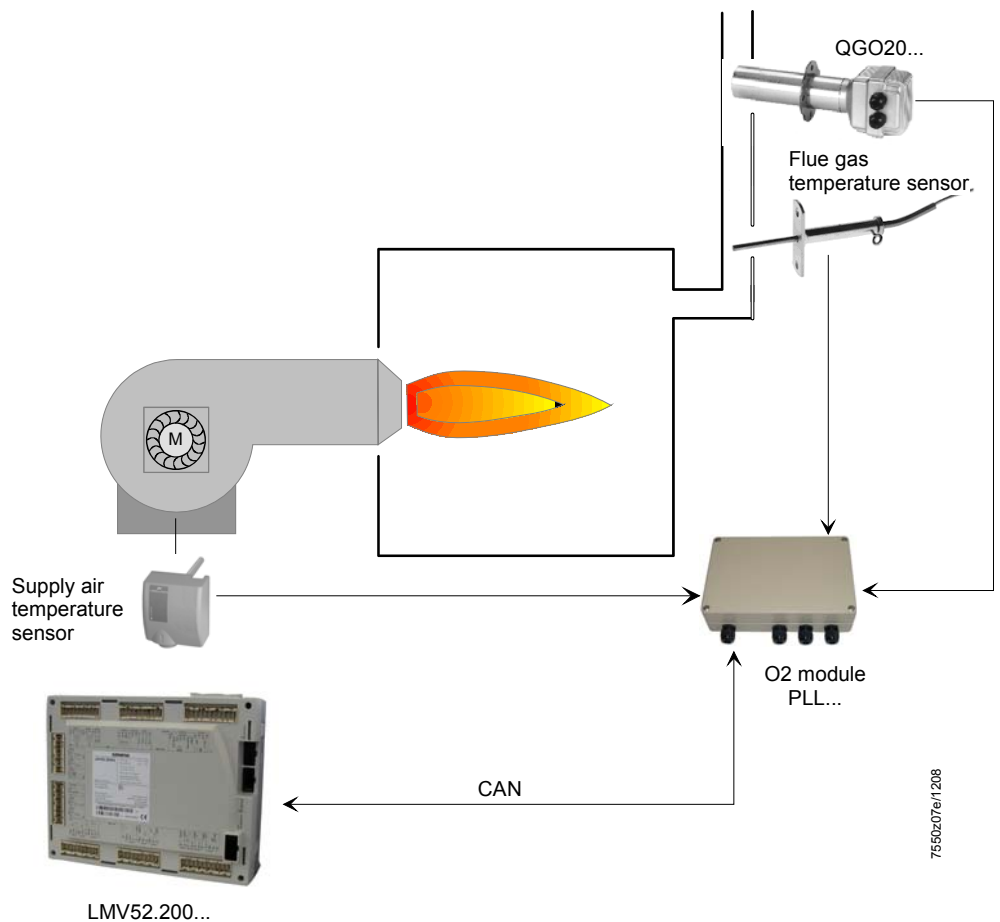
The LMV52... system is an extended LMV51... system. A special feature of the LMV52... is control of the residual oxygen content to increase the boiler's efficiency.

In addition to the features of the LMV51..., the LMV52... provides O2 trim control, control of a maximum of 6 actuators, control of a VSD, and acquisition of cumulated fuel consumption and current fuel throughput. The LMV52... system uses an O2 sensor (QGO20...), an external O2 module, and the standard components of the LMV51... system.

**ATTENTION:** for the proper burner adjustment, it is necessary to install a fuel meter for each burner.

The PLL... O2 module is a detached measuring module for the QGO20... sensor and for 2 temperature sensors (Pt1000 / LG-Ni 1000). The module communicates with the LMV52... via CAN bus.

The fuel meters must be connected directly to the fuel-related inputs of the basic unit. On the AZL5... display and operating unit, the individual consumption values can be read out and the meter readings can be reset.



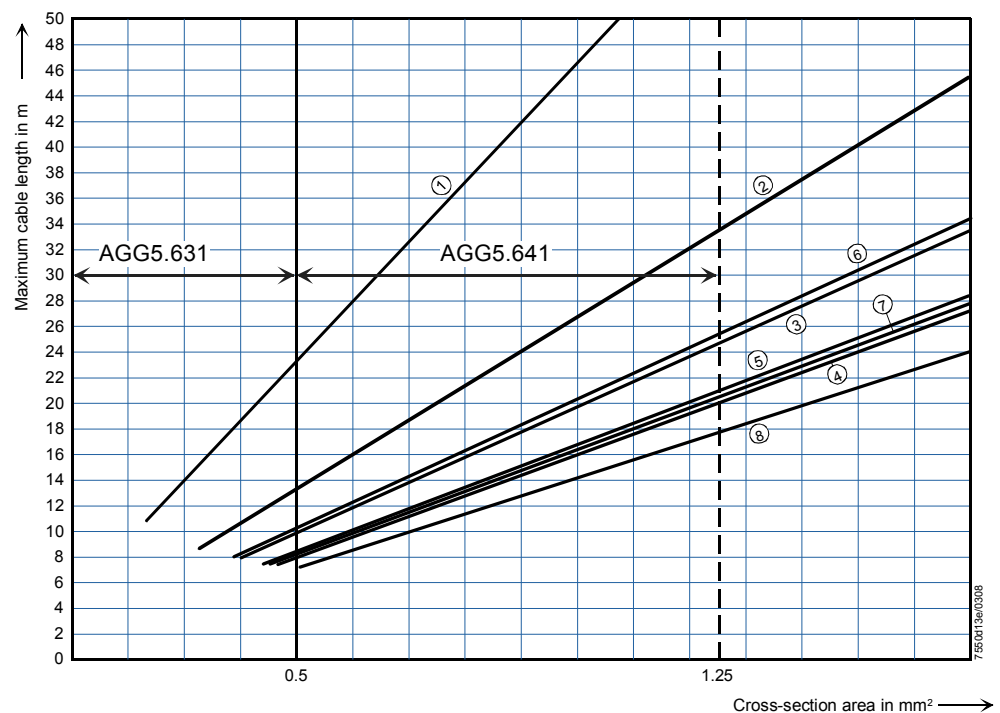
## Determination of the maximum cable length

The maximum cable length between transformer and CAN bus users is dependent on the type of cable (cross-sectional area), the number of actuators and the type of actuator used (current).

The following graphs can be used to determine the maximum CAN bus cable lengths between the transformer and group of actuators or the AZL5..., depending on the relevant influencing factors.

The assumption was made that the actuators within the group are close to one another. The **minimum** cross-sectional area for the system examples shown results from the start of the curve.

The **maximum** cable lengths for the defined system cables AGG5.641 and AGG5.631 result from the points of intersection in the graph.



AGG5.631 (cable type 2)  
AGG5.641 (cable type 1)

- |                |                               |
|----------------|-------------------------------|
| ① 1 x SQM45... | ⑤ 2 x SQM48...                |
| ② 2 x SQM45... | ⑥ 1 x SQM45... + 1 x SQM48... |
| ③ 3 x SQM45... | ⑦ 2 x SQM45... + 1 x SQM48... |
| ④ 4 x SQM45... | ⑧ 3 x SQM45... + 1 x SQM48... |

### CAN bus connection between transformer and actuator group



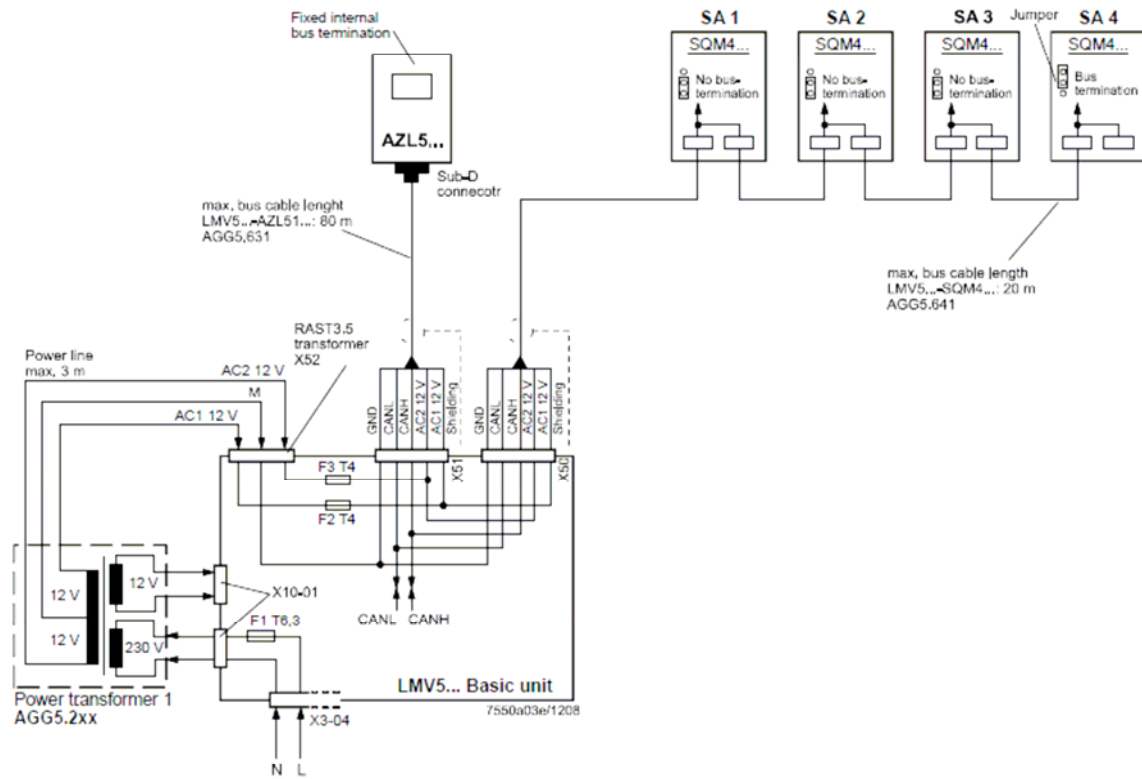
When connecting a PLL52... O2 module, the maximum permissible cable length of a network is to be reduced by 2 m.

**Example:** - System cable: AGG5.641 (connecting cable to the actuators)  
- Actuators: 2 x SQM45...

The point of intersection of the vertical line for the AGG5.641 (1.25 mm<sup>2</sup>) and curve ① (2 x SQM45...) gives a maximum cable length of 33.4 m between the transformer and the group of actuators.

Example 1

**Installation of all components in the burner;  
CAN bus cable «LMV5... →shielding last actuator» 20 m**

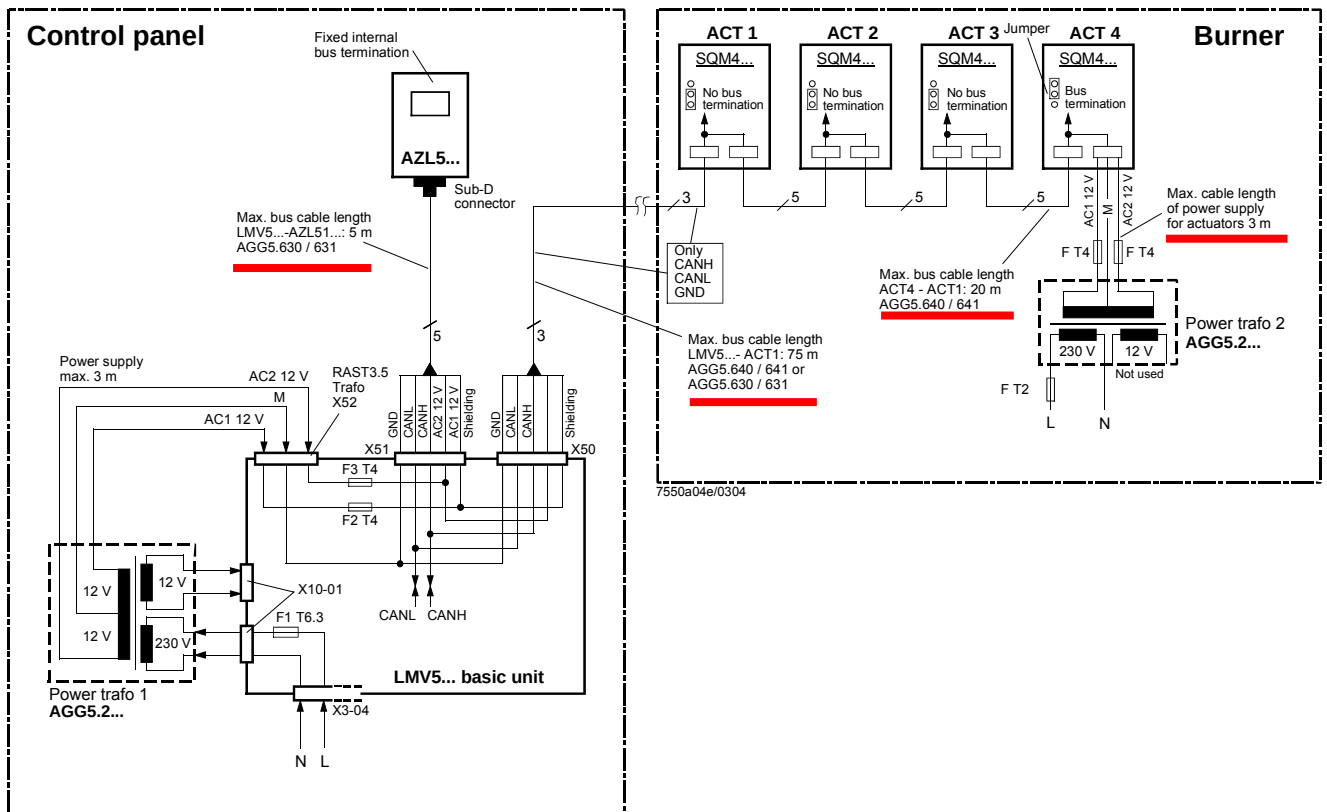


Note on example 1

**Total length of CAN bus cable ≤ 100 m**

## Example 2

**LMV5... basic unit in the control panel, actuator on the burner;  
CAN bus cable «LMV5... → SA» > 20 m**



### Notes on example 2

#### Total length of CAN bus cable ≤ 100 m

Whenever the distance between the LMV5... and the last actuator exceeds 20 m, or if more than one SQM48 is used on the burner (refer to sizing chart “Determination of maximum cable length”), a second transformer is required for powering the actuators.

In that case, transformer 1 powers the LMV5... basic unit and the AZL5... display and operating unit (**Fig. 1**). Transformer 2 powers the actuators (**Fig. 2**).



With the CAN bus cable connections from the LMV5... (**Fig. 1**) to the first actuator (**Fig. 2**), the 2 voltages AC1 and AC2 on the LMV5... side must **not** be connected and only cables CANH, CANL and M (+shielding) are to be connected to the first actuator (**Fig. 2**).

In that case, the actuators must be powered by a second transformer which to be located near the actuators.

The power from that transformer (lines AC1, AC2, M) must be fed to the actuator (ACT4 in the example above) and then connected through via bus cable AGG5.640 (cable type 1) to all the other actuators.

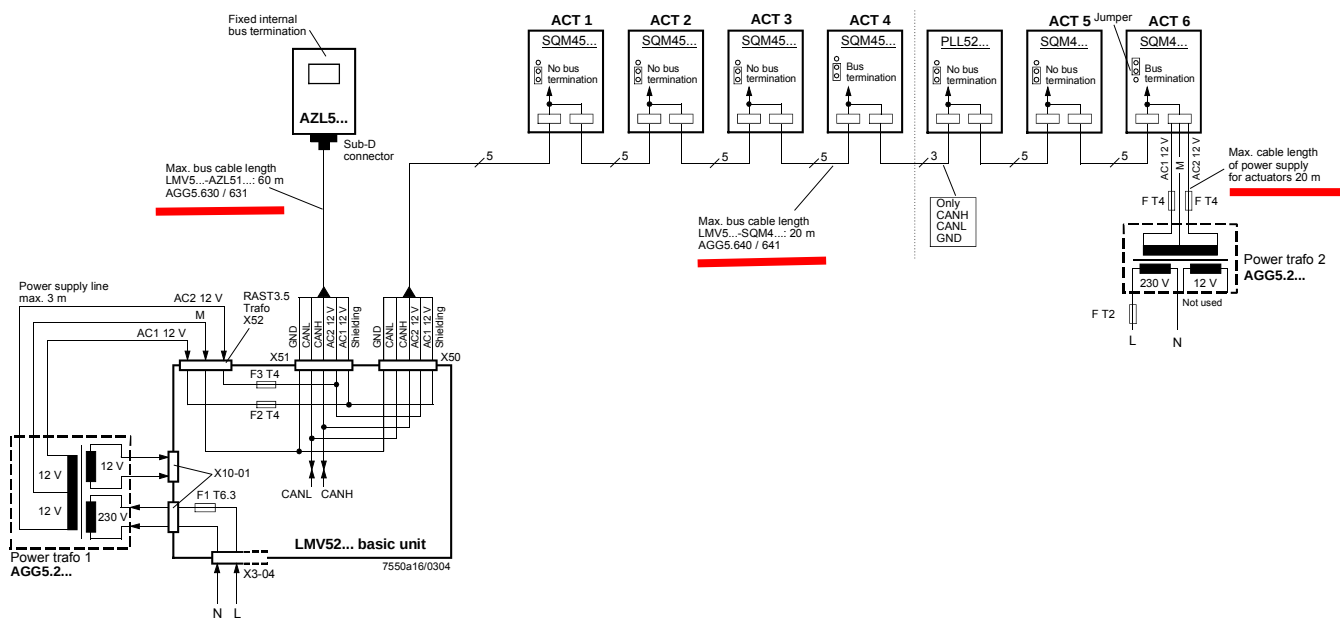
The fuses required for transformer 1 are accommodated in the LMV5... basic unit.



For transformer 2, these 3 fuses must be located close to the transformer (for type, refer to Basic Documentation P7550).

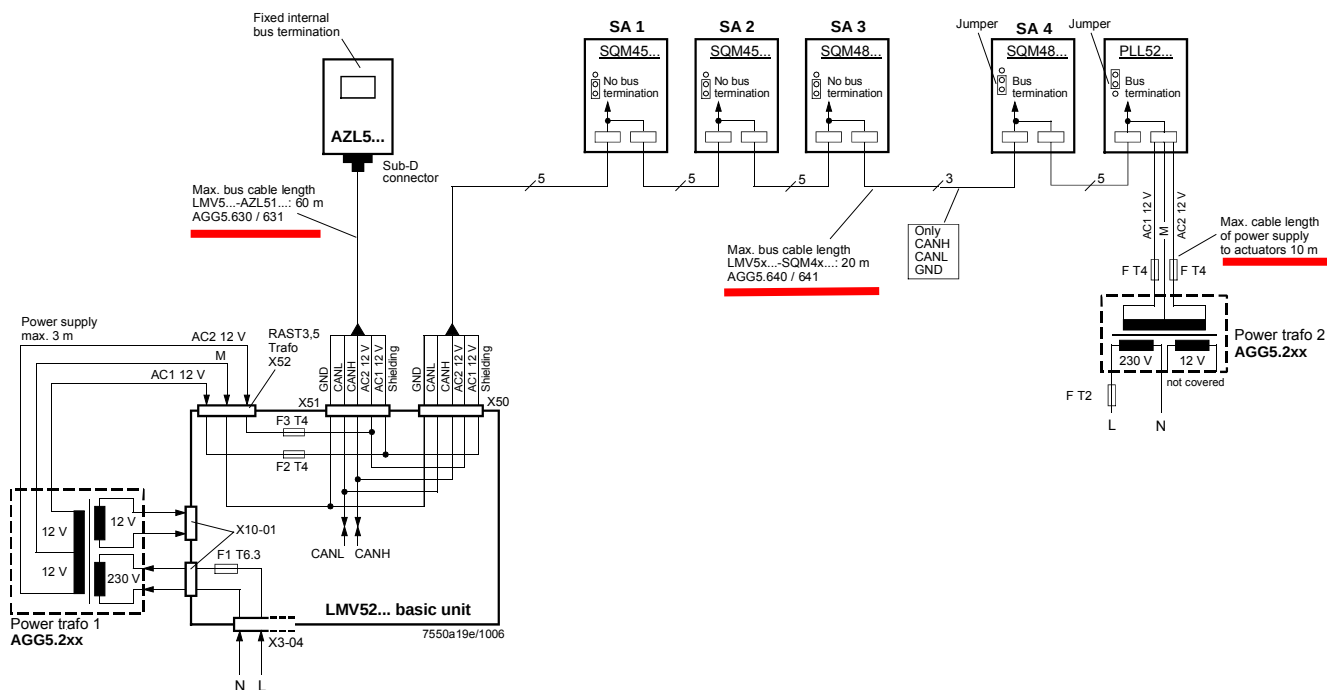
Example 3a

**Installation of all components in the burner;  
CAN bus cable «LMV52... ↔ SA» > 20 m with 6 actuators and O2 module  
PLL52...**



Example 3b

**Installation in the control panel, actuator on the burner;  
CAN bus cable «LMV52... ↔ SA» > 25 m with 4 actuators and O2 module  
PLL52...**



On LMV52... applications with more than 4 actuators (SQM45...), a second transformer is required for powering the extra actuators.

In that case, transformer 1 powers the LMV52... basic unit, the **AZL5...**, and the first 4 actuators.



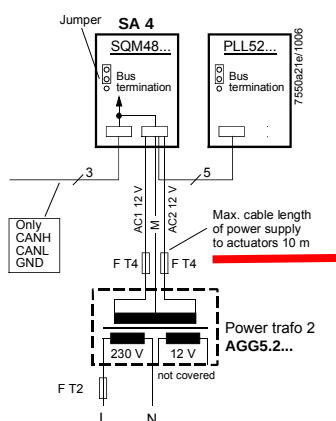
Interrupt the connection between the components at a suitable location. On the actuator side, the 2 voltages AC1 and AC2 must **not** be connected but only lines «CANH, CANL and M» (+shield) to the O2 module and the other actuator.

In that case, the actuators (SA5, SA6) and the O2 module must be powered by a second transformer to be located near the actuators and the O2 module.

Connect the power supply line from that transformer to the O2 module PLL52... (in example 3a «SA6» / in example 3b «Auxiliary terminal») (lines AC1, AC2, M) and from there, via bus cable AGG5.640 (cable type 1), through to the second actuator (SA) and the O2 module.

The fuses required for transformer 1 are accommodated in the LMV52... basic unit.

Optionally, the supply voltage can also be delivered via a conduit box and fed into the connecting line between SA4 and PLL52...

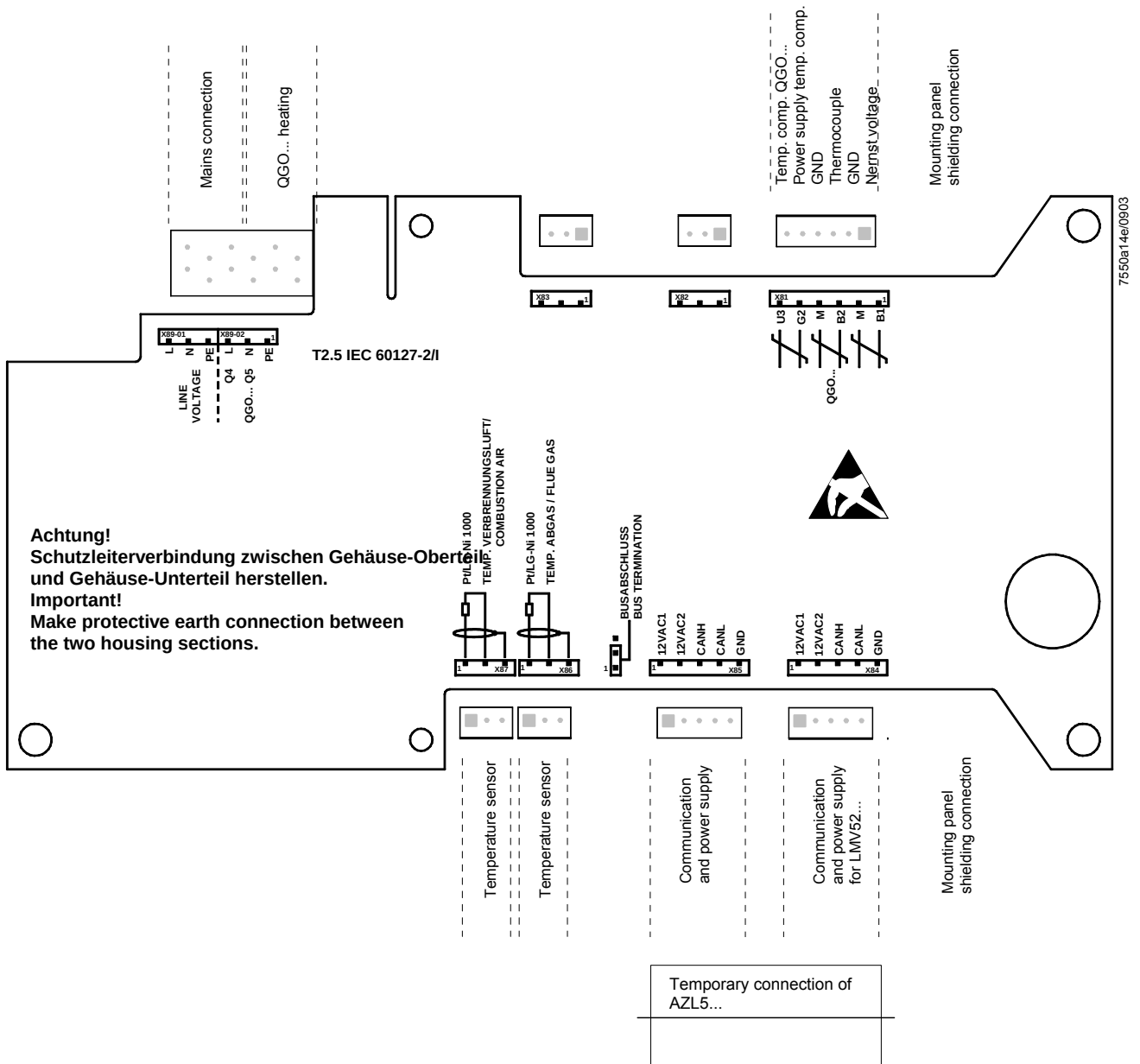


For transformer 2, the OEM must fit the 3 fuses close to the transformer.

# O2 module

In comparison with the LMV51... system, the extra components to be connected with the LMV52... system are the O2 module and the O2 sensor QGO... and, optionally, the combustion air and flue gas temperature sensors. The O2 module is to be connected to the basic unit via the CAN bus. The O2 module must be located in the vicinity of the QGO... (< 10 m), aimed at keeping interference on the sensitive detector lines as low as possible. For sensor heating, the O2 module requires a separate mains connection facility.

## 18.8.1 Inputs and outputs



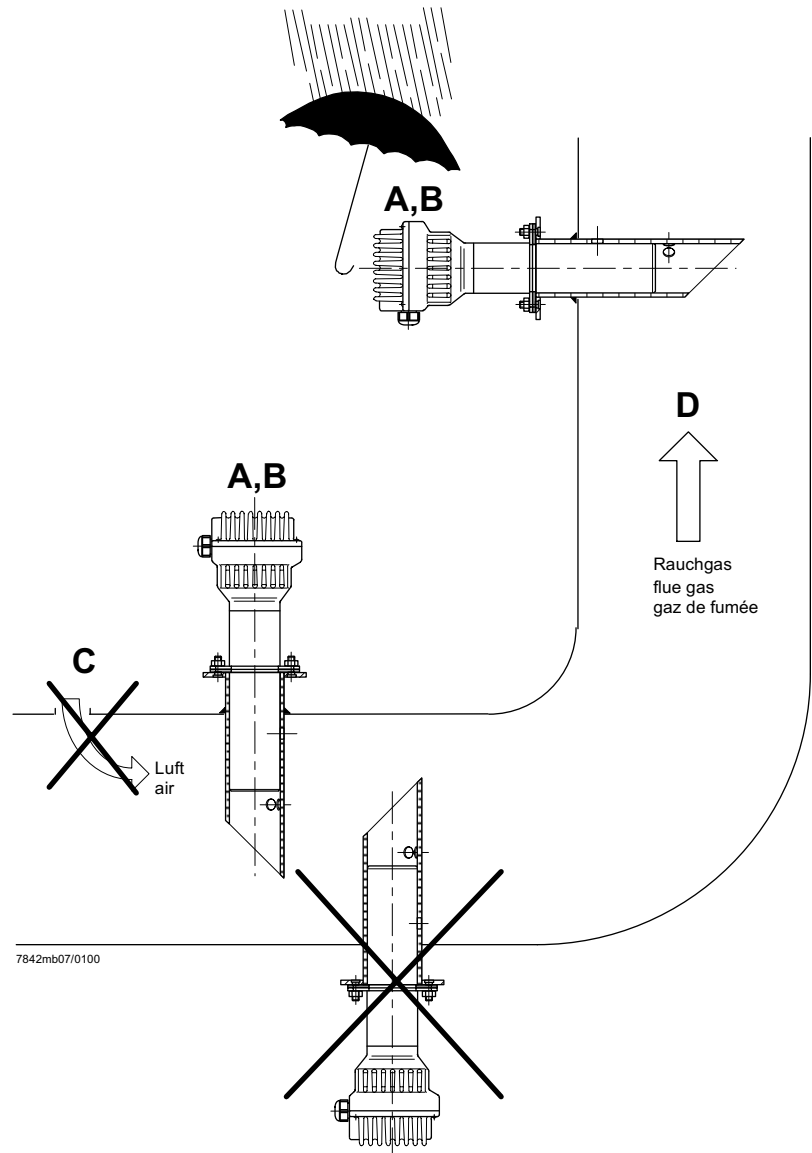
## QGO20...

Montageanleitung  
Mounting instruction  
Instruction de montage  
Monteringsanvisning  
Montage-aanwijzing

Istruzioni di montaggio  
Asennusohje  
Instrucciones de montaje  
Monteringsinstruktion  
Montasjeanvisning



Fühler aus Keramik - zerbrechlich  
Ceramic detector - fragile  
Sonde en céramique - fragile



### O<sub>2</sub>-Fühler QGO20... und Rauchgassammler AGO20...

Voraussetzungen für eine korrekte messtechnische Erfassung des O<sub>2</sub>-Gehaltes der Rauchgase:

A - QGO20... **nur** mit Rauchgassammler AGO20... einsetzen

B - Einbauort des QGO20... so nahe am Brenner wie möglich, in einem Bereich ohne Turbulenzen und Inhomogenitäten. Nicht direkt im Bereich von Klappen oder Bögen montieren. Idealer Abstand: 5 x Kamindurchmesser.

C - Zwischen Brenner und Fühler darf keine Luft in die Rauchgase gelangen.

D - Strömungsgeschwindigkeit 1...10 m/s. Rauchgastemperatur am Messort ≤ 300°C

### O<sub>2</sub>-detector type QGO20... and flue gas collector type AGO20...

Presupposition for the correct measurement of the O<sub>2</sub> content of the flue gases:

A - Use QGO20... **only** with flue gas collector type AGO20...

B - Mounting position of the QGO as close as possible to the burner, in a homogenous area without any turbulences. Do not mount the QGO20... in the area of dampers or curves. Ideal distance: Five times the diameter of the stack.

C - No air must be allowed to join the flue gases on their way from the burner to the detector.

D - Flow velocity 1...10 m/s. Flue gas temperature at the measuring position ≤ 300°C

### Sonde O<sub>2</sub> QGO20... et collecteur des gaz de fumée AGO20...

Conditions requises pour une détection correcte de la teneur en O<sub>2</sub> des gaz de fumée:

A - Utiliser le QGO20... **exclusivement** avec le collecteur des gaz de fumée AGO...

B - Lieu de montage du QGO20... le plus près possible du brûleur, dans un domaine homogène sans turbulences. Ne pas le monter dans le domaine des clapets ou dans les courbes. Distance idéale: Cinq fois le diamètre de la cheminée.

C - Entre le brûleur et la sonde, il ne doit pas pénétrer d'air dans les gaz de fumée.

D - Vitesse d'écoulement 1...10 m/s. Température des gaz fumée au lieu de la mesure ≤ 300°C

Anschluss-Schema

6-adriges abgeschirmtes Kabel. Adern möglichst paarweise verdreht. Abschirmung an Klemme GND des RPO... . Abschirmung nicht mit Schutzleiter oder M verbinden!

Anschlusskabel z.B.:

|                           |                                              |
|---------------------------|----------------------------------------------|
| LifYCY                    | 6 x 2 x 0,20 / 22 oder                       |
| LiYCY                     | 6 x 2 x 0,20                                 |
| B1 (+)                    | Signal O2-Messzelle                          |
| M (-)                     | Masse für B1, B2                             |
| B2 (+)                    | Thermoelement-Spannung                       |
| M (-)                     |                                              |
| U3 (+)                    | Signal Temperaturkompensations-<br>element   |
| G2 (-)                    | Speisung Temperaturkompensations-<br>element |
| GND                       | Masse für Anschirmung                        |
| 3 x 1,5 mm <sup>2</sup> : |                                              |
| Q4                        | Fühlerheizung (AC 230 V)                     |
| Q5                        | Fühlerheizung (AC 230 V)                     |

⏏ Erde\*



**Vorsicht** bei den Anschlüssen U3 und G2!  
Ein Fehlverdrahten der Anschlüsse führt zu einem Ausfall des Kompensationselementes.

\* Am RPO... steht nur 1 Erdleiterklemme zur Verfügung. Beide Erdleiter müssen auf **eine** Klemme geführt werden.

Wiring diagram

Shielded 6-core cable. Wires should be twisted in pairs. Screen must be connected to terminal GND of the RPO... . Do not connect the shielding to the protective earth or M!

Connecting cable e.g.:

|                           |                                                      |
|---------------------------|------------------------------------------------------|
| LifYCY                    | 6 x 2 x 0,20 / 22 or                                 |
| LiYCY                     | 6 x 2 x 0,20                                         |
| B1 (+)                    | Signal from O2-measuring cell                        |
| M (-)                     | Ground for B1, B2                                    |
| B2 (+)                    | Thermocouple voltage                                 |
| M (-)                     |                                                      |
| U3 (+)                    | Signal from temperature<br>compensation element      |
| G2 (-)                    | Power supply for temperature<br>compensation element |
| GND                       | Ground for screening                                 |
| 3 x 1,5 mm <sup>2</sup> : |                                                      |
| Q4                        | QGO... detector heating (AC 230 V)                   |
| Q5                        | QGO... detector heating (AC 230 V)                   |

⏏ Earth\*



**Caution** when connecting U3 and G2!  
Faulty wiring leads to failure of the compensation element.

\* At the RPO..., there is only 1 earth terminal available. Both earth wires must be connected to **the same** earth terminal.

Schéma de raccordement

Câble blindé à 6 brins. Brins torsadés si possible par paires. Blindage sur la borne GND du RPO... . Ne pas connecter le blindage avec le conducteur de protection ou M!

Câble de raccordement p.ex.:

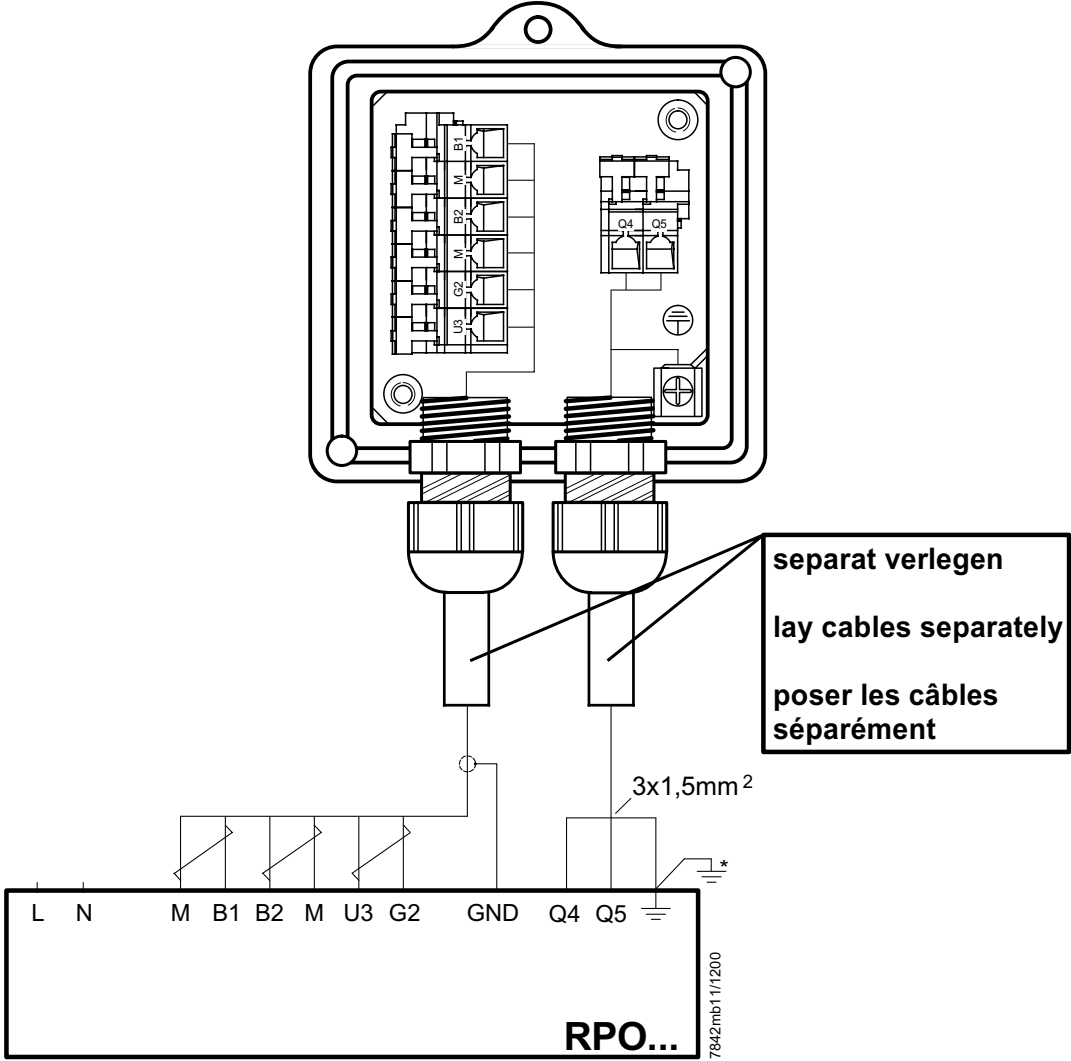
|                           |                                                             |
|---------------------------|-------------------------------------------------------------|
| LifYCY                    | 6 x 2 x 0,20 / 22 ou                                        |
| LiYCY                     | 6 x 2 x 0,20                                                |
| B1 (+)                    | Signal de la cellule de mesure d'O2                         |
| M (-)                     | Masse pour B1, B2                                           |
| B2 (+)                    | Tension de thermocouple                                     |
| M (-)                     |                                                             |
| U3 (+)                    | Signal de l'élément de cpmensation de<br>température        |
| G2 (-)                    | Alimentation de l'élément de<br>compensation de température |
| GND                       | Masse du blindage                                           |
| 3 x 1,5 mm <sup>2</sup> : |                                                             |
| Q4                        | Chauffage de sonde QGO... (AC 230 V)                        |
| Q5                        | Chauffage de sonde QGO... (AC 230 V)                        |

⏏ Terre\*



**Prière de faire attention** lors des raccordements U3 et G2. Une erreur de câblage des fils de raccorde-  
ment conduit à une destruction de l'élément de compensation.

\* Le RPO... ne dispose que d'une seule borne de mise à la terre. Les deux fils de mise à la terre doivent être connectés sur **la même** borne.



## Hinweise für Installation und Inbetriebnahme

- Distanz zwischen Wand des Rauchgaskanals und Rauchgasaustritt (B) des AGO20... min. 10 mm
- Die Kaminisolierung darf nicht über den Anschlussflansch hinausragen und dadurch den Fühlerkopf isolieren (therm. Überlastung). Der Fühlerkopf muss frei bleiben! Strahlungswärme vermeiden; z.B. durch Wärmeleitbleche
- Bei der ersten Inbetriebnahme ist das Mess-System ca. 2 Stunden vor Gebrauch einzuschalten. Bei kurzen Abschaltungen der Anlage (1-2 Wochen) ist es empfehlenswert, das Mess-System (QGO... und RPO) nicht auszuschalten.
- Während des Aufheizvorganges kann der Fühler falsch messen.



- QGO20... nie im kalten Zustand bei laufendem Brenner im Kamin einsetzen.
- Nach Fühlertausch, Ansteuerung der Fühlerheizung überprüfen.
- Spannung an Q4 - Q5 muss im 2 s Takt pulsieren.
- **Sofort ausschalten** falls Spannung nicht pulsiert  
→ RPO austauschen

## Commissioning and Installation Guide

- The distance between the wall of the flue gas duct and the flue gas outlet (B) of the AGO20... must be a minimum of 10 mm
- The insulation of the chimney must not project beyond the connecting flange, thus insulating the head of the sensor (thermal overload). The head of the sensor must remain uncovered! Avoid heat due to radiation, e.g. through thermal conductive plates
- When starting up the plant for the first time, the measuring system should be switched on approx. 2 hours prior to usage. If the plant is switched off for short periods of the time (1 to 2 weeks), it is recommended to leave the measuring system (QGO... and RPO) switched on.
- During the heating up phase, the detector could deliver an incorrect signal.



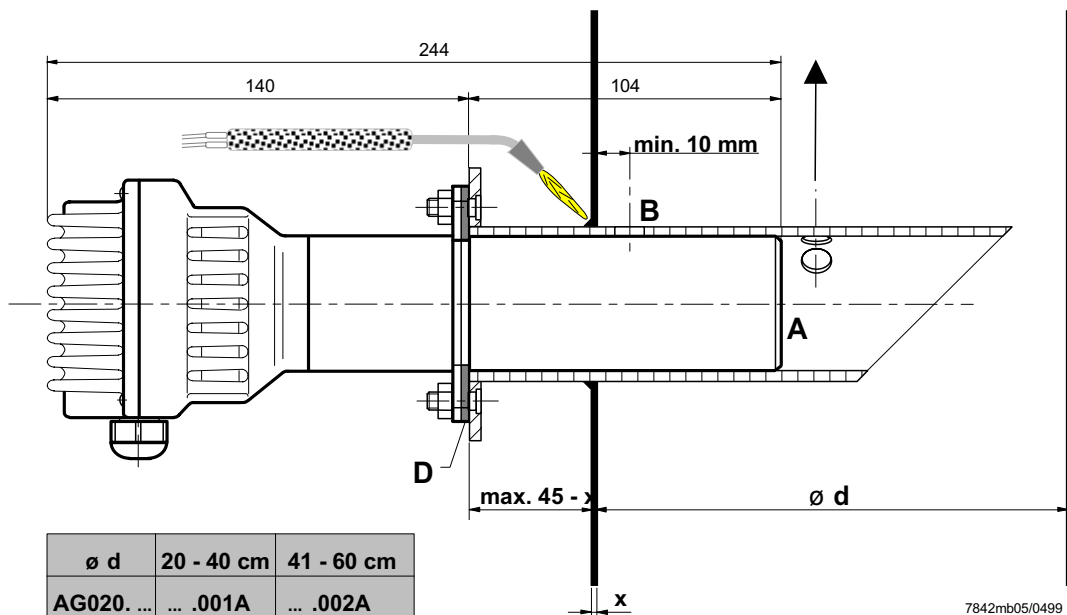
- Never use a cold QGO20... in the flueway while burner is operating.
- After changing the sensor, check the proper functioning of the sensor's heating element
- Voltage at Q4 - Q5 must pulsate at 2-s intervals
- If voltage does not pulsate, **switch equipment off immediately**  
→ replace RPO

## Instructions de mise en service et installation

- La distance entre la paroi de la conduite de gaz et la sortie des gaz de fumée (B) du AGO20... doit être d'au moins 10 mm.
- L'isolation de la cheminée ne doit pas dépasser la bride de raccordement, c'est-à-dire couvrir la tête de la sonde (surcharge thermique). La tête de la sonde ne doit pas être couverte! Éviter la chaleur de rayonnement, p.ex. par tôles thermoconductrices
- Lors de la première mise en service, le dispositif de mesure doit être raccordé environ 2 heures avant l'utilisation. En cas de courtes interruptions de l'installation (1-2 semaines), il est recommandé de ne pas déclencher le dispositif de mesure (QGO... et RPO).
- Pendant l'opération d'échauffement, il est possible que la sonde ne mesure pas correctement.

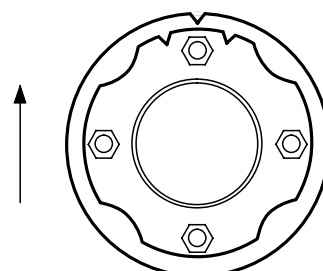


- Ne jamais introduire le QGO20... à l'état froid ou le laisser introduit dans la cheminée quand le brûleur est en marche.
- Lors d'un changement de sonde, vérifier le signal de chauffage de celle-ci.
- Les tensions aux bornes Q4 - Q5 doivent commuter toutes les 2 s.
- **Déconnecter immédiatement** en cas de non-commutation des tensions  
→ Echanger le RPO



7842mb05/0499

**Kerben beachten!**  
**Observe notches!**  
**Attention aux entailles!**



Legende:

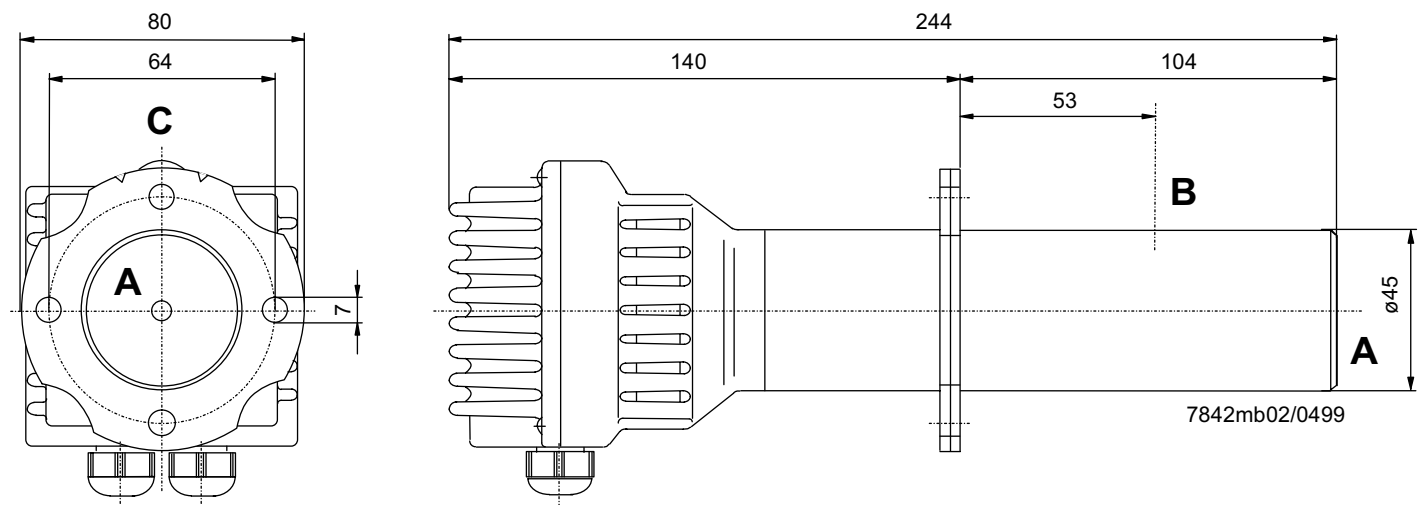
Strömungsrichtung

Direction of flow of flue gases

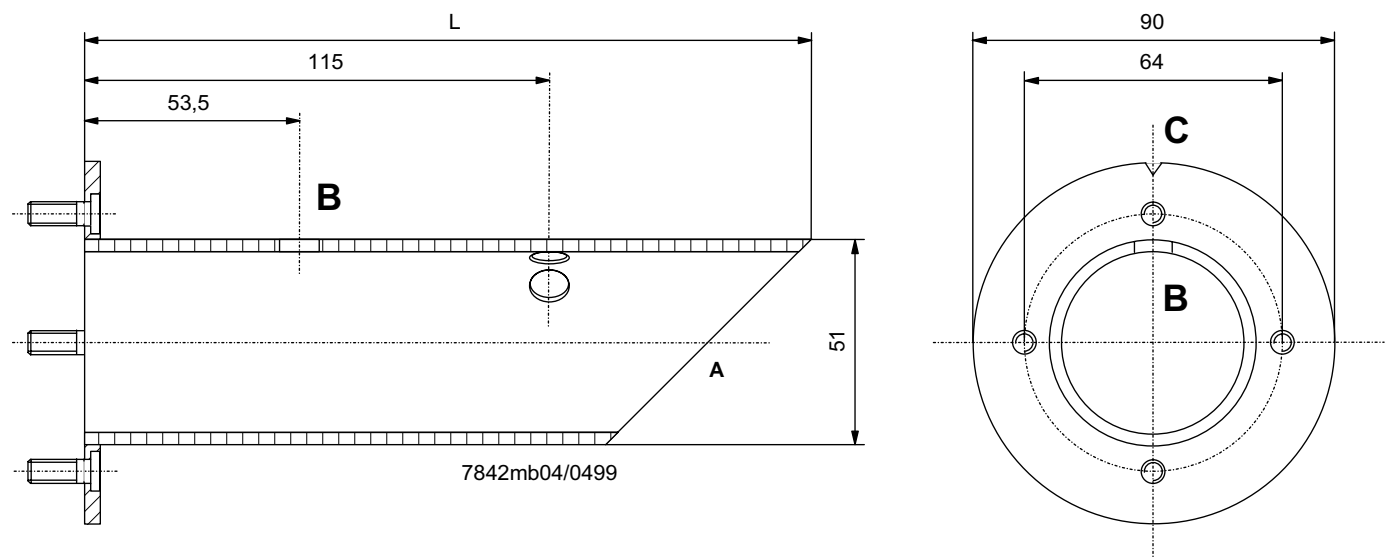
Direction du courant des gaz de fumée

7842mb06/0499

QGO20...



AGO20...



L = 180 mm für AGO20.001A  
L = 260 mm für AGO20.002A

A = Rauchgaseintritt  
B = Rauchgasaustritt  
C = Kerbe  
D = Flachdichtung (beiliegend)

L = 180 mm for AGO20.001A  
L = 260 mm for AGO20.002A

A = Flue gas inlet  
B = Flue gas outlet  
C = Notch  
D = Flat seal (enclosed)

L = 180 mm pour AGO20.001A  
L = 260 mm pour AGO20.002A

A = Entrée du gaz de fumée  
B = Sortie de gaz de fumée  
C = Entaille  
D = Joint d'étanchéité plat (inclus)

## Technical Data PLL52...

LMV52... basic unit

Refer to chapter *Technical Data!*

PLL52...

|                        |                                                       |                           |
|------------------------|-------------------------------------------------------|---------------------------|
| Mains voltage «X89-01» | AC 120 V<br>-15 % / +10 %                             | AC 230 V<br>-15 % / +10 % |
| Safety class           | I with parts according to II<br>as per DIN EN 60730-1 |                           |
| Mains frequency        | 50 / 60 Hz ±6 %                                       |                           |
| Power consumption      | Ca. 4 VA                                              | Ca. 4 VA                  |
| Degree of protection   | IP54, housing closed                                  |                           |
| Transformer AGG5.210   |                                                       |                           |
| - Primary side         | AC 120 V                                              |                           |
| - Secondary side       | AC 12 V (3x)                                          |                           |
| Transformer AGG5.220   |                                                       |                           |
| - Primary side         | AC 230 V                                              |                           |
| - Secondary side       | AC 12 V (3x)                                          |                           |

Environmental conditions

|                       |                   |
|-----------------------|-------------------|
| <b>Storage</b>        | DIN EN 60 721-3-1 |
| Climatic conditions   | class 1K3         |
| Mechanical conditions | class 1M2         |
| Temperature range     | -20...+60 °C      |
| Humidity              | < 95 % r.h.       |
| <b>Transport</b>      | DIN EN 60 721-3-2 |
| Climatic conditions   | class 2K2         |
| Mechanical conditions | class 2M2         |
| Temperature range     | -30...+70 °C      |
| Humidity              | < 95 % r.h.       |
| <b>Operation</b>      | DIN EN 60 721-3-3 |
| Climatic conditions   | class 3K5         |
| Mechanical conditions | class 3M2         |
| Temperature range     | -20...+60 °C      |
| Humidity              | < 95 % r.h.       |



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

## Terminal ratings, cable lengths and cross-sectional areas

LMV52... basic unit

Refer to chapter «Technical Data / LMV5... and AZL5...!»

PLL52...

|                                              |                                                   |
|----------------------------------------------|---------------------------------------------------|
| <b>Cable lengths / cross-sectional areas</b> |                                                   |
| Electrical connection «X89»                  | Screw terminals up to max. 2.5 mm <sup>2</sup>    |
| Cable lengths                                | ≤10 m to QGO20...                                 |
| Cross-sectional areas                        | Refer to description of QGO20...<br>Twisted pairs |

### Analog inputs:

|                                |                                |
|--------------------------------|--------------------------------|
| Fresh air temperature detector | Pt1000 / LG-Ni1000             |
| Flue gas temperature detector  | Pt1000 / LG-Ni1000             |
| QGO20...                       | Refer to Data Sheet N7842      |
| Interface                      | Communication bus for LMV52... |



# MANUALE USER SUPPORT

## MULTI-THERMOSTAT

### MCX06C

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

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

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

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

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

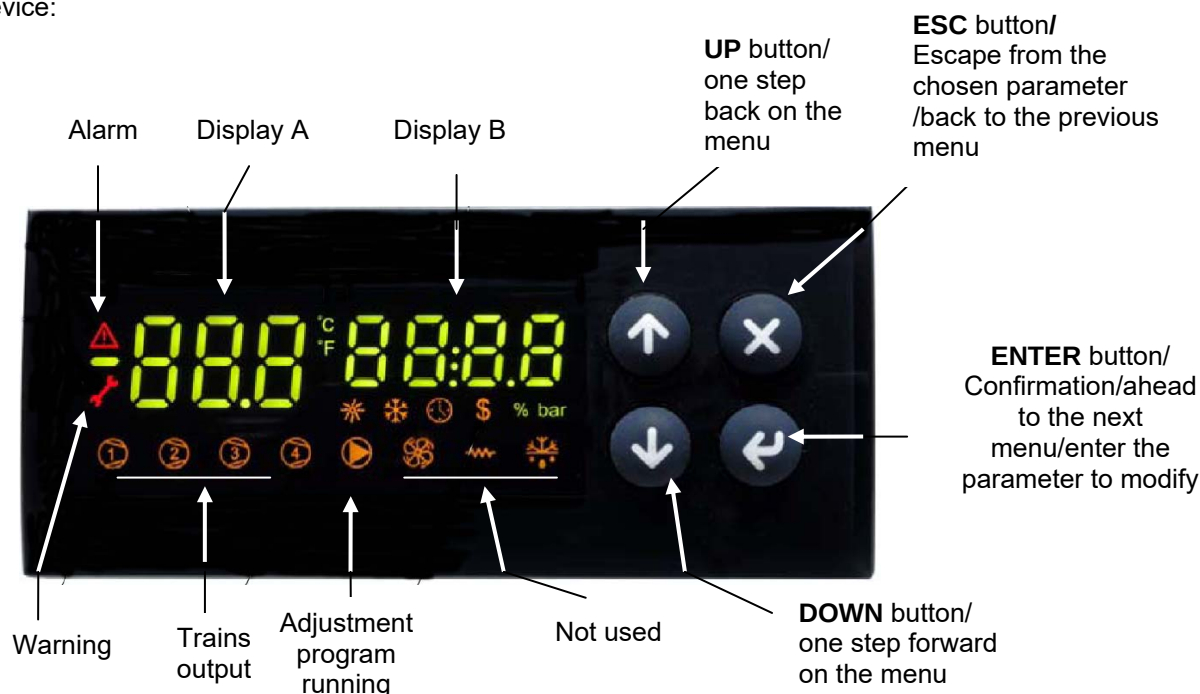
When set-point **trS** is got to, output number 5 is ON (terminals C5-NO5) linked to the relais KTRS. It switches the resistors off and activates an alarm on the device.

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

See below the set-point recommended figures.

#### User interface:

Device:

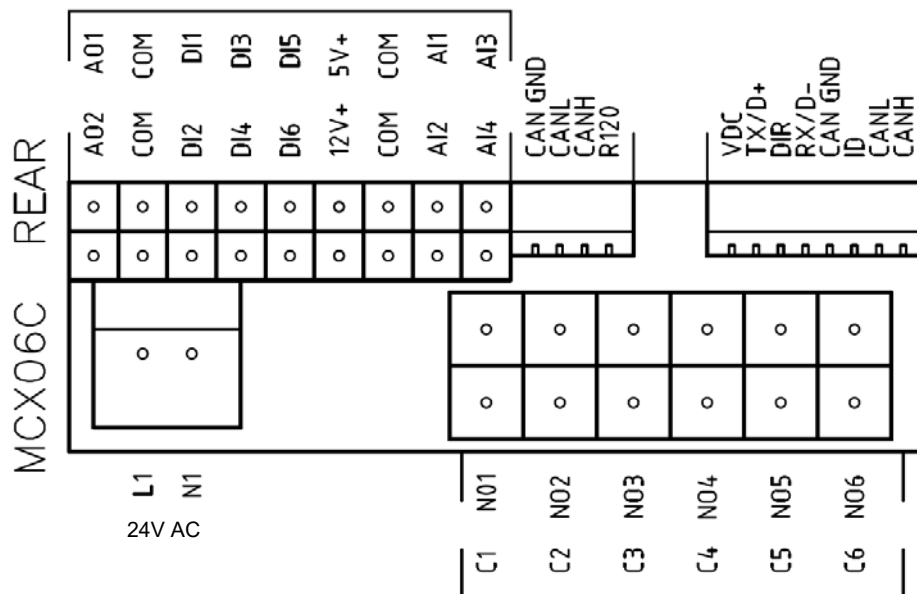


#### Note :

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

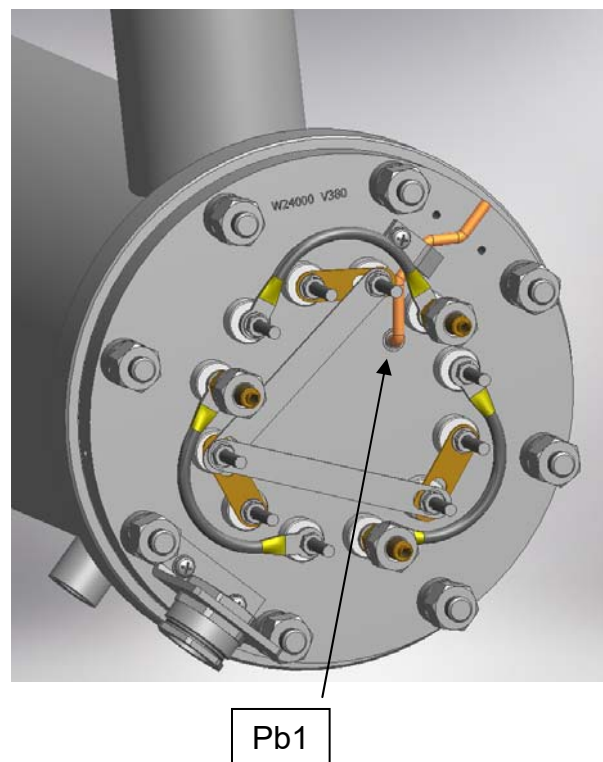
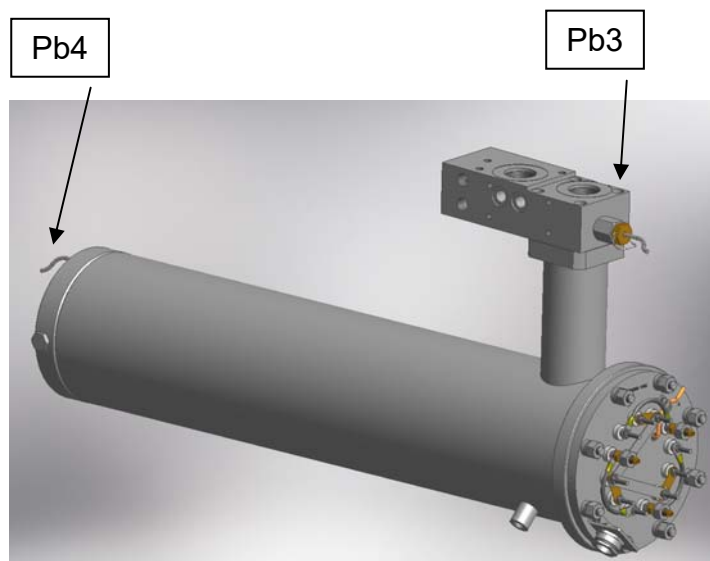
In normal operation, the display B shows the oil output temperature (probe Pb3).

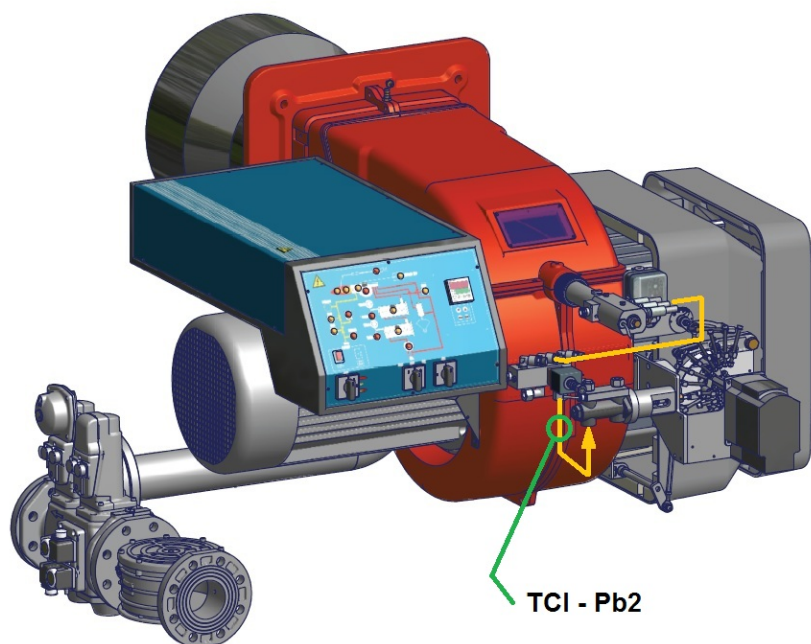
## Connections from terminal side :



## Probe connection:

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





(tCI - Pb2 probe only for mechanical atomizing burners)

#### Menu :

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

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

#### Login:

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

Without password, only set-points can be modified.

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

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

submenu **CnF** - configuration parameters group :

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

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

Submenu **REG** – regulation parameters group :

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

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

### Alarms & Warning:

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

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

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

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

### Set point adjustment:

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

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

Here below recommended set points:

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

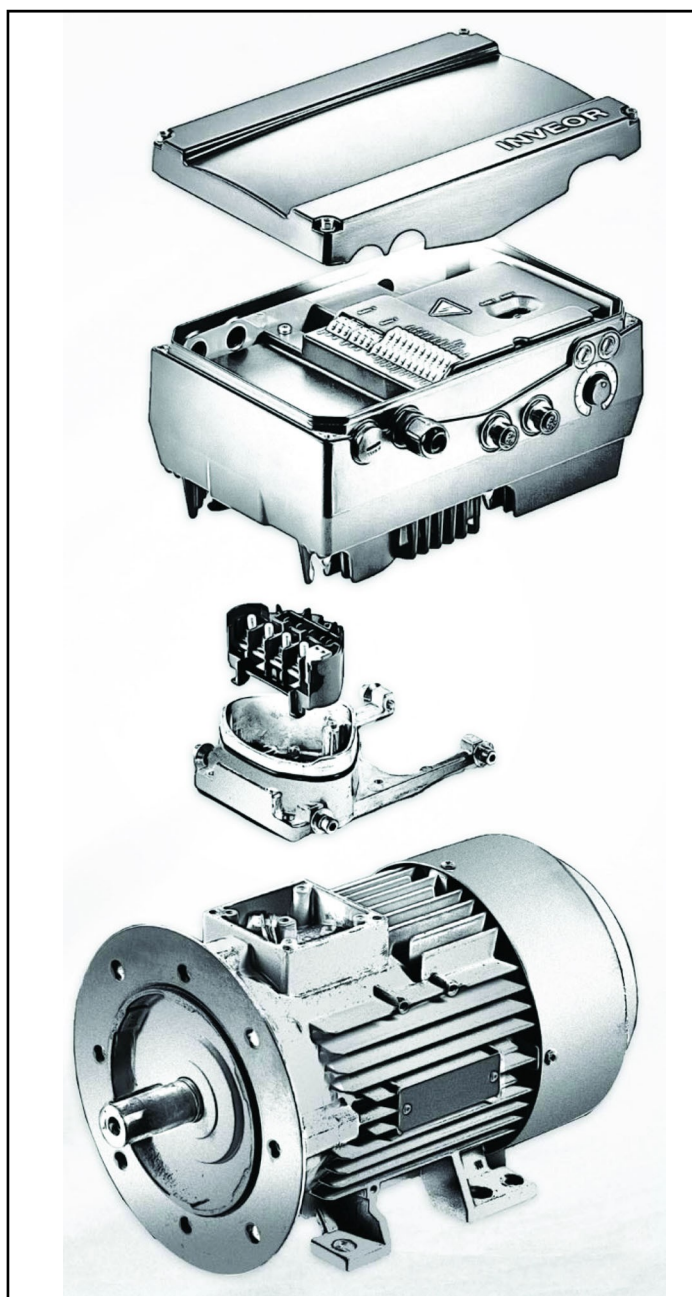
The above temperature values are suggested and refer to a plant designed according to the prescriptions in the burner user manual.

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

# KOSTAL INVERTER

Connection and programming  
for electronically controlled burners with

**LMV2x/3x, LMV5x, ETAMATIC  
and INVERTER regulation**



**Service Manual  
TECHNICAL  
INSTRUCTIONS**

---

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## IDENTIFICAZIONE INVERTER

**INVEOR Mx IVxx PWxx LPxx APxx GHxx DKxx COxx 1**

1 2 3 4 5 6 7 8 9 10

|          | Key                                                                                                                            | Key                                                                                           |
|----------|--------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| <b>1</b> | Drive controller series: INVEOR                                                                                                | <b>6</b> Application circuit board:<br>AP12 - Standard<br>AP13 - CANopen                      |
| <b>2</b> | Installation location/size: motor-integrated - M, size: α, A, B, C, D                                                          | <b>7</b> Control:<br>DK01 - Standard (without membrane keypad)<br>DK04 – With membrane keypad |
| <b>3</b> | Input voltage<br>: IV02 - 230 V                                                                                                | <b>8</b> Housing<br>:<br>GH10 – standard heat sink (black painted)                            |
| <b>4</b> | Recommended motor rating<br>:<br>kW: 0.55; 0.75; 1.1; 1.5; 2.2; 3.0; 4.0; 5.5; 7.5; 11.0; 15.0; 18.5; 22.0                     | <b>9</b> Firmware version<br>:<br>CO00 - Standard<br>CO01 - Specific                          |
| <b>5</b> | Printed circuit boards<br>:<br>LP01 / LP03 – Standard (without brake chopper);<br>LP02 / LP04 – Standard (with brake chopper); | <b>10</b> Equipment generation: 1 – current version                                           |

The **LMV5x** device controls fan motor rpm via a sensor and commands it via the inverter with a **4÷20mA** signal.

The **LMV3x/LMV2x** device controls fan motor rpm via a sensor and commands it via the inverter with a **0÷10V** signal.

Generally, the inverter curve goes from 50% to 100% of motor rpm. As well as improving burner regulation, this allows for a saving in terms of fan motor consumption.

## INVEOR M INVERTER SIZES

**TAGLIE  
INVERTER INVEOR M...**



**α**



**A**



**B**



**C**



**D**

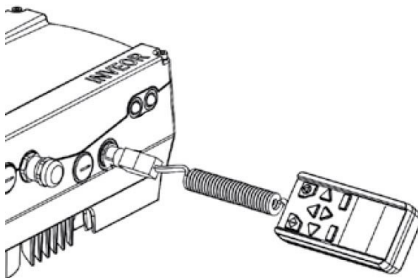
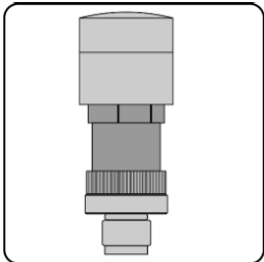
## User interface

### COMMUNICATION (on request)

The drive controller can be put in operation in the following ways:



**Attention:** Contact the manufacturer to order the most suitable device.

|                                                                                                                                                                                                                                                                                |                                                                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| <b>USB adaptor for PC</b>                                                                                                                                                                                                                                                      |                                                                                       |
| <b>Via the INVERTER PC software</b>                                                                                                                                                                                                                                            |                                                                                       |
|                                                                                                                                                                                                                                                                                |    |
| <b>INVEOR MMI remote display:</b>                                                                                                                                                                                                                                              |                                                                                       |
| <p>INVEOR MMI is a portable display on which all inverter parameters can be viewed and changed. Manual available on the KOSTAL website.</p>                                                                                                                                    |   |
| <b>Bluetooth connection:</b>                                                                                                                                                                                                                                                   |                                                                                       |
| <p>Using the Bluetooth adaptor you can connect via app from any device. Download the app for Android / iOS from the Google Play Store / App Store.</p>                                                                                                                         |  |
| <p>The Bluetooth adaptor is required to create a Bluetooth connection with the inverter. To view and change the inverter parameters, use an external interface device – tablet or mobile phone. Download the app for Android / iOS from the Google Play Store / App Store.</p> |  |

## ELECTRICAL CONNECTIONS

### Motor connection variants for INVERTERS sizes A, B and C

Star or delta connection for speed controller integrated on the motor

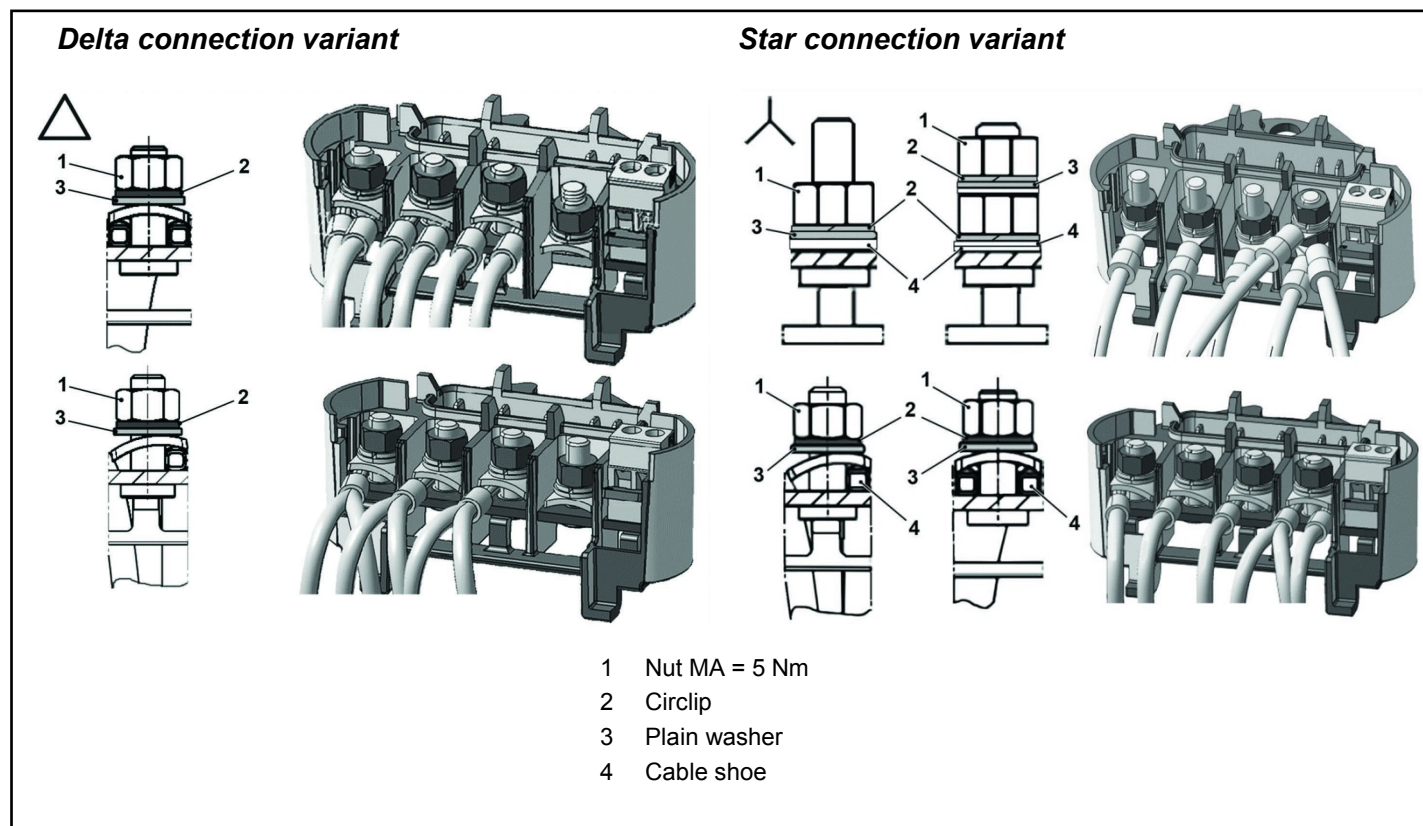
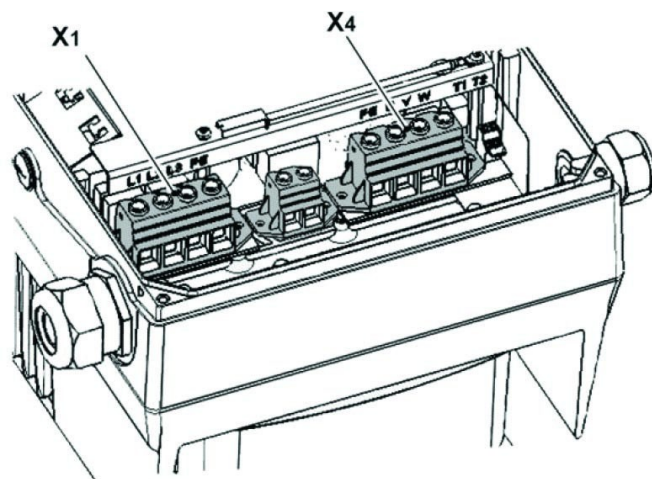


Fig. 1

## Motor connection variants for INVERTER size D



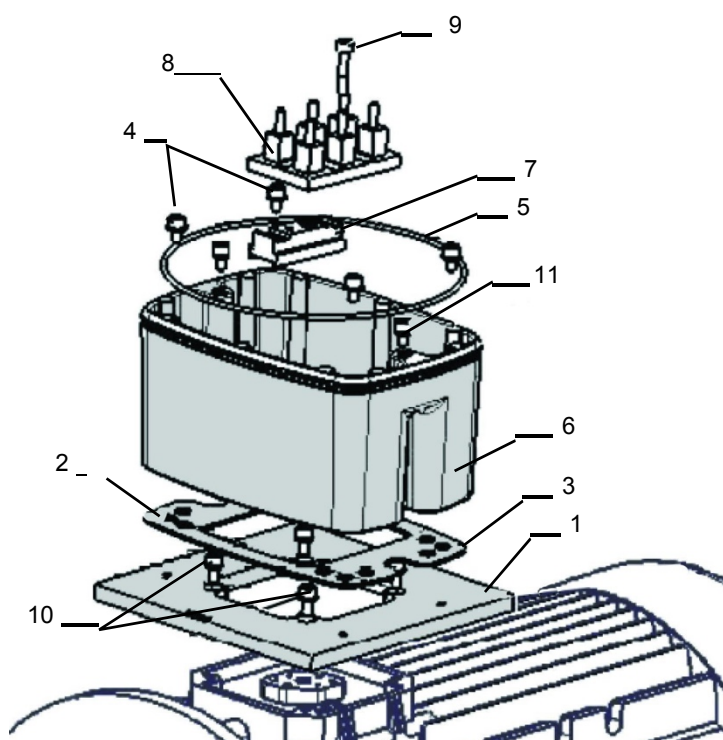
| X1 terminal no. | Designation | Assignment           |
|-----------------|-------------|----------------------|
| 1               | L1          | Mains phase 1        |
| 2               | L2          | Mains phase 2        |
| 3               | L3          | Mains phase 3        |
| 4               | PE          | Protective conductor |

Tab. 1 - X1 terminal assignment - 3 x 400 VAC

| X4 terminal no. | Designation | Assignment           |
|-----------------|-------------|----------------------|
| 1               | PE          | Protective conductor |
| 2               | U           | Mains phase 1        |
| 3               | V           | Mains phase 2        |
| 4               | W           | Mains phase 3        |

Tab. 2 - X1 terminal assignment - 3 x 400 VAC

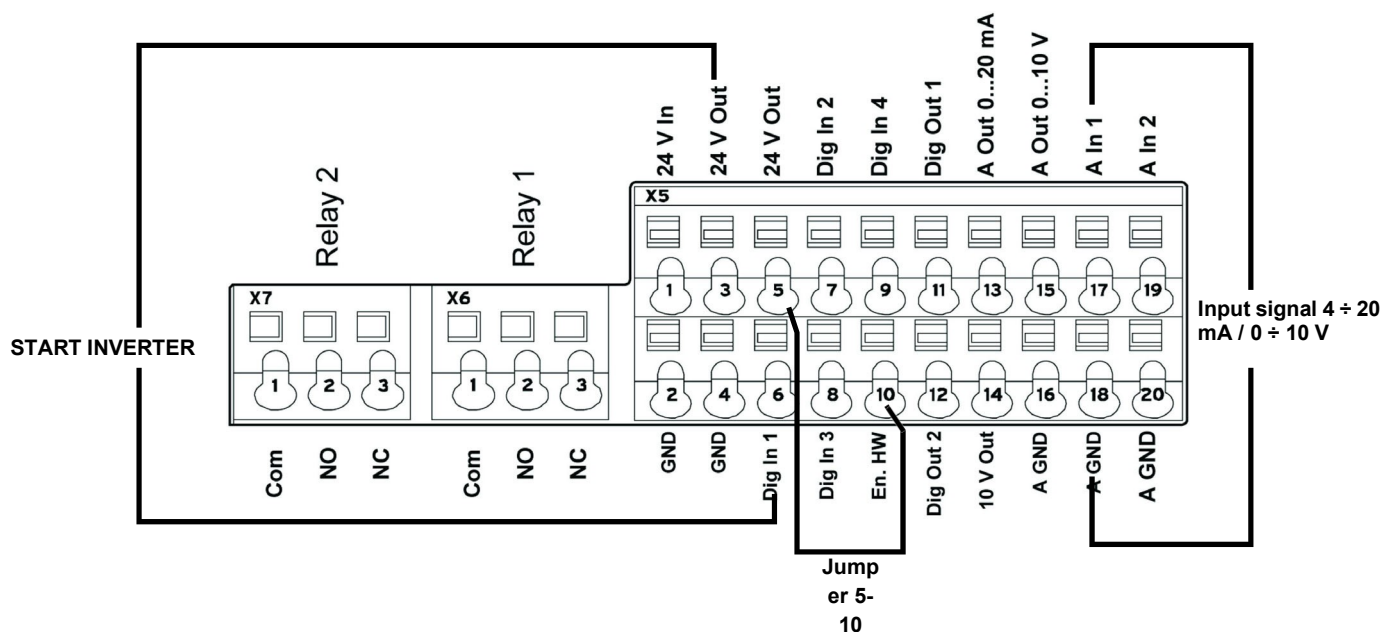
Fig. 2 – Assembly sequence: Connection box – adapter plate size D



### Key:

- 1 Adapter plate option (variant)
- 2 Holes depending on motor
- 3 Seal
- 4 Retaining bolts with spring elements
- 5 O-ring seal
- 6 INVEOR / adapter plate support
- 7 Terminal heightening option
- 8 Original terminal (not included)
- 9 Extended screw option (for pos.7)
- 10 Retaining bolts with spring elements option
- 11 INVEOR/support retaining bolts

## Connection of INVERTER signals and commands

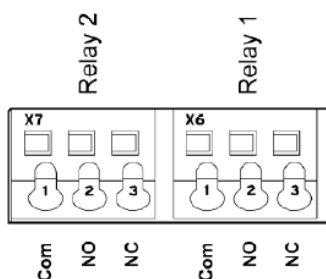


## Electrical connections and parameter configuration

There are 2 relays on the INVERTER. Connecting terminals X7-1-2-3 and X6-1-2-3 are used for:

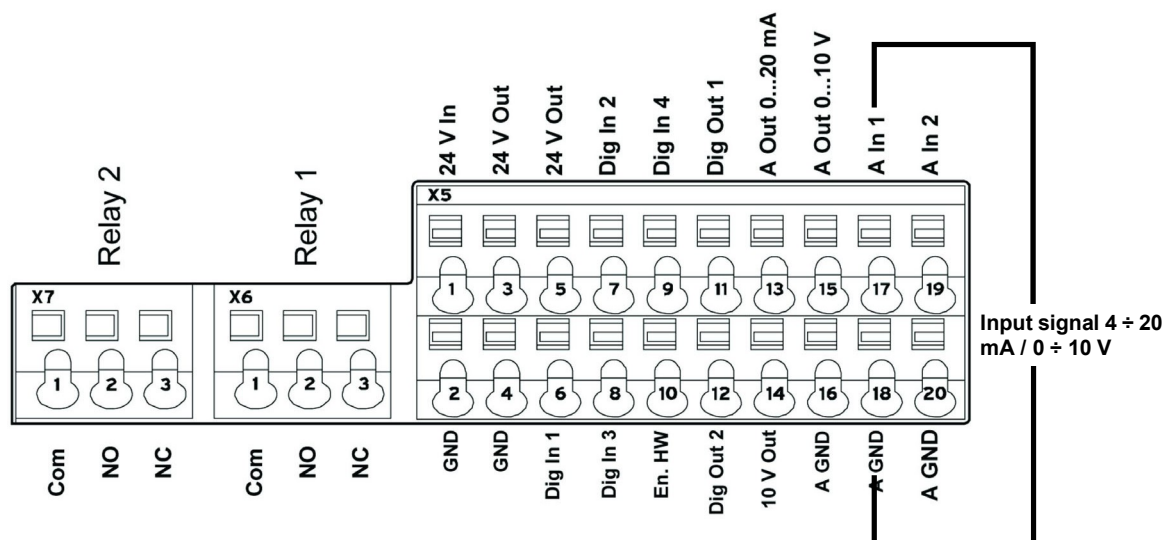
**LMV2/3x:** Relay 1 is used as a safety contact on the safety loop series of the equipment. Relay 2 is used as a fault indicator on the burner panel front.

**LMV5x / ETAMATIC:** Relay 1 is used as a contact for control of fan motor start. Relay 2 is used as a fault indicator of the INVERTER to the LMV5x / ETAMATIC equipment.



| Parameter |                          |                                                                                                                                                                      |
|-----------|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.181     | Automatic reset function | Automatic reset of faults.<br>The INVERTER resets the fault after the set time.<br><b>Set value = 30 seconds</b>                                                     |
| 1.182     | Automatic reset numbers  | With the reset function the maximum number of automatic resets can be limited.<br><b>Set value = 0 (maximum number of automatic resets)</b>                          |
| 4.190     | Relay 1 functions        | Select the operating mode of relay 1.<br><b>Set value = LMV2x/3x..= 11 (NC inverted error)</b><br><b>Set value = LMV5x / ETAMATIC = 19 (motor is in NO function)</b> |
| 4.210     | Relay 2 functions        | Select the operating mode of relay 2.<br><b>Set value = LMV2x/3x..= 11 (NC inverted error)</b><br><b>Set value = LMV5x / ETAMATIC = 11 (NC inverted error)</b>       |
| 4.210     | V O operation            | <b>Set value = 10 (NO error)</b>                                                                                                                                     |

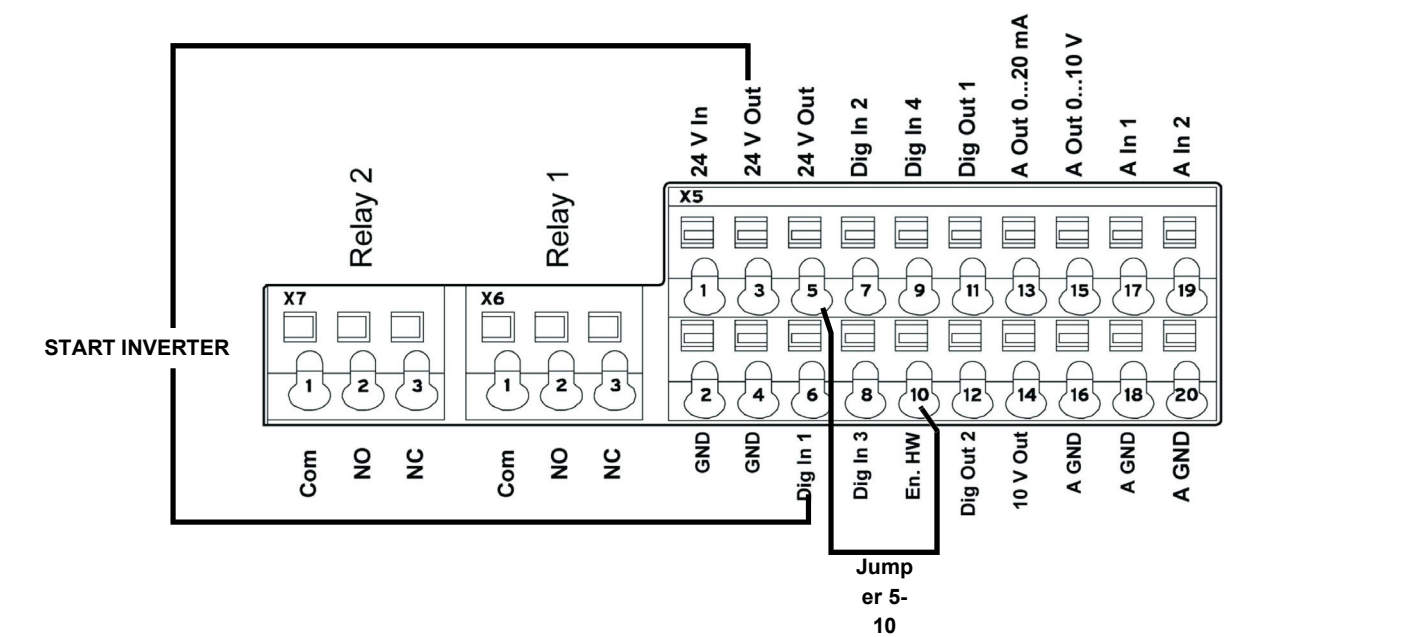
## 0-10V / 4-20mA analogue input configuration



Input AI1 can be configured as voltage or current input. It is configured as 4-20mA input current for LMV5-Etamatic, and 0-10V input voltage for LMV2x/3x.

|       |                           |                                                                                                                                                                                                                                 |
|-------|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4.020 | Input type AI1            | Specifies the input type, whether voltage or current.<br><b>1=</b> Voltage input 0-10V (LMV2x/3x)<br><b>2=</b> Current input 0/4-20mA (LMV5 ETAMATIC)                                                                           |
| 4.021 | AI1 Standard low          | Specifies the minimum value of the analogue input as a percentage of the range.<br>E.g.:<br>0...10 V or 0...20 mA = 0 %...100 %<br>2...10 V or 4...20 mA = 20 %...100 %<br><b>Set value = 20% for LMV2x/3x, LMV5x, ETAMATIC</b> |
| 4.022 | AI1 Standard high         | Specifies the maximum value of the analogue input as a percentage of the range at 10V or 20mA.<br><b>Set value = 100%</b>                                                                                                       |
| 4.023 | AI1 Response time         | Specifies the deadband on the input signal.<br><b>Set value = 1%</b>                                                                                                                                                            |
| 4.024 | AI1 Filter time           | An input change is taken into consideration after this time. If it is too short, a wire break error may appear if the 4-20 mA signal goes to 0 for a short time.<br><b>Set value = 4 seconds</b>                                |
| 4.030 | AI1 Input function        | Specifies whether the input is 0 = analogue / 1 = digital input.<br><b>Set value = 0 analogue</b>                                                                                                                               |
| 4.033 | AI1 Measure unit, input 1 | Specifies the unit of measurement of input 1.<br><b>Set value = 0 (%)</b>                                                                                                                                                       |
| 4.034 | AI1 Lower limit           | Specifies the lower limit of input 1.<br><b>Set value = 0 (%)</b>                                                                                                                                                               |
| 4.035 | AI1 Upper limit           | Specifies the upper limit of input 1.<br><b>Set value = 100 (%)</b>                                                                                                                                                             |
| 4.036 | AI1 Wire break time, 5s   | Specifies the time after which the fault appears if input AI1 is interrupted (wire break).<br><b>Set value = 5 seconds</b>                                                                                                      |
| 4.037 | AI1 Inversion             | Inverts the signal of input 1.<br><b>Set value = 0 (disabled)</b>                                                                                                                                                               |

Configuration of control contact / INVERTER starting and stopping



| Terminal                                        |                                                                                                                                                                                   |
|-------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| X5-3 (24V Out)... X5-6 (Digit In1)..            | Bringing 24V to terminal <b>X5-6</b> enables INVERTER operation and the contact that switches it on/off.<br>On LMV2/3x <b>X5-3</b> (24V Out) also powers the motor speed encoder. |
| X5-5 (24V Out) connected with X5-10 ( En.HW)... | Required to enable braking ramp xxxx                                                                                                                                              |

## Configuration of INVERTER start / stop parameters and operating mode

| Parameter |                               |                                                                                                                                                                                                                                                                                                  |
|-----------|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.020     | Min. frequency (Hz)           | Minimum input frequency in Hz.<br><b>Set value = 0 Hz (LMV2x-3x / LMV5x)</b><br><b>Set value = &gt; 35 Hz (ETAMATIC)</b>                                                                                                                                                                         |
| 1.021     | Max. frequency (Hz)           | Maximum input frequency in Hz.<br><b>Set value = 51,5 Hz (LMV2x-3x / LMV5x)</b><br><b>Set value = 50 Hz (ETAMATIC)</b>                                                                                                                                                                           |
| 1.050     | Ramp 1<br>Braking time 1      | Braking time at switch-off to reach the speed of 0 Hz after the start/stop contact has opened (not used).<br><b>Set value = 10 seconds</b>                                                                                                                                                       |
| 1.051     | Ramp 1<br>Acceleration time 1 | Acceleration time 1 is the time necessary for the drive controller to accelerate from 0 Hz to maximum frequency (not used).<br><b>Set value = 10 seconds</b>                                                                                                                                     |
| 1.052     | Ramp 2<br>Braking time 2      | Braking time at switch-off to reach the speed of 0 Hz after the start/stop contact has opened.<br><b>Set value = 10 seconds</b>                                                                                                                                                                  |
| 1.053     | Ramp 2<br>Acceleration time 2 | Acceleration time 2 is the time necessary for the drive controller to accelerate from 0 Hz to maximum frequency.<br><b>Set value = 10 seconds</b>                                                                                                                                                |
| 1.054     | Selects ramp used             | Digital input 1 ( <b>dig In1 / X5-6</b> ) selects the ramp used.<br><b>Set value = 1 (parameters 1.052 and 1.053)</b>                                                                                                                                                                            |
| 1.088     | Quick stop                    | Not used but set.<br><b>Set value = 10 seconds</b>                                                                                                                                                                                                                                               |
| 1.100     | Operating mode                | Frequency control mode: specifies the operating mode of the INVERTER. In our case it is always frequency control (0).<br><b>Set value = 0</b>                                                                                                                                                    |
| 1.130     | Reference set point           | Determines the source from which the reference value is read.<br>In our case it is always analogue input AI1.<br><b>Set value = 1 (analogue input 1)</b>                                                                                                                                         |
| 1.131     | Enabling software             | Depending on the change made, the motor may start immediately.<br>Selection of the source for enabling control.<br><b>Set value = 0</b>                                                                                                                                                          |
| 1.132     | Start-up protection           | Selection of behaviour in response to enabling software.<br><b>Set value = 1</b><br><b>(Start only with rising edge at input of control enable)</b>                                                                                                                                              |
| 1.150     | Motor rotation direction      | Do not change this parameter. To invert the direction of rotation, invert 2 of the 3 INVERTER / MOTOR cabling wires, so that the INVERTERS always have the same setting.<br><b>Set value = 1 forwards only / clockwise rotation</b><br><b>(no changes to direction of rotation are possible)</b> |

## Motor data

The motor data depend on the type of motor used. Refer to the data shown on the motor nameplate. Follow the steps below:

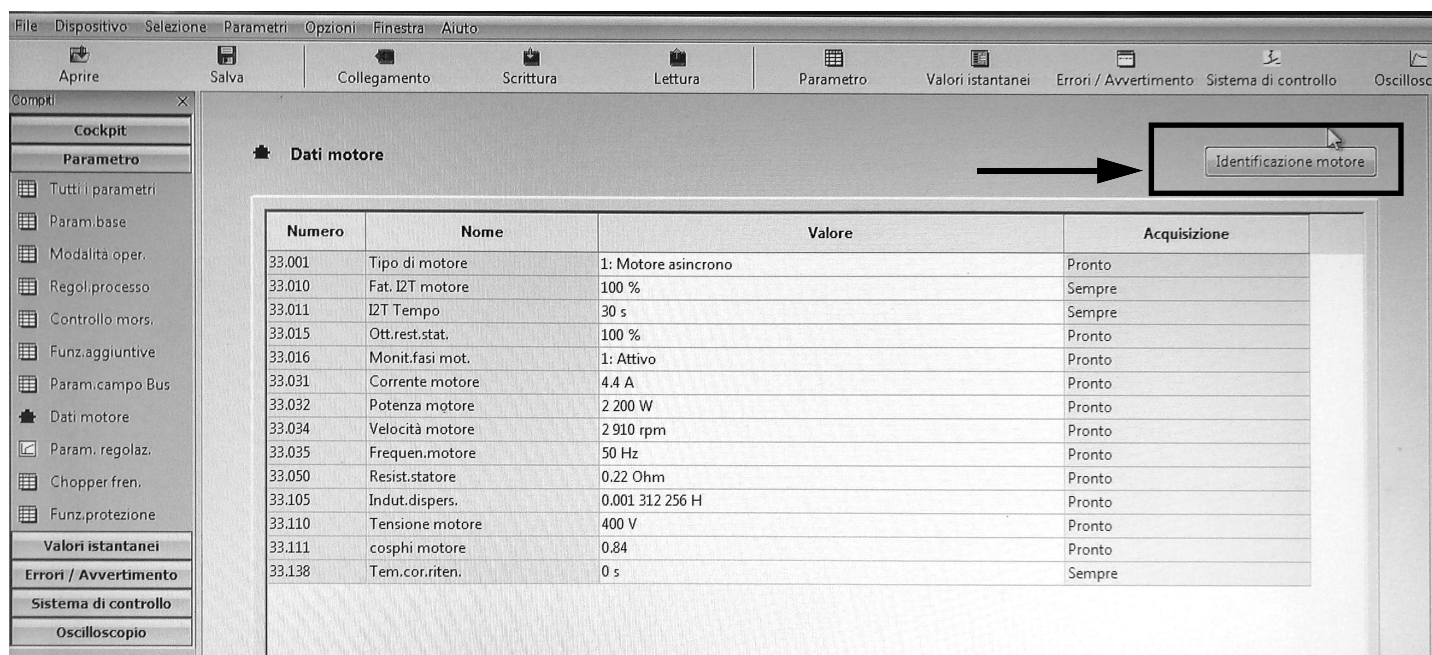
- Enter the motor data;
- Activate the motor recognition function;
- If the operation ends successfully, enter the remaining parameters.

During the recognition phase, the INVERTER measures some parameters and changes some settings.

N.B.: At each start-up of the recognition programme, recheck all the parameters in this manual.

| Parameter |                               |                                                                                                                                                                                                                        |
|-----------|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 33.001    | Motor type                    | Selection of motor type.<br><b>Set value = 1 (asynchronous motor)</b>                                                                                                                                                  |
| 33.010    | Motor I <sup>2</sup> t factor | Not used. Only for encoders.<br><b>Set value = 100%</b>                                                                                                                                                                |
| 33.011    | I <sup>2</sup> t time         | Not used. Only for encoders<br><b>Set value = 30 seconds</b>                                                                                                                                                           |
| 33.015    | R optimisation                | If necessary, this parameter can be used to optimise the start-up behaviour.<br>Not used<br><b>Set value = 100%</b>                                                                                                    |
| 33.016    | Motor phase control           | The "Motor connection interrupted" error monitoring (error 45) can be enabled/disabled with this parameter.<br><b>Set value = 1 (enabled control)</b>                                                                  |
| 33.031    | Motor current                 | Maximum motor current.<br><b>Set value = motor nameplate current value in amps</b>                                                                                                                                     |
| 33.032    | Motor rating                  | Motor shaft rating.<br><b>Set value = motor nameplate rating value in watts</b>                                                                                                                                        |
| 33.034    | Motor rpm                     | Motor rpm.<br><b>Set value = motor nameplate speed in rpm</b>                                                                                                                                                          |
| 33.035    | Motor frequency               | Nominal motor frequency.<br><b>Set value = motor nameplate frequency in Hz</b>                                                                                                                                         |
| 33.050    | Stator resistance             | Recognised by INVERTER.<br><b>Set value = automatically detected, value in Ohm</b>                                                                                                                                     |
| 33.105    | Leakage inductance            | Recognised by INVERTER.<br><b>Set value = automatically detected, value in henry</b>                                                                                                                                   |
| 33.110    | Motor voltage                 | Nominal motor voltage.<br><b>Set value = 400V</b>                                                                                                                                                                      |
| 33.111    | Motor cos phi                 | Data on motor nameplate.<br><b>Set value = 0,xx</b>                                                                                                                                                                    |
| 33.138    | Holding current time          | Needed to stop the motor!! After braking it is held at continuous current for a specified time interval. Ensure that there is no overheating in this phase. Recommended time: max 5 s.<br><b>Set value = 0 seconds</b> |

Activate the “Motor identification” function and follow the instructions proposed by the INVERTER, then change the parameters described below. The image shows the software screen on the PC.



| Parameter |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-----------|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 34.010    | Control type        | Open-loop asynchronous motor.<br><b>Set value = 100 (open-loop asynchronous motor)</b>                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 34.020    | Flying restart      | <b>Set value = 1 (enabled)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 34.021    | Flying restart time | Calculated by Inverter.<br><b>Set value = value calculated by INVERTER in ms</b>                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 34.090    | Speed controller Kp | Calculated by the inverter during the motor recognition phase. Reset it to 2000 after motor recognition.<br><b>Set value = 2000 mA/rad/sec</b>                                                                                                                                                                                                                                                                                                                                                                |
| 34.091    | Speed controller Tn | Calculated by the inverter during the motor recognition phase. Reset it to 7.5 seconds after motor recognition.<br><b>Set value = 7.5 seconds</b>                                                                                                                                                                                                                                                                                                                                                             |
| 34.110    | Slip trimmer        | If set to <b>1</b> the function is enabled.<br>If set to <b>0</b> the motor performs as if connected to the mains.<br>If compensation is enabled, the system aligns the stator frequency with the rotor. As a result, the actual motor rpm increase and are brought in line with the theoretical motor nameplate rpm. The motor is supplied with the same voltage and frequency, but the current increases and the rpm are brought to the nameplate data.<br><b>Set value = 1 (compensation for slippage)</b> |

### Output signal variant for reading motor rpm (optional)

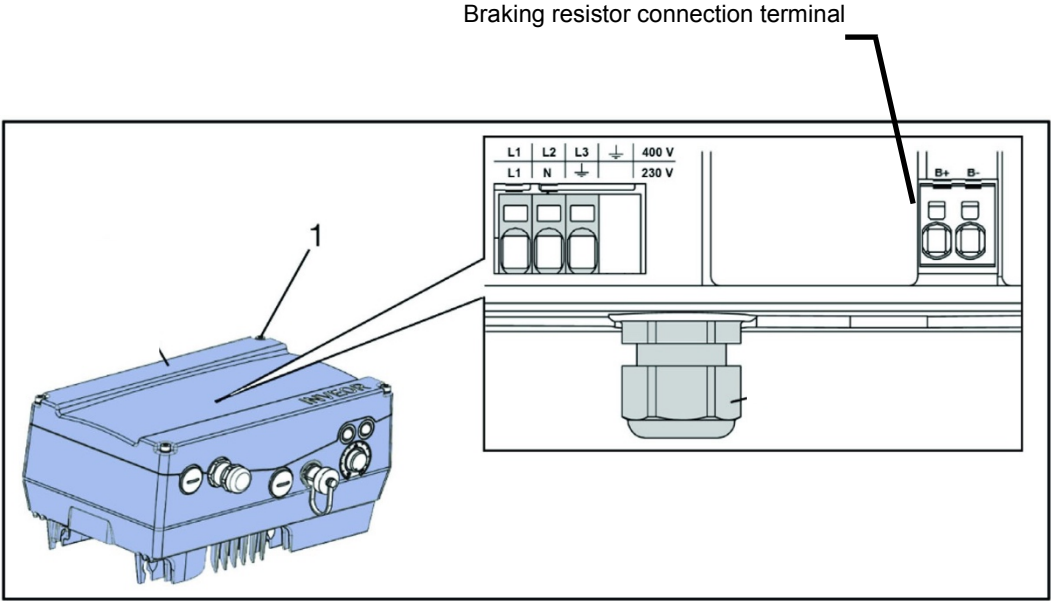
To have a 4-20 mA analogue output that indicates the motor rpm to the terminals X5-13 (Aout 0-20 mA) and X5-16 (A GND), set the parameters below:

| Parameter |                                      |                                                                                                                                                                                                                                                                                                                                                            |
|-----------|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4.100     | Analogue output AO1                  | Selection of analogue output options.<br>In our case, to have an output proportional to the rpm, set 19.<br><b>Set value = 19 (actual rpm)</b>                                                                                                                                                                                                             |
| 4.101     | Minimum value of analogue output AO1 | Output signal at 0-20 mA.<br>To obtain a 4-20 mA signal with (4 mA = 0 motor rpm), follow the example: if motor rpm are a maximum 2900, calculate:<br>$2900 / 20 \times 4 = 580$ , which is the negative value corresponding to 0 mA from which to start.<br>Therefore:<br>0 mA = - 580,<br>20 mA = 2900<br><b>Set value = - xxx (-580 in the example)</b> |
| 4.102     | Maximum value of analogue output AO1 | Maximum rpm value for 20 mA.<br><b>Set value = xxxx (2900 in the above example)</b>                                                                                                                                                                                                                                                                        |

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>NOTE 1</b> | If the system enters pendulum mode with LMV.. / ETAMATIC, adjust parameters <b>34.090</b> and <b>34.091</b> by increasing them, in particular parameter <b>34.090</b> , in steps of 100mA/rad/sec.                                                                                                                                                                                                                                                                                                                        |
| <b>NOTE 2</b> | With LMV 2x/3x with INVERTER control, the device controls the standby rpm with <b>param. 653</b> .<br>If, after the fan is switched off, the device LMV 2x/3x sees that the motor continues to run, error <b>83</b> diagnostic <b>32</b> appears. This occurs if there is significant fan inertia (e.g. on burners with very heavy forward curved blades), then always disable parameter 653, setting it to <b>0</b> .                                                                                                    |
| <b>NOTE 3</b> | With LMV 2x/3x the signal 0-10V for motor rpm control during standardisation is brought to approximately 9.7 V and the fan motor rpm is saved.<br>According to the LMV manual, the INVERTER should be set to max 52.5 Hz<br>During standardisation, the INVERTER is driven at approximately 51 ÷ 51.5 Hz and may go out of absorption range with the motor.<br>For this reason, set the INVERTER to max 51.5 Hz.<br>During standardisation, the INVERTER will reach 50Hz and the over-absorption problem will be reduced. |
| <b>NOTE 4</b> | If the <u>analogue wire break fault</u> is displayed on the INVERTER and the 4-20 mA inverter signal continues to oscillate between 1 ÷ 6 mA, it does not always mean that the LMV 2x/3x or ETAMATIC equipment is faulty. It could be due to the old firmware of the INVERTER and should therefore be updated. If this is the case, contact the Service Centre.                                                                                                                                                           |

| FAULTS / PROBLEMS.. SOLUTIONS |                                         |                                                                                                                                                                                                     |
|-------------------------------|-----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Parameter 36.020</b>       | If error 36 appears                     | Problems detected in the mains supply. By setting this parameter to 0, the INVERTER no longer checks the mains and the error message disappears. It is recommended to leave the parameter set to 1. |
| <b>Parameter 33.105</b>       | If mains voltage drops during operation | When the mains voltage drops, the INVERTER decreases the motor rpm.<br>To reduce this change, set the parameter to 0, which should solve the problem.                                               |

Brake chopper connections



Brake chopper connections

| Terminal no. | Designation | Assignment                      |
|--------------|-------------|---------------------------------|
| 1            | B+          | Braking resistor connection (+) |
| 2            | B-          | Braking resistor connection (-) |

Optional assignment of brake chopper

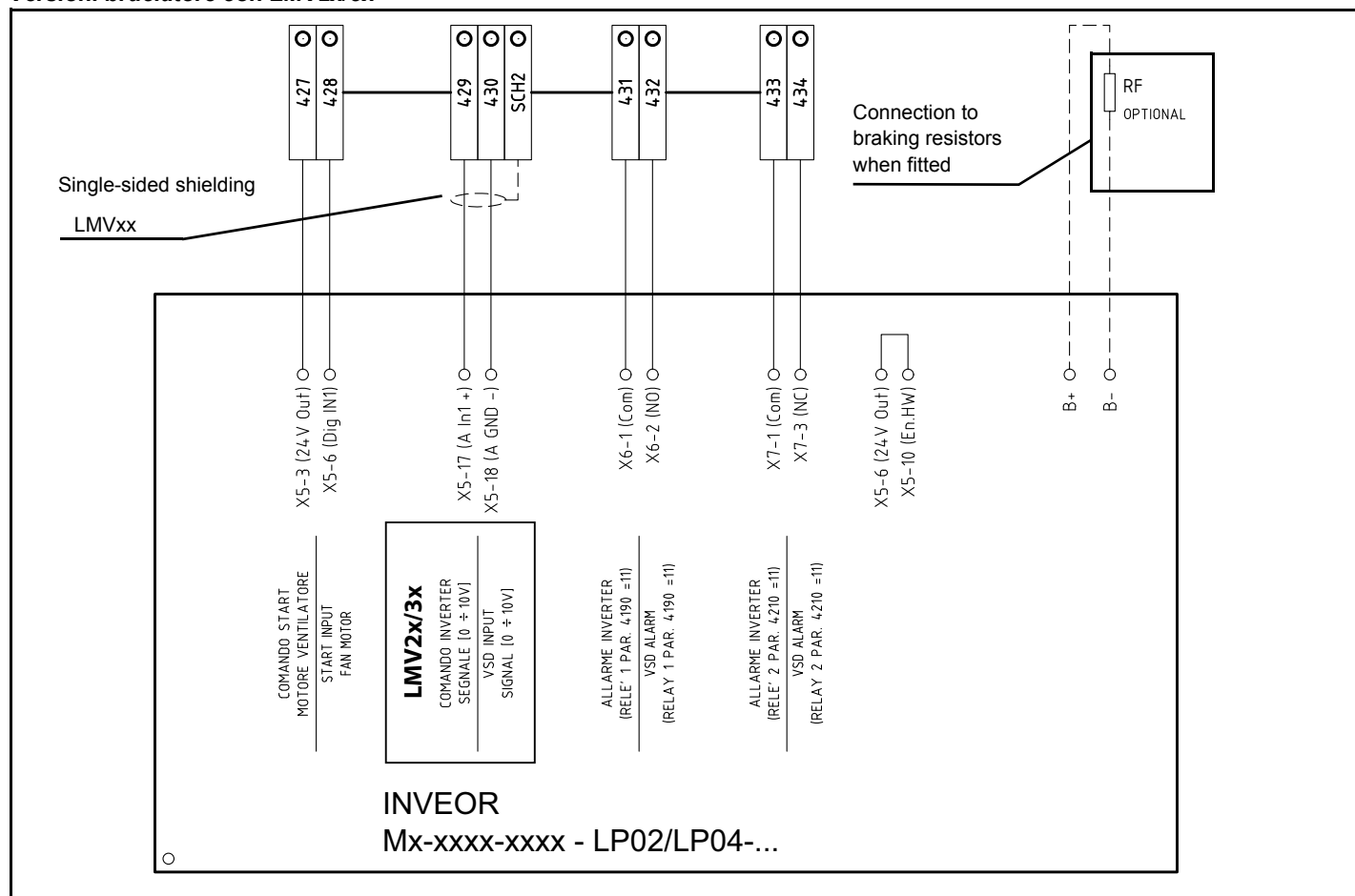
| Parameter        |                     |
|------------------|---------------------|
| Braking resistor | Enabled or disabled |

Braking resistors

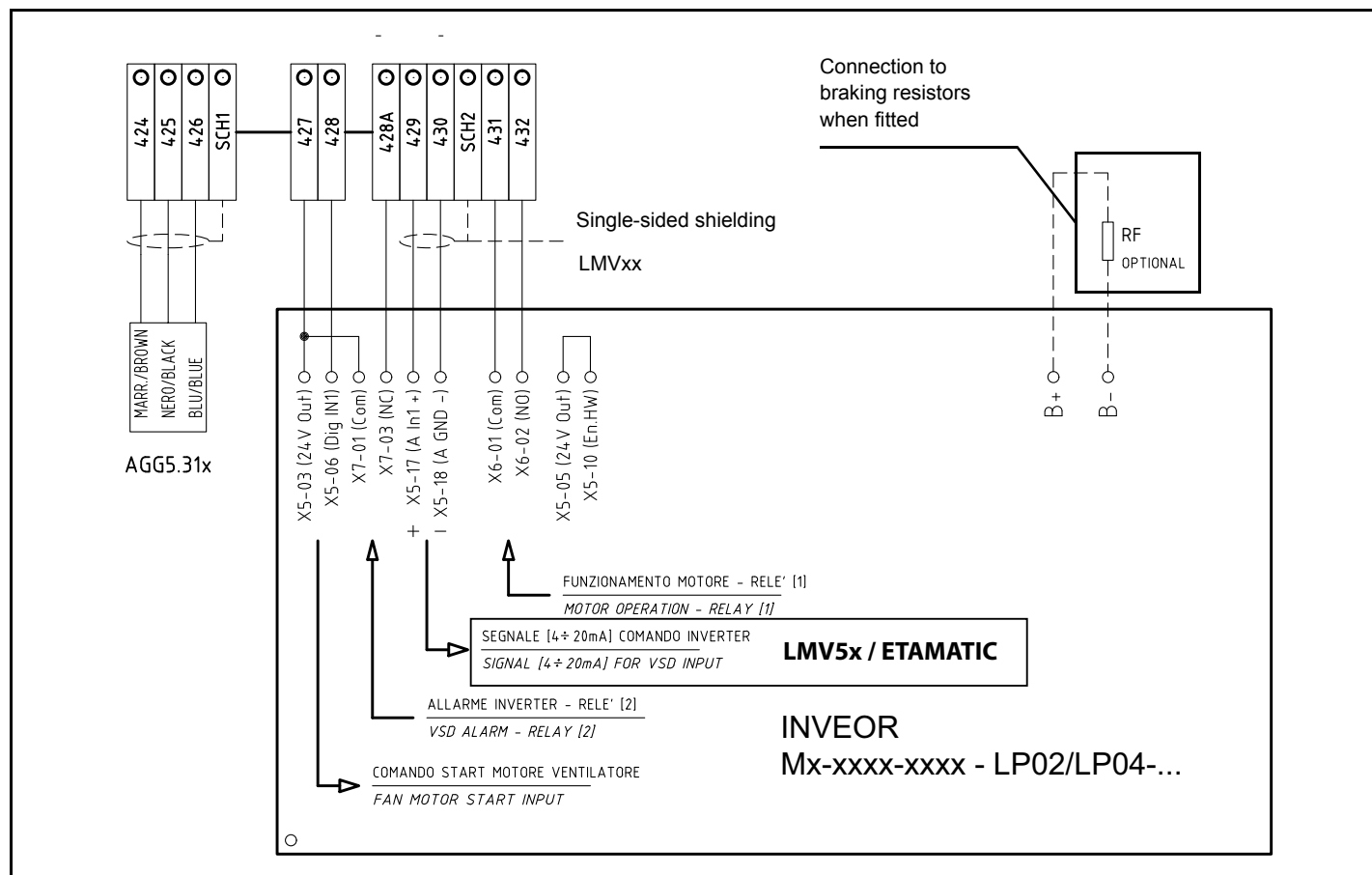


## Burner terminal block with interface INVERTER

### Versioni bruciatore con LMV2x/3x



### Versioni bruciatore con LMV5x o ETAMATIC





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