FRX2050

HAGC31-CU01

Microprocessor controlled

Gas burners

MANUAL OF INSTALLATION - USE - MAINTENANCE

BURNERS - BRUCIATORI - BRULERS - BRENNER - QUEMADORES - ГОРЕЛКИ

M039614CA 0.3 08/2023

DANGERS, WARNINGS AND NOTES OF CAUTION

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

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

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

CAREFULLY KEEP THIS MANUAL FOR FUTURE REFERENCE.

1) GENERAL INTRODUCTION

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

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

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

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

Contact qualified personnel only.

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

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

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

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

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

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

2) SPECIAL INSTRUCTIONS FOR BURNERS

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

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

a Remove the power supply by disconnecting the power cord from the mains.

b Disconnect the fuel supply by means of the hand-operated shut-off valve and remove the control handwheels from their spindles.

Special warnings

- Make sure that the burner has, on installation, been firmly secured to the appliance, so that the flame is generated inside the appliance fire-box.
- Before the burner is started and, thereafter, at least once a year, have qualified personnel perform the following operations:

a set the burner fuel flow rate depending on the heat input of the appliance;

b set the flow rate of the combustion-supporting air to obtain a combustion efficiency level at least equal to the lower level required by the regulations in force;

c check the unit operation for proper combustion, to avoid any harmful or polluting unburnt gases in excess of the limits permitted by the regulations in force;

d make sure that control and safety devices are operating properly;

e make sure that exhaust ducts intended to discharge the products of combustion are operating properly;

f on completion of setting and adjustment operations, make sure that all mechanical locking devices of controls have been duly tightened;

g make sure that a copy of the burner use and maintenance instructions is available in the boiler room.

- In case of a burner shut-down, reser the control box by means of the RESET pushbutton. If a second shut-down takes place, call the Technical Service, **without trying to RESET further**.
- The unit shall be operated and serviced by qualified personnel only, in compliance with the regulations in force.

3) GENERAL INSTRUCTIONS DEPENDING ON FUEL USED

3a) ELECTRICAL CONNECTION

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

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

GENERAL

- The burner shall be installed by qualified personnel and in compliance with regulations and provisions in force; wrong installation can cause injuries to people and animals, or damage to property, for which the manufacturer cannot be held liable.
- Before installation, it is recommended that all the fuel supply system pipes be carefully cleaned inside, to remove foreign matter that might impair the burner operation.
- Before the burner is commissioned, qualified personnel should inspect the following:

a the fuel supply system, for proper sealing;
b the fuel flow rate, to make sure that it has been set based on the firing rate required of the burner;
c the burner firing system, to make sure that it is supplied for the designed fuel type;
d the fuel supply pressure, to make sure that it is included in the range shown on the rating plate;
e the fuel supply system, to make sure that the system dimensions are adequate to the burner firing rate, and that the system is equipped with all the safety and control devices required by the regulations in force.

- When the burner is to remain idle for some time, the fuel supply tap or taps should be closed.

SPECIAL INSTRUCTIONS FOR USING GAS

Have qualified personnel inspect the installation to ensure that:

a the gas delivery line and train are in compliance with the regulations and provisions in force;
b all gas connections are tight;
c the boiler room ventilation openings are such that they ensure the air supply flow required by the current regulations, and in any case are sufficient for proper combustion.

- Do not use gas pipes to earth electrical equipment.
- Never leave the burner connected when not in use. Always shut the gas valve off.
- In case of prolonged absence of the user, the main gas delivery valve to the burner should be shut off.

Precautions if you can smell gas

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

- Do not obstruct the ventilation openings of the room where gas appliances are installed, to avoid dangerous conditions such as the development of toxic or explosive mixtures.

DIRECTIVES AND STANDARDS

Gas burners

European directives

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

Harmonized standards

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

Light oil burners

European directives

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

Harmonized standards

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

Heavy oil burners

European Directives

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

Harmonized standards

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

Gas - Light oil burners

European Directives

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

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

Gas - Heavy oil burners

European directives:

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

Harmonized standards

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

Industrial burners

European directives

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

Harmonized standards

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

Burner data plate

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

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

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

SYMBOLS USED

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

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

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

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

BURNER SAFETY

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

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

Residual risks deriving from misuse and prohibitions

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

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

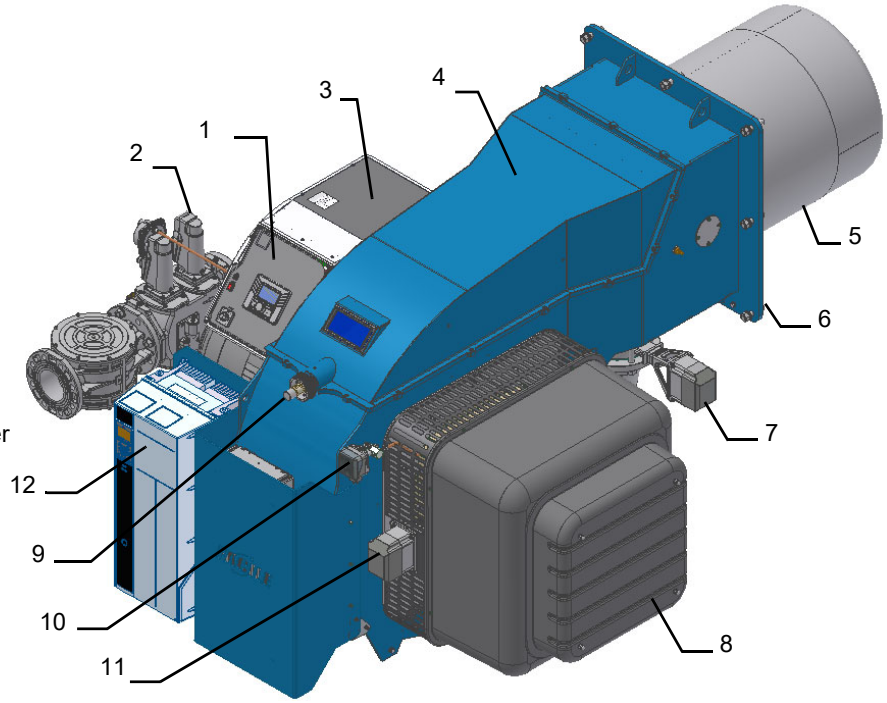
After any maintenance, it is important to restore the protection devices before restarting the machine.
All safety devices must be kept in perfect working order.
Personnel authorized to maintain the machine must always be provided with suitable protections.

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

PART I: SPECIFICATIONS

Note: the figure is indicative only

1 Mimic panel with startup switch
2 Gas valve group
3 Electrical panel
4 Cover
5 Blast tube + Combustion head
6 Flange
7 Actuator
8 Silcencer
9 Head adjusting ring nut
10 Air pressure switch
11 Actuator
12 FB = micro-processor control, with inverter



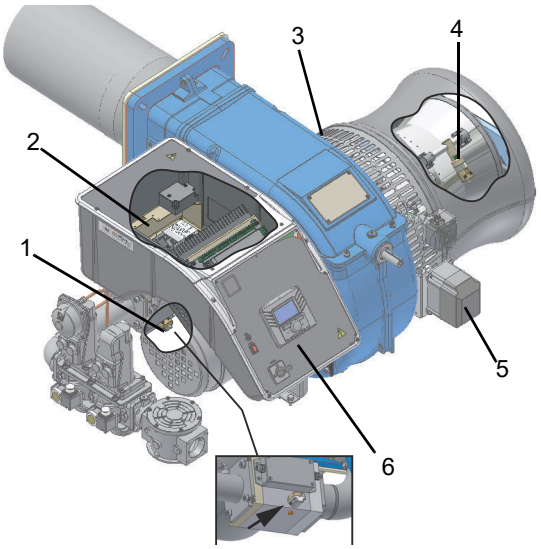
Gas operation: From the supply line the gas fuel passes through the gas train (filter, safety valves, gas pressure regulator and butterfly valve). The pressure regulator sets the gas pressure within the combustion head utilization limits. Air is supplied by a fan, which may be onboard or separated depending on burner configuration, and is channeled through an air damper.

The air damper and the gas butterfly valve are actuated by servomotors according to load curves, in order to achieve the correct proportion between fuel and air flows, and to optimize flue gas parameters.

The adjustable combustion head can improve the burner performance by controlling the flame geometry and combustion efficiency.

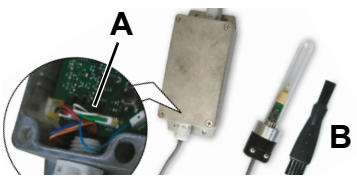
Fuel and air are routed through separated channels inside the combustion head, then mixed to ignite the flame inside the combustion chamber. The ignition spark is provided by electrodes and a high voltage transformer (a pilot flame may also be employed, depending on burner configuration).

Pre-ventilation of the combustion chamber is usually implemented according to gas directives.
The control panel, onboard or separated, allows the operator to monitor each operating phase.



1 1 mass GAS flow sensor which constantly measures GAS flow inside the combustion chamber.NB Insert image of the burners with all the components (see example). Add sensors and actuator.
2 **FACILE unit** Manages all the burner adjustment and safety functions
3 **GAS servomotor, thi**s device acts on the GAS butterfly valve. Its position is calculated by the FACILE flame control device and depends on the power required by the system and the current measurement of the GAS flow sensor
4 **Mass AIR flow sensor which constantly measures AIR flow** inside the combustion chamber.
5 **AIR servomotor,** this device acts on the AIR damper. Its position is calculated by the FACILE flame control device and depends on the quantity of gas measured by the GAS flow sensor.
6 **USER display,** installed on the machine, with which only the non-safety parameters can be varied or changed. With this display it is not possible to adjust or set the AIR/GAS ratio. It is a visual display.

WARNING!
The flow sensors are calibrated and set in **by the manufacturer** according to the burner type, its output and the sampled fluid. Do not disconnect a trerminal (A)
It is therefore not possible to replace the sensors installed on a machine with other sensors intended for measurements on fluids other than those intended.
Periodic quarterly cleaning of the sensor is recommended.
Use a soft bristle brush (B) to clean the sensor



Burner model identification

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

Type	**FRX2050**	Model	**M-.**	**MD.**	**S.**	***.**	**A.**	**1.**	**100.**	**FB.**
	(1)		**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(8)**

1	BURNER TYPE	**FRX2050**
2	FUEL	M - Natural gasTown gas
3	OPERATION	MD - Fully modulating
4	BLAST TUBEBLAST TUBE	SR = Standard blast tube + ABS polymer (silenced) air intake LR = Extended blast tube + ABS polymer (silenced) air intake
5	DESTINATION COUNTRY	* - see data plate
6	BURNER VERSION	A - StandardStandard Y - SpecialSpécial
7	EQUIPMENT	1 = 2 gas valves + gas proving system 8 = 2 gas valves + gas proving system + maximum gas pressure switch
8	GAS CONNECTION	80 = DN80 100 = DN100 125=DN125
9	MICRO-PROCESSOR CONTROL	FA = micro-processor control, without inverter FB = micro-processor control, with inverter

Technical Specifications

BURNER TYPE		**FRX2050 M-..**
Output	min. - max. kW	1300 - 12550
Fuel		Natural gas
Category		(see next paragraph)
Gas rate- Natural gas	min.- max. (Stm^3/h)	138 - 1328
Gas pressure	mbar	(see Note 2)
Power supply triphase		220V/230V 3~ / 380V/400V 3N ~ 50Hz
Auxiliary Power supply		220V/230V 2~ / 220V/230V 1N ~ 50Hz
Total power consumption	kW	37,5
Electric motor	kW	37,0
Protection		IP40
Operation		Progressive - Fully modulating
Gas train 80	Valves size / Gas connection	80 / DN80
Gas train 100	Valves size / Gas connection	100 / DN100
Gas train 125	Valves size / Gas connection	125 / DN125
Operating temperature	°C	-10 ÷ +50
Storage Temperature	°C	-20 ÷ +60
Working service		Continuous

Note1:	**All gas flow rates are referred to Stm^3/h (1.013 mbar absolute pressure, 15° C temperature) and are valid for G20 gas (net calorific value H_i = 34.02 MJ / Stm^3);**
Note2:	**Maximum gas pressure = 500mbar (with Siemens VGD or Dungs MultiBloc MBE)** **Minimum gas pressure = see gas curves.**

WARNING: Burners are suitable only for indoor operation with a maximum relative humidity of 80%

WARNING! *If the calorific value and/or density of the fuel changes, an "OFFSET & SPAN" of the sensor curves must be carried out, if recalibration is not possible.*

The burner is designed for continuous operation if supplied with a flame detection electrode or a **UV/IR** sensor approved for such use.

If the burner is equipped with a **UV/IR** sensor that is not approved for continuous service, it must be programmed to shut down every 24 hours of operation in the presence of a continuous flame.

Gas categories and countries of application

GAS CATEGORY	COUNTRY
I_{2H}	AT, ES, GR, SE, FI, IE, HU, IS, NO, CZ, DK, GB, IT, PT, CY, EE, LV, SI, MT, SK, BG, LT, RO, TR, CH
I_{2E}	LU, PL
$I_{2E(R)B}$	BE
I_{2EK}	NL
I_{2ELL}	DE
I_{2Er}	FR

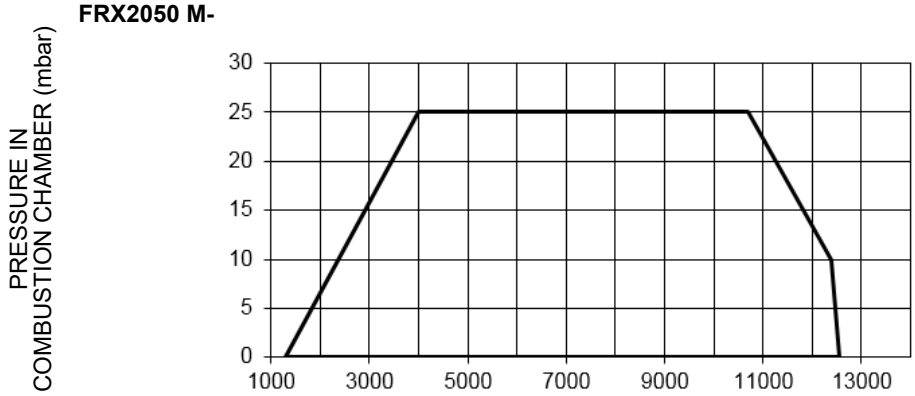
Fuel

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

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

Performance Curves

FRX2050 M-



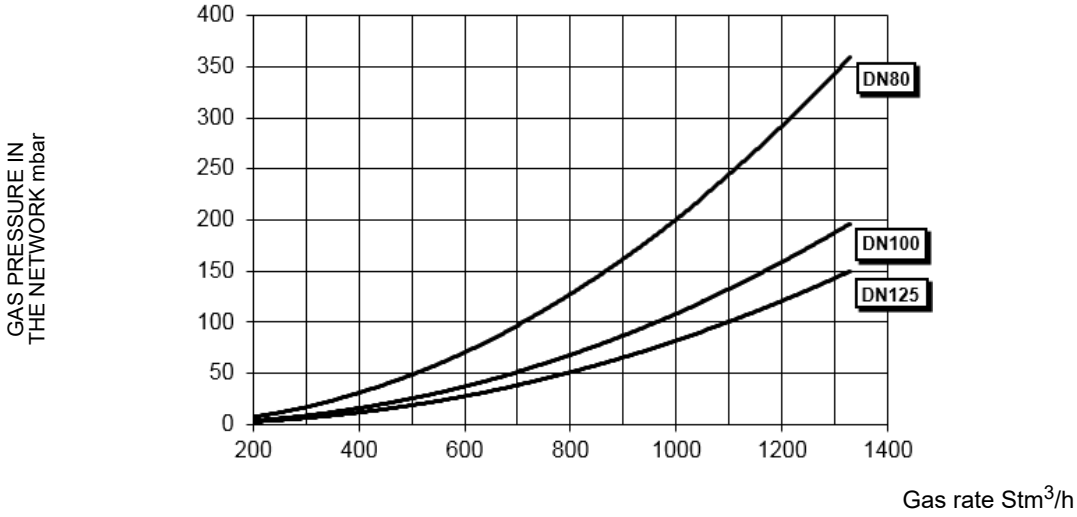
To get the input in kcal/h, multiply value in kW by 860.

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

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

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

FRX2050

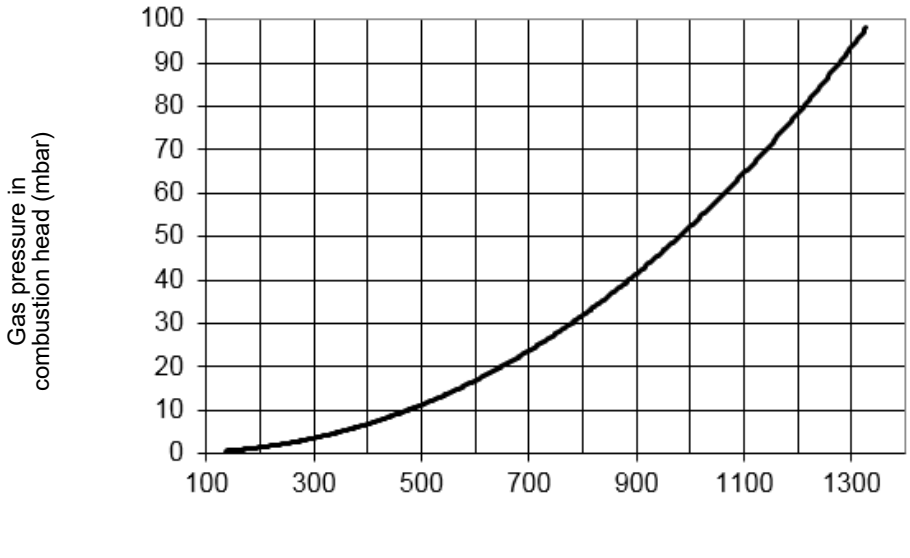


WARNING: the diagrams refers to natural gas. For different type of fuel please refer to the paragraph "Fuel" at the beginning of this chapter.

Gas pressure burner head vs natural gas flow rate

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

FRX2050 M-..



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

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

$$\Delta p2 = \Delta p1 \ * \left(\frac{Q2}{Q1}\right)^2 * \left(\frac{\rho 2}{\rho 1}\right)$$

Where:

$p1$	Natural gas pressure shown in diagram
$p2$	Real gas pressure
$Q1$	Natural gas flow rate shown in diagram
$Q2$	Real gas flow rate
$\rho 1$	Natural gas density shown in diagram
$\rho 2$	Real gas density

How to read the burner “Performance curve”

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

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

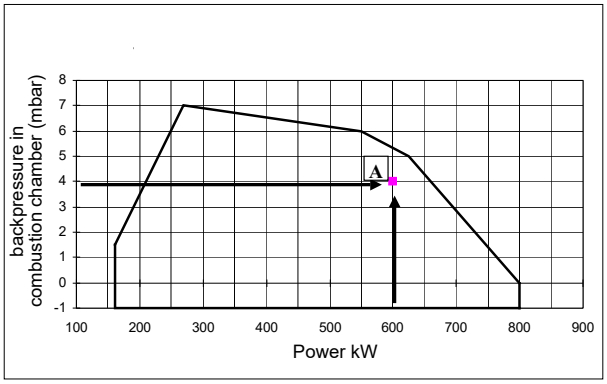
Example:

Furnace input: 600kW

Backpressure: 4 mbar

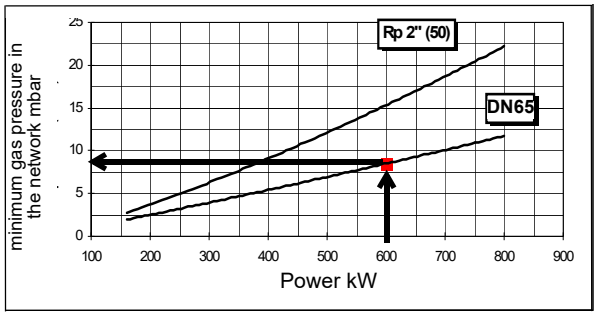
In the “Performance curve” diagram, draw a vertical line matching the furnace input value and an horizontal line matching the backpressure value. The burner is suitable if the intersection point A is inside the performance curve.

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



Checking the proper gas train size

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



Combustion head gas pressure curves

Combustion head gas pressure depends on gas flow and combustion chamber backpressure. When backpressure is subtracted, i depends only on gas flow, provided combustion is properly adjusted, flue gases residual O2 percentage complies with "Recommendec combustion values" table and CO in the standard limits). During this stage, the combustion head, the gas butterfly valve and the actuator are at the maximum opening. Refer to , showing the correct way to measure the gas pressure, considering the values o pressure in combustion chamber, surveyed by means of the pressure gauge or taken from the boiler's Technical specifications.
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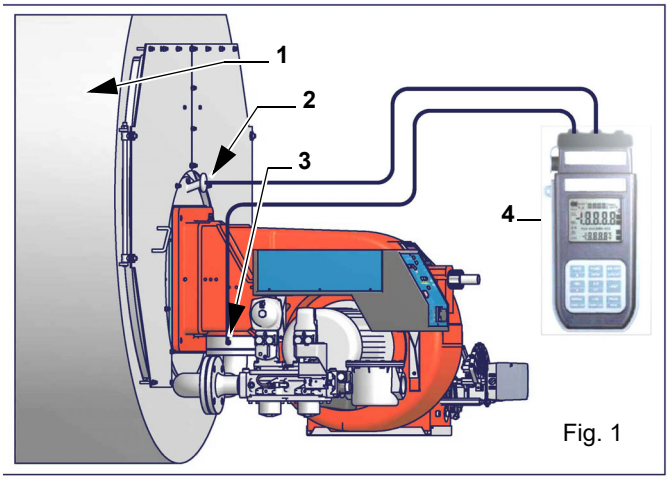


Fig. 1

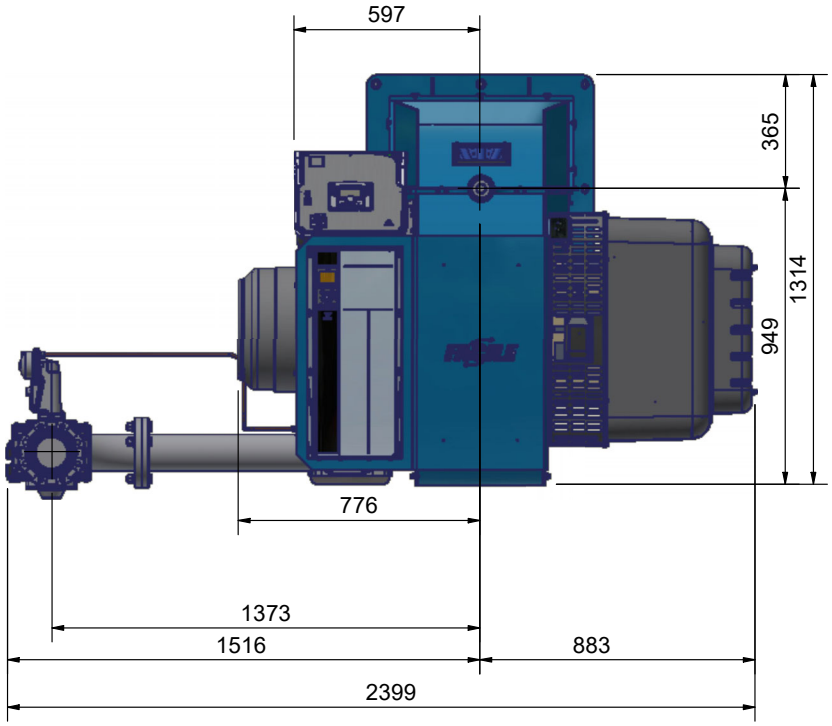
Note: the figure is indicative only.
Key
1 Generator
2 Pressure outlet on the combustion chamber
3 Gas pressure outlet on the butterfly valve
4 Differential pressure gauge

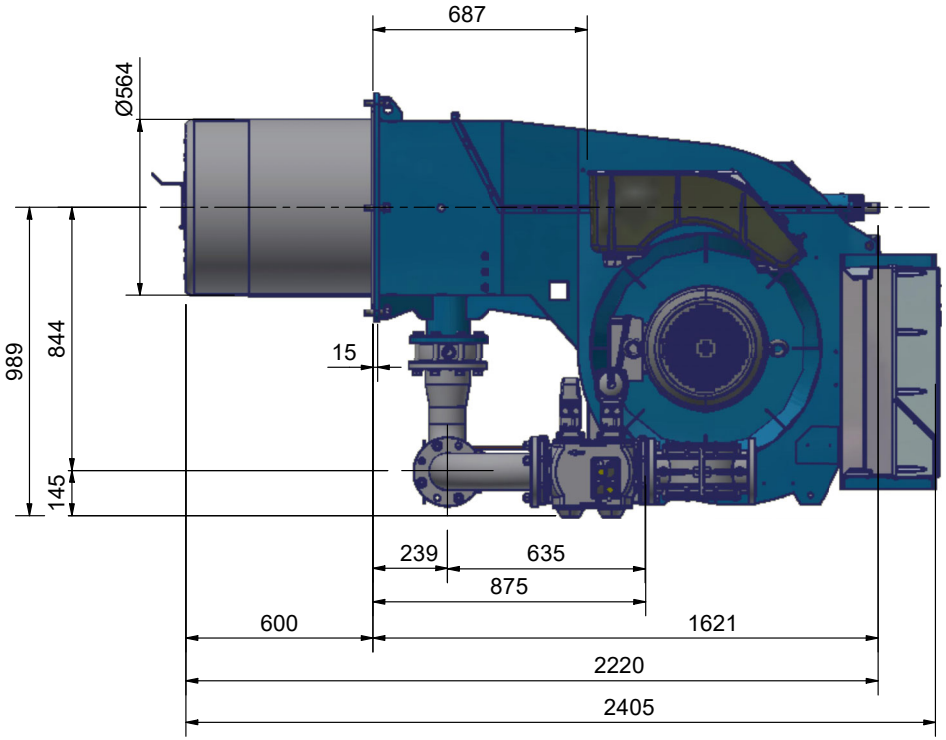
ATTENTION: THE BURNED GAS RATE MUST BE READ AT THE GAS FLOW METER. WHEN IT IS NOT POSSIBLE, THE USER CAN REFERS TO THE PRESSURE-RATE CURVES AS GENERAL INFORMATION ONLY.

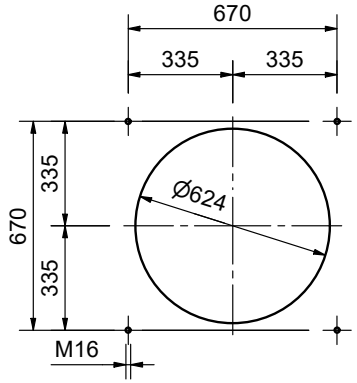
Measuring gas pressure in the combustion head

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

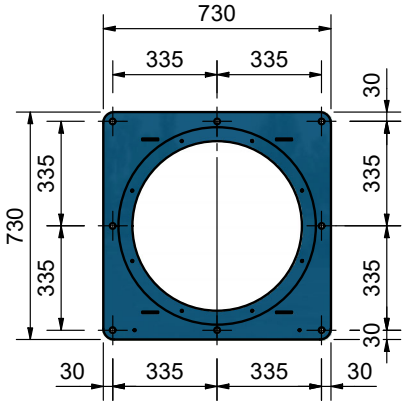
Overall dimensions (mm) - FRX2050 M-.MD.LR.XX.A.1.80.FB







Boiler recommended drilling template



Burner flange

PART II: INSTALLATION

MOUNTING AND CONNECTING THE BURNER

Transport and storage

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

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

Packing

The burners are despatched in wooden crates whose dimensions are:

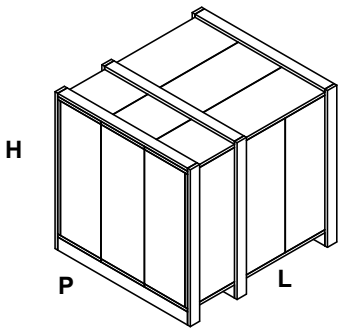
- 3220 mm X 2100 mm X 1780 mm (L x P x H).

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

The following are placed in each packing case:

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

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

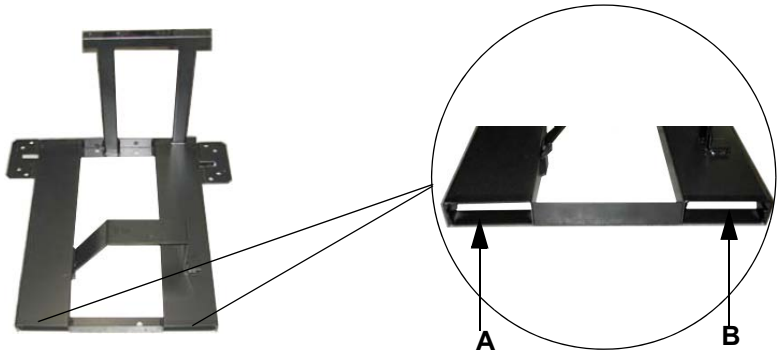


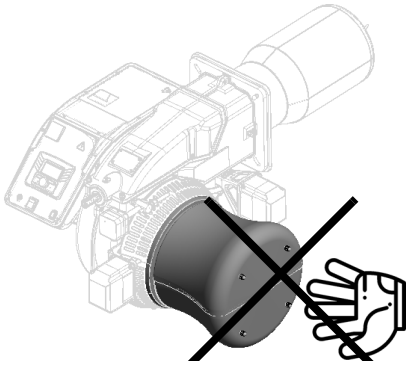
Handling the burner

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

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

The burner is mounted on a stirrup provided for handling the burner by means of a fork lift truck: the forks must be inserted into the A anb B ways. Remove the stirrup only once the burner is installed to the boiler.



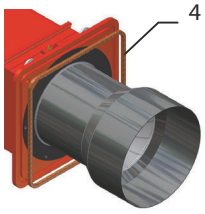


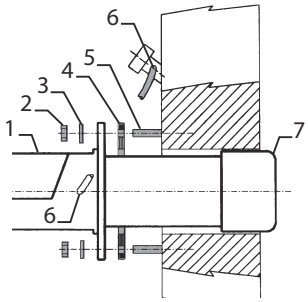
Don't lift the burner by the air intake silencer!

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).





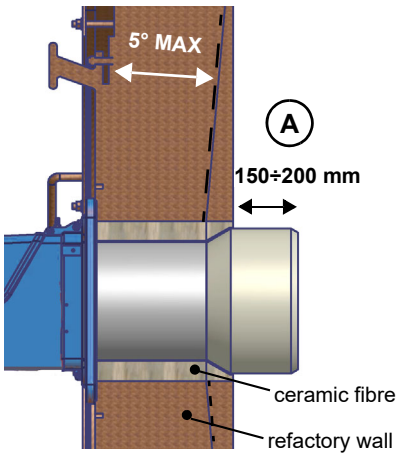
Keys

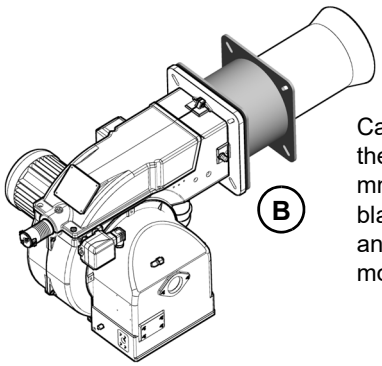
1 Burner
2 Fixing nut
3 Washer
4 Sealing gasket
5 Stud bolt
7 Blast tube

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

Matching the burner to the boiler (low NOx burners)

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



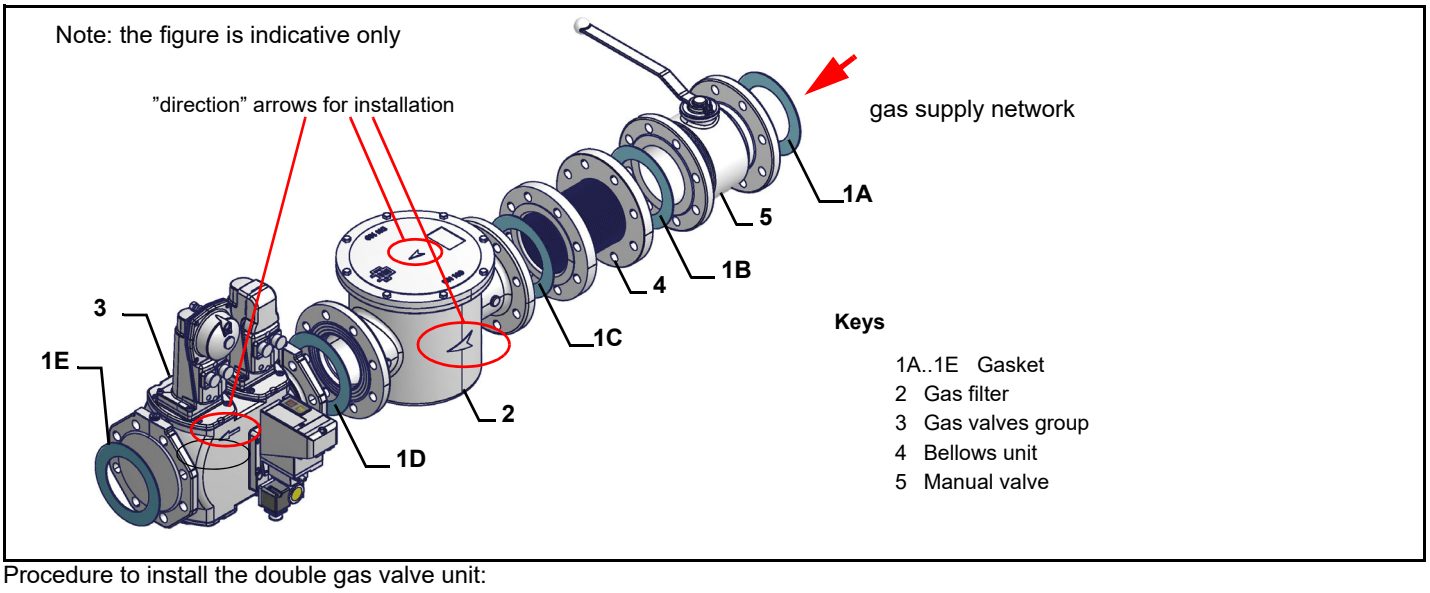


Cast-iron boilers, three pass flue boilers (with the first pass in the rear part): the blast tube must protrude at least 150÷200 mm into the combustion chamber (Fig. **A**).The length of the blast tubes does not always allow this requirement to be met, and thus it may be necessary to use a suitably-sized spacer to move the burner backwards (Fig. **B**).

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

GAS TRAIN CONNECTIONS

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



Procedure to install the double gas valve unit:

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

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

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

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

To mount the gas train, proceed as follows:

-

1 In case of threaded joints: use proper seals according to the gas used- in case of flanged joints: place a gasket between the elements

2 Fasten all the items by means of screws, according to the diagrams showed, observing the mounting direction for each item

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

Gas Filter (if provided)

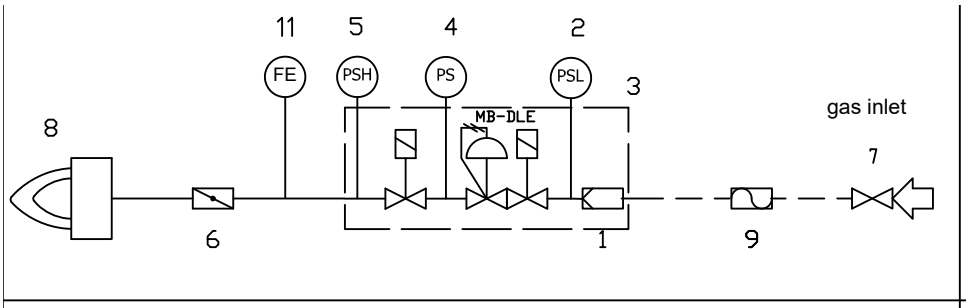
The gas filters remove the dust particles that are present in the gas, and prevent the elements at risk (e.g.: burner valves, counters and regulators) from becoming rapidly blocked. The filter is normally installed upstream from all the control and on-off devices.

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

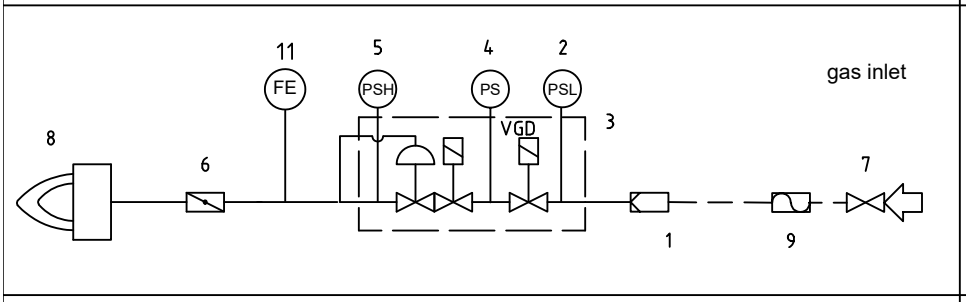
Once the train is installed, connect the gas valves group and pressure switches plugs.

GAS TRAIN CONNECTION

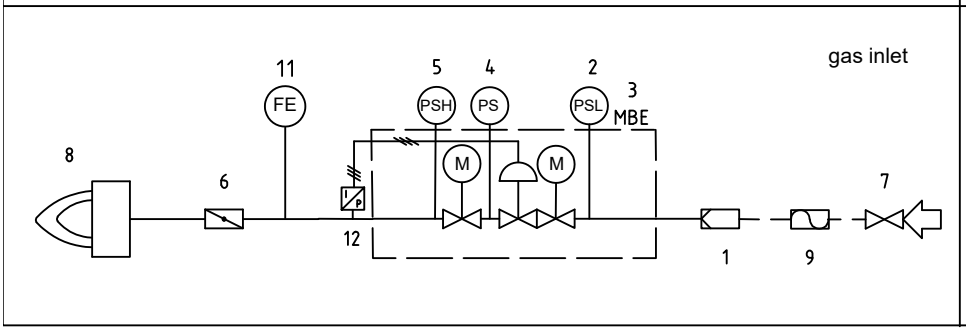
The following diagrams show some examples of possible gas trains with the components supplied with the burner and those fitted by the installer. The gas trains and the connection of the burner to the fuel supply line must be done in accordance with current local regulations.



con valvole MB-DLE



con valvole VGD

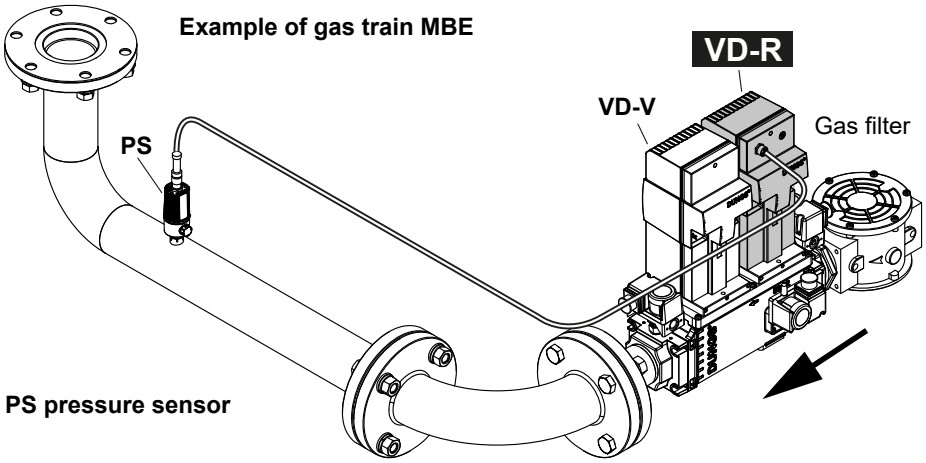


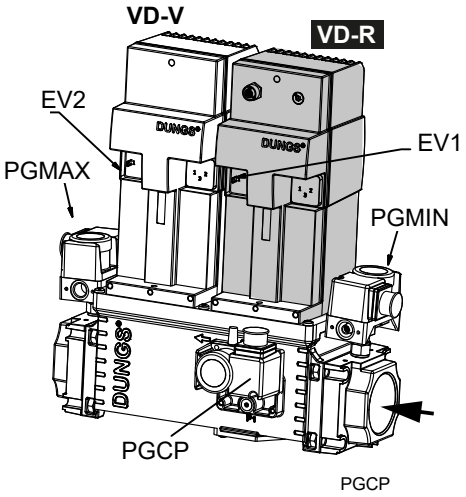
con valvole MBE

Legend:

1 Filter
2 Low pressure switch - PGMIN
3 Safety valve
4 Proving system pressure switch - PGCP (opzionale)
5 High pressure switch PGMAX: mandatory for MBE, optional for VGD and DMV-DLE
6 Butterfly valve
7 Upstream manual valve rampa
8 Main burner
9 Antivibration joint (*optional)
11 Valve for manual leakage testing of safety valves (mandatory only if the burner is not provided with standard proving system)
12 MBE pressure sensor

MultiBloc MBE



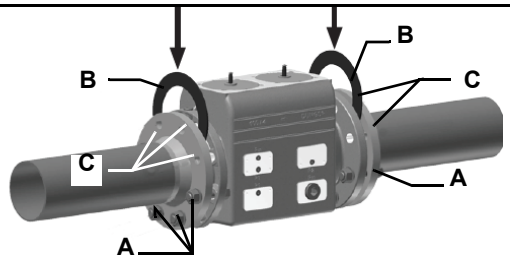


ATTENTION: once the gas train is mounted according, the gas proving test mus be performed, according to the procedure set by the laws in force.

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

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

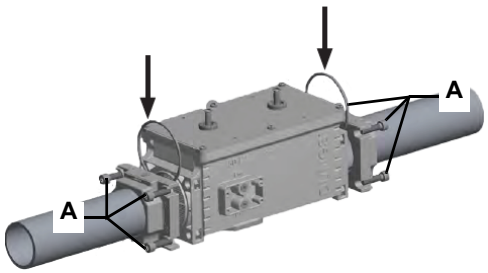
Threaded train with MultiBloc MBE - Mounting



1. Insert studs A.
2. Insert seals B.
3. Insert studs C.
4. Tighten studs in accordance with section 8.

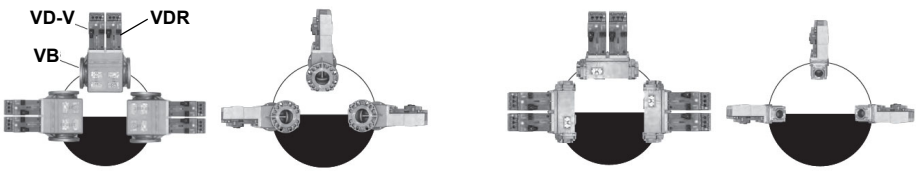
Ensure correct position of the seal!

5. Perform leak and functional tests after mounting.
6. Screws (4xM5x20) for VD assembly are supplied.

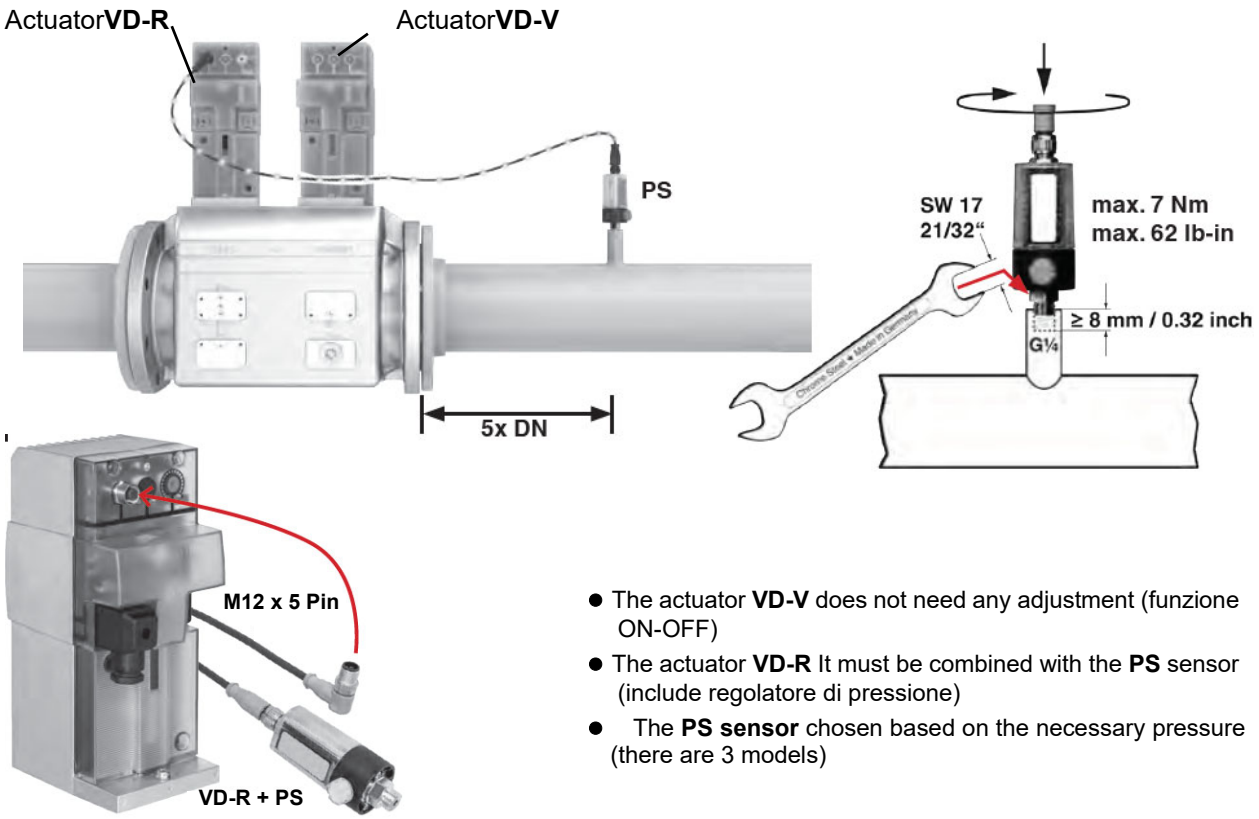


1. Mount flange into pipe systems. Use appropriate sealing agent.
2. Insert VB together with supplied O-rings.
Check current position of O-rings.
3. Tighten supplied screws (8xM8x30) in accordance with section 8.
4. Screws (4xM5x25) for VD assembly are supplied.
5. After installation, perform leakage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

Mounting position MBE / VB / VD



Mounting VD-R & PS-...



- The actuator **VD-V** does not need any adjustment (funzione ON-OFF)
- The actuator **VD-R** It must be combined with the **PS** sensor (include regolatore di pressione)
- The **PS sensor** chosen based on the necessary pressure (there are 3 models)

1. Gas pressure regulation is possible with VD-R and PS pressure sensor only.
WARNING! For US/CN installation, the output pressure must be monitoried by min. and max. pressure switches set to +/- 20% of the setpoint.
2. Mounting on pipe. Sensor position: 5x DN according to MBE. Pipe fitting with female thread size ¼, mount sensor with seal, observe torque.
3. The pressure sensor includes a vent limiter according to UL 353 and ANSI Z21.18/CSA 6.3. No venting required in locations where vent limiters are accepted by the jurisdiction.
4. Only PS pressure sensors specified by DUNGS are authorised to be connected to the VD-R‘s M12 interface.

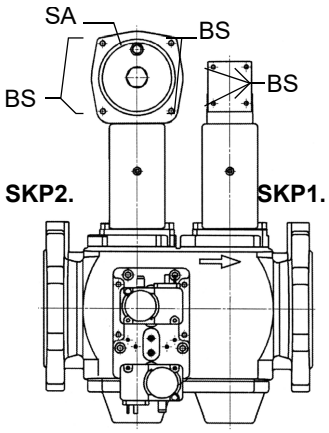
Siemens VGD20.. e VGD40..

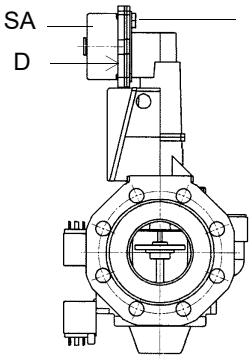
Siemens VGD20.. and VGD40.. gas valves - with SKP2.. (pressure governor)

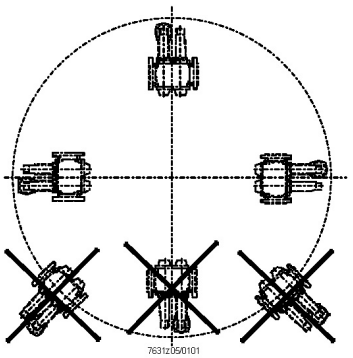
- Connect the reference gas pipe (**TP** in figure; 8mm-external size pipe supplied loose), to the gas pressure nipples placed on the gas pipe, downstream the gas valves: gas pressure must be measured at a distance that must be at least 5 times the pipe size.
- Leave the blowhole free (**SA** in figure).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

Caution: the SKP2 diaphragm D must be vertical (see Fig. 1).

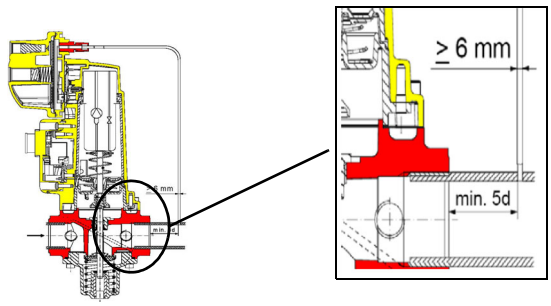
WARNING: removing the four screws BS causes the device to be unserviceable!







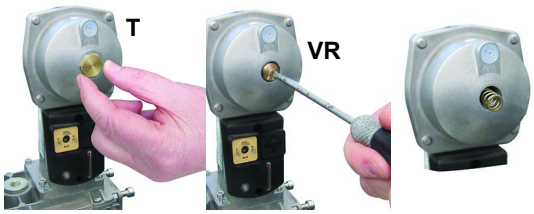
SIEMENS VGD..MOUNTING POSITIONS



Siemens VGD valves with SKP actuator:
The pressure adjusting range, upstream the gas valves group, changes according to the spring provided with the valve group.

Fig. 1

Gas valveversion with SKP2 (built-in pressure stabilizer)



To replace the spring supplied with the valve group, proceed as follows:
- Remove the cap (T)
- Unscrew the adjusting screw (VR) with a screwdriver
- Replace the spring

Stick the adhesive label for spring identification on the type plate.

Performance range (mbar)	0 - 22	15 - 120	100 - 250
Spring colour	**neutral**	**yellow**	**red**

Gas Filter (if provided)

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

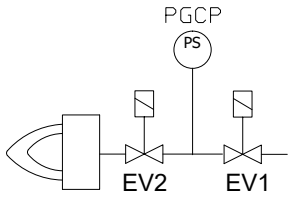
ATTENTION: it is reccomended to install the filter with gas flow parallel to the floor in order to prevent dust fall on the safety valve during maintenance operation.

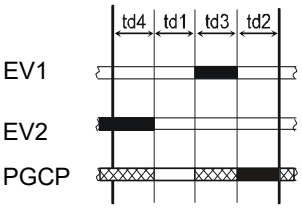
Once the train is installed, connect the gas valves group and pressure switches plugs.

Integrated proving system

This paragraph describes the integrated proving system operation sequence:

- At the beginning both the valves (EV1 and EV2) must be closed.
- Test space evacuating: EV2 valve (burner side) opens and keep this position for a preset time (td4), in order the bring the test space to ambient pressure.Test atmospheric pressure: EV2 closes and keep this position for a preset time (test time td1). The pressure switch PGCP has not to detect a rise of pressure.
- Test space filling: EV1 opens and keep this position for a preset time (td3), in order to fill the test space.
- Test gas pressure: EV1 closes and keep this position for a preset time (td2). The pressure switch PGCP has not to detect a pressure drop down.





If all of the test phases are passed the proving system test is successful, if not a burner lockout happens.

On LMV5x and LMV2x/3x and LME73 (except LME73.831BC), the valve proving can be parameterized to take place on startup, shutdown, or both. On LME73.831BC the valve proving is parameterized to take place on startup only.

Rotation of electric motor

Once the electrical connection of the burner is executed, remember to check the rotation of the electrical motor (pump motor if any, and fan motor) . The motor should rotate according to the “arrow” symbol on the body. In the event of wrong rotation, change 2 of the 3 phases of the three-phase power cable and check again the rotation of the motor.

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

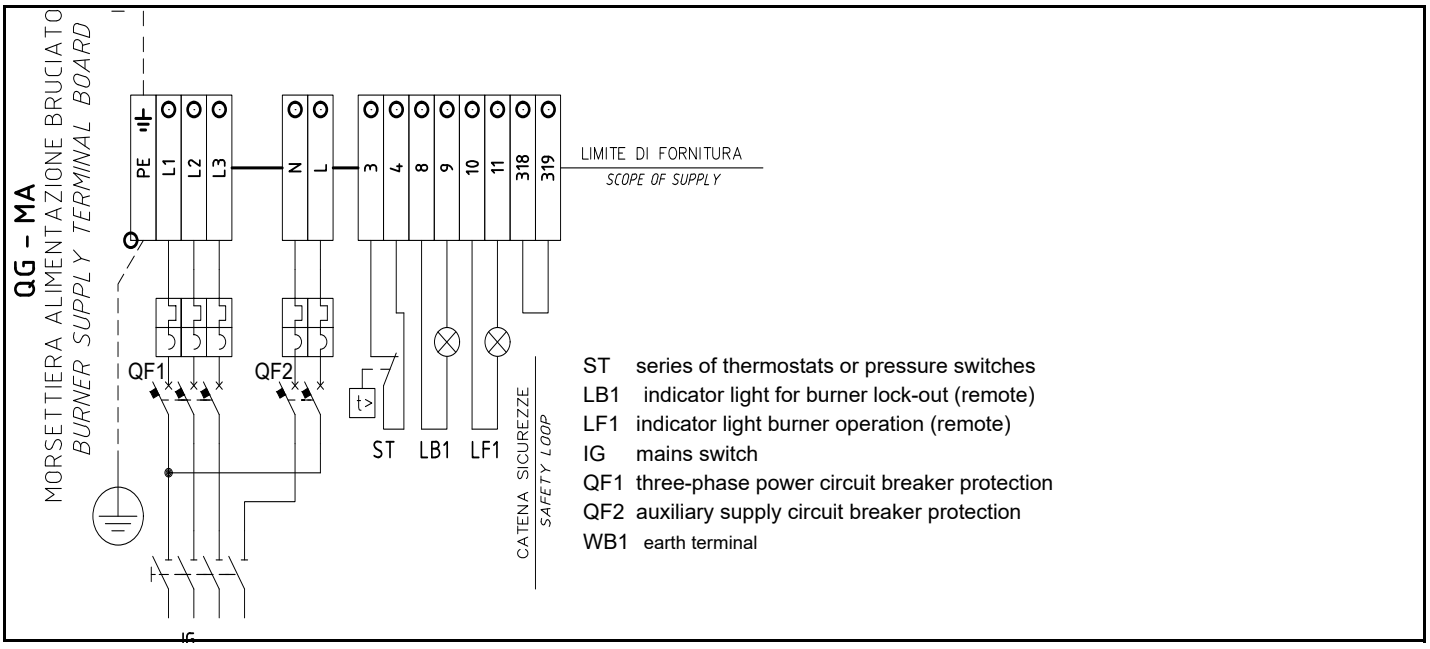
DANGER! Incorrect motor rotation can seriously damage property and injure people.

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

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

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

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



BURNERS WITH INVERTER VARIANT (if provided)

INVEOR M

DANFOSS FC101

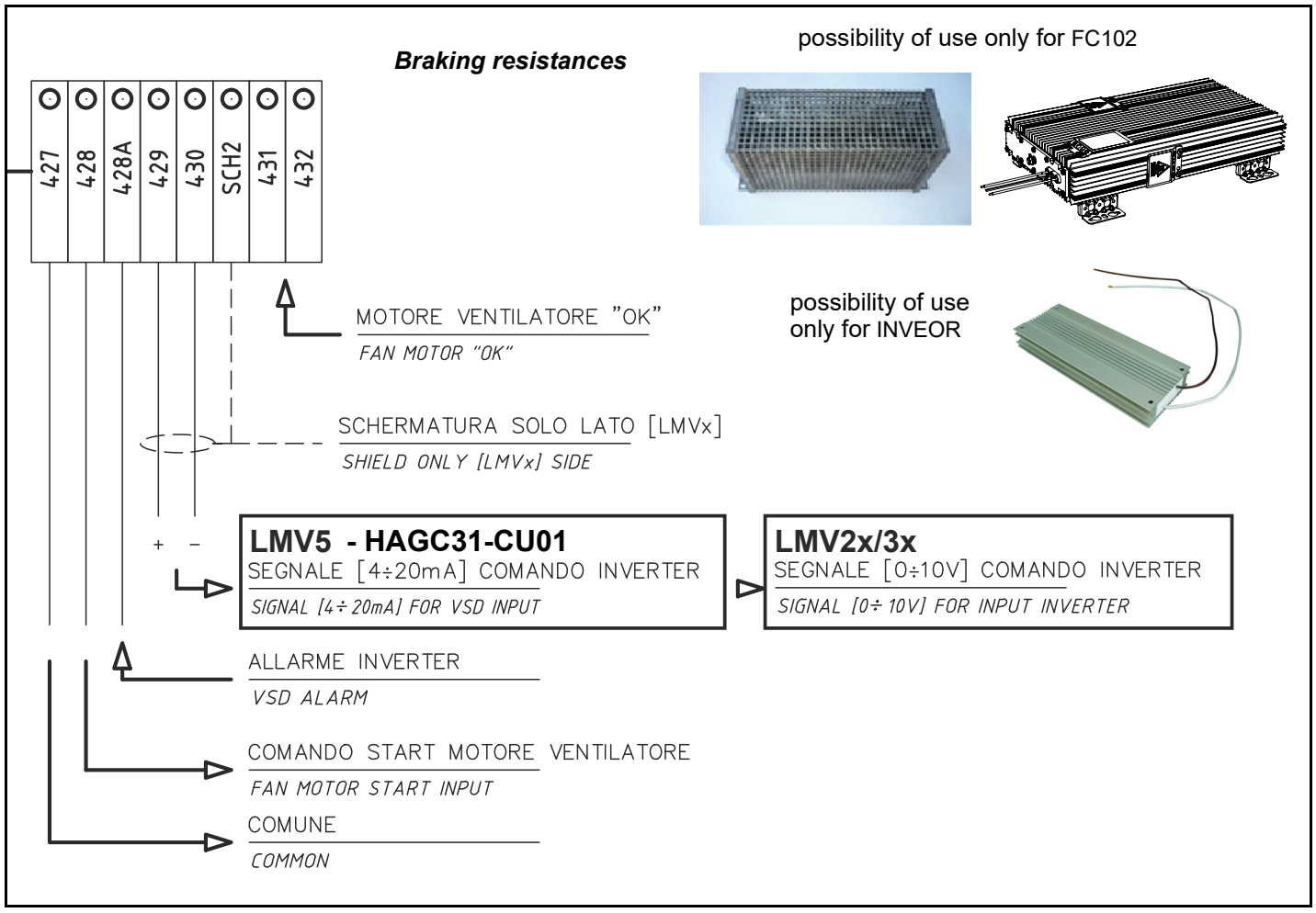
DANFOSS FC102

Segnali di imput per l'Inverter a seconda dell apparecchiatura:	
LMV51.300 / LMV52.xxx	4÷20mA
HAGC31-CU01	4÷20mA
LMV37.400 / LMV26.300	0÷10V

The **LMV51.300 / LMV52.xxx, HAGC31-CU01 e LMV37.400/LMV26.300** electronic cam burners with fan motor driven by inverter in addition to the air and fuel adjustment curves also have a fan motor speed adjustment curve.

Generally the curve of the inverter goes from 50% to 100% of the engine revolutions. This, in addition to improving the setting of the burner also allows a saving on the consumption of the fan engine.

Terminal interface with Inverter



PART III: OPERATION

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

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

WARNING: before starting the burner up, be sure that the manual cutoff valves are open and check that the pressure upstream the gas train complies the value quoted on paragraph "Technical specifications". Be sure that the mains switch is closed.

IN THE EVENT OF A BLOCKAGE, THE CAUSE MUST BE ASSESSED. IF THE FLAME BACKFIRE WARNING LIGHT IS ON, IT IS IMPERATIVE TO CHECK THE INTEGRITY AND GOOD CONDITION OF THE COMBUSTION HEAD AS DESCRIBED IN THE MAINTENANCE SECTION BEFORE UNLOCKING THE APPLIANCE.

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 AUTHORISED 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.

Burner front panel

Keys

A4 Control Panel display
F1 Fuse
S1 Main switch
S2 Reset pushbutton for control box
S8 Burner control knob

Gas operation

DANGER!

The gas minimum pressure switch, installed upstream from the safety valves, ensures the network distributes the gas at a pressure suitable to switch on the machine start cycle.
In compliance with the regulations in force, the cycle starts with the pre-ventilation phase.

(Burners fitted with gas proving system). The gas safety valves proving system can be executed during this phase and/or at the burner shut-off, according to the device setting. Failing which a safety interlock is tripped.

The fan starts and the air damper, driven by the servomotor, opens as far as the high flame position. The air pressure switch, detecting a pressure, ensures the fan's operation. Failing which a safety interlock is tripped.
At the end of preventilation, in sequence, the burner management system moves the servomotor to the ignition position, supplies the ignition transformer and orders the opening of the gas safety valve group.
The gas from the net passes through a filter, the double safety valves and the pressure regulator. The regulator holds the gas head pressure within the use limits.
Fuel and comburent are channelled separately till they meet in the flame development area (combustion chamber) where the spark, discharged by the ignition electrodes located on the burner's head, must ignite the flame in a safety time of less than 3 s, as provided for by the reference regulations.
The flame is detected by a sensor that can be an ionization or UV or IR sensor. Failing which a safety interlock is tripped. From now on flame detection will be continuous, until the burner is switched off.
At the end of the safety time, the control unit de-energizes the ignition transformer, moving the servomotor to the low or high flame position according to system demand.
The burner operation is now controlled by the modulator, if any, or by the boiler controller (i.e.: high-low flame thermostat).
The dedicated actuators move, simultaneously and proportionally, the air damper, the fuel butterfly valve, the head position (if the burner include this option) and the VSD optimizing exhaust gas values and obtaining efficient combustion.

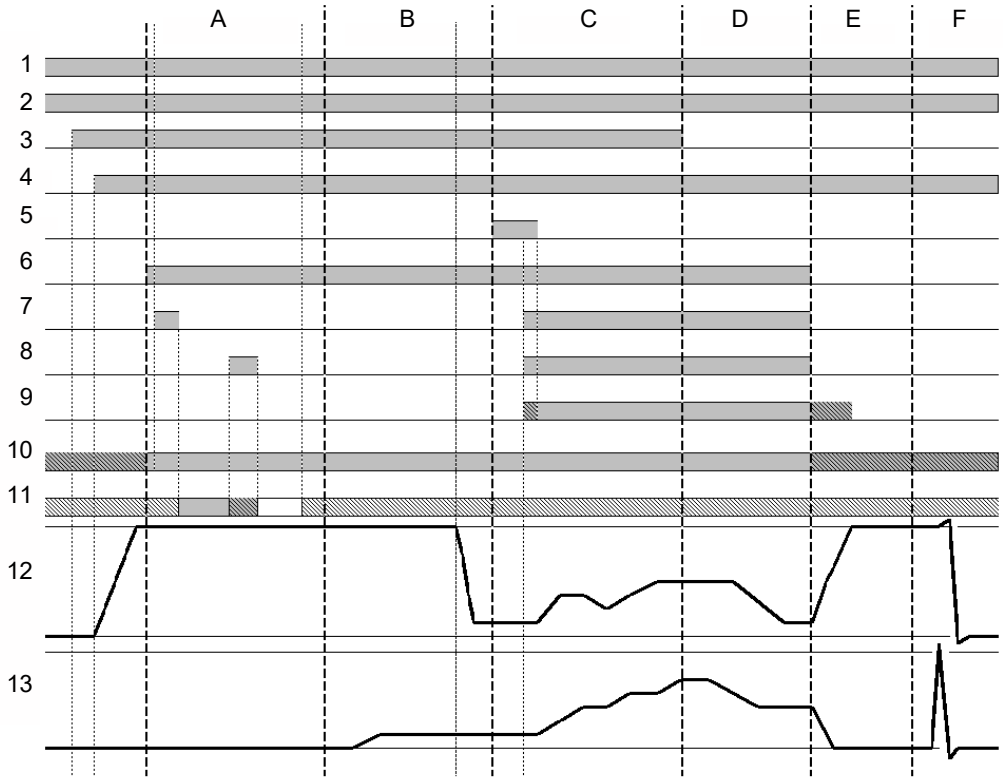
The position of the combustion head, set manually or automatically (if the option is included in the supply), contributes to adjust the burner's output.
If the monitored variable (pressure or temperature) of the boiler/generator/oven fluid exceeds a preset value, the machine switch-off phase is started. The flame control unit moves the servomotor to the low flame position (minimum power supplied), closes the safety valves and starts the post-ventilation phase, if any.
At the end of this stage, the burner remains in stand-by waiting for a new start-up sequence

For further details, see the attached equipment manual.

WORKING DIAGRAM OF THE BURNER

A: Gas leakage test
B: Pre purge
C: Operation
D: Shutdown
E: Post purge
F: Actuator position check

1 Safety Loop
2 PGAS Max
3 Heat demand
4 Fan motor
5 Ignition trasf.
6 Shutoff valve
7 Gas valve 1
8 Gas valve 2
9 Flame signal
10 PGAS min
11 PGCP
12 Air actuator
13 Gas actuator



(First) Start-up preliminary operations - gas supply

Recommended actions to be carried out in sequence:

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

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

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

ADJUSTING AIR AND GAS FLOW RATESm

WARNING! During commissioning operations, do not let the burner operate with insufficient air flow (danger of formation of carbon monoxide).
WARNING! the combustion air excess must be adjusted according to the values in the following chart.

Recommended combustion parameters		
Fuel	***Recommended CO_2 (%)***	***Recommended O_2 (%)***
Natural gas	9,2 ÷ 10,3	2,5 ÷ 4,5

RC21.52 Control panel

ATTENTION: IF THE RC21.52 CONTROL PANEL IS DISCONNECTED, NO OPERATION OF THE BURNER IS ALLOWED! THE SYSTEM DOESN'T OPERATE!

ICONS DESCRIPTION

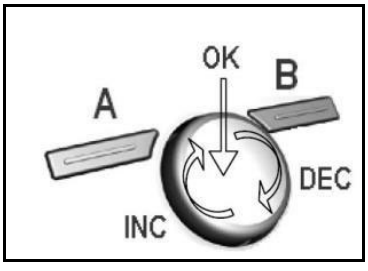
Symbo	Description	Symbo	Description
	Working mode: OFF mode		Gas train (valves)
	Working mode: manual regulation		Flame signal
	Fan motor		Flame signal level
	Ignition transforme		Alarm (non-volatile lockout or volatile fault)

MAIN WINDOW

1	Data and time	can be set by **[Menu]** > **[General settings]**
2	Icons (burner indications)	burner active loads, burner working mode and burner faults
3	Burner heat capacity	the current burner heat capacity during burner operation
4	String (burner information)	burner information, burner position or fault description
5	Menu push button	access to menu
6	Mode push button	burner working mode can be modified (OFF, manual regulation or
7	Temperature or pressure feedback	boiler main sensor (temperature or pressure)
8	Temperature or pressure setpoint	regulation setpoint.

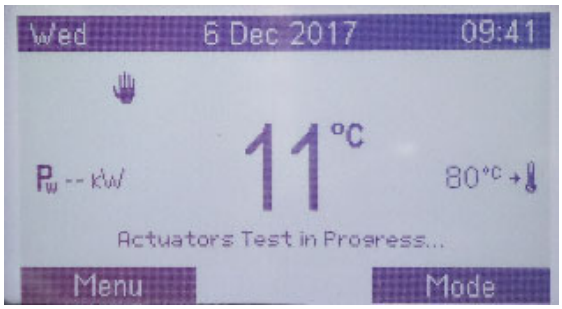
BUTTONS AND ENCODER

A Button	
[Menu]:	to access to menu
[Esc]:	back to the main window
B Button	
[Mode]:	burner working mode setting
[Back]:	back to the previous window
[Confirm]:	to confirm the settings
[Save]:	to save the settings
Knob	
INC:	to increase the selected value or next menu
DEC:	to decrease the selected value or previous menu
OK:	to confirm the settings



Start-up preliminary operations

Al primo avviamento collegare il Service Tool per poter accedere ai parametri e alla regolazione del bruciatore.
After power-on and initializing operations, the display is as follow:



At the first start-up the following message is shown:
"**set boiler unit parameters**"
So, the following operations have to be performed.

1 .
BOILER SETTING
↓
2 . AIR/GAS CURVES SCANNING

1 - BOILER SETTING

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

1st level	2nd level	3rd level	4th level	Description
Menu				Main menu
	Parameters			Menu level for making the parameter settings
		Boiler unit		Settings for the boiler unit
			Max Power	This parameter is the maximum boiler capacity (express in kW).
			Min Power	This parameter is the minimum boiler capacity (express in kW).
			Max Load	This parameter is the maximum boiler load (express in %).This parameter is used to limit the burner working capacity range.
			Min Load	This parameter is the minimum boiler capacity (express in kW). This parameter is used to limit the burner working capacity range.
			Boiler set point	Temperature or pressure setpoint

After that, the following message will be displayed
"learning curve must be made"
Follow "air/curve scanning" indications, see the next paragraph .

ATTENTION: BOILER SETTINGS CAN BE DELETED BY USING THE PARAMETER: [Menu] > [Parameters] > [Boiler unit] > [Delete boiler setting]

For further information please refer to the attached controlboard/control panel user manual

(AIR/GAS) CURVES SCANNING

ATTENTION: BEFORE USING THE APPLIANCE, THE CURVES SCANNING HAS TO BE PERFORMED

ATTENTION: DURING CURVES SCANNING, DO NOT ACT ON PRESSURE GOVERNOR AND MAKE SURE THAT AIR INLET IS NOT OBSTRUCTED

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

1st level	2nd level	3rd level	4th level	Description
Menu				Main menu
	Parameters			Menu level for making the parameter settings
		Boiler unit		Settings for the boiler unit
			Learning curve	Set to “on”. After parameter enabling, the actuator tests are performed

The boiler thermostat must be set to "on". After that, the curves scanning starts and ignition sequence begins

WARNING! DURING THE SCAN, CHECK THAT THE OXYGEN LEVEL IS ABOUT 3% (BETWEEN 2.5% AND 4.5%)

In every point, during this function, the actuators positions are regulated in order to reach the air and gas setpoint. If the sensor signal (air and gas) remains inside the band, for 30 seconds, the actuator position is stored. When both the positions of the actuators are stored, the next operating point can be reached. The function ends when all the points are verified.

After that, the burner goes off and the symbol ⏻ is displayed. If during the entire procedure, O_2 and CO were between the reccomended levels, start the burner by setting the parameter “operation” to “auto or “manual”. Otherwise repeat the scanning procedure.

1st level	2nd level	3rd level	4th level	Description
Menu				Main menu
	Parameters			Menu level for making the parameter settings
		Burner		Settings for the boiler unit
			Operation	Off = burner off manual = manual operation auto = automatic operation
			Manual power	output (kW), (only if operation is set to “manual”)

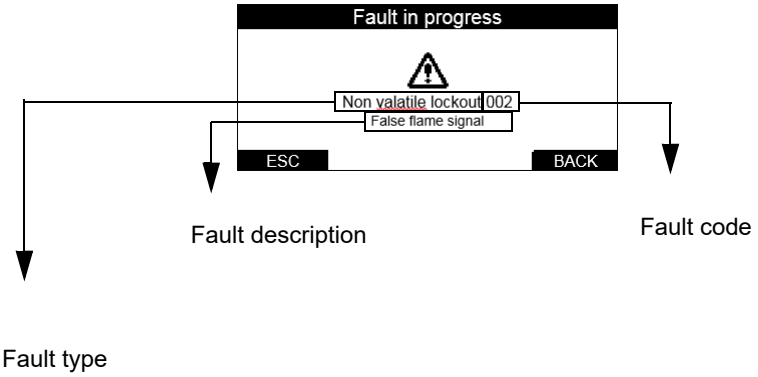
ATTENTION: IF THE FUNCTION ENDS CORRECTLY (THE LAST POINT IS VERIFIED), THE APPLIANCE IS READY TO USE.

ATTENTION: FOR EVERY POINT, IF THE SYSTEM IS NOT ABLE TO REGULATE THE AIR AND GAS SIGNAL BEFORE THE END OF THE TIMEOUT (5 MINUTES) THE CURVES SCANNING ENDS WITH THE RELATED FAULT INDICATION.

Scanning error codes

No.	Error	Cause	Solution
22	Gas pressure too low	Curve scanning cannot be completed because the gas pressure is too low	Increase the gas valve output pressure value. Reset the burner and repeat the curve scanning. If the problem is not solved, increase the pressure again, and reset the burner. After that repeat the curve scanning procedure.
23	Air pressure too low	Air pressure is too low; required output cannot be reached	1) Check the boiler parameters, max output 2) Wrong combustion head position. 3) Air inlet obstruced. 4) Boiler obstructed/dirty, check the gas flue and the smoke flow on the combustion chamber
24	Gas pressure too high	Gas pressure it too high. Gas servomotor never goes over 40° during curve scanning. Automatic adjusting procedure could be unstable	1) Reduce the gas valve output pressure value. Reset the burner and repeat the curve scanning. 2) If the problem is not solved, repeat the previuos step.

Fault window



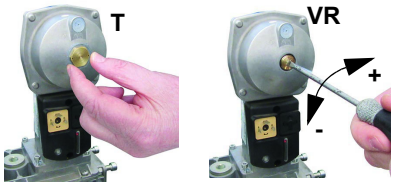
Press *Esc* or *Back* to come back to the RC21 main window.
In case of non-volatile fault, if the unit can be reset, the B button indication becomes Reset (instead of **Indietro**).
To reset the unit press the B button (2 times in order to confirm the operation).

ADJUSTING THE GAS VALVES GROUP

ATTENTION: DO NOT CHANGE GAS VALVES SETTING DURING THE CURVES SCANNING PROCESS!

Gas valveversion with SKP2 (built-in pressure stabilizer)

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



MultiBloc MBE

Regulation VD-R whith PS

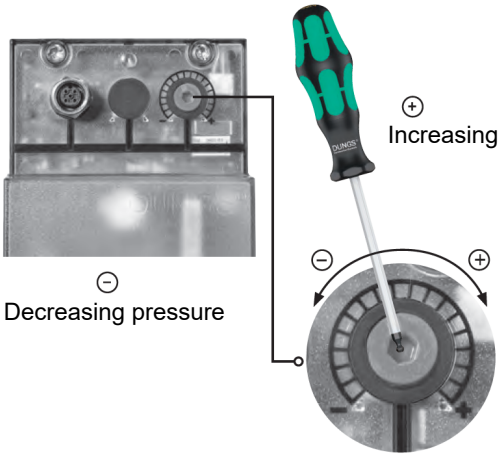


Fig. 2

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

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

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

ATTENTION: To set the outlet pressure of the VD-R regulator, act on the adjustment ring nut (Fig. 10)
The position of the indicator in the dial indicates the value of the outlet pressure calculated as a percentage of the full scale of the PS sensor (Fig. 11)

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

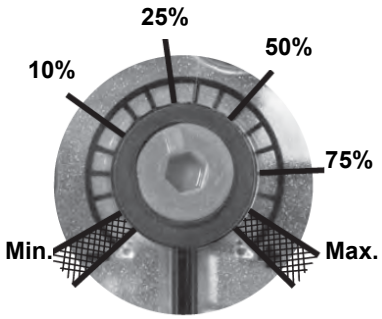
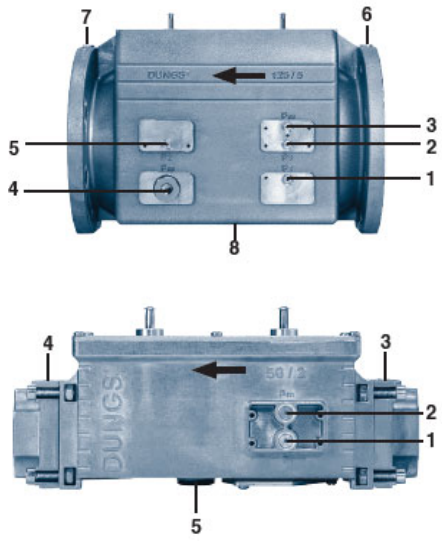
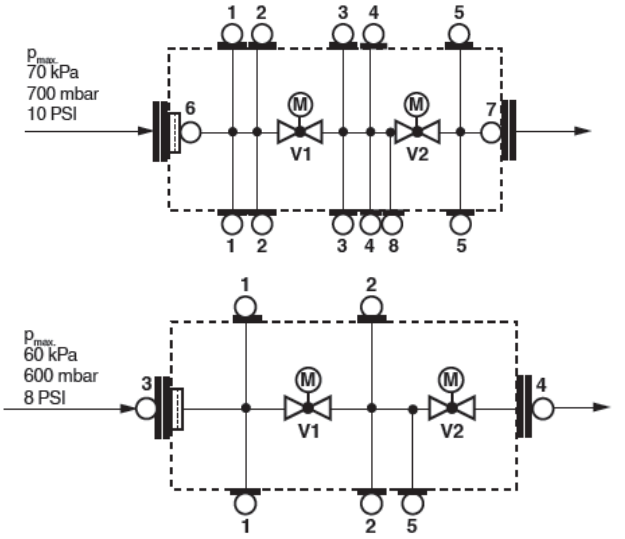


Fig. 3

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

Pressure taps MultiBloc MBE





1, 2, 3, 5
Sealing plug

G ⅛ ISO 228
4
For system accessories

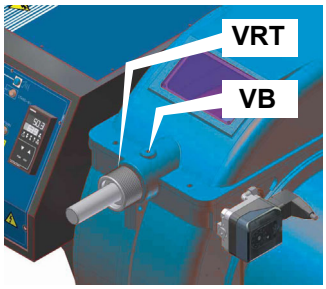
G ¾

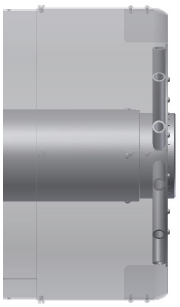
Fig. 4

Adjusting the combustion head

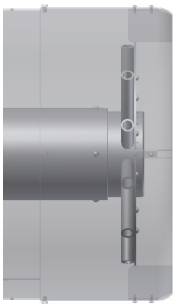
CAUTION: perform these adjustments once the burner is turned off and cooled.

The combustion head position affects the flame stability. The burner is factory-adjusted with the combustion head in its "all-ahead" position. Laboratory tests have shown that this is the optimal configuration to assure flame stability. If different settings are required, it is possible to change the position: loosen the VB screw and slightly move the combustion head backwards, turning clockwise the knob VRT. Fasten VB screw when the adjustment is accomplished.



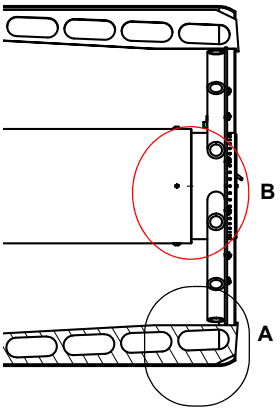


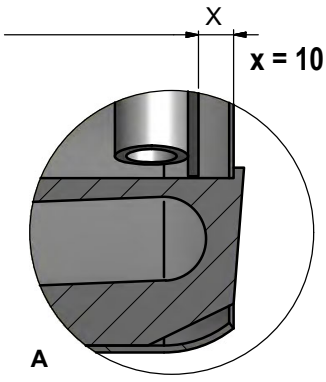
"all-ahead" position

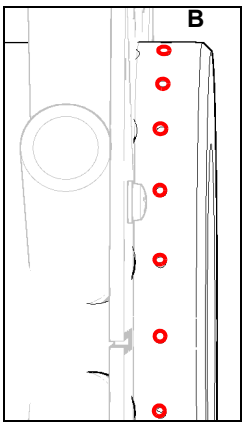


"all-backwards" head position

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







The diffuser position must be set during the commissioning according to the regulation needs. The diffuser position is factory set as shown in figure ”A” (x = 10 mm)
Depending on the boiler application, it is possible to act on the holes (figure B) to improve the flame stability and NOx, CO emission values. If necessary, close/open the holes in figure “B” using the screws kit given with the burner.

Calibration air and gas pressure switches

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

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

Calibration of air pressure switch

To calibrate the air pressure switch, proceed as follows:

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

Calibration of low gas pressure switch

With the burner operating at maximum power, increase the regulation pressure by slowly turning the control knob clockwise until the burner stops, taking care it does not go into lockout and the display shows the error "**Err c20 d0**".
As for the gas pressure switch calibration, proceed as follows:

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

Calibration the maximum gas pressure switch (when provided)

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

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

PGCP Gas leakage pressure switch

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

PART IV: MAINTENANCE

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

Attention:

- Read carefully the “warnings” chapter at the beginnig of this manual
- All operations on the burner must be carried out with the mains disconnected and the fuel manaul cutoff valves closed!
- Any maintenance, cleaning or check intervals are a mere indication: the functionality of the burner - and its components - depends, among other things, from capacity utilisation rate, environment, nature and quality of the fuels used
- never loose the sealed screws! otherwise, the device warranty will be immediately invalidate!

ROUTINE MAINTENANCE

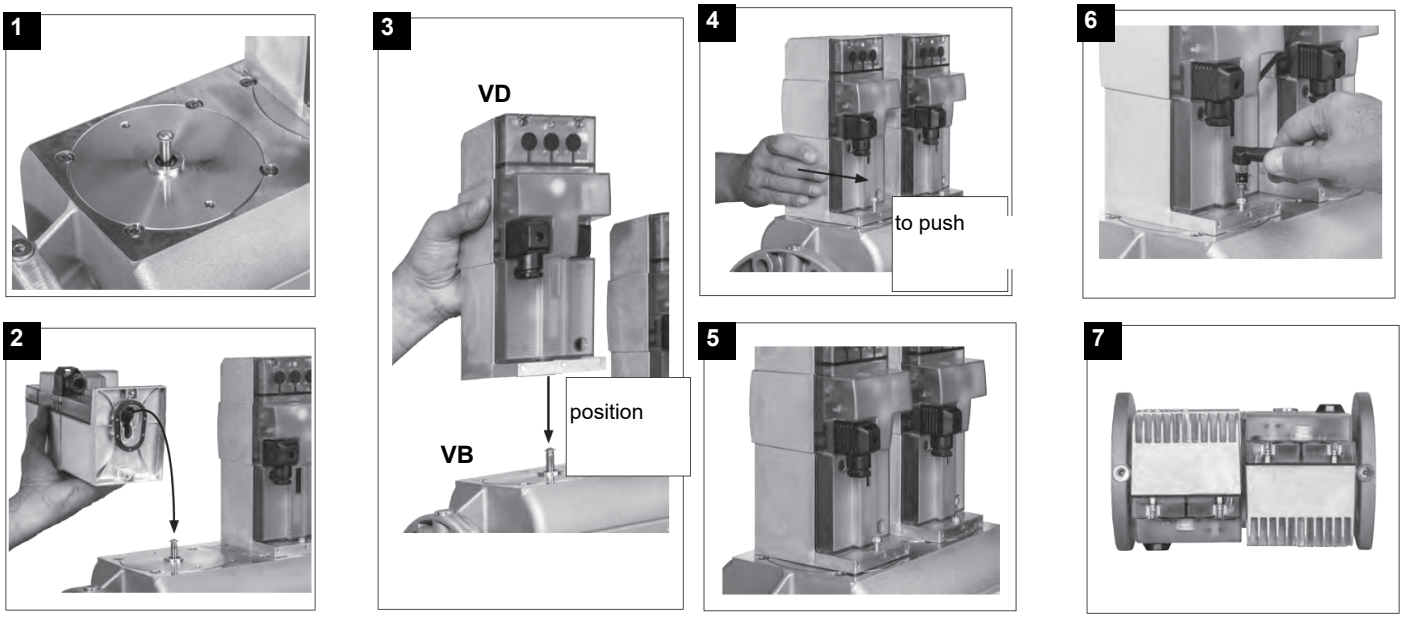
- Check that the gas meter is not moving when the burner is off. In case it is rotating, look for possible leaks.
- Check the cleaning condition of the vent. Clean the vent by using exclusively a dry brush. If needed, disassemble it from the motor’s shaft and wash it by using non corrosive detergents.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

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

- At least every 2 months, or more often if needed, clean the room where the burner is installed.Avoid leaving installations, papers, nylon bags, etc., inside the room. They could be sucked by the burner and cause malfunctioning.
- Check that the room’s vents are free from obstructions.

ATTENTION: During the filter maintenance procedure, the gas flow sensor must remain clean. Avoid contact with dust or other debris

MultiBloc VD-V VD-R Mounting



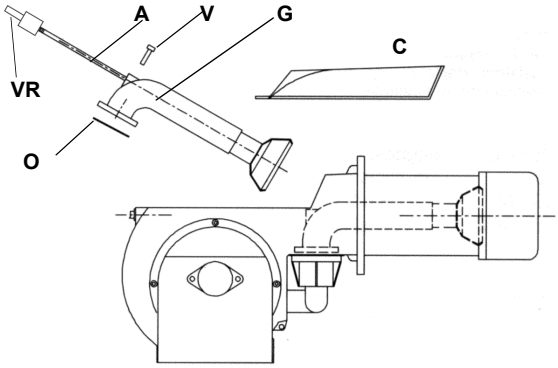
1. Position VD on VB, fig. 2+3.
2. Slide VD forward up to the stop, fig. 4.
3. Screw VD on with 2 M5 screws for each, max. 5 Nm/44 in.-lb., fig. 5/6.
4. VD can be mounted rotated by 180°, fig. 7.

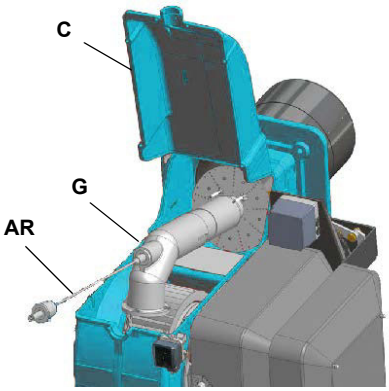
Removing the combustion head

Attention: before adjusting the combustion head, turn the burner off and wait until it gets cold.

- Remove the cover **C**.
- remove the electrodes cables;
- unscrew the 3 screws **V** which hold in position the gas manifold **G** and pull out the complete group as shown in the picture below.
- Clean the combustion head by a compressed air blow or, in case of scale, scrape it off by a scratchbrush.

Note: to replace the combustion head reverse the procedure described above having care to place correctly the O ring (**OR**) between burner and gas manifold.





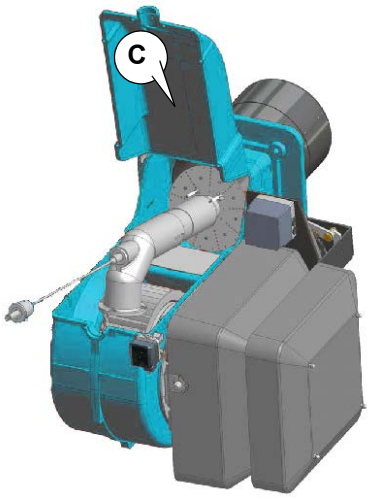
Key

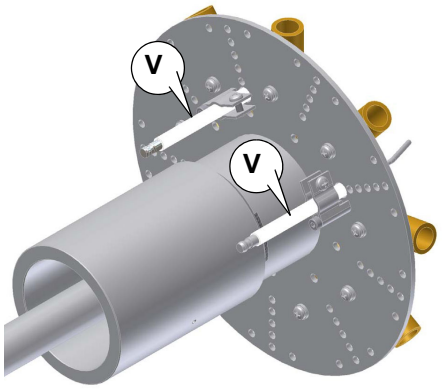
VRT	Head adjusting screw
AR	Threaded rod
V	Fixing screw
G	Gas manifold
OR	”O” ring
C	Cover

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

To replace the electrodes, proceed as follows:

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





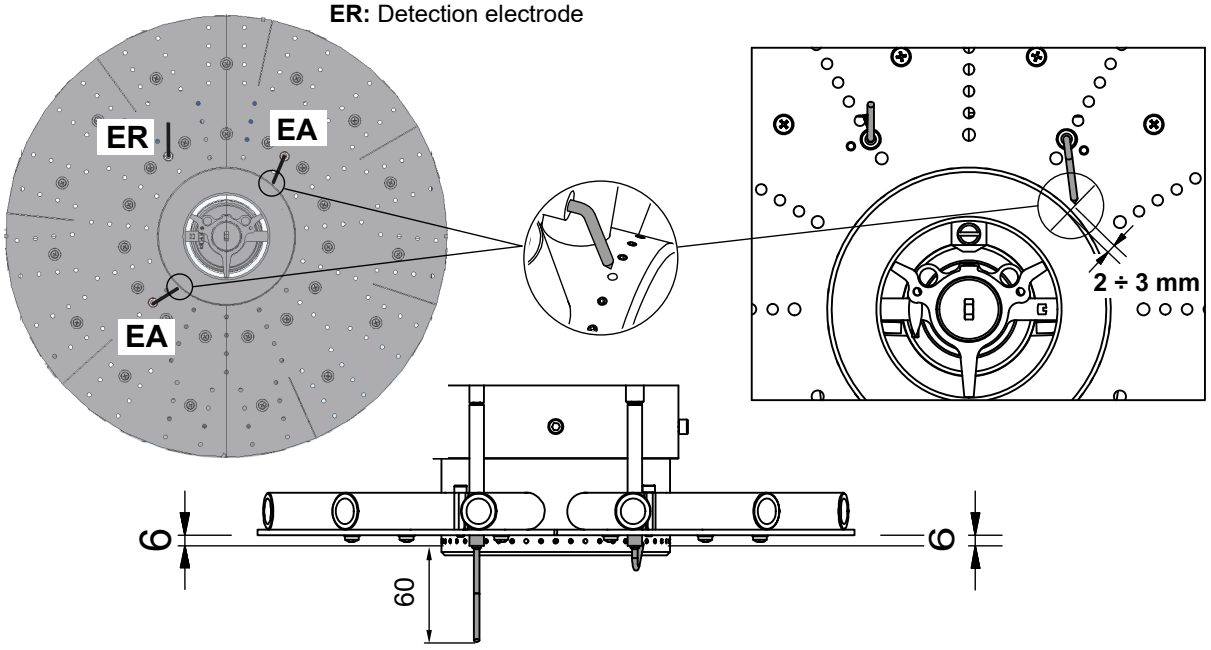
Electrodes Adjustment

Important Note: Check the ignition and detection electrodes after removing/adjusting the combustion head.

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

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

EA: Ignition electrode
ER: Detection electrode



Air flow sensor maintenance

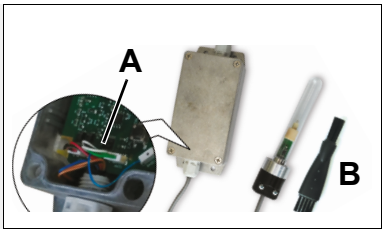
ATTENTION! Do not touch the sensor (figure 9) with hands. Clean only with cotton cloth. do not use any cleaning product.

WARNING: never loose the sealed screws! otherwise, the device warranty will be immediately invalidate!

WARNING! Periodic quarterly cleaning of the sensor is recommended.
Use a soft bristle brush (B) to clean the sensor

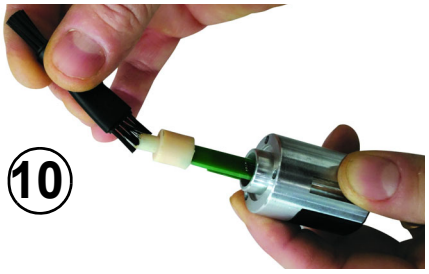
WARNING! The flow sensors are calibrated and set in **by the manufacturer** according to the burner type, its output and the sampled fluid. Do not disconnect a trerminal (A)
It is therefore not possible to replace the sensors installed on a machine with other sensors intended for measurements on fluids other than those intended.
Periodic quarterly cleaning of the sensor is recommended.

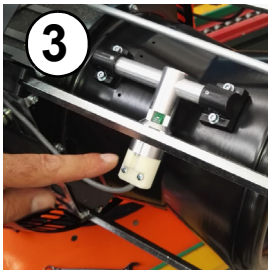
- Use a soft bristle brush (B) to clean the sensor

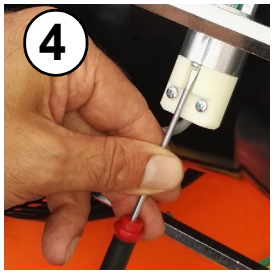


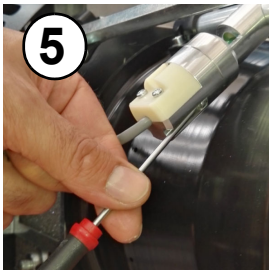
To clean the air flow sensor, proceed as follows:

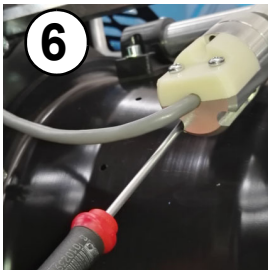
1 Remove the air intake silencer (1,2)
2 Loose the srews (4,5,6)
3 Remove the air flow sensor from its slot, carefully (7,8)
4 clean the bulbe with a cotton cloth, taking care not to touch it with hands or with the bristles provided;
5 Make sure there is no grease on the sensor surface
6 Replace the air flow sensor into its slot.

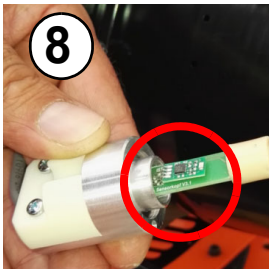


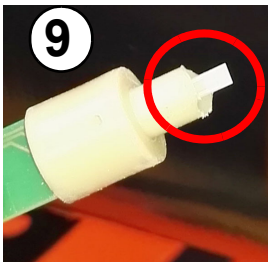










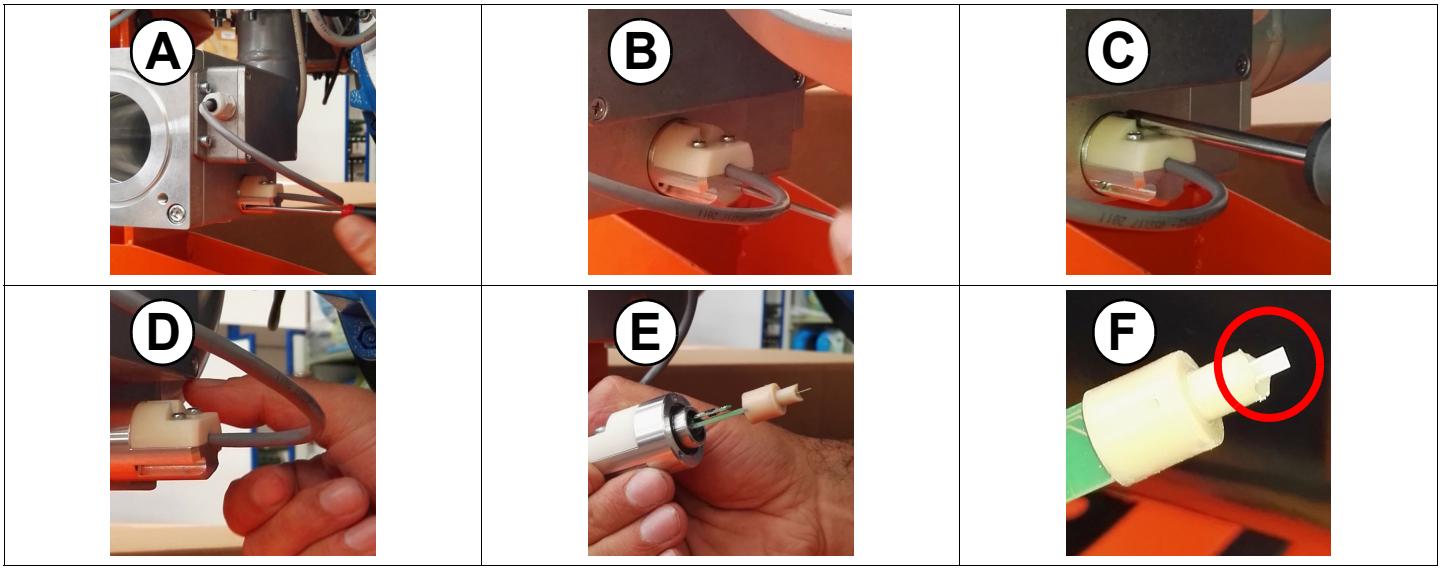


Gas flow sensor maintenance

ATTENTION! DO NOT TOUCH THE SENSOR (figure F) WITH HANDS. CLEAN ONLY WITH COTTON SWAB. DO NOT USE ANY CLEANING PRODUCT.

To clean the gas flow sensor, proceed as follows:

1 Loose the srews (A, B, C)
2 Remove the gas flow sensor from its slot, carefully (D)
3 clean the bulbe with a cotton swab, taking care not to touch it with hands;
4 replace the gas flow sensor into its slot.



Burner service term

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

Seasonal stop

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

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

Burner disposal

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

WIRING DIAGRAMS

Refer to the attached wiring diagrams.

WARNING

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

TROUBLESHOOTING GUIDE Gas operation

BURNER DOESN'T LIGHT	* No electric power supply	* Restore power supply
	* Main switch open	* Close switch
	* Thermostats open	* Check set points and thermostat connections
	* Bad thermostat set point or broken thermostat	* Reset or replace the thermostat
	* No gas pressure	* Restore gas pressure
	* Safety devices (manually operated safety thermostat, pressure switches and so on) open	* Restore safety devices; wait till boiler reaches operating temperature then check safety device functionality.
	* Broken fuses	* Replace fuses. Check current absorption
	* Fan thermal contacts open (three phases motors only)	* Reset contacts and check current absorption
	* Burner control lock out	* Reset and check its functionality
	* Burner control damaged	* Replace burner control
GAS LEAKAGE: BURNER LOCKS OUT (NO FLAME)	* Gas flow is too low	* Increase the gas flow * Check gas filter cleanness * Check butterfly valve opening when burner is starting (only Hi-Low flame and progressive)
	* Ignition electrodes discharge to ground because dirty or broken	* Clean or replace electrodes
	* Bad electrodes setting	* Check electrodes position referring to instruction manual
	* Electrical ignition cables damaged	* Replace cables
	* Bad position of cables in the ignition transformer or into the electrodes	* Improve the installation
	* Ignition transformer damaged	* Replace the transformer
BURNER LOCKS OUT WITH FLAME PRESENCE	* Wrong setting of flame detector	* Adjust flame detector
	* Flame detector damaged	* Replace flame detector
	* Bad cables of flame detector	* Check cables
	* Burner control damaged	* Replace burner control
	* Phase and neutral inverted	* Adjust connections
	* Ground missing or damaged	* Check ground continuity
	* Voltage on neutral	* Take off tension on neutral
	* Too small flame (due to not much gas)	* Adjust gas flow * Check gas filter cleanness
	* Too much combustion air	* Adjust air flow rate
only FOR LME22: BURNER CONTINUES TO PERFORM ALL ITS FEATURES WITHOUT IGNITING THE BURNER	* Air pressure switch damaged or bad links	* Check air pressure switch functions and links
	* Burner control damaged	* Replace burner control
BURNER LOCKS OUT WITHOUT ANY GAS FLOW	* Gas valves don't open	* Check voltage on valves; if necessary replace valve or the burner control * Check if the gas pressure is so high that the valve cannot open
	* Gas valves completely closed	* Open valves
	* Pressure governor too closed	* Adjust the pressure governor
	* Butterfly valve closed	* Open the butterfly valve
	* Maximum pressure switch open.	* Check connection and functionality
	* Air pressure switch doesn't close the NO contact	* Check connections * Check pressure switch functionality
THE BURNER IS BLOCKED AND THE EQUIPMENT PROVIDES A LOCK CODE "CAUSE AIR PRESSURE SWITCH FAULT"	* Air pressure switch damaged (it keeps the stand-by position or badly set)	* Check air pressure switch functionality * Reset air pressure switch
	* Air pressure switch connections wrong	* Check connections
	* Air fan damaged	* Replace motor
	* No power supply	* Reset power supply
	* Air damper too closed	* Adjust air damper position
BURNER LOCKS OUT DURING NORMAL RUNNING	* Flame detector circuit interrupted	* Check wiring * Check photocell
	* Burner control damaged	* Replace burner control
	* Maximum gas pressure switch damaged or badly set	* Reset pressure switch or replace it
THE BURNER STARTS AND AFTER A WHILE IT REPEATS THE STARTING CYCLE.	* Gas pressure switch badly set	* Reset the pressure switch
	* Gas filter dirty	* Clean gas filter
	* Gas governor too low or damaged	* Reset or replace the governor
BURNER STANDS WHILE RUNNING WITHOUT ANY SWITCHING OF THERMOSTATS	* Thermal contacts of fan motor open	* Reset contacts and check values * Check current absorption
FAN MOTOR DOESN'T START	* Internal motor wiring broken	* Replace wiring or complete motor
	* Fan motor starter broken	* Replace starter
	* Fuses broken (three phases only)	* Replace fuses and check current absorption
BURNER DOESN'T SWITCH TO HIGH FLAME	* Hi-low flame thermostat badly set or damaged	* Reset or replace thermostat
	* Servomotor cam badly set	* Reset servomotor cam
***mechanical only*: SOMETIMES THE SERVOMOTOR RUNS IN THE WRONG WAY**	* Servomotor capacitor damaged	* Replace capacitor
PHASE-TO-PHASE SUPPLY OR PRESENCE OF VOLTAGE ON NEUTRAL*	* Lights up and freezes	* In such cases, insert an RC circuit (our code 2531003).

List of error codes

FAULT CODE	DISPLAY STRING	DESCRIPTION	SUGGESTION
01	Ignition fault	BLOCK NO flame signal detection at the end of safety time.	1) Gas valve outlet pressure too low, check the pressure during ignition 2) Gas actuator position too closed 3) Ignition electrode not correctly positioned 4) Flame detection electrode not correctly positioned 5) Check Phase, Neutral and Protective Earth electric connections 6) Check AIR actuator position
02	Extraneus Flame /	BLOCK False flame signal during stand-by or preventilation time.	1) Defective or badly positioned detetction electrode, check electrode integrity 2) Defective or damaged electrode wiring, check electrode wiring 3) Disconnect the detector cable from the device, reset the system, if the problem reappears replace the HAGC31 unit
03	Safety Loop OPEN/	BLOCK Safety thermostats chain open during operation.	1) Check boiler safety thermostats / pressure switches 2) Check boiler safety thermostats / pressure switches wiring
04	Loos of Flame	BLOCK Loss of flame during operation.	1) Gas valve pressure outlet too low, check pressure during operation 2) Flame detection electrode not correctly positioned 3) Check Phase, Neutral and Protective Earth electric connections
05	Control Board internal error	BLOCK Internal device error	1) Check all the electrical connections 2) If it persists, replace the HAGC31 unit
06	Control Board internal error	BLOCK Internal device error	1) Check all the electrical connections 2) If it persists, replace the HAGC31 unit
07	AIR pressure switch	BLOCK Insufficient air pressure during prewash, during ignition or during operation	1) Check air pressure switch calibration 2) Blocked air inlet, check air inlet 3) Hydraulic connection line gas pressure switch obstructed 4) Minimum required power too low
08	Max Gas pressure switch	BLOCK Maximum gas pressure switch intervenes during start-up or during operation.	1) Check max gas pressure switch calibration 2) Check the main gas outlet valve pressure 3) Backpressure too high during ignition, reduce ignition power 4) Dirty or obstructed boiler, check the flue gas pipe and the smoke passage in the combustion chamber
09	Maxim number of manual reset	BLOCK Maximum number of manual reset is reached, switch off for 10 seconds to reactivate the burner, then reactivate the system	
10	AIR Actuator	BLOCK AIR servomotor positioning error, max or min limit switch not reached during servomotor testing	1) Blocked servomotor, check the servomotor movement 2) Servomotor wiring error 3) Servomotor does not reach maximum position check flue dampers movement 4) Servomotor does not reach minimum position check flue dampers movement 5) External EMC disturbances, check wiring 6) Defective servomotor, replace it
11	GAS Actuator	BLOCK GAS servomotor positioning error, max or min limit switch not reached during servomotor testing	1) Blocked servomotor, check the servomotor movement 2) Servomotor wiring error 3) Servomotor does not reach maximum position check flue dampers movement 4) Servomotor does not reach minimum position check flue dampers movement 5) External EMC disturbances, check wiring 6) Defective servomotor, replace it
13	AIR cross-check error	BLOCK AIR signal congruence band servomotor position exceeded, AIR flow correction required too high.	1)Has the boiler been soiled? 2) Blocked air inlet? 3) Incorrect engine revolutions, check engine ventilation integrity 4) Dirty air fan? 5) Blocked chimney? 6) Dirty AIR sensor, check the AIR sensor lead
14	GAS cross-check error	BLOCK GAS signal congruence band servomotor position exceeded, GAS flow correction required too high, it occurs only during normal operation	1) Is the gas valve out of calibration? 2) The gas inlet pressure has increased too much 3) The gas inlet pressure has decreased too much 4) GAS sensor dirty
15	V1 Gas leak	BLOCK Valve V1 loses gas does not pass VPS test	1) PGCP pressure calibration not correct 2) Defective valve, replace it, loses gas!
16	V2 Gas leak	BLOCK Valve V2 loses gas does not pass VPS test	1) PGCP pressure calibration not correct 2) Defective valve, replace it, loses gas!
17	AIR Actuator	BLOCK AIR servomotor positioning error, during operation, required position not in line with the actual position.	1) EMC faults distort communication, verify EMC arriving from outside 2) Defective servomotor movement, check the movement of the damper manually 3) Defective servomotor, replace it
18	GAS Actuator	BLOCK GAS servomotor positioning error, during operation, required position not in line with the actual position.	1) EMC faults distort communication, verify EMC arriving from outside 2) Defective servomotor movement, check the movement of the damper manually 3) Defective servomotor, replace it
22	Gas pressure too low	BLOCK During curves scan: Gas pressure after the valve is insufficient to complete the scan	1) check GAS pressure input if correct adjust the valve. 2) Maximum power required too high control maximum boiler power Increase the gas pressure at the outlet of the main gas valve, reset the burner and reactivate the curve scan, if the problem recurs, increase the outlet pressure again and reset the burner again and reactivate the curve scan.

23	Air pressure too low	BLOCK During curves scan: Air port too low, not enough to reach the required power	1) Check the boiler parameters, maximum power. 2) Position of combustion head not correct. 3) Blocked air inlet 4) Dirty or obstructed boiler, check the flue gas pipe and flue passage on the combustion chamber
24	Gas pressure too high	BLOCK During curves scan or at end of scan: Outlet gas valve pressure too high, the GAS servomotor during the scan never exceeded the 40° positioning, the automatic regulation could be unstable.	1) If the Block is reset, the Burner works normally with high pressure after the valve, the regulation could be unstable with continuous changes of servomotors positioning. 2) Reduce the gas pressure at the valve outlet, reset the block and reactivate the curve scan 3) If error is signalled again repeat step 2.
31	Air Pressure Switch Faulty	Device external fault. AIR sensor defective, the contact results closed with ventilation Off	1) Defective AIR pressure switch 2) AIR pressure switch wiring incorrect
32	Power Supply	Device external fault. DC 24. 24V power supply incorrect	1) Check electrical connections 2) Check 24V DC power supply on terminals X2 3) Check 24V power supply
33	Power Supply	Device external fault. AC 230V, power has fallen below 170V. The system will automatically reset if the mains voltage> 200V.	1) Check 230V single-phase power supply 2) Check wiring 3) Check power supply on terminals X1
34	Safety Loop OPEN	Device external fault. Safety thermostats chain open with burner waiting for heat request. It automatically resets when the anomaly disappears	1) Check boiler safety thermostats / pressure switches 2) Check boiler safety thermostats / pressure switches wiring
35	Max Gas Pressure Switch Faulty	Device external fault. Defective MAXIMUM Gas pressure switch, it results open when the burner is off	1) Check the Max pressure switch wiring 2) If necessary, replace the Maximum pressure switch
36	Min Gas Pressure Switch	Device external fault. Mains gas pressure too low.	1) Check the mains gas pressure 2) Check minimum pressure switch calibration 3) Check minimum pressure switch contacts 4) If necessary, replace the minimum pressure switch
37	--	BLOCK Display communication error	1) Check Display electrical connection 2) Replace display 3) Communication error of the main equipment, replace the device
38	Air flow sensor	Device external fault. Air signal sensor below the minimum threshold	1) Check sensor wiring 2) Clean sensor 3) Replace sensor
39	Gas flow sensor	Device external fault. Gas signal sensor below the minimum threshold	1) Check sensor wiring 2) Clean sensor 3) Replace sensor
43	Curve scanning Fault	BLOCK During the scan the air and gas signals are not stable the system cannot keep the position of the servomotors stable.	1) Check gas outlet valve pressure 2) Verify damper servomotor connections, reduce mechanical clearance 3) Chamber counter-pressure unstable, check boiler exhaust fumes 4) Check the gas supply pressure. 5) Check gas pressure regulator
44	Generic	BLOCK Microprocessor communication error.	1) Verify correct assembly of removable EPROM memories 2) Check the display, modbus, wifi, open term wiring 3) Replace the main unit
45	Generic	Device external fault. Process probe error.	1) Check process probe 2) Check the wiring of the process probe 3) Check the process probe connections 4) Check thermoregulation programming
46	Fan Thermal relay	Device external fault. Fan thermal relay interrupted.	1) Check motor thermal relay 2) Check motor ventilation electric absorption

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HAGC31 – CU01

Electronic control &
Display RC21.52

Flame control device
for blown gas burner
with integrated air/gas ratio control

TECHNICAL INSTRUCTIONS

M12931CC - Rel. 0.0 - 02/2022

INDICE

1. INTRODUCTION

1 - 1. Notes on the documentation

Please observe the safety instructions in this manual.

1 - 2. Symbols

Symbol used in this manual are explained below:

SYMBOL	DESCRIPTION
	Immediate danger to life and limb!
	Risk of death from electric shock!
	Potentially dangerous situation for the environment and the product!
	Useful information and instructions.

Tab.1 - Symbols

1 - 3. Acronyms and abbreviations

WORD	DESCRIPTION
ACT	Actuator
CO	Carbon Monoxide
FE	Functional Earth
L	Power Supply Line Conductor
N	Power Supply Neutral Conductor
OR	Restricting Orifice
OT	Open Therm
PE	Protection Earth
APS	Air pressure switch
PS(MAX)	Gas Pressure Switch (Maximum Pressure)
PS(MIN)	Gas Pressure Switch (Minimum Pressure)
PS(VP)	Gas Pressure Switch (for Valve Proving)
PV	Pilot Valve
SV	Shutoff Valve
V1	Gas Valve (1)
V2	Gas Valve (2)
VPS	Valve Proving System

Tab.2 - Acronyms and abbreviations

2. SAFETY INSTRUCTIONS

2 - 1. Warning notes

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

 **Do not open, interfere with or modify the unit!**

 **Do not remove or modify any safety components on the system!**

The HAGC31 safety parameters can be modify only by RC21.55 service tool. After a settings modification, the functionality of the burner has to be verified.
The HAGC31 safety parameters can be modify only by RC21.55 service tool.
In case of memorization error (the parameter data shown at display is corrupted), few attempts to write settings can be performed.
If the error persists, the unit has to be put in a safety state!

2 - 2. Installation notes


Installation work must be carried out by competent persons.The relevant national regulations have to be observed.


Before performing any wiring changes in the connection area of the HAGC31, completely isolate the unit from the main supply (all-polar disconnection).

- 
Ensure protection against electric shock hazard by providing adequate protection for the unit's connection terminal.
- 
Do not feed external mains voltage to the control outputs of the unit. When testing external components controlled by the HAGC31 (fan motor, valves etc.), the burner control unit may never be plugged in.
- 
Dropping the unit or shock can adversely affect the safety functions. Such units may not be put into operation, even if they do not exhibit any visible damage.
- 
On commissioning the wiring has to be carefully checked according the appropriate diagram. Incorrect wiring can damage the unit and endanger the installation.
- 
Observe the correct mains polarity.
- 
The fuse rating has to ensure that the limit specified in the TECHNICAL FEATURES AND DATA will not be exceeded. If these precautions are not observed, the effect of a short circuit can cause severe damage to the control and installation.
- 
Make certain that the maximum permissible current rating of the connection terminals will not be exceeded.
- 
Always run the high-voltage ignition cable separately while observing the greatest possible distances to the unit and to other cables.
- 
Never run the detector cable together with other cables.
- 
Only the allowed external power supplies must be used (refer to TECHNICAL FEATURES AND DATA).
- Observe the maximum permissible lengths of detector cables (refer to TECHNICAL DATA).


If the RC21.52 control panel is disconnected, no operation of the burner is allowed! The system doesn't operate!


In case of Internal communication error the burner automatic regulation mode is not allowed! The system can only operate in manual regulatuion mode!

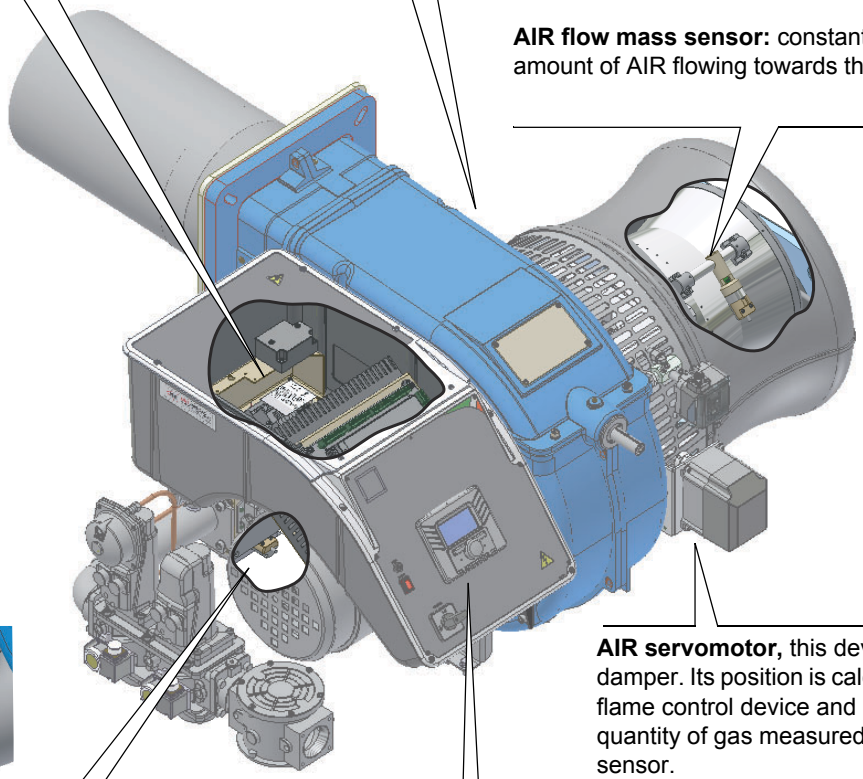
3. GENERAL DESCRIPTION

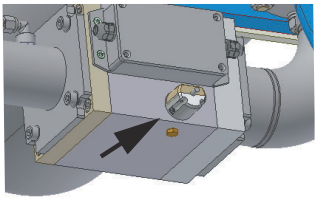
The Facile series burner control unit is a device for continuous automatic adjustment of the AIR/GAS ratio. The system is composed of:

FACILE unit
Manages all the burner adjustment and safety functions

1 GAS servomotor, this device acts on the GAS butterfly valve. Its position is calculated by the FACILE flame control device and depends on the power required by the system and the current measurement of the GAS flow sensor

AIR flow mass sensor: constantly measures the amount of AIR flowing towards the combustion head.





AIR servomotor, this device acts on the AIR damper. Its position is calculated by the FACILE flame control device and depends on the quantity of gas measured by the GAS flow sensor.

GAS flow mass sensor: which constantly measures the amount of gas flowing towards the combustion head. NB Insert image of the burners with all the components (see example). Add sensors and actuator.

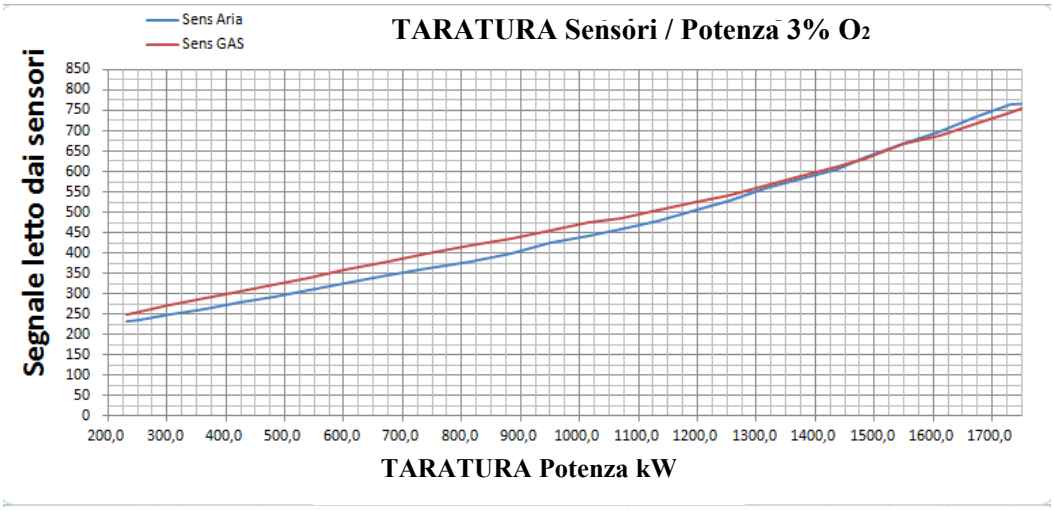
USER display, installed on the machine, with which only the non-safety parameters can be varied or changed. With this display it is not possible to adjust or set the AIR/GAS ratio. It is a visual display.

SERVICE display, supplied with the technical assistance services. With this display it is possible to change the settings and adjust the burner. This is necessary at first ignition of the burner. This display must only be used by technical personnel authorised and trained by CIBUNIGAS.

3 - 1. FACILE SYSTEM – PRINCIPLE OF OPERATION

The control device manages the AIR and GAS flow, continuously measuring the AIR/GAS volumes using mass flow sensors and keeping constant the ratio between fuel and combustion. This ratio is defined by CIB UNIGAS and may be adapted to system requirements only by personnel authorised by CIB UNIGAS. The ratio between their masses is factory set so that residual O2 in fumes is around 3%. This is usually regulated within a regulation window of 2.5% to 3.5%. This ratio is defined by the CALIBRATION parameters which define the CALIBRATION curves of the AIR/GAS flow sensors.

The system uses mass sensors which constantly measure AIR/GAS flows. The value read by the sensors is not dependent on environmental changes in pressure, temperature, altitude, etc.



For safety reasons, at first start-up of the system, the THERMAL UNIT PARAMETERS must be set. These parameters are dependent on the installation. See thermal unit parameter settings.

It will then be necessary to activate the CURVE SCAN function.

After activating this function, the system will turn on and adjust the Burner to the minimum power set by the CALIBRATION parameters (point P1). The AIR and GAS servomotors are automatically set in the appropriate positions to read from the sensors the flows stored in CALIBRATION point P1. If the sensor signal remains stable for 30 seconds, the relative reference positions for the AIR and GAS servomotors will be automatically memorised. Subsequently, the system moves to CALIBRATION point P2, P3, P4, etc., always storing the servomotor reference positions.

The number of points to be scanned depends directly on the thermal unit parameters set previously.

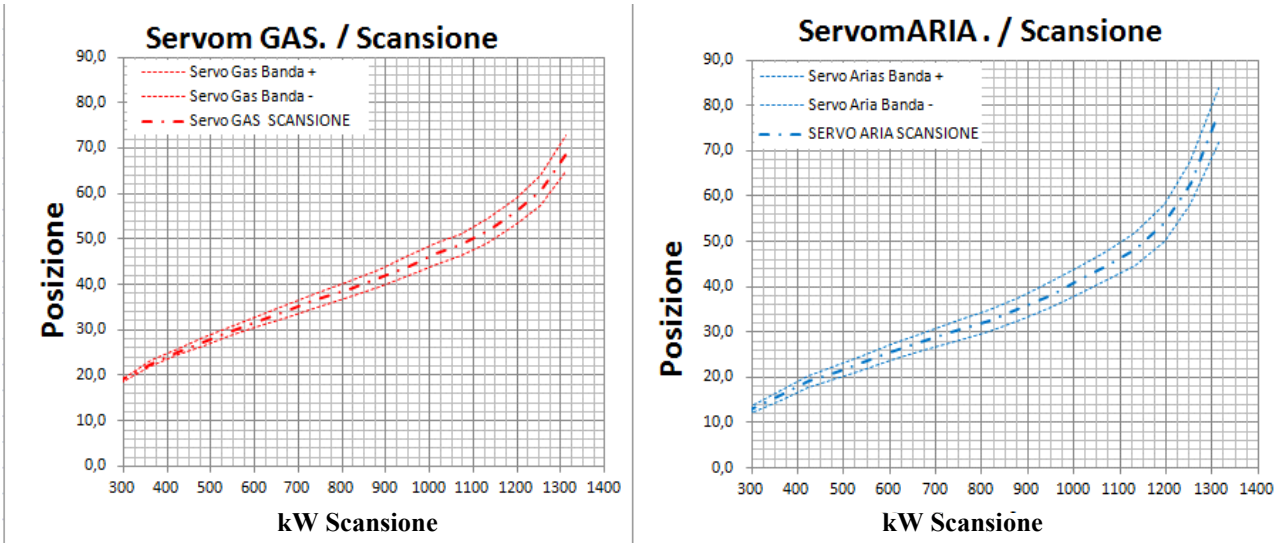
During the scan, the Operator only needs to check that the residual O2 in fumes is within the range of 2.5% to 3.5%.

At the end of the Curve scan, the Burner will turn off. If there are no error messages, the system is ready for normal operation.

The duration of the curve scan function depends on the number of points to be scanned. A calibration point is usually stored and adjusted in approximately 45 seconds. Therefore, if there are 30 points to be scanned, the time required for the scan is approximately 23 minutes.

The average scan time on real installation is approximately 16 minutes.

Example scan:



EXAMPLE SCAN

An example curve scan can be seen on the graph. The maximum boiler power required is 1300Kw. The curves referred to Banda+ and Banda- are the operating limits allowed by the system. The servo scan curves are referred to the positions of the servomotors stored during the curve scan. The operating limits of the servomotors are defined by the parameters (see, for example, section 21-3. CONSISTENCY FUNCTIONS)

NORMAL OPERATION

After performing the curve scan procedures, the Burner adjusts the AIR/GAS flows as defined by the AIR/GAS sensor curve calibration parameters. The curve scan parameters where the positions related to the servomotors are used as a safety control. During the required power change, the system will position the servomotors as stored on the curve scan parameters. When the stored positions are reached, the system will start to adjust the air/gas flows by following the air/gas sensor calibration parameters.
During normal operation, the system constantly controls and checks the measured flows and positions of the servomotors. The positions of the servomotors are constantly compared with the positions of the servomotors stored during the curve scan (at first start-up). A deviation is permissible within the limits set by CIB UNIGAS. If the deviation exceeds these limits, the system safety lock is activated due to lack of congruent signals. The limits are set to ensure operation in conditions of normal use. Excessive deviations indicate a malfunctioning of the system, e.g. the gas regulator valve is damaged, the boiler is dirty, the boiler chimney is obstructed, the burner fan is dirty, the air inlet is obstructed, etc.

INTEGRATED POWER REGULATOR

The system has an integrated power regulator which constantly measures the temperature or pressure process variable and compares it with the required set point. An error between the value read and the set point will generate an increase or decrease in required power. The calculation of required power depends on the PID parameters set on the integrated power regulator.
The system also has an integrated electronic regulation thermostat where it is possible to set the operating limits.

4. ELECTRICAL CONNECTIONS

4 - 1. ELECTRICAL LIMITATIONS

Any cable connection and connection to the power supply must be carried out by specialised, informed and trained personnel who are directly coordinated or authorised by Technical Assistance. Always check in advance that the electrical interlocking system is equipped with a safety circuit breaker.

WARNING! It is strictly forbidden to use the fuel interlocking pipes for the execution and/or completion of earthing.

.DANGER: Incorrect rotation of the motor can cause serious material damage and personal injury.

WARNING: before starting up the burner, ensure that the manual shut-off valves are open and check that the pressure value upstream of the ramp is consistent with the values in the "Technical data" section. Also ensure that the main power switch is closed.

DANGER: During calibration operations, take care not to operate the burner with insufficient air flow (danger of carbon monoxide emission). If this happens, make the gas decrease slowly until normal combustion values are reached.

WARNING: Under no circumstances must the sealed screws be loosened. If this happens, the component guarantee ceases to be valid.

- The system must be built in compliance with current regulations.
  - •Earthing. Always check in advance the connection, functionality and compliance of the earthing wire with health and safety regulations. In case of doubt, request an accurate check by qualified technical personnel.
  - •Check the connection of the earthing system.
  - •Do not use external earths (e.g. fuel interlocking pipes, metal structures, etc.) to earth the burner.
  - •When connecting the electric power supply wires to the burner's MA terminal board, ensure that the earthing wire is longer than the phase and neutral conductors.
  - •Do not invert the phase and neutral connections.
  - •Ensure that on the burner's power line there is an omnipolar disconnector and a residual current switch, a magnetothermal switch or fuses.
  - •Power the burner with a flame-resistant electrical cable with cross-section adequate to the installed capacity (see attached circuit diagram), observing the voltage values indicated on the burner nameplate.
  - •Always check in advance the protection of the power supply network against power surges and electromagnetic interferences. If these and other values contrast with the data provided by the manufacturer, cut off the burner from the power sources and urgently contact authorised Technical Assistance.•Check that the voltage for which the system and the burner motors are set corresponds to the mains voltage (+/- 10%).
  - •Ensure that the IP degree of protection is consistent with the characteristics of the installation location and environment.
  - •Before any operation of the machine's electrical panel, open the system's omnipolar disconnector and move the switch on the burner's electrical panel to the OFF position.

In any event:

Make the electrical connections to the terminal block according to the circuit diagrams attached to the manual.

The electrical panel comes complete with terminal block for connections to the system's power line and, if there is an on-board panel, a plug for modulation probe connections (if present).

4 - 2. USE RESTRICTIONS

THE BURNER IS DESIGNED AND CONSTRUCTED TO WORK ONLY AFTER BEING CORRECTLY PAIRED WITH 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 ENSURE THE CORRECT ASSEMBLY OF THE APPLIANCE, ENTRUSTING INSTALLATION TO QUALIFIED PERSONNEL AND MAKING SURE THAT FIRST START-UP IS PERFORMED BY AN ASSISTANCE CENTRE AUTHORISED BY THE BURNER MANUFACTURER. IN THIS REGARD, IT IS ESSENTIAL TO HAVE AN ELECTRICAL CONNECTION TO THE ADJUSTMENT AND SAFETY COMPONENTS OF THE GENERATOR (WORKING THERMOSTATS, SAFETY THERMOSTATS, ETC.) TO ENSURE PROPER AND SAFE OPERATION OF THE BURNER.

ANY OPERATION OF THE APPLIANCE THAT IS UNRELATED TO INSTALLATION OPERATIONS OR OCCURRING AFTER COMPLETE OR PARTIAL TAMPERING (E.G. DISCONNECTION, EVEN PARTIAL, OF ELECTRICAL CONDUCTORS, OPENING OF THE GENERATOR HATCH, DISASSEMBLY OF PARTS OF THE BURNER) IS THEREFORE TO BE EXCLUDED.

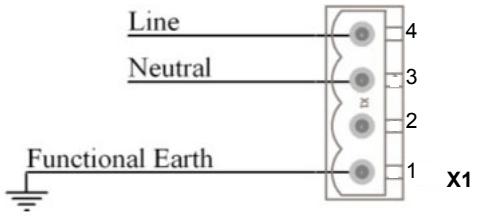
NEVER OPEN OR DISASSEMBLE ANY MACHINE COMPONENT UNLESS FOR MAINTENANCE PURPOSES.

TO PUT THE MACHINE IN SAFETY MODE, OPERATE THE MAIN DISCONNECT SWITCH. IN THE EVENT OF ANOMALIES THAT REQUIRE THE BURNER TO BE TURNED OFF, IT IS POSSIBLE TO OPERATE THE AUXILIARY LINE SWITCH ON THE FRONT PANEL.

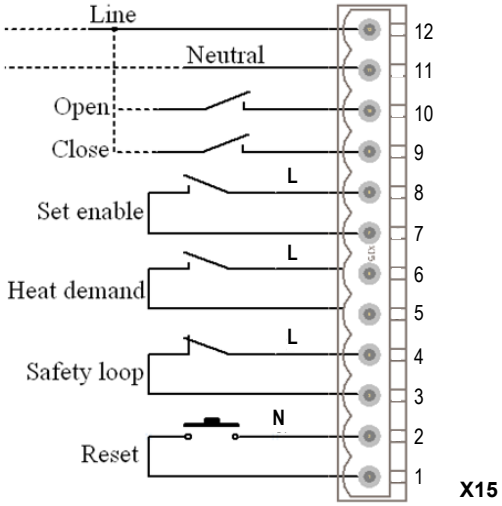
IN THE EVENT OF LOCKOUT, UNLOCK THE DEVICE BY PRESSING THE RESET BUTTON. IF LOCKOUT HAPPENS AGAIN, CONSULT TECHNICAL ASSISTANCE WITHOUT MAKING ADDITIONAL ATTEMPTS.

WARNING: DURING NORMAL OPERATION, THE BURNER PARTS CLOSEST TO THE GENERATOR (COUPLING FLANGE) ARE SUBJECT TO HEATING. TO AVOID SCALDING, DO NOT TOUCH THEM.

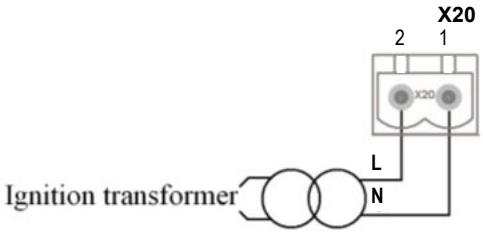
0 - 1. High voltage connections descriptions

X1: 4-pole STELVIO connector P5			
SYMBOL			
			
POLES	TYPE	DESCRIPTION	NOTES
1	Input	Functional Earth	High voltage
2	-		
3	Input	Neutral conductor	
4	Input	Line conductor	

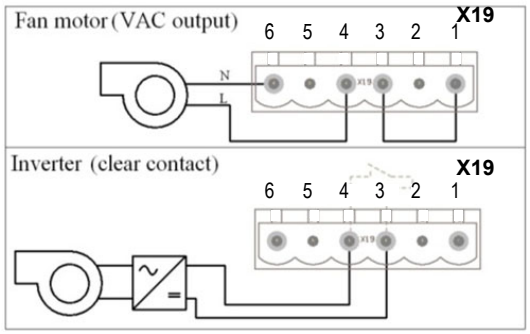
Tab.1 - X1 descriptions

X15: 12-pole STELVIO connector P5			
SYMBOL			
			
POLES	TYPE	DESCRIPTION	NOTES
1	Input	Reset	High voltage
2	Output	Neutral conductor	
3	Input	Safety loop (series of contact)	
4	Output	Line conductor	
5	Input	Heat demand contact (series of contacts)	
6	*Output*	*Line conductors (not available)*	
7	*Input*	*Setpoint enable(not available)*	
8	Output	Line conductors	
9	Input	Close (command from external regulator)	
10	Input	Close (command from external regulator)	
11	Output	Neutral conductor	
12	Output	Line conductor	

Tab.2 - X15 descriptions

X20: 2-pole STELVIO connector P5Ignition transformer			
SYMBOL			
			
POLES	TYPE	DESCRIPTION	NOTES
1	Output	Neutral conductor	High voltage
2	Output	Ignition transformer (line conductor)	

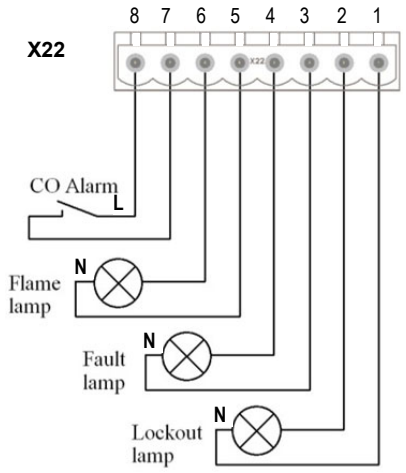
Tab.3 - X20 descriptions

X19: 6-pole STELVIO connector P5Ventilation/inverter release			
SYMBOL			
			
POLES	TYPE	DESCRIPTION	NOTES
Fan motor			
1-3	Connect together (by external wiring) – Line conducto		
2	-	-	High voltage
4	Output	Fan motor (line conductor)	
5	-	-	
6	Output	Fan motor (neutral conductor)	
Inverter			
1	-	-	Clear contact
2	-	-	
3	Output	Clear contact (common)	
4	Output	Clear contact (normally opened)	
5	-	-	
6	-	-	

X19 descriptions
X19 terminal board, ventilation motor / motor contactor / INVERTER consent contact connection

X22: 8-pole STELVIO connector P5

SYMBOL

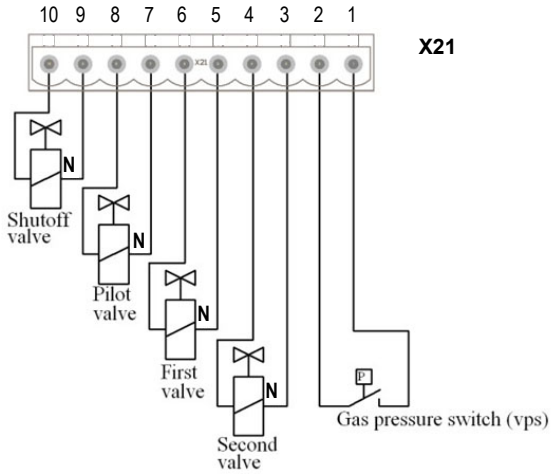


POLES	TYPE	DESCRIPTION	NOTES
1	Output	Lockout lamp (neutral conductor)	
2	Output	Lockout lamp (line conductor)	
3	Output	Fault lamp (neutral conductor)	
4	Output	Fault lamp (line conductor)	
5	Output	Flame lamp (neutral conductor)	High voltage
6	Output	Flame lamp (line conductor)	
7	Input	CO alarm / Thermal motor protection	
8	Output	Line conductor	

Tab.4 - X22 descriptions

X21: 10-pole STELVIO connector P5

SYMBOL

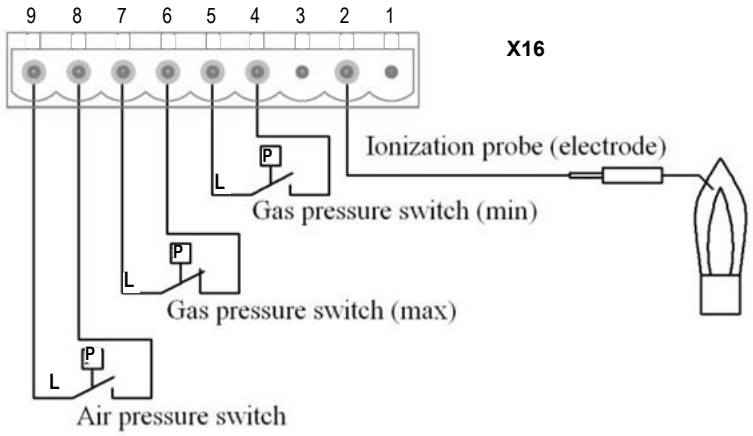


POLES	TYPE	DESCRIPTION	NOTES
1	Input	Gas pressure switch (for valve proving system)	
2	Output	Line conductor	
3	Output	Second valve (neutral conductor)	
4	Output	Second valve (line conductor)	
5	Output	First valve (neutral conductor)	
6	Output	First valve (line conductor)	High voltage
7	*Output*	*Pilot valve (neutral conductor)(not available)*	
8	*Output*	*Pilot valve (line conductor)(not available)*	
9	Output	Shutoff valve (neutral conductor)	
10	Output	Shutoff valve (line conductor)	

Tab.5 - X21 descriptions

X16: 9-pole STELVIO connector P5

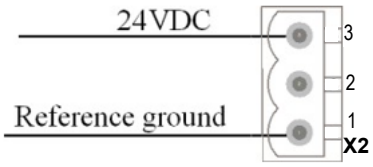
SYMBOL



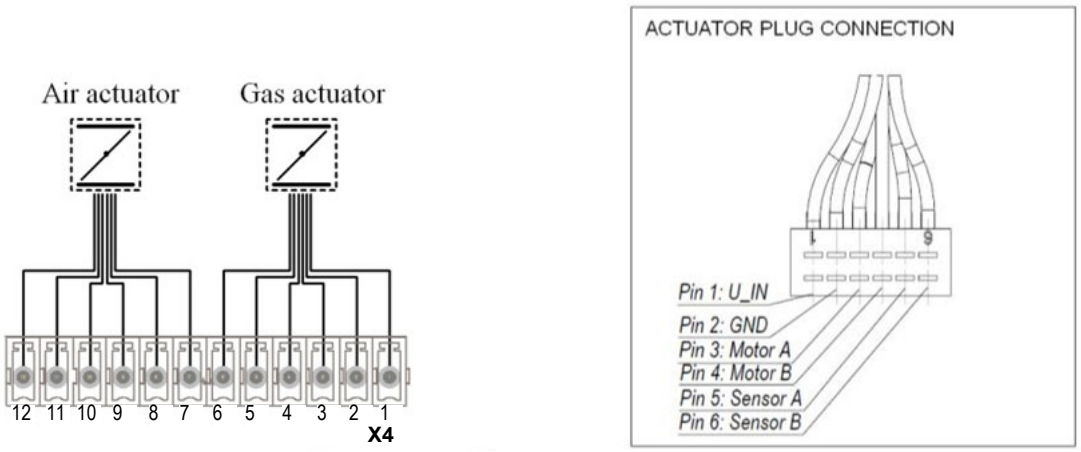
POLES	TYPE	DESCRIPTION	NOTES
1	-	-	
2	Input	Ionization probe (electrode)	High voltage
3	-	-	
4	Input	Gas pressure switch (minimum pressure)	
5	Output	Line conductor	
6	Input	Gas pressure switch (maximum pressure)	
7	Output	Line conductor	
8	Input	Air pressure switch	
9	Output	Line conductor	

Tab.6 - X16 descriptions

0 - 2. Low voltage connections descriptions

X2: 3-pole STELVIO connector P5			
SYMBOL			
			
POLES	TYPE	DESCRIPTION	NOTES
1	Input	Reference ground (GND)	Low voltage
2	-	-	
3	Input	24VDC (from external power supply)	

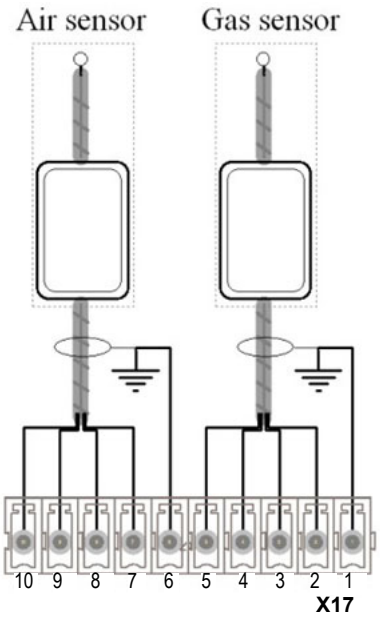
Tab.7 - X2 descriptions

X4: 12-pole STELVIO connector P3,5			
SYMBOL			
			
POLES	TYPE	DESCRIPTION	NOTES
1	Input	Sensor B (gas actuator) Green	Low voltage
2	Input	Sensor A (gas actuator) Yellow	
3	Output	Motor B (gas actuator) Grey	
4	Output	Motor A (gas actuator) Brown	
5	Output	Reference ground (GND) Black	
6	Output	24VDC Red	
7	Input	Sensor B (air actuator) Green	
8	Input	Sensor A (air actuator) Yellow	
9	Output	Motor B (air actuator) Grey	
10	Output	Motor A (air actuator) Brown	
11	Output	Reference ground (GND) Black	
12	Output	24VDC Red	

Tab.8 - X4 descriptions

X17: 10-pole STELVIO connector P3,5

SYMBOL

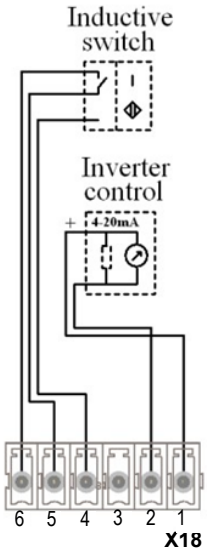


POLES	TYPE	DESCRIPTION	NOTES
1	Output	Functional earth (FE)	Low voltage
3	Input	4-20mA Gas signal4 Grey	
4	Output	Reference ground (GND) White	
5	Output	24VDC Brown	
6	Output	Functional earth (FE)	
8	Input	4-20mA Air signal9 Grey	
9	Output	Reference ground (GND) White	
10	Output	24VDC Brown	

Tab.9 - X17 descriptions

X18: 6-pole STELVIO connector P3,5

SYMBOL

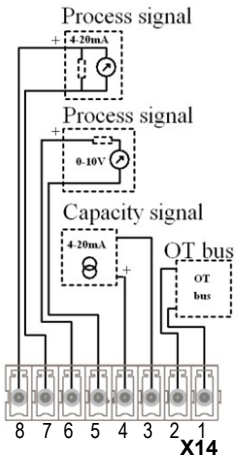


POLES	TYPE	DESCRIPTION	NOTES
1	Output	4-20mA Inverter control signal (+)	Low voltage
2	Output	4-20mA Inverter control signal (-)	
3	-	-	
4	*Output*	*Reference ground (GND) (not available)*	
5	*Input*	*Input signal (inductive sensor) (not available)*	
6	Output	24VDC	

Tab.10 - X18 descriptions

X14: 8-pole STELVIO connector P3,5

SYMBOL



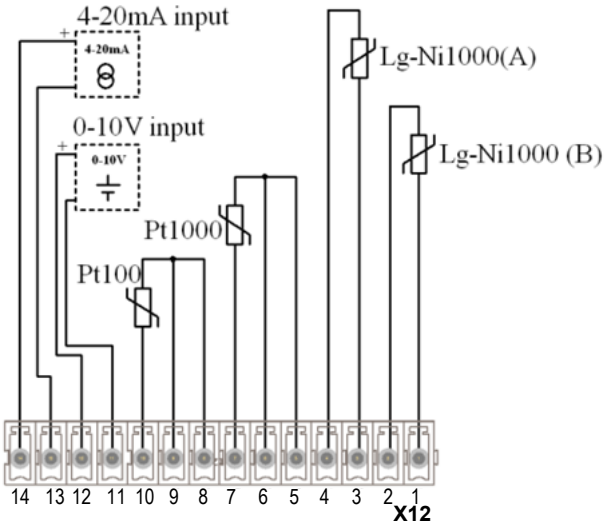
POLES	TYPE	DESCRIPTION	NOTES
1	*Input / Output*	*Open Therm bus(not available)*	Low voltage
2	*Input / Output*	*Open Therm bus(not available)*	
3	Input	4-20mA Capacity signal (-)	
4	Input	4-20mA Capacity signal (+)	
5	*Output*	*Reference ground (GND)(not available)*	
6	*Output*	*0-10V Process signal7(not available)*	
7	*Output*	*4-20mA Process signal (-)(not available)*	
8	*Output*	*4-20mA Process signal (+)(not available)*	

Tab.11 - X14 descriptions

Powered device: 4-20mA input

X12: 14-pole connector

SYMBOL



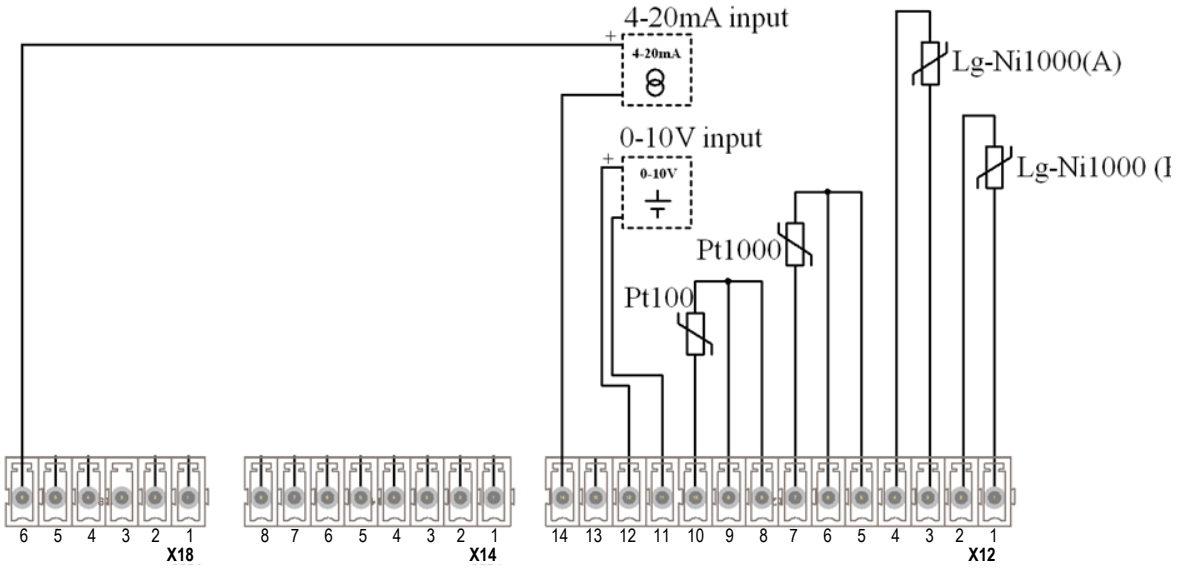
POLES	TYPE	DESCRIPTION	NOTES
1	Input	Lg-Ni1000 sensor (B)	Low voltage
2	Input		
3	Input	Lg-Ni1000 sensor (A)	
4	Input		
5	Input	Pt1000 sensor	
6	Input		
7	Input		
8	Input	Pt100 sensor	
9	Input		
10	Input		
11	Input	Reference ground (GND)	
12	Input	0-10V thermocouple or pressure sensor)	
13	Input	4-20mA (-) (thermocouple or pressure sensor) POWERED DEVICE	
14	Input	4-20mA (+) (thermocouple or pressure sensor) NOT POWERED DEVICE	

Tab.12 - X12 descriptions

Not Powered device: 4-20mA input

X12: 14-pole STELVIO connector P3,5

SYMBOL

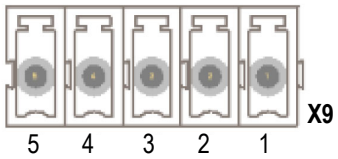


POLES	TYPE	DESCRIPTION	NOTES
1	Input	Lg-Ni1000 sensor (B)	Low voltage
2	Input		
3	Input	Lg-Ni1000 sensor (A)	
4	Input		
5	Input	Pt1000 sensor	
6	Input		
7	Input		
8	Input	Pt100 sensor	
9	Input		
10	Input		
11	Input	Reference ground (GND)	
12	Input	0-10V thermocouple or pressure sensor)	
13	Input	-	
14	Input	4-20mA (-) (thermocouple or pressure sensor) NOT POWERED DEVICE	

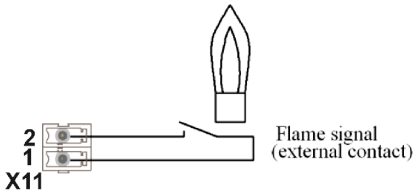
X18 connector

6	Output	4-20mA (+) (thermocouple or pressure sensor) NOT POWERED DEVICE	Low voltage

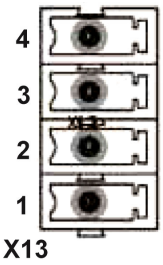
Tab.13 - X12 descriptions

X11: 2-pole STELVIO connector P3,5			
SYMBOL			
			
POLES	TYPE	DESCRIPTION	NOTES
1	Output	24VDC	Low voltage
2	Input - Output	Reference ground (GND)	
3	Output	SDA (Data)	
4	Output	SCL (clock)	
5	Output	Functional earth (FE)	

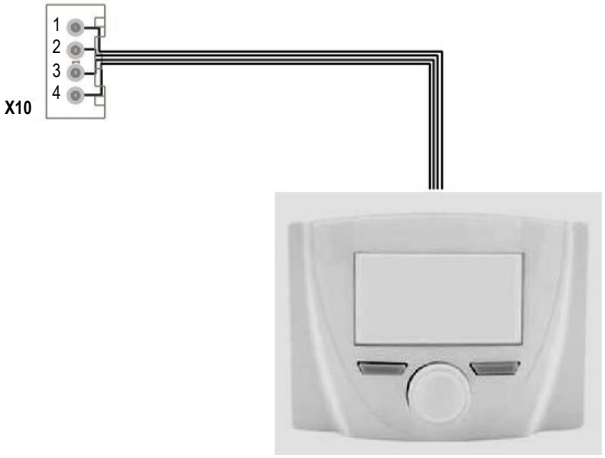
Tab.14 - X9 descriptions

X11: 2-pole STELVIO connector P3,5			
SYMBOL			
			
POLES	TYPE	DESCRIPTION	NOTES
1	*Input*	*Flame signal (external contact) (not available)*	*Low voltage*
2	*Input*		

Tab.15 - X11 descriptions

X13: 4-pole STELVIO connector P3,5			
SYMBOL			
POLES	TYPE	DESCRIPTION	NOTES
1	-		Low voltage
2	-		
3	-		
4	-		

Tab.16 - X13 descriptions

X10: 4-pole connector DISPLAY electrical connections			
SYMBOL			
			
POLES	TYPE	DESCRIPTION	NOTES
1	Black or white		Low voltage
2	Red or brown		
3	Yellow		
4	Green		

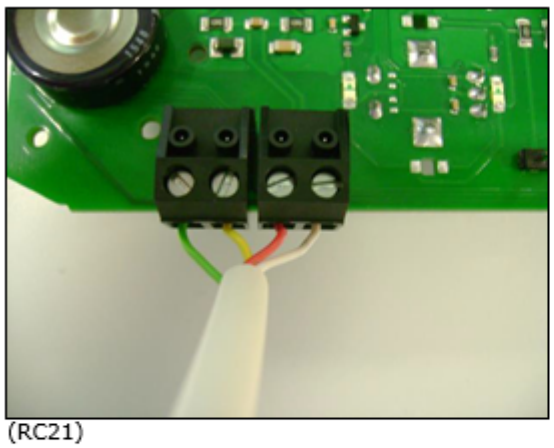
X10 descriptions

4 - 5.

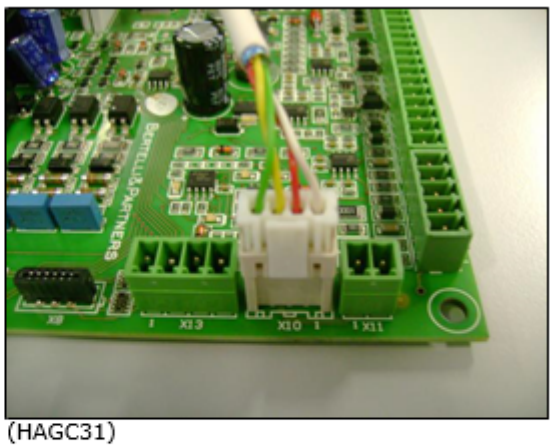
5. FEATURES

5 - 1. Connection cables

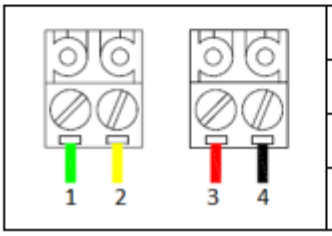
Section: 2 x 2 x 0,75 mm^2 (0,5mm^2 min, 1,5mm^2 max)
Maximum length: see Permitted cables length.



(RC21)



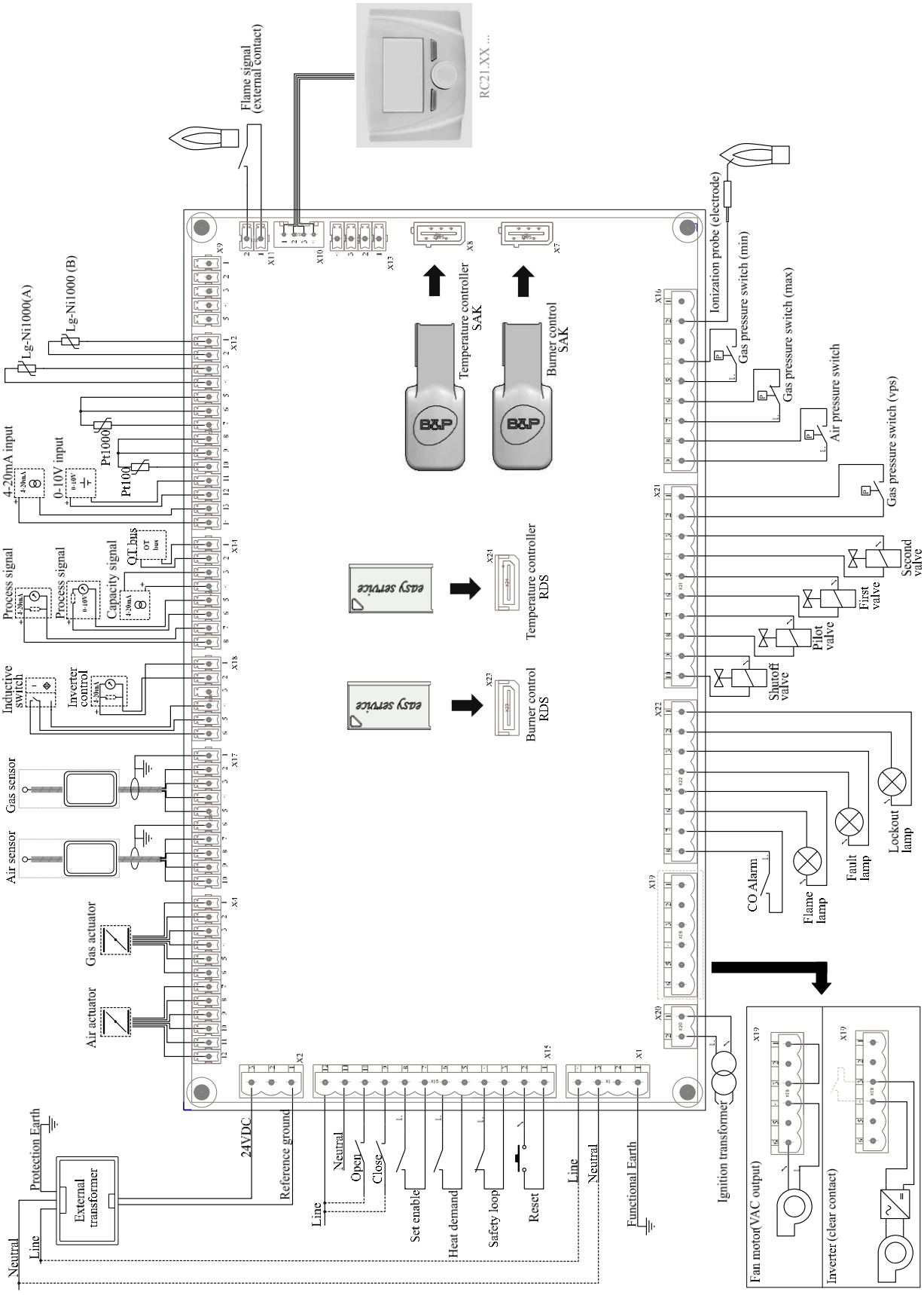
(HAGC31)



1	Green	+ 24 V
2	Yellow	GND
3	Red or Brown	A+
4	Black or White	B-

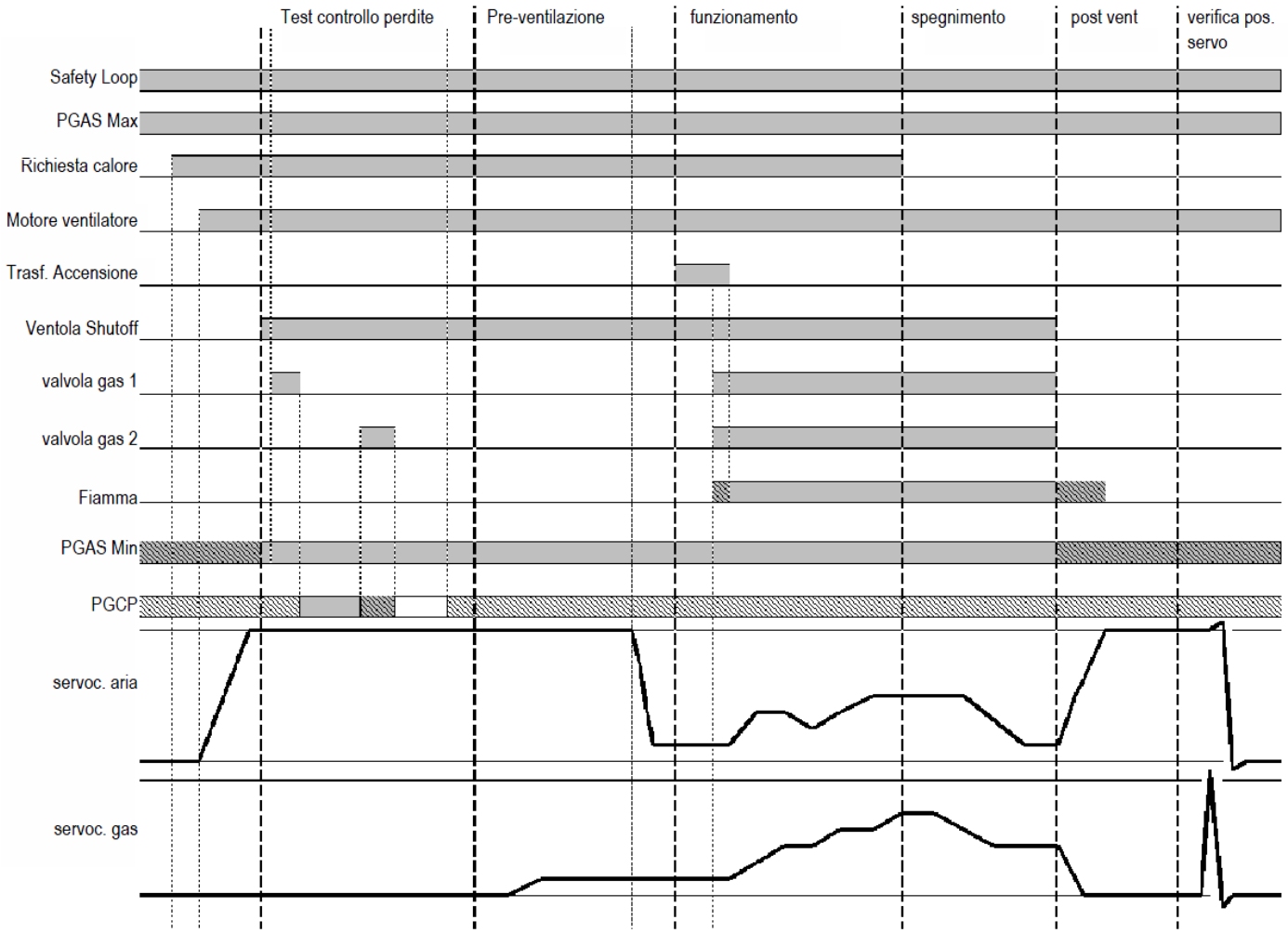
6. GENERAL WIRING DIAGRAM

(full configuration)



Fig, 1 Connections diagram (full configuration)

7. BURNER WORKING DIAGRAM



Fig, 2. Diagramma

8. CONTROL PANEL

WARNING: IF THE CONTROL PANEL IS DISCONNECTED, BURNER OPERATION IS DISABLED AND THE SYSTEM WILL NOT WORK!

Control panel

8 - 1. ICONS DESCRIPTION

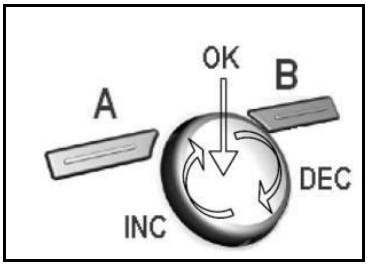
Symbo	Description	SymboСимвол	Description
	Working mode: OFF mode		Gas train (valves)
	Working mode: manual regulation		Flame signal
	Fan motor		Flame signal level
	Ignition transforme		Alarm (non-volatile lockout or volatile fault)

8 - 2. MAIN WINDOW

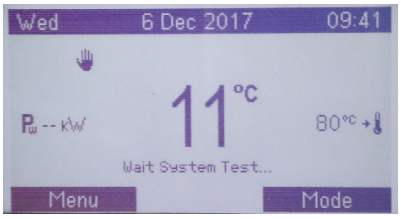
1	Data and time	can be set by **[Menu]** > **[General settings]**
2	Icons (burner indications)	burner active loads, burner working mode and burner faults
3	Burner heat capacity	the current burner heat capacity during burner operation
4	String (burner information)	burner information, burner position or fault description
5	Menu push button	access to menu
6	Mode push button	burner working mode can be modified (OFF, manual regulation or
7	Temperature or pressure feedback	boiler main sensor (temperature or pressure)
8	Temperature or pressure setpoint	regulation setpoint.

8 - 3. BUTTONS AND ENCODER

A Button	
[Menu]:	to access to menu
[Esc]:	back to the main window
B Button	
[Mode]:	burner working mode setting
[Back]:	back to the previous window
[Confirm]:	to confirm the settings
[Save]:	to save the settings
Knob	
INC:	to increase the selected value or next menu
DEC:	to decrease the selected value or previous menu
OK:	to confirm the settings



9. START-UP PRELIMINARY OPERATIONS



At the first start-up the following message is shown:

"**set boiler unit parameters**"

So, the following operations have to be performed.

1 . BOILER SETTING
↓
2 . AIR/GAS CURVES SCANNING

9 - 1. BOILER SETTING

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

1st level	2nd level	3rd level	4th level	Description
Menu				Main menu
	Parameters			Menu level for making the parameter settings
		Boiler unit		Settings for the boiler unit
			Max Power	This parameter is the maximum boiler capacity (express in kW).
			Min Power	This parameter is the minimum boiler capacity (express in kW).
			Max Load	This parameter is the maximum boiler load (express in %).This parameter is used to limit the burner working capacity range.
			Min Load	This parameter is the minimum boiler capacity (express in kW). This parameter is used to limit the burner working capacity range.
			Boiler set point	Temperature or pressure setpoint

After that, the following message will be displayed
"learning curve must be made"

Follow "air/curve scanning" indications, see the next paragraph .

ATTENTION: BOILER SETTINGS CAN BE DELETED BY USING THE PARAMETER: [Menu] > [Parameters] > [Boiler unit] > [Delete boiler setting]

9 - 2. (AIR/GAS) CURVES SCANNING

After having entered the thermal group parameters correctly, the display will prompt you to activate the curve scanning procedure, during the curve scanning phase the Burner will start the prewash phase, will go to the ignition position and then automatically the system will measure and regulate the ARIA GAS flow rates in various calibration points, the positions of the servomotors in the various calibration points will also be memorized, during this phase do not change the gas valve calibration pressures and do not change the position of the combustion head.
Calibration points: the AIR GAS curve self-learning system, adjusts and stores the calibration positions of the servomotors, normally 30 calibration points are stored in order to be able to adjust the Burner from the minimum power to the maximum power declared, during the curve scan the points tested by the system depend on the thermal group parameters set previously, for each calibration point the system normally requires about 35-40 seconds, if the time required exceeds 300 seconds the system goes to lockout with relative error message 43 Curves scan failed.

ATTENTION: BEFORE USING THE APPLIANCE, THE CURVES SCANNING HAS TO BE PERFORMED

ATTENTION: DURING CURVES SCANNING, DO NOT ACT ON PRESSURE GOVERNOR AND MAKE SURE THAT AIR INLET IS NOT OBSTRUCTED

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

1st level	2nd level	3rd level	4th level	Description
Menu				Main menu
	Parameters			Menu level for making the parameter settings
		Boiler unit		Settings for the boiler unit
			Learning curve	Set to “on”. After parameter enabling, the actuator tests are performed

The boiler thermostat must be set to "on". After that, the curves scanning starts and ignition sequence begins

WARNING! DURING THE SCAN, CHECK THAT THE OXYGEN LEVEL IS ABOUT 3% (BETWEEN 2.5% AND 4.5%)

In every point, during this function, the actuators positions are regulated in order to reach the air and gas setpoint. If the sensor signal (air and gas) remains inside the band, for 30 seconds, the actuator position is stored. When both the positions of the actuators are stored, the next operating point can be reached. The function ends when all the points are verified.

After that, the burner goes off and the symbol ⏻ is displayed. If during the entire procedure, O_2 and CO were between the reccomended levels, start the burner by setting the parameter “operation” to “auto or “manual”. Otherwise repeat the scanning procedure.

1st level	2nd level	3rd level	4th level	Description
Menu				Main menu
	Parameters			Menu level for making the parameter settings
		Burner		Settings for the boiler unit
			Operation	Off = burner off manual = manual operation auto = automatic operation
			Manual power	output (kW), (only if operation is set to “manual”)

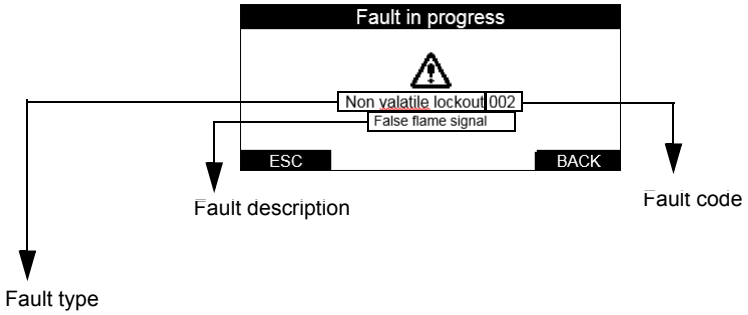
ATTENTION: IF THE FUNCTION ENDS CORRECTLY (THE LAST POINT IS VERIFIED), THE APPLIANCE IS READY TO USE.

ATTENTION: FOR EVERY POINT, IF THE SYSTEM IS NOT ABLE TO REGULATE THE AIR AND GAS SIGNAL BEFORE THE END OF THE TIMEOUT (5 MINUTES) THE CURVES SCANNING ENDS WITH THE RELATED FAULT INDICATION.

Scanning error codes

No.	Error	Cause	Solution
22	Gas pressure too low	Curve scanning cannot be completed because the gas pressure is too low	1) Check GAS inlet pressure if correct adjust the valve. 2) Increase the gas valve output pressure value. Reset the burner and repeat the curve scanning. If the problem is not solved, increase the pressure again, and reset the burner. After that repeat the curve scanning procedure.
23	Air pressure too low	Air pressure is too low; required output cannot be reached	1) Check the boiler parameters, max output 2) Wrong combustion head position. 3) Air inlet obstruced. 4) Boiler obstructed/dirty, check the gas flue and the smoke flow on the combustion chamber
24	Gas pressure too high	Gas pressure it too high. Gas servomotor never goes over 40° during curve scanning. Automatic adjusting procedure could be unstable	1) If the Block is reset, the Burner operates normally with high pressure after the valve, the adjustment may be unstable with continuous changes in servomotor positioning. 3) Reduce the gas valve output pressure value. Reset the burner and repeat the curve scanning. 2) If the problem is not solved, repeat the previuos step.

9 - 3. Fault window



Press *Esc* or *Back* to come back to the RC21 main window.

In case of non-volatile fault, if the unit can be reset, the B button indication becomes Reset (instead of **Indietro**).

To reset the unit press the B button (2 times in order to confirm the operation).

9 - 4. Skip curves scanning

NB If you want to check operation of the burner before activating the curve scan, with this parameter you can force the system to operate. Manual. This function is usually used to perform a general check of the system. Make a power request of approximately 10%, turn the system on and wait for it to be in a stable condition. Check the value of residual O2 in fumes and, if acceptable, request power of 20%. Wait for the system to stabilise and measure emissions. Proceed by steps of 10% until you reach maximum power. If necessary, adjust the output power of the gas valve suitable for the required power. If everything is working correctly, activate the curve scan function.

If the following parameter is enabled
[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Gruppo termico ➔ Salta scansione],
the appliance can be used even if the curves scanning has not been performed.

☞ In this case, the burner operating mode without flow sensors cannot be enabled. In this case, the curves scanning cannot be performed.

☞ After every switching off of the burner, the parameter is disabled.

9 - 5. Gas pressure checking during curves scanning

During curves scanning, if the detected gas pressure is too low (*), the lockout condition is reached. Before using the appliance, the curves scanning function must be successfully repeated (after the reset from lockout).
If, during the curve scan, the GAS servomotor reaches 90° and the required power is not reached, the burner is tripped and the message “gas pressure too low” will appear on the display. If this happens, increase the output pressure of the gas valve and reactivate the curve scan procedure.

9 - 6. Air pressure checking during curves scanning

During curves scanning, if the detected air pressure is too low (*), the lockout condition is reached. Before using the appliance, the curves scanning function must be successfully repeated (after the reset from lockout).
In this case, the error is due to insufficient air flow or unduly high back pressure which consequently reduces total air flow, or the maximum power of the thermal unit is too high.

9 - 7. Gas pressure checking at the end of curves scanning

At the end of curves scanning function, if the detected gas pressure is too high (**), the lockout condition is reached.
After the reset from lockout the appliance is ready to operate (without repeating the curves scanning function).

This error is due to the excessively high pressure in the gas valve outlet, if during the curve scan the gas Servomotor has never exceeded 45 °, the aforementioned error appears on the display, if an error is reset the system will function correctly even if the pressure is too high, to optimize the system is recommended to reduce the gas pressure at the valve outlet and then reactivate the curve scanning function, too high a pressure makes the system very sensitive to small movements of the GAS servomotor.

(*) If the actuator remains in his open position for more than Low pressure checking timeout, the too low pressure condition is detected.

(**) t the end of curves scanning function, if none stored position is greater than 45°, the too high pressure condition is detected.

9 - 8. Ignition position

The ignition position after scanning is automatically calculated by the system
[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Bruciatore ➔ Tipo accensione] allows to set how to calculate the ignition point of the burner.

If the parameter is set to [Posizioni], the burner ignition point (positions of air and gas actuators) are set by
[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Attuatori ➔ Accensione aria] and
[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Attuatori ➔ Accensione gas].

Otherwise, if the parameter is set to [Potenza], the burner ignition point (positions of air and gas actuators) is calculated starting from the following burner capacity value
[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Bruciatore ➔ Potenza accensione].

9 - 9. Running position

After burner ignition, at the end of safety time, when Running position stabilization time is expired the air and gas actuators move following the burner capacity reference value.

☞ The amount of gas is calculated referring to the burner heat capacity.

☞ The amount of air is calculated starting from the gas feedback signal, in order to obtain the correct O2 value.

9 - 10. KOSTAL INVERTER configuration (if present)

% inverter power at ignition:

Menu / Parameters / Inverter / Position: Ignition, settable from 1 to 100%. If set to 1 the burner will switch on with the inverter at minimum frequency before reaching the frequency required by the regulation system. If set at 100%, the ignition point will be made with the inverter at maximum frequency.
N.B. Maximum and minimum inverter frequency can only be set on inverter parameters.

Ramping signal 4-20mA:

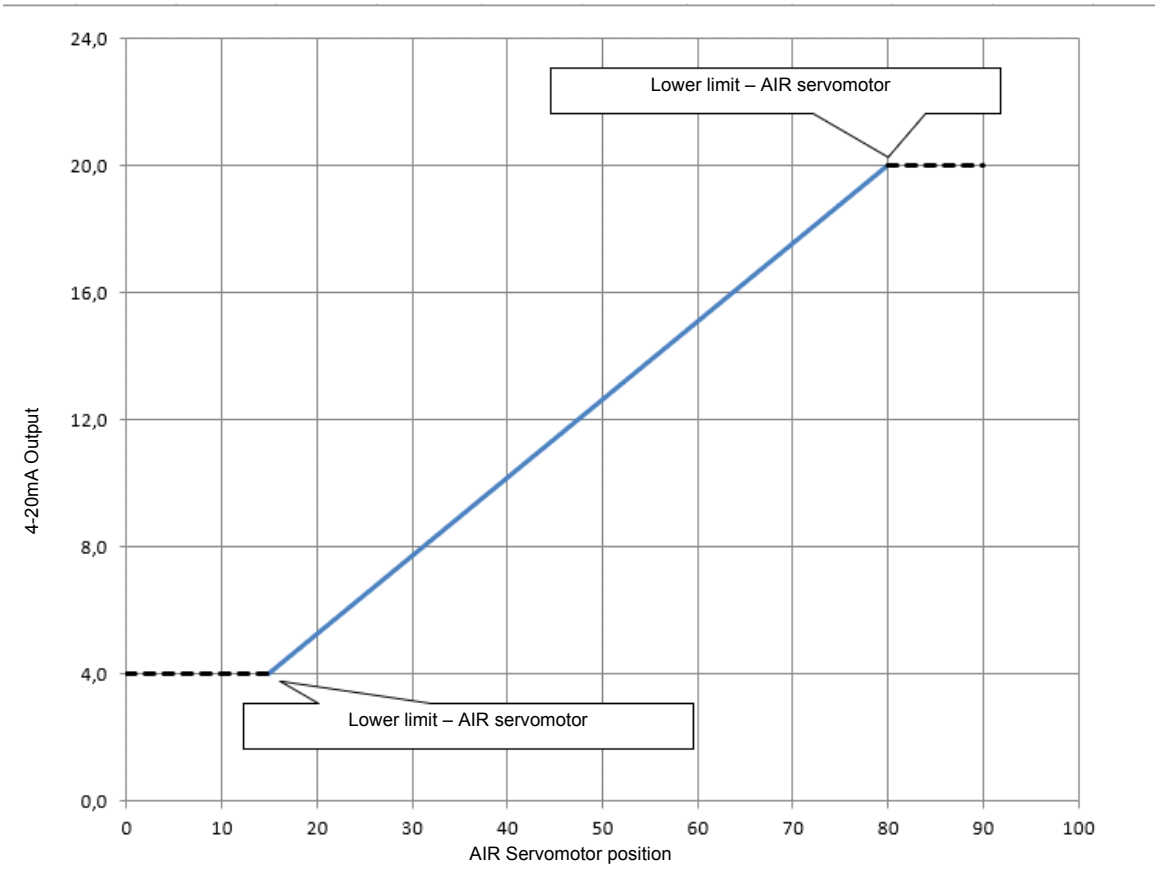
Menu / Parameters / Inverter / Ramping: Signal, settable from 0 to 100 seconds, defines the ramp up and ramp down times of the 4-20mA signal generated by the BMS. Set a value higher than the ramp up time set on the INVERTER. Too short a time may generate high motor inrush currents, causing the INVERTER to shut down. Too long a time will generate an air flow rate delay, which, in turn, will generate an error on the BMS. It is recommended to set a value between 5 and 20 seconds.

Lower reference limit – air damper:

Menu / Parameters / Inverter / Lower limit - air servomotor The 4-20mA signal generated by the BMS and used to modify the ventilator rpm is calculated based on the position of the air servomotor. If the air servomotor increases its position, the inverter will increase the rpm. This parameter defines the lower limit of the air servomotor. If the air servomotor is in a lower position than this limit, the 4.20mA output will be set to 4mA and the inverter will always generate the minimum frequency. It is usually set to 15°.

Upper reference limit – air damper:

Menu / Parameters / Inverter / Upper limit – air servomotor The 4-20mA signal generated by the BMS and used to modify the ventilator rpm is calculated based on the position of the air servomotor. If the air servomotor increases its position, the inverter will increase the rpm. This parameter defines the upper limit of the air servomotor. If the air servomotor is in a higher position than this limit, the 4.20mA output will be set to 20mA and the inverter will always generate the maximum frequency. It is usually set to 80°.



Operating mode: 4-20mA output

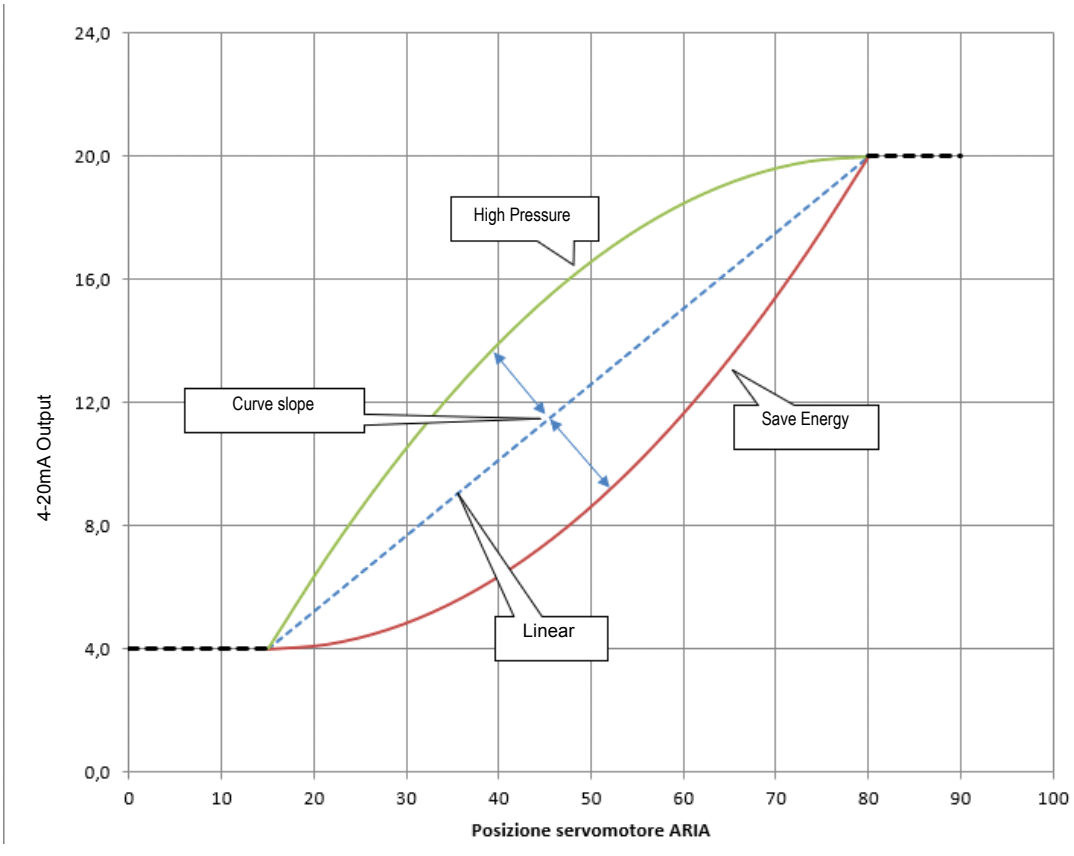
Menu / Parameters / Inverter / Operating mode There are several inverter operating modes to choose from.

- **Disable inverter**: Inverter disabled: the 4-20mA output is always set to 0mA, normally used for burners without inverters.
- **Max**: 4-20mA output is always set to 20mA. It is used on burners with inverters but always operating at maximum. The inverter is always used as a soft start.
- **Linear:** With this configuration the 4-20mA output is set linearly according to the position of the air servomotor. If the air servomotor is in the minimum position, output=4mA; if the air servomotor is in the maximum position, output=20mA; if the air servomotor is in the middle of its inverter regulation range, output will be 50%, 12mA. According to laboratory tests, the Linear operating mode is the most suitable for most systems.
- **Save Energy / High Pressure**: These two operating modes have been designed to vary the inverter operating logic. The Save Energy function calculates the 4-20mA output by controlling the flow rate of the air damper. With this function you will have low air pressures on the fan and lower energy consumption than the High Pressure and Linear functions. With this function active, in some installations flame vibrations or operating instability may be generated.
- **High Pressure**: Calculates the 4-20mA output with priority on the inverter, resulting in higher air pressures compared to the Save Energy or Linear functions. This function is activated in case of vibrations or instability during operation with Linear or Save Energy control.

Curve slope, Save Energy / High Pressure operating modes

Menu / Parameters / Inverter / Curve slope. Settable from 0 to 100%,

Defines the slope of the curves of the **Save Energy and High Pressure** operating modes, normally set to 50%. If set at 0%, the operating curves will be calculated with a value identical to linear operation.



AIR Servomotor position

9 - 11. Operating position

Once stabilisation of the operating position is complete the air and gas actuators reach the next burner capacity reference value.

☞ The gas quantity is calculated in relation to the heat output of the burner.

☞ The amount of air is calculated from the gas feedback signal to get the correct O2 value.

10. INTEGRATED POWER CONTROLLER

BURNER AUTOMATIC REGULATION

During automatic regulation, the capacity reference value is calculated starting from the following parameters/values.

- Regulation setpoint and
- Process feedback (temperature or pressure)

The following indications allow to configure the automatic regulation function.

10 - 1. Sensor type

By the parameter [RC21_55_param_XX.pdf ➔ Menu parametri ➔ Regolazione ➔ Tipo di sonda],
one of the following inputs/sensors can be selected.

INPUT	DESCRIPTION	CONNECTOR
4-20mA p	4-20mA capacity signal	X14
4-20mA i	4-20mA signal (thermocouple or pressure sensor)	X12
0-10V i	0-10V signal (thermocouple or pressure sensor)	X12
Pt100 2f	Pt100 sensor (2-wire circuit)	X12
Pt100 3f	Pt100 sensor (3-wire circuit)	X12
Pt1k 2f	Pt1000 sensor (2-wire circuit)	X12
Pt1k 3f	Pt1000 sensor (3-wire circuit)	X12
LgNi1K A	LgNi1000 sensor (A)	X12
LgNi1K B	LgNi1000 sensor (B)	X12
3 punti	3-position input	X15

Tab.21 - Table 37. Regulation inputs

☞ **After setting the sensor type, please wait 20seconds before changing any parameter (to allow to the control board to configure and store the new settings).**

10 - 2. Feedback type

Only if one of the following inputs is selected,
- if the button Salva is pressed during burner calibration, the calibration function ends and the current settings of the air/gas curves are stored. This operation can be done only if at least 10 operating points (over a maximum of 30) are already set.[4-20mA i]
- if the button Salva is pressed during burner calibration, the calibration function ends and the current settings of the air/gas curves are stored. This operation can be done only if at least 10 operating points (over a maximum of 30) are already set.[0-10V i]

the feedback type (temperature or pressure) has to be set by the parameter
[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Regolazione ➔ Misura].

☞

[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Regolazione] and
[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Gruppo termico]
are expressed in tenths of Bar.

10 - 3. Feedback limits

Only if one of the following inputs is selected,
- [4-20mA i]
- [0-10V i]

the maximum and minimum limits (temperature or pressure) have to be set by the following parameters
[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Regolazione ➔ Massimo sonda]
[RC21_52_param_XX.pdf ➔ Menu parametri ➔ Regolazione ➔ Minimo sonda].

10 - 4. Setpoint limits

Setpoint limits have to be set by the following parameters
[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Regolazione ➔ Setpoint massimo] and
[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Regolazione ➔ Setpoint minimo].

10 - 5. Switch-off and switch-on points

Switch-off and switch-on points of the burner are set by the following parameters
[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Regolazione ➔ Soglia spento] and
[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Regolazione ➔ Soglia accensione].

During burner regulation, if the feedback (temperature or pressure) exceeds
[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Gruppo termico ➔ Setpoint regolazione] +
[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Regolazione ➔ Soglia spento]
the burner is switched off.

The burner is switched on when the feedback falls below
[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Gruppo termico ➔ Setpoint regolazione] +
[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Regolazione ➔ Soglia accensione].

10 - 6. PID parameters

During burner automatic regulation, the output capacity is calculated by a PID control algorithm. The PID parameters are the following:
[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Regolazione ➔ Proporzionale]
[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Regolazione ➔ Integrale]
[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Regolazione ➔ Derivativo].

A dead band around the setpoint can be set by the following parameter
[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Regolazione ➔ Banda morta].

10 - 7. Temperature sensor offset

Only if one the following inputs is selected
- [Pt100]
- [Pt1000]
- [LgNi1000]

the temperature value can be adjusted by setting the following offset
[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Regolazione ➔ Offset sonda temperatura].

10 - 8. 3-point regulation

If the following inputs is selected
- [3 punti]

the following parameters have ti be set.
[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Regolazione ➔ Tempo minimo consenso].
in the minimun time for the action of 3-point contact (open or close)

[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Regolazione ➔ Percentuale gestione potenza].
In the burner capacity percentage (encreased or decreased) in relation to the regulation time base.

10 - 9. Regulation setpoint

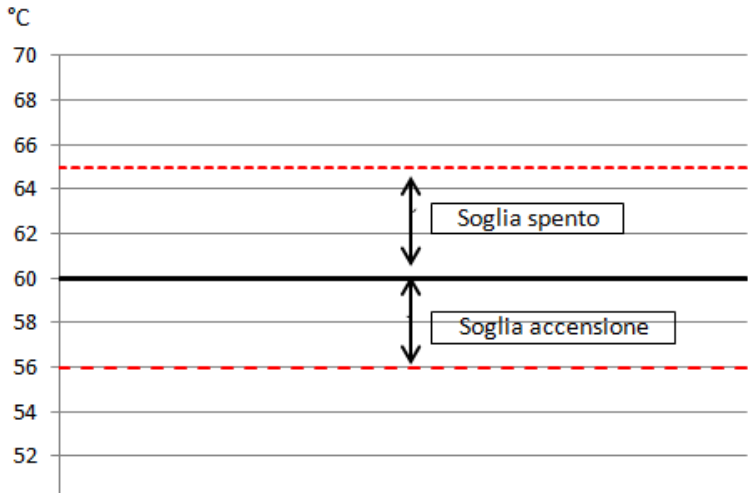
After setting all the previous parameters, the last parameter that has to be set is the regulation setpoint
[RC21_52_param_XX.pdf ➔ Menu parametri ➔ Gruppo termico ➔ Setpoint regolazione].

.

Power controller – parameter set.

Level 1	*Level 2*	*Level 3*	*Level 4*	*Selection*	*Description*
Menu					
	Parameters				
		Control			
			Probe type	4-20mA p 4-20mA i 0-10V i Pt100 2 wires Pt100 3 wires Pt1000 2 wires Pt1000 3 wires LgNi1000 A LgNi1000 B 3 points	Parameter which selects the type of probe installed if a probe is selected, or the type of operation. At 3 points the system works with a 3-point external modulator. At 4-20mAp the system works with an external power modulator through a signal of 4-20mA. **N.B. If the setting is changed, wait for at least 20 seconds until proceeding with other settings.**
			Measurement	Temperature pressure	Defines the unit of measurement that appears on the display, in °C or bar
			Maximum probe value	0-999	If the probe is 0-10 or 4-20mA it defines the maximum value read by the probe in °C or kPa
			Minimum probe value	0-999	If the probe is 0-10 or 4-20mA it defines the minimum value read by the probe in °C or kPa
			Maximum setpoint	0-999	Maximum setpoint settable by the user
			Minimum setpoint	0-999	Minimum setpoint settable by the user
			Switch-off threshold	0-999	Burner switch-off threshold .. Regulation setpoint + Switch-off threshold = Burner switch-off temperature or pressure
			Switch-on threshold	-999 to 999	Burner switch-on threshold .. Regulation setpoint + Switch-on threshold = Burner switch-on temperature or pressure
			Proportional	10	Proportional band within which the PID regulation parameters calculate the power to be supplied
			Integral	16	Integral time expressed in seconds
			Derivative	0	Derivative time expressed in seconds
			Dead band	0	Regulating dead band
			Temperature probe offset	0	Corrects the value read by the temperature probe.
			Minimum release time	1	Only for 3-point regulation, if the signal is inferior to the minimum time allowed the system will not increase or decrease power. The increase or decrease signal is added and the system will only increase power if the sum exceeds the minimum time.
			Power management percentage	20%	If the minimum release time is met, the system will increase or decrease power of the set % value.

The power controller also has an integrated electronic operating thermostat. The operating limits of this thermostat are set using the switch-off threshold and switch-on threshold parameters. These parameters are added to the boiler regulation setpoint, e.g.:
Setpoint: 60°C
Switch-off Threshold: 5
Switch-on Threshold: -2
The burner will be automatically switched off if the temperature measured is:
Higher than Setpoint + Switch-off Threshold = 60+5 = 65°C
The burner is switched back on if the temperature measured is lower than Setpoint + Switch-on Threshold = 60 + (- 2) = 58°C



10 - 10. PID REGULATION PARAMETERS

PROPORTIONAL is the proportional band referred to setpoint regulation
e.g.:
Boiler setpoint = 60°C
Proportional = 10
The proportional band is equal to Setpoint + Proportional and Setpoint - Proportional = 60+10= 70°C and to 60-10=50°C
With this configuration the proportional band ranges from 50°C to 70°C,
- If, during operation, the process variable measures a value lower than 50°C, the PID will calculate power to be supplied = at 100%
- If, on the other hand, the temperature measured is higher than 70°C, the PID will always calculate power = 0% = Minimum power of the burner.
This action does not depend on the temperature curve. The PID calculation only comes into operation if within the proportional band.

INTEGRAL TIME: Active only if within the proportional band, expressed in seconds,
e.g.:
Setpoint: 60°C
Integral time: 16 seconds
Temperature measured: 51°C
Power calculated by the modulator: 90%.
if within 16 seconds there is no increase in temperature, the system automatically increases power supplied. The percentage of power increase depends on the integral time set and by the error measured between the set point and current temperature value.
At the end of integral time, if there have been no temperature changes and if the temperature is not equal to the setpoint, the system will always increase or decrease the power.

E.g.:
Setpoint: 60°C. Temperature measured: 60°C.
Power calculated: 20%.
- If the temperature drops to 59°C, the system will increase power (e.g. it will go from 20% to 25%).
- If after 16 seconds the temperature measured is still 59°C, the system will increase power again, always at set intervals of 16 seconds until maximum power at 100% is reached.

10 - 11. Regulation parameters: information relating to settings

☞ The following string

Impostare parametri regolazione...

indicates that not all regulation parameters were set.

☞ After setting the sensor type, please wait 20seconds before changing any parameter (to allow to the control board to configure and store the new settings).

☞ After setting the sensor type, please observe the following table in order to set all the needed parameters!

SENSOR TYPE	PARAMETER REQUIRED	PARAMETER POSITION (MENU)
4-20mA capacity signal	-	-
Thermocouple (4-20mA signal or 0-10V signal)	Measurement	Regulation menu
	Maximum probe value	Regulation menu
	Minimum probe value	Regulation menu
	Maximum setpoint	Regulation menu
	Minimum setpoint	Regulation menu
	Switch-off threshold	Regulation menu
	Switch-on threshold	Regulation menu
	Proportional	Regulation menu
	Integral	Regulation menu
	Derivative	Regulation menu
	Dead band	Regulation menu
	Probe offset	Regulation menu
	Regulation setpoint	Thermal unit menu
Pt100 (2-wire or 3-wire) or Pt1000 (2-wire or 3-wire) or LgNi1000	Maximum setpoint	Regulation menu
	Minimum setpoint	Regulation menu
	Switch-off threshold	Regulation menu
	Switch-on threshold	Regulation menu
	Proportional	Regulation menu
	Integral	Regulation menu
	Derivative	Regulation menu
	Dead band	Regulation menu
	Probe offset	Regulation menu
	Regulation setpoint	Thermal unit menu
3-position input	Minimum release time	Regulation menu
	Power management percentage	Regulation menu

Tab.22 - Regulation parameters

☞ After setting all the needed parameters, the string

Impostare parametri regolazione...

disappears and the burner is ready to operate.

11. BURNER CALIBRATION

NB Calibration/Adjustment of the Air/Gas curves is carried out at CIBUNIGAS. This is required to define the curves of the air/gas ratio of the burner. It is set to maintain excess air at 3%. The calibration phase requires approximately 2-3 hours of continuous burner operation. If, for any reason, the burner is turned off during the calibration phase, all stored curve settings are cancelled and calibration must be performed again.
For optimum calibration, set a minimum of 10 points and a maximum of 30. For each calibration point, indicate the correct gas flow expressed in KW/h. It is therefore necessary to have a gas flow meter and a combustion analyser installed on the system.
CIBUNIGAS advises against performing calibration/adjustment of air/gas curves directly on the system.
For this reason, the device has 2 removable EPROM memories where the air/gas curves are stored. These memories are used to transfer the burner settings from one device to another, for example in the case of flame control device replacement.
If, for any reason, the memories are damaged, refer to CIB UNIGAS to receive new memories containing the original calibration curves. Just indicate the burner serial number in the request.

11 - 1. Activation of the CALIBRATION function

The positions of the actuators can be checked by carrying out a calibration without clearing the saved air/gas settings. During this phase it is not possible to change the saved air/gas settings. The positions of the actuators can be temporarily modified only to test the burner behaviour.

NB If the Air/Gas curves are already defined, activation of the calibration function allows to turn on the burner and to enter the single points using the display to check the functioning of the burner in the points automatically stored during the curve scan. The position of the servomotors can be changed in the single points, but none of the points can be stored or changed. To repeat calibration, you must first delete the stored AIR/GAS curves. CIB UNIGAS ADVISES AGAINST deleting calibration curves.

Please observe the following steps in order to activate the function.

1.Reset the unit (only if lockout state is shown).

2.Check the absence of fault.

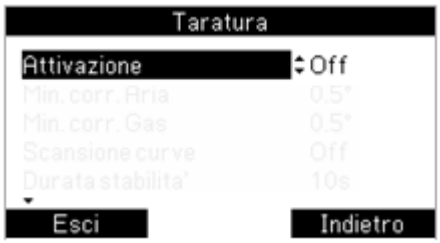
3.Set the burner working mode to manual regulation or automatic regulation.

4.Open the heat demand thermostat.

5.Set the ignition position.

The burner ignition point (positions of air and gas actuators) have to be set by the following parameters:
[RC21_52_param_XX.pdf ➔ Menu parametri ➔ Attuatori ➔ Accensione aria] and
[RC21_52_param_XX.pdf ➔ Menu parametri ➔ Attuatori ➔ Accensione gas].

6.Enable the parameter
[RC21_52_param_XX.pdf ➔ Menu parametri ➔ Calibrazione ➔ Attivazione].



Fig, 3. RC21 display: calibration activation

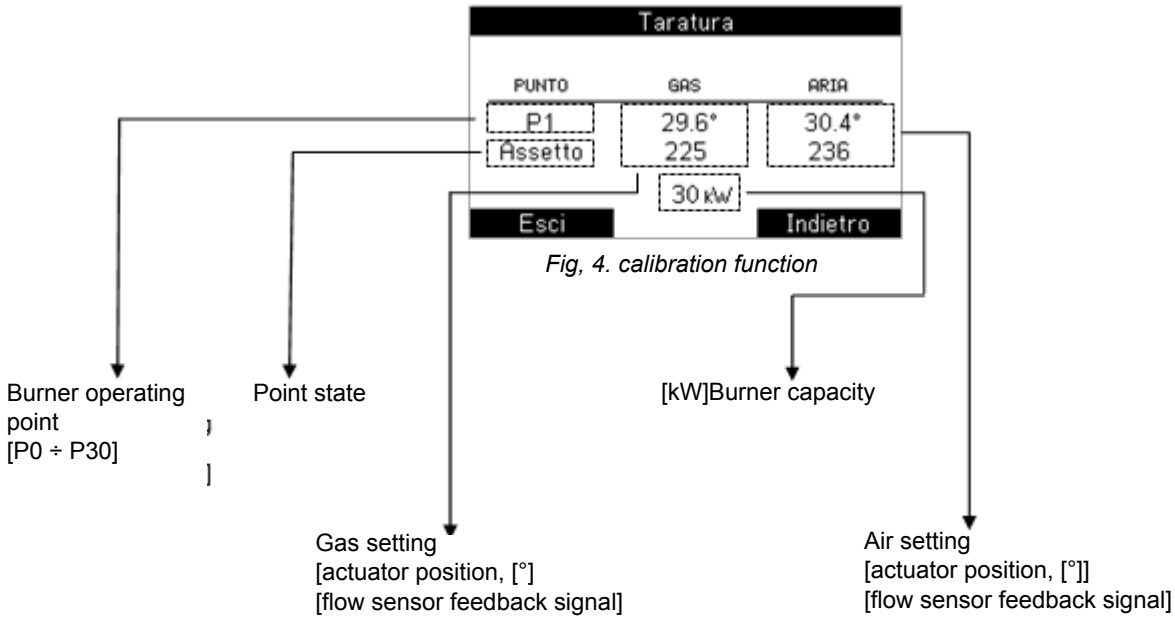
After parameter enabling, the actuator tests are performed.

7.Close the heat demand thermostat.

After that, calibration function starts and ignition sequence begins.

11 - 2. Display indication (during burner calibration)

When the burner reaches the running position, the following window is shown on the display.



Fig, 4. calibration function

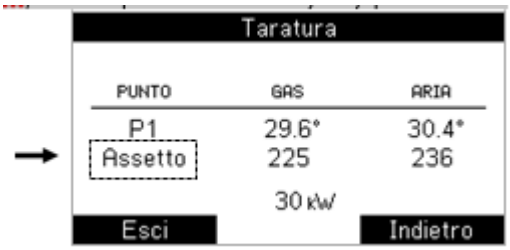
During burner calibration at least 10 operating points have to be set. At maximum, 30 operating points can be set.

INDICATION	DESCRIPTION
PUNTO P1 Assetto	Operating point of the burner. (This point can be set or verified if it is already stored). The string is a description of the point state. ➢*Assetto*: the burner is reaching a different operating point (during this phase no changes can be made). ➢*<none>*: in this phase all the settings can be modified (air, gas and capacity) except the burner operating point. ➢*Stabile*: the burner has reached the new settings. All the settings can be modified, also the burner operating point. ➢Bloccato: the current operating point is already stored. No settings can be modified.
GAS 29.6° 229	Gas: actuator position and flow sensor feedback are shown.
ARIA 30.4° 236	Air: actuator position and flow sensor feedback are shown.
30 kW	Burner capacity. During calibration, the burner capacity of the current operating point can be set. During burner normal operation, the burner current capacity is shown.

Tab.23 - Display indication during calibration function

11 - 3. Settings and actions (during burner calibration)

During the indication Assetto, it is no possible to modify any parameter.
During calibration of the various calibration curves, reach the desired O2 level during normal burner operation. This is usually 4-4.5% for points P0-P1-P2-P3 and 3-3.5% for the other points.

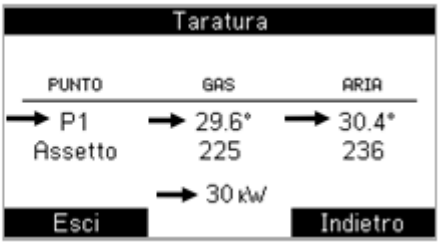


Fig, 5. RC21 display: calibration function

When the burner reaches the shown operating point, the indication Assetto disappears and it is possible to modify the settings of the first burner working point P0.

☞ P0 is not included in the air/gas curves followed during burner regulation. P0 setting are used only for burner ignition.

Press the knob to select the setting to modify.



Fig, 6. RC21 display: calibration function

Rotate the knob to modify the selected setting.

To confirm the new setting press the button Conferma
or
to delete the new setting press the button

Annulla **Conferma**

☞ The point settings are saved when the next burner operating point is reached.

☞ The next burner operating point can be set (and reached) only if the indication Stabile is shown.

☞ P0 is not included in the air/gas curves followed during burner regulation.
After calibration data saving, P0 settings will be stored in:
[RC21_52_param_XX.pdf ➔ Menu parametri ➔ Attuatori ➔ Accensione aria] and
[RC21_52_param_XX.pdf ➔ Menu parametri ➔ Attuatori ➔ Accensione gas].

Select P0 by pressing the knob and rotate to select P1.

To reach the operating point P1 press the button Conferma.

To come back to the previous display window press the button Annulla.

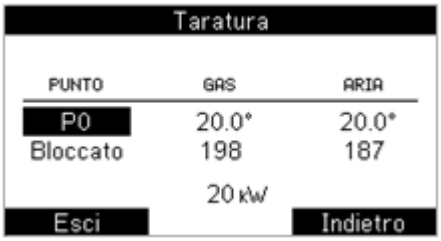
☞ During the reaching of the next operating point, the indication Assetto is shown.

☞ When the indication Assetto disappears, it is possible to modify the settings of the current burner operating point.

When the operating point is selected and the indication Stabile is shown:
- the next operating point can be set or
- the previous operating point (already stored) can be reached.

In the first case (next operating point is set) the (new) air and gas settings are the same of the previous point with added [RC21_52_param_XX.pdf ➔ Menu parametri ➔ Calibrazione ➔ Min. corr. Aria] and [RC21_52_param_XX.pdf ➔ Menu parametri ➔ Calibrazione ➔ Min. corr. Gas].

In the second case (operating point already stored) the burner can reach all the previous store points. During this phase the indication Bloccato is shown.



Fig, 7. RC21 display: calibrated point.

All the previous points can be reached but none of these points can be modified

Please pay attention to the following points:
- if the button Esci is pressed during burner calibration, the calibration function ends and all the settings of the air/gas curves are deleted.

- if the button Indietro is pressed during burner calibration, the calibration function ends and all the settings of the air/gas curves are deleted.

- if no modifications are performed during calibration, the function ends at the end of Calibration timeout (all the settings of the air/gas curves are deleted).

- if the button Salva is pressed during burner calibration, the calibration function ends and the current settings of the air/gas curves are stored. This operation can be done only if at least 10 operating points (over a maximum of 30) are already set.

- In order to modify the stored settings of the air/gas curves please perform the following steps.

N.B. WARNING, if the original data are deleted, there will be no way to recover them, please contact CIB UNIGAS to receive a new EPROM memory with the original air-gas curves, on the request indicate the Burner serial no

-

- Delete the air/gas settings by using the parameter [RC21_55_param_XX.pdf ➔ Menu parametri ➔ Calibrazione ➔ Cancella dati]

and

- Execute a calibration function

11 - 4. Additional considerations

To store the air/gas settings during calibration, at least 10 (over a maximum of 30) operating points have to be set.

If all the 30 points are modified and stored, P30 is the higher point of the air/gas curves.
If not all the 30 points are set, the last stored point is the higher point of the air/gas curves.

To avoid burner operation near the limits of the air/gas curves, the lower and the higher points of the curves (e.g. P1 and P30) are not considered during burner regulation.
For this reason, the burner working point during regulation will be calculated between the second and the second-last point (e.g. P2 and P29).

By performing a calibration without deleting the stored air/gas settings, the actuators positions can be verified.

During this phase, the stored air/gas settings can not be modified.
The actuators positions can be temporarly modified only to test the burner behavior.

CAUTION! A SCAN OF THE AIR/GAS CURVES MUST BE PERFORMED BEFORE USING THE DEVICE.

CAUTION! IN THIS CASE, THE OPERATING MODE OF THE BURNER WITHOUT SENSOR CANNOT BE ACTIVATED.

CAUTION! IN THIS CASE, THE OPERATING MODE OF THE BURNER WITHOUT SENSOR CANNOT BE ACTIVATED.

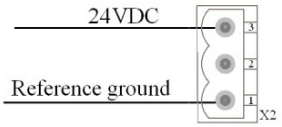
12. EGARC (Electronic Gas Air Ratio Control)

This control incorporates the functionality of electronic combustion control according to the requirements of EN12067-2:2004.

13. Voltage supply check

After connecting the system to the supply network, check the VDC supply voltage on X2 connector.

The supply voltage has to be according to the TECHNICAL DATA.



Fig, 8. X2 connector

If possible and necessary, adjust it by rotating the plastic screw on the external power supply.

13 - 1. Safety checks

The system should be tested on commissioning the installation as well as after a service or longer shut- down:

- Burner startup with open-circuit to the flame sensor (*): the unit has to go into lockout condition at the end of safety time!
- Burner startup with short-circuit between flame sensor (electrode) and ground: the unit has to go into lockout condition at the end of safety time!
- Burner normal operation with simulated loss of flame (for that purpose, cut-off the gas supply): after restart and at the end of safety time the unit has to go into lockout condition!

14. Recommendation on path of the flame signal

Flame sensor device is a 2 pole sensor: the anode is the electrode and the cathode is the burner.

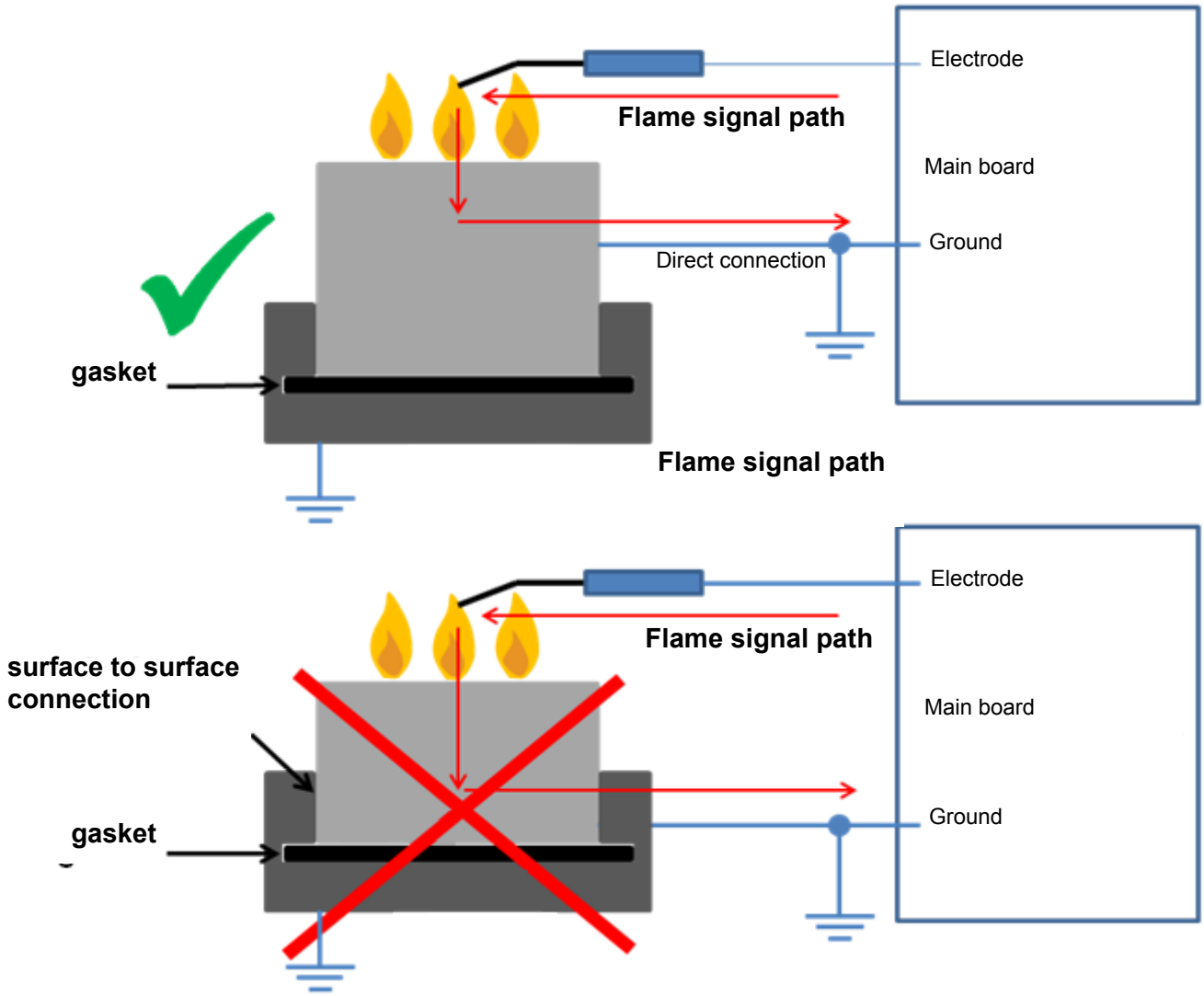
☞ Always ensure a reliable low resistance (< 10Ω) path and connection to the devices involved on carrying flame signal:

- Board to electrode and electrode connection
- Electrode construction
- Burner
- Return ground connection

☞ When sealing/gaskets are involved in combustion chamber design always provide a direct connection to the burner. Surface to surface connection must be avoided.

☞ Take care about mechanical and thermal stability of the connections.

Avoid to comply with the above constraints can lead the appliance to malfunction or lock-out, in this case not covered by the warranty.



Fig, 9. Flame signal path recommendation

14 - 1. FLAME DETECTION

Maximum flame resistance during operation:	5.7MΩ
Maximum flame resistance during ignition sequence:	5.2MΩ
Maximum Parasitic flame resistance:	6.2MΩ
Max eddy capacity:	1nF
Minimum resistance of the electrode and of the detection cable towards ground:	50MOhm
Short circuit current:	

14 - 2. Short circuit between probe and earth

A short-circuit between ionization probe and earth causes the burner to initiate lockout for no flame signal detection at the end of safety time.

14 - 3. Loss of flame signal during operation

If the flame signal is lost during operation a maximum of 2 repetitions can be made.
If the flame signal is lost for the third time during operation the unit reaches the lockout condition. After 10 minutes of burner operation, a new repetition possibility is added (2 repetitions at most).

14 - 4. False flame signal

If false flame signal condition continues for more than 10s the unit reaches the lockout condition.

14 - 5. No flame signal detection at the end of safety time

In case of no flame signal at the end of safety time the unit will initiate a non-volatile lockout.

15. LOCKOUT AND RESET

☞ Reset action shall not be carried out from a different location from the appliance!

☞ The unit can be reset by pushing the remote reset button for more than 0.5s and less than 4s. The unit can be reset locally by RC21 control panel.

☞ Lockout can be reset only 5 times consecutively within one hour, then power supply has to be disconnected for a new 5 reset possibilities.

☞ If the 5 reset possibilities within one hour are not expired, the reset counter is decremented every hour.

☞ The unit can only be reset if power supply is applied to the unit.

16. Permanent operation

Il Bruciatore con sistema di rivelazione fiamma a ionizzazione può funzionare in servizio continuo 24/24 senza necessità di spegnimenti.

17. TECHNICAL FEATURES AND DATA

17 - 1. Technical features

- Internal protection fuse (short-circuit protection)
- Built-in EMC filter (suppression of the EMC interferences)
- Flame detection section working freely from supply voltage polarity and from potential difference between line/neutral and ground.
- Flame supervision with DINAMICO (using ionization probe)
- Non-volatile lockout
- Continuous operation (using ionization probe)
- Flash storage microcontroller
- Stable timings independent of voltage variation, temperature variation and switch-on cycles (microcontroller based programming sequence)
- Microcontroller programming port (for upgrading in R&D or in field)
- Inverter management (free contact output)
- Valve proving system function
- Communication to Open Therm unit
- Communication port for burner monitoring
- Removable data key
- Built-in temperature controller
- RC21 display control panel (modbus interface)
- Modbus additional interface

17 - 2. External power supply

Model:	Delta	PMH-24V50WCA
Input voltage:		230VAC
Output voltage:		24VDC
Output power:		≥ 35W

17 - 3. Operating voltage and frequency

17 - 3 - 1.Mains AC voltage (external power supply input)

Mains voltage:	230VAC+10%-15%
Mains frequency:	50Hz±5%
Power consumption in stand by:	< 20W

17 - 3 - 2.DC voltage (external power supply output, HAGC31 input)

Voltage operating range:	24VDC+10%-15%

17 - 3 - 3.AC undervoltage protection

Undervoltage safety shutdown:	mains voltage < 170VAC
Restart (after undervoltage):	mains voltage > 200VAC

17 - 4. Circuit protection devices

Protection varistor:	300V D14
Protection fuse:	10A T 250VAC
Protection fuse (built-in for gas valves):	2,5A T

17 - 5. Outputs

Ignition transformer:	230VAC 2,2A MAX cosϕ 0.2
Fan motor:	230VAC 3,4A MAX cosϕ 0.9
Shutoff valve:	230VAC 0,3A MAX cosϕ 0.6
Gas valve (1):	230VAC 0,5A MAX cosϕ 0.6
Gas valve (2):	230VAC 0,3A MAX cosϕ 0.6
Pilot valve:	230VAC 0,3A MAX cosϕ 0.6

17 - 6. Inputs

Heating thermostat:	3mA 230VAC
Safety loop:	3mA 230VAC
Air pressure switch:	3mA 230VAC
Gas (minimum) pressure switch:	3mA 230VAC
Gas (maximum) pressure switch:	3mA 230VAC
Gas pressure switch for VPS:	3mA 230VAC
Open command:	3mA 230VAC
Close command:	3mA 230VAC

17 - 7. Actuators

Gas actuator:	Schneider Electric	STE4,5 Q3 51/6 L
Air actuator:	Schneider Electric	STE4,5 Q3 51/6 L

17 - 8. Flow sensors

Gas flow sensor:	IST AG	FS5 flow sensor
Air flow sensor:	IST AG	FS5 flow sensor
Current loop minimum value:		4mA
Current loop maximum value:		20mA
Upper threshold value (loop check function):	22,5mA	
Lower threshold value (loop check function):		1,8mA

17 - 9. Regulation inputs

INPUT SENSOR	MEASURING RANGE	RESOLUTION	ACCURACY	NOTE
4-20mA capacity signal	-	32µA	≤ 0,6%	Input resistance: 50Ω
4-20mA signal (thermocouple or pressure sensor)	-	32µA	≤ 0,6%	Input resistance: 50Ω
0-10V signal (thermocouple or pressure sensor)	-	10mV	≤ 0,3%	Input resistance: 10KΩ
Pt100	-50°C ÷ 300°C	1°C	≤ 0,6%	Pt100
Pt1000	-50°C ÷ 300°C	1°C	≤ 0,6%	Pt1000
LgNi1000	-50°C ÷ 200°C	1°C	≤ 0,6%	LgNi1000

Tab.24 - Regulation inputs

17 - 10. Permitted cables length

DESCRIPTION	CABLE LENGTH	NOTES
Mains supply (VAC input)	< 50m	(X1)
24VDC input	< 1m	External power supply output (X2)
Heating thermostat	< 50m	
Safety loop	< 50m	
Air pressure switch	< 3m	
Gas pressure switch (max)	< 10m	
Gas pressure switch (min)	< 10m	
Gas pressure switch (for vps)	< 10m	
Flame detector cable	< 3m	
Reset	< 50m	Reset action shall not be carried out from a different location from the appliance!
CO alarm	< 50m	
Air flow sensor	< 3m	Shielded cable
Gas flow sensor	< 3m	Shielded cable
Air actuator	< 3m	
Gas actuator	< 3m	
Inverter sensor (feedback)	< 3m	
Pt100 sensor	< 50m	
Pt1000 sensor	< 50m	
Lg-Ni1000 sensor	< 50m	
Open command	< 50m	
Close command	< 50m	
Setpoint enable	< 50m	
(4-20mA) Capacity signal	< 50m	
(4-20mA) Thermocouple or pressure sensor	< 50m	
(0-10V) Thermocouple or pressure sensor	< 50m	
Fan motor	< 50m	
Fan inverter control	< 50m	
Ignition transformer	< 3m	
Shutoff valve	< 50m	
Pilot valve	< 10m	
First valve	< 10m	
Second valve	< 10m	
Lockout lamp	< 50m	
Fault lamp	< 50m	
Flame lamp	< 50m	
RC21.52	< 1m	

Tab.25 - Cables length

17 - 11. EGARC accuracy

The EGARC accuracy can be referred to the air and gas flow rates measured by the flow sensors.

The calculation has been performed taking account of the regulation dead band parameter, set by the customer [RC21_52_param_XX.pdf ➔ Menu parametri ➔ Regolazione ➔ Banda morta] in addition to the hardware tolerances.

Therefore, the EGARC accuracy can be declared from (minimum) 2% to (maximum) 6%.

18. Environmental conditions and IP protection degree

Storage temperature: -30°C / +70°C
Working temperature: -20°C / +60°C
Case protection degree: IP00
Humidity (with no condensing): <95% @ 40°C

Condensation, water ingress and ice formation are not permitted!

19. SPECIAL FUNCTIONS

19 - 1. AIR/GAS SERVOMOTORS

At the power-on reset, the unit performs the following tests:

- Air actuator test
- Gas actuator test

19 - 2. Air actuator test

After each switch-off, the system checks the correct position of the AIR servomotor moves to the open position in order to verify the position.
After that, the actuator moves to the close position in order to verify the position.
If no fault is detected, the actuator moves to the close position
[RC21_52_param_XX.pdf ➔Menu parametri ➔ Attuatori ➔ Chiusura aria].
Otherwise (in case of fault) the unit reaches the lockout condition.

19 - 3. Gas actuator test

After each switch-off, the system checks the correct position of the GAS servomotor. The gas actuator moves to the open position to check the correct movement and then gas actuator moves to the open position in order to verify the position.
After that, the actuator moves to the close position check the correct movement and successively in order to verify the position.
If no fault is detected, the actuator moves to the close position
[RC21_52_param_XX.pdf ➔ Menu parametri ➔ Attuatori ➔ Chiusura gas].
Otherwise (in case of fault) the unit reaches the lockout condition.o.

☞ Actuator tests are also executed at the end of every heat demand and after a lockout reset.

19 - 4. Actuators anti blocking function

During long periods of inactivity, with the burner switched off and flame off, the device will perform tests on the servomotors at regular intervals. This serves to ensure functioning of the burner when requested by the application.

19 - 5. AIR AND GAS MASS SENSORS

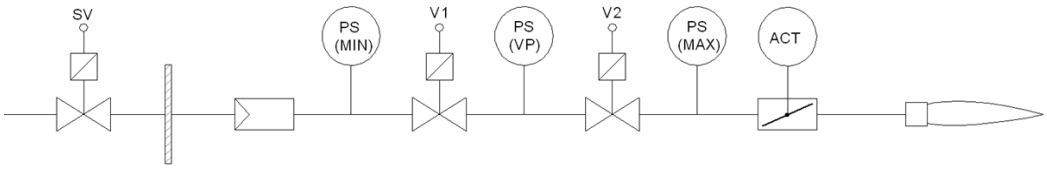
19 - 5 - 1.Current loop check function

If the current signal from the flow sensor (air or gas) falls below the lower threshold value or rises above the upper threshold value, the unit performs a safety shutdown.

19 - 6. GAS TRAIN

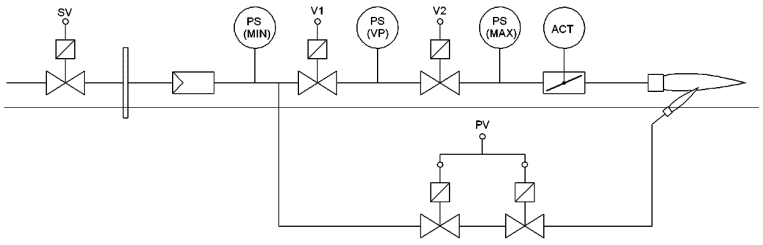
Using the display it is possible to select the type of gas ramp installed, with or without pilot ignition.
[RC21_52_param_XX.pdf ➔ Menu parametri ➔ Bruciatore ➔ Configurazione] allows to set the gas train configuration

19 - 6 - 1.Direct ignition



Fig, 10.

19 - 6 - 2.Gas pilot gas ramp with pilot ignition



20. SYSTEM INPUTS

20 - 1. Safety loopSafety Loop

X15 connector: 3-4.
Safety loop (series of contact) has to be closed in order to allow burner ignition and burner operation. During standby, if safety loop is opened the unit remains in standby position even if heat demand contact closes.
If safety loop opens during burner operation, the unit performs a safety shutdown.
If safety loop opens for a maximum of
[RC21_52_param_XX.pdf ➔ Menu parametri ➔ Ingressi ➔ Aperture sic.] times, the unit reaches the lockout condition.

20 - 2. Air pressure switch

X16 connector: 8-9.

The air pressure switch confirms the presence or the absence on air flow.
During standby, if fan motor is de-energized and the pressure switch is closed (air simulation condition), the system remains in standby position " a Display viene visualizzato il codice di anomalia corrispondente" , even if heat demand contact closes.
When the fan motor is energized (after a heat demand), if no air flow is detected, the unit performs a safety shutdown when air pressure switch timeout is expired.
When the fan motor is energized (after a heat demand), if air pressure switch closes before the end of air pressure switch checking time, the unit reaches the lockout condition.
If the pressure switch opens during ignition sequence or during burner operation, the unit reaches the lockout condition.

20 - 3. Gas minimum pressure switch

X16 connector: 4-5.
During the burner ignition sequence, if the switch is opened after shutoff valve energization, the unit performs a safety shutdown.
At maximum, two repetitions can be made.
After the third fault (gas minimum pressure switch doesn't close) the unit remains in standby position
and a specific fault code is shown.
After the Gas minimum pressure switch timeout, a new repetition can be performed. During burner operation, if the switch opens the unit performs a safety shutdown.

20 - 4. Gas maximum pressure switch

Gas maximum pressure switch has to be closed in order to allow burner ignition and burner operation. During standby, if gas maximum pressure switch is opened the unit remains in standby position "a display viene visualizzato il codice di anomalia corrispondente "even if heat demand contact closes.
If the switch opens during burner operation, the unit reaches the lockout condition.

20 - 5. Heat demandBoiler thermostat ON-OFF, burner heat request

X15 connector: 5-6.
If no fault is detected, closing heat demand contact the burner ignition sequence starts.
If the contact opens during burner operation, the unit performs a controlled shutdown.

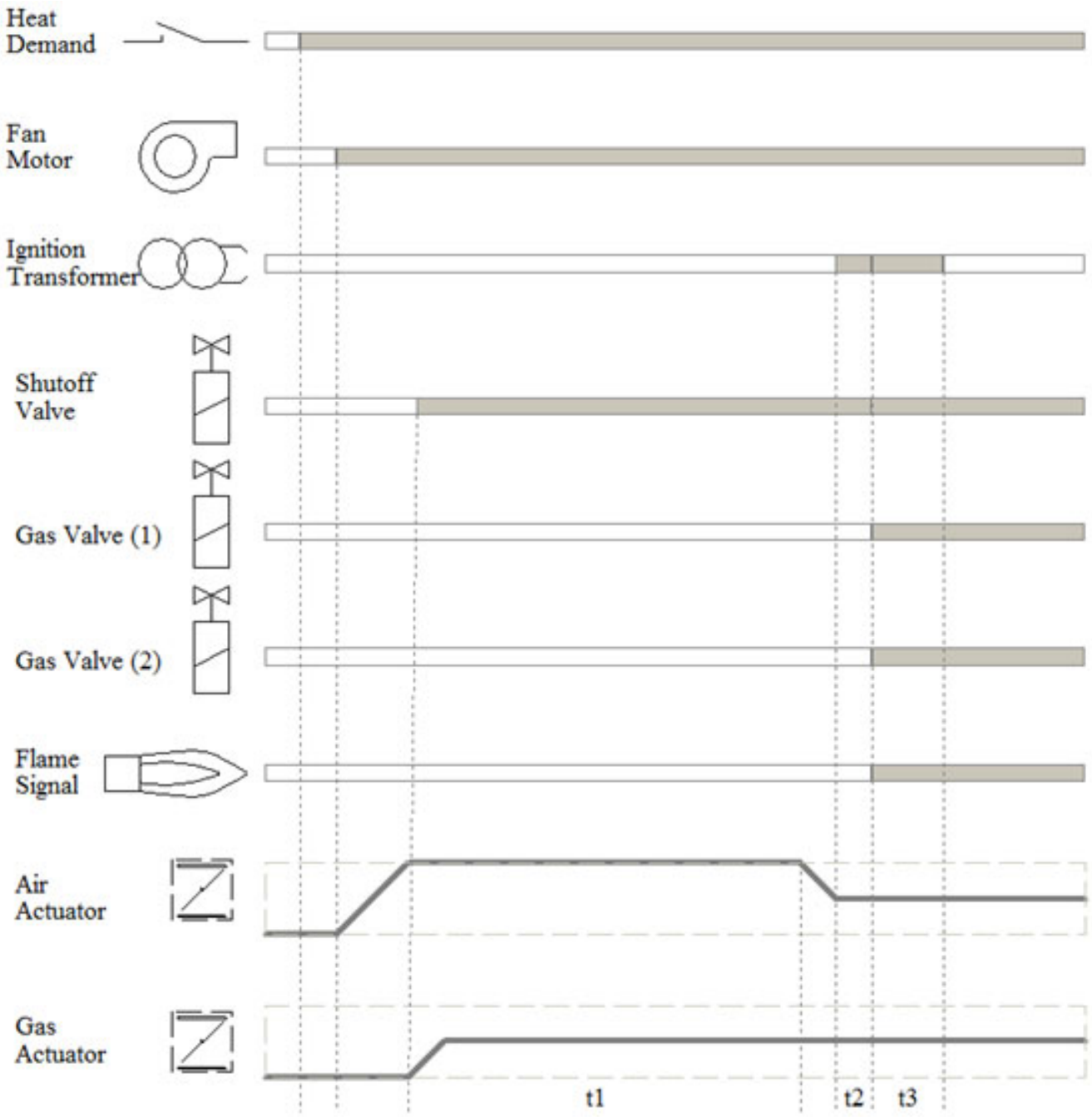
21. BURNER STARTUP SEQUENCE

21 - 1. Gas train: direct ignition

21 - 1 - 1.Ignition sequence

Closing heat demand contact, fan motor is energized, the air actuator moves to the pre-purge position
[RC21_52_param_XX.pdf ➔ Menu parametri ➔ Attuatori ➔ Prevent. aria] and the gas actuator moves to the ignition position.
The (gas) ignition position of the burner (position of the gas actuator) can be set by
[RC21_52_param_XX.pdf ➔ Menu parametri ➔ Attuatori ➔ Accensione gas]
or calculated, starting from the stored air/gas curves, by setting the ignition capacity
[RC21_52_param_XX.pdf ➔ Menu parametri ➔ Bruciatore ➔ Potenza accensione].
When the pre-purge position is reached, the shutoff valve is energized and pre-purge phase begins (see
Pre-purge time).
During this phase there is the test on the flame amplifier and on the components related to safety functions; a damage in the flame sensing circuit corresponding to the condition of flame signal present or a damage in a component assuring a safety function prevents the start of the ignition sequence.
During this phase valve proving system can be performed
[RC21_52_param_XX.pdf ➔ Menu parametri ➔ Controllo tenuta ➔ Esecuzione].
At the end of pre-purge phase, the air actuator moves to the ignition position.
The (air) ignition position of the burner (position of the air actuator) can be set by
[RC21_52_param_XX.pdf ➔ Menu parametri ➔ Attuatori ➔ Accensione aria].
or calculated, starting from the stored air/gas curves, by setting the ignition capacity
[RC21_52_param_XX.pdf ➔ Menu parametri ➔ Bruciatore ➔ Potenza accensione].
When the position is reached, the ignition transformer is energized and pre-ignition phase begins (see Pre-ignition time).
At the end of pre-ignition time, Safety time begins and all valves of the gas train are energized. In case of flame signal detection at the end of safety time, burner running phase begins.
Opening heat demand contact, the unit performs a shutdown followed by (if enabled) a post-purge phase
[RC21_52_param_XX.pdf ➔ Menu parametri ➔ Bruciatore ➔ Temporizzazioni ➔ Postv.],
[RC21_52_param_XX.pdf ➔ Menu parametri ➔ Attuatori ➔ Postv. aria] and
[RC21_52_param_XX.pdf ➔ Menu parametri ➔ Attuatori ➔ Postv. gas].
In case of no flame signal detection at the end of safety time, the unit reaches the lockout condition.
A post-purge phase can be performed
[RC21_52_param_XX.pdf ➔ Menu parametri ➔ Bruciatore ➔ Temporizzazioni ➔ Postv. Blocco],
[RC21_52_param_XX.pdf ➔ Menu parametri ➔ Attuatori ➔ Postv. aria] and
[RC21_52_param_XX.pdf ➔ Menu parametri ➔ Attuatori ➔ Postv. gas].
During this phase valve proving system can be performed
[RC21_52_param_XX.pdf ➔ Menu parametri ➔ Controllo tenuta ➔ Esecuzione]

21 - 1 - 2.



Fig, 11.

Legend:

SYMBOL	DESCRIPTION
t1	Pre-purge time
t2	Pre-ignition time
t3	Safety time

21 - 1 - 3.Capacity reference value: automatic regulation

Please refer to the next chapter “
TOMATIC REGULATION”.
The burner capacity regulation is performed with the following rules.

21 - 1 - 4.Increasing burner capacity

When burner capacity is increased, the first actuator that moves is the air actuator.
The gas actuator moves when [RC21_55_param_XX.pdf ➔ Menu parametri ➔ Processo ➔ Ritardo attuatore] is expired.
In this way the correct air excess during regulation is guaranteed.I

21 - 1 - 5.Decreasing burner capacity

When burner capacity is decreased, the first actuator that moves is the gas actuator.
The air actuator moves when [RC21_55_param_XX.pdf ➔ Menu parametri ➔ Processo ➔ Ritardo attuatore] is expired.
In this way the correct air excess during regulation is guaranteed.

21 - 1 - 6.Burner capacity regulation

During burner capacity regulation, both the actuators move following their own PID parameters.
There is a “dead” band of either side of the regulation point (air and gas) in which no action is taken.
Dead bandwidth can be set by [RC21_55_param_XX.pdf ➔ Menu parametri ➔ Processo ➔ Banda morta].
Normally set to 5 for good regulation response

21 - 2. AIR/GAS regulation curves

These parameters are used to vary the calibration curves if the desired air/gas ratio needs to be changed. The air/gas ratio is usually set by CIB UNIGAS to maintain O2 at 3%. In special cases or in several boiler models, O2 at 3% is not accepted by the installation. In this case, if you want to increase excess air, use the Air Offset parameter to increase or decrease O2 at low flows. O2 increases by increasing Offset and decreases by decreasing Offset. Proceed by steps (max. 5) and check burner operation at minimum and maximum power. NB: After changing the Offset and Molt parameters, redo the curve scan. The Molt parameter is used to decrease or increase oxygen to the maximum power. Offset moves the whole Molt calibration curve higher or lower. The curve gradient changes, variations in the Offset parameter affect the whole curve, in many cases only at maximum power. ONLY AUTHORISED CIB UNIGAS PERSONNEL can change the air/gas curve parameters. In any case, use the RC21_55 programming display as provided to authorised CIBUNIGAS centres only.


Four parameters allow to change the slope of the curves and/or add an offset to every point of the curves.

[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Processo ➔ Offset aria],
[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Processo ➔ Molt. aria],
[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Processo ➔ Offset gas],
[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Processo ➔ Molt. gas].

If this effect is not needed, the coefficients have to be set to 1
[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Processo ➔ Molt. aria] and
[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Processo ➔ Molt. gas]

and the offsets have to be set to 0
[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Processo ➔ Offset aria] and
[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Processo ? Offset gas].

21 - 3. Consistency function

During burner regulation, the cross-check function is enabled.
Every setpoint value (air or gas) corresponds to a theoretical actuator position.


The following parameters has to be set by the burner manufacturer in order to fulfil the appliance requirements.

By the following parameters, a band around the actuator theoretical position can be set.

[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Attuatori ➔ Offset banda aria],
[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Attuatori ➔ Molt. banda aria],
[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Attuatori ➔ Offset banda gas],
[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Attuatori ➔ Molt. banda gas].

During burner regulation, the actuator (air or gas) can only reach working positions inside the just described band.

NB: The servo motor pass bands must be set up by specialised personnel only and must ensure proper operation in the absence of CO, even when the maximum position is reached for the gas servo motor and the minimum position for the air servo motor, defined by the air/gas pass band Offset and air/gas Molt. pass band parameters.

A setpoint cross-check band can be set by the following parameter:

The congruency pass band is always monitored by the system. If the servo motors reach the maximum or minimum position and if the air or gas signal is higher or lower than the congruency pass band for a longer time than congruency timeout, the system is locked due to lack of congruency, signalling if the problem occurred on air or gas adjustment.

[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Attuatori ➔ Banda congruenza].

By the following parameter, a cross-check timeout can be set.

[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Attuatori ➔ Timeout congruenza].

During burner regulation, if the flow sensor signal (air or gas) remains outside the cross-check band for the just described timeout, the unit reaches the lockout condition.

The cross-check function is disabled in the following conditions:
- Continuous check of the gas pressure switch forDuring burner calibration
- Continuous check of the gas pressure switch forDuring curves scanning
- Continuous check of the gas pressure switch forIf skip curves scanning is enabled
- Continuous check of the gas pressure switch forDuring burner operating without flow sensors.

21 - 4. End of the heat demand

At the end of the heat demand (when heat demand contact opens), the burner immediately switches off only if the burner is at the minimum capacity.
Otherwise, the burner switching off timeout starts decreasing.
The burner shutdown is performed when
[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Bruciatori ➔ Temporizzazioni ➔ Tempo discesa]
is expired or when the burner reaches the minimum capacity.

Regulation parameters: setting information flame detection

22. VPS GAS VALVE SEAL CONTROL

22 - 1. Valve proving system (VPS)

22 - 1 - 1.VPS setting

Valve proving system can be enabled by
[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Controllo tenuta ➔ Esecuzione].

Valve proving system function can be:

Disabled
Enabled: performed during the pre-purge phase
Enabled: performed during the post-purge phase (at the end of the heat demand)
Enabled: both of the previous (during pre-purge phase and at the end of the heat demand)

-VPS: Enabled –
Even if the VPS function is performed only at the end of the heat demand, if the network supply is disconnected, the VPS function will be performed once during the next pre-purge phase.

-VPS:
After a reset from lockout, even if the VPS function is performed only at the end of the heat demand, the VPS function will be performed once during the next pre-purge phase.

22 - 1 - 2.VPS: gas pressure switch

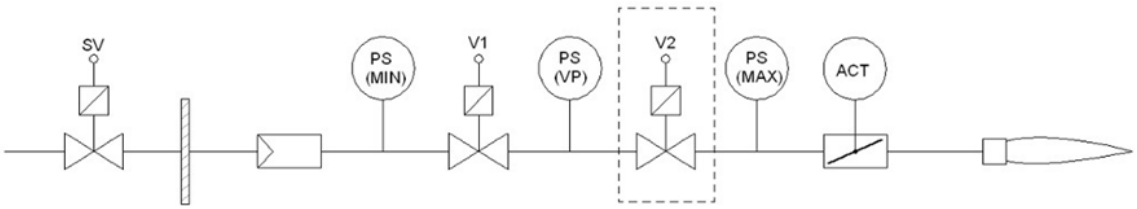

The gas pressure switch (sensing device) used to complete the VPS shall comply with EN 1854.

22 - 1 - 3.VPS: direct ignition configuration

VPS is executed by using a standard pressure switch mounted between the valves V1 and V2 of the gas train.
The pressure switch is normally set to 50% of the gas mains pressure. VPS sequence:

- Evacuation of the test space by opening the burner side valve for

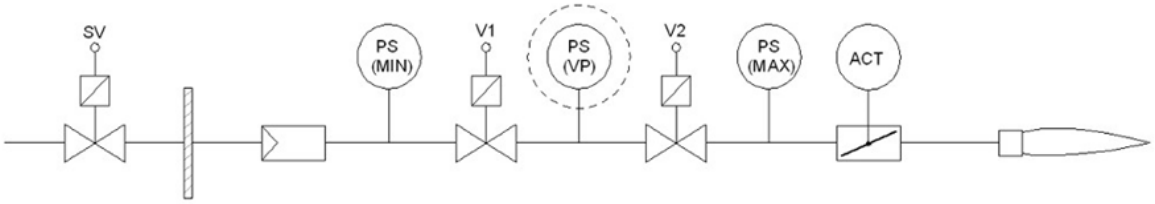
[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Controllo tenuta ➔ T. scarico]



Fig, 12. VPS evacuation time (direct ignition)

- Discharge of the test space by opening the side valve V2 of the burner

[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Controllo tenuta ➔ T. pressione atmo]

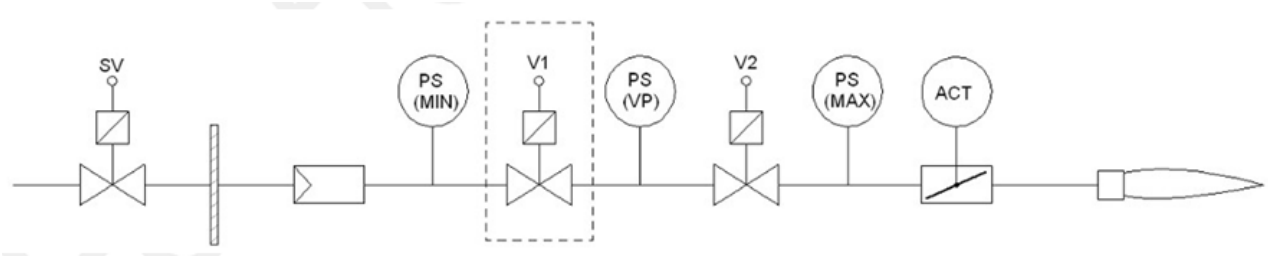


Fig, 13. VPS atmospheric pressure time (direct ignition)

In this phase, gas pressure switch must be opened.
If the valve on the mains side is leaking, atmospheric pressure is not maintained. In this case, valve proving sequence ends and the unit reaches the lockout condition.

- Continuous check of the gas pressure switch forFilling of the test space by opening the mains side valve for

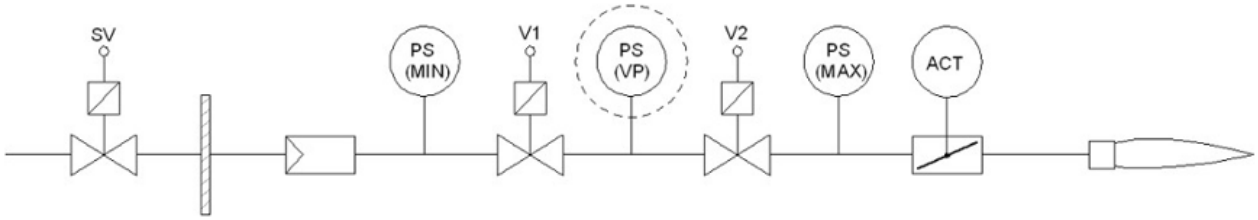
[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Controllo tenuta ➔ T. riempimento]



Fig, 14. VPS filling time (direct ignition)

- Filling the test space by opening the Burner valve V1

[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Controllo tenuta ➔ T. pressione gas]



Fig, 15. VPS gas pressure test time (direct ignition)

In this phase, gas pressure switch must be closed.
If the valve on the burner side is leaking, pressure falls below the switching point of the gas pressure switch. In this case, valve proving sequence ends and the unit reaches the lockout condition.

- End of the valve proving sequence (no faults detected).

Formula to calculate VPS test time: “T. atmo. pressure” – “T gas pressure”. The time set is calculated in order to ensure that the system measures a loss within the maximum limits allowed by law. According to standard EN 1643, the maximum loss allowed on systems with a power of < 500 KW is 50dm3/h . If thermal power is > di 500 KW, the limit is 200dm3/h.

The formula to calculate the test time is as follows:

$$t_{Test} = \frac{(P_G - P_W) \cdot V \cdot 3600}{P_{atm} \cdot Q_{Leck}}$$

tTest=Tempo da impostare su VPS come tempo ti test
QLeck=Perdita massima amissibile
PG=Pressione gas di ingresso prima delle valvole a bruciatore spento
PW=Pressione di set del pressostato PGCP, normalmente PG/2
Patm=Pressione gas barometrica 1013 mbar
V=Volume in litri tra le valvole da etstare = Volume valvola 1 + volume valvola 2 + eventuale volume tubazione usato tra V1 e V2

Valvola Gas	Volume V1-V2 (Litri)
VGD 2"	0,8
VGD DN65	1,3
VGD DN80	1,5
VGD DN100	3
VGD DN 125	5,2
VGD DN 150	8,7
MB-D(LE) 403	0,04
MB-D(LE) 405-407	0,11
MB-D(LE) 410-412	0,33
MB-D(LE) 415-420	0,24

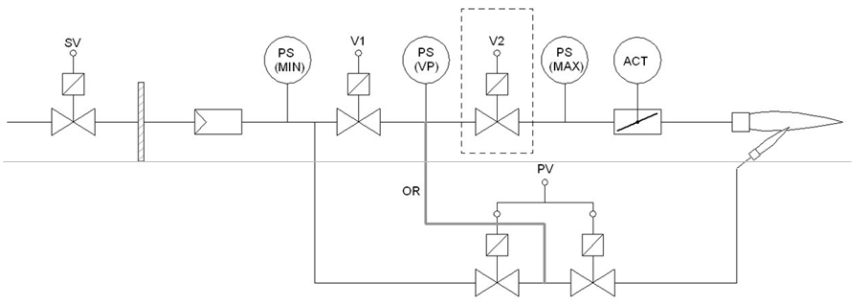
E.g.:
Max. burner power <500 Kw. Max. allowable loss QLeck 50 dm3/h
Inlet gas pressure PG 100 mbar
Set-point pressure PGCP PW=PG/2=100/2=50mbar
Valve VGD 2” V=0.8 litres
Atmospheric pressure (Patm)=1013 mbar
tTest= ((100-50)*0.8*3600)/(1013*50)=2.84 secs

From the calculation, the test time is 2.84 secs. Round up and set the loss control test value at 3 secs.

22 - 1 - 4.VPS: gas pilot configuration

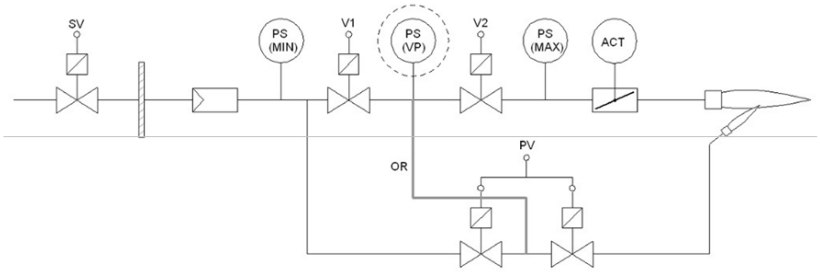
VPS sequence:

Evacuation of the test space by opening the burner side valve for
[RC21_52_param_XX.pdf ➔ Menu parametri ➔ Controllo tenuta ➔ T. scarico]



Fig, 16. VPS evacuation time (gas pilot)

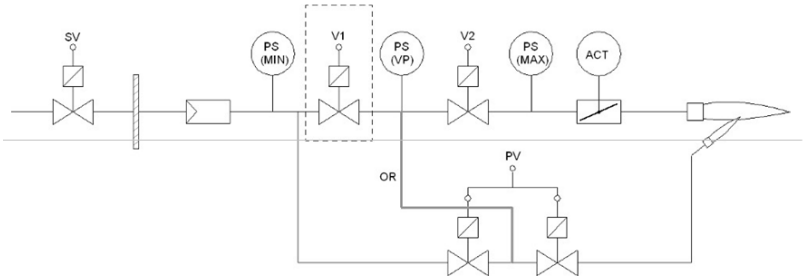
Continuous check of the gas pressure switch for
[RC21_52_param_XX.pdf ➔ Menu parametri ➔ Controllo tenuta ➔ T. pressione atmo]



Fig, 17. VPS atmospheric pressure time (gas pilot)

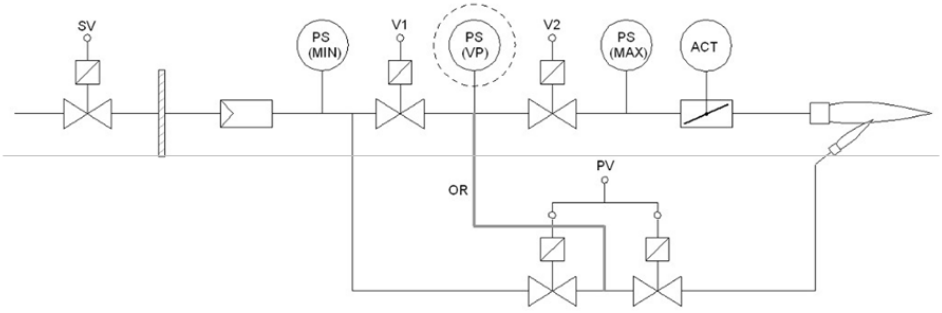
In this phase, gas pressure switch must be opened.
If a valve on the mains side is leaking (V1 or mains side pilot valve), atmospheric pressure is not maintained. In this case, valve proving sequence ends and the unit reaches the lockout condition.

Filling of the test space by opening the mains side valve for
[RC21_52_param_XX.pdf ➔ Menu parametri ➔ Controllo tenuta ➔ T. riempimento]



Fig, 18. VPS filling time (gas pilot)

Continuous check of the gas pressure switch for
[RC21_52_param_XX.pdf ➔ Menu parametri ➔ Controllo tenuta ➔ T. pressione gas]



Fig, 19. VPS gas pressure test time (gas pilot)

In this phase, gas pressure switch must be closed.
If a valve on the burner side is leaking (V2 or burner side pilot valve), pressure falls below the switching point of the gas pressure switch. In this case, valve proving sequence ends and the unit reaches the lockout condition.

End of the valve proving sequence (no faults detected).

23. *TIMINGS*

TIMING	VALUE	DESCRIPTION
Air pressure switch timeout	10s	Maximum guaranteed time
Air pressure switch checking time	0	

Tab.26 - Table of timings (general)

TIMING	VALUE	DESCRIPTION
Pre-purge time	30s	Minimum guaranteed time

Tab.27 - Table of timings (pre-purge time)

TIMING	VALUE	DESCRIPTION
Pre-ignition time	1s	Minimum guaranteed time

Tab.28 - Table of timings (pre-ignition time)

TIMING	VALUE	DESCRIPTION
Safety time	3s	Maximum guaranteed time

Tab.29 -

TIMING	VALUE	DESCRIPTION
Post-purge time	Adjustable	
Please refer to the following parameters: *[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Bruciatore ➔ Temporizzazioni ➔ Postv.]* *[RC21_55_param_XX.pdf ➔ Menu parametri ➔ Bruciatore ➔ Temporizzazioni ➔ Postv. Blocco]*		

Tab.30 - Table of timings (post-purge time)

TIMING	VALUE	DESCRIPTION
Flame failure response time (FFRT)	< 1s	

Tab.31 -

TIMING	VALUE	DESCRIPTION
False flame signal time before lockout	10s	Maximum guaranteed time

Tab.32 - Table of timings (false flame signal time before lockout)

TIMING	VALUE	DESCRIPTION
Running position stabilization time	10s	

Tab.33 - Table of timings (running position stabilization time)

TIMING	VALUE	DESCRIPTION
RC21: communication timeout	60s	
RC21: (window) timeout during menu access	4min	

Tab.34 - Table of timings (RC21 timeout)

TIMING	VALUE	DESCRIPTION
Internal communication timeout	10s	

Tab.35 - Table of timings (internal communication timeout)

TIMING	VALUE	DESCRIPTION
Calibration timeout	30min	

Tab.36 -

TIMING	VALUE	DESCRIPTION
Actuators anti blocking timeout	120min	

Tab.37 - Table of timings (actuators anti blocking timeout)

TIMING	VALUE	DESCRIPTION
Gas minimum pressure switch timeout	10min	

Tab.38 - Table of timings (gas minimum pressure switch timeout)

TIMING	VALUE	DESCRIPTION
Low pressure checking timeout	15s	

TIMING	VALUE	DESCRIPTION
Prepurge pressure checking timeout	10s	

24. RC21.52 CONTROL PANEL

If the control panel is disconnected, no operation of the burner is allowed!
The system doesn't operate!

Fig, 20. RC21.52 control panel

RC21.52 is the user interface of HAGC31-CU01 control board.
RC21 is composed of wide display (dot matrix) with white backlight, 2 push buttons and a jog dial knob.

24 - 1. Technical data

24 - 1 - 1.Dimensions

External dimensions: approx. L/W/H 128 x 36 x 98 mm

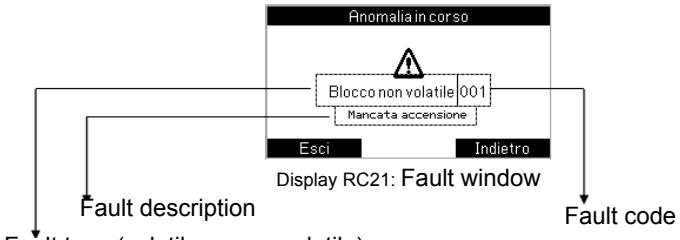
24 - 1 - 2.Power supply and consumption

Power supply: 24VDC ± 5%
Power consumption: Max 250mW
Polarized bipolar twisted cable (shielded if necessary).

24 - 1 - 3.Communication

(Not isolated) RS485 bus and communication driver, ModBus master protocol.
Polarized bipolar twisted cable (shielded if necessary).

24 - 1 - 4.Connection cablesFault window



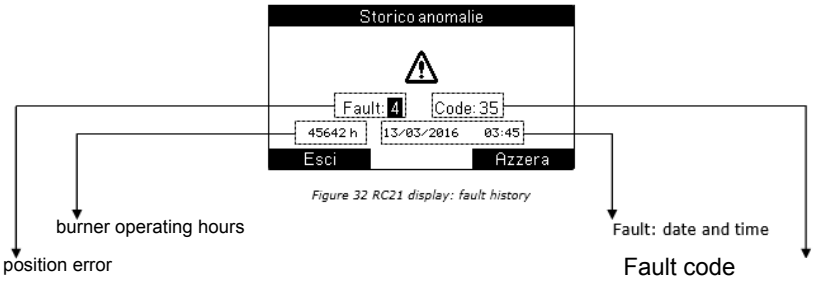
Fault type [volatile or non-volatile]
Press Esci or Indietro to come back to the RC21 main window.

In case of non-volatile fault, if the unit can be reset, the B button indication becomes Reset (instead of Indietro).

To reset the unit press the B button (2 times in order to confirm the operation).

24 - 2. History of anomalies

The last 8 faults are shown.
The most recent fault is shown at the position 1, the least recent at position 8.

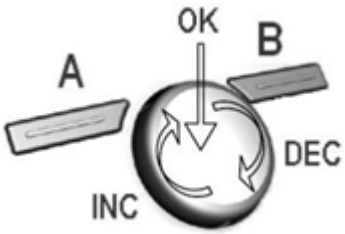


List of error codes

FAULT CODE	DISPLAY STRING	DESCRIPTION	SUGGESTION
01	Ignition fault	BLOCK NO flame signal detection at the end of safety time.	1) Gas valve outlet pressure too low, check the pressure during ignition 2) Gas actuator position too closed 3) Ignition electrode not correctly positioned 4) Flame detection electrode not correctly positioned 5) Check Phase, Neutral and Protective Earth electric connections 6) Check AIR actuator position
02	Extraneus Flame /	BLOCK False flame signal during stand-by or preventilation time.	1) Defective or badly positioned detetction electrode, check electrode integrity 2) Defective or damaged electrode wiring, check electrode wiring 3) Disconnect the detector cable from the device, reset the system, if the problem reappears replace the HAGC31 unit
03	Safety Loop OPEN/	BLOCK Safety thermostats chain open during operation.	1) Check boiler safety thermostats / pressure switches 2) Check boiler safety thermostats / pressure switches wiring
04	Loos of Flame	BLOCK Loss of flame during operation.	1) Gas valve pressure outlet too low, check pressure during operation 2) Flame detection electrode not correctly positioned 3) Check Phase, Neutral and Protective Earth electric connections
05	Control Board internal error	BLOCK Internal device error	1) Check all the electrical connections 2) If it persists, replace the HAGC31 unit
06	Control Board internal error	BLOCK Internal device error	1) Check all the electrical connections 2) If it persists, replace the HAGC31 unit
07	AIR pressure switch	BLOCK Insufficient air pressure during prewash, during ignition or during operation	1) Check air pressure switch calibration 2) Blocked air inlet, check air inlet 3) Hydraulic connection line gas pressure switch obstructed 4) Minimum required power too low
08	Max Gas pressure switch	BLOCK Maximum gas pressure switch intervenes during start-up or during operation.	1) Check max gas pressure switch calibration 2) Check the main gas outlet valve pressure 3) Backpressure too high during ignition, reduce ignition power 4) Dirty or obstructed boiler, check the flue gas pipe and the smoke passage in the combustion chamber
09	Maxim number of manual reset	BLOCK Maximum number of manual reset is reached, switch off for 10 seconds to reactivate the burner, then reactivate the system	
10	AIR Actuator	BLOCK AIR servomotor positioning error, max or min limit switch not reached during servomotor testing	1) Blocked servomotor, check the servomotor movement 2) Servomotor wiring error 3) Servomotor does not reach maximum position check flue dampers movement 4) Servomotor does not reach minimum position check flue dampers movement 5) External EMC disturbances, check wiring 6) Defective servomotor, replace it
11	GAS Actuator	BLOCK GAS servomotor positioning error, max or min limit switch not reached during servomotor testing	1) Blocked servomotor, check the servomotor movement 2) Servomotor wiring error 3) Servomotor does not reach maximum position check flue dampers movement 4) Servomotor does not reach minimum position check flue dampers movement 5) External EMC disturbances, check wiring 6) Defective servomotor, replace it
13	AIR cross-check error	BLOCK AIR signal congruence band servomotor position exceeded, AIR flow correction required too high.	1)Has the boiler been soiled? 2) Blocked air inlet? 3) Incorrect engine revolutions, check engine ventilation integrity 4) Dirty air fan? 5) Blocked chimney? 6) Dirty AIR sensor, check the AIR sensor lead
14	GAS cross-check error	BLOCK GAS signal congruence band servomotor position exceeded, GAS flow correction required too high, it occurs only during normal operation	1) Is the gas valve out of calibration? 2) The gas inlet pressure has increased too much 3) The gas inlet pressure has decreased too much 4) GAS sensor dirty
15	V1 Gas leak	BLOCK Valve V1 loses gas does not pass VPS test	1) PGCP pressure calibration not correct 2) Defective valve, replace it, loses gas!
16	V2 Gas leak	BLOCK Valve V2 loses gas does not pass VPS test	1) PGCP pressure calibration not correct 2) Defective valve, replace it, loses gas!
17	AIR Actuator	BLOCK AIR servomotor positioning error, during operation, required position not in line with the actual position.	1) EMC faults distort communication, verify EMC arriving from outside 2) Defective servomotor movement, check the movement of the damper manually 3) Defective servomotor, replace it
18	GAS Actuator	BLOCK GAS servomotor positioning error, during operation, required position not in line with the actual position.	1) EMC faults distort communication, verify EMC arriving from outside 2) Defective servomotor movement, check the movement of the damper manually 3) Defective servomotor, replace it
22	Gas pressure too low	BLOCK During curves scan: Gas pressure after the valve is insufficient to complete the scan	1) check GAS pressure input if correct adjust the valve. 2) Maximum power required too high control maximum boiler power Increase the gas pressure at the outlet of the main gas valve, reset the burner and reactivate the curve scan, if the problem recurs, increase the outlet pressure again and reset the burner again and reactivate the curve scan.
23	Air pressure too low	BLOCK During curves scan: Air port too low, not enough to reach the required power	1) Check the boiler parameters, maximum power. 2) Position of combustion head not correct. 3) Blocked air inlet 4) Dirty or obstructed boiler, check the flue gas pipe and flue passage on the combustion chamber

24	Gas pressure too high	BLOCK During curves scan or at end of scan: Outlet gas valve pressure too high, the GAS servomotor during the scan never exceeded the 40° positioning, the automatic regulation could be unstable.	1) If the Block is reset, the Burner works normally with high pressure after the valve, the regulation could be unstable with continuous changes of servomotors positioning. 2) Reduce the gas pressure at the valve outlet, reset the block and reactivate the curve scan 3) If error is signalled again repeat step 2.
31	Air Pressure Switch Faulty	Device external fault. AIR sensor defective, the contact results closed with ventilation Off	1) Defective AIR pressure switch 2) AIR pressure switch wiring incorrect
32	Power Supply	Device external fault. DC 24. 24V power supply incorrect	1) Check electrical connections 2) Check 24V DC power supply on terminals X2 3) Check 24V power supply
33	Power Supply	Device external fault. AC 230V, power has fallen below 170V. The system will automatically reset if the mains voltage> 200V.	1) Check 230V single-phase power supply 2) Check wiring 3) Check power supply on terminals X1
34	Safety Loop OPEN	Device external fault. Safety thermostats chain open with burner waiting for heat request. It automatically resets when the anomaly disappears	1) Check boiler safety thermostats / pressure switches 2) Check boiler safety thermostats / pressure switches wiring
35	Max Gas Pressure Switch Faulty	Device external fault. Defective MAXIMUM Gas pressure switch, it results open when the burner is off	1) Check the Max pressure switch wiring 2) If necessary, replace the Maximum pressure switch
36	Min Gas Pressure Switch	Device external fault. Mains gas pressure too low.	1) Check the mains gas pressure 2) Check minimum pressure switch calibration 3) Check minimum pressure switch contacts 4) If necessary, replace the minimum pressure switch
37	--	BLOCK Display communication error	1) Check Display electrical connection 2) Replace display 3) Communication error of the main equipment, replace the device
38	Air flow sensor	Device external fault. Air signal sensor below the minimum threshold	1) Check sensor wiring 2) Clean sensor 3) Replace sensor
39	Gas flow sensor	Device external fault. Gas signal sensor below the minimum threshold	1) Check sensor wiring 2) Clean sensor 3) Replace sensor
43	Curve scanning Fault	BLOCK During the scan the air and gas signals are not stable the system cannot keep the position of the servomotors stable.	1) Check gas outlet valve pressure 2) Verify damper servomotor connections, reduce mechanical clearance 3) Chamber counter-pressure unstable, check boiler exhaust fumes 4) Check the gas supply pressure. 5) Check gas pressure regulator
44	Generic	BLOCK Microprocessor communication error.	1) Verify correct assembly of removable EPROM memories 2) Check the display, modbus, wifi, open term wiring 3) Replace the main unit
45	Generic	Device external fault. Process probe error.	1) Check process probe 2) Check the wiring of the process probe 3) Check the process probe connections 4) Check thermoregulation programming
46	Fan Thermal relay	Device external fault. Fan thermal relay interrupted.	1) Check motor thermal relay 2) Check motor ventilation electric absorption

24 - 2 - 1.Buttons and encoder



A button
- *[Menu]:* to access to menu
- *[Esci]:* back to the main window

B button
- *[Modo]:* burner working mode setting
- *[Indietro]:* back to the previous window
- *[Conferma]:* to confirm the settings
- *[Salva]:* to save the settings

Knob
- INC: to increase the selected value or next menu
- DEC: to decrease the selected value or previous menu

➢OK:to confirm the settings

Fig, 21. knob and buttons concept

25. *MENU DESCRIPTIONS*

25 - 1. [Informazioni]

Please refer to the attached document RC21_52_info_XX.pdf.

25 - 1 - 1.[Meters]

[Ore alimentazione]: power-on hours (read only).

[Ore lavoro]: burner running hours (read only).

[Ore lavoro R]: burner running hours (can be reset).

[Avviamenti]: burner startups counter (read only).

[Avviamenti R]: burner startups counter (can be reset).

[Numero blocchi]: burner lockout counter (read only).

[Numero blocchi R]: burner lockout counter (can be reset).

[Gas bruciato]: burned gas quantity (read only).

[Gas bruciato R]: burned gas quantity (can be reset).

[Data reset gas]: burned gas counter reset date.

25 - 1 - 2.[Reset menu]

[Ore lavoro]: burner running hours: reset command.

[Avviamenti]: burner startups counter: reset command.

[Numero blocchi]: burner lockout: reset command.

[Gas bruciato]: burned gas quantity: reset command.

[Tutti]: all the four previous counters: reset command.

[Portata aria]: Air volumetric flow rate.

[Portata gas]: Gas volumetric flow rate.

25 - 1 - 3.[Displays air/gas curves]

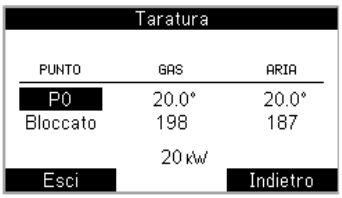
Air/gas: settings visualization.

The display is as follow:

Rotate the knob to select the point of the air/gas curves.

To see the point settings press the button *Conferma*

During this visualization mode, the unit performs a controlled shutdown.



Fig, 22. RC21 display: air/gas settings visualizationDisplay

25 - 1 - 4. [Generals]

[Firmware RC21]: RC21 firmware version.

[Firmware HAGC31 BC]: HAGC31 firmware version (burner control).

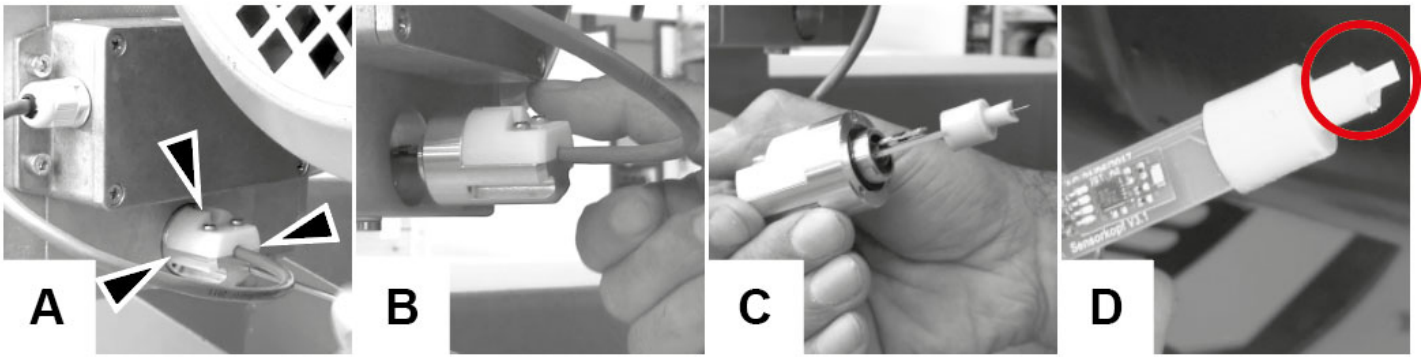
[Firmware HAGC31 TR]: HAGC31 firmware version (burner regulation).

26. *Gas flow sensor maintenance*

ATTENTION! do not touch the sensor (figure D) with hands. clean only with cotton swab. do not use any cleaning product.

To clean the gas flow sensor, proceed as follows:

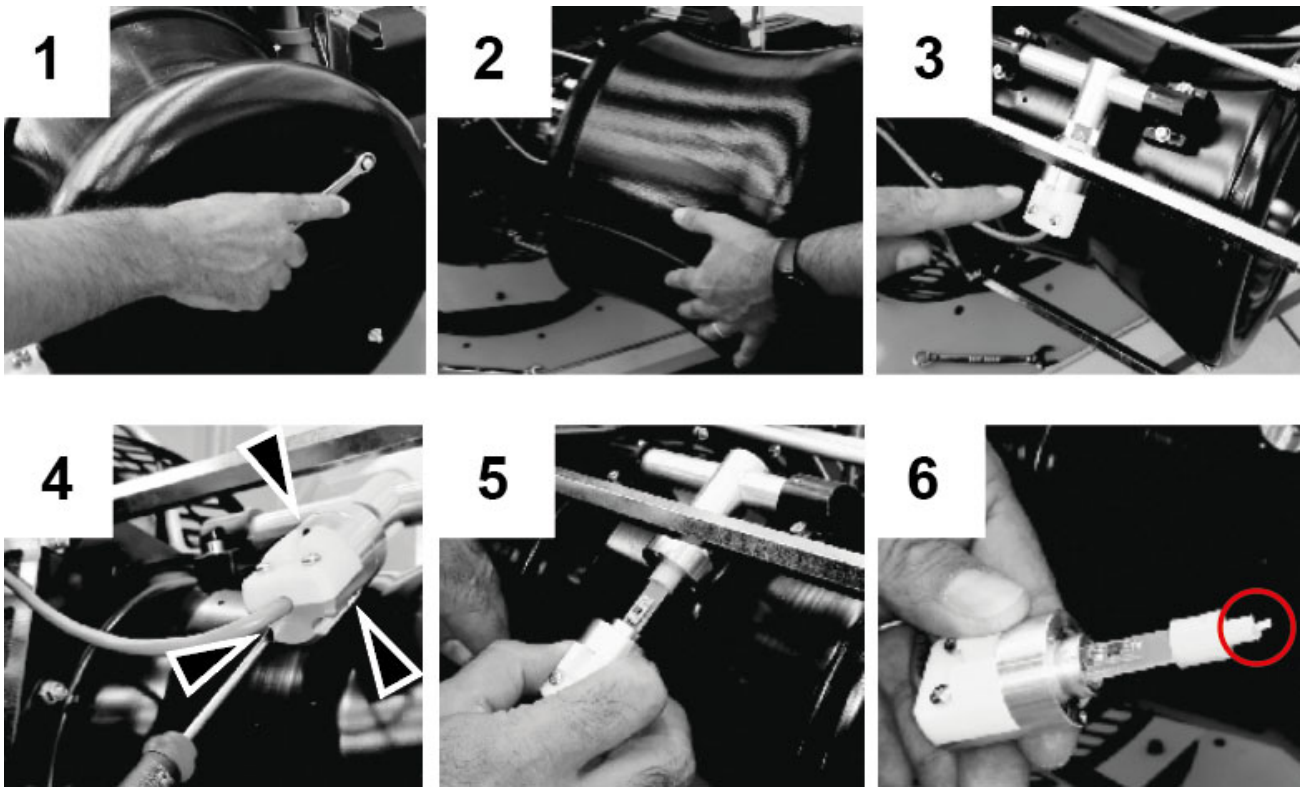
1 Loose the srews (A)
2 Remove the gas flow sensor from its slot, carefully (B)
3 clean the bulbe with a cotton swab (D), taking care not to touch it with hands;
4 replace the gas flow sensor into its slot.



27. Air flow sensor maintenance

ATTENTION! do not touch the sensor (figure 9) with hands. clean only with cotton swab. do not use any cleaning product.

To clean the gas flow sensor, proceed as follows:



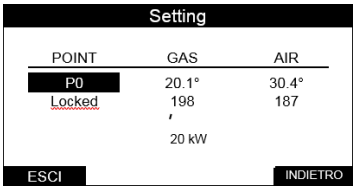
To clean the air flow sensor, proceed as follows:

1 Remove the air intake silencer (1)
2 Loose the srews (4)
3 Remove the air flow sensor from its slot, carefully (5)
4 clean the bulbe with a cotton swab, taking care not to touch it with hands;
replace the air flow sensor into its slot.

5. TROUBLESHOOTNG GUIDE

Burner Doesn't Light	* No electric power supply	* Wait until power supply is back
	* Main switch open	* Close the switch
	* Thermostats open	* Check set points and thermostat connections
	* Bad thermostat set point or broken thermostat	* Set or replace the thermostat
	* No gas pressure	* Restore gas pressure
	* Safety devices (manually operated safety thermostat or pressure switch and so on) open	* Restore safety devices; wait that boiler reaches its temperature then check safety device functionality.
	* Broken fuses	* Replace fuses. Check current absorption
	* Fan thermal contacts open (only three phases)	* Reset contacts and check current absorption
	* Burner control locked out	* Reset and check its functionality
	* Burner control damaged	* Replace burner control
Gas Leakage: Burner Locks Out (No Flame)	* Gas flow too low	* Increase the gas flow * Check gas filter cleanness * Check butterfly valve opening when burner is starting (only Hi-Low flame and progressive)
	* Ignition electrodes discharge to ground because dirty or broken	* Clean or replace electrodes
	* Bad electrodes setting	* Check electrodes position referring to instruction manual
	* Electrical ignition cables damaged	* Replace cables
	* Bad position of cables in the ignition transformer or into the electrodes	* Improve the installation
	* Ignition transformer damaged	* Replace the transformer
Burner Locks Out With Flame Presence	* Bad flame detector set	
	* Flame detector damaged	* Replace or adjust flame detector
	* Bad cables of flame detector	* Check cables
	* Burner control damaged	* Replace burner control
	* Phase and neutral inverted	* Adjust connections
	* Ground missing or damaged	* Check ground continuity
	* Voltage on neutral	* Take off tension on neutral
	* Too small flame (due to not much gas)	* Adjust gas flow * Check gas filter cleanness
	* Too much combustion air	* Adjust air flow rate
Burner Continues To Perform Pre-purge	* Burner control damaged	* Replace burner control
	* Air servomotor damaged	* Replace servomotor
Burner Continues To Perform All Its Features Without Igniting The Burner	* Air pressure switch damaged or bad links	* Check air pressure switch functions and links
	* Burner control damaged	* Replace burner control
Burner Locks Out Without Any Gas Flow	* Gas valves don’t open	* Check voltage on valves; if necessary replace valve or the burner control * Check if the gas pressure is so high that the valve cannot open
	* Gas valves completely closed	* Open valves
	* Pressure governor too closed	* Adjust the pressure governor
	* Butterfly valve too closed	* Open the butterfly valve
	* Maximum pressure switch (if installed) open.	* Check connection and functionality
	* Air pressure switch doesn’t close the NO contact	* Check connections * Check pressure switch functionality
Burner Locks Out And The Control Window Shows A P (Siemens & Staefa Only)	* Air pressure switch damaged (it keeps the stand-by position or badly set	* Check air pressure switch functionality * Reset air pressure switch
	* Air pressure switch connections wrong	* Check connections
	* Air fan damaged	* Replace motor
	* No power supply	* Reset power supply
	* Air damper too closed	* Adjust air damper position
Burner Locks Out During Normal Running	* Flame detector circuit interrupted	* Check wiring * Check photocell
	* Burner control damaged	* Replace burner control
	* Maximum gas pressure switch damaged or badly set	* Reset pressure switch or replace it

When Starting The Burner Opens For A While The Valves And Then Repeats From The Beginningthe Cycle From Pre-purge	* Gas pressure switch badly set	* Reset the pressure switch
	* Gas filter dirty	* Clean gas filter
	* Gas governor too low or damaged	* Reset or replace the governor
Burner Stands While Running Without Any Switching Of Thermostats	* Thermal contacts of fan motor open	* Reset contacts and check values * Check current absorption
Fan Motor Doesn't Start	* Internal motor wiring broken	* Replace wiring or complete motor
	* Fan motor starter broken	* Replace starter
	* Fuses broken (three phases only)	* Replace fuses and check current absorption
Burner Doesn't Switch To High Flame	* Hi-low flame thermostat badly set or damaged	* Reset or replace thermostat
	* Servomotor cam badly set	* Reset servomotor cam
Sometimes The Servomotor Runs In The Wrong Way	* Servomotor capacitor damaged	* Replace capacitor

Menu	Menu or field	Menu or field	Menu or field	Description	Default setting
Information menu	Meter menu	[Supply hours]		Hours of supply	0
		[Operation hours]:		burner operation hours	0
		[R operation hours]:		partial burner operation hours (can be reset)	0
		[Ignitions]:		burner ignition counter	0
		[R ignitions]:		burner ignition counter (can be reset)	0
		[Number of blocks]:		burner block counter	0
		[R number of		partial counter of burner blocks (can be reset)	0
		[Reset menu]	[Operation hours]:	burner operation hours: reset command	input with confirmation
			[Ignitions]:	ignition counter: reset command	input with confirmation
			[Number of blocks]:	burner blocks	input with confirmation
			[All]:	all four previous counters	input with confirmation
	Displays air/gas curves		Air/gas: display of settings The display will be as follows:  Turn the knob to select the air/gas curves point.		
		[General]	[Firmware RC21]:	RC21 firmware.	
			[Firmware HAGC31]:	HAGC31 firmware.	

Menu	Menu or field	Menu or field	Menu or field	Description	Default setting
Parameters menu	Burner	[Operation]		burner operation mode	OFF
		Manual power]:		manual power of the burner	Min. output Min. output
		[Ignition type]:		burner ignition mode (*)	Actuator position from parameter
		Ignition power]:		burner ignition power (*)	(P2) ==> [kW]
		[Times]	[Post-ventilation]:	post-ventilation time	10
			[Post-ventilation after block]	post-ventilation time after block	30
			[Descent time]:	switch-off time	60
	Thermal unit	[Maximum power]:		maximum power of the burner	-
		[Minimum power]:		minimum power of the burner	-
		[Maximum load]:		maximum load of the burner	-
		[Minimum load]:		minimum load of the burner	-
		[Curve scan]:		Storage position of actuators without changing air/gas curves	Function disabled
		[Band being scanned]:		setpoint bandwidth during curve scanning	15
		[Skip scan]:		skip the curve scan, activation parameter	Function disabled
		[Clear settings]:		boiler settings: clear command	
		[Identification]	Not available		
		[Fuel]			
		[Settings]			
	Process	[Air offset]		air setpoint offset	0
		[Air multiplier]:		air setpoint coefficient	1
		[Gas offset]:		gas setpoint offset	0
		[Gas multiplier]:		gas setpoint coefficient	1
		[Dead band]:		dead band during regulation (dead band close to setpoint = [Band	
		[Actuator delay]:		actuator delay during regulation	1
	Calibration	[Activation]:		calibration function, activation parameter	Function disabled
		[Min. air current]:		minimum growth of air actuator position	0.5
		[Min. gas current]:		minimum growth of gas actuator position	0.5

Parameters menu	Calibration	[Stability duration]:		stabilisation time before saving point	30
		[Stability duration]:		calibration settings: clear command	input with confirmation
	[Inputs]:	[Safety openings]:		maximum number of safety loop openings	3
		No sensors:		operation of burner without sensors, activation parameter	Function disabled
	Outputs			Not available	
	Actuators	[Air shut-off]		air actuator: shut-off position	0
		[Gas shut-off]		gas actuator: shut-off position	0
		[Air pre-ventilation]		air actuator: pre-ventilation position	90
		[Air ignition]:		air actuator: ignition position	
		[Gas ignition]:		gas actuator: ignition position	
		[Air post-ventilation]		air actuator: post-ventilation position	90
		[Gas post-ventilation]		gas actuator: post-ventilation position	0
		[PID air P]:		PID parameters of air actuator: P factor P factor	1
		[PID air I]:		PID parameters of air actuator: P factor I factor	40
		[PID air D]:		PID parameters of air actuator: P factor D factor	10
		[PID gas P]:		PID parameters of gas actuator: P factor	1
		[PID gas I]:		PID parameters of gas actuator: I factor	55
		[PID gas D]:		PID parameters of gas actuator: D factor	15
		[Gas band offset]: gas actuator:		offset for calculation of the band	7
		[Air band multiplier]:		air actuator: coefficient for calculation of the band	0.11
		[Gas band offset]:		gas actuator: offset for calculation of the band	-13

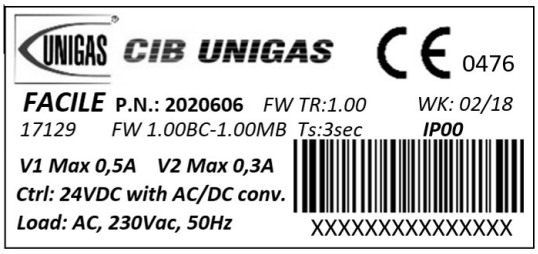
Parameters menu	Actuators	[Gas band multiplier]:		gas actuator: coefficient for calculation of the band	0.11
		[Timeout consistency]:		cross-check timeout	60
		[Band consistency]:		cross-check band	5
	Seal control	[Execution]:		Seal control system function (VPS), activation parameter	Function disabled
		[Discharge time]:		VPS discharge time	3
		[Atmospheric pressure time]:		VPS atmospheric pressure monitoring time	5
		[Filling time]:		VPS filling time	3
		[Gas pressure time]:		VPS gas pressure monitoring time	5
	Settings	[Date / time]:		Date and time	
		[Contrast]:		Display contrast.	
	Display	[Display lighting]:		Display lighting.	
		[Knob lighting]:		Knob lighting mode.	

29. Service and disposal notes

☞ Check wiring and all safety functions each time a unit has been replaced!

☞ The unit contains electrical and electronics components and may not be disposed of together with household garbage. Local and currently valid legislation must be observed.

30. Adhesive label set on the electrical control equipment



- Application type
- Customer code
- Firmware version
- Safety time
- IP protection degree
- Operating voltage and frequency
- Maximum load rating of outputs
- Production week

Bar code type ITF indicating origin, code, date, serial number. 50mm x 23mm

Fig, 23. Adhesive label (control board housing)

31. Certification

According to the general requirements of the standard

- EN298:2012 (Burner Control)
- EN12067-2:2004 (GARC)
- EN1643 (VPS)
- EN60730-1, Annex H (Software requirements)
- EN60730-2-5 (Particular requirements for automatic electrical burner control)

31 - 1. Environmental conditions

Working temperature:0 ÷ 50°C

31 - 2. Storage temperature:-10°C ÷ 60°C**Other characteristics** Data storage time (after 2 hours lading):> 24 hours

Clock time accuracy:± 15 min/year (max)

31 - 2 - 1. Firmware version

See Data version tables.

31 - 3. User interface

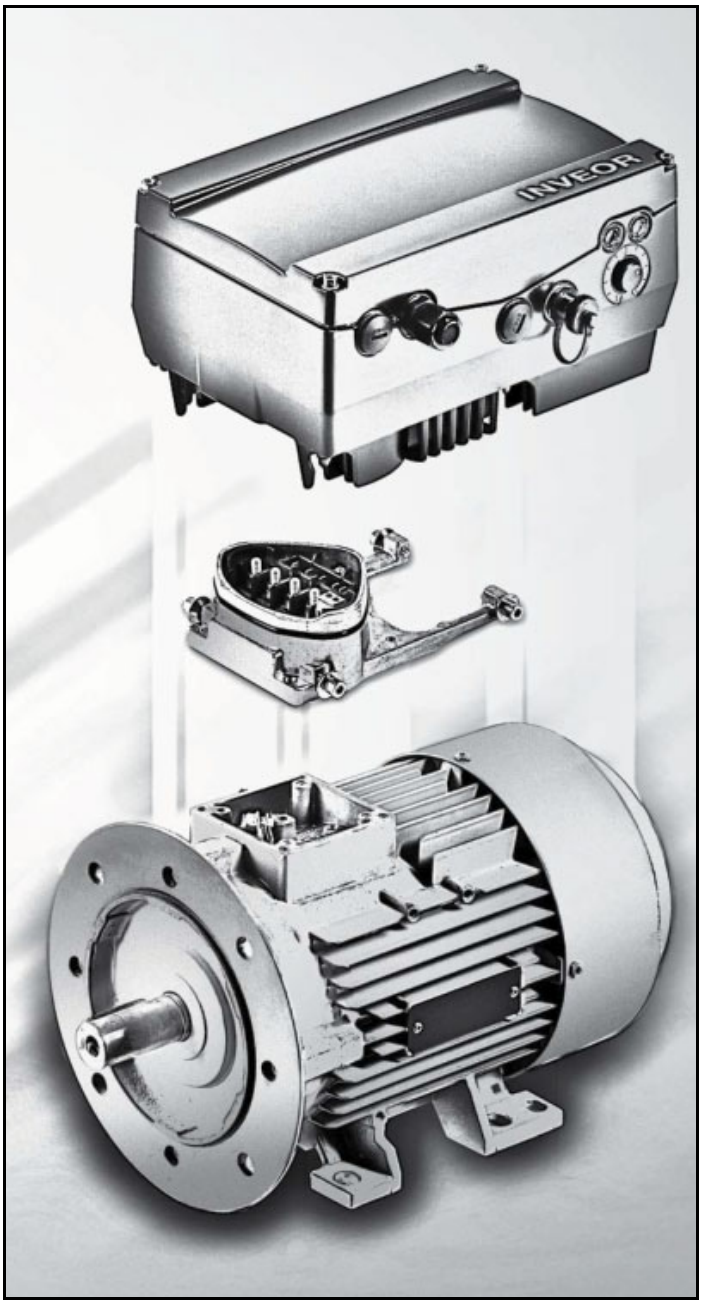
31 - 3 - 1. Mechanical characteristics

- Monochromatic display (black/white) 240x128, view area 70x39mm.
- White backlight.
- Jog Dial (encoder) knob: 24-positions and push function.
- 2 push buttons.

KOSTAL INVERTER

Connection and programming
for electronically controlled burners with

HAGC31 - CU01 & RC21.52
and INVERTER regulation



Service Manual
TECHNICAL
INSTRUCTIONS

M12937CA - Rel. 0 - 10/2021

Table of contents:

KOSTAL inverter for FACILE burners

Description / Operation

Facile series burners can be equipped with VSD inverters and are identified in the burner model as follows:

M-.MD.L.x.XX.X.x.xx.FB where FB = electronically controlled burner with inverter.

The inverter device is installed directly on the motor, is already wired and tested by the manufacturer, and needs no further adjustment by the service technician.

The inverter device does not have a display or a keypad.

Factory settings: 35Hz / 50Hz (minimum/maximum frequency)

Maximum operating frequency is reached during pre-washing of the combustion chamber and, if necessary, during normal operation.

ATTENTION: Special equipment must be used when modifying the parameters on the inverter.

Parameters that can be set from display RC21.52 on the burner

From the burner display RC21.52 a number of inverter operating parameters can be set in combination with the burner.

The engine speed is controlled by a 4 - 20 mA signal generated by the HAGC31 - CU01 device on the burner,

4mA = minimum inverter frequency,

20mA = maximum inverter frequency, normally 35-50Hz.

Using the burner display HAGC31 - CU01 the following operating parameters can be changed:

% inverter power at ignition:

Menu / Parameters / Inverter / Position: Ignition, settable from 1 to 100%. If set to 1 the burner will switch on with the inverter at minimum frequency before reaching the frequency required by the regulation system. If set at 100%, the ignition point will be made with the inverter at maximum frequency.
N.B. Maximum and minimum inverter frequency can only be set on inverter parameters.

Ramping signal 4-20mA:

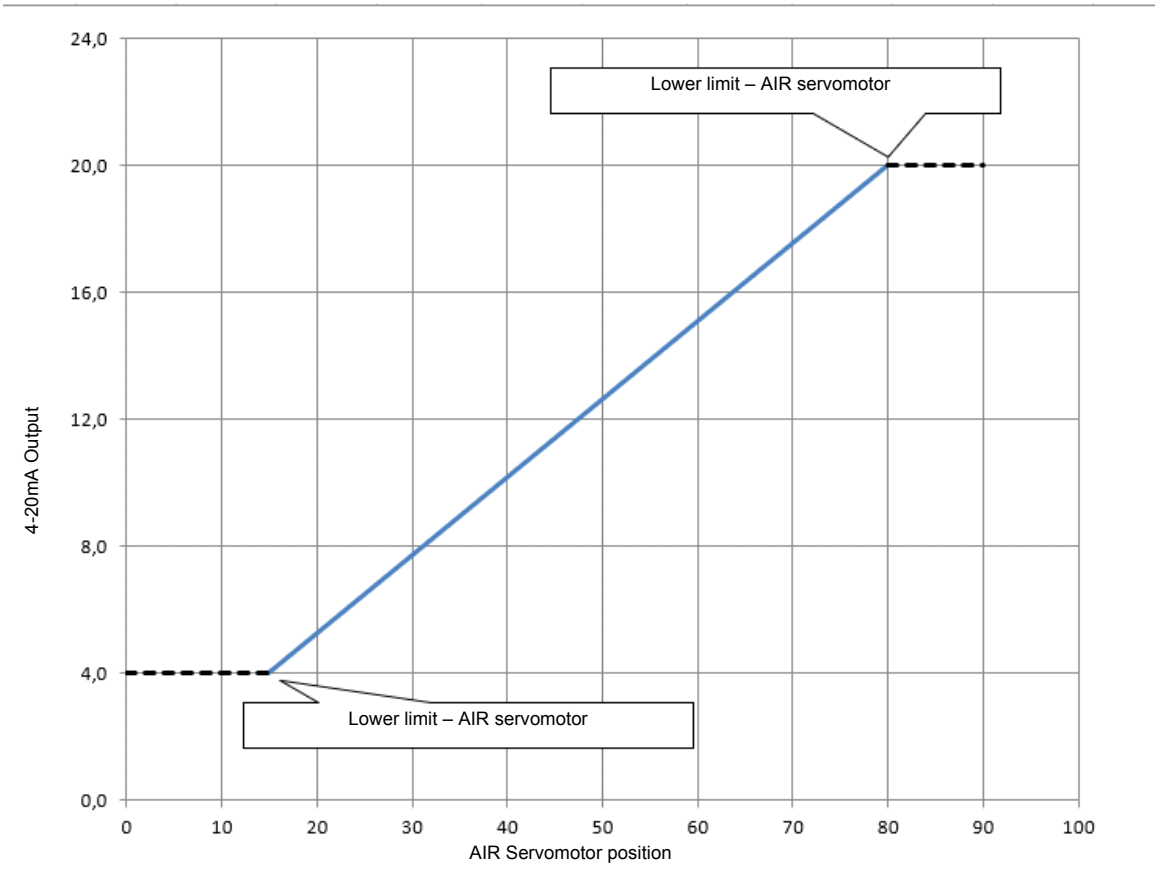
Menu / Parameters / Inverter / Ramping: Signal, settable from 0 to 100 seconds, defines the ramp up and ramp down times of the 4-20mA signal generated by the BMS. Set a value higher than the ramp up time set on the INVERTER. Too short a time may generate high motor inrush currents, causing the INVERTER to shut down. Too long a time will generate an air flow rate delay, which, in turn, will generate an error on the BMS. It is recommended to set a value between 5 and 20 seconds.

Lower reference limit – air damper:

Menu / Parameters / Inverter / Lower limit - air servomotor The 4-20mA signal generated by the BMS and used to modify the ventilator rpm is calculated based on the position of the air servomotor. If the air servomotor increases its position, the inverter will increase the rpm. This parameter defines the lower limit of the air servomotor. If the air servomotor is in a lower position than this limit, the 4.20mA output will be set to 4mA and the inverter will always generate the minimum frequency. It is usually set to 15°.

Upper reference limit – air damper:

Menu / Parameters / Inverter / Upper limit – air servomotor The 4-20mA signal generated by the BMS and used to modify the ventilator rpm is calculated based on the position of the air servomotor. If the air servomotor increases its position, the inverter will increase the rpm. This parameter defines the upper limit of the air servomotor. If the air servomotor is in a higher position than this limit, the 4.20mA output will be set to 20mA and the inverter will always generate the maximum frequency. It is usually set to 80°.



Operating mode: 4-20mA output

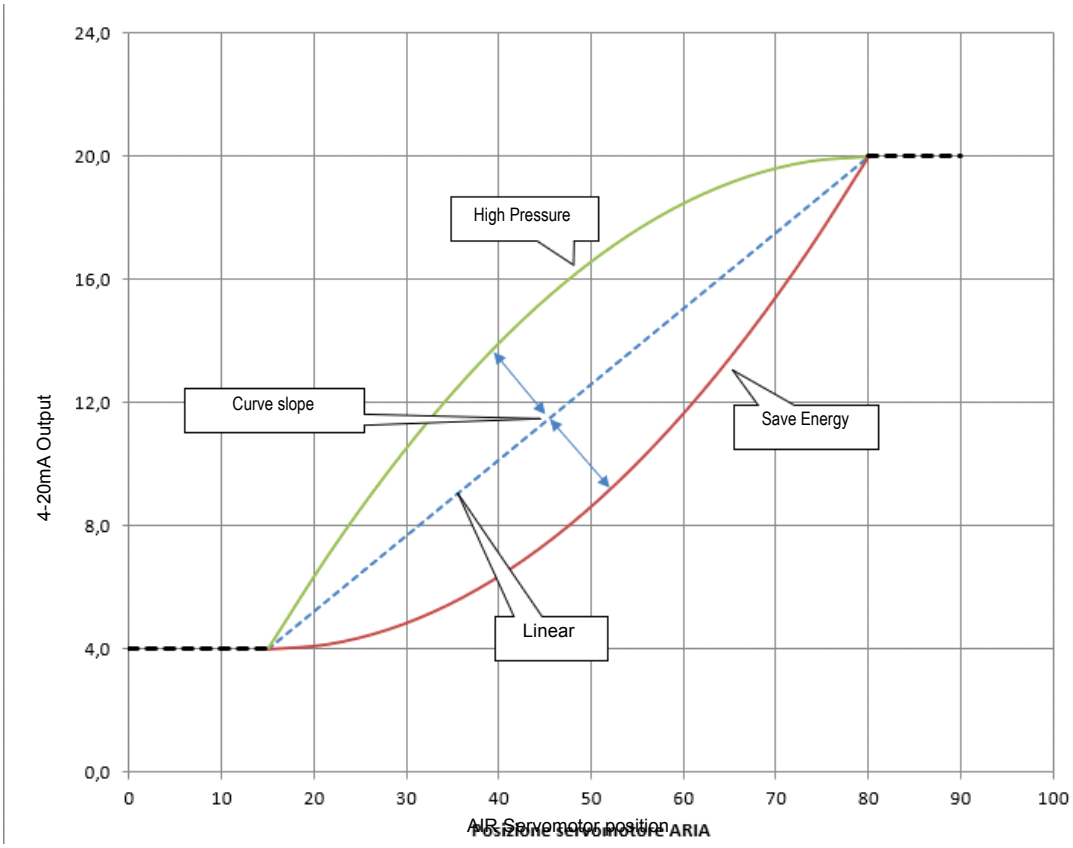
Menu / Parameters / Inverter / Operating mode There are several inverter operating modes to choose from.

- **Disable inverter**: Inverter disabled: the 4-20mA output is always set to 0mA, normally used for burners without inverters.
- **Max**: 4-20mA output is always set to 20mA. It is used on burners with inverters but always operating at maximum. The inverter is always used as a soft start.
- **Linear:** With this configuration the 4-20mA output is set linearly according to the position of the air servomotor. If the air servomotor is in the minimum position, output=4mA; if the air servomotor is in the maximum position, output=20mA; if the air servomotor is in the middle of its inverter regulation range, output will be 50%, 12mA. According to laboratory tests, the Linear operating mode is the most suitable for most systems.
- **Save Energy / High Pressure**: These two operating modes have been designed to vary the inverter operating logic. The Save Energy function calculates the 4-20mA output by controlling the flow rate of the air damper. With this function you will have low air pressures on the fan and lower energy consumption than the High Pressure and Linear functions. With this function active, in some installations flame vibrations or operating instability may be generated.
- **High Pressure**: Calculates the 4-20mA output with priority on the inverter, resulting in higher air pressures compared to the Save Energy or Linear functions. This function is activated in case of vibrations or instability during operation with Linear or Save Energy control.

Curve slope, Save Energy / High Pressure operating modes

Menu / Parameters / Inverter / Curve slope. Settable from 0 to 100%,

Defines the slope of the curves of the **Save Energy and High Pressure** operating modes, normally set to 50%. If set at 0%, the operating curves will be calculated with a value identical to linear operation.



IDENTIFICAZIONE INVERTER

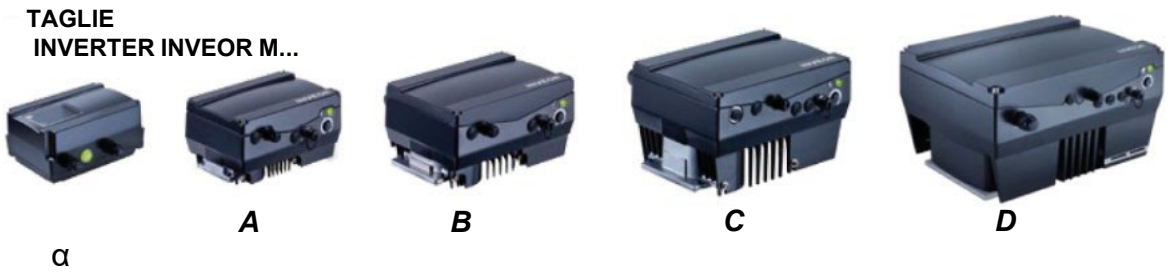
INVEOR Mx IVxx PWxx LPxx APxx GHxx DKxx COxx 1

1 2 3 4 5 6 7 8 9 10

	Key		Key
1	Drive controller series: INVEOR	**6**	Application circuit board: AP12 - Standard AP13 - CANopen
2	Installation location/size: motor-integrated - M,size: α, A, B, C, D	**7**	Control: DK01 - Standard (without membrane keypad) DK04 – With membrane keypad
3	Input voltage : IV02 - 230 V	**8**	Housing : GH10 – standard heat sink (black painted)
4	Recommended motor rating : 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	**9**	Firmware version : CO00 - Standard CO01 - Specific
5	Printed circuit boards : LP01 / LP03 – Standard (without brake chopper); LP02 / LP04 – Standard (with brake chopper);	**10**	Equipment generation: 1 – current version

The **HAGC31 - CU01** device controls fan motor rpm via a sensor and commands it via the inverter with a **4÷20mA** 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

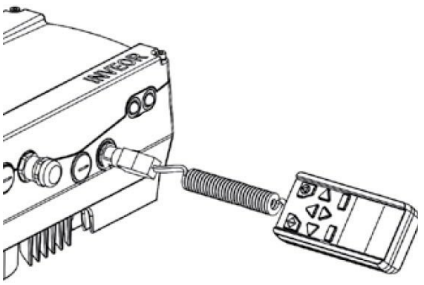
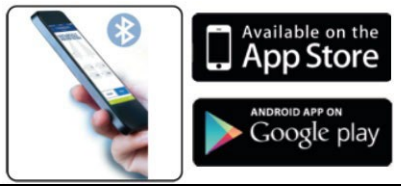
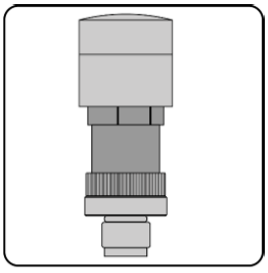


User interface

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.

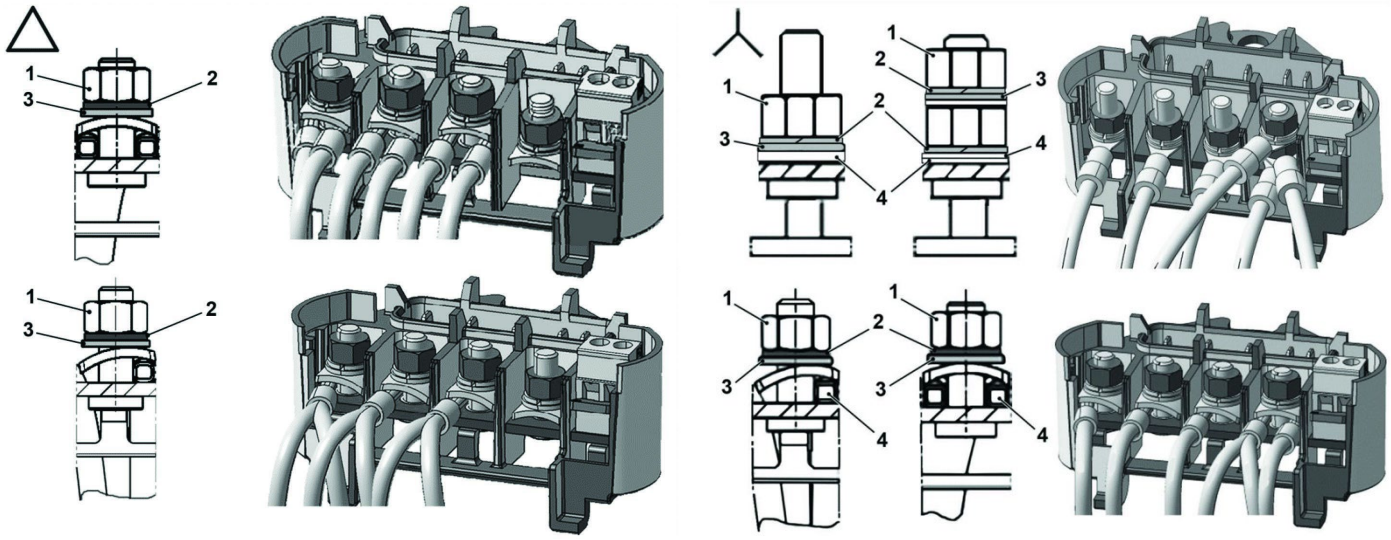
USB adaptor for PC	
Via the INVERTER PC software	
	
INVEOR MMI remote display:	
INVEOR MMI is a portable display on which all inverter parameters can be viewed and changed. Manual available on the KOSTAL website.	
Bluetooth connection:	
Using the Bluetooth adaptor you can connect via app from any device. Download the app for Android / iOS from the Google Play Store / App Store.	
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.	

ELECTRICAL CONNECTIONS

Motor connection variants for INVERTERS sizes A, B and C

Star or delta connection for speed controller integrated on the motor

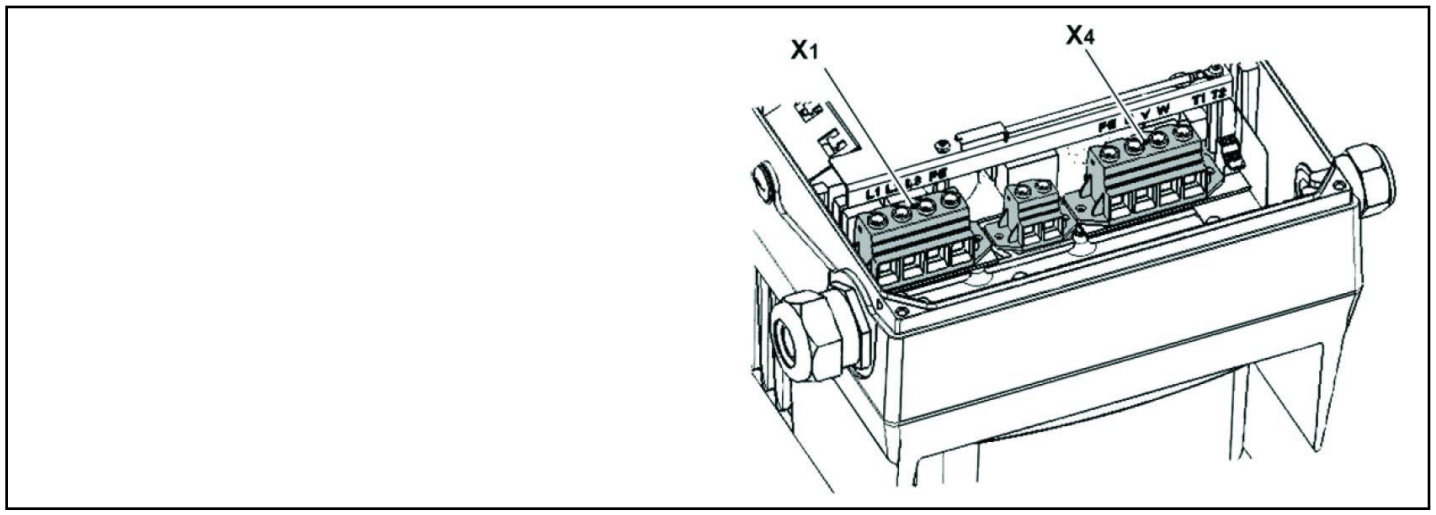
Delta connection variant ***Star connection variant***



1 Nut MA = 5 Nm
2 Circlip
3 Plain washer
4 Cable shoe

Fig. 1

Motor connection variants for INVERTER size D



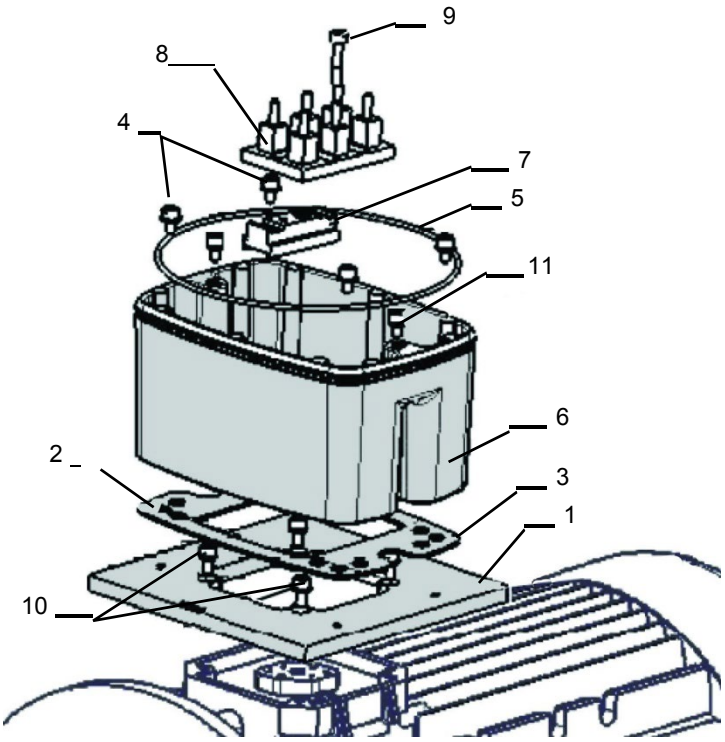
X1 terminal no.	Designation	Assignment
1	L1	Mains phase 1
2	L2	Mains phase 2
3	L3	Mains phase 3
4	PE	Protective conductor

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

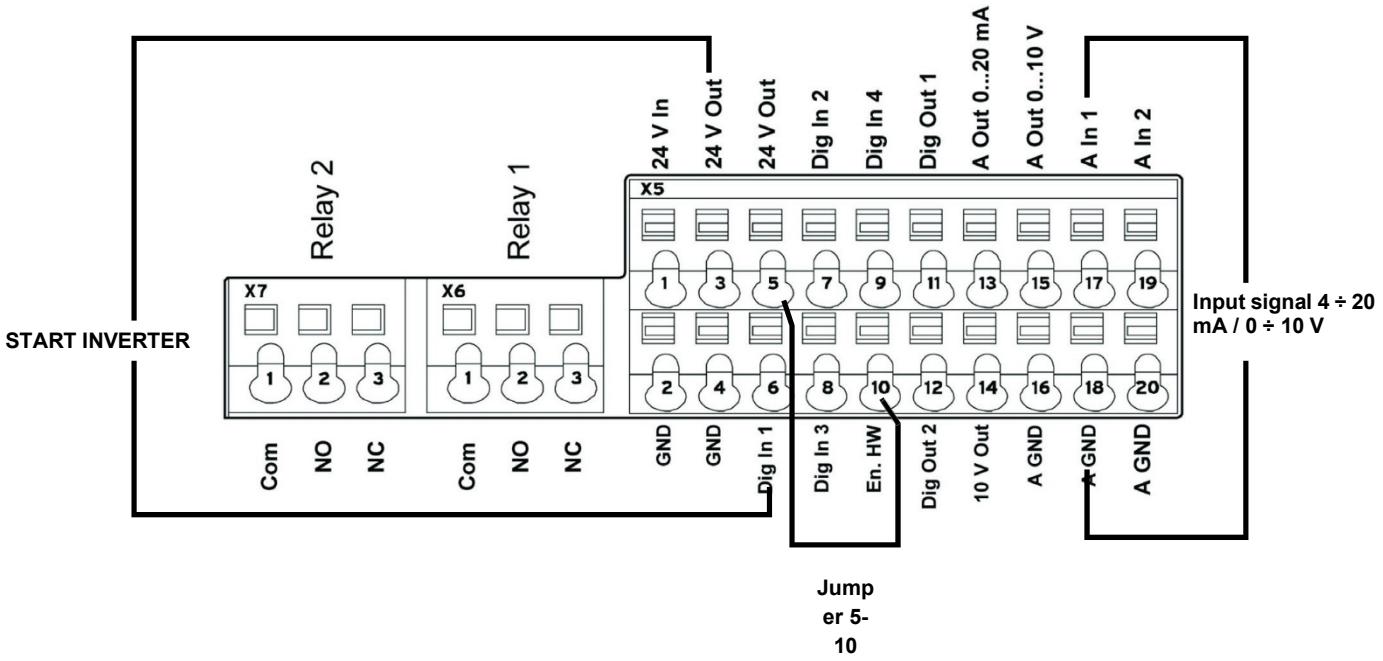
Fig. 2 – Assembly sequence: Connection box – adapter plate size D



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

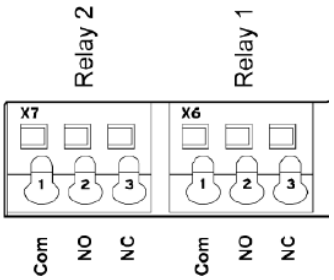
Connection of INVERTER signals and commands



Electrical connections and parameter configuration

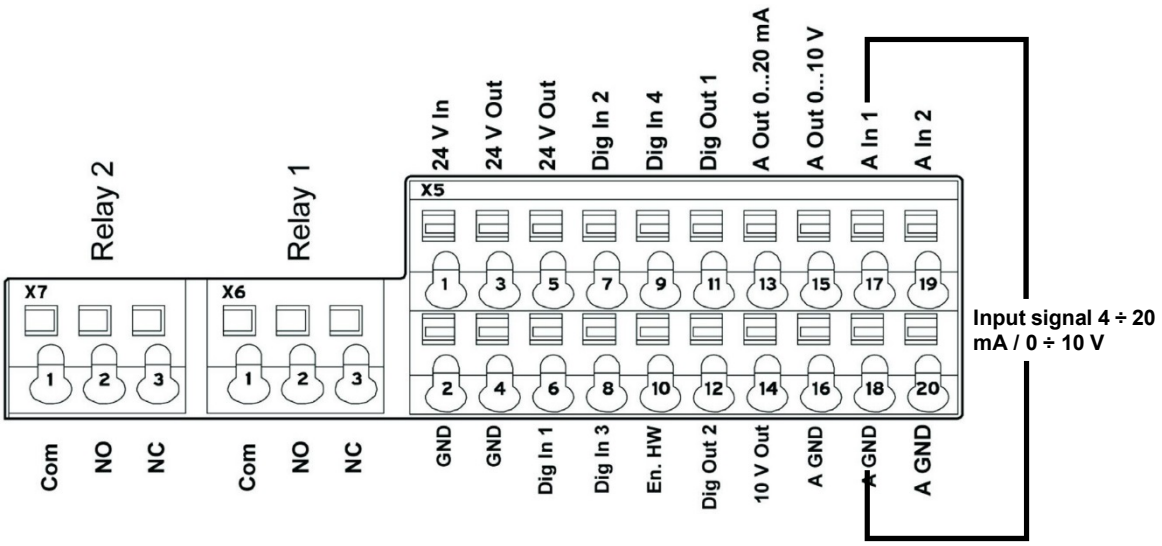
There are 2 relays on the INVERTER. Connecting terminals X7-1-2-3 and X6-1-2-3 are used for:

HAGC31 - CU01: 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 HAGC31 - CU01 equipment.



Parameter		
1.181	Automatic reset function	Automatic reset of faults. The INVERTER resets the fault after the set time. **Set value = 10 seconds**
1.182	Automatic reset numbers	With the reset function the maximum number of automatic resets can be limited. **Set value = 0 (maximum number of automatic resets)**
4.190	Relay 1 functions	Select the operating mode of relay 1. **Set value = 11 (NC inverted error)**
4.210	Relay 2 functions	Select the operating mode of relay 2. **Set value = 11 (NC inverted error)**
4.230	V O operation	**Set value = 10 (NO error)**

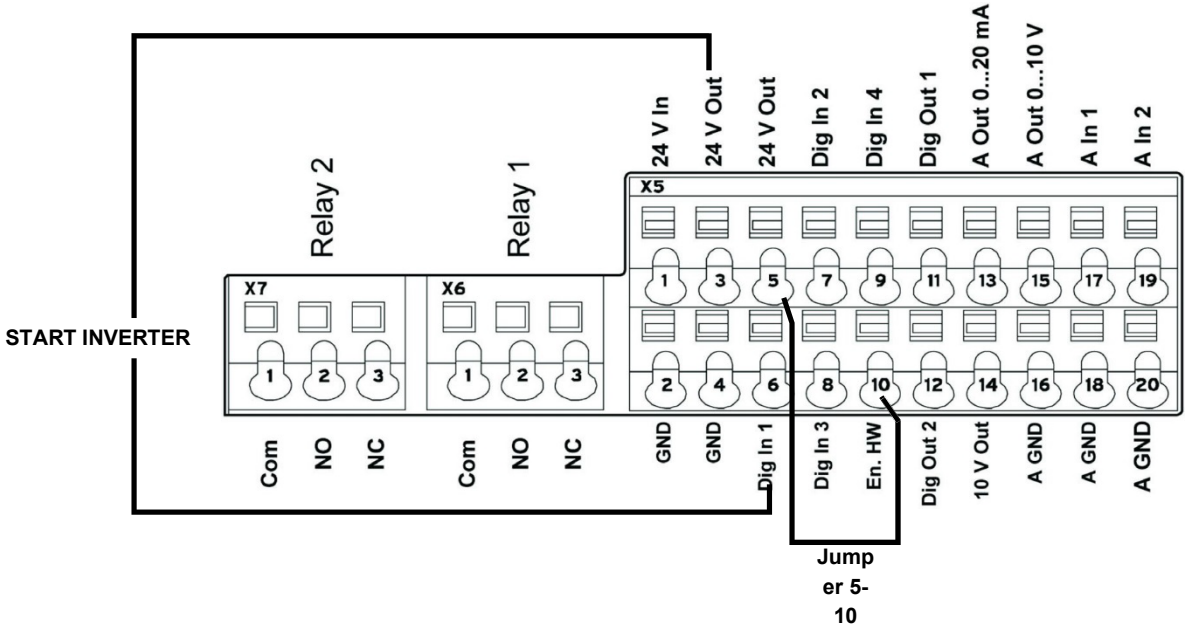
0-10V / 4-20mA analogue input configuration



Input AIn1 can be configured as voltage or current input. It is configured as 4-20mA input current for HAGC31 - CU01.

4.020	Input type AI1	Specifies the input type, whether voltage or current. **2**= Current input 0/4-20mA
4.021	AI1 Standard low	Specifies the minimum value of the analogue input as a percentage of the range. E.g.: 0…10 V or 0…20 mA = 0 %...100 % 2…10 V or 4…20 mA = 20 %...100 % **Set value = 20%**
4.022	AI1 Standard high	Specifies the maximum value of the analogue input as a percentage of the range at 10V or 20mA. **Set value = 100%**
4.023	AI1 Response time	Specifies the deadband on the input signal. **Set value = 1%**
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. **Set value = 4 seconds**
4.030	AI1 Input function	Specifies whether the input is 0 = analogue / 1 = digital input. **Set value = 0 analogue**
4.033	AI1 Measure unit, input 1	Specifies the unit of measurement of input 1. **Set value = 0 (%)**
4.034	AI1 Lower limit	Specifies the lower limit of input 1. **Set value = 0 (%)**
4.035	AI1 Upper limit	Specifies the upper limit of input 1. **Set value = 100 (%)**
4.036	AI1 Wire break time, 5s	Specifies the time after which the fault appears if input AI1 is interrupted (wire break). **Set value = 5 seconds**
4.037	AI1 Inversion	Inverts the signal of input 1. **Set value = 0 (disabled)**

Configuration of control contact / INVERTER starting and stopping



Terminal	
X5-3 (24V Out)… X5-6 (Digit In1)..	Bringing 24V to terminal **X5-6** enables INVERTER operation and the contact that switches it on/off.
X5-5 (24V Out) connected with X5-10 (En.HW)…	Required to enable braking ramp

Configuration of INVERTER start / stop parameters and operating mode

Parameter		
1.020	Min. frequency (Hz)	Minimum input frequency in Hz. **Set value = > 35 Hz**
1.021	Max. frequency (Hz)	Maximum input frequency in Hz. **Set value = 50 Hz**
1.050	Ramp 1 Braking time 1	Braking time at switch-off to reach the speed of 0 Hz after the start/stop contact has opened (not used). **Set value = 15 seconds**
1.051	Ramp 1 Acceleration time 1	Acceleration time 1 is the time necessary for the drive controller to accelerate from 0 Hz to maximum frequency (not used). **Set value = 10 seconds**
1.052	Ramp 2 Braking time 2	Braking time at switch-off to reach the speed of 0 Hz after the start/stop contact has opened. **Set value = 10 seconds**
1.053	Ramp 2 Acceleration time 2	Acceleration time 2 is the time necessary for the drive controller to accelerate from 0 Hz to maximum frequency. **Set value = 10 seconds**
1.054	Selects ramp used	Digital input 1 (**dig In1 / X5-6**) selects the ramp used. **Set value = 2 (parameters 1.052 and 1.053)**
1.088	Quick stop	Not used but set. **Set value = 10 seconds**
1.100	Operating mode	Frequency control mode: specifies the operating mode of the INVERTER. In our case it is always frequency control (0). **Set value = 0**
1.130	Reference set point	Determines the source from which the reference value is read. In our case it is always analogue input AI1. **Set value = 1 (analogue input 1)**
1.131	Enabling software	Depending on the change made, the motor may start immediately. Selection of the source for enabling control. **Set value = 0**
1.132	Start-up protection	Selection of behaviour in response to enabling software. **Set value = 1** **(Start only with rising edge at input of control enable)**
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. **Set value = 1 forwards only / clockwise rotation** **(no changes to direction of rotation are possible)**

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:

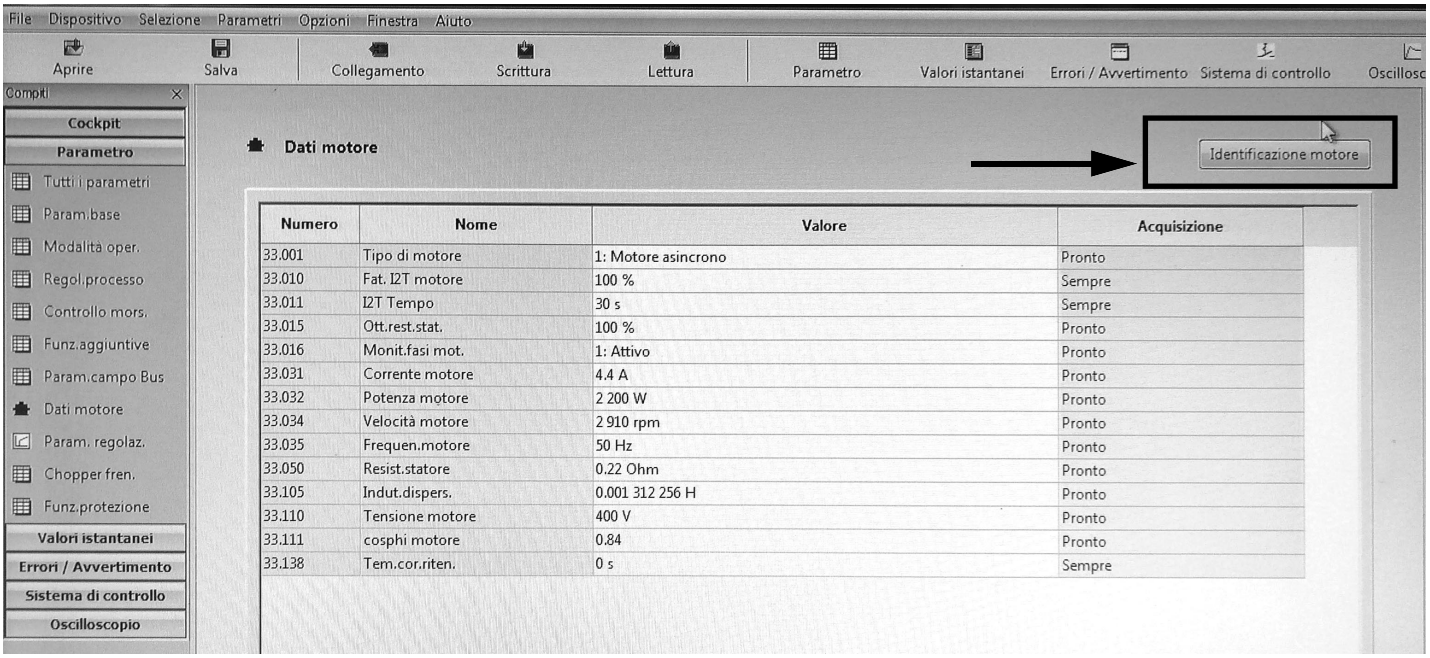
- Enter the motor data;
- Activate the motor recognition function;
- If the operation ends successfully, enter the remaining parameters.

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. **Set value = 1 (asynchronous motor)**
33.010	Motor I^2t factor	Not used. Only for encoders. **Set value = 100%**
33.011	I^2t time	Not used. Only for encoders **Set value = 30 seconds**
33.015	R optimisation	If necessary, this parameter can be used to optimise the start-up behaviour. Not used **Set value = 100%**
33.016	Motor phase control	The "Motor connection interrupted" error monitoring (error 45) can be enabled/disabled with this parameter. **Set value = 1 (enabled control)**
33.031	Motor current	Maximum motor current. **Set value = motor nameplate current value in amps**
33.032	Motor rating	Motor shaft rating. **Set value = motor nameplate rating value in watts**
33.034	Motor rpm	Motor rpm. **Set value = motor nameplate speed in rpm**
33.035	Motor frequency	Nominal motor frequency. **Set value = motor nameplate frequency in Hz**
33.050	Stator resistance	Recognised by INVERTER. **Set value = automatically detected, value in Ohm**
33.105	Leakage inductance	Recognised by INVERTER. **Set value = automatically detected, value in henry**
33.110	Motor voltage	Nominal motor voltage. **Set value = 400V**
33.111	Motor cos phi	Data on motor nameplate. **Set value = 0,xx**
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. **Set value = 0 seconds**

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. **Set value = 100 (open-loop asynchronous motor)**
34.020	**Flying restart**	**Set value = 1 (enabled)**
34.021	**Flying restart time**	Calculated by Inverter. **Set value = value calculated by INVERTER in ms**
34.090	**Speed controller K_P**	Calculated by the inverter during the motor recognition phase. Reset it to 2000 after motor recognition. **Set value = 500 mA/rad/sec**
34.091	**Speed controller T_N**	Calculated by the inverter during the motor recognition phase. Reset it to 7.5 seconds after motor recognition. **Set value = 7.5 seconds**
34.110	**Slip trimmer**	If set to **1** the function is enabled. If set to **0** the motor performs as if connected to the mains. 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. **Set value = 1 (compensation for slippage)**

Output signal variant for reading motor rpm (optional)

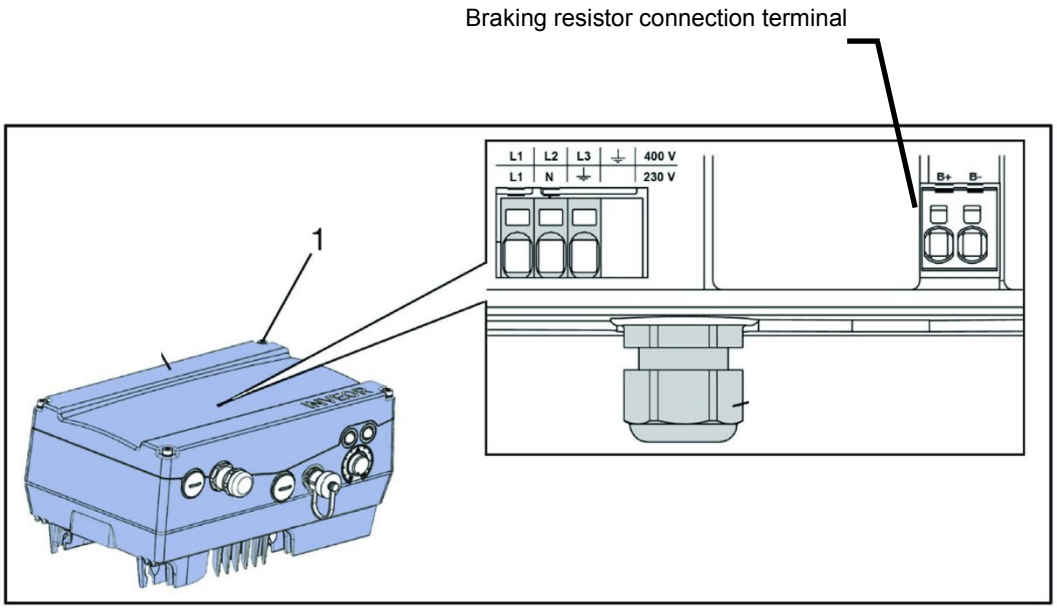
To have a 4-20 mA analogue output that indicates the motor rpm to the terminals X5-13 (Aout 0-20 mA) and X5-16 (A GND), set the parameters below:

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

NOTE 1	If the system enters pendulum mode with HAGC31 - CU01, adjust parameters **34.090** and **34.091** by increasing them, in particular parameter **34.090**, in steps of 100mA/rad/sec.
NOTE 2	With HAGC31 - CU01 with INVERTER control, the device controls the standby rpm with **param. 653**. If, after the fan is switched off, the device HAGC31 - CU01 sees that the motor continues to run, error **83** diagnostic **32** 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 **0**.
NOTE 3	With HAGC31 - CU01 the signal 0-10V for motor rpm control during standardisation is brought to approximately 9.7 V and the fan motor rpm is saved. According to the HAGC31 - CU01 manual, the INVERTER should be set to max 50 Hz
NOTE 4	**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 HAGC31 - CU01 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		
Parameter 36.020	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.
Parameter 33.105	If mains voltage drops during operation	When the mains voltage drops, the INVERTER decreases the motor rpm. To reduce this change, set the parameter to 0, which should solve the problem.

Brake chopper connections



Brake chopper connections

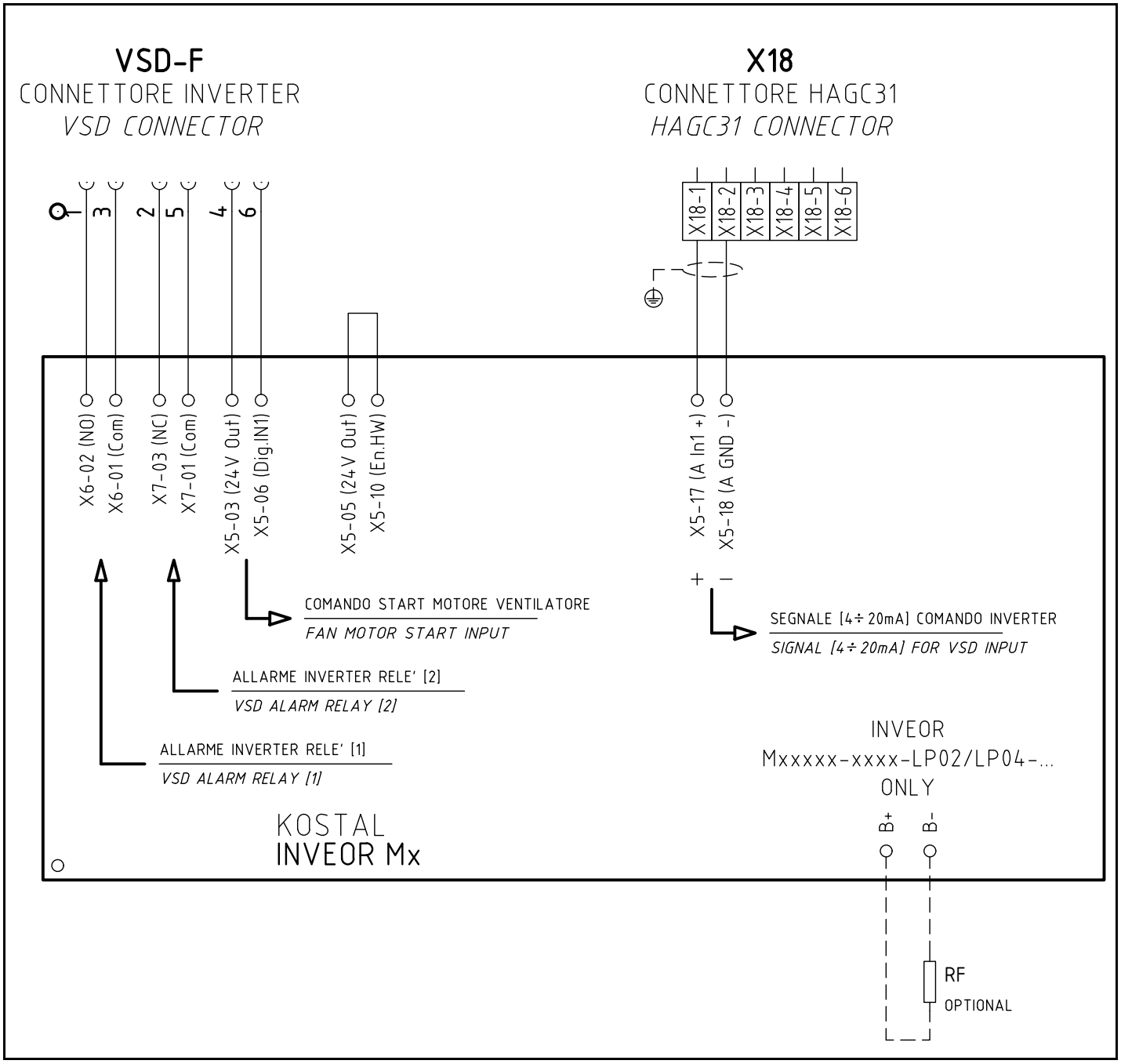
Terminal no.	Designation	Assignment
1	B+	Braking resistor connection (+)
2	B-	Braking resistor connection (-)

Optional assignment of brake chopper

Parameter	
Braking resistor	Enabled or disabled

Braking resistors

Burner terminal block with interface INVERTER



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