

General warnings

1 General warnings

1.1 Guarantee and responsibility

The rights to the guarantee and the responsibility will no longer be valid in the event of damage to things or injury to people, if such damage/injury was due to any of the following causes:

- ▶ intervention of unqualified personnel;
- ▶ carrying out of unauthorised modifications on the equipment;
- ▶ powering of the burner with unsuitable fuels;
- ▶ faults in the fuel supply system;
- ▶ repairs and/or overhauls incorrectly carried out;
- ▶ use of non-original components, including spare parts, kits, accessories and optional;
- ▶ force majeure.

The manufacturer furthermore declines any and every responsibility for the failure to observe the contents of this manual.

- ▶ Personnel must always use the personal protective equipment envisaged by legislation and follow the indications given in this manual.
- ▶ Personnel must observe all the danger and caution indications shown on the machine.
- ▶ Personnel must not carry out, on their own initiative, operations or interventions that are not within their province.
- ▶ Personnel must inform their superiors of every problem or dangerous situation that may arise.

1.2 Installation safety notes



It is obligatory to carry out all installation, maintenance and disassembly operations with the electricity supply disconnected.



After removing all the packaging, check the integrity of the contents. If in doubt, do not use the spare part; contact the supplier.



Isolate the fuel supply.



Wait for the components in contact with heat sources to cool down completely.



The installation must be carried out by qualified personnel, as indicated in this manual and in compliance with the standards and legal requisites in force.



After carrying out maintenance, cleaning or checking operations, reassemble the cover and all the safety and protection devices of the burner.

1.3 Notes on safety for the electrical wiring



- ▶ The electrical wiring must be carried out with the electrical supply disconnected.
- ▶ Electrical wiring must be carried out by qualified personnel and in compliance with the regulations currently in force in the country of destination. Refer to the wiring diagrams.
- ▶ The manufacturer declines all responsibility for modifications or connections different from those shown in the wiring diagrams.
- ▶ Do not invert the neutral with the phase in the electrical supply line.
- ▶ Check that the electrical supply of the burner corresponds to that shown on the identification label and in this manual.
- ▶ The burners have been set for intermittent operation. This means they should compulsorily be stopped at least once every 24 hours to enable the control box to perform checks of its own start-up efficiency. Normally the boiler's thermostat/pressure switch ensures the stopping of the burner. If this is not the case, a time switch must be fitted in series to the L-N to stop the burner at least once every 24 hours. Refer to the wiring diagrams.
- ▶ The electrical safety of the device is obtained only when it is correctly connected to an efficient earthing system, made according to current standards. It is necessary to check this fundamental safety requirement. In the event of doubt, have the electrical system checked by qualified personnel.
- ▶ The electrical system must be suitable for the maximum output absorbed by the device (indicated in the manual); in particular, check that the cable section is suitable for the level of power absorbed by the device.
- ▶ For the main power supply of the device from the electricity mains:
 - do not use adapters, multiple-outlet sockets, or extensions;
 - use an omnipolar switch (in compliance with the safety laws in force).
- ▶ do not touch the device with wet or damp body parts and/or in bare feet
- ▶ Do not pull the electric cables.

No condensation, water infiltration or ice formation is permitted.



Installation

2 Installation

The MO535-MR1SF-MKIV.1 digital control box replaces the previous versions:

- MKI (15000.01)
- MKII (15000.02)
- MKIII
- MKIII.1
- MKIII.2
- MKIII.3
- MKIV

It can be installed on one-stage burners with intermittent operation, fuel oil models (with or without pre-heating).

Equipment

Control box	.....	No. 1
Control box protection	.....	No. 1
Short-circuit socket	.....	No. 1
Cable clamp	.....	No. 1
Fixing screws	.....	No. 3
Instruction	.....	No. 1



The short-circuit socket must be installed on the control box (Fig. 5) only for burners not supplied with a light oil heater.

Key to layout (Fig. 1)

N	Neutral
L	Line
SB	External lockout signalling
PH / K	Oil heater / Enabling switch thermostat for start up after preheating
MV	Fan motor
V	Oil valve
RS	Remote reset
F	Flame detector

OLD VERSION

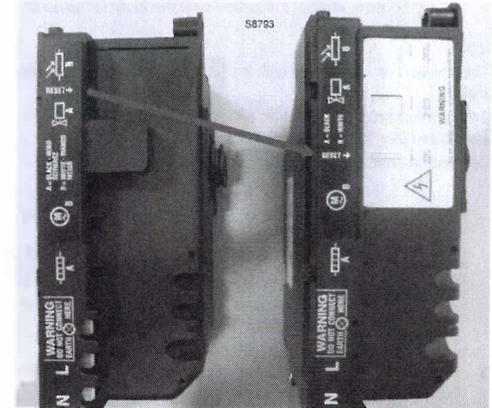
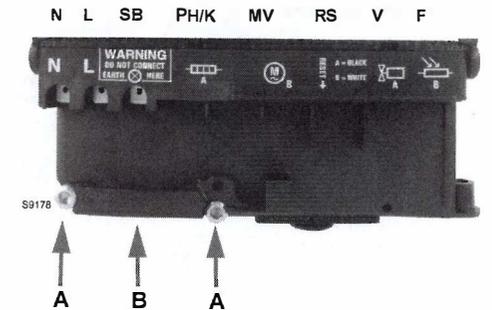


Fig. 1



NEW VERSION WITH NEW CABLE CLAMP (B) AND SCREWS (A)

Fig. 2



NEW CABLE CLAMP (B)

Fig. 3



NEW PROTECTION WITH TWO SCREWS (A) AND BULKHEAD CABLE CLAMPS (B)

Fig. 4

Installation



The control box can be used on burners with or without a heater.

If the heater is damaged, insert the jumper 7) (Fig. 5) in the control box so that the burner can work without the heater until the latter is replaced.



Fig. 5

NOTE:

The control box is supplied with the jumper 7) (Fig. 5) already installed.

If the control box is installed on a burner with heater, it is necessary to remove the jumper 7) before replacing the cover.

Connect the heater cables and thermostat as well.



All the installation, maintenance and dismantling operations should be performed voltage free.

The replacement of the Control box must be performed by qualified personnel, as indicated in this manual and in accordance with standards and regulations in force.

To remove the control box (Fig. 6), proceed as follows:

- loosen the screws 1) and open the guard 2) to remove all the components.
- Remove the coil 3).
- Loosen the two screws 4).
- Move the control box slightly, then disconnect the electric cables of the electrodes.

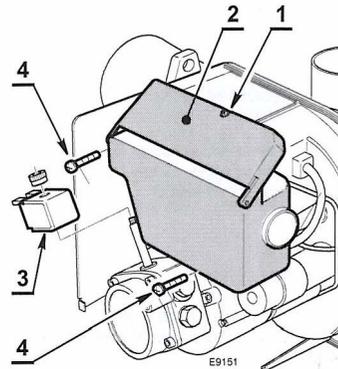


Fig. 6

Electrical system

3 Electrical system

3.1 Example of an electrical system without heater

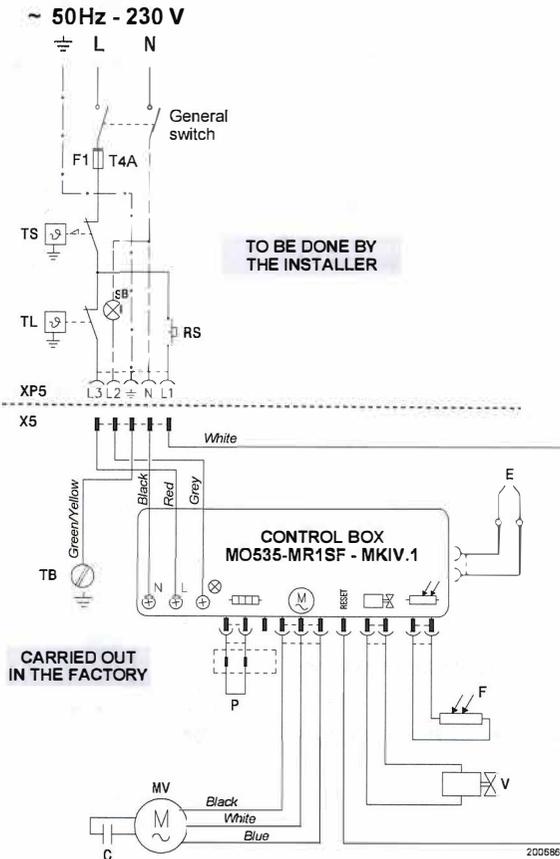


Fig. 7



- Do not invert the neutral with the phase in the electrical supply line.
- Check that the electrical supply of the burner corresponds to that shown on the identification label and in this manual.
- The section of the conductors must be at least 1mm². (Unless otherwise required by local guidelines and laws).



Test the burner by checking the shutdown of the burner by opening the thermostats and the lockout by darkening the photoresistance.



If the hood is still present, remove it and proceed with the electrical wiring according to the wiring diagrams.

Use flexible cables in compliance with the EN 60 335-1 standard.

Key (Fig. 7)

C	Capacitor
E	Ignition electrodes
F	Flame detector
MV	Fan motor
P	Short circuit socket
RS	Remote reset
SB	Remote lock-out signal (230V - 0.5A max)
TB	Burner earth
TL	Heat request thermostat
TS	Safety thermostat
V	Oil valve
XP5	5- pole socket
X5	5 pin plug

3.2 Operating programme without heater

Normal operation

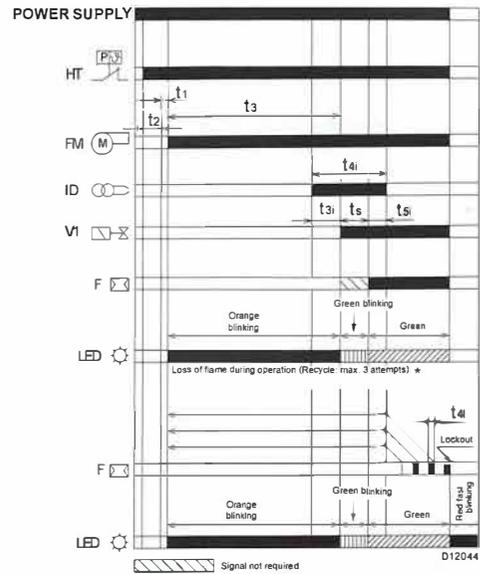


Fig. 8

Lockout due to ignition failure

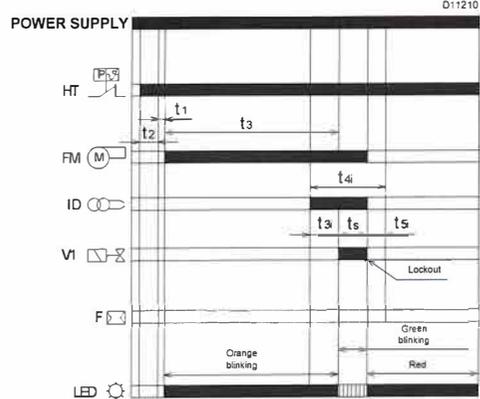


Fig. 9

Lockout due to extraneous light during pre-purging

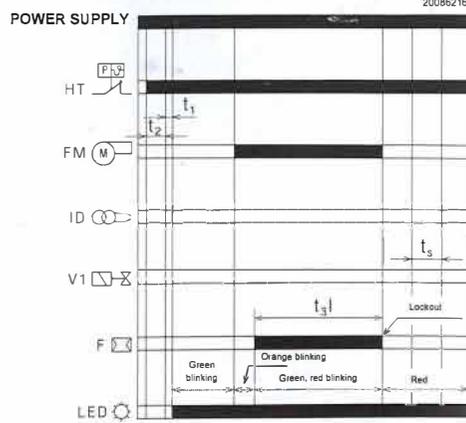


Fig. 10

Key (Fig. 8 - Fig. 9 - Fig. 10)

- F Flame detector
- HT Heat request thermostat (TL)
- ID Ignition device
- MV Fan motor
- SB Remote lockout signal
- V1 Oil valve
- LED Reset push-button LED colour
- ts Safety time
- t1 Standby time
- t2 Initialisation check time
- t3 Pre-purge time
- t3i Pre-ignition time
- t3l Checks extraneous light during pre-purging
- t4i Total spark ignition time
- t4l Reaction time to achieve safety shutdown due to flame failure
- t5i Post-ignition time
- * Only 3 consecutive re-ignition attempts are permitted

3.3 Example of an electrical system with heater

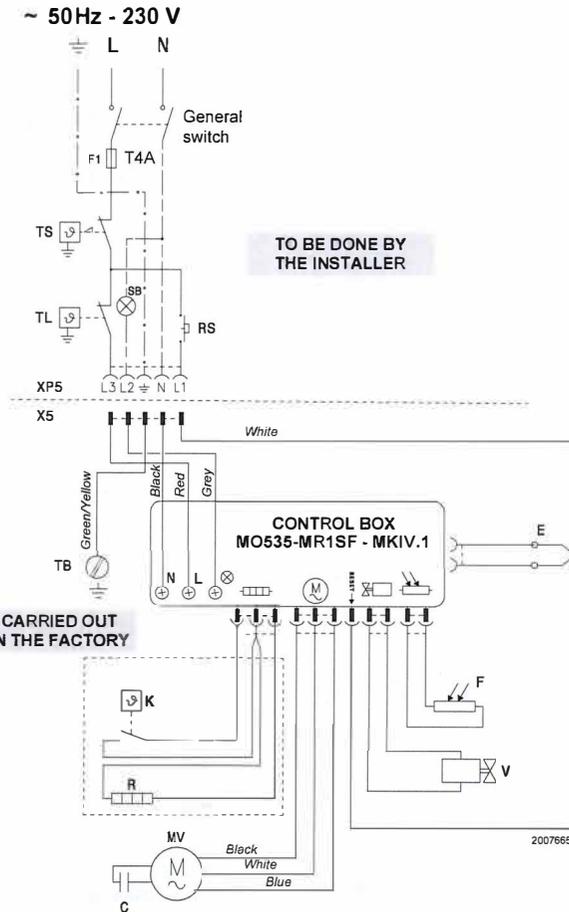


Fig. 11



WARNING

- Do not invert the neutral with the phase in the electrical supply line.
- Check that the electrical supply of the burner corresponds to that shown on the identification label and in this manual.
- The section of the conductors must be at least 1mm². (Unless otherwise required by local guidelines and laws).



WARNING

Test the burner by checking the shutdown of the burner by opening the thermostats and the lockout by darkening the photosistance.



CAUTION

If the hood is still present, remove it and proceed with the electrical wiring according to the wiring diagrams.
Use flexible cables in compliance with the EN 60335-1 standard.

Key (Fig. 11)

- C Capacitor
- E Ignition electrodes
- F Flame detector
- K Start-up thermostat
- MV Fan motor
- R Heater
- RS Remote reset
- SB Remote lock-out signal (230V - 0.5A max)
- TB Burner earth
- TL Heat request thermostat
- TS Safety thermostat
- V Oil valve
- XP6 6- pole socket
- X6 6 pin plug

3.4 Operating programme with heater

Normal operation

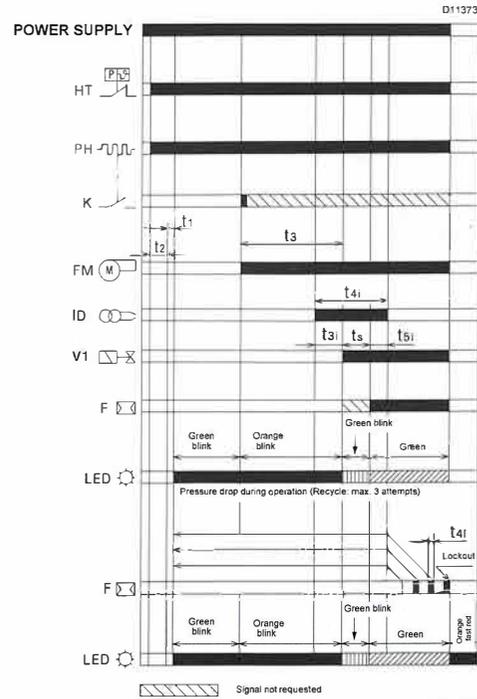


Fig. 12

Lockout due to extraneous light during pre-purging

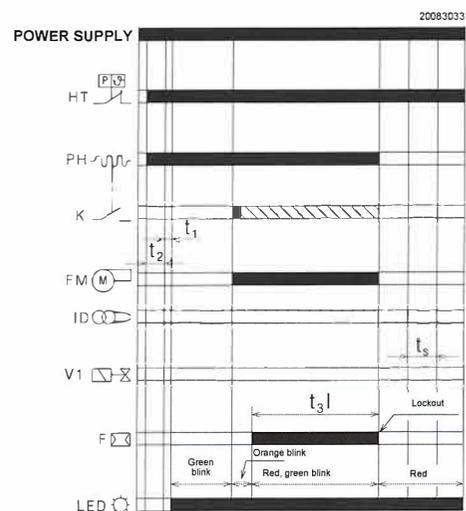


Fig. 13

Lockout due to ignition failure

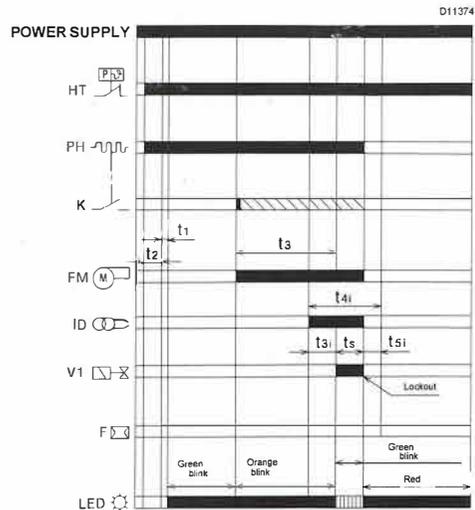


Fig. 14

Key (Fig. 12 - Fig. 13 - Fig. 14)

- F Flame detector
- HT Heat request thermostat (TL)
- ID Ignition device
- K Start-up thermostat
- MV Fan motor
- PH Heater
- V1 Oil valve
- LED Reset push-button LED colour
- t1 Standby time
- t2 Initialisation check time
- t3 Pre-purge time
- t3i Pre-ignition time
- t3l Checks extraneous light during pre-purging
- t4i Total spark ignition time
- t4l Reaction time to achieve safety shutdown due to flame failure
- t5i Post-ignition time
- ts Safety time

3.5 Electrical characteristics

Description	Unit of measurement	Parameters
Rated power supply voltage (range), tolerance	V A.C.	210...230, + 10%, - 15%
Rated power supply frequency (range), tolerance	Hz	50, 60, + 5%, - 5%
Max power consumption (without load)	VA	15
Maximum and minimum operating temperature	°C	- 20...+ 70
Maximum moistness (without condensation, water intake or ice formation)	R.H.	< 95% at 40°C
Maximum and minimum storage temperature	°C	-30...+80
Protection level (with box protection)	IP	40
Internal protection	V	300 AC, D10
External protection fuse	-	T4A, 250V A.C.
Ignition discharge voltage	kV pk	18
Ignition discharge current	mA rms	25
Maximum number of re-ignition	no./min	1
Maximum operating current:		
- output - Oil valve - excitation current (V)	mA awg	400
- output - Oil valve - maintenance current (V)	mA awg	70
- output - Fan motor (MV)	A	1.6 (cos φ ≥ 0.6 at 230V A.C.)
- output - Pre-heater (PH-K)	A	1 (resistive load at 230 V A.C.)
- output - Remote lockout signal (SB)	A	0.5 (resistive load at 230 VA C.)
Maximum length of input cables:		
- of mains voltage L, N	m	20
- of pre-heater PH, K	m	1
- of flame detector F	m	1
- of fan motor MV	m	1
- of remote lockout signal SB	m	10
- of remote reset RS	m	3
- of oil valve	m	1
Classification	-	FMCLXN

3.6 Operating times

Description	Unit of measurement	Parameters
Waiting time for an input signal	s	≤ 1
Initialisation standby time (after the power supply voltage has become stable)	s	3.5
Maximum pre-heating time	s	max 600 *
Pre-purging time	s	15
Total spark ignition time	s	10
Spark pre-ignition time	s	2
Spark post-ignition time	s	3
Safety time:		
- during start up (safety time)	s	5
- during operation (in case of flame failure)	s	≤ 1
Lockout time in the case of an extraneous light or parasite flame signal during the initialisation standby time (or during the pre-heating time)	s	25
Lockout time in the case of an extraneous light or parasite flame signal during the pre-purging time	s	25
Reset hold time using integrated push-button	s	0.4
Reset hold time using remote reset	s	0.8

3.7 Flame sensor characteristics

Description	Unit of measurement	Parameters
Type of sensitive element		Photoconductive cell
Functioning principle		Detection of visible light
Sensitivity to the flame during the pre-purging	Lux	> 1
Typical sensitivity to the flame during normal operation	Lux	> 3
Typical sensitivity to the flame failure	Lux	< 2

* independent by flame control

3.8.10 Reset protection and remote reset

The system will only unlock after the button has been released. The unit can also be reset via an external button (remote reset) which connects the L terminal (LINE) to the RESET terminal (refer to the wiring diagrams). Max length of external remote reset cable is 3 meters.

3.8.11 Reset push-button anomaly

if the reset push-button or the remote reset breaks or is kept pressed for more than 60 seconds, the fault is indicated by the blinking of the led (see section 3.8.2) as long as the fault is present.

This fault is merely a visualisation.

- If the fault is detected during pre-purging or safety time, the burner does not stop (the start-up sequence will continue).
- If the fault is detected during operation, the burner does stop and stays stopped with the fault signal active.
- If the fault is detected during a lockout, the fault is not signalled and the burner cannot be reset. When the fault disappears, the LED stops blinking.

3.8.12 External lockout indicator

The burner is equipped with an external locking signal function, i.e. to signal (together with the integrated reset push-button) a burner locking alarm.

The control box enables the command of an external lamp by way of the exit ⓧ (230Vac-0.5Amp max).

3.8.13 Frequency main supply anomaly

The control-box automatically detects the value of the frequency of the main supply in the range of 50 - 60 Hz, in both cases working times are verified. The fault is indicated by way of the blinking LED (see section 3.8.2).

- If the anomaly is detected before heat demand the burner does not start.
- If the fault is detected during the pre-purging, the burner remains in purge condition and the fault is appropriately signalled.
- If the anomaly is detected during running position the burner remains in operation. When the anomaly disappears, the burner restarts.

3.8.14 Internal voltage anomaly

The control-box automatically detects if the internal voltage works correctly. The fault is indicated by way of the blinking LED (see section 3.8.2).

- If the anomaly is detected during the initialisation check time, the burner does not start.
- If the anomaly is detected after a lockout the burner does not start.
- If the anomaly is detected after a shutdown test the burner does not start.
- The fault is not detected during normal running, the burner remains in this state. When the fault disappears, the burner restarts.

3.8.15 Checking the fan motor

The control box automatically detects the presence of the fan motor and, in the event of a fault, it performs a lockout. The lockout is indicated by the blinking led (see section 3.8.2).

3.8.16 Checking the electronic circuit controlling the oil valve

The control box detects the presence of a fault inside the electronic circuit controlling the oil valve, the fault is indicated by the blinking led ("see section 3.8.2"):

- if the anomaly is detected during the initialisation, the burner goes into lockout.
- if the anomaly is detected during the pre-purging, the burner goes into lockout.
- During a recycling, if the fault is detected, the burner does not start and goes into lockout.
- If the anomaly is detected during running position the burner remains in operation. The fault is not detected if the burner is in lockout.

3.8.17 EEPROM check

The control-box automatically detects if EEPROM memory of microcontroller has failed and will perform a lockout. The lockout is indicated by blinking led (see section 3.8.2).

3.9 Automatic pre-heating deactivation

It is possible to disable the pre-heater function in automatic mode by pressing the reset push-button of the control box or the remote reset.

Pre-heating deactivation sequence	Colour of the push-button led
Allow the disabling of the pre-heating only when there is no lockout or fault	-
Allow the disabling of the pre-heating using the reset push-button or the remote reset.	-
Supply the burner and simultaneously keep pressed the reset push-button or the remote reset for 3 seconds.	RED
Release the reset push-button or the remote reset within 3 seconds.	OFF
The burner will start disabling the pre-heating only if the reset push-button or the remotereset is released within 3 seconds.	-

Tab. A

When the pre-heating is disabled, the pre-heating remains off until:

- a lockout occurs
- the main supply voltage is interrupted
- there is a stop due to intermittent operation.

The deactivation of the automatic pre-heating function is not lost if the shut-down function is enabled.

3.10 Programming menu

The programming menu can only be accessed via the reset push-button or the remote reset during OPERATION.

If in page menu the reset push-button is not pressed, after 10 seconds occur automatic exit and there is a green led blinking for the value set.

If the number of pressures on the push-button exceeds the maximum allowable, the value in memory will remain the maximum one.

If the push-button or remote reset is pressed for more than 60 seconds, a failure of the push-button will be visualised and the control-box will restart.

BLOCK DIAGRAM FOR ENTERING THE MENU

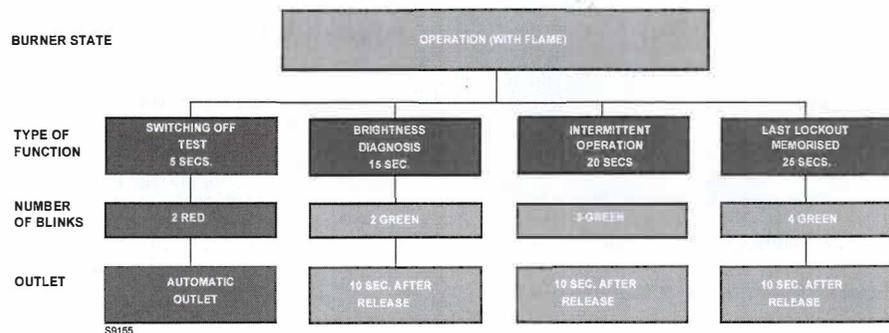


Fig. 15

Function	Button release time	No. of Led blinks per menu page	No. of pressings of the reset push-button	No. of Led blinks (green)	Quitting the menu
Shutdown test	5s ≤ t < 10s	2 blinks RED	/ none	/ none	Automatic, at the end of the blinking
Light diagnosis	15s ≤ t < 20s	2 blinks GREEN	1 = enabled 2 = disabled (default)	1 blink 2 blink	10 sec. after the release of the button
Intermittent operation	20s ≤ t < 25s	3 blinks GREEN	1 = 0 disabled 2 = 1 hour 3 = 24 hours (default)	1 blink 2 blink 3 blink	10 sec. after the release of the button
Last lockout memorised	25s ≤ t < 30s	4 blinks GREEN	/ none	Displaying the type of lockout according to the table section 3.8.2	10 sec. after the release of the button

Tab. B

3.10.1 Shutdown test

Sequence for shutdown test

- Programming allowed in OPERATION.
- Press the button for 5 sec. ≤ t < 10 sec.
- The RED LED blinks twice (0.2 sec. ON; 0.2 sec. OFF)
- Release the button
- The burner will initialise a shutdown followed by a restart

After shutdown, the burner restarts automatically and the number of recycling attempts is restored.

At the exit of shutdown test page menu there are no leds flashing.

3.10.2 Light diagnosis

Sequence for enable/disable

- Programming allowed in OPERATION.
- Press the button for 15 sec. ≤ t < 20 sec.
- GREEN led flashing 2 times
- Release the button
- GREEN led OFF
- Press push-button 1 time for enable or 2 times for disable function
- GREEN led ON and OFF at every press and release
- After 10 sec., the GREEN LED will blink for the number of times programmed (0.5 sec. ON; 0.5 sec. OFF).

3.10.3 Intermittent operation

Sequence for enable/disable

- Programming allowed in OPERATION.
- Press the button for 20 sec. ≤ t < 25 sec.
- GREEN led flashing 3 times
- Release the button
- GREEN led OFF
- Press push-button 1 time for disable function
- Press the button twice to enable a shutdown every 1 hour
- Press the button 3 times to enable a shutdown every 24 hours
- GREEN led ON and OFF at every press and release
- After 10 sec., the GREEN LED will blink for the number of times programmed (0.5 sec. ON; 0.5 sec. OFF)

The modification of the intermittent operation setting parameter takes effect:

- after the activation of a switch-off test;
- after flame disappearance during operation;
- after disconnecting and reconnecting the electrical supply.

3.10.4 Display of the last lockout that occurred

The control box allows the last lockout that occurred and has been stored to be displayed, by accessing of "Programming menu" on page 14.

Access to this page is possible only Operating.

Display sequence of the last lockout that occurred

- Keep the button pressed for 25 sec. = t < 30 sec.
- The GREEN led blinks 4 times.
- Release the button.
- Display of the type of lockout stored for 10 sec.

The display time for the type of lockout can be extended by pressing the reset push-button during the display of the lockout (the display of the lockout continues for another 10s).

NOTE:

(*) Always wait 1 sec. with each pressing and release of the button to ensure the command is logged correctly.

Electrical system

3.11 Lockout types

Whenever a lockout occurs, the control box shows the reasons for the fault (and the reasons can be identified by the reset push-button colour). The sequence of pulses issued by the control box of the LED in the reset push-button identifies the possible types of fault, which are listed in the table below

Description	Lockout time	Led colour	Probable cause
Presence of extraneous light during standby	After 25 seconds	▲▲▲▲	- presence of a false flame signal after heat demand
Pre-heating not terminated	After 600 seconds	▲▲▲▲	- fault in the resistor of the oil pre-heater - fault in the switch or start-up thermostat - the short-circuit socket is not connected
Presence of extraneous light detected during pre-purging	After 25 seconds	▲▲▲▲	- presence of false flame signal during pre-purging
Extraneous light detected during pre-heating	After 25 seconds	▲▲▲▲	- presence of false flame signal during post-purging
The flame is not detected after the safety time	After 5 seconds from oil-valve starts	RED Steady ON	- flame detector defective or dirty - oil valve defective or dirty - faulty ignition transformer - badly regulated burner - oil fuel not present
Flame failure during operation	After 3 recycles	▲▲▲▲	- badly adjusted burner - oil valve defective or dirty - flame detector defective or dirty
Fan motor error	Immediate	▲●▲●	- faulty fan motor - fan motor not connected
Malfunction in the internal control circuit of the oil valve	Immediate	▲■▲■	- faulty oil valve - internal control circuit of the oil valve faulty
Eeprom error	Immediate	●■●■	- faulty internal memory

Tab. C

Blinking frequency of the reset push-button for status indication, "Faults diagnosis - lockouts" on page 10.



WARNING

To reset the control box after visual diagnostics have been displayed, you must press the reset push-button or the remote reset.



WARNING

In the event the burner stops, in order to prevent any damage to the installation, do not unblock the burner more than twice in a row. If the burner locks out for a third time, contact the customer service.



DANGER

In the event there are further lockouts or faults with the burner, the maintenance interventions must only be carried out by qualified, authorised personnel, in accordance with the contents of this manual and in compliance with the standards and regulations of current laws.

Faults / Solutions

4 Faults / Solutions

Here below you can find some causes and the possible solutions for some problems that could cause a failure to start or incorrect operation of the burner.

A fault usually makes the lockout led signal which is situated inside the reset push-button of the control box.

When the lockout lamp comes on, the burner will only attempt to start up after the reset push-button has been pressed. If ignition is then normal, the stop can be attributed to a temporary fault that is not dangerous.

If however the lock out continues the cause must be determined and the solution found.

Faults	Possible cause	Fault diagnostics	Solutions
The burner does not start when there is heat demand.	Lack of electrical supply.	OFF	Check presence of voltage in the L - N the pin plug. Check the conditions of the fuses.
	The flame detector sees false light.	■▲■▲	Check that safety thermostat is not lock out. Eliminate the extraneous light
	The connections in the control box are wrongly inserted. The heater is faulty or the P short-circuit socket is not connected.	OFF ■□■□	Check and connect all the plugs and sockets properly. Replace them.
The burner goes into lockout mode before or during the pre-purging.	The flame detector sees extraneous light	▲▲▲▲	Eliminate the extraneous light.
Burner runs normally in the pre-purge and ignition cycle and locks out after 5 seconds ca.	The flame detector is dirty.	RED	Clear it.
	The flame detector is faulty.	Steady ON	Replace it.
	Flame moves away or fails.		Check pressure and output of the fuel. Check air output. Change nozzle. Check the coil of solenoid valve.
Burner starts with an ignition delay.	The ignition electrodes are wrongly positioned.	OFF	Adjust them according to the instructions of this manual.
	Air output is too high.		Set the air output according to the instructions of this manual.
	Nozzle dirty or worn.		Replace it.

Tab. D



WARNING

The manufacturer cannot accept responsibility for any damage to persons, animals or property due to error in installation or in the burner adjustment, or due to improper or unreasonable use or non observance of the technical instruction enclosed with the burner, or due to the intervention of un-qualified personnel.