CONTRIVE

FIRO

AUTOMATIC BURNER CONTROL SYSTEM

The burner control unit FIRO is suitable for the control of industrial burners up to 350 kW, pursuant to EN 746-2, for intermittent or continuous operation.
Flame control by means of ionization rod (even shared with ignition).

Advanced self-diagnostic system provides the display of either the cycle status, the causes that produced lockouts or the immediate diagnostic of the failures that affect the equipment or the burner.
Firo provides lockout output and remote reset input.

Times and operating cycle are configurable: the same device can be used to control different types of gas burners, meeting all relevant requirements.

The pull-out terminal blocks allow the control device to be easily replaced during maintenance operations.

CE

SAFETY INFORMATION

Read and understand this manual before installing, operating, or servicing this unit. This unit must be installed according to this manual and local regulations. The drawings may show units without covers or safety shields to illustrate details. Disconnect power supply and follow all usual safety precautions before carrying out any operation on the device. Be sure to reinstall covers or shields before operating any devices.
The device is not user serviceable, a faulty device must be put out of order and sent back for servicing.

CONTRIVE manufactures products used as components in a wide variety of industrial systems and equipment. The selection and application of products remain the responsibility of the equipment manufacturer or end user.
CONTRIVE accepts no responsibility for the way its products are incorporated into the final system design. All systems or equipment designed to incorporate a product manufactured by CONTRIVE must be supplied to the end user with appropriate warnings and instructions as to the safe use and operation of that part.
Any warnings provided by CONTRIVE must be promptly provided to the end user.

CONTRIVE guarantees for two years from the date of manufacture of its product to replace, or, at its option, to repair any product or part thereof (except fuses and with some limitations for tubes and photocells) which is found defective in material or workmanship or which otherwise fails to conform to the description of its sales order. CONTRIVE makes no warranty of merchantability or any other warranty express or implied. CONTRIVE assumes no liability for any personal injury, property damage, losses, or claims arising from misapplication of its products.

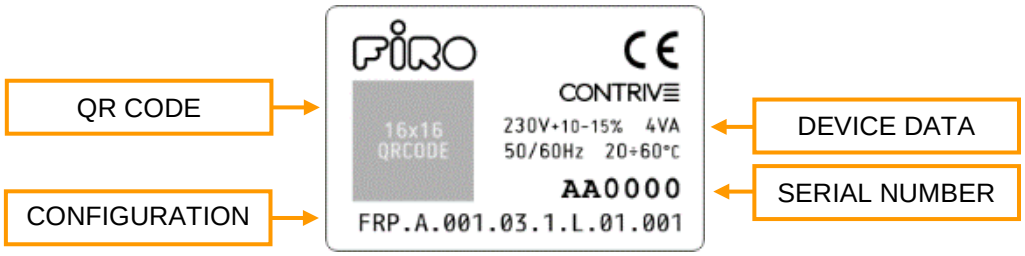
CERTIFICATION

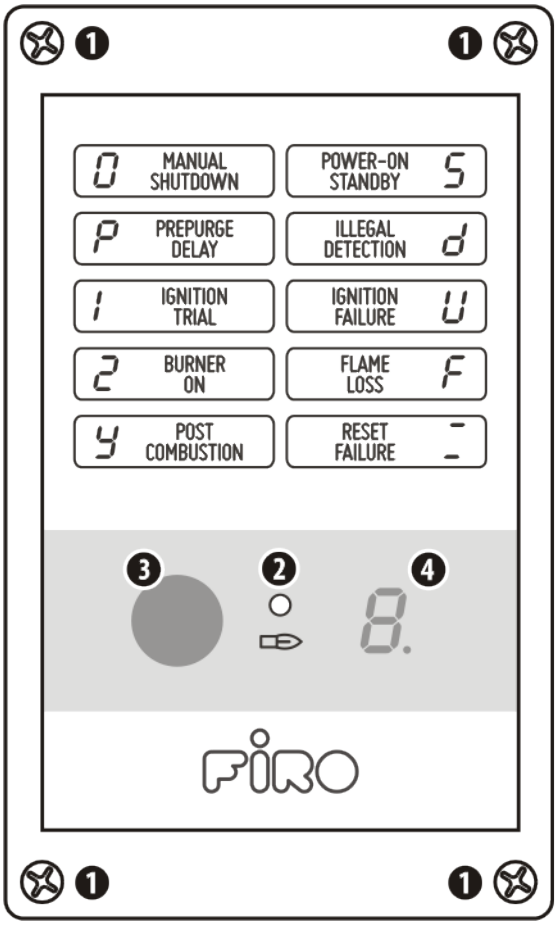
- Gas Equipment Directive (2009/142/EC)
- Low Voltage Equipment Directive (2014/35/EC)
- EMC Directive (2014/30/EC)

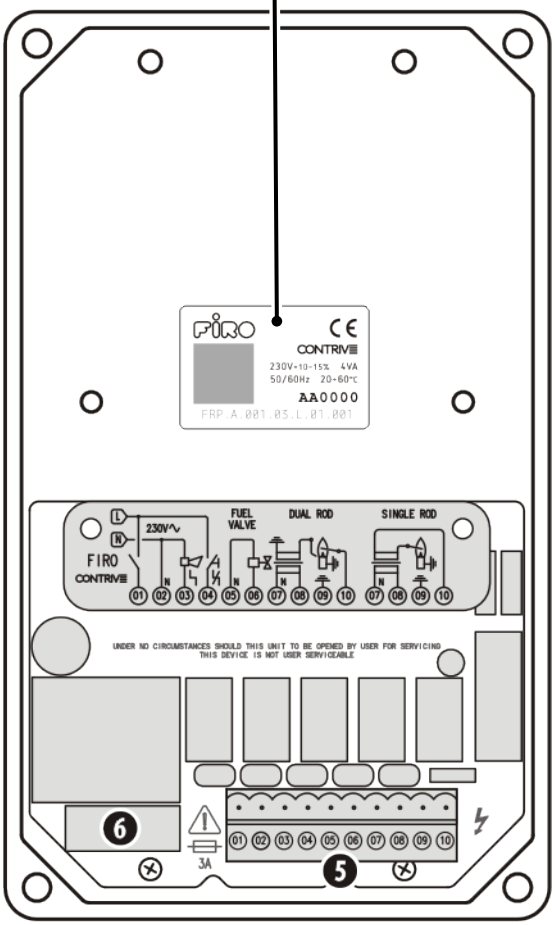
IN CONJUNCTION WITH:
EN298 – EN746-2 – EN60730-1 – EN13611

Please perform the following tasks after receiving the product:

- Inspect the unit for damage. If the product appears damaged upon receipt, contact the shipper immediately.
- Verify receipt of the correct unit by checking the label.
- If you have received the wrong model or the device does not function properly, contact your supplier.







FRONT PANEL

FITTING SCREWS	**1**
FLAME PRESENCE INDICATOR – RED	**2**
RESET / SHUTOFF BUTTON	**3**
STATUS DISPLAY	**4**

INTERNAL

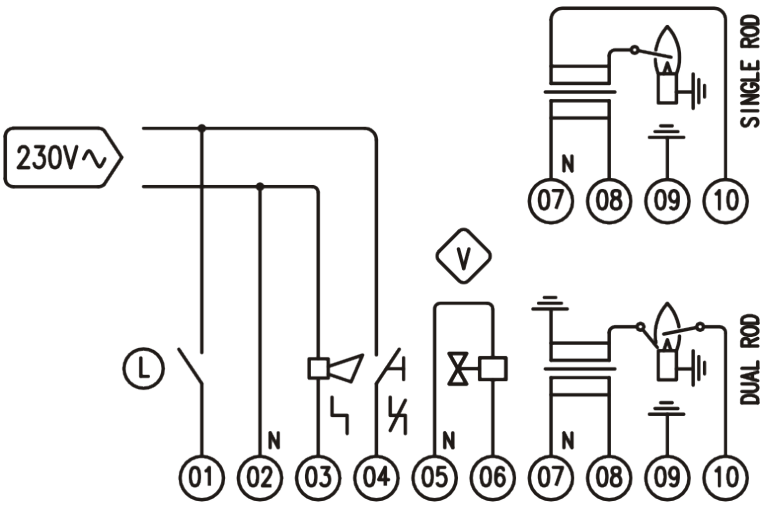
5	TERMINAL BOARD
6	POWER SUPPLY FUSE [1]

1 ULTIMATE PROTECTION AGAINST DANGEROUS CONDITIONS BY MEANS OF INTERNAL, NON REPLACEABLE 5A SAFETY FUSE

USE POWER, SIGNAL AND CONTROL CABLE SUITABLE FOR THE TYPE OF OPERATION AND COMPLYING WITH ALL REGULATIONS
DO NOT ROUTE CONNECTIONS TOGETHER WITH FREQUENCY CONVERTER CABLES OR CABLES EMITTING STRONG FIELDS
PROVIDE RELIABLE CONNECTION TO PE (PROTECTION EARTH) AND BURNER FRAME, RECOMMENDED WIRE GAUGE > 4 mm^2
ALL ELECTRONIC SYSTEMS MUST BE SUPPLIED BY A DEDICATED TRANSFORMER IN A TN-S EARTHING SYSTEM

USE UNSCREENED HIGH-VOLTAGE CABLE FOR IGNITION AND IONIZATION ROD LINES, LAYING CABLES INDIVIDUALLY, AVOIDING METAL CONDUITS. KEEP HIGH VOLTAGE IGNITION CABLES AS SHORT AS POSSIBLE, AVOIDING LOOPS AND KEEP ALL OTHER CABLES, ESPECIALLY THOSE OF IONIZATION ROD, AS FAR APART AS POSSIBLE

WIRING DIAGRAM



L	EXTERNAL LIMITS	
V	FUEL VALVE	
01	POWER SUPPLY – PHASE	
02	POWER SUPPLY – NEUTRAL	N
03	OUTPUT BURNER LOCKOUT	
04	INPUT REMOTE RESET	
05	FUEL VALVE – NEUTRAL	N
06	FUEL VALVE – PHASE	V
07	IGNITION TRANSFORMER – NEUTRAL	N
08	IGNITION TRANSFORMER – PHASE	
09	GROUND	GND
10	FLAME DETECTOR INPUT	ROD

FLAME DETECTED ONLY IF THE NEUTRAL IS WIRED TO TERMINAL 2 AND CONNECTED TO GROUND

RESET

A reset action is supposed to be a clear defined manual action. An automatic reset is not allowed by EN 13611:2015. FIRO limits the maximum number of remote resets (input terminal 4) to 5 actions within a span of 15 minutes. Lockout (resettable only from local button) exceeding this limit.

STATUS DISPLAY

The STATUS DISPLAY [4] gives, at any time, a clear indication about the working conditions of both the burner and the equipment, making it easier to detect any failure occurring in the system or the device.

LOCKOUTS

STANDBY
WAITING FOR RESET WHEN PROGRAMMED FOR STANDBY MODE AT POWER-ON.

FLAME SIMULATION
FLAME DETECTION DURING PREPURGE OR POSTPURGE (AFTER POSTCOMBUSTION).

RESET / COMMAND ERROR
TOO MANY REMOTE RESETS
(MORE THAN 5 WITHIN 15 MIN).

IGNITION FAILURE
NO FLAME DETECTED AT THE END OF SAFETY TIME (IGNITION TRIAL).

FLAME FAILURE
FLAME QUENCHING DURING NORMAL BURNER OPERATION.

CYCLE

MANUAL SHUTDOWN
UNIT HAS BEEN PUT OUT OF SERVICE FROM PUSH BUTTON. PUSH AGAIN TO RESTORE.

PREPURGE
PURGE OF COMBUSTION CHAMBER OR MIN TIME FOR ILLEGAL FLAME PROVING.

IGNITION
SAFETY TIME. BURNER IGNITION TRIAL WITH PILOT FUEL VALVE OPEN.

BURNER ON
FUEL VALVE IS OPEN, OPERATING POSITION FOR SINGLE STAGE BURNERS.

POSTCOMBUSTION
WAITING FOR FLAME QUENCHING AFTER LOCKOUT OR SHUTDOWN REQUEST.

POSTPURGE
PURGE OF COMBUSTION CHAMBER, SHOWN TOGETHER WITH ASSOCIATED CODE.

FAILURES

IGNITION OUTPUT FAILURE
IGNITION DEVICE OUTPUT REMAINS INACTIVE.

FUEL VALVE OUTPUT FAILURE
FUEL VALVE OUTPUT REMAINS INACTIVE.

OUTPUT RELAYS FAILURE [1]
SHORT CIRCUIT ON OUTPUT RELAY CONTACT
LOADS DISCONNECTED BY SAFETY RELAY.

UNDERVOLTAGE
POWER SUPPLY VOLTAGE TOO LOW
SYSTEM REMAINS ACTIVE.

OVERVOLTAGE
POWER SUPPLY VOLTAGE TOO HIGH
FUSE INTENTIONALLY BROKEN AFTER 5".

MASTER SAFETY RELAY FAILURE [1]
SHORT CIRCUIT ON SAFETY RELAY CONTACT.
OUTPUTS RELEASED.

PROGRAM ERROR
WRONG PROGRAM SEQUENCE.
UNSAFE OPERATION STOPPED.

MEMORY ERROR
DATA CORRUPTION.
CONFIGURATION ERROR.

TIMEBASE ERROR
MISMATCH BETWEEN 1ST AND 2ND INTERNAL TIMEBASE GENERATORS.

SYSTEM ERROR
MICROPROCESSOR IS NOT OPERATING PROPERLY.

FLAME INPUT FAILURE
FLAME SENSOR REVERSED POLARITY OR UNRELIABLE FLAME AMPLIFIER.

RESET FAILURE
PUSH BUTTON OR REMOTE RESET ACTIVE FOR LONG TIME (MORE THAN 10 SECONDS).

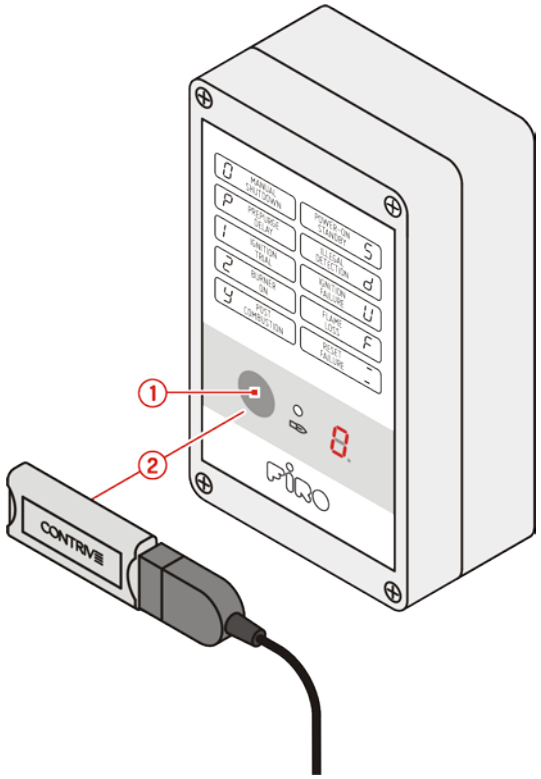
[1] A PREMANENT FAILURE TO THE RELAY CONTACT MAY CAUSE THE MAIN FUSE TO BLOWN, AS A SAFETY MEASURE TO PREVENT DANGEROUS CONDITIONS. IN SUCH CASE THE UNIT MUST BE RETURNED TO FACTORY FOR SERVICING.

WARNINGS

SELF-TEST
VERIFICATION AND INITIALIZATION OF SYSTEM COMPONENTS AT POWER-ON.

CONFIGURATION
UNIT IN CONFIGURATION MODE THROUGH INFRARED COMMUNICATION LINK.

CONFIGURATION



The device is fully configurable using the free software *F|tool* and the infrared adapter *Q|beam.USB*.

1. Press the button to put the unit in MANUAL SHUTDOWN
2. Point and keep Q|beam.USB toward the device push button at a distance of 30 to 60 cm

Display shows a horizontal dash while linked. Some parameters are password protected and can be modified only by authorized users or by factory.

Configuration parameters and usage log can be retrieved also by free APP running on Android devices.

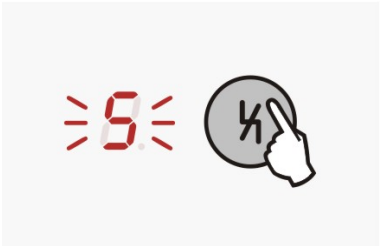
Correct reception is confirmed by a green blink of LED 2.

PARAMETERS

101	START-UP MODE	AUTOSTART	A
		STANDBY	S
303	PREPURGE (WAITING) TIME	0" ...	000
	DEFAULT 1"	... 250"	250
401	PRE-IGNITION TIME [1]	0,5"	
402	SAFETY TIME	2" ...	02
	DEFAULT 3"	... 25"	25
403	BURNER STARTUP ATTEMPTS	1	1
		2	2
		3	3
		4	4

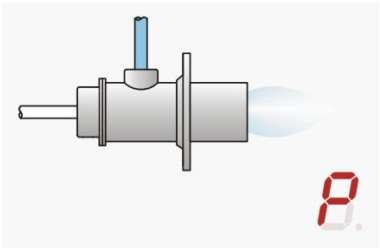
504	FLAME FAILURE	LOCKOUT	L
		RECYCLE	C
		IGNITION RESTORATION	K
505	FLAME FAILURE RESPONSE TIME	1" ...	01
	DEFAULT 1"	... 12"	12
602	POSTPURGE (WAITING) TIME	0" ...	000
	DEFAULT 1"	... 250"	250
	ENCLOSURE	PLASTIC	FRP
		ALUMINIUM	FRA

[1] NON-CONFIGURABLE PARAMETER



101 – START-UP MODE

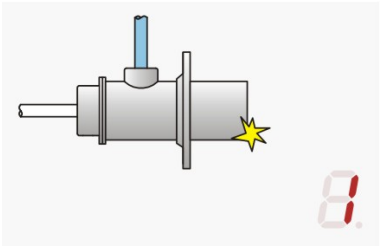
At power-on, once the self-test has been successfully completed, the unit waits in STANDBY mode until a reset operation is performed from push button, input or through a fieldbus remote command. Setting AUTOSTART mode, the cycle starts automatically, unless the units has been turned off while in lockout.



303 – PREPURGE TIME

EN298 § 3.124.1 - § 3.124.2 - § 3.124.3 - § 3.124.4

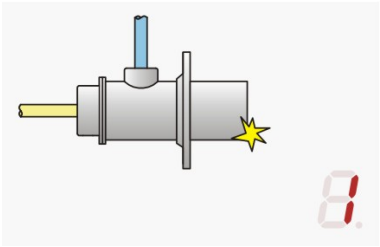
Set pre-purge time in forced draught burners according to applicable and relevant standards (EN 676). During this time the flame simulation test is carried out.
This is a merely waiting time if there is no air control.



401 – PRE-IGNITION TIME

EN298 § 3.135.3

The ignition transformer is turned on 500 ms before the pilot fuel valve to check the correct operation before supplying the fuel.
This is a fixed time and can not be changed.



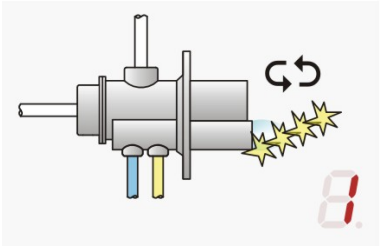
402 – SAFETY TIME

EN298 § 3.116

Set the correct time following EN 746-2 (or other relevant) requirements:

Natural draught burners ≤ 350 kW → 10" > 350 kW → 5"
IGNITION POWER ≤ 33% NOMINAL POWER WITH MAXIMUM OF 350 KW

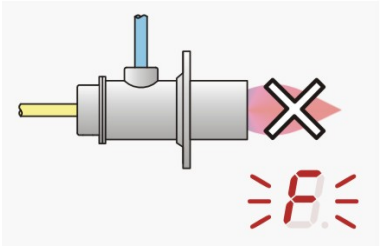
Forced draught burners ≤ 70 kW → 5" > 70kW → 3"
IGNITION POWER ≤ 10% NOMINAL POWER WITH MAXIMUM OF 350 KW



403 – BURNER STARTUP ATTEMPTS

EN746-2 - EN676

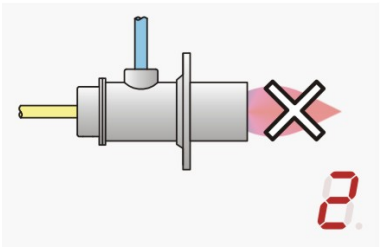
When the flame is not detected at the end of startup safety time, it is possible to make up to 4 startup attempts (including the first one), if the safety of the application is not impaired, repeating the cycle from the beginning.
A lockout will occur if no flame has formed within programmed attempts.



504 – FLAME FAILURE

EN298 § 7.101.2.3

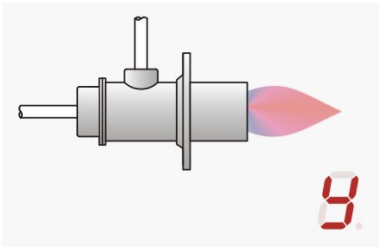
Determines the behavior at flame loss during normal burner operation.
For burners with occasionally unstable flame signal a single recycle (including pre-purge) or direct ignition restoration can be attempted. The setting is to be determined on the basis of burner capacity and relevant application standard.



505 – FLAME FAILURE RESPONSE TIME

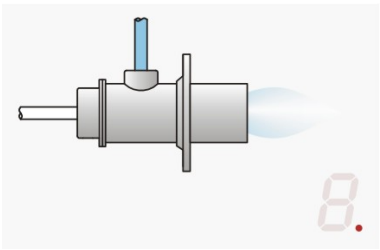
EN298 § 3.105.1 - § 7.101.3.4.3 - § 7.101.3.7

If the flame fails during operation, gas valves are switched off within this safety time that must be in accordance with relevant application standards (default for EN 298 is 1” and must not exceed 5”, including valves closing time for EN 746-2).



509 – ALLOWED POST-COMBUSTION TIME

Flame signal allowed for 20” once fuel valves has been closed.
Lockout occurs when the flame is detected after this post-combustion time.
Useful when fuel valves are distant from the burner.



602 – POSTPURGE TIME

EN298 § 3.124.6

Set post-purge time in forced draught burners according to standards (EN 676).
The flame simulation test is carried out during this time.
This is a merely waiting time if there is no air control.

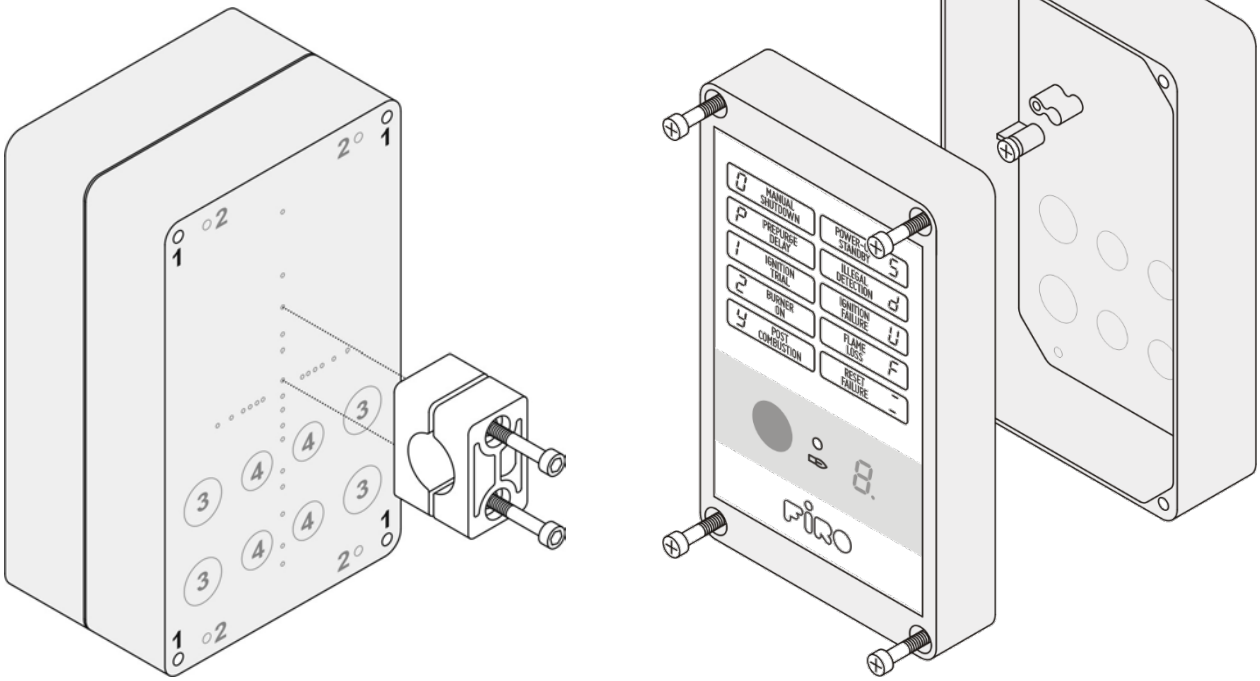
CONFIGURATION CODE

FRP = PLASTIC | FRA = ALUMINUM	START-UP MODE . 101	PREPURGE TIME . 303	SAFETY TIME . 402	START-UP ATTEMPTS . 403	FLAME FAILURE BEHAVIOR . 504	FLAME FAILURE RESPONSE TIME . 505	POSTPURGE TIME . 602
FRP	A	001	03	1	L	01	001

ENCLOSURE

According to European Standard EN60529 a minimum protection degree IP40 must be guaranteed, raised to IP54 for open air application.

ALUMINUM ENCLOSURES MUST BE CONNECTED TO PROTECTIVE EARTH



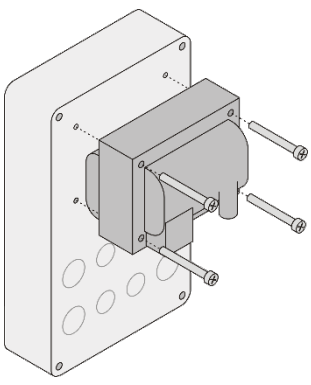
1	EXTERNAL FITTING HOLES (4) 4.2 mm SELF TAPPING OR M5 THREAD FORMING SCREW	106 x 186 mm
2	BREAKABLE FITTING HOLES (4) 4,0 mm DIAMETER	77 x 182 mm
3	BREAKABLE HOLES FOR WIRING (4) SUITABLE FOR PG11 CABLE GLAND	Ø 19,0 mm
4	BREAKABLE HOLES FOR WIRING (4) SUITABLE FOR PG9 CABLE GLANDS	Ø 15,5 mm

FRA - CAST ALUMINUM ALLOY EN AB 46100 IP64
OVERALL DIMENSION: 200 x 120 x 71 mm WEIGHT: ≈ 850 g
ELECTROSTATIC POLYESTER POWDER COATING RAL9006

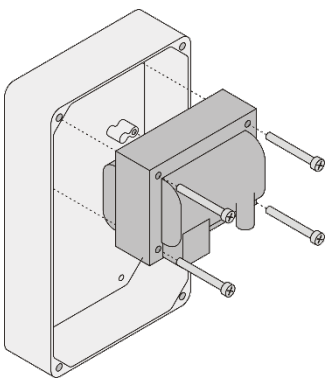
FRP - THERMOPLASTIC POLYMER BLEND UL-V0 IP64
OVERALL DIMENSION: 200 x 120 x 71 mm WEIGHT: ≈ 550 g
GLOSSY SURFACE FINISH RAL9006

IGNITION TRANSFORMER

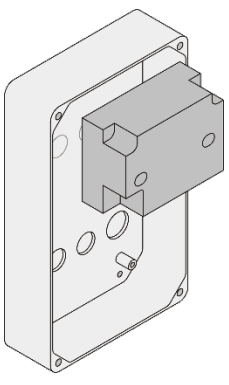
The ignition transformer could be mounted inside the device or fixed on the back of the unit.



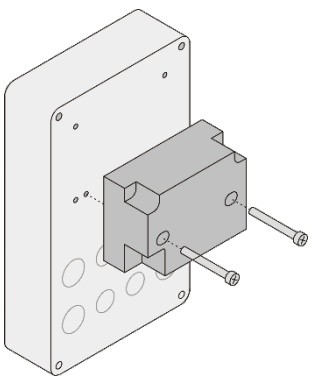
TRE820
EXTERNAL FITTING HOLES
4.2mm SELF TAPPING SCREW



TRE820
EXTERNAL FITTING HOLES
4.2mm SELF TAPPING SCREW



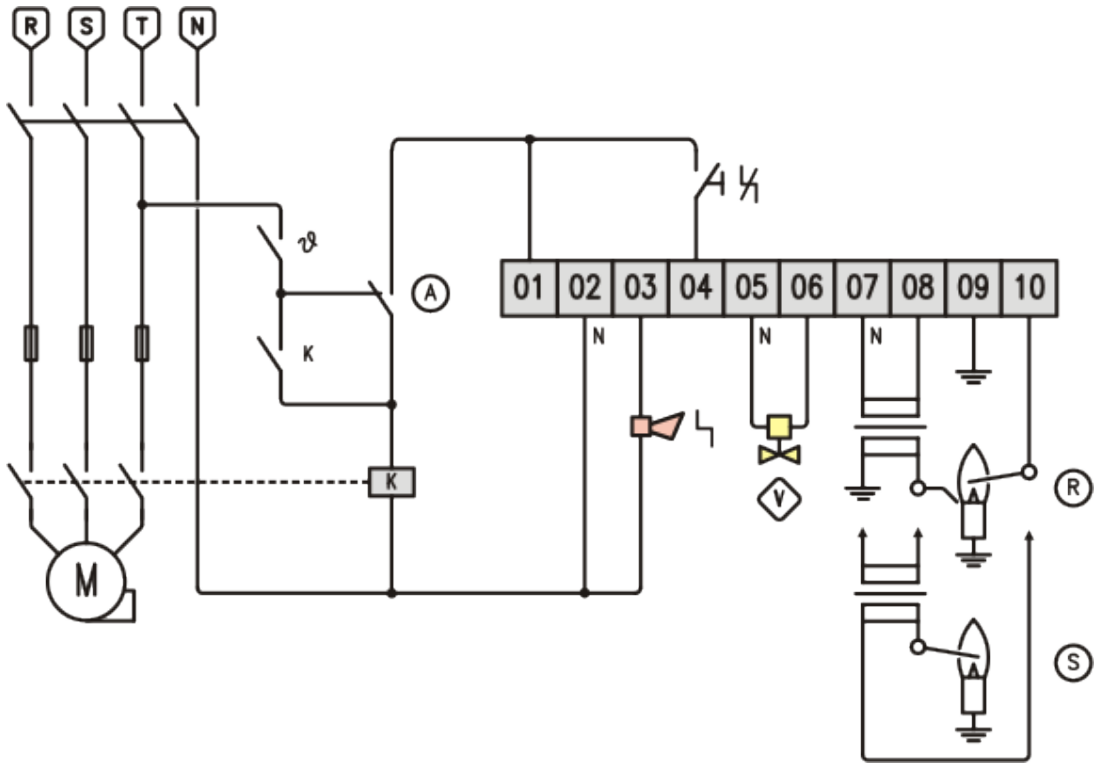
TRK2
ASSEMBLY INSIDE
WITH SILICON GLUE



TRK2
EXTERNAL FITTING HOLES
4.2mm SELF TAPPING SCREW

GAS BURNER

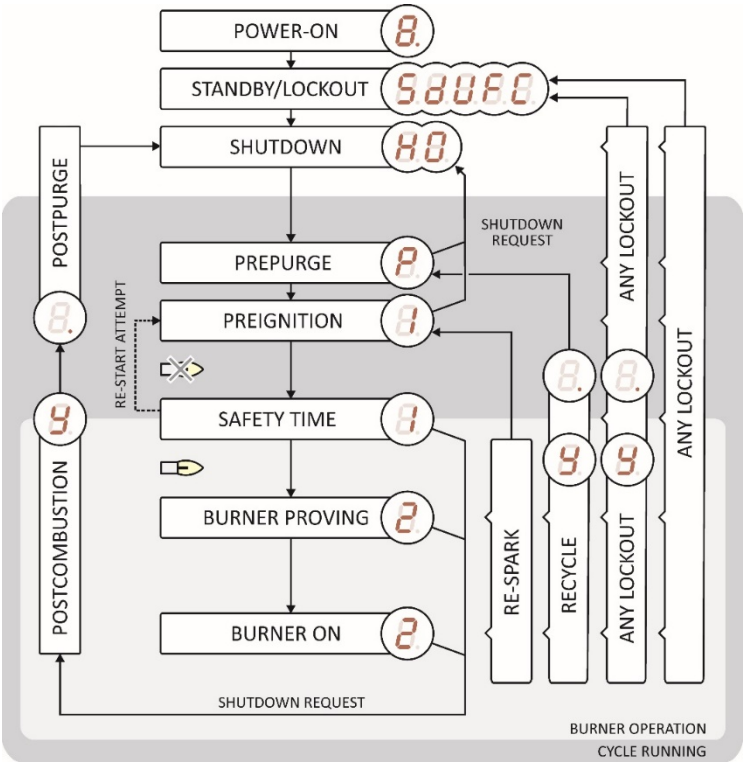
The burner is turned ON/OFF together with device power supply.
A flame simulation test is carried out during pre-purge (waiting time).
The fuel valve [V] will be activated only if the ignition output is detected during pre-ignition time.
The fuel valve remains open during the programmed safety time, if a valid flame signal is detected within the safety time, the valve is kept open: the burner is ON. If no flame is detected the system will lockout.
In accordance with EN746-2 and EN676, up to 4 ignition attempts are allowed if the safety is not impaired.
Push the front panel button to reset from lockout (will take place at release).
Flame quenching during burner operation will force the system to lockout, recycle or ignition restoration.
To put the burner out of service (manual shutdown) push the front panel button during the operating cycle.
A post-combustion time (max 20 seconds) is allowed after a lockout or shutdown request, followed by post-purge.
It is possible to share a single rod for ignition and flame detection using special ignition transformers.



ϑ	THERMOSTAT
K	POWER RELAY
M	BLOWER
(A)	LOW AIR PRESSURE SWITCH

(V)	GAS VALVE
(S)	SINGLE ROD CIRCUIT
(R)	DUAL ROD CIRCUIT
↳	BURNER LOCKOUT
↯	RESET INPUT

⚠ ALL SAFETY SWITCHES SHOULD BE APPROVED AS LIMIT CONTROLS
THE USE OF ELECTRONIC SWITCHES MAY CAUSE ERRATIC OPERATIONS



PROGRAM SEQUENCE

A **SELF TEST** IS PERFORMED AT POWER-ON, ONCE SUCCESSFULLY COMPLETED BURNER IS READY TO START.

IF THE UNIT HAS BEEN TURNED OFF WHILE IN **LOCKOUT** OR PARAMETER 101 HAS BEEN SET TO **STANDBY**, IT WILL BE NECESSARY TO PUSH THE LOCAL OR REMOTE BUTTON TO EXIT FROM NON-VOLATILE LOCKOUT.

FLAME SIMULATION VERIFIED WHILE IN WAITING OR PREPURGE.

AFTER PRESET **WAITING OR PREPURGE** TIME HAS ELAPSED, IGNITION DEVICE ACTIVATED AND VERIFIED, THEN THE GAS VALVE IS OPEN.

BURNER PROVING STARTS IF THE FLAME IS DETECTED WITHIN THE **SAFETY TIME**.

IF NO FLAME IS DETECTED WITHIN THE SAFETY TIME, A LOCKOUT OCCURS. DEPENDING ON PARAMETER 403 THE UNIT COULD CARRY OUT UP TO THREE FURTHER **START-UP ATTEMPTS**.

AFTER THE BURNER PROVING THE IGNITION CYCLE IS COMPLETED AND BURNER IS ON.

FLAME FAILURE DURING OPERATION LEADS TO LOCKOUT, IGNITION RESTORATION OR RECYCLE (PARAMETER 504).

MANUAL SHUTDOWN REQUEST WILL TURN OFF THE BURNER, WAITING FOR ALLOWED POSTCOMBUSTION AND OPTIONAL POSTPURGE, BURNER CAN BE SWITCHED OFF REMOVING THE POWER SUPPLY.

TECHNICAL DATA

POWER SUPPLY

VOLTAGE	230 V +10-15%
FREQUENCY	50/60 Hz
LINE FUSE	3 A QUICK-ACTING - 5x20mm
POWER CONSUMPTION	4 VA MAX
POWER DISSIPATION	3 W MAX

OVERVOLTAGE CATEGORY II PURSUANT TO EN 60730

FLAME DETECTION

MINIMUM IONIZATION CURRENT	> 1 µA
CURRENT LIMITATION	< 1 mA
DETECTOR LINE LENGTH	< 30 m
SINGLE ROD LINE LENGTH	< 2 m
DETECTOR VOLTAGE	250 Vac
DETECTOR INSULATION	> 50 MΩ

ENVIRONMENT

OPERATING TEMPERATURE	(-4 … 140 °F) -20 … 60 °C
STORAGE TEMPERATURE	(-40 … 185 °F) -40 … 85 °C
RELATIVE HUMIDITY	NO CONDENSATION ALLOWED
WEIGHT	≈ 880 g ALUMINIUM | ≈ 550 g PLASTIC
PROTECTION CLASS	IP64 NEMA3
MOUNTING POSITION	ANY

THIS UNIT IS NOT INTENDED FOR EXPLOSIVE OR CORROSIVE ENVIRONMENTS

OUTPUTS

MAX RATED VOLTAGE	250 Vac
MAX SWITCHING VOLTAGE	440 Vac
MAX LOAD (PER OUTPUT)	2 A cosφ=0,7

CONTRIVE S.r.l. I-24040 SUISIO (Bergamo) via Enrico Fermi 18