Q2

PARAMETRIC BURNER CONTROLLER

TECHNICAL INFORMATION

CONTENT

Parametric... what does it means?

... that it is possible to "tailor" the operation of Q2 to virtually any burner application technology, modifying parameters and behavior in each stage of the burner management cycle, activating and assigning a predefined duration to each one.

that means

... for each stage you can define which fuel or air valves to turn on, choose which inputs to control, predefine an actuator position that controls the air or gas flow ...

... then it will be simple to configure Q2 to manage:

• SINGLE STAGE DIRECT IGNITION UP TO 350kW

• MULTISTAGE OF UNLIMITED CAPACITY

• INTERMITTENT OR CONTINUOUS OPERATION

• ON/OFF OR MODULATING

• FLAMELESS

• STAGED GAS

• STAGED AIR

• RECUPERATIVE

• REGENERATIVE

Here is a summary list of Q2 features:

• Supports natural and forced draught gas burners.

• Blue flame oil burners.

• Hydrogen burners.

• Single stage burners.

• Multi-stage burners.

• Permanent operation.

• Air pressure switch.

• Fuel pressure switch.

• Proof of closure input.

• Up to 4 fuel valves.

• Air valve or fan output.

• Valve proving system (tightness control).

• Flame detection by means of UV sensor, dual or single electrode.

• Optional 2nd UV flame detector.

• Independent and configurable flame sensitivity.

• Electro-optical shutter control.

• Ignition transformer can be housed inside.

• 3 points actuator with preset positions and remote modulation control.

• High-temperature mode for indirect flame surveillance and flameless operation.

• Built-in fieldbus control, IIoT ready.

• Front magneto-optic jack for configuration and commissioning.

• LED-bar flame signal indicator.

• Advanced self-diagnostic report of cycle status, lockouts and failures.

• Log memory for lockouts, faults, unit and valves operating time.

1. VERSIONS

Q2 is available in 4 versions, the following table shows the features integrated in each version.

For all versions 2 supply voltages are available.

		Q21	Q22	Q26	Q28
1st stage fuel valve		●	●	●	●
2nd stage fuel valve			●	●	●
2nd flame sensor			●	●	●
Hi temperature bypass / Flameless			●	●	●
UV electro optical shutter control				●	●
Safety fuel valve	Valve Proving System			●	●
Bypass fuel valve				●	●
Fuel pressure switch input				●	●
Safety valve proof of closure				●	●
Air valve				●	●
Air pressure switch				●	●
Actuator (3 points control)					●
Actuator potentiometer					●

1. Interface boards are independent units installed in the base that communicate via infrared optical interface with the main unit with which they share only power from the mains.

2. Controls shall provide the degree of protection against ingress of water and dust appropriate to their IP classification when mounted and used in the declared manner (EN 60730-1 § 12.1.1).

ORDER CODE

8 0 0 2 . 4 0 . 28

INTERFACE BOARD [1]
0   NO
1   Q.io   4 IN + 2 OUT + 1 DAC + WIFI
2   Q.net   PROFINET + 2 IN + 2 OUT

CABLE OUTLETS [2]
0   NO
1   CABLE GLANDS
2   BLANKING PLUGS

MAIN POWER SUPPLY
3   115V
4   230V

IGNITOR (INTERNAL)
0   NO
T   TRE820PISO
K   TRK2

VERSION
21   Q21   201 x 201 x 92 mm
22   Q22   201 x 201 x 92 mm
26   Q26   201 x 201 x 92 mm
28   Q28   201 x 201 x 92 mm

Please perform the following tasks after receiving the product:

- Inspect the unit: If the product appears damaged upon receipt, contact the shipper immediately.

- Verify receipt of the correct power supply voltage by checking the label.

- Contact your supplier if you received the wrong model or the device does not work properly.

2. COVER

BAYBLEND® FR3010 - PC+ABS INCREASED HEAT RESISTANCE

BLACK FIREPROOF POLYURETHANE COATING
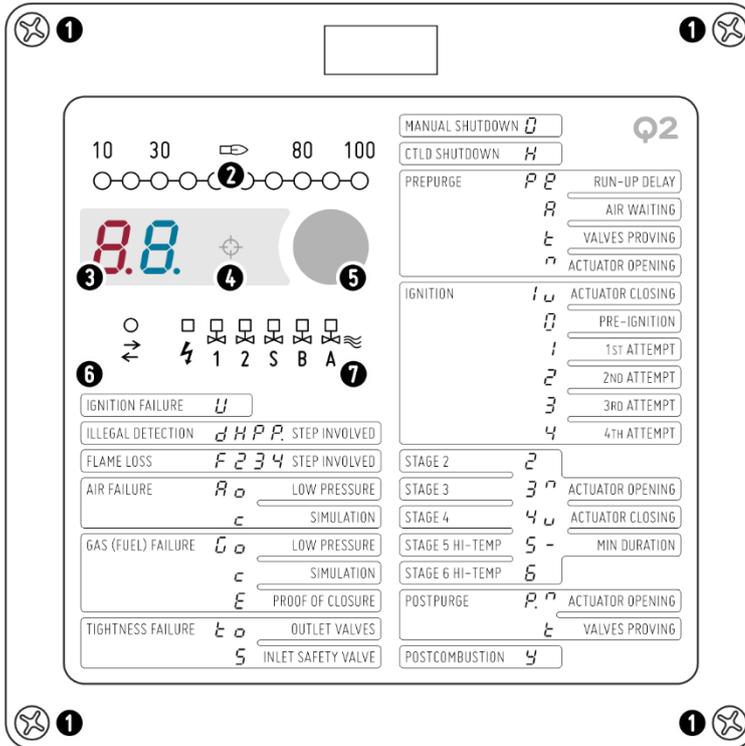
FRONT PANEL

1. M5 FITTING SCREWS
2. FLAME BAR GRAPH
3. STATUS DISPLAY
4. OPTICAL INTERFACE
5. RESET/SHUTDOWN BUTTON
6. COM INDICATOR
7. OUTPUT INDICATORS

To ensure an IP67 degree of protection, the 4 screws [1] must be tightened with a tightening torque of approximately 1.5 Nm.
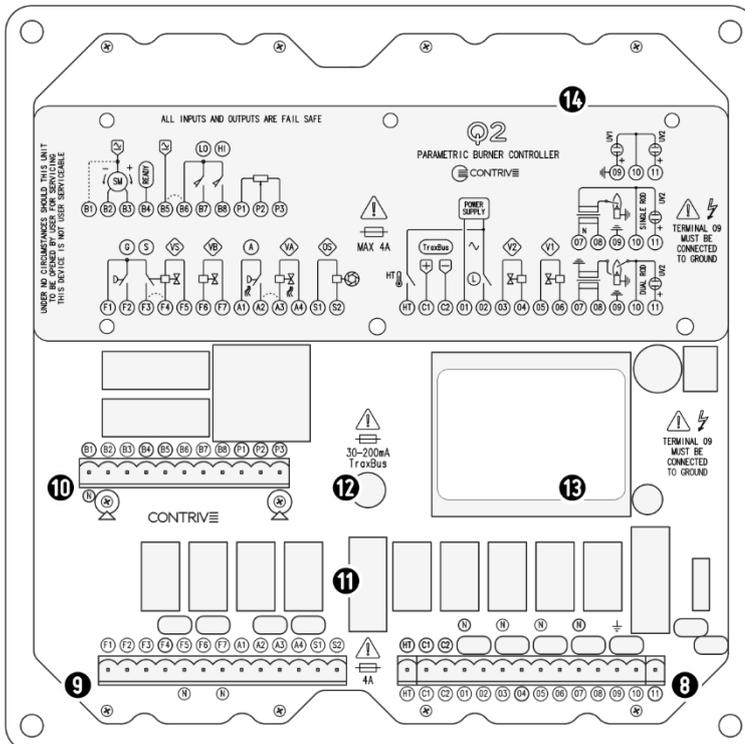
INTERNAL

8. MAIN TERMINAL BOARD
9. EXTENDED TERMINAL BOARD
10. ACTUATOR TERMINAL BOARD
11. POWER SUPPLY FUSE [1]
12. TraxBus FUSE
13. IDENTIFICATION LABEL
14. PROTECTIVE COVER

[1] ULTIMATE PROTECTION AGAINST DANGEROUS CONDITIONS BY MEANS OF INTERNAL NON-REPLACEABLE SAFETY FUSE

Electrical connections are made through connectors positioned inside the unit.

The entire equipment is housed in the upper section and can therefore be replaced easily and quickly when necessary

OUTPUT INDICATORS [7]

IGNITION TRANSFORMER	⚡	A ≈	AIR VALVE
1ST STAGE (PILOT) FUEL VALVE	1	S	SAFETY FUEL VALVE
2ND STAGE (MAIN) FUEL VALVE	2	B	BYPASS MULTIFUNCTION VALVE
BLINKS WITH VALID COMMAND RECEIVED	⇄	100 ●	BLINKS WHILE IN HIGH TEMPERATURE BYPASS

FRONT VIEW
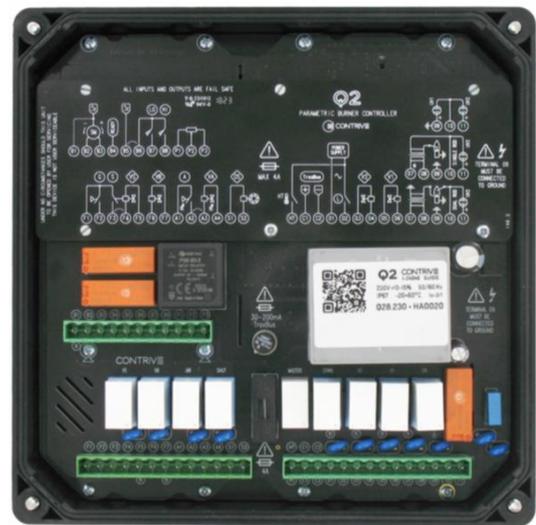
Q28 INTERNAL VIEW

ELECTRONIC IGNITION TRANSFORMER

INDUCTIVE IGNITION TRANSFORMER

3. BASE

ALUMINIUM ALLOY EN AB 46100

HIGH CORROSION RESISTANCE POLYESTER GRAPHITE GRAY COATING
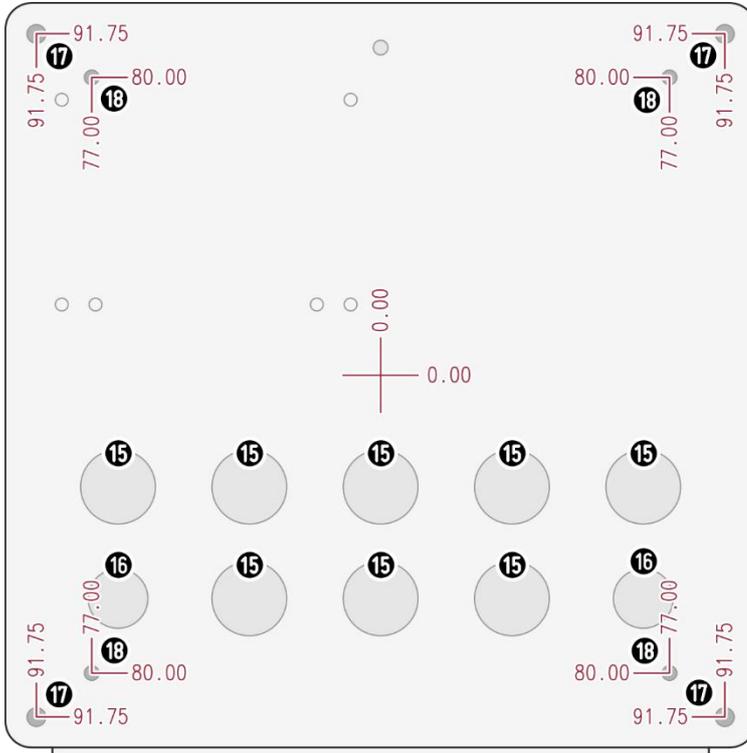
BACK VIEW
DIMENSIONS IN MILLIMETERS
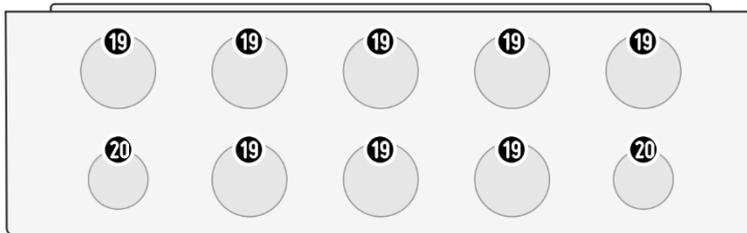
BOTTOM VIEW

15   **Ø 20 mm (8)**
BREAKABLE HOLES FOR
M20 CABLE GLAND

16   **Ø 16 mm (2)**
BREAKABLE HOLES FOR
M16 CABLE GLAND

17   **M5 (4)**
EXTERNAL FITTING HOLES

18   **4mm (4)**
BREAKABLE FITTING HOLES

The device can be fixed using the 4 threaded holes in the base [17] using 4 M5 screws (not supplied), or by opening the 4 knockout holes [18] for M4 screws (not supplied). The positions of the holes for the panel on which the unit sits on are shown in the figure.

For cable entry there are 10 threaded holes suitable for receiving cable glands, the unused holes must be closed with stoppers, the back side features 8 knockout holes for additional cable exits.

19   **M20 x 1,5 (8)**
FOR M20 CABLE GLANDS

20   **M16 x 1,5 (2)**
FOR M16 CABLE GLANDS

According to European Standard EN13611 § 8.2, a minimum protection degree IP40 must be guaranteed, raised to IP54 for open air application.

TO GUARANTEE IP67 IT IS NECESSARY TO USE SPECIFIC STOPPERS AND CABLE GLANDS

STOPPERS:
• M16 LAPP SKINDICHT® 52006116
• M20 LAPP SKINDICHT® 52006126
• M16 TE EP-ROP-M16-BL-B
• M20 TE EP-ROP-M20-BL-B

CABLE GLANDS:
• M16 BIEMME BM4917N
• M20 BIEMME BM4920N

TIGHTENING TORQUES:
• For M16 apply a tightening torque of 2.5 Nm
• For M20 apply a tightening torque of 5.0 Nm

4. WIRING
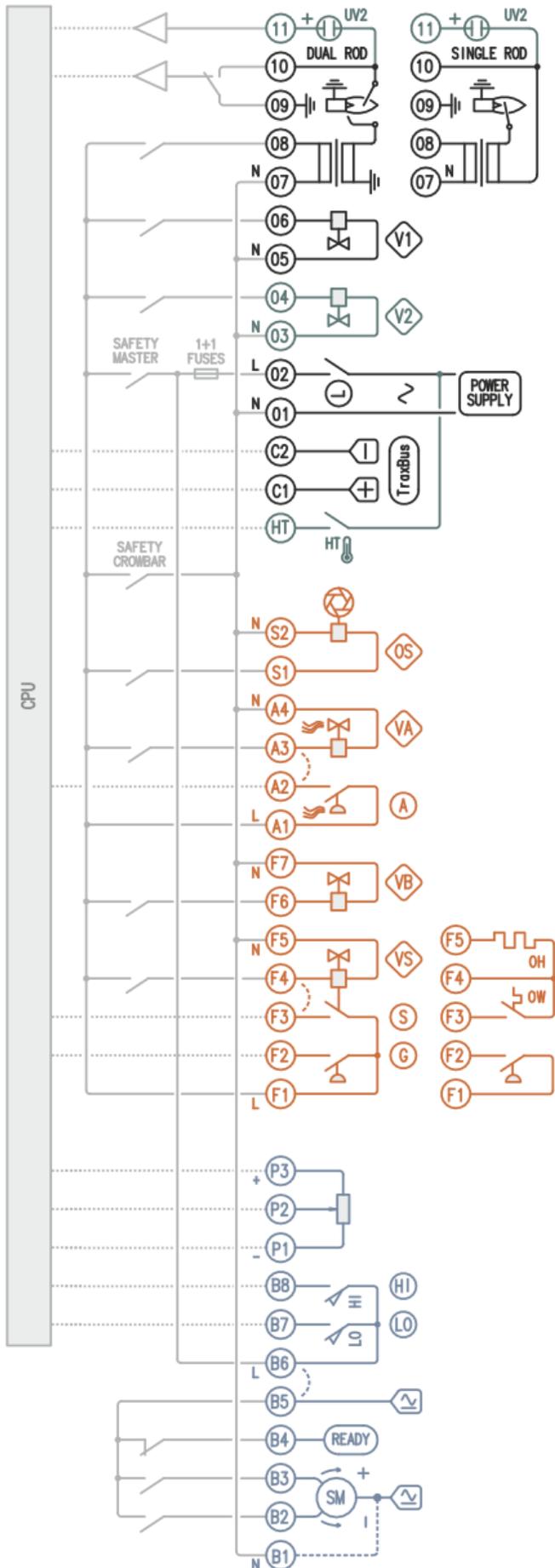
BASE TERMINAL BOARD [8]

11	IN	2ND FLAME INPUT
10	IN	1ST FLAME INPUT
09		GROUND
08	OUT	IGNITOR
07	OUT	NEUTRAL
06	OUT	V1 - PILOT FUEL VALVE
05	OUT	NEUTRAL
04	OUT	V2 - MAIN FUEL VALVE
03	OUT	NEUTRAL
02	IN	POWER SUPPLY PHASE
01	IN	POWER SUPPLY NEUTRAL
C2		TraxBus -
C1		TraxBus +
HT	IN	HIGH TEMPERATURE BYPASS

EXTENDED TERMINAL BOARD [9]

S2	OUT	NEUTRAL
S1	OUT	ELECTRO OPTICAL SHUTTER
A4	OUT	NEUTRAL
A3	OUT	VA - AIR VALVE
A2	IN	AIR PRESSURE SWITCH [1]
A1	OUT	PHASE
F7	OUT	NEUTRAL
F6	OUT	VB - BYPASS VALVE
F5	OUT	NEUTRAL
F4	OUT	VS - SAFETY FUEL VALVE [OH]
F3	IN	PROOF OF CLOSURE SWITCH [OW]
F2	IN	FUEL PRESSURE SWITCH [2]
F1	OUT	PHASE

ACTUATOR TERMINAL BOARD [10]

P3	OUT	POTENTIOMETER (OPEN)
P2	IN	POTENTIOMETER
P1	OUT	POTENTIOMETER (CLOSE)
B8	IN	HI POSITION LIMIT SWITCH
B7	IN	LO POSITION LIMIT SWITCH
B6	OUT	PHASE
B5	IN	POWER SUPPLY
B4	OUT	READY (FREE TO MOVE)
B3	OUT	OPEN
B2	OUT	CLOSE
B1	OUT	NEUTRAL

CONTRIVE

The **BLACK** terminals of the base terminal block [8] are available for all versions, while the **GREEN** ones only starting from the Q22 version (2nd stage and high temperature input).

The **ORANGE** terminals add functions for the Q26 and Q28 versions.

The **BLUE** terminals associated with the actuator are available in the Q28 version only.

(L) EXTERNAL LIMITS	(G) FUEL [2] PRESSURE SWITCH	(SM) ACTUATOR (DAMPER)
(V1) 1ST STAGE FUEL VALVE	(S) PROOF OF CLOSURE SWITCH (VS)	(LO) LO POSITION LIMIT SWITCH
(V2) 2ND STAGE FUEL VALVE	(VS) SAFETY FUEL VALVE	(HI) HI POSITION LIMIT SWITCH
	(VB) MULTIFUNCTIONAL BYPASS VALVE	
	(A) AIR [1] PRESSURE SWITCH	
	(VA) AIR VALVE BLOWER	
	(OS) ELECTRO OPTICAL SHUTTER(S)	

[OH]   FUEL PRE-HEATER (OIL BURNERS)

[OW]   HEATHER THERMOSTAT (OIL BURNERS)

[1]   The air pressure switch input can be used to suspend cycle progress while waiting for external consent to proceed with prepurge.

[2]   The fuel pressure switch input can be used to suspend cycle progress while waiting for external consent to proceed with ignition.

5. 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.

EC TYPE EXAMINATION ▪ NOTE

Since EN 298 does not describe all functions of Q2 – implemented to manage all possible industrial scenarios – the operator is responsible for ensuring that parameters and functions are appropriate for the application. Certification applies only for options and values allowed by EN 298.

6. CERTIFICATIONS

CE 0063 — Regulation (EU) 2016/426 relating to appliances burning gaseous fuels in conjunction with relevant directives, regulations and standards
Certificate No. **26GR0050/00** - PIN **0063DR1822**

UL CERTIFIED — FUNCTIONAL SAFETY MODULE — For systems up to SIL 3
pursuant to EN 61508
Certificate No. **FSCO-00172**
Functional safety activities for the entire product life cycle are entrusted to QSD sistemi

6.1. STANDARDS

- Regulation (EU) 2016/426
  on appliances burning gaseous fuels and repealing Directive 2009/142/EC

- Directive (EU) 2014/35
  Low Voltage Equipments

- Directive (EU) 2014/30
  Electromagnetic Compatibility

- IEC EN 60730-1:2022
  Automatic electrical controls - Part 1: General requirements

- EN 60730-2-5:2015+A1:2022
  Automatic electrical controls - Part 2-5: Particular requirements for automatic electrical burner control systems

- IEC 61508:2010
  Functional safety of Electrical/Electronic/Programmable Electronic safety-related systems

- EN 13611:2019
  Safety and control devices for burners and appliances burning gaseous and/or liquid fuels - General requirements

- EN 298:2022
  Automatic burner control systems for burners and appliances burning gaseous or liquid fuels

- EN 1643:2022
  Safety and control devices for gas burners and gas burning appliances - Valve proving systems for automatic shut-off valves

- ISO EN 13577-2:2023
  Industrial furnaces and associated processing equipment – Safety - Part 2: Combustion and fuel handling systems

- ISO EN 13577-4:2022
  Industrial furnaces and associated processing equipment – Safety - Part 4: Protective systems (ISO 13577-4:2022)

- CAN/CSA-C22.2
  NO. 60730-2-5:22 -
  Automatic electrical controls - Part 2-5: Particular requirements for automatic electrical burner control systems
  (Binational standard with CSA/ANSI Z21.20:22 and UL 60730-2-5)

- IEC EN 62443-4-2
  Security for industrial automation and control systems - Technical security requirements for IACS components

- Directive (EU) 2022/2555
  on measures for a high common level of cybersecurity across the Union (NIS-2)

- Regulation (EU) 2024/2847
  on horizontal cybersecurity requirements for products with digital elements (Cyber Resilience Act)

6.2. SAFETY INTEGRITY LEVEL

Although **EN ISO 13577-4** offers procedural simplification (exempting devices already compliant with product standards such as EN 298 from the requirements of IEC 61511, IEC 62061, and ISO 13849), this regulatory flexibility does not address the challenges posed by the most demanding industrial applications.

In **High Demand** applications, where safety functions are frequently stressed, simple compliance with EN 298 is no longer sufficient to guarantee the reliability expected by Tier-1 operators. In these scenarios, **SIL 3** is the definitive benchmark for safety: this level cannot be merely assumed; it requires a rigorous assessment verified by a Notified Body in accordance with Annex J of EN 13611.

The SIL 3 certification simplifies the integration of Q2 into complex systems that require functional safety verification according to IEC 61511, allowing its use without the need for any device risk analysis.

Suitable for Safety Integrity Level	UP TO SIL 3
Type of subsystem	Type B EN 61508-2:2010
Mode of operation	High demand mode EN 61508-4:2010
$MTTF_D$ MEAN TIME TO DANGEROUS FAILURE	> 367.600.000 hours MORE THAN 41 YEARS, 8 MONTHS

INDIVIDUAL SAFETY FUNCTIONS	PFH_D	SFF
SF-1 FLAME SURVEILLANCE DIRECT SURVEILLANCE LOW TEMPERATURE MODE a. FLAME LOSS b. ILLEGAL FLAME DURING PURGE PHASES	$2{,}72 \times 10^{-9}$ 1/h	98,85%
SF-1 FLAME SURVEILLANCE HTO INDIRECT SURVEILLANCE HIGH TEMPERATURE MODE a. FLAME LOSS	$2{,}59 \times 10^{-9}$ 1/h	98,97%
SF-2 GAS LEAKAGE a. TIGHTNESS TEST b. NORMAL OPERATION FUEL PRESSURE SWITCH DETECTING AN INCOHERENT CONDITION	$2{,}59 \times 10^{-9}$ 1/h	98,97%

SFF (Safe Failure Fraction) indicates the proportion of total failures of a component or system that occur in a safe manner, meaning without causing additional hazard.

PFH$_D$ (Probability of Dangerous Failure per Hour) quantifies the probability of a dangerous failure occurring within one hour.

Functional safety activities for the entire product life cycle are entrusted to QSD sistemi.

Q2

CONTRIVE

7. TECHNICAL DATA

POWER SUPPLY

VOLTAGE	115V or 230V +10 -15%
FREQUENCY	50 ... 60 Hz
LINE FUSE	4 A
	5x20mm SLOW BLOW
POWER CONSUMPTION	10 VA MAX

OVERVOLTAGE CATEGORY III PURSUANT TO EN 60730

PROCESS INPUTS

MAX CURRENT PER INPUT	3 mA
G S A HT	
RESPONSE TIME	< 1 s
CONFIGURABLE	

OUTPUTS

MAX RATED VOLTAGE	250 V AC
MAX SWITCHING VOLTAGE	270 V AC
MAX LOAD PER OUTPUT	2 A - cosφ = 0.7
V1 V2 VS VB VA OS	

ACTUATOR

MAX SWITCHING VOLTAGE	300 V AC/DC
MAX LOAD PER OUTPUT	4A @ 250V AC
OPEN CLOSE READY	2A @ 30V DC
LIMIT SWITCHES VOLTAGE	same as power supply
LIMIT SWITCHES CURRENT	3 mA MAX
POTENTIOMETER VOLTAGE	5V DC
POTENTIOMETER RESISTANCE	100...10000 Ω
POTENTIOMETER LINE LENGTH	3 m MAX

OVERVOLTAGE CATEGORY III PURSUANT TO EN 60730

TraxBus

VOLTAGE	30 V DC MAX
FUSE	63...200 mA
	SUBMINIATURE FUSE
BAUD RATE	4800 / 9600 / 19200 / 38400

ENVIRONMENT

OPERATING TEMPERATURE	-20 ... 60 °C
	-4 ... 140 °F
STORAGE TEMPERATURE	-40 ... 85 °C
	-40 ... 185 °F
RELATIVE HUMIDITY	up to 95%
	NO CONDENSATION ALLOWED
PROTECTION CLASS	IP67
DIMENSIONS	201 x 201 x 92 mm MAX
WEIGHT	2000 g
MOUNTING POSITION	ANY

THIS UNIT IS NOT INTENDED FOR
EXPLOSIVE OR CORROSIVE ENVIRONMENTS

FLAME INPUT 1

MINIMUM DETECTABLE CURRENT	1 µA
CURRENT LIMITATION	1 mA
SENSOR VOLTAGE	250 V AC
SIGNAL DISPLAY	0...100%
	0...30 µA
SENSOR TYPE	ELECTRODE / UV PHOTOTUBE
SENSOR LINE LENGTH	< 3 m
SHARED ROD LINE LENGTH	< 2 m

PROBE LINE INSULATION MUST BE GREATER THAN 50 MΩ

FLAME INPUT 2

MINIMUM DETECTABLE CURRENT	1 µA
CURRENT LIMITATION	1 mA
SENSOR VOLTAGE	250 V AC
SIGNAL DISPLAY	0...100%
	0...30 µA
SENSOR TYPE	UV PHOTOTUBE
SENSOR LINE LENGTH	< 3 m

PROBE LINE INSULATION MUST BE GREATER THAN 50 MΩ

8. INSTALLATION

- The power must be supplied by TN-S power supply systems. For use in ungrounded grid systems or for phase-to-phase systems an isolation transformer with single-side grounding must be installed, the installation of an isolation transformer is recommended for all applications.
- In three-phase systems, always use the same phase for all connections.
- 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 electromagnetic fields.
- Provide reliable connection to PE (protection earth) and burner frame, recommended wire gauge > 4 mm^2
- 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 as far apart as possible.

8.1.   SAFETY NOTES

- Q2 is a safety device. Under no circumstances should the unit be modified, serviced, or opened. The manufacturer will not assume responsibility for damage resulting from unauthorized modification of the unit.
- Mounting, installation, configuration, commissioning, burner start-up and service must only be carried out by qualified personnel.
- Before performing any work in the connection area of the device, disconnect the unit from the main power supply (all-pole disconnection).
- Protection against electrical shock hazard on the unit and all other connected electrical components must be ensured through proper wiring and grounding practices in accordance with applicable standards (see details in the specific section)..
- Dropping or impacting the device may cause it to malfunction. Such units should not be operated even if they show no apparent damage.
- Condensation and water ingress into the unit must be prevented.

8.2.   DISPOSAL

WEEE Directive 2012/19/EU
Waste Electrical and Electronic Equipment Directive

At the end of the product life, dispose of the product in a corresponding recycling center.
Do not dispose of the unit with the normal household waste.

8.3. POWER SUPPLY AND GROUNDING

- Any burner control equipment requires a ground system that provides a zero-voltage reference: the voltage measured from Neutral to all unpowered lines should be 0 volts.
- Run the ground wire in the same raceway as the hot and neutral from the main distribution service panel to burner control equipment and ensure that all metal parts are connected to ground.
- The power transformer and distribution cables must be sized to handle the inrush currents of the solenoid valves and ignition transformer: the voltage drop at the end of the line in the worst condition must be kept within 15% of nominal voltage.
- Typical 50/60Hz ground system has sufficient low-impedance at nominal frequency to maintain all metal surfaces at the same ground reference. But, this same system could be unable to provide this at higher frequencies because of the increased impedance caused by the SKIN EFFECT. At high frequencies surfaces are working better than solid cables: connect all metal surfaces of the kiln to improve the performance of the ground at high frequencies.
- A common distribution network is better than several independent cables routed to each equipment. The ground wire within multicore cables is not enough to provide proper grounding.
- All ground wires must be routed to a single ground point (star connection). The same should be made inside the equipment: route all ground wires to the ground screw on the equipment base, then a single ground pigtail should be provided between the ground screw on the equipment base and the equipment terminal board.
- All the equipment must be connected to a single point ground, using different ground connections could present a safety hazard.
- The earth ground wire must be capable of conducting high inrush and short circuit currents: an AWG13 / $2,5mm^2$ copper conductor is adequate but AWG11/$4mm^2$ and wide straps or brackets are preferred.
- The ground path impedance must be less than 1 ohm. For a ground path to be low impedance at RF frequencies, the connection must be made with minimum length conductors having maximum surface areas. Since the ground is the return path for the ignition spark, this rule must be observed for the connection to burner heads (especially when electronic transformers are used).
- All ground connections should be free of non-conducting coatings and protected against rust.
- Utilizing conduit as an exclusive means of providing a ground must be avoided.
- Do not run high voltage ignition transformer wires in the same conduit with other wiring.
- Ensure the frame of the ignition transformer is securely connected to control panel frame and/or the burner frame. It is best to have the equipment, the ignition transformer and the burner on the same metal surface.
- When the ignition transformer is introducing excessive electromagnetic interferences (E/J errors) an additional transient suppressing device and/or filter could be installed from hot and neutral terminals of ignition transformer to ground.
- Periodically, the spark electrode should be inspected for proper gapping and cracked ceramics. Problems at high temperature may arise from electrode bending or ceramic degradation. An electrode cannot be considered reliable flame detector when the temperature is above 1000/1200 °C (1800/2200°F).
- Inspect neatness of wiring in junction boxes and cabinets. It is best to have connections short and direct. Avoid bunching-up and tying-off wires. Also, connections should be periodically inspected for tightness and corrosion.
- Care must be taken not to route the control and communication cables in close proximity to any starter motor contactors located in the control panel or across any high voltage ignition wires.
- The use of a small busbar trunking system improves reliability and simplifies the installation.

9. RESET

A reset action is supposed to be a clearly defined manual action.

An automatic reset is not allowed by EN 13611:2019.

When manual action is initiated from remote, without being within the visible sight of the appliance:

- actual status and relevant information of the process shall be visible to the user,
- Q2 limits the maximum number of resets to 5 actions within a span of 15 minutes.

There will be a lockout (which can only be reset by a local button) when this limit is exceeded.

10. IGNITOR

For direct spark ignition, an ignition transformer is required.

You may use either of the following types with Q2:

- traditional inductive working at power supply frequency
  TRE820PISO – 8 kV, 20mA, 19% duty cycle

- electronic working at high frequency to save space and weight
  TRK2 – 15 kV, 30mA, 33% duty cycle

Provide reliable connection between burner frame and internal ground bar or one of the external ground screws of the device, recommended wire gauge > 4 mm2.

Use unshielded high voltage cables keeping them as short as possible, avoiding loops, and keep all other cables as far apart as possible.

For applications involving frequent activations, the installation of an RC snubber (0.1μF - 100 Ω - 1/2 W - 600 VAC) in parallel with the load (between terminals 07 and 08) is recommended in order to extend the life of the relay contact.

Duty cycle

The duty cycle indicates for how long the ignition transformer can operate within 180 s.

$$Max\ operating\ time = Duty\ cycle\ [\%] \times 180\ s\ /\ 100\%$$

Considering 19% duty cycle of TRE820, the maximum operating time is 34 s within 3 minutes.
This means a maximum of two (2) ignition attempts, each with five (5) second duration are allowed per minute to avoid damages.

Considering 33% duty cycle of TRK2, the maximum operating time is 60 s within 3 minutes.
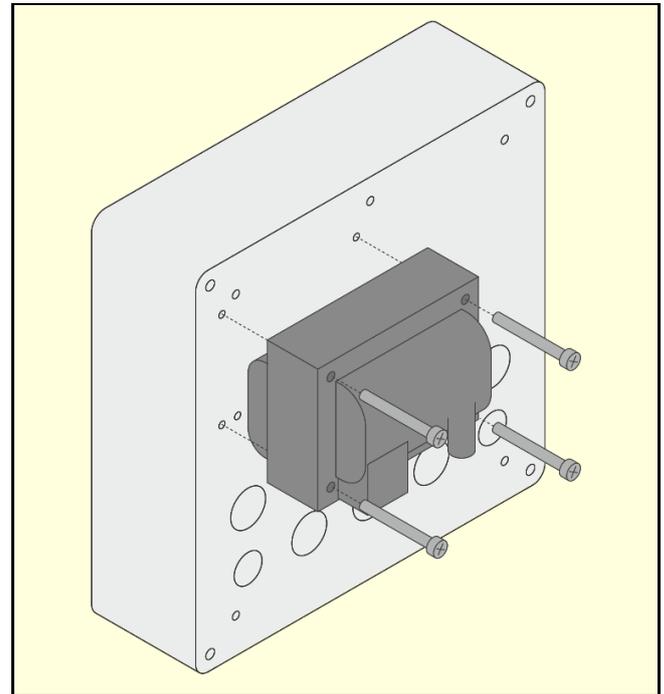This means a maximum of four (4) ignition attempts, each with five (5) second duration are allowed per minute to avoid damages.
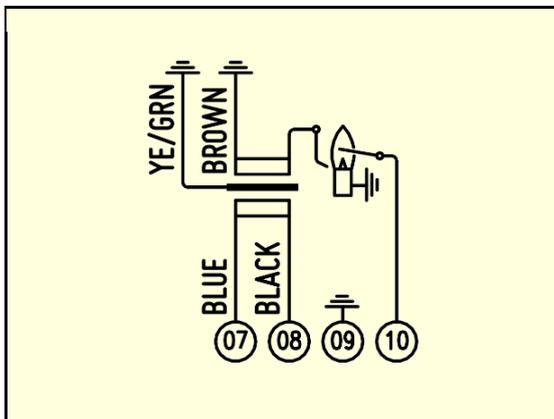
10.1. STANDARD IGNITOR

Traditional inductive ignition transformer working at power supply frequency
TRE820PISO – 8 kV, 20mA, 19% duty cycle
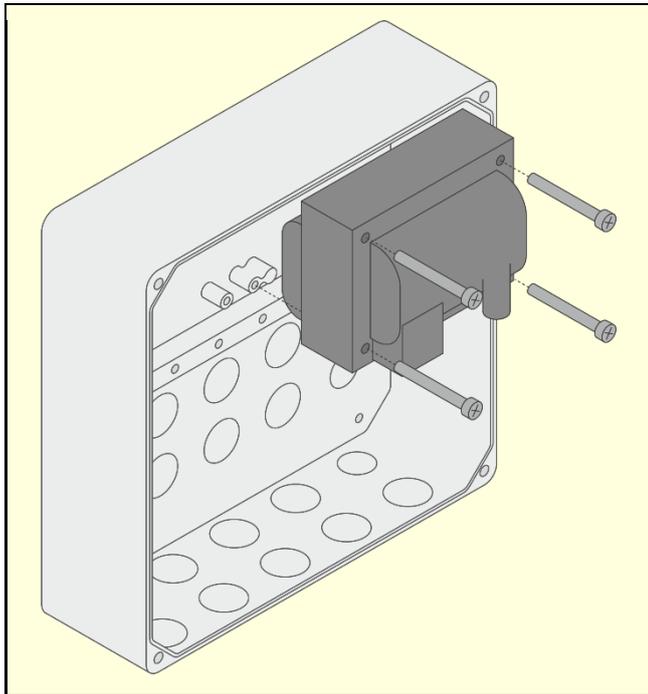
TRE820PISO inside
4 PARKER SCREWS 4,2 x 32 mm

TRE820PISO on back side
4 PARKER SCREWS 4,2 x 45 mm

2 independent electrodes

The high voltage creates a spark between the ignition electrode and burner ground.

The flame current flows from the dedicated electrode into the control unit.

BLUE WIRE	NEUTRAL	CONNECT TO TERMINAL 07
BLACK WIRE	PHASE	CONNECT TO TERMINAL 08
YELLOW GREEN	GROUND	CONNECT TO GROUND
BROWN WIRE	HV RETURN	CONNECT TO GROUND
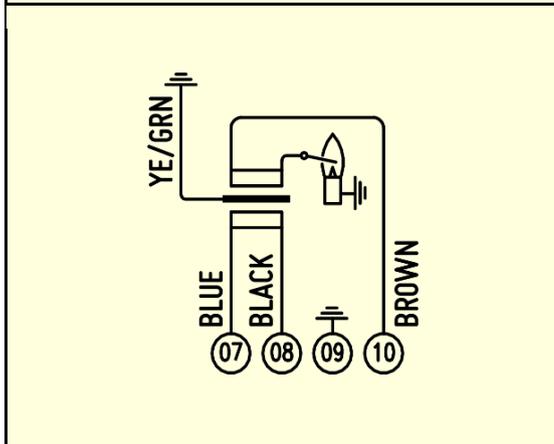
1 shared electrode

A single electrode used for both ignition and flame detection.

Electrode switched to ground during the ignition. The flame current flows from the electrode through the secondary winding into the control unit.
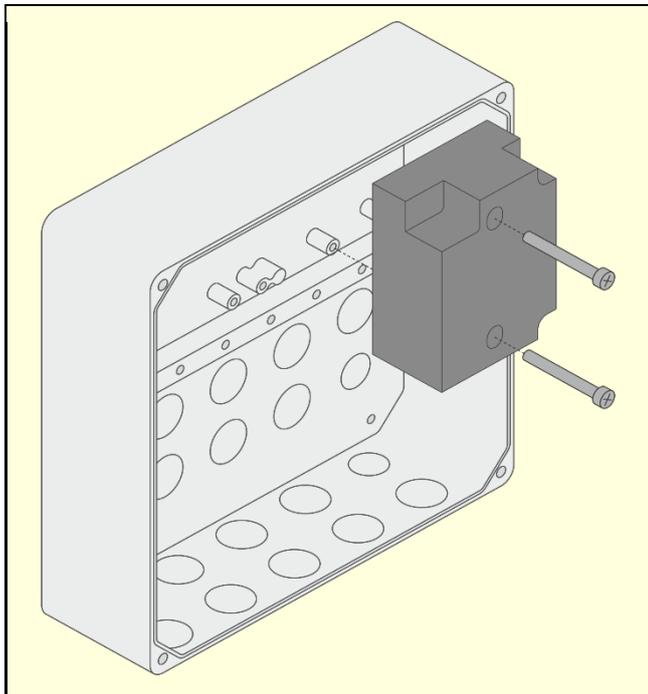
BLUE WIRE	NEUTRAL	CONNECT TO TERMINAL 07
BLACK WIRE	PHASE	CONNECT TO TERMINAL 08
YELLOW GREEN	GROUND	CONNECT TO GROUND
BROWN WIRE	HV RETURN	CONNECT TO TERMINAL 10

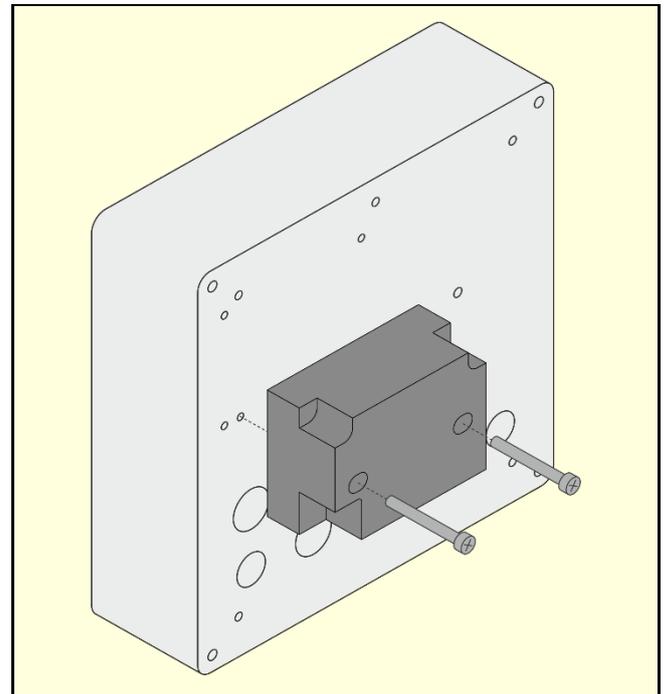THE LENGTH OF THE HIGH VOLTAGE CABLE MUST BE WITHIN 2 METERS

10.2. ELECTRONIC IGNITOR

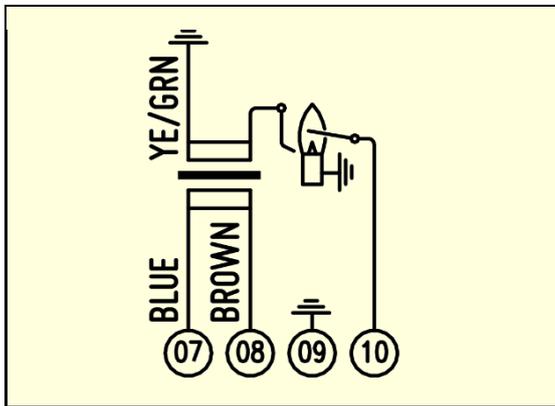Electronic ignition transformer working at high frequency to save space and weight

TRK2 – 15 kV, 30mA, 33% duty cycle

TRK2 inside
2 PARKER SCREWS 4,2 x 38 mm

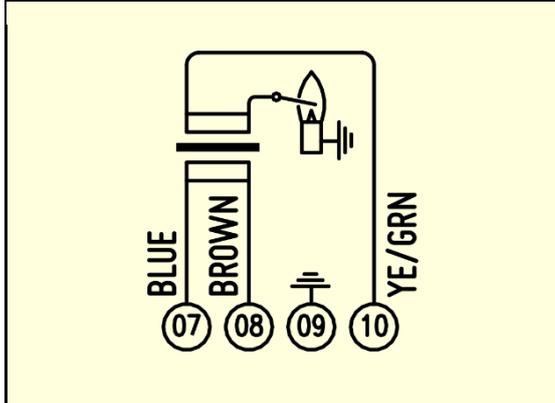**TRK2 on back side**
2 PARKER SCREWS 4,2 x 38 mm

2 independent electrodes

The high voltage creates a spark between the ignition electrode and burner ground.

The flame current flows from the dedicated electrode into the control unit.

```
BLUE WIRE      NEUTRAL     CONNECT TO TERMINAL 07
BLACK WIRE     PHASE       CONNECT TO TERMINAL 08
YELLOW GREEN   GROUND      CONNECT TO GROUND
```


1 shared electrode

A single electrode used for both ignition and flame detection.

Electrode switched to ground during the ignition. The flame current flows from the electrode through the secondary winding into the control unit.

```
BLUE WIRE      NEUTRAL     CONNECT TO TERMINAL 07
BLACK WIRE     PHASE       CONNECT TO TERMINAL 08
YELLOW GREEN   GROUND      CONNECT TO TERMINAL 10
```

THE LENGTH OF THE HIGH VOLTAGE CABLE MUST BE WITHIN 2 METERS

11. FLAME SUPERVISION

The device supplies an isolated voltage of about 230V$_{AC}$ to power the sensors which, in the event of flame presence, produce a rectified current up to 60 µA.

The signal is cancelled in the event of a short circuit or reversed polarity.

The bar graph shows the intensity of the flame signal as a percentage value up to 100% according to what is selected in the configuration (parameter G06):

- The lower signal of the two inputs
- The signal measured at input 1
- The signal measured at input 2
- The higher of the two signals
- The average of the signals measured on the two inputs

Typically, phototubes produce higher signals than electrodes, but here the display is adapted to have uniform views.

For multi-stage burners, different flame monitoring solutions can be adopted depending on the pilot burner behavior:

11.1.   ALTERNATING PILOT

An alternating pilot is extinguished at the end of the second safety time.

Since the two flames are present at the same time only during the 2nd safety time, surveillance is allowed with a single sensor capable of detecting both, or with two sensors connected to the same input.

11.2.   PERMANENT PILOT

It means the pilot burner remains operative and will be shut off simultaneously with the main flame.

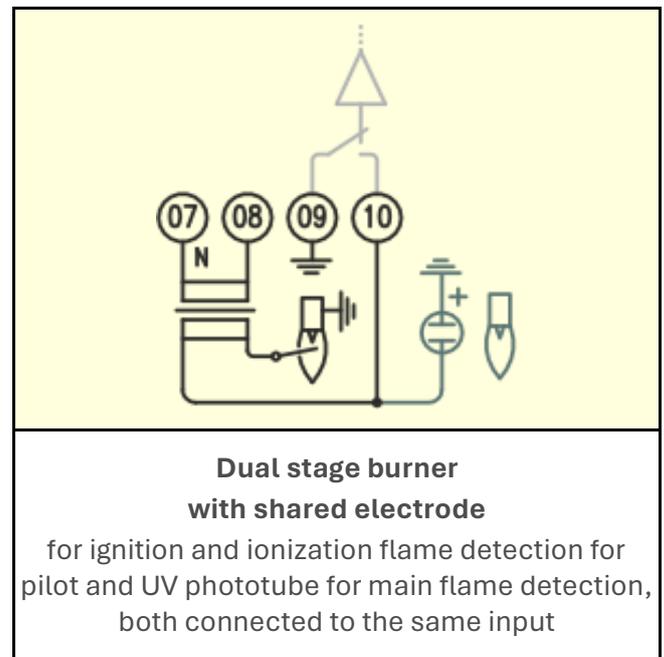In this case the two flames must be monitored independently, you need to use both flame input 1 and flame input 2 (EN 13577-2 § 4.10.1).
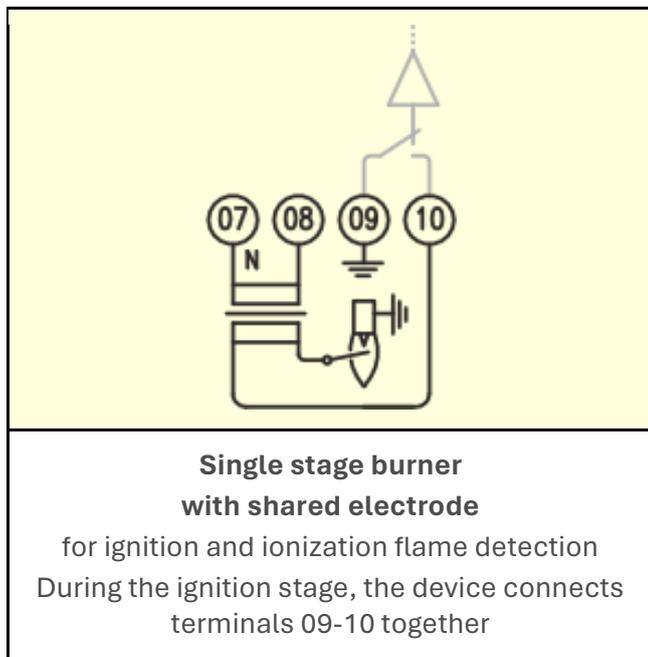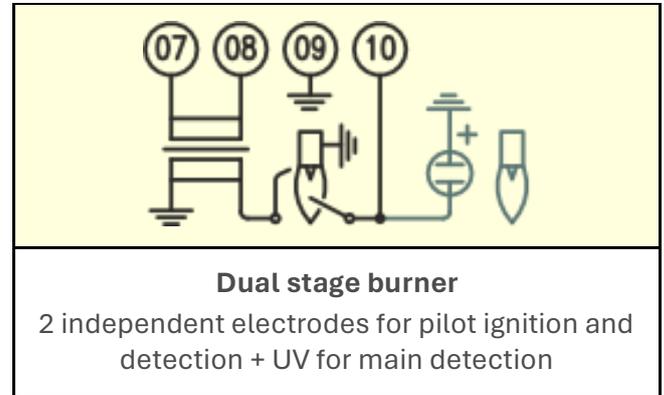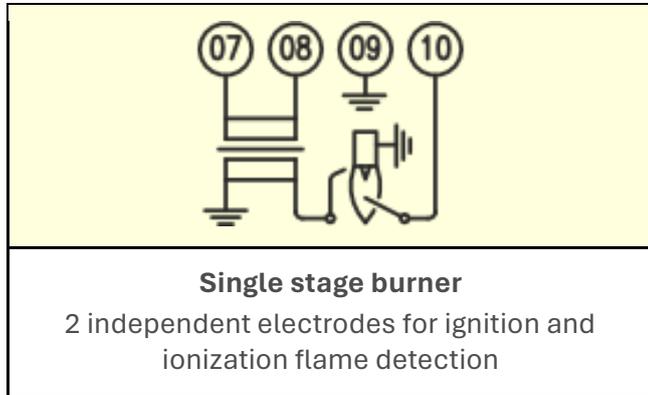
For systems where the pilot burner remains in use during main burner operation, a separate flame detector device to supervise the pilot and main flames shall be fitted.

The main flame detector device shall be so positioned that it cannot in any circumstances detect the pilot flame.
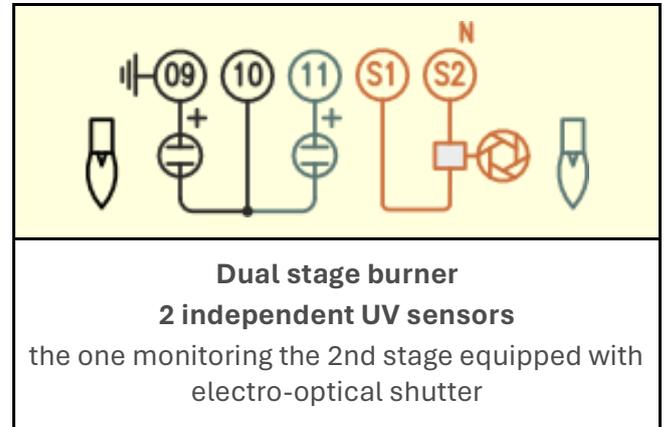
11.3. FLAME SENSOR 1

Both UV phototubes and ionization electrodes (also shared with the ignition) can be connected to this flame input 1.

The use of a single shared electrode is not possible when the ignitor is activated during prepurge, post-combustion or post-purge.

Single stage burner

2 independent electrodes for ignition and ionization flame detection

Dual stage burner

2 independent electrodes for pilot ignition and detection + UV for main detection

Single stage burner
with shared electrode

for ignition and ionization flame detection
During the ignition stage, the device connects terminals 09-10 together

Dual stage burner
with shared electrode

for ignition and ionization flame detection for pilot and UV phototube for main flame detection, both connected to the same input

11.4. FLAME SENSOR 2

Some versions have a second input for independent flame monitoring which can only be done with a UV phototube. While the first input is usually used to detect the flame in direct ignition burners or pilot burners, this second input is intended to detect the flame of an additional burner stage.

UV sensor
connected to the 2nd flame input
equipped with electro-optical shutter for permanent operation

Dual stage burner
2 independent UV sensors
the one monitoring the 2nd stage equipped with electro-optical shutter
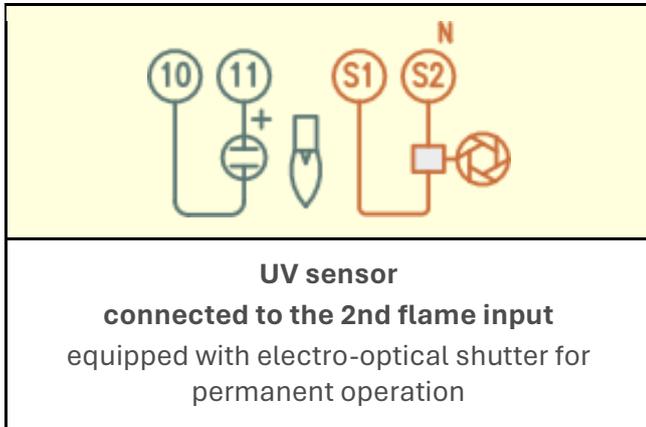
11.5. UV SENSORS

The UV1 and UV4H sensors can be used for flame detection when the burner is intended for non-permanent use, i.e. when a shutdown is expected within 24 hours of operation.

The UV8 sensor incorporating an electro-optical shutter - controlled by Q2 - can be used for applications intended for permanent operation.

Both devices use a phototube that triggers an ionization process when hit by electromagnetic radiation: the electrons emitted by the negative electrode are captured by the positive electrode, producing a current flow.
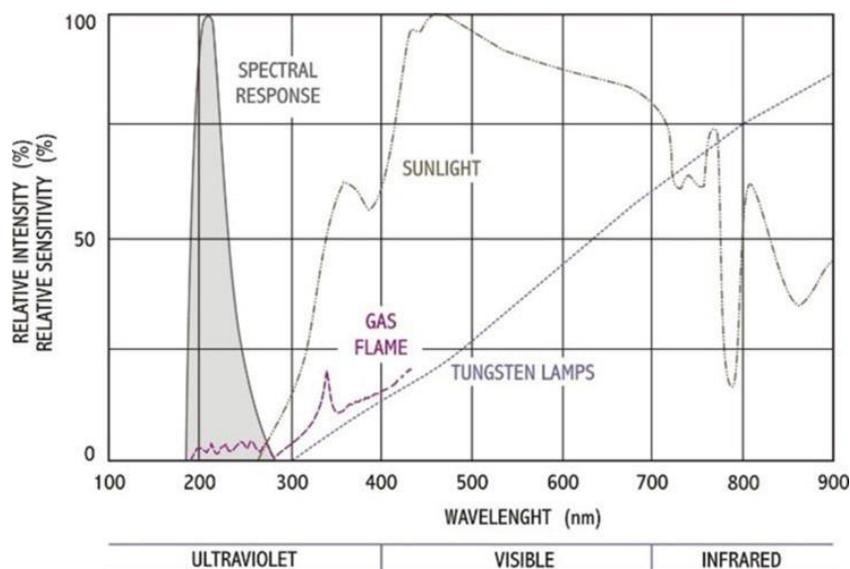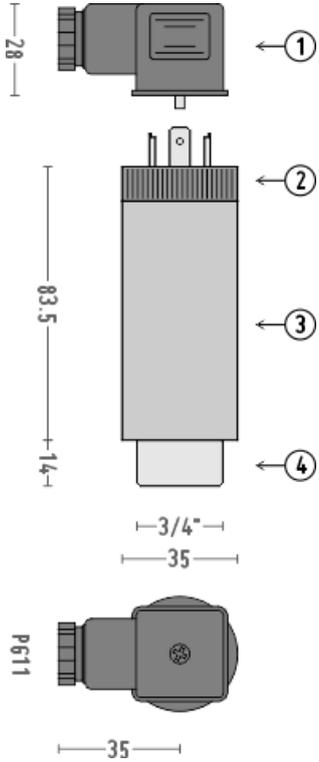

Sensitivity shows no response in the visible region and is limited to a very narrow band of the ultraviolet spectrum typical of radiation by gas and oil flames.
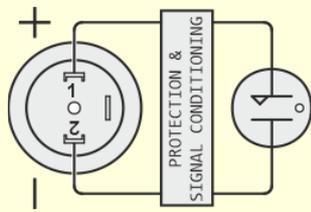
11.6.   UV1

UV FLAME DETECTOR

INTERNAL QUARTZ GLASS PROTECTION
TRANSMITTANCE > 92% @ 190 nm
WITH MINERAL FIBER SEALING GASKET

1.   DIN43650 - ISO4400 CONNECTOR
2 POLES + EARTH - PG11

2.   DIN43650 - ISO4400 SOCKET
2 POLES + EARTH

3.   EPOXY GLASS BODY
GRAY POLYESTER COATING

4.   3/4" BURNER HEAD CONNECTION
NICKEL PLATED BRASS

1 UV SENSOR POSITIVE   CONNECT TO TERMINAL 09/11
2 UV SENSOR NEGATIVE   CONNECT TO TERMINAL 10

CLASS II DEVICE
CONNECTION TO GROUND NOT REQUIRED

11.7.   UV4H

UV FLAME DETECTOR – SUITABLE FOR HYDROGEN FLAME MONITORING

INTERNAL QUARTZ GLASS PROTECTION
TRANSMITTANCE > 92% @ 190 nm
WITH MINERAL FIBER SEALING GASKET

1.   DIN43650 - ISO4400 CONNECTOR
2 POLES + EARTH - PG11

2.   DIN43650 - ISO4400 SOCKET
2 POLES + EARTH

3.   EPOXY GLASS BODY
GRAY POLYESTER COATING

4.   3/4" BURNER HEAD CONNECTION
NICKEL PLATED BRASS

1 UV SENSOR POSITIVE   CONNECT TO TERMINAL 09/11
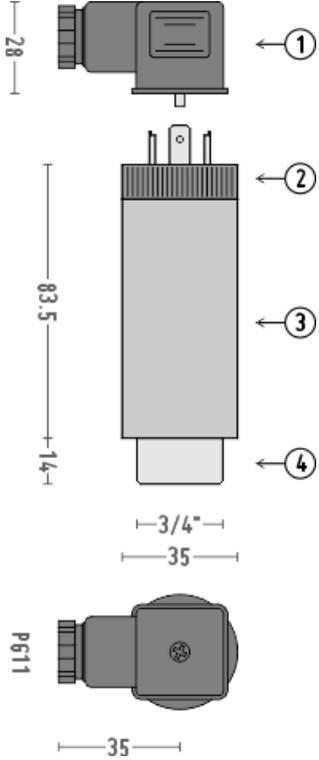2 UV SENSOR NEGATIVE   CONNECT TO TERMINAL 10

CLASS II DEVICE
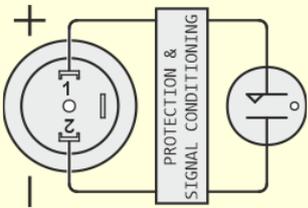CONNECTION TO GROUND NOT REQUIRED

11.8. UV8

UV FLAME DETECTOR – WITH EMBEDDED OPTICAL SHUTTER

INTERNAL QUARTZ GLASS PROTECTION
TRANSMITTANCE > 92% @ 190 nm
WITH MINERAL FIBER SEALING GASKET

1. FEMALE CONNECTOR SIDE ENTRY
    4 POLES+ EARTH

2. MALE SOCKET WITH LEVER
    4 POLES + EARTH - PG11

3. ALUMINIUM BODY
    GRAY POLYESTER COATING

4. EPOXY GLASS INSULATOR
    GRAY POLYESTER COATING

5. 3/4" BURNER HEAD CONNECTION
    NICKEL PLATED BRASS

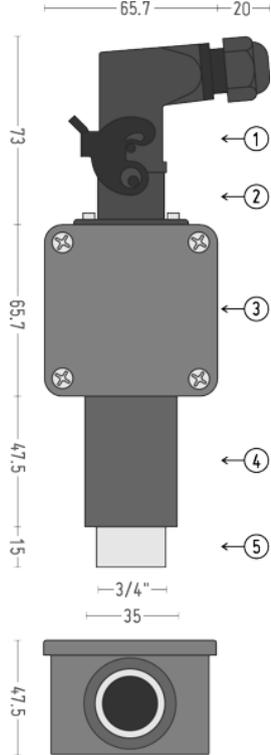| 1 UV SENSOR POSITIVE | CONNECT TO TERMINAL 09/11 |
2 UV SENSOR NEGATIVE	CONNECT TO TERMINAL 10
3 UV SHUTTER SUPPLY	CONNECT TO TERMINAL S1
4 UV SHUTTER SUPPLY	CONNECT TO TERMINAL S2

CONNECTION TO GROUND IS REQUIRED

11.9. PERMANENT OPERATION

When a burner remains operative consecutively for more than 24 hours without shutdown, the flame monitoring system must be suitable for permanent operation according to the provisions of EN298 § 7.101.4.1.2.

Q2 performs continuous self-tests of the flame monitoring circuitry and a periodic check on sensors and is suitable for permanent operation.

There are no additional requirements for sensing flame with ionization electrodes, according to the provisions of EN298 7.101.4.1.3

For permanent operation of UV phototubes an electro-optical shutter wired at terminals S1-S2 is required, according to the provisions of EN298 § 7.101.4.1.5 and § 7.101.4.1.2.

Parameter G07 allows you to activate this function for one or both sensors.

Alternatively, it is possible to use both flame inputs - each with its own independent UV sensor - to monitor the same flame, in this case permanent operation with signal redundancy is obtained.

If the pilot burner flame is monitored via UV, but is only active during main burner ignition or for a period of less than 24 hours, a pilot flame monitoring shutter is not required, as it is not in permanent operation.

If the main burner flame is monitored via UV, but is active for less than 24 hours, a main flame monitoring shutter is not required, as it is not in permanent operation.

12. VALVE PROVING SYSTEM

By activating the valve proving system, it is possible to check for any leaks in one of the fuel solenoid valves, preventing the burner from starting.

This verification is required by the EN13577-2 and EN 676 standards for burners with capacities greater than 1200 kW and by NFPA 86 for burners with capacities greater than 117 kW (or 400,000 BTU/hour).

The tightness of the pipework and the fuel solenoid valves can be performed:

- at burner start (before the pre-purge)
- after a controlled shutdown, lockout or failure (before post-purge)
- both, before the startup and after the shutdown of the burner.
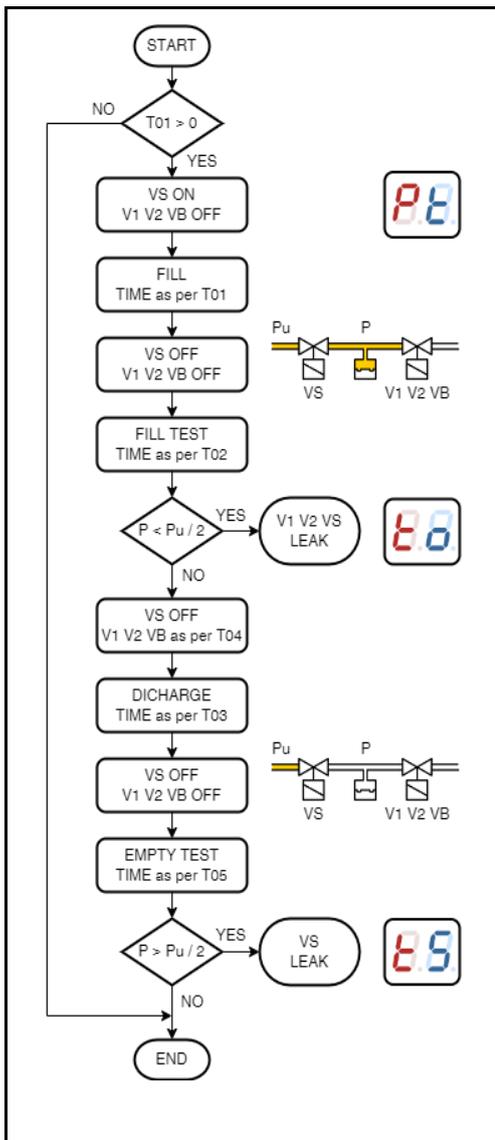
Before start-up

The fuel pressure switch is set at half the inlet pressure.

The safety valve is opened for the time set in parameter **T01**, by setting SKIP TEST no leakage test will be performed.
During this time the fuel fills the test volume, after which the safety valve is released and the test volume remains sealed full.

The test volume remains sealed full for the time set with parameter **T02**. A possible leak of the outlet valves will cause the emptying of the test volume with intervention of the fuel pressure switch and consequent lockout.

If the fuel pressure switch does not trip, the downstream valve(s) and pipework have passed the leak test.

Parameter **T04** defines which valves will be activated for fuel discharge into the combustion chamber or for venting into the atmosphere. These valves will be activated for the time set by parameter **T03**.

The test volume remains sealed without fuel for the time set with parameter **T05**. A possible leak of the upstream valve would lead to the filling of the test volume with intervention of the pressure switch and consequent lockout.

If the pressure switch does not trip, the upstream valve has passed the leak test.

After shutdown

The pressure switch is set at half the inlet pressure.

The safety valve is opened for the time set in parameter **T11**, by setting SKIP TEST no leakage test will be performed.

During this time the fuel fills the test volume, after which the safety valve is released and the test volume remains sealed full.
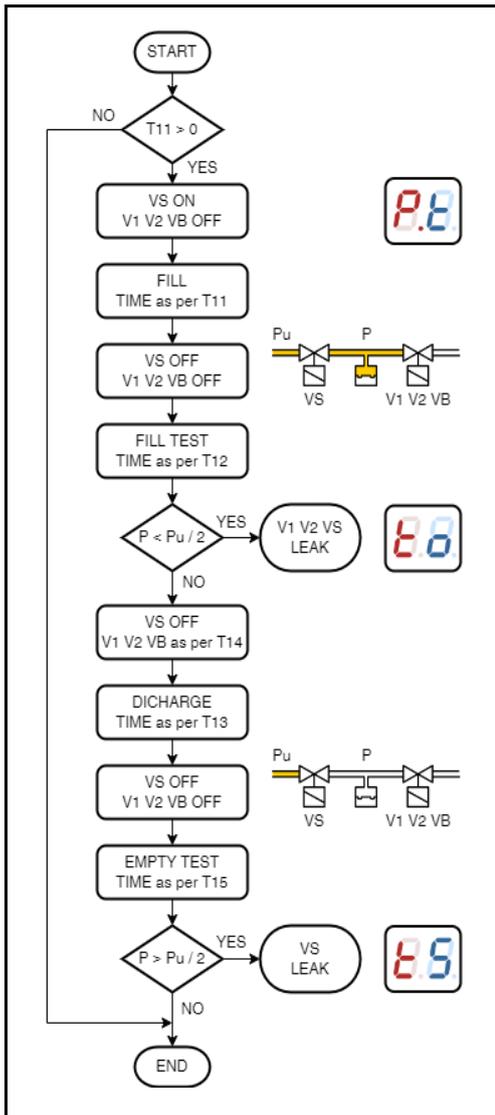
The test volume remains sealed full for the time set with parameter **T12**. A possible leak of the outlet valves will cause the emptying of the test volume with intervention of the pressure switch and consequent lockout.

If the fuel pressure switch does not trip, the downstream valve(s) and pipework have passed the leak test.

Parameter **T14** defines which valves will be activated for fuel discharge into the combustion chamber or for venting into the atmosphere. These valves will be activated for the time set by parameter **T13**.

The test volume remains sealed without fuel for the time set with parameter **T15**. A possible leak of the upstream valve would lead to the filling of the test volume with intervention of the pressure switch and consequent lockout.

If the pressure switch does not trip, the upstream valve has passed the leak test.

12.1. LEAKAGE RATE

According the EN 1643 standard the system shall prevent the opening of the valves when the leakage rate exceeds 0,1% of the burner heat input, starting over 50 dm^3/h.

Recommended max leakage ≤ 200 dm^3/h
Example:　　With a burner capacity of 100 m^3/h, the maximum leakage rate is 100 dm3/h.

If the burner capacity is 30 m^3/h, the maximum leakage rate would be 50 dm^3/h.

The effective leakage rate in dm^3/h is given from the following equation (EN 13611):

$$q_L = \frac{(3600 \cdot \Delta P_T \cdot V_T)}{(P_{ATM} \cdot t_p)}$$

From the above equation we can derive the duration of the fill test and empty test periods required to detect the maximum permissible leakage

$$t_p = \frac{(3600 \cdot \Delta P_T \cdot V_T)}{(P_{ATM} \cdot q_L)}$$

The total duration of the test is　　　*2 · to + 2 · tp*

Pu	inlet pressure
Q	max flow rate (total burner capacity) [m^3/h]
q_L	leakage rate (0,1% of total burner capacity = 0.001 $\cdot$ Q)
ΔPT	difference between inlet pressure and final test pressure [mbar] equal to 0,5 Pu (fuel pressure switch setting)
VT	test volume [dm^3] [liters]
P_{ATM}	atmospheric pressure [mbar] = 1013 mbar
t_P	test periods [s] T03 T05 T12 T15 (recommended 25s)
t_o	dis/charge times [s] T01 T04 T11 T13 (recommended 5s)

Test volume

Test volume VT consists of inner volume of outlet chamber of upstream valve + inlet chamber of all downstream valves + pipework volume. The table shows the internal volumes of the valves[1] and the volume for each meter of pipe referred to different nominal diameters.

[1] The data refer to valves manufactured by Delta Elektrogas, the correct data must be obtained from the documentation of the valve manufacturer.

Nominal Diameter	Valve volume [dm^3]	Pipe volume [dm^3/m]
DN10	0.07	0.1
DN15	0.07	0.2
DN20	0.12	0.3
DN25	0.12	0.5
DN32	0.47	0.8
DN40	0.47	1.3
DN50	0.62	2.0
DN65	2.60	3.3
DN80	2.60	5.0
DN100	5.00	7.9
DN125	17.20	12.3
DN150	17.20	17.7

Example

2	valves DN50	= 0,62 dm^3	upstream outlet chamber + downstream inlet chamber
1m	pipework	= 2.0 dm^3	
Pu	inlet pressure	= 100 mbar	ΔPT = 0.5 Pu 0 = 50 mbar
Q	max flow rate	= 40 m^3/h	
q_L	leakage rate	= 0.001 Q = 40 dm^3/h	increased to minimum 50dm^3/h

$$V_T = 0,62 + 2 = 2,62 dm^3$$

$$t_p = \frac{3600 \cdot \Delta P_T \cdot V_T}{P_{ATM} \cdot q_L} = \frac{3600 \cdot 50 \cdot 2,62}{1013 \cdot 50} = 9,3s$$

Set 10 seconds for fill and empty test periods (T03 T05 T12 T15) and pressure switch threshold at 50 mbar.

The Q2 device simplifies installation by integrating both leakage control and minimum pressure detection into a single pressure switch. If you wish to set the pressure switch to a value other than $0,5 \cdot Pu$ for minimum pressure intervention, you simply need to differentiate the test times:

- **T02 / T12:** test times for the downstream valve(s).
- **T05 / T15:** test times for the upstream valve.

The following coefficients should be applied to compensate for variations in the pressure switch intervention threshold:

Pressure switch setting	Test time downstream T02 / T12	Test time upstream T05 / T15
20%	160%	40%
30%	140%	60%
40%	120%	80%
50%	**100%**	**100%**
60%	80%	120%
70%	60%	140%
80%	40%	160%

Times are expressed as percentages relative to the reference time for a standard 50% calibration.

Practical Example

If previous calculations resulted in 10 seconds with Pu = 200 mbar:

- Setting the intervention point to **100 mbar** (**50%**):
    - T02/T12 = **10** seconds (downstream test)
    - T05/T15 = **10** seconds (upstream test)

- Setting the intervention point to **60 mbar** (**30%**):
    - T02/T12 = **14** seconds (downstream test)
    - T05/T15 = **6** seconds (upstream test)

- Setting the intervention point to **140 mbar** (**70%**):
    - T02/T12 = **6** seconds (downstream test)
   - T05/T15 = **14** seconds (upstream test)

The total test time (excluding filling and emptying phases) always remains 20 seconds.

Notes:
- the upward tripping point of a pressure switch is slightly different from the downward one.
- minimum time that can be set in Q2 is 5 seconds.
- a utility for calculating test times is available in the **Q.Suite** software.

12.2.   LAYOUT

The test volume changes as the burner configuration changes.
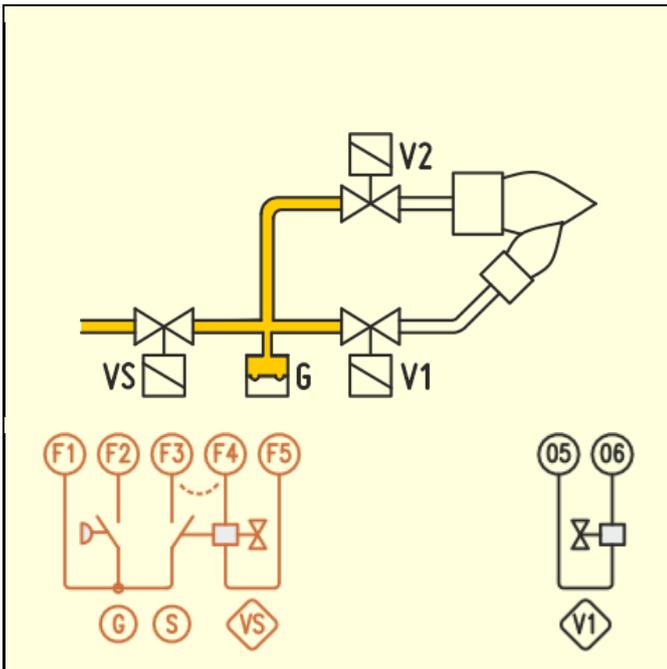Here are 4 typical applications.
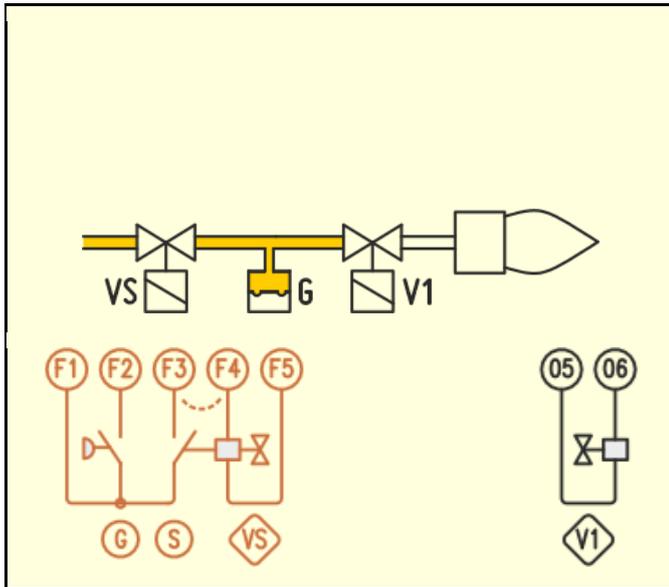
Single stage burner

In addition to the safety valve, there is only 1 fuel valve. The test is carried out for these two valves and the connecting pipework, the discharge takes place directly in the combustion chamber.

If the safety valve does not have the proof of closure limit switch **S**, a jumper must be made between terminals F3-F4.
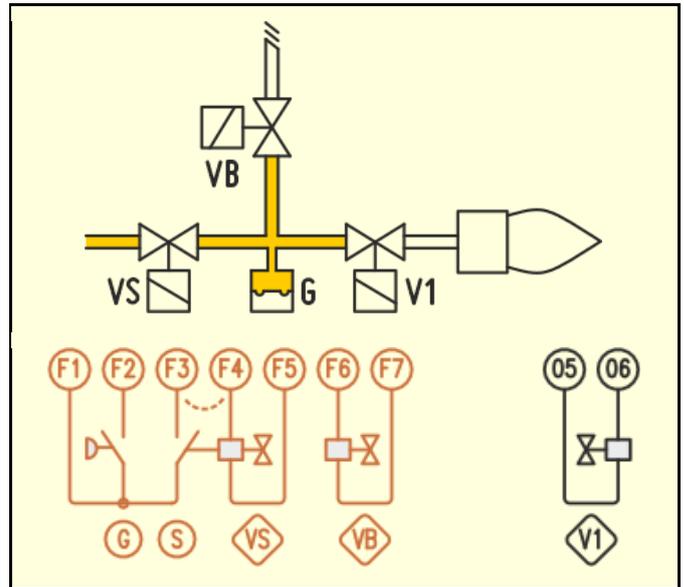
Single stage burner + exhaust

In addition to the safety valve, there is a fuel valve and a valve used for venting into the atmosphere. Testing is done for these valves and the connecting pipework.

If the safety valve does not have the proof of closure limit switch **S**, a jumper must be made between terminals F3-F4.

Dual stage burner

In addition to the safety valve, there are 2 fuel valves. The test is carried out for these two valves and the connecting pipework, the discharge takes place directly in the combustion chamber.

If the safety valve does not have the proof of closure limit switch **S**, a jumper must be made between terminals F3-F4.
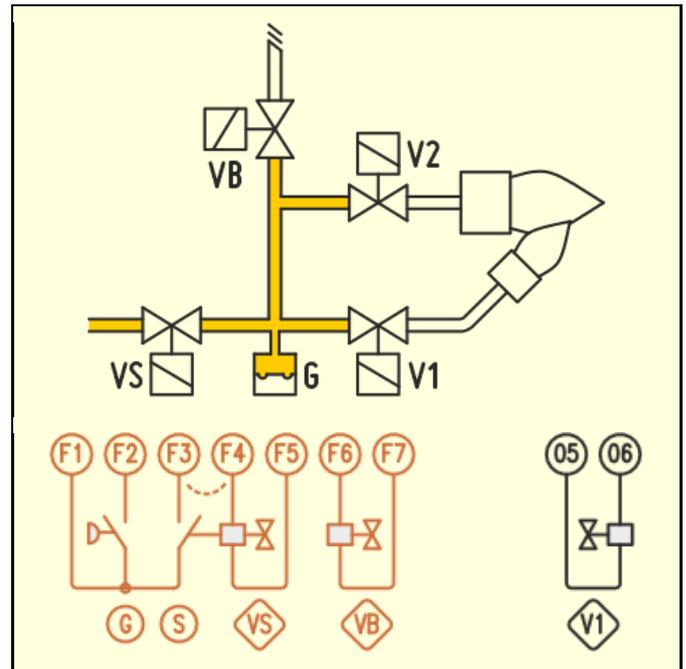

Dual stage burner + exhaust

In addition to the safety valve, there are 2 fuel valves and a valve used for venting into the atmosphere. Testing is done for these valves and the connecting pipework.

If the safety valve does not have the proof of closure limit switch **S**, a jumper must be made between terminals F3-F4.

12.3. PROOF OF CLOSURE

For applications subject to NFPA 85 (Hazard Code for Boilers and Combustion Systems) and NFPA 86 (Standard for Ovens and Furnaces) and for applications described in EN13577-2 § 4.3.6 compliant with ISO 13577-4.

This feature is known by several names:

- Proof of Closure (POC)
- Closed Position Indicator (CPI)
- Fuel valve end switch (FVES)

Parameter G09 allows you to define the maximum time within which the activation or deactivation of the VS valve (terminal F4) must be confirmed by the limit switch placed on the valve itself (terminal F3).

If the status is inconsistent, the device performs a specific failure lockout.

Connect the F3-F4 terminals together when the VS valve is not equipped with the limit switch **S**.
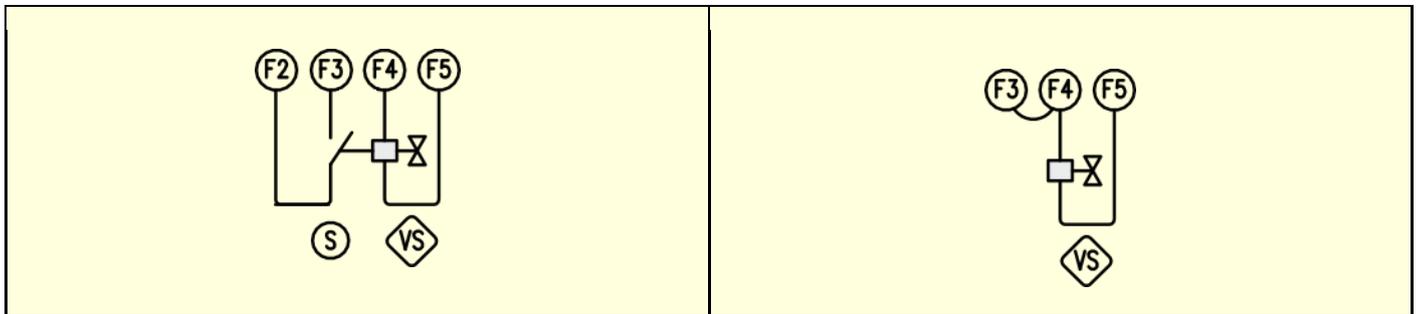
WITH
PROOF OF CLOSURE LIMIT SWITCH

WITHOUT
PROOF OF CLOSURE LIMIT SWITCH

13. FUEL PRESSURE SWITCHES

The minimum fuel pressure switch is connected to terminals F1-F2.

This single minimum pressure switch is also used by the valves proving function, if enabled.

This means that the minimum pressure intervention will take place at 1/2 of the nominal pressure, because this is the setting required for the correct operation of the tightness control.

	If there is a pressure switch that detects excessive fuel pressure (EN 13577-2 § 4.3.5), it will be connected in series as shown in the figure.

The monitoring of the gas pressure switch can be disabled or enabled in each stage (EN 13577-2 § 4.3.4 and § 4.3.5), also setting the response time to compensate for delays in the formation of the correct pressure or unwanted interventions due to vibrations or other accidental phenomena.

13.1. POSITIONING

Standard EN ISO 13577-2 § 4.3.4 and § 4.3.5 requires that gas pressure switches ensure reliable pressure detection without prescribing a specific positioning relative to the valves.
The Q2 device features the pressure switch downstream of the main safety valve and upstream of the burner valves, ensuring:

- Simplified installation
- Enhanced safety through continuous cross-check between valve status and pressure switch feedback

This configuration is fully compliant with the requirements of standard ISO 13577-4:2022.

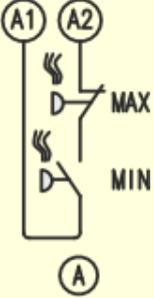|	The pressure switch that detects the minimum gas pressure must always be installed downstream of the VS valve.

13.2. WAIT BEFORE IGNITION

This input can also temporarily suspend the cycle while waiting for an external signal.

	For example, if the actuator is controlled externally, it is essential to wait for it to reach the required closed position before proceeding with ignition (**I** contact). The FUEL PRESSURE RESPONSE TIME must be set to a value greater than the time required for the actuator to travel.
	If pressure switches are present, they will be connected in series. The **I** contact must be kept closed in all phases in which the air pressure switch check is active.

14. AIR PRESSURE SWITCHES

The minimum air pressure switch is connected to terminals A1-A2.

If there is a pressure switch that detects excessive air pressure, it will be connected in series as shown in the figure.

The monitoring of the air pressure switch can be disabled or enabled in each stage (EN 13577-2 § 4.6.2 / NFPA 86 § 8.6.6), also setting the response time to compensate for delays in the formation of the correct pressure or unwanted interventions due to vibrations or other accidental phenomena.
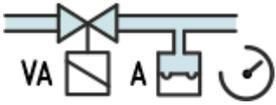
The pressure switch that detects the minimum air pressure must always be installed downstream of the VA valve.

VFD controlled motor - NFPA 86 compliance

According to NFPA 86 § 8.6.3, variable frequency drives (VFDs) that control blowers required for combustion must be interlocked in the burner management system: an auxiliary contact from the starter must be wired in series with the air pressure switches to shut down in the event of a fault.

14.1.   WAIT BEFORE PREPURGE

This input can also temporarily suspend the cycle while waiting for an external signal.

For example, if the actuator is controlled externally, it is essential to wait for it to reach the required open position before proceeding with purge cycle (**P** contact).

The AIR PRESSURE RESPONSE TIME must be set to a value greater than the time required for the actuator to travel.

If pressure switches are present, they will be connected in series. The **P** contact must be kept closed in all phases in which the air pressure switch check is active.

15. ACTUATOR

A three-point actuator in combination with a butterfly valve can be connected for staged or modulating burner capacity control.

To detect any anomalies during operation, parameter **G01** is set with the maximum time required to cover the complete travel.

If the actuator power supply voltage is the same as that of the device and loads, take the power supply phase from terminal B6 by connecting it to terminal B5 and connect the actuator neutral to terminal B1.

If the actuator is powered separately, connect one end of the power supply to terminal B5 and the other end to the actuator neutral (common return).

Voltage will be present at terminal B2 when closing is requested.

Voltage will be present at terminal B3 when opening is requested.

Voltage at terminal B4 will only be present when the actuator is not moving and is not forced into the closed or open position.

This output can be used as consent for an optional external thermoregulator as shown in the figure.

When the actuator is not controlled by Q2, terminal B4 supplies voltage to external regulator (TIC) which can operate the contacts to request closing or opening.

15.1. LIMIT SWITCHES

In addition to the open and close outputs of the actuator, it is necessary to connect the limit switches which define:

- fully closed position to terminal B7
- fully open position to terminal B8
- common return to terminal B6

These contacts are internally powered at the same supply voltage used for the device and the loads.

Before starting the pre-purge and post-purge phases, it will be possible to force the complete opening of the actuator to guarantee the maximum flow of air, while before proceeding with burner ignition it will be possible to force the closed position.

15.2. POTENTIOMETER

If the actuator is equipped with a potentiometer, it will be possible to set predefined positions in each step of the program. A voltage of 5V is supplied to terminals P1 (negative) and P3 (positive) while the potentiometer feedback is connected to terminal P2.

The potentiometer can have a resistance value between 100 Ω and 10 kΩ.

0% and 100% are the positions of the closed and open limit switches respectively and within this range the actuator can be positioned simply by indicating the opening percentage. It is also possible to define arbitrary positions of the 1% and 99% limits in order to adapt the linear regulation range to specific needs.

Typical configuration: the limits of the actuator travel are between the position of the LO limit switches (0% which usually defines the minimum for ignition) and that of the HI limit switch (100% which defines the maximum for purge).
The travel from 1 to 99% develops entirely within the two limit switches.

The fully closed position set for the potentiometer (corresponding to 1%) is higher than the position of the LO limit switch, while the fully open position (99%) corresponds to that of the HI limit switch.
Useful when the minimum flow rate during operation (LO limit switch) can be reduced below the minimum required for the ignition (1% of the potentiometer).

The fully open position set for the potentiometer (corresponding to 99%) is lower than the position of the HI limit switch, while the fully closed position (1%) corresponds to that of the LO limit switch.
Useful when the flow rate during operation is reduced (99%) respect to the one set for prepurge (HI limit switch).

Both limit positions set for the potentiometer (1% and 99%) are different from the limits set by the limit switches (LO and HI).
Useful when the process requires that in particular conditions a minimum flow rate and a maximum flow rate outside the typical regulation range must be reached.

This makes it possible to create applications in which each operating phase can be associated with an actuator position both for capacity control or cooling operations:
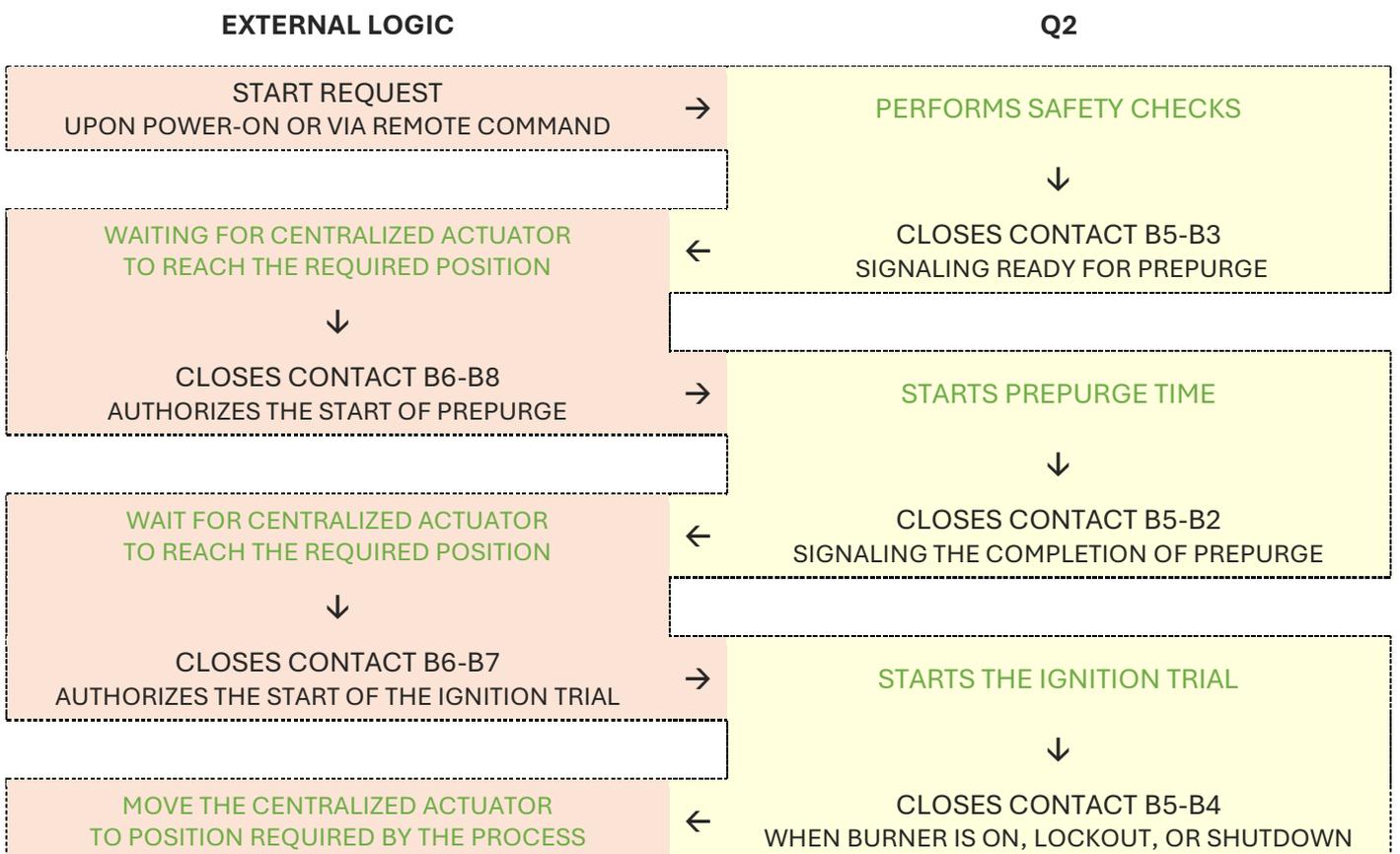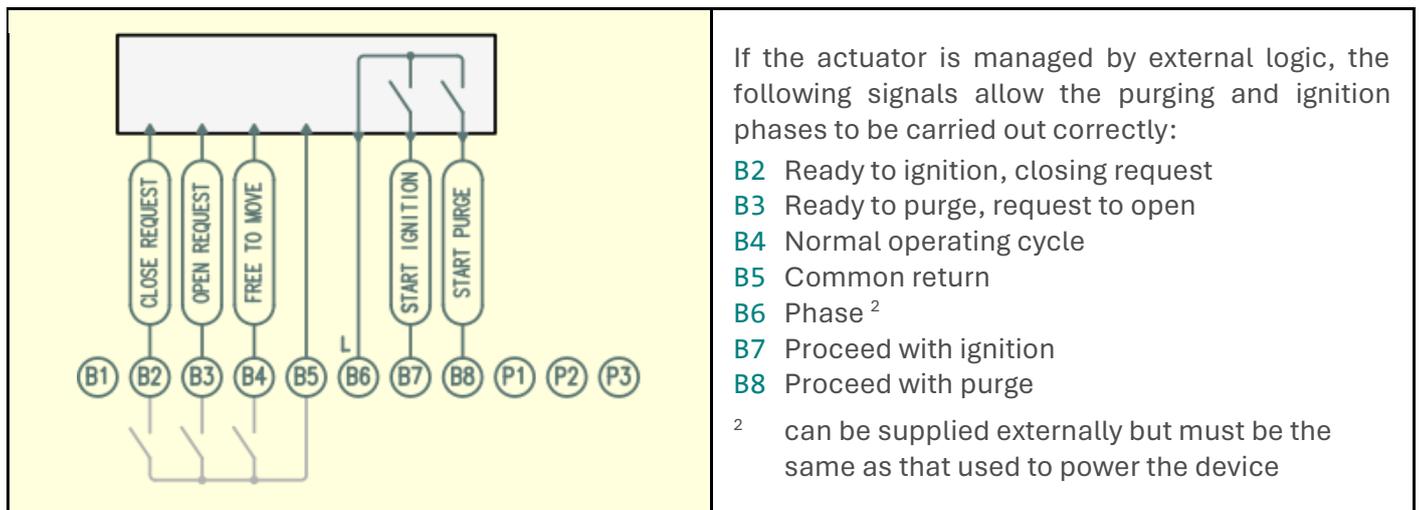
- Forced to 0% (position of close switch)
- At any position within defined limits 1% to 99% [1]
- Forced to 100% (position of open switch)

The limit switch activation point is defined by suitably positioning the servomotor cams.
The travel limits of the actuator can be set during the commissioning phase: the actuator is moved manually and when the required flow is reached, the position is stored.

[1] A different position can be requested at any time via a remote control (with the exception of the purging and ignition phases during which the 0% and 100% positions cannot be overridden).

15.3. CENTRALIZED ACTUATOR

If the actuator is managed by external logic, the following signals allow the purging and ignition phases to be carried out correctly:

B2 Ready to ignition, closing request
B3 Ready to purge, request to open
B4 Normal operating cycle
B5 Common return
B6 Phase [2]
B7 Proceed with ignition
B8 Proceed with purge

[2] can be supplied externally but must be the same as that used to power the device

| EXTERNAL LOGIC		Q2
START REQUEST UPON POWER-ON OR VIA REMOTE COMMAND	→	PERFORMS SAFETY CHECKS
		↓
WAITING FOR CENTRALIZED ACTUATOR TO REACH THE REQUIRED POSITION	←	CLOSES CONTACT B5-B3 SIGNALING READY FOR PREPURGE
↓		
CLOSES CONTACT B6-B8 AUTHORIZES THE START OF PREPURGE	→	STARTS PREPURGE TIME
		↓
WAIT FOR CENTRALIZED ACTUATOR TO REACH THE REQUIRED POSITION	←	CLOSES CONTACT B5-B2 SIGNALING THE COMPLETION OF PREPURGE
↓		
CLOSES CONTACT B6-B7 AUTHORIZES THE START OF THE IGNITION TRIAL	→	STARTS THE IGNITION TRIAL
		↓
MOVE THE CENTRALIZED ACTUATOR TO POSITION REQUIRED BY THE PROCESS	←	CLOSES CONTACT B5-B4 WHEN BURNER IS ON, LOCKOUT, OR SHUTDOWN

16. GAS BURNERS

Gas burners utilize natural gas or liquefied petroleum gas (LPG) as fuel and offer clean combustion with precise flame control, low emissions and are suitable for high temperature applications.

This is the complete Q2 terminal block for gas burner application.
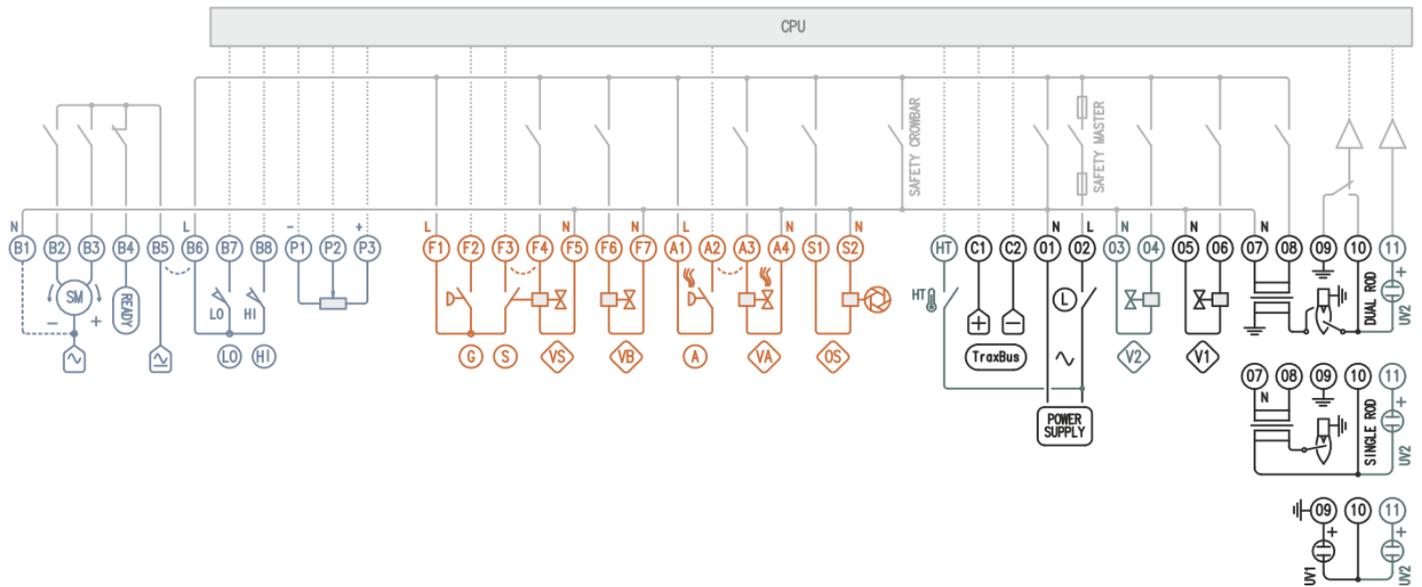
16.1. SINGLE STAGE – DIRECT IGNITION – ON/OFF

To turn on/off the burner you can act directly on the power supply of the device or with remote control.

Air simulation test is carried out before to activate the air output [VA], if enabled.

When the pressure switch A [1] detects the air pressure, the pre-purge time starts.

During the pre-purge, no gas pressure must be detected and the flame simulation test is carried out.

The fuel valve [V1] will only be activated if the behavior of the ignition device [IT] matches with the settings.

Flame detection by means of dedicated ionization electrode [2]. If a valid flame signal is detected within the programmed safety time, the valve is kept open: the burner is on.

If no flame is detected there will be a lockout. In accordance with EN 13577-2 and EN676, up to 3 further ignition attempts are allowed if safety is not impaired.

In the event of a flame, air or gas failure during operation, it is possible to set an immediate re-ignition, a complete recycle from the beginning or a lockout.
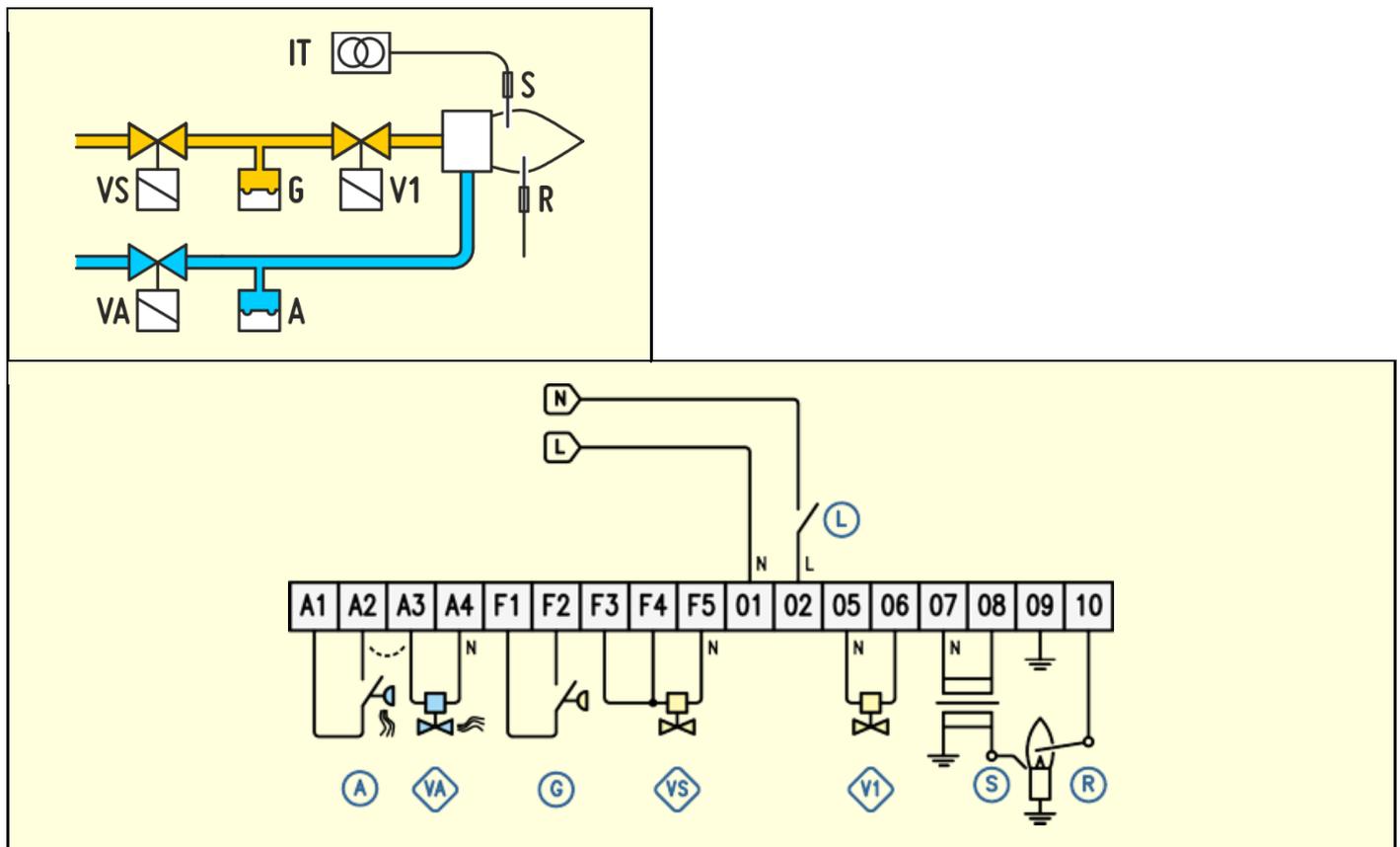
After a lockout or a shutdown request, a post-combustion time is allowed, possibly followed by post-purging.

Reset from lockout can be done via front push button or with a remote control.

To put the burner out of service (manual shutdown) press the button on the front panel during the operating cycle.

[1] If there is no air pressure switch, make a jumper between terminals A2-A3.

[2] Permanent operation guaranteed when flame detection is carried out with an electrode.

A	AIR PRESSURE SWITCH	L	OPTIONAL EXTERNAL LIMITS
VA	AIR VALVE	V1	FUEL VALVE
G	FUEL PRESSURE SWITCH	S	IGNITION ROD
VS	SAFETY VALVE	R	FLAME DETECTTION ROD

16.2. DUAL STAGE – MODULATING

The same connections can be used both for burners with a single high/low flame and for burners with independent pilot and main flame.

For systems where the pilot burner remains in use during main burner operation, a separate flame detector device to supervise the pilot and main flames shall be fitted.

The main flame detector device shall be so positioned that it cannot in any circumstances detect the pilot flame.

Flame detection via single electrode [S] also used for ignition [2].

A UV phototube [U] can be used for independent monitoring of the main flame. If the main burner remains operative for more than 24 hours consecutively, it will be necessary to use phototubes equipped with electro-optical shutters which guarantee permanent use.

At the start of the cycle the air simulation test is performed before activating the air output [VA], if enabled. When the pressure switch A [1] detects the air pressure, the pre-purge time starts.

During the pre-purge, no gas pressure must be detected and the flame simulation test is carried out.

The fuel valve [V1] will only be activated if the behavior of the ignition device [IT] matches with the settings.

If a valid flame signal is detected within the programmed safety time, the valve is kept open: the burner is on. If no flame is detected there will be a lockout. In accordance with EN 13577-2 and EN676, up to 3 further ignition attempts are allowed if safety is not impaired.

Three low temperature operating stages can be configured for each of which it is possible to define which valves are active.

In this typical application there will be an initial period with only the pilot flame (stage 2 [3]) which can be followed by stage 3 [3] with the pilot [V1] and main [V2] valve active. If an interrupted pilot is desired, this stage represents the second safety time before proceeding to stage 4 [3] in which only the main valve V2 will be active.

In the event of a flame, air or gas failure during operation, it is possible to set an immediate re-ignition, a complete recycle from the beginning or a lockout.

The behavior of the VB multifunctional valve can be configured in each stage to perform specific tasks, if required.

The HT input activates the high temperature mode with exclusion of direct flame monitoring and step to stage 5 [3], which may have a short duration and be used as a transition to any subsequent stage 6 [3].

The behavior when the HT signal is removed is configurable (step to a low temperature stage, shutdown or recycling) in any case direct flame monitoring is reinstated.

By starting the cycle with the HT signal present, at the end of the pre-purge the ignition stage will not be performed but you will proceed directly to stage 5.
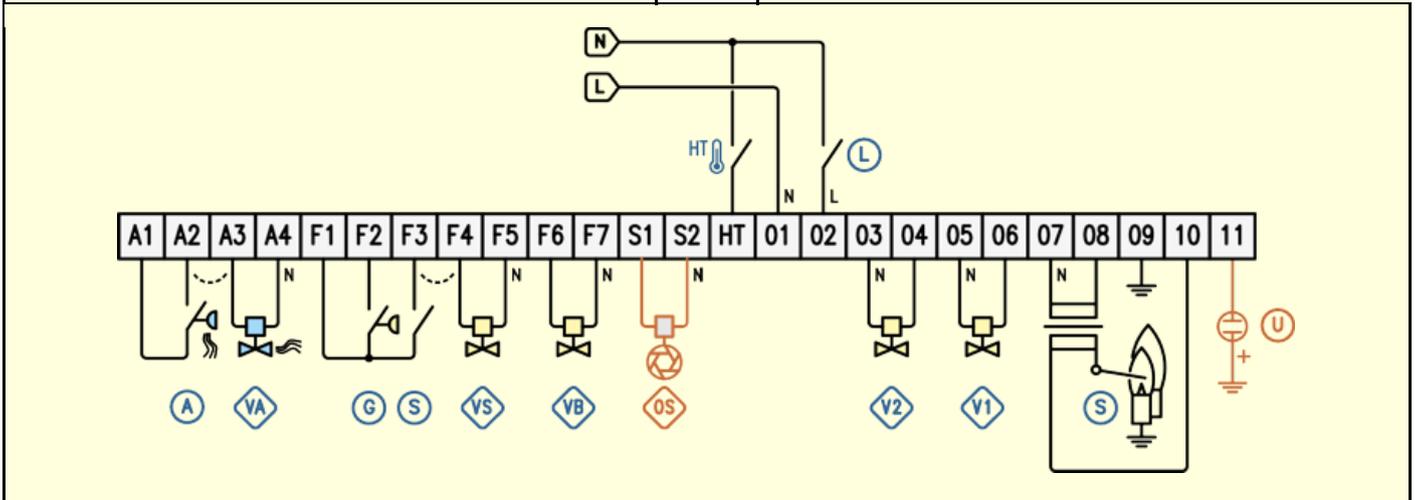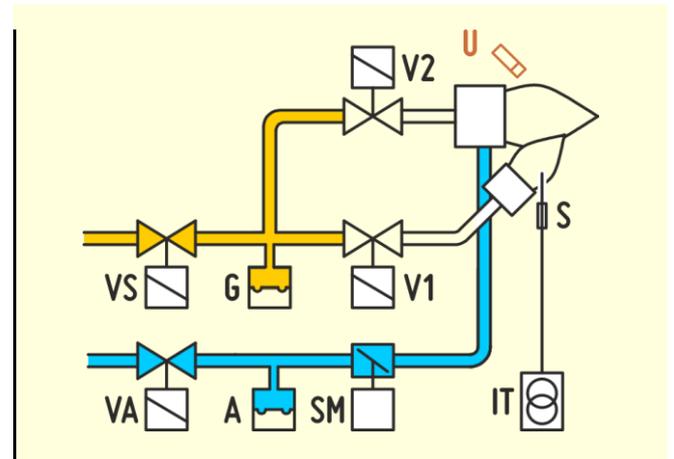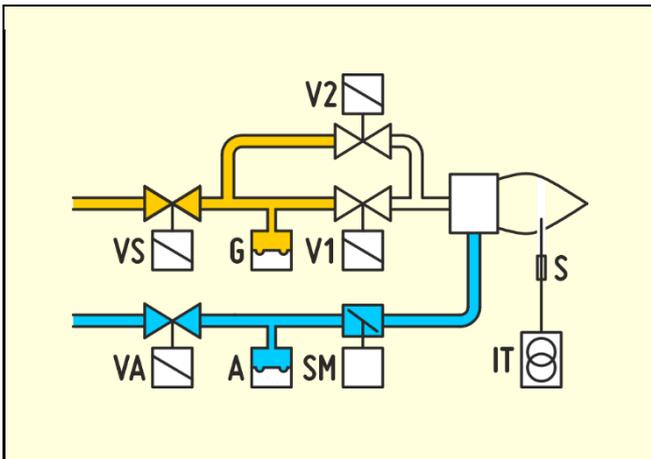
After a lockout or a shutdown request, a post-combustion time is allowed, possibly followed by post-purging. Reset from lockout can be done via front push button or with a remote control.

To put the burner out of service (manual shutdown) press the button on the front panel during the operating cycle.

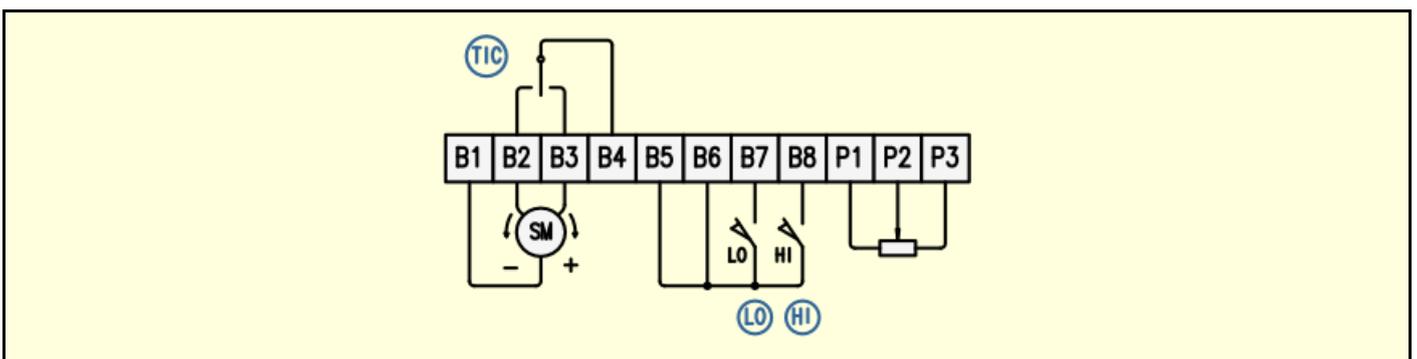[1] If there is no air pressure switch, make a jumper between terminals A2-A3.

[2] Permanent operation guaranteed when flame detection is carried out with an electrode.

[3] The duration of each stage can be set

A	AIR PRESSURE SWITCH	V2	2ND STAGE VALVE (MAIN)
VA	AIR VALVE	V1	1ST STAGE VALVE (PILOT)
G	FUEL PRESSURE SWITCH	S	IGNITION / DETECTION ROD
S	PROOF OF CLOSURE SWITCH	U	MAIN FLAME UV DETECTOR
VS	SAFETY VALVE	SM	AIR DAMPER ACTUATOR
VB	MULTIFUNCTIONAL VALVE	TIC	TEMPERATURE CONTROLLER
OS	ELECTRO OPTICAL SHUTTER	LO	0% POSITION LIMIT SWITCH
HT	HIGH TEMPERATURE BYPASS	HI	100% POSITION LIMIT SWITCH
L	OPTIONAL EXTERNAL LIMITS		

17. OIL BURNERS

Oil burners are designed to burn various types of liquid fuels including heavy oil, light oil and even waste oil and are suitable in applications where a constant heat output is required for extended periods.

This is the Q2 terminal block for an oil burner and below is a wiring diagram for a typical application.
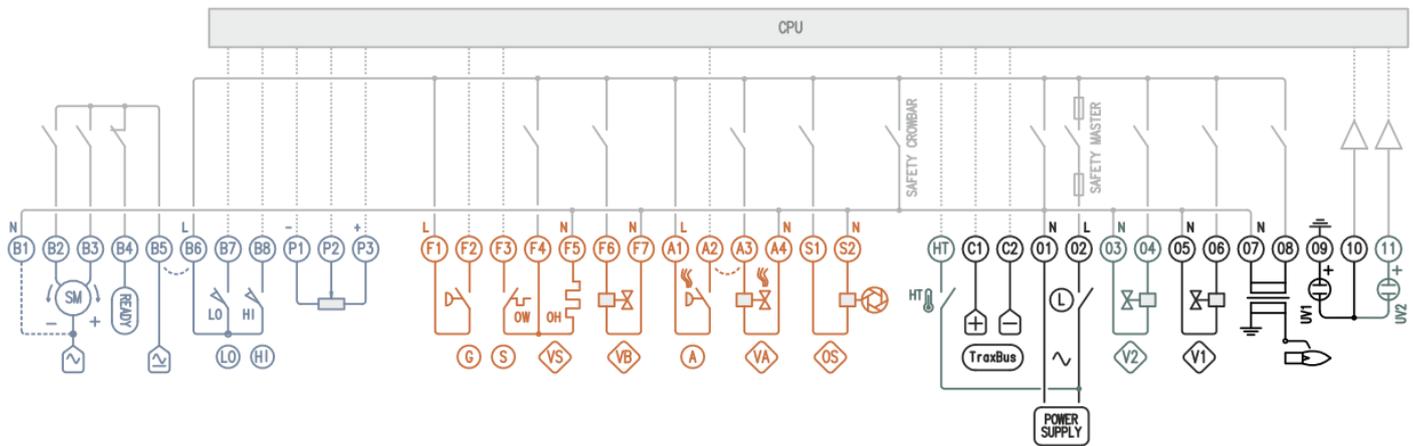
At the start of the cycle, the air simulation test is performed to check the efficiency of the pressure switch A[1] connected to the A1-A2 terminals before proceeding with the activation of the OH preheater connected to the F4-F5 terminals. Once the fuel temperature has been reached, the thermostat WH inside the pre-heater will activate the input at terminal F3 and the motor controlled by the VA output at terminals A3-A4 will start.

When the pressure switch A detects the air pressure, the pre-purge time starts.

Usually in this stage the ignition transformer is activated to burn any oil leaks and consequently detect the presence of unwanted flames.

After having detected the correct fuel pressure by means of the pressure switch at terminals F1-F2 and having verified the activation of the ignitor output, the selected valves will activate (normally the valve V1 connected to terminals 05-06). If a valid flame signal is detected within the programmed safety time, the valve is kept open: the burner is on.

If no flame is detected there will be a lockout (up to 3 further ignition attempts can be defined before lockout[2]).

For any subsequent stages it will be possible to define which valves must be active (typically the second stage valve V2 connected to terminals 03-04 with the possibility of intermittent or interrupted operation for V1).

The multifunction valve VB (terminals F6-F7) can be configured as a return valve or as a further stage.

In the event of a flame failure during operation, it is possible to set an immediate re-ignition[2], a complete recycle from the beginning or a lockout.

After a lockout or a shutdown request, a post-combustion time is allowed, possibly followed by post-purging.

For flame detection, one or two (if independent supervision of 2 flames is required) UV sensors are used, which can be equipped with electro-optical shutters in case of permanent use.

If the temperature of the combustion chamber walls exceeds 750°C it will be possible to exclude the direct flame surveillance by activating the HT input with a signal coming from a safety thermoregulator.

Reset from lockout can be done with a front button or with a remote control. To put the burner out of service (manual shutdown) press the button on the front panel during the operating cycle.

For modulating burners, it is possible to control the air damper servomotor by forcing it to the maximum flow rate for ventilation and minimum for ignition. If it is equipped with a potentiometer, it will also be possible to control its position with remote commands, alternatively the control can be obtained with a traditional thermoregulator (TIC) which receives consent from terminal B4, which excludes it during the ventilation or ignition stages.

[1]   If there is no air pressure switch, make a jumper between terminals A2-A3.
[2]   Restarting the ignition is not permitted for burners with a maximum fuel flow rate > 30 kg/h.
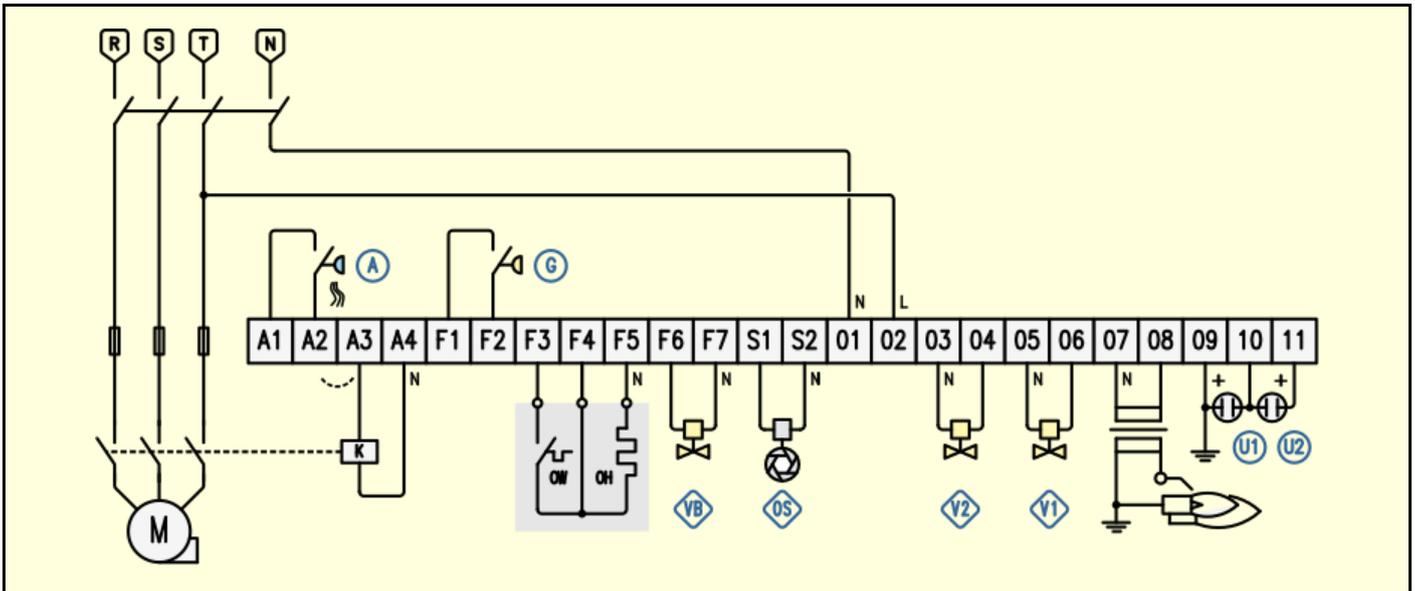
A	AIR PRESSURE SWITCH	V2	2ND STAGE VALVE (MAIN)
VA	FUEL PRESSURE SWITCH	V1	1ST STAGE VALVE (PILOT)
G	MOTOR RELAY	S	PILOT FLAME DETECTOR
S	FUEL THERMOSTAT	U	AIR DAMPER ACTUATOR
VS	FUEL HEATER	SM	TEMPERATURE CONTROLLER
VB	RETURN VALVE	TIC	0% POSITION LIMIT SWITCH
OS	ELECTRO OPTICAL SHUTTER	LO	100% POSITION LIMIT SWITCH
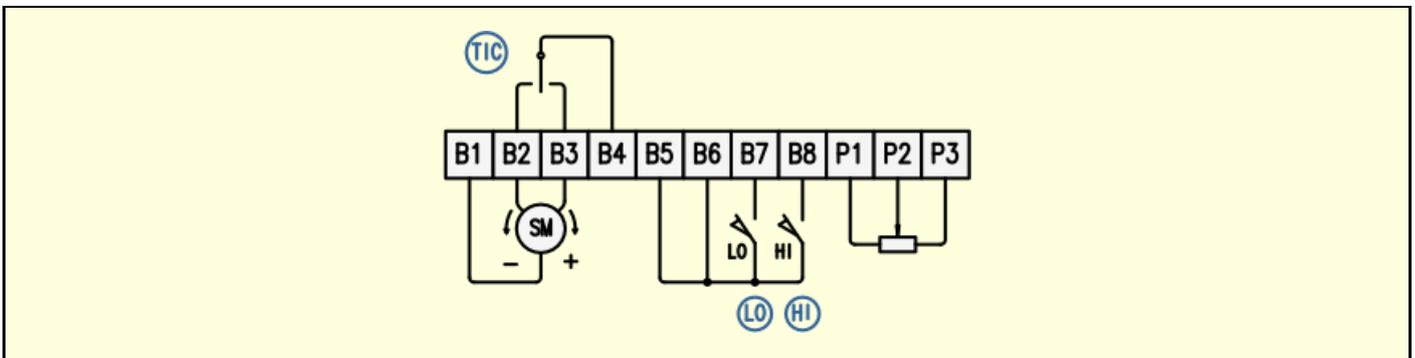
18. HIGH TEMPERATURE MODE

During the start-up process, as long as the temperature of the combustion chamber walls is below 750°C, the flame surveillance must be active (low temperature mode). When the temperature rises above this spontaneous ignition temperature is possible to disable the direct flame surveillance: an external safety temperature controller activates the input at terminal **HT** entering the indirect flame control (high temperature mode).

Parameter **G08** defines whether the high temperature mode is activated immediately or at the next burner restart and also allows subordinating the **HT** input to an enabling sent with a remote control for those requiring further safety on the external signal.

When the high temperature mode is active the last indicator of the flame signal bar graph flashes and the intensity of the flame signal is not reported.

When the temperature falls below the spontaneous ignition temperature (750°C) the external temperature controller removes the voltage from terminal **HT**. Returning to low temperature operation the flame surveillance by means of UV sensor or flame rod is reinstated.

Any failure to **HT** input leads to lockout.

A failure of external temperature controller must remove the voltage from **HT** input.

⚠️ The independent **HTO** sensor must comply with the specifications of EN ISO 13577-2 § 4.10.3 and EN 298 § 3.138 to § 3.146. The temperature limit for high-temperature operation must be no lower than 750°C and must be correctly detected.

✋ it is possible to activate an additional safety measure which involves enabling the high temperature mode with a remote command sent periodically (parameter G08),

18.1. FLAMELESS OPERATION

In a flameless burner, the flame front is deliberately avoided and combustion reactions occur when fuel and air are mixed together with entrained and recirculated combustion products, this significantly reduces NOx emissions. For the process to take place, the combustion products must be above the self-ignition temperature (> 850°C for safety).

The ignition of the burner takes place as for any low temperature burner. Once the self-ignition temperature is reached, the high temperature mode is activated for which there are two stages. For each of these stages it is possible to define the behavior of the valves which will activate and deactivate the fuel flow in order to obtain the desired behavior.
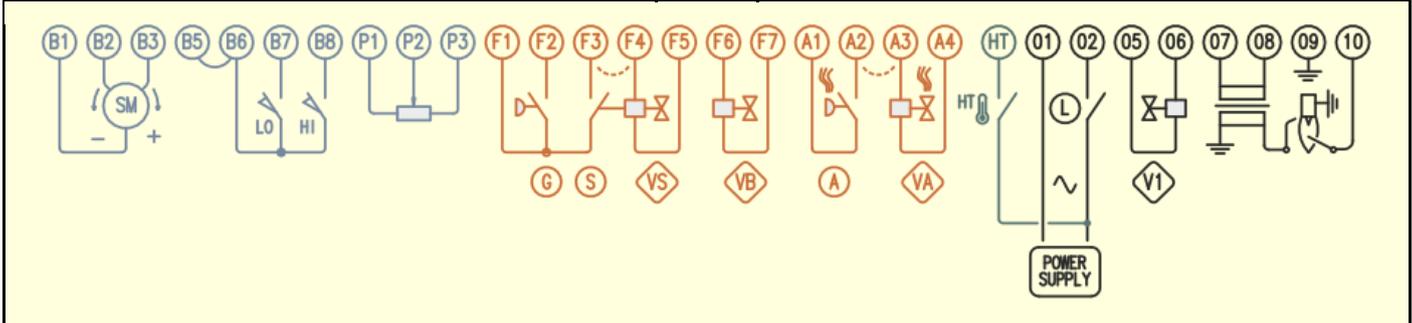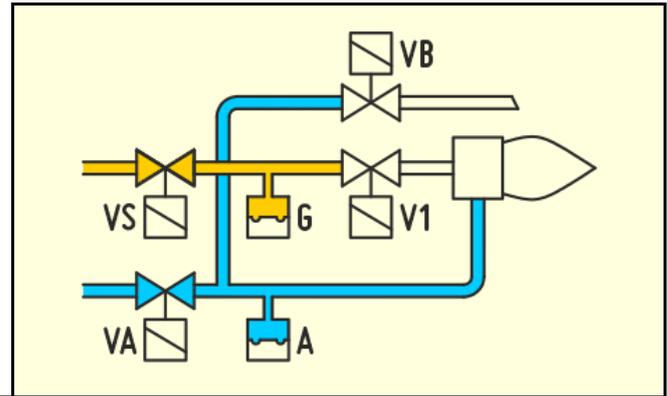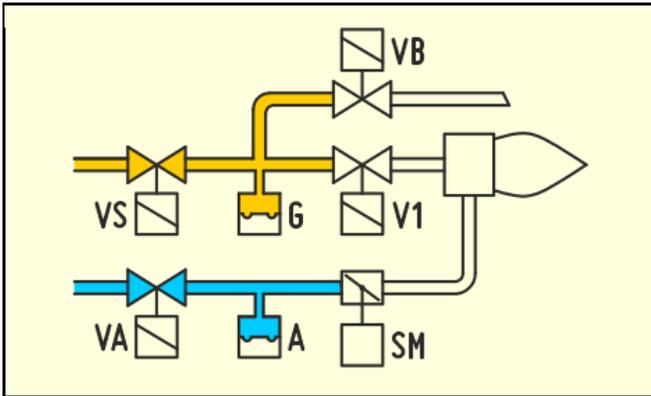
GAS staged burner

The V1 valve is active during the low temperature stage, once the self-ignition temperature is reached it will be switched off to activate - with a possible intermediate stage - the VB valve which injects gas directly into the combustion chamber.

The SM actuator can be used to change the airflow.

AIR staged burner

When the self-ignition temperature is reached, the VB valve will be activated which injects additional air into the combustion chamber. Different configurations for the air valves are also possible.

Optionally the V2 valve can be used to activate a different fuel flow.
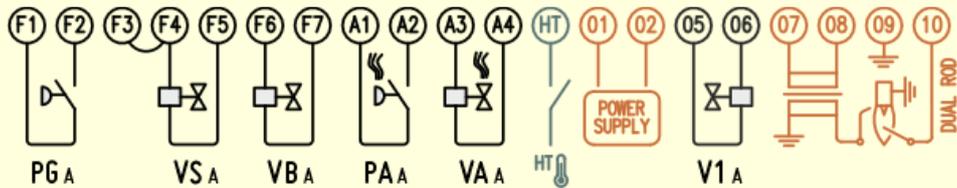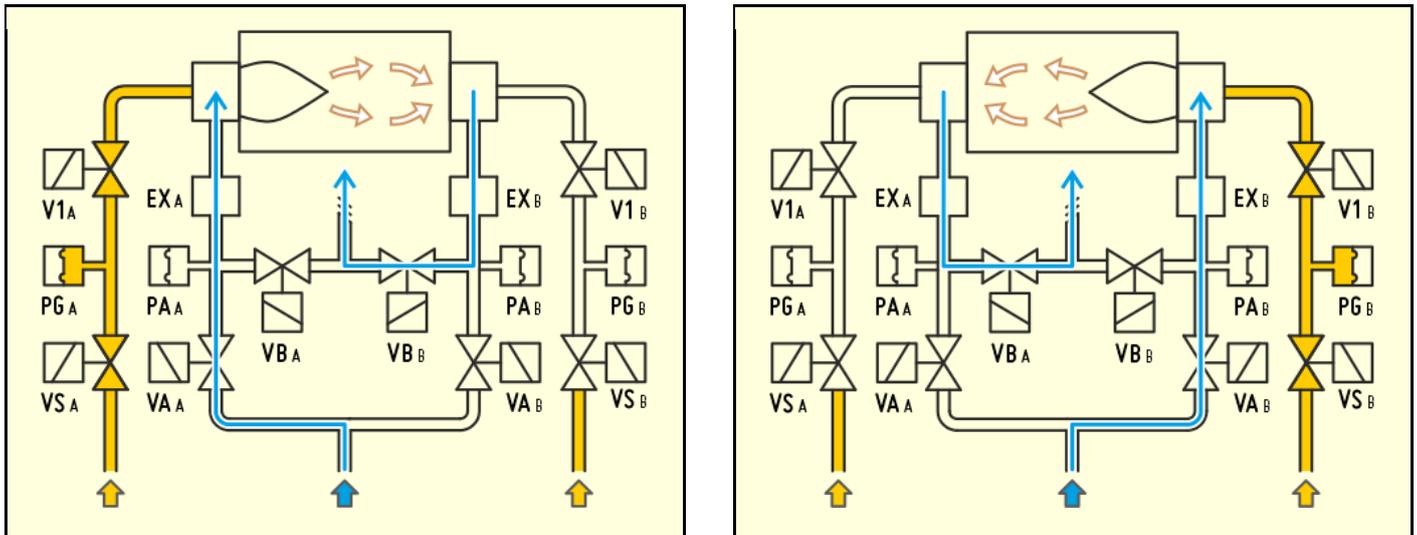
19. REGENERATIVE BURNERS

REGENERATIVE BURNERS WITH DIRECT IGNITION

Two identical devices control two burners which work in a common combustion chamber, each burner is equipped with a heat retainer (alumina ball or honeycomb) which accumulates heat in the passive phase because it is crossed by the hot exhaust gases which are vented through the VB valve which is active with the burner off.

An external logic switches the burners on and off alternately (via fieldbus or electric control) so that the active one receives preheated air from passing through the heat retainer.

Reversing period is generally between 30 and 300 seconds.

Flameless mode can be activated when the combustion chamber temperature exceeds the auto-ignition threshold.

VS A	FUEL SAFETY VALVE	VS B
V1 A	FUEL CONTROL VALVE	V1 B
VA A	AIR CONTROL VALVE	VA B
VB A	EXHAUST CONTROL VALVE	VB B
PG A	FUEL PRESSURE SWITCH	PG B
PA A	AIR PRESSURE SWITCH	PA B
EX A	HEAT EXCHANGE MEDIA	EX B
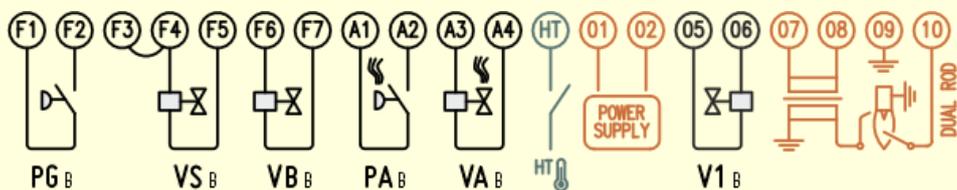
REGENERATIVE BURNERS WITH CONTINUOUS PILOT

When frequent reversals occur between the two burners, configurations with a permanent pilot flame are preferred.

In the application shown, the pilot burners are activated after the completion of the independent tightness test for each burner (where applicable). The ignition management of the main burners (equipped with regenerators) is handled via an electrical signal (Qio) or fieldbus (TraxBus or Profinet).

The control logic operates by switching between the following stages.

- Low Temperature with direct flame monitoring:
  switching between Stage 2 (pilot only) and Stage 3 (pilot + main burner).
- High Temperature with indirect flame monitoring (based on the temperature threshold signal):
  switching occurs between Stage 5 (pilot only) and Stage 6 (pilot + main burner).
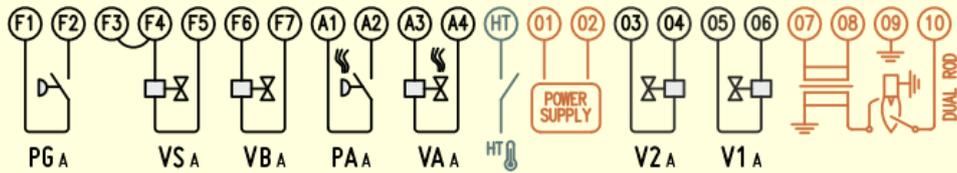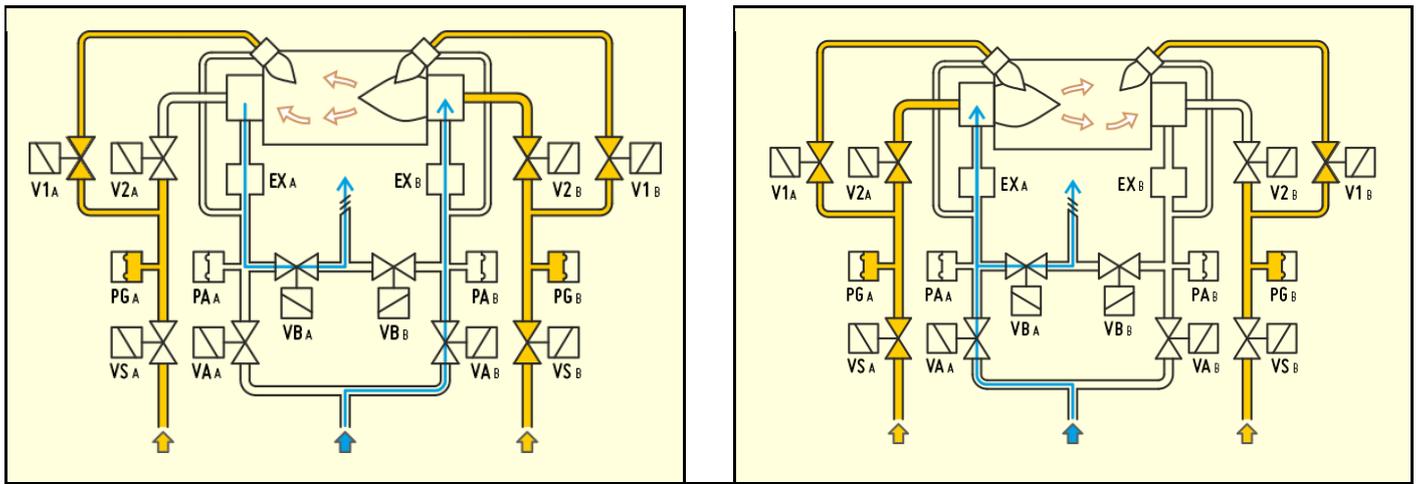
VS A	FUEL SAFETY VALVE	VS B
V1 A	FUEL PILOT CONTROL VALVE	V1 B
V2 A	FUEL MAIN CONTROL VALVE	V2 B
VA A	AIR CONTROL VALVE	VA B
VB A	EXHAUST CONTROL VALVE	VB B
PG A	FUEL PRESSURE SWITCH	PG B
PA A	AIR PRESSURE SWITCH	PA B
EX A	HEAT EXCHANGE MEDIA	EX B
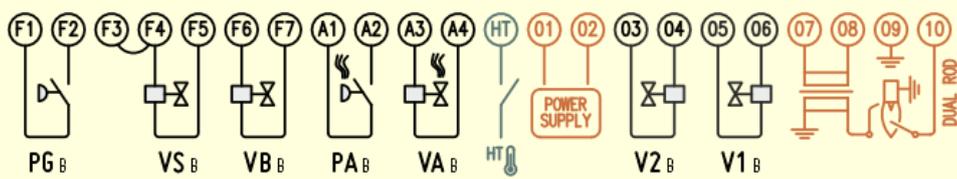
20. SEQUENCE

The cycle diagram shows the operating sequence of the device.
A detailed description of the operations for each phase of the program follows.
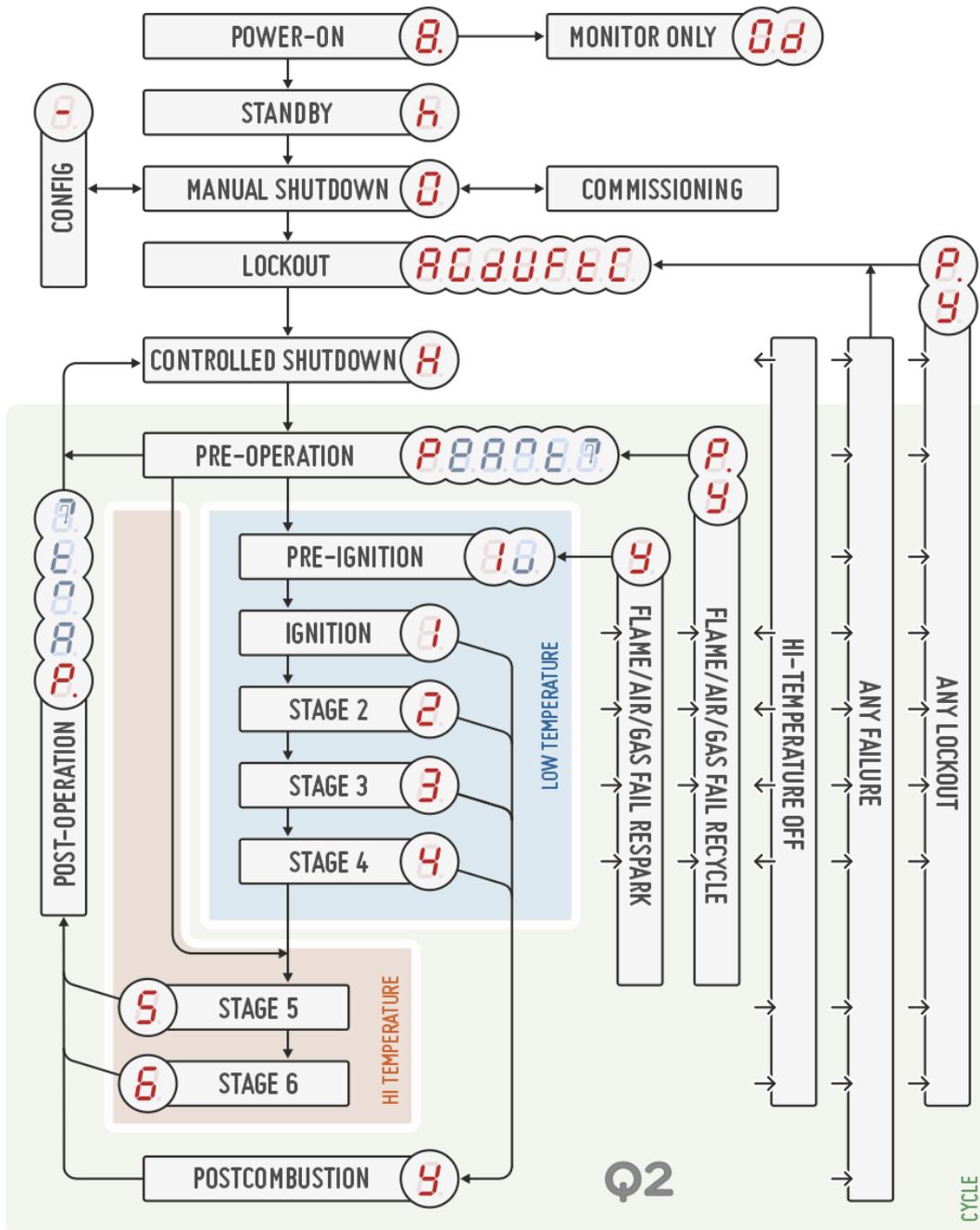
20.1. POWER ON

A self-test is performed to verify correct device operation: all indicators will be on for one second.
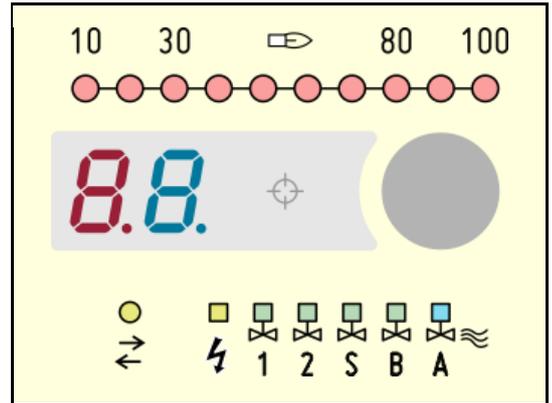
20.2. CONFIGURATION

The configuration environment can only be reached when the device is in MANUAL SHUTDOWN[1] and the optical jack Q.link in place.

[1]   If MONITOR MODE set to Burner OFF (display 0)
the changes will take effect at the next restart.

Using the Q.Suite software it is possible to read the current configuration of the device.

To modify the operating parameters, it is necessary to enter the complete password of the device.

A red dash appears when the device is linked.

Parametrization procedure compliant to
EN ISO 13849-1
EN ISO 61508-3

20.3. STANDBY

If the device was not switched off while in lockout, the operating cycle resumes at the next switch-on, unless it is configured so that an intentional start-up is always required: in this case it remains in stand-by until reset from local push button.

The fuel valves are off while the behavior of the air valve and the position of the actuator can be defined.

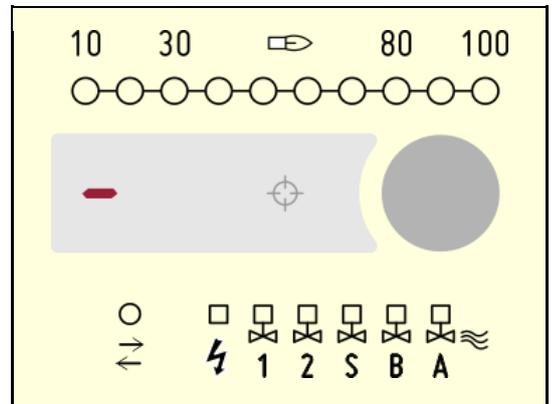The air pressure switch can be enabled to detect air failure or air simulation, depending on air output setting.
Response time of the air pressure switch is adjustable to tolerate short events.

ALLOWED REMOTE COMMANDS
S s A a 0 o f L D d Dxx
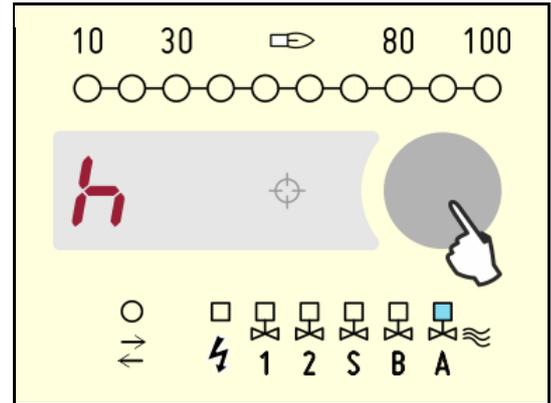
20.4. MANUAL SHUTDOWN

Pressing the front button after the cycle has started, forces the out of service condition: all outputs are deactivated and the device can no longer be controlled remotely.
The actuator position is the same set for Power-ON and can be changed remotely.

This is the only condition from which it is possible to access the configuration and enter the commissioning environment.

The leakage test, postcombustion and postpurge stages cannot be interrupted.

ALLOWED REMOTE COMMANDS
S s L D d Dxx
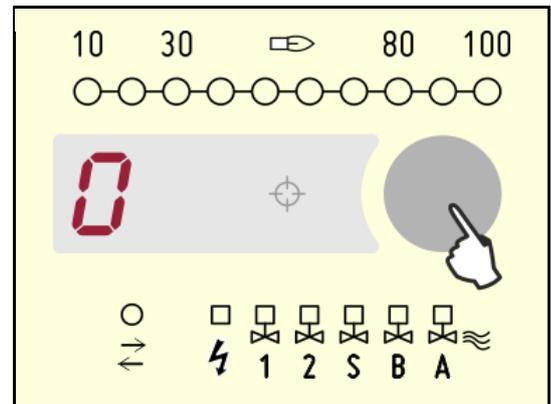
20.5. LOCKOUT

It is the maximum non-volatile safety condition which is reached following any anomaly in the operation of the burner or the unit.

All the outputs are disabled except the air valve output which can be activated, but without checking the pressure switch or the air flow switch (because in case of incorrect detection the unit is already in lockout).

The only possible operation is an intentional reset from the front button or remote control.

If the device was switched off while in lockout, at the next power-on it will be in the same condition and a reset will be required to exit the lockout condition.

ALLOWED REMOTE COMMANDS

H R S s A a 0 o f L D d Dxx[1] B Y

[1] Depending on configuration
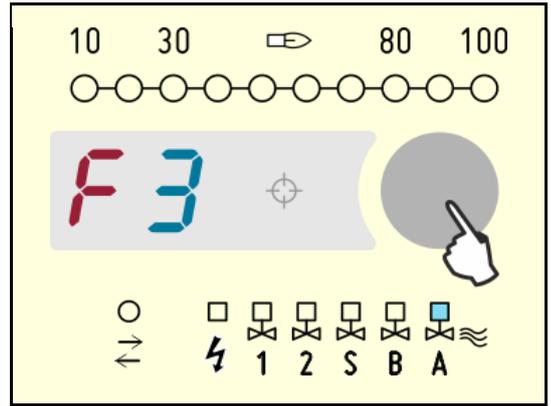
In the example above **F3** represents a flame failure during stage 3

20.6. CONTROLLED SHUTDOWN

The burner was switched off with remote control.

The fuel valves are deactivated with the exception of the VB output, for which it is possible to define the behavior (for example it could be the discharge valve in regenerative burners).

It is also possible to set the behavior of the air valve and possibly the position of the actuator.
The air pressure switch can be enabled to detect air failure or air simulation, depending on air output setting.

The fuel pressure switch can be enabled to detect fuel failure or fuel simulation, depending on fuel output setting. Response times of the air and fuel pressure switches are adjustable to tolerate short drops or spikes).

The flame surveillance can be activated to identify possible flame simulation (illegal detection).

It is possible to prevent restarting the burners too quickly by setting a minimum shutdown duration (for example, to avoid pauses which are too short in burners with impulsive regulation).

ALLOWED REMOTE COMMANDS

H R S s A a 0 o f L D d Dxx
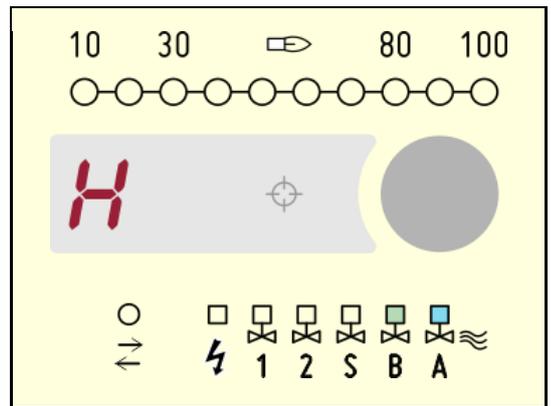
20.7. PRE OPERATION

Before starting the ignition cycle, the efficiency of the air pressure switch is verified: the air valve is off and within 60 seconds the air pressure switch contact must be open.

The correct functioning of the relays is verified: the ignitor light turns on for a short instant (but the output remains off).
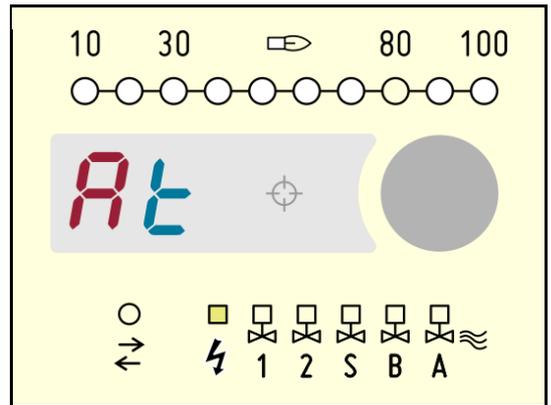
With the start of the cycle, the preparatory stage is entered.

It is possible to activate the fuel valve tightness test which is carried out before the predefined pre-purge time.
Any manual shutdown requests from the button are ignored during the fuel valve tightness test.
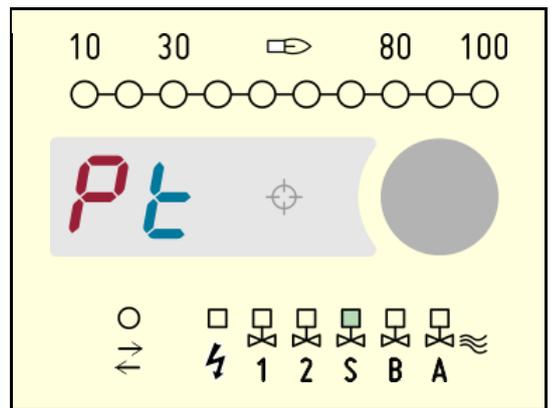
A possible delay of the air pressure introduced by blower run-up can be compensated by introducing a waiting time.
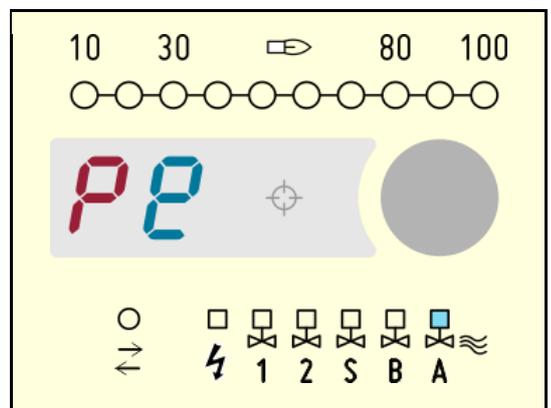
The prepurge time can be set and starts counting once the actuator has reached the set position.
If the actuator position is set to 100% (limit switch position) it cannot be changed remotely.

The fuel valves are off while it is possible to define the behavior of the air valve which can be controlled via the air pressure switch: with the air valve off there will be a lockout in the event of presence (simulation), while with an active air valve there will be a lockout in the absence of air for a time longer than the one set.

The purge time is counted only when the presence of air is detected by the pressure switch or flow switch.
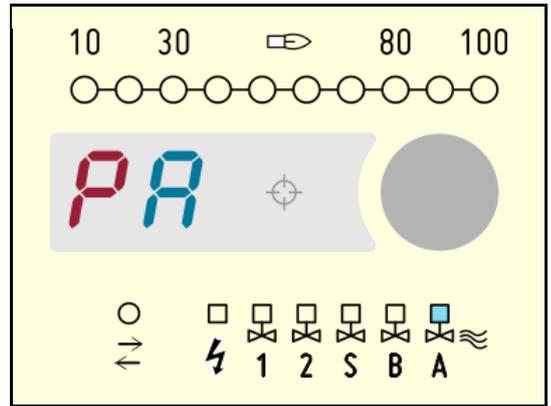
The fuel pressure switch can be enabled to detect unwanted fuel presence or pressure switch failure.

Response times of the air and fuel pressure switches are adjustable to tolerate short drops or spikes.

The prepurge stage can be interrupted by a Manual Shutdown request through the button. The blue display cycles as the prepurge time is running.
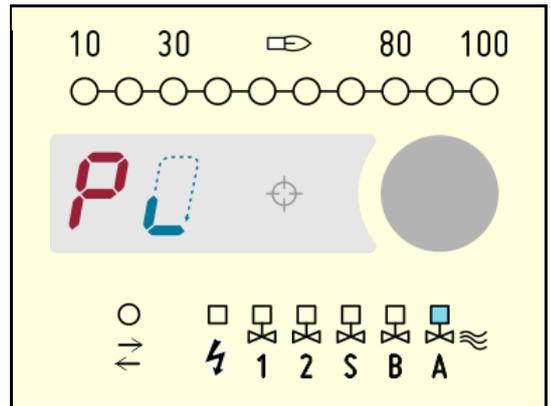
The flame surveillance should be activated for all installed sensors to identify possible flame simulation (illegal detection), for liquid fuels the ignitor should also be activated.

If the ignition transformer is active in this stage, it will not be possible to use a shared electrode for ignition and flame detection.

ALLOWED REMOTE COMMANDS

H R S s A a O o f L D d Dxx

20.8. PRE IGNITION (STAGE 0)

This is the stage before the ignition of the burner.

The FUEL SAFETY VALVE is active while the other fuel valves are closed and it is possible to define the behavior of the AIR valve.

The air pressure switch can be enabled to detect air failure or air simulation, depending on air output setting.

If the fuel pressure switch is enabled, it must detect the presence of fuel within the set time, otherwise a lockout will occur.
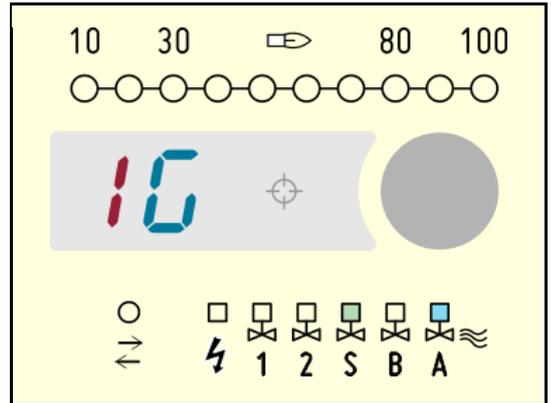
Response times of the air and fuel pressure switches are adjustable to tolerate short drops or spikes.

The ignition transformer is activated to verify the correct operation of the output before proceeding to open the fuel valves.

The actuator is moved to the predefined position for the ignition. If the actuator position is set to 0% (limit switch position) it cannot be changed remotely.
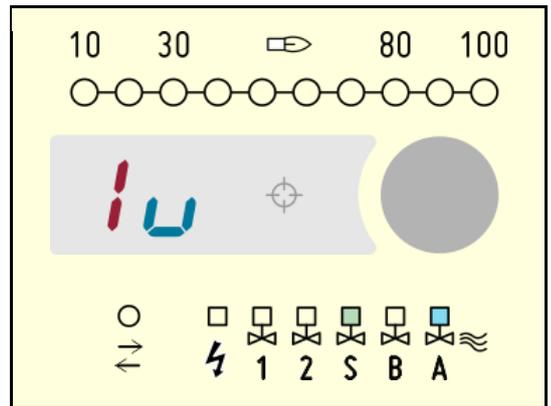
When the actuator has reached the predefined ignition position and the time set for the pre-ignition phase has elapsed, the cycle continues with the next stage.

(!) If the HT input is active, direct flame monitoring is disabled and the cycle proceeds directly to stage 5.

ALLOWED REMOTE COMMANDS
H R S s A a O o f L D d

20.9. IGNITION (STAGE 1)

This is the safety time during which the fuel can be introduced into the combustion chamber while waiting for the flame to form. The duration is ruled by specific standards and can be set.

The behavior of all fuel valves and the air valve can be defined.

The air pressure switch can be enabled to detect air failure or air simulation, depending on air output setting.

The fuel pressure switch can be enabled to detect fuel failure.

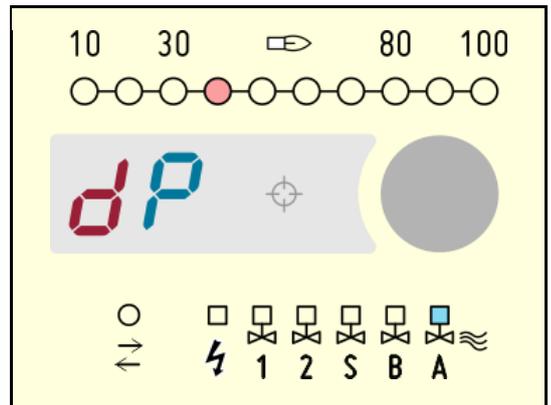Response times of the air and fuel pressure switches are adjustable to tolerate short drops or spikes.
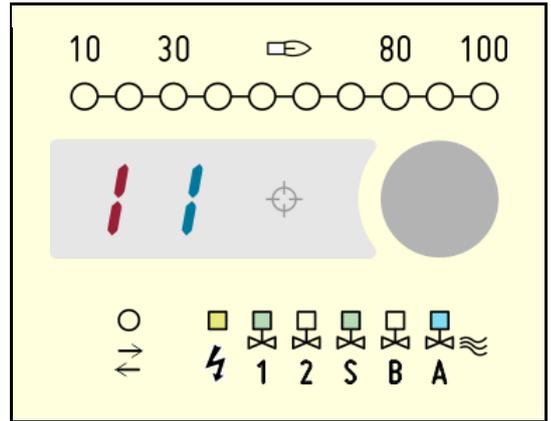
The actuator remains in the position reached in the previous step and cannot be controlled remotely.

The ignitor is usually activated, but it is possible to keep it off.

If the flame is detected by one or both of the selected sensors, the burner has ignited correctly and the cycle continues to stage 2, otherwise lockout occurs due to ignition failure.
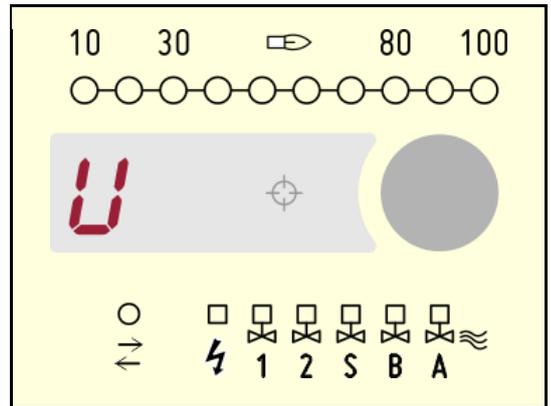
The standards allow in some cases to make up to a maximum of 3 further ignition attempts, the number of attempts can be set within this range.
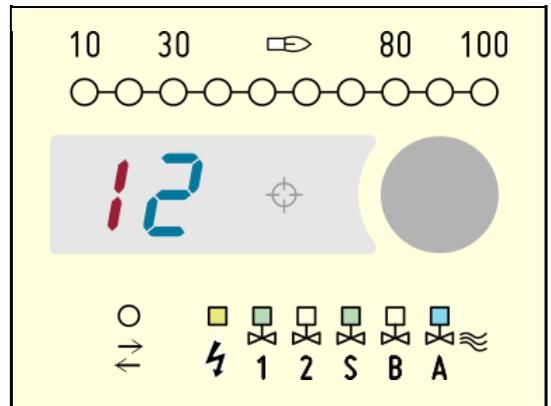
ALLOWED REMOTE COMMANDS

H R S s A a O o f L D d

20.10. STAGE 2

This is the first stage reached after the ignition for burners operating in low temperature mode (HT input off).

For direct ignition – single stage – burners, this is the only operating stage which will therefore be set as continuous.

For multi-stage burners it is possible to set the duration of this stage which usually corresponds to the operation of the pilot burner only, after which stage 3 begins.
The behavior of all fuel valves and the air valve can be defined.

The actuator position can be preset and even changed remotely.
The air pressure switch can be enabled to detect air failure or air simulation, depending on air output setting.
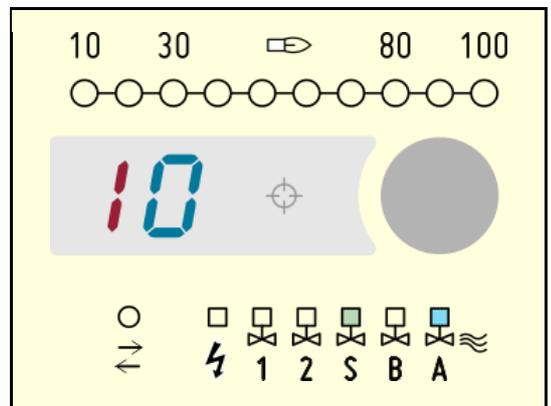The fuel pressure switch can be enabled to detect fuel failure.
Response times of the air and fuel pressure switches are adjustable to tolerate short drops or spikes.
The presence of flame is detected by one or both sensors (in this case it will most likely be the only sensor that detects the flame which could also be the only one installed).

The reaction time to the flame loss can be set.

If enabled, the electro-optical shutter periodically checks the correct operation of the UV sensor.
Specific parameters define the behavior in the event of flame quench, fuel pressure failure and air pressure failure:

- lockout
- re-ignition
- recycle from the beginning

If necessary, the post-combustion and post-purge stages will be performed before.

The transition to another low temperature stage can be requested with remote control. This stage can be terminated by:

- manual shutdown
- controlled shutdown
- lockout

The transition to high temperature mode (stage 5) can take place immediately upon activation of the HT input or at next burner restart, according to parameter G08.

It is also possible to define a minimum duration during which any controlled shutdown requests are ignored (for example to avoid too short operating periods in burners with impulse regulation).

ALLOWED REMOTE COMMANDS

H R S s A a O o f L D d Dxx

ALLOWED STAGE ROUTING

3 4

20.11. STAGE 3

This stage is reached at the end of stage 2 or following a remote request.

For operation with permanent pilot (always on) this stage could last until a shutdown or lockout occurs, and therefore will not have a predefined duration, while in the event of alternating pilot this can be set and represents the second safety time before the transition to stage 4.

The behavior of all fuel valves and the air valve can be defined.

The actuator position can be preset and even changed remotely.

The air pressure switch can be enabled to detect air failure or air simulation, depending on air output setting.
The fuel pressure switch can be enabled to detect fuel failure.
Response times of the air and fuel pressure switches are adjustable to tolerate short drops or spikes.

The presence of flame is detected by one or both sensors.

The reaction time to the flame loss can be set.

If enabled, the electro-optical shutter periodically checks the correct operation of the UV sensor.
Specific parameters define the behavior in the event of flame quench, fuel pressure failure and air pressure failure:

- lockout
- re-ignition
- recycle from the beginning

If necessary, the post-combustion and post-purge stages will be performed before.

The transition to another low temperature stage can be requested with remote control. This stage can be terminated by:

- manual shutdown
- controlled shutdown
- lockout

The transition to high temperature mode (stage 5) can take place immediately upon activation of the HT input or at next burner restart, according to parameter G08.

It is also possible to define a minimum duration during which any controlled shutdown requests are ignored (for example to avoid too short operating periods in burners with impulse regulation).

ALLOWED REMOTE COMMANDS

H R S s A a O o f L D d Dxx

ALLOWED STAGE ROUTING

2 4

20.12. STAGE 4

This stage is reached at the end of stage 3 or following a remote request.

The pilot flame could be switched off but different behaviors can be defined for each stage. This stage typically has no predefined duration and ends only with a shutdown or lockout.

It's anyway possible to set a duration at the end of which the burner will simply be switched off (controlled shutdown).
The behavior of all fuel valves and the air valve can be defined.

The actuator position can be preset and even changed remotely.

The air pressure switch can be enabled to detect air failure or air simulation, depending on air output setting.
The fuel pressure switch can be enabled to detect fuel failure.
Response times of the air and fuel pressure switches are adjustable to tolerate short drops or spikes.

The presence of flame is detected by one or both sensors.

The reaction time to the flame loss can be set.

If enabled, the electro-optical shutter periodically checks the correct operation of the UV sensor.
Specific parameters define the behavior in the event of flame quench, fuel pressure failure and air pressure failure:
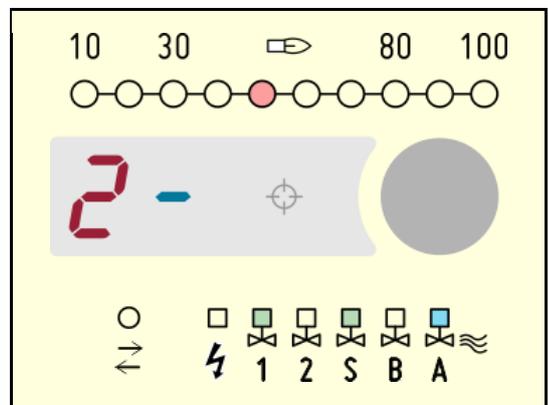
- lockout
- re-ignition
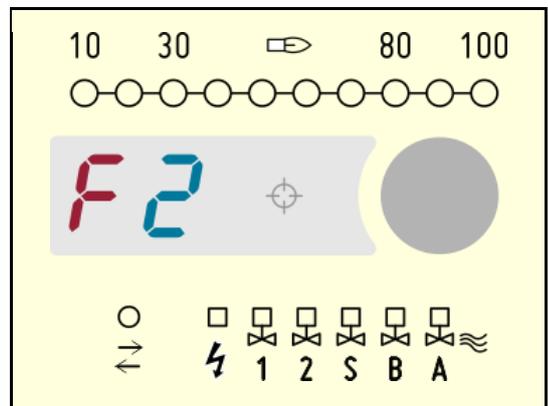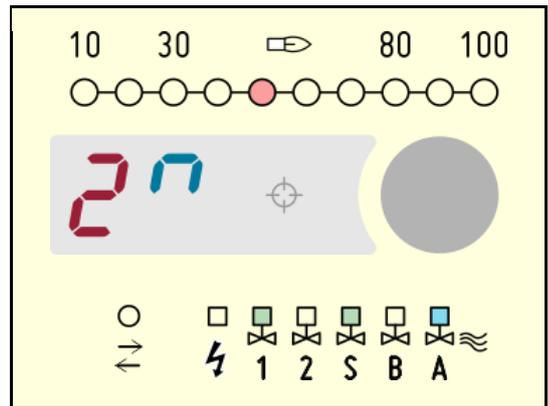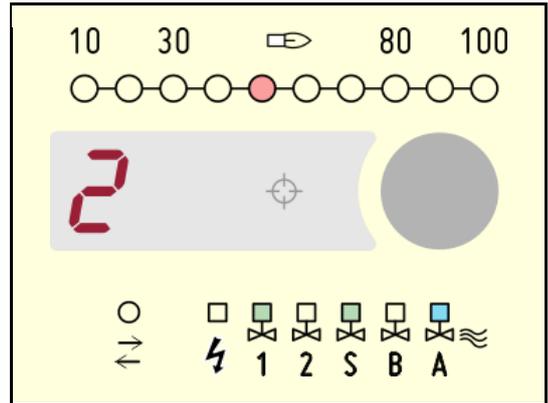- recycle from the beginning

If necessary, the post-combustion and post-purge stages will be performed before.

The transition to another low temperature stage can be requested with remote control. This stage can be terminated by:

- manual shutdown
- controlled shutdown
- lockout

The transition to high temperature mode (stage 5) can take place immediately upon activation of the HT input or at next burner restart, according to parameter G08.

It is also possible to define a minimum duration during which any controlled shutdown requests are ignored (for example to avoid too short operating periods in burners with impulse regulation).

ALLOWED REMOTE COMMANDS

H R S s A a O o f L D d Dxx

ALLOWED STAGE ROUTING

2 3

20.13. STAGE 5

This stage is reached when the HT input is activated.

The transition can take place immediately from a low temperature stage (2, 3 or 4) or when the burner is restarted, depending on parameter G08.

This could be the low to high temperature transition during which the behavior of all fuel valves and the air valve can be defined.

The presence of fuel and air can be verified by activating the pressure switches, defining their reaction time (to tolerate any short drops in pressure).

The duration of this stage before moving on to stage 6 can be set. Set this stage as continuous if this is the only high temperature operating stage. This stage can be terminated by:

- manual shutdown
- controlled shutdown
- HT signal removal (see below)
- lockout

It is also possible to define a minimum duration during which any controlled shutdown requests are ignored.

Parameter 506 defines the behavior when the HT signal is removed:

- move to controlled shutdown
- move to ignition
- move to low temperature stage 2
- move to low temperature stage 3
- move to low temperature stage 4

(!) The LED 100 of the flame signal bargraph is blinking when in high temperature mode.

The transition to any other high temperature stage can be managed with remote control.

Parameters 507 and 508 define the behavior in the event of air pressure failure and fuel pressure failure:

- lockout
- re-ignition
- recycle from the beginning

After post-purge stage, if set and due.

The actuator position can be preset and even changed remotely.

ALLOWED REMOTE COMMANDS

H R S s A a O o f L D d Dxx
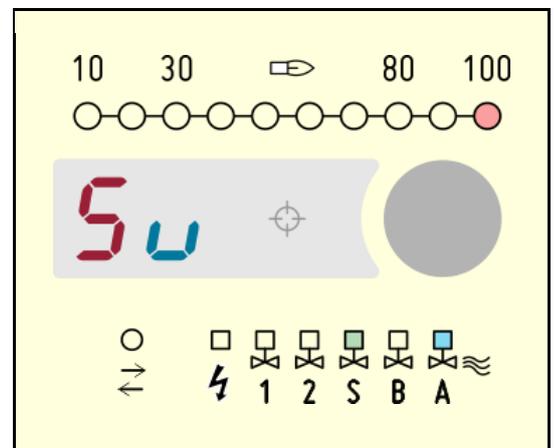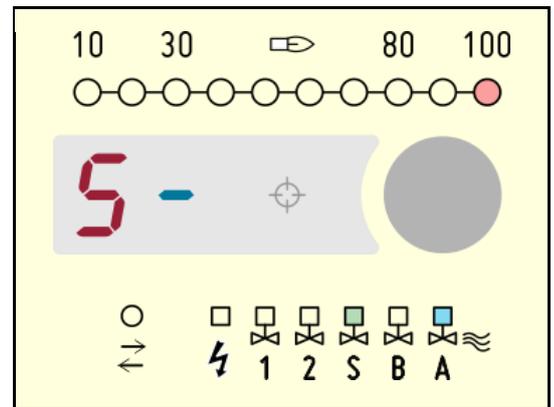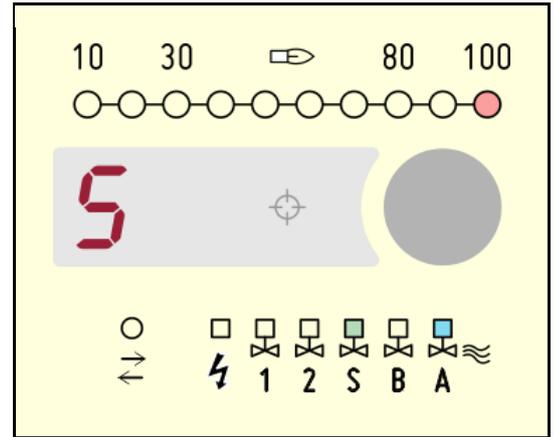
ALLOWED STAGE ROUTING

6

20.14. STAGE 6

This is the steady state operating condition for a burner working in high temperature mode and is reached at the end of stage 5.

The presence of fuel and air can be verified by activating the pressure switches, defining their reaction time (to tolerate any short drops in pressure).
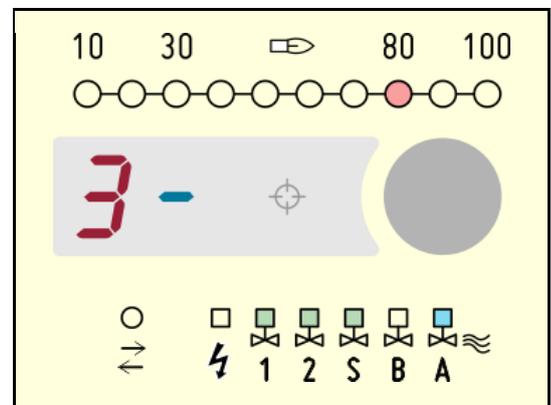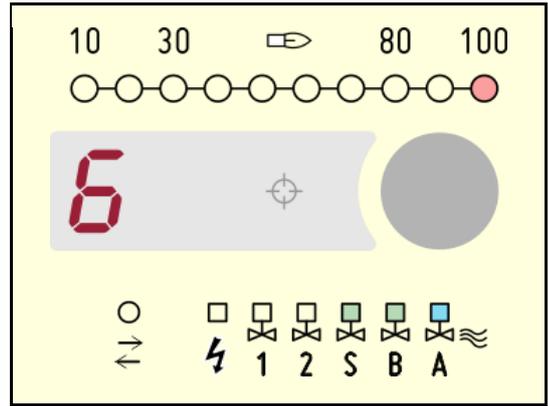

This stage usually does not have a predefined duration, but can be terminated by:

- manual shutdown
- controlled shutdown
- HT signal removal (see below)
- lockout

It is anyway possible to set a duration at the end of which the burner will move to controlled shutdown.

It is also possible to define a minimum duration during which any controlled shutdown requests are ignored.
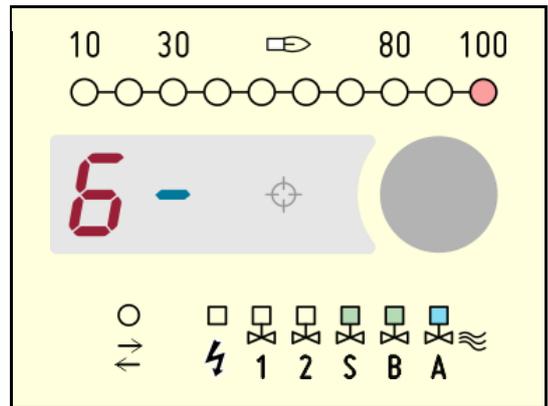
Parameter 606 defines the behavior when the HT signal is removed:

- move to controlled shutdown
- move to ignition
- move to low temperature stage 2
- move to low temperature stage 3
- move to low temperature stage 4

(!) The LED 100 of the flame signal bargraph is blinking when in high temperature mode.

The transition to any other high temperature stage can be managed with remote control.

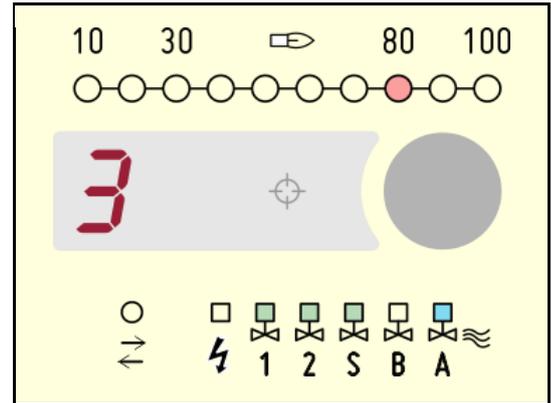Parameters 607 and 608 define the behavior in the event of air pressure failure and fuel pressure failure:

- lockout
- re-ignition
- recycle from the beginning

After post-purge stage, if set and due.

The actuator position can be preset and even changed remotely.
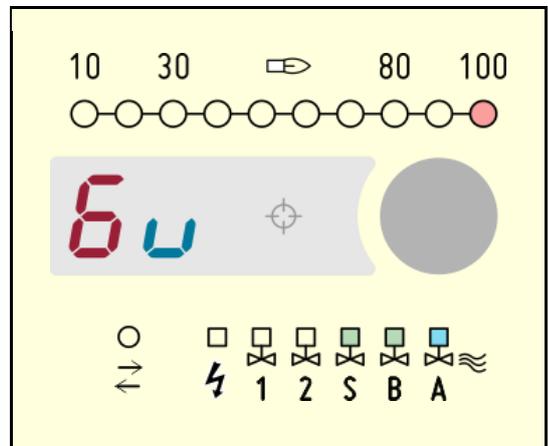
ALLOWED REMOTE COMMANDS

H R S s A a O o f L D d Dxx

ALLOWED STAGE ROUTING

5

20.15. POST COMBUSTION

After a shutdown request or an anomaly that leads to a lockout from low temperature stages, the flame may not quench immediately and it is possible to define the maximum duration of this period during which the presence of the flame is tolerated.

The fuel valves are off while the behavior of the air valve can be defined.

The air pressure switch can be enabled to detect air failure or air simulation, also defining the response time (to tolerate any short drops in pressure).

The actuator position can be preset and even changed remotely.

In this stage it can be defined which sensors will detect the presence of the flame, possibly activating the ignitor (for liquid fuels).

If the ignition transformer is activated in this stage, it will not be possible to use a shared electrode for ignition and flame detection.

When the flame signal disappears, the shutdown cycle proceeds to the post-operation stage.

An immediate lockout occurs if the flame does not quench within the set time.
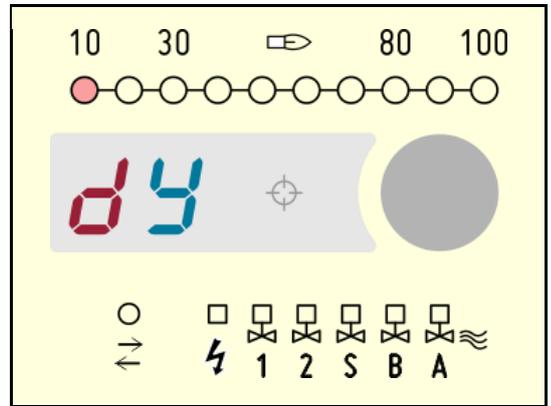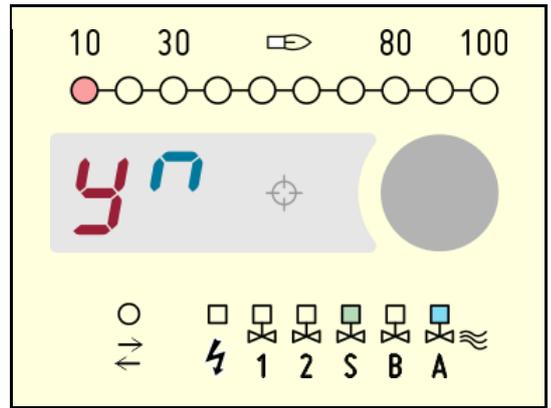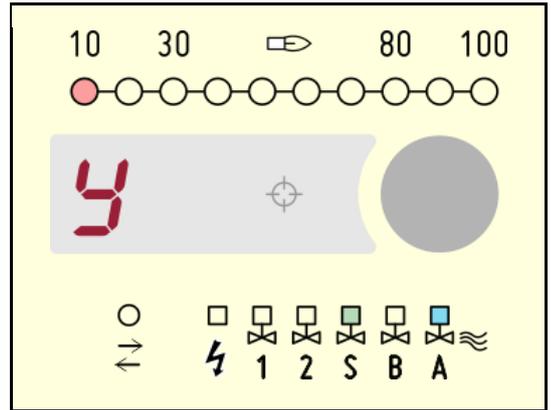
(!) POST-OPERATION is performed if a lockout cause occurs during POSTCOMBUSTION, while a failure will lead to immediate lockout (because the information for managing the process is no longer reliable).

ALLOWED REMOTE COMMANDS

H R S s A a O o f L D d Dxx

20.16. POST OPERATION

Once the flame is quenched, some final activities can be performed.

It is possible to activate the fuel valve tightness test which is carried out before the post-purge.
Any manual shutdown requests from the button are ignored during the fuel valve tightness test.
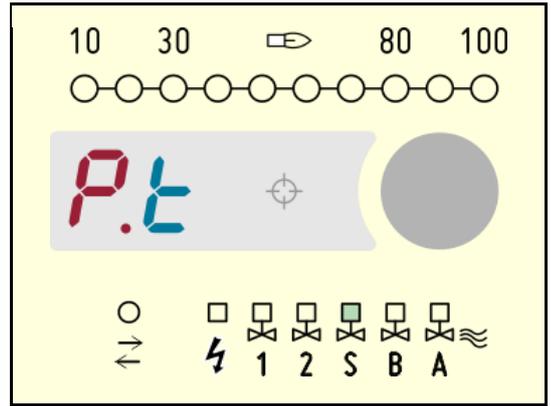
The post-purge time can be set and starts counting once the actuator has reached the set position.
If the actuator position is set to 100% (limit switch position) it cannot be changed remotely.

The fuel valves are off while it is possible to define the behavior of the air valve which can be controlled via the air pressure switch: with the air valve off there will be a lockout in the event of presence (simulation), while with an active air valve there will be a lockout in the absence of air for a time longer than the one set.

The purge time is counted only when the presence of air is detected by the pressure switch or flow switch.

Response time of the air pressure switch is adjustable to tolerate short drops or spikes.
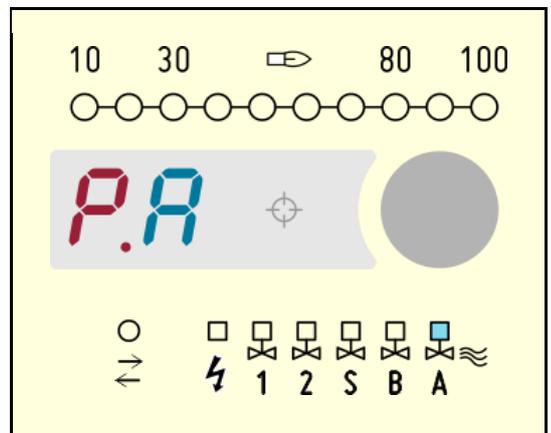
The post-purge stage cannot be interrupted by a Manual Shutdown request through the button. The blue display cycles as the post-purge time is running.

Post-purge always completes and cannot be stopped.
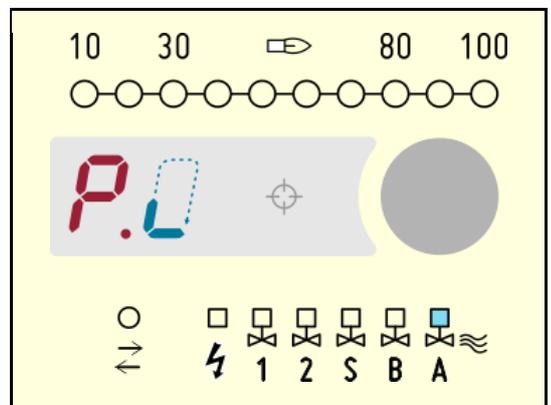
The flame surveillance should be activated for all installed sensors to identify possible flame simulation (illegal detection), for liquid fuels the ignitor should also be activated.

If the ignition transformer is active in this stage, it will not be possible to use a shared electrode for ignition and flame detection.

When all activities have been completed, the controlled shutdown or lockout condition is reached.

10	30		80	100

dP.

O → ⇄   ⚡ 1 2 S B A
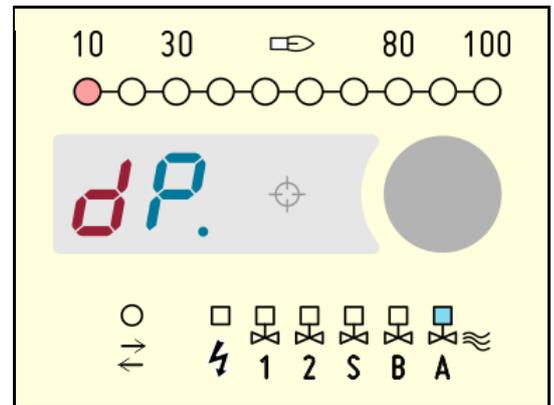
(!) The time will be completed if a lockout cause occurs during POSTPURGE, while a failure will lead to immediate lockout (because the information for managing the process is no longer reliable).

ALLOWED REMOTE COMMANDS
H R S s O o f L D d

20.17. MONITOR ONLY

The device can be configured to be used as a dual channel flame relay suitable for permanent operation:
parameter S01 - Power-on behavior

The display shows 0 when no flame is detected.
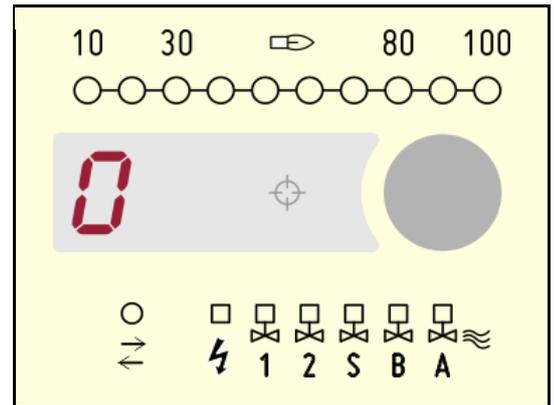
Output V1 (terminal 6) is activated when the presence of flame is detected by the sensor connected to input 2 (terminal 10).

The display shows 1 when only the sensor connected to input 1 detects flame.
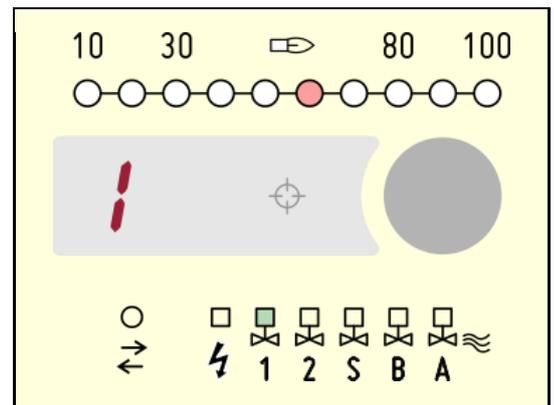
Output V2 (terminal 4) is activated when the presence of flame is detected by the sensor connected to input 2 (terminal 11).

The display shows 2 when only the sensor connected to input 2 detects flame.
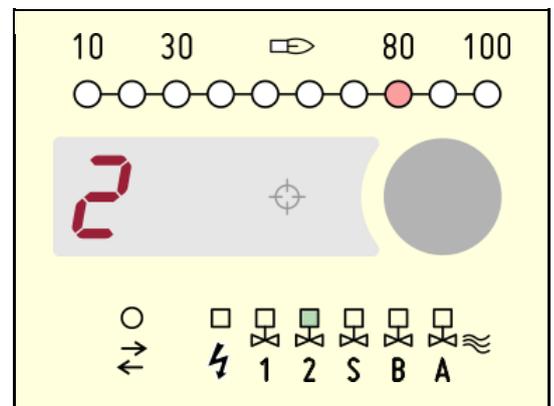
The display shows 3 when both sensors detect flame.

The bargraph shows the flame signal according to the settings of parameter G06 (Flame signal display).

If enabled, the electro-optical shutter periodically checks the correct operation of the UV sensors:
parameter G07 - Electro-optical shutter
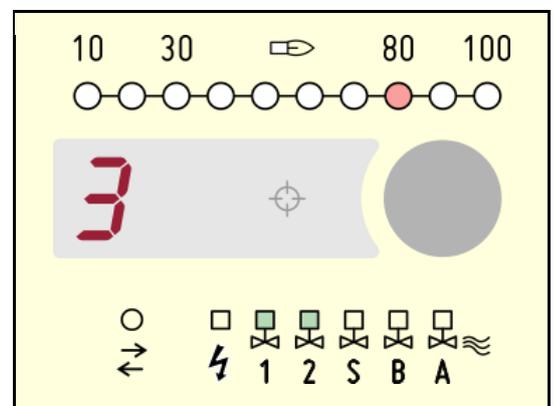
ALLOWED REMOTE COMMANDS
S s L

20.18. COMMISSIONING

Some operations useful for commissioning can be managed by the specific utility available in the Q.Suite program.

The first 4 character of the password are required to enter COMMISSIONING mode.

Press the button to place the device in MANUAL SHUTDOWN and put the optical jack Q.link in position.
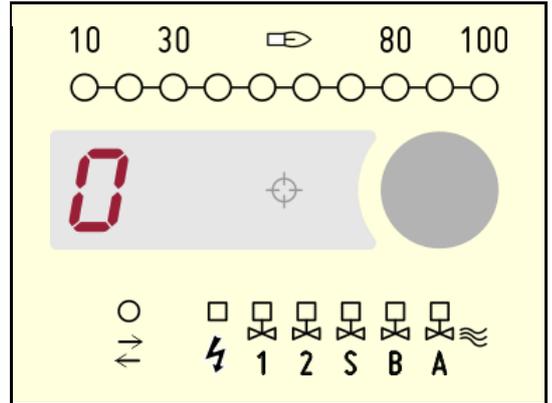
⚠ A period of inactivity greater than 5 minutes or the removal of the magneto-optical jack forces exiting the commissioning environment and returning to MANUAL SHUTDOWN.

The blue display dot indicates that the device is in COMMISSIONING mode.

Once entered COMMISSIONING mode, the device responds to the commands that are given by the specific software utility to proceed step by step.
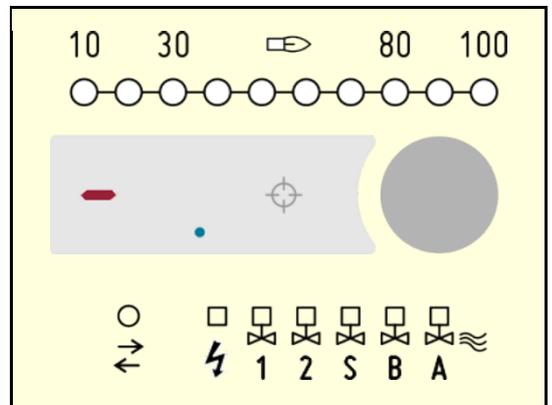
21. DISPLAY

The STATUS DISPLAY 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.
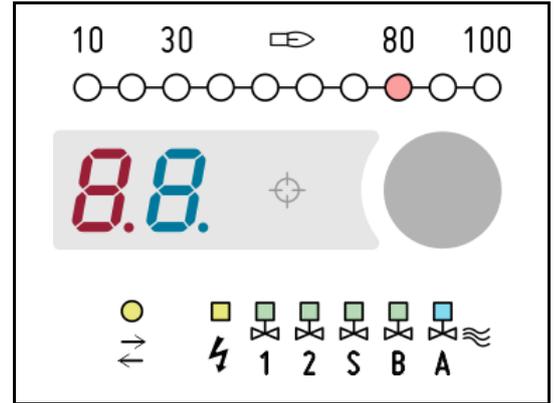
SELF TEST
AT POWER-ON: CHECKING THAT THE
SYSTEM IS FULLY FUNCTIONAL

SELF TEST
ALL INDICATOR LIGHTS ARE ON
TO VERIFY THEY ARE WORKING

CONFIGURATION
OPTICAL JACK Q.LINK IN POSITION
WAIT FOR DATA TRANSFER

COMMISSIONING
THE BLUE DOT IS SHOWN
THE DISPLAYS SHOW THE SPECIFIC STEP

21.1. CYCLE

The red display shows the step in progress while the blue one could provide possible additional indications on specific tasks.

STEP		TASK	
MANUAL SHUTDOWN UNIT HAS BEEN PUT OUT OF SERVICE FROM PUSH BUTTON. PUSH AGAIN TO EXIT	*0.*		
STANDBY WAITING FOR RESET WHEN PROGRAMMED FOR STANDBY MODE AT POWER-ON	*h.*		
CONTROLLED SHUTDOWN THE BURNER HAS BEEN SHUT DOWN BY REMOTE COMMAND	*H.*	*-.*	**PAUSE TIME** IGNORE RESTART COMMANDS UNTIL THE END OF THE SET MINIMUM PAUSE TIME
AIR PRESSURE SWITCH TEST AIR VALVE OFF: PRESSURE SWITCH MUST REACT CONSISTENTLY WITHIN 60 SECONDS	*A.*	*t.*	**RELAYS TEST** CROSS CHECK OF OUTPUT AND SAFETY RELAYS
PRE-OPERATION PRE-ARRANGEMENT ACTIVITIES BEFORE BURNER IGNITION	*P.*	*t.*	**TIGHTNESS CONTROL** OPTIONAL FUEL VALVE TIGHTNESS TEST IN PROGRESS
		h.	**OIL PREHEATING** WAITS FOR THE FUEL TO REACH THE REQUIRED IGNITION TEMPERATURE
		8.	**AIR RUN-UP DELAY** OPTIONAL WAITING TIME FOR AIR REACHING RATED FLOW
		A.	**AIR WAITING** INSUFFICIENT AIR WAITING FOR PRESSURE OR FLOW SWITCH
		0.	**ACTUATOR OPENING** THE ACTUATOR MOVES TO REACH THE REQUIRED POSITION FOR THE PREPURGE
		0.	**ACTUATOR CLOSING** THE ACTUATOR MOVES TO REACH THE REQUIRED POSITION FOR THE PREPURGE
		7.	**PREPURGE** PURGE OF COMBUSTION CHAMBER IN PROGRESS

STEP	TASK

PRE-IGNITION PREPARATION OF THE SETUP FOR BURNER IGNITION	**ACTUATOR CLOSING** THE ACTUATOR MOVES TO REACH THE REQUIRED POSITION FOR THE IGNITION
	ACTUATOR OPENING THE ACTUATOR MOVES TO REACH THE REQUIRED POSITION FOR THE IGNITION
	SPARK ACTIVATION TURN ON AND CHECK THE CORRECT BEHAVIOR OF THE IGNITOR
	WAITING FOR FUEL PRESSURE THE MINIMUM FUEL PRESSURE IS NOT YET DETECTED

IGNITION 1ST SAFETY TIME FUEL VALVE OPEN - WAITING FOR FLAME	**FIRST ATTEMPT** 3 MORE ATTEMPTS MAY FOLLOW IN CASE of IGNITION FAILURE
	SECOND ATTEMPT 2 MORE ATTEMPTS MAY FOLLOW IN CASE of IGNITION FAILURE
	THIRD ATTEMPT 1 MORE ATTEMPT MAY FOLLOW IN CASE OF IGNITION FAILURE
	FOURTH ATTEMPT LAST ALLOWED ATTEMPT LOCKOUT WILL FOLLOW IN CASE OF IGNITION FAILURE

Q2

STEP		TASK	
STAGE 2 LOW TEMPERATURE TYPICALLY PILOT ONLY OR SINGLE STAGE	*2*		
STAGE 3 LOW TEMPERATURE TYPICALLY PILOT & MAIN BURNER	*3*	**ACTUATOR OPENING** THE ACTUATOR MOVES OPENING TO REACH THE REQUESTED POSITION	*0*
STAGE 4 LOW TEMPERATURE TYPICAL MAIN ONLY (INTERRUPTED PILOT)	*4*	**ACTUATOR CLOSING** THE ACTUATOR MOVES CLOSING TO REACH THE REQUESTED POSITION	*0*
STAGE 5 HIGH TEMPERATURE TRANSITION STAGE	*5*	**FORCED STAY** IGNORES SHUTDOWN COMMANDS UNTIL THE END OF THE MINIMUM DURATION TIME	*-*
STAGE 5 HIGH TEMPERATURE OPERATING STAGE	*6*		
POST-COMBUSTION WAITING FOR FLAME QUENCHING AFTER LOCKOUT OR SHUTDOWN REQUEST	*4*		
POST-OPERATION POST-ARRANGEMENT ACTIVITIES AFTER BURNER SHUTDOWN	*P*	**TIGHTNESS CONTROL** OPTIONAL FUEL VALVE TIGHTNESS TEST IN PROGRESS	*t*
		AIR WAITING WAITING FOR RATED AIR PRESSURE BEFORE TO CONTINUE WITH POSTPURGE	*A*
		ACTUATOR OPENING THE ACTUATOR MOVES TO REACH THE REQUIRED POSITION FOR THE POSTPURGE	*0*
		ACTUATOR CLOSING THE ACTUATOR MOVES TO REACH THE REQUIRED POSITION FOR THE POSTPURGE	*0*
		POSTPURGE PURGE OF COMBUSTION CHAMBER IN PROGRESS	*7*

21.2. LOCKOUT

The red display reports the lockout origin while the blue one can provide further details, both flashing.

LOCKOUT	DETAIL

AIR
ERROR IN THE
AIR PRESSURE DETECTION

PRESSURE / FLOW FAILURE
AIR PRESSURE OR FLOW NOT DETECTED
WHEN AIR OUTPUT IS ON

PRESSURE / FLOW SIMULATION
AIR PRESSURE OR FLOW DETECTED
WHEN AIR OUTPUT IS OFF

FUEL (GAS)
ERROR IN THE
FUEL PRESSURE DETECTION

PRESSURE FAILURE
AIR PRESSURE OR FLOW NOT DETECTED
WHEN AIR OUTPUT IS ON

PRESSURE SIMULATION
AIR PRESSURE OR FLOW DETECTED
WHEN AIR OUTPUT IS OFF

PROOF OF CLOSURE
INCOHERENT STATUS OF
SAFETY FUEL VALVE LIMIT SWITCH

OIL HEATING
INSUFFICIENT TEMPERATURE DETECTED
BY THE FUEL HEATER THERMOSTAT

TIMEOUT / DROP
FAILURE TO PREHEAT
IN MAX ALLOWED TIME

ACTUATOR
MALFUNCTION DETECTED
BY OPERATING THE ACTUATOR

TIMEOUT
THE REQUESTED POSITION HAS NOT BEEN
REACHED IN THE MAXIMUM TRAVEL TIME

ILLEGAL DETECTION
FLAME DETECTED
WHEN THE BURNER SHOULD BE OFF

DURING CONTROLLED SHUTDOWN
FLAME SIMULATION WHILE THE BURNER
WAS IN CONTROLLED SHUTDOWN

DURING PREPURGE
FLAME SIMULATION DURING
PRE-OPERATION / PREPURGE

DURING POSTPURGE
FLAME SIMULATION DURING
POST-OPERATION / POSTPURGE

AT THE END OF POSTCOMBUSTION
FLAME STILL PRESENT AT THE END OF THE
ALLOWED POSTCOMBUSTION TIME

UNSUCCESSFUL IGNITION
NO FLAME DETECTED AT THE END OF
1ST SAFETY TIME (IGNITION TRIAL)

Q2

CONTRIVE

LOCKOUT	DETAIL

FLAME LOSS
FLAME QUENCHING DURING
LOW TEMPERAURE OPERATION — **F**

DURING 2ND STAGE
THE FLAME SIGNAL IS MISSING
OR INSUFFICIENT

DURING 3RD STAGE
THE FLAME SIGNAL IS MISSING
OR INSUFFICIENT

DURING 4TH STAGE
THE FLAME SIGNAL IS MISSING
OR INSUFFICIENT

TIGHTNESS CONTROL
VALVE PROVING SYSTEM HAS DETECTED
A LEAKAGE IN THE FUEL VALVES — **t**

UPSTREAM VALVE
LEAKAGE DETECTED TO
VS FUEL SAFETY VALVE

DOWNSTREAM VALVE(S)
LEAKAGE DETECTED TO
ONE OR MORE VALVES (V1 / V2 / VB)

REMOTE RESET
MORE THAN 5 ALLOWED REMOTE RESETS
WITHIN 15 MINUTES

COMMUNICATION
INACTIVITY FOR A TIME LONGER
THAN THE SET TIMEOUT

TRAXBUS
MISSING COMMANDS
FROM SUPERVISORS

HOST
NO COMMUNICATION WITH
EXPANSION BOARD

CYBER ATTACK
WRONG PASSWORD ATTEMPTING TO
ACCESS THE FRONT IR INTERFACE

ACCESS DENIED
TO CONFIGURATION OR
COMMISSIONING ENVIRONMENTS

CYBER ATTACK
WRONG PASSWORD ATTEMPTING TO
ACCESS THE QNET WEBSERVER

ACCESS DENIED
AFTER 5 CONSECUTIVE ATTEMPTS WITH
THE WRONG PASSWORD

CYBER ATTACK
WRONG PASSWORD ATTEMPTING TO
ACCESS THE TRAXGATEWAY WEBSERVER

ACCESS DENIED
AFTER 5 CONSECUTIVE ATTEMPTS WITH
THE WRONG PASSWORD

CYBER ATTACK
WRONG PASSWORD ATTEMPTING TO
ACCESS THE QIO WEBSERVER

ACCESS DENIED
AFTER 5 CONSECUTIVE ATTEMPTS WITH
THE WRONG PASSWORD

21.3. FAILURES

The red display reports the failure detected while the blue one can provide further details, both flashing.

FAILURE	DETAIL

§ PUSH BUTTON ACTIVE FOR MORE THAN 10 SECONDS	

OUTPUT INOPERATIVE THE OUTPUT SHOULD BE ON BUT REMAINS INACTIVE	**IGNITOR** NO FEEDBACK VOLTAGE DETECTED AT IGNITOR OUTPUT
	V1 OUTPUT NO FEEDBACK VOLTAGE DETECTED AT THE FUEL VALVE OUTPUT V1
	V2 OUTPUT NO FEEDBACK VOLTAGE DETECTED AT THE FUEL VALVE OUTPUT V2
	VB OUTPUT NO FEEDBACK VOLTAGE DETECTED AT THE FUEL VALVE OUTPUT VB

FLAME DETECTION MALFUNCTION OF A FLAME SUPERVISION INPUT OR SENSOR	**FLAME INPUT 1** INCONSISTENT OR OUT OF RANGE SIGNAL FLAME SURVEILLANCE UNRELIABLE
	FLAME INPUT 2 INCONSISTENT OR OUT OF RANGE SIGNAL FLAME SURVEILLANCE UNRELIABLE
	DETECTOR 1 ELECTRO OPTICAL SHUTTER TEST FAILED UV SENSOR 1 UNRELIABLE
	DETECTOR 2 ELECTRO OPTICAL SHUTTER TEST FAILED UV SENSOR 2 UNRELIABLE
	DETECTOR 1 & 2 ELECTRO OPTICAL SHUTTER TEST FAILED BOTH UV SENSORS ARE UNRELIABLE
	FLAME AMPLIFIERS PERIODIC TEST FAILED FLAME AMPLIFERS ARE UNRELIABLE

OVERVOLTAGE POWER SUPPLY VOLTAGE OVER 110% (RECORDED IN LOG MEMORY)	**SEVERE** EVENT LASTING LONGER THAN 5 SECONDS FUSE IS INTENTIONALLY BLOWN

FAILURE	DETAIL

§ UNDERVOLTAGE
SUPPLY VOLTAGE LOWER THAN 85%
(RECORDED IN LOG MEMORY)

INPUTS
MALFUNCTION OF A DIGITAL INPUT
DURING CONTINUOUS VERIFICATION

AIR PRESSURE SWITCH
FAIL SAFE TEST FAILED
UNRELIABLE INPUT

FUEL (GAS) PRESSURE SWITCH
FAIL SAFE TEST FAILED
UNRELIABLE INPUT

HIGH TEMPERATURE
FAIL SAFE TEST FAILED
UNRELIABLE INPUT

IGNITION FEEDBACK
FAIL SAFE TEST FAILED
UNRELIABLE FEEDBACK INPUT

V1 FEEDBACK
FAIL SAFE TEST FAILED
UNRELIABLE FEEDBACK INPUT

V2 FEEDBACK
FAIL SAFE TEST FAILED
UNRELIABLE FEEDBACK INPUT

VB FEEDBACK
FAIL SAFE TEST FAILED
UNRELIABLE FEEDBACK INPUT

PROOF OF CLOSURE INPUT
FAIL SAFE TEST FAILED
UNRELIABLE INPUT

100% LIMIT SWITCH
FAIL SAFE TEST FAILED
UNRELIABLE INPUT

0% LIMIT SWITCH
FAIL SAFE TEST FAILED
UNRELIABLE INPUT

ACTUATOR LIMIT SWITCHES
BOTH LIMIT SWITCHES
CLOSED AT SAME TIME

FAILURE		DETAIL	

OUTPUT SHORT
OUTPUT FOUND ACTIVE
WHEN SHOULD HAVE BEEN TURNED OFF

IGNITOR
FEEDBACK VOLTAGE DETECTED
AT THE IGNITOR OUTPUT

V1 OUTPUT
FEEDBACK VOLTAGE DETECTED
AT THE FUEL VALVE OUTPUT V1

V2 OUTPUT
FEEDBACK VOLTAGE DETECTED
AT THE FUEL VALVE OUTPUT V2

VB OUTPUT
FEEDBACK VOLTAGE DETECTED
AT THE FUEL VALVE OUTPUT VB

MASTER SAFETY RELAY
A SHORT CIRCUIT
HAS BEEN DETECTED IN THE CONTACT

§ MEMORY
DATA CORRUPTION
IN MEMORIES

RAM 1
OCCURRED TO MICROPROCESSOR 1
CONTROLLER

RAM 2
OCCURRED TO MICROPROCESSOR 2
DEPLOYER

EEPROM
OCCURRED TO NON-VOLATILE
LOCKOUT MEMORY

§ PROGRAM
THE PROGRAM IS NOT CARRIED OUT
IN THE CORRECT SEQUENCE

JUMP 1
OCCURRED TO MICROPROCESSOR 1
CONTROLLER

JUMP 2
OCCURRED TO MICROPROCESSOR 2
DEPLOYER

§ MISMATCH
CONTRADICTORY BEHAVIOR OF
MICROCONTROLLERS

FAILURE	DETAIL

§ SYSTEM MICROPROCESSOR MALFUNCTIONING	

	CRC 1 FIRMWARE CORRUPTION MICROPROCESSOR 1 CONTROLLER
	CRC 2 FIRMWARE CORRUPTION MICROPROCESSOR 2 DEPLOYER
	INVALID PARAMETER VALUE NOT ALLOWED FOR A CONFIGURATION PARAMETER
	CPU FAIL 1 CPU TEST FAILURE MICROPROCESSOR 1 CONTROLLER
	CPU FAIL 2 CPU TEST FAILURE MICROPROCESSOR 2 DEPLOYER
	WATCHDOG LACK OF COMMUNICATION BETWEEN MICROPROCESSORS
	MCU OVERVOLTAGE LOGIC POWER SUPPLY TOO HIGH, FUSE BLOWN IF LASTS MORE THAN 5 SECONDS
	MCU UNDERVOLTAGE LOGIC POWER SUPPLY TOO LOW
	MCU TEMPERATURE OPERATING TEMPERATURE OUT OF RANGE
	LOCKOUT MEMORY NON-VOLATILE MEMORY DATA MISMATCH

§ NON-RESETTABLE FAILURES
FOR NON-PERSISTENT FAILURES THE NORMAL OPERATION WILL RESUME AT THE NEXT POWER ON

21.4. MONITOR

By selecting operation as a simple flame relay, the red display shows the status of supervised flames.

NO FLAME	
NEITHER OF THE TWO SENSORS DETECTED THE PRESENCE OF A FLAME	*0*

	FLAME 1 DETECTED
1	THE FLAME HAS BEEN DETECTED BY SENSOR CONNECTED TO INPUT 1
2	**FLAME 2 DETECTED** THE FLAME HAS BEEN DETECTED BY SENSOR CONNECTED TO INPUT 2
3	**FLAMES DETECTED** THE FLAME HAS BEEN DETECTED BY BOTH SENSORS

22. CONFIGURATION

All parameters can be read, but modification is password protected (factory default 00000000).
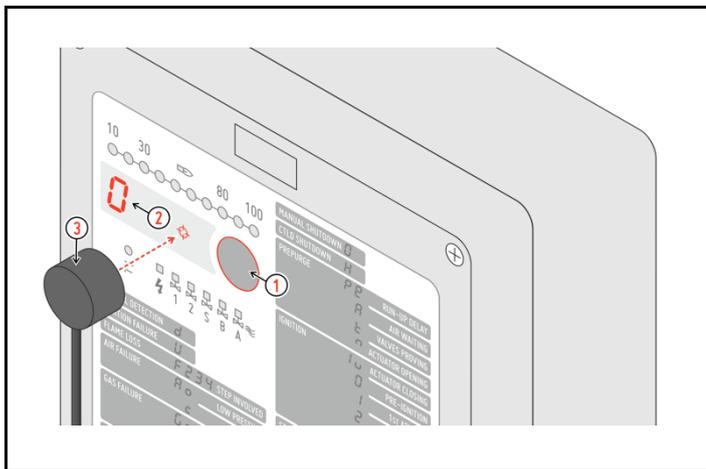
To change the device configuration:

1. Press the front button to force the MANUAL SHUTDOWN condition.

2. Display code 0 confirms that current status is MANUAL SHUTDOWN.

3. Put the optical jack on the crosshairs between the display and the key, the internal magnet will hold it in place.

Connect the optical jack **Q.link** to a USB port on PC and start **Q.Suite** software.

(!) If the optical jack is detected at power on (in AUTOSTART mode) Q2 goes directly into MANUAL SHUTDOWN for configuration.

It is highly recommended to save and retain the configuration of every device to a dedicated file. This practice is essential to:

1. **Ensure Spare Part Management**
    It enables the rapid and accurate restoration of settings in case of device replacement or failure.

2. **Provide Compliance Evidence**
    It offers documented proof that all standard and project requirements have been correctly implemented.

Why is it important to maintain a copy of the configurations?

The system features 122 individually configurable functional parameters (excluding the 5 communication-related parameters). This vast range of choices results in an astronomical number of possible configurations: $4{,}001 \times 10^{161}$.

22.1. GENERAL

DEVICE RELATED SETTINGS.

G00 – PASSWORD

Password to access configuration and commissioning environment.

- *4 to 8 alphanumeric characters (DEFAULT 00000000)*

At first setup you will be asked to change the password.

EN298 § 7.101.3.1

IEC EN 62443-4-2 § 5.9 – EU DIRECTIVE 2022/2555 – EU REGULATION 2024/2847
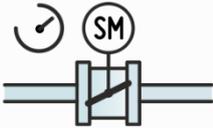
G01 – ACTUATOR MAX TRAVEL TIME

Time required by the actuator to complete the full travel:

- *disabled (default)*
- *10 … 300 seconds*

This time is automatically acquired by the device during the commissioning.

Specific fault will be shown if the actuator takes longer.
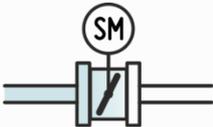
G02 – ACTUATOR 1% POSITION

Position detected by the potentiometer as fully closed of the actuator.

- *0 … 4095 bit*

This position is automatically acquired by the device during the commissioning.
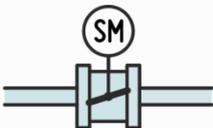
EN298 § 7.101.2.6

G03 – ACTUATOR 99% POSITION

Position detected by the potentiometer as fully open of the actuator.

- *0 … 4095 bit*

This position is automatically acquired by the device during the commissioning.

EN298 § 7.101.2.6
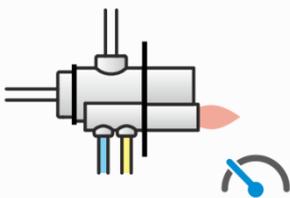
G04 – FLAME 1 SENSITIVITY

The minimum flame signal detectable by the sensor connected to input 1 (terminal 10) can be either a UV sensor or an electrode.

- *1 … 9 µA (DEFAULT 2 µA)*
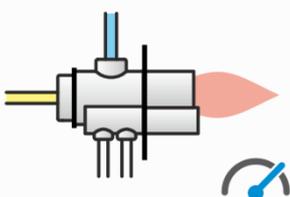
G05 – FLAME 2 SENSITIVITY

The minimum flame signal detectable by the UV sensor connected to input 2 (terminal 11).

- *1 … 9 µA (DEFAULT 2 µA)*
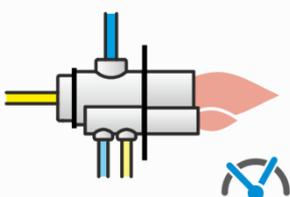
G06 – FLAME SIGNAL DISPLAY

Flame signal that will be displayed by the bargraph:

- *SENSOR 1*
- *SENSOR 2*
- *LOWEST signal among two sensors*
- *HIGHEST signal among two sensors (DEFAULT)*
- *AVERAGE of two sensors signal*

EN298 § 3.107

G07 – ELECTRO OPTICAL SHUTTER

When a UV sensor is used and permanent operation of the burner is required it will be necessary to place an electro-optical shutter in front of the sensor, set to which sensor it has been fitted:
- *INACTIVE (DEFAULT)*
- *UV SENSOR 1 at terminal 10*
- *UV SENSOR 2 at terminal 11*
- *BOTH*

This device will be activated periodically to verify the reaction of the sensor to flame quenching.

EN298 § 7.101.4.1.2 – § 7.101.4.1.5

G08 – HIGH TEMPERATURE

The high temperature input at the HT terminal allows activation of the indirect surveillance of the flame. The signal must come from a safety thermoregulator which is activated when the walls of the combustion chamber exceed the auto-ignition temperature of the fuel.

As long as this signal is present, the flame sensors will be excluded:
- *IMMEDIATE (DEFAULT)*
- *NEXT START*
- *IMMEDIATE CONFIRMED via remote command*
- *NEXT START CONFIRMED via remote command*

EN 13577-2 § 4.10.3

G09 – PROOF OF CLOSURE SWITCH RESPONSE TIME

The VS fuel valve connected to terminal F4 can be equipped with a limit switch to check its physical position. This parameter allows you to define the time within which the limit switch contact must be detected as closed after the VS valve has been activated:
- *1 … 10 seconds (DEFAULT 1)*
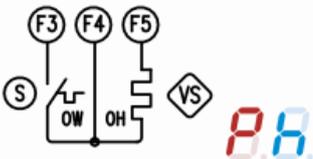
When the valve is not equipped with the "proof of closure switch", it will be necessary to read the output status directly by connecting the terminal F3 to terminal F4.

NFPA85 – NFPA86 § 3.3.69.7 – EN13577-2 § 4.3.6 – ISO23511-1

G09 – OIL PREHEATING TIME

For the oil burner, the fuel heater is connected to terminal F4 and the associated thermostat must give consent to terminal F3 within the maximum time of 10 minutes, otherwise there will be a lockout. Select this option only if the burner is equipped with a fuel heater.
- *OIL HEATER*
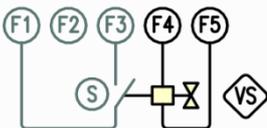
22.2. POWER ON

SETTINGS THAT DEFINE THE BEHAVIOR OF THE DEVICE AFTER BEING POWERED.

S01 – POWER-ON BEHAVIOR

This parameter defines the behavior of the device at power on, once the self-test has been successfully completed:

- *AUTOSTART: cycle starts automatically (DEFAULT)* [1]
- *STANDBY: push the button / remote control to start cycle*
- *MONITOR: detects the flame, no cycle (like a flame relay)*

[1] Unless the unit has been turned off while in lockout (non-volatile).

EN298 § 3.121.1

S02 – AIR VALVE
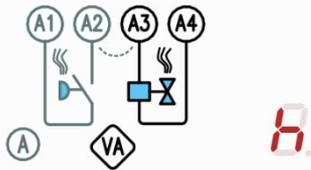
During this stage the air valve can be:

- *OFF (DEFAULT)*
- *ON*
- *REMOTE CONTROL ONLY*

S03 – ACTUATOR POSITION
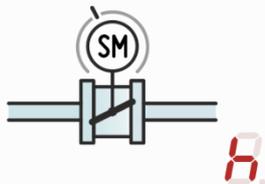
When the device is powered, it is possible to force the actuator into a predefined position:

- *NO ACTION* [3] *(DEFAULT)*
- *LO LIMIT SWITCH POSITION* [1]
- *HI LIMIT SWITCH POSITION* [1]
- *POSITION 1 … 99 %* [2] [3]

[1] Position cannot be changed by remote control

[2] Potentiometer must be connected

[3] A different position can be requested with remote control

S04 – AIR PRESSURE RESPONSE TIME

If the air valve is active during this stage (parameter S02) the contact of the air pressure switch must be closed, if it is open for a time longer than that set with this parameter there will be an air loss lockout.

If the air is inactive in this stage, the contact of the air pressure switch must be open, if it closes for a time longer than the one set with this parameter, there will be an air simulation lockout.

- *DISABLED (DEFAULT)*
- *1 … 25 seconds*

22.3. LOCKOUT

SETTINGS THAT DEFINE THE BEHAVIOR OF THE DEVICE WHEN IT REACHES THE MAXIMUM SAFETY CONDITION FOLLOWING AN ANOMALY IN THE PROCESS OR A FAULT IN THE DEVICE OR IN THE ELECTRICAL ELEMENTS OF THE BURNER

EN298 § 3.121
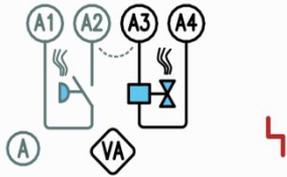
L01 – AIR VALVE

During this stage the air valve can be:

- *OFF (DEFAULT)*
- *ON*
- *REMOTE CONTROL ONLY*

L02 – ACTUATOR POSITION

When the device is in lockout, it is possible to force the actuator into a predefined position:

- *NO ACTION [3]*
- *LO LIMIT SWITCH POSITION [1] (DEFAULT)*
- *HI LIMIT SWITCH POSITION [1]*
- *POSITION 1 … 99 % [2] [3]*

[1] Position cannot be changed by remote control

[2] Potentiometer must be connected

[3] A different position can be requested with remote control

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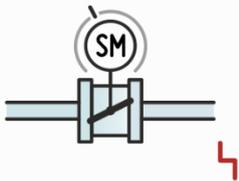
22.4. CONTROLLED SHUTDOWN

SETTINGS THAT DEFINE THE BEHAVIOR OF THE DEVICE AFTER IT RECEIVES A SHUTDOWN REQUEST
EN298 § 3.119
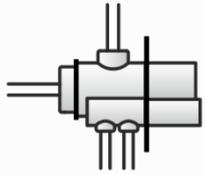
C01 – MINIMUM BURNER PAUSE TIME

In some processes it is necessary to prevent an immediate restart of the burner after a controlled shutdown, it is therefore possible to define a minimum pause time during which any restart requests will be ignored.

- *0 … 250 seconds (DEFAULT 0)*

For oil burners without pre-purge the interval between shutdown and the next start attempt shall be more than 30 seconds.

EN298 § 7.101.2.7
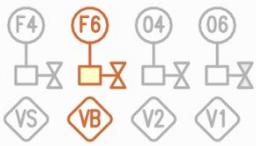
C02 – FUEL VALVES

To adapt operation to different types of process, it is possible to define which fuel valves are active when the burner is in controlled shutdown.

- *VB at terminal F6 (DEFAULT OFF)*

In regenerative burners this could be the gas exhaust valve.
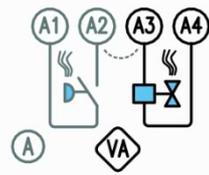
C03 – AIR VALVE

During this stage the air valve can be:

- *OFF (DEFAULT)*
- *ON*
- *REMOTE CONTROL ONLY*

C04 – ACTUATOR POSITION

When performing a controlled shutdown, it is possible to force the actuator into a predefined position:

- *NO ACTION [3]*
- *LO LIMIT SWITCH POSITION [1] (DEFAULT)*
- *HI LIMIT SWITCH POSITION [1]*
- *POSITION 1 … 99 % [2][3]*

[1] Position cannot be changed by remote control
[2] Potentiometer must be connected
[3] Remote command may require a different position
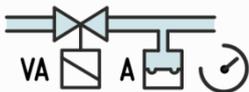
C05 – AIR PRESSURE RESPONSE TIME

If the air valve is active during this stage (parameter C03) the contact of the air pressure switch must be closed, if it is open for a time longer than that set with this parameter there will be an air loss lockout.

If the air is inactive in this stage, the contact of the air pressure switch must be open, if it closes for a time longer than the one set with this parameter, there will be an air simulation lockout.

- *DISABLED (DEFAULT)*
- *1 … 25 seconds*

C06 – FUEL PRESSURE RESPONSE TIME

During this stage the fuel flow is stopped and the relative pressure switch must therefore be inactive, but a residual presence could be detected. This parameter allows you to define the maximum time within which the presence of fuel must no longer be detected before a lockout occurs.

- *DISABLED (DEFAULT)*
- *1 … 25 seconds*
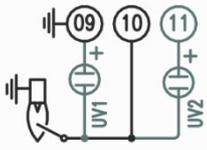
C07 – FLAME DETECTORS

While the burner is in controlled shutdown it is possible to carry out the flame simulation test, it is therefore necessary to define which sensors are active in this stage to detect an illegal flame.

- *NONE*
- *FLAME 1 at terminal 10 (UV sensor or electrode)*
- *FLAME 2 at terminal 11 (UV sensor)*
- *FLAME 1+2 (DEFAULT)*

EN298 § 7.101.2.9

22.5. TIGHTNESS TEST

SETTINGS THAT DEFINE THE TIGHTNESS TEST MODALITIES OF THE FUEL SOLENOID VALVES - IF DUE - BEFORE EACH IGNITION OF THE BURNER
EN1643 – EN 13577-2 – EN676 – NFPA85 – NFPA86

T01 – FILL VALVE OPENING TIME

Define the time needed to fill with fuel the test volume.

This is the activation time of the SAFETY valve at terminal F4.

- *SKIP TEST (DEFAULT)*
- *1 … 25 seconds*

Must be ≤ 3 seconds according to EN 1643 § 7.101.3
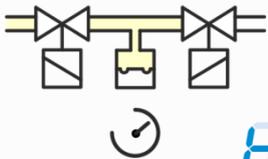
T02 – FILL TEST DURATION

The time during which it occurs that the test volume (sealed filled) does not lose pressure due to a leak in the downstream valve(s) depends on the burner capacity, according to the relevant application standard.

- *5 … 3600 seconds (default 60)*

T03 – DISCHARGE VALVE(S) OPENING TIME

Define the time required to drain the fuel from the test volume: this is the activation time of the discharge valve(s):

- *1 … 25 seconds (DEFAULT 1)*
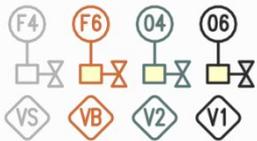
T04 – DISCHARGE VALVE(S)

The fuel required for the test can be discharged into the combustion chamber or vented into the atmosphere (see relevant standards). Define which valve(s) will be activated during the discharge phase.

- *VB at terminal F6 (DEFAULT OFF)*
- *V1 at terminal 06 (DEFAULT ON)*
- *V2 at terminal 04 (DEFAULT ON)*
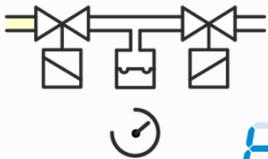
T05 – EMPTY TEST DURATION

The time during which it is verified that the test volume (sealed empty) is not filled with fuel due to a leak in the upstream valve depends on the burner capacity, according to the relevant application standard.

- *5 … 3600 seconds (default 60)*

22.6. PREPURGE

SETTINGS THAT DEFINE THE BEHAVIOR DURING PREPURGE OF COMBUSTION CHAMBER
EN298 § 3.114 – 7.101.3.2 – § 7.101.3.3 – EN 13577-2 § 4.11.1

FOR BURNER WITHOUT FANS IS THE WAITING TIME
EN298 § 3.124.1 – § 3.124.2
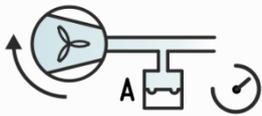
P01 – AIR RUN-UP DELAY

To compensate for the delayed air flow due to distant or slow opening valves or to the time required for the fan to reach the necessary flow rate, it is possible to set a waiting time.

This delay is performed only if the air pressure switch check is active in this phase (parameter P05).

- *0 … 3600 seconds (DEFAULT 0)*

P02 – AIR VALVE

During this stage the air valve can be:
- *OFF*
- *ON (DEFAULT)*

Initially the air valve will be deactivated anyway for a while to verify the correct operation of the pressure switch (air simulation test).

Remote control is disabled.
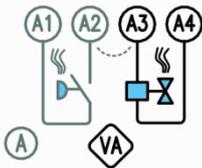
P03 – ACTUATOR POSITION

When the prepurge starts, it is possible to force the actuator into a predefined position.

The pre-purge time starts after reaching the required position.

- *NO ACTION [3]*
- *LO LIMIT SWITCH POSITION [1]*
- *HI LIMIT SWITCH POSITION [1] (DEFAULT)*
- *POSITION 1 … 99 % [2][3]*

[1] Position cannot be changed by remote control
[2] Potentiometer must be connected
[3] Remote command may require a different position

P04 – PREPURGE TIME

Set prepurge time in forced draught burners according to relevant standards (EN 676).

- *0 … 6000 seconds (DEFAULT 30)*

During this time the flame simulation test is carried out.
The time starts when the actuator reaches the required position.

EN298 § 3.124.1 – § 3.124.2 – § 3.124.3 – § 3.124.4
EN13577-2 §4.11.1 – NFPA86 §3.3.59
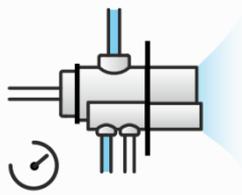
P05 – AIR PRESSURE RESPONSE TIME

If the air valve is active in this stage (parameter P02) the purge time will be counted only when the contact of the air pressure switch is closed for a time longer than that set with this parameter.

If the contact is open for a time longer than that set with this parameter there will be an air loss lockout.

If the air valve is disabled in this stage, the contact of the air pressure switch must be open, if it closes for a time longer than the one set with this parameter, there will be an air simulation lockout.

The input can also be used to pause the cycle progress while waiting for external consent to proceed with the pre-purge.

- *DISABLED (DEFAULT)*
- *1 … 25 seconds*

P06 – FUEL PRESSURE RESPONSE TIME

During this stage the fuel flow is stopped and the relative pressure switch must therefore be inactive, but a residual presence could be detected. This parameter allows you to define the maximum time within which the presence of fuel must no longer be detected before a lockout occurs.

- *DISABLED (DEFAULT)*
- *1 … 25 seconds*
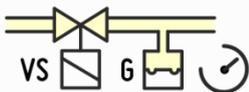
P07 – FLAME DETECTORS

During the prepurge it is possible to carry out the flame simulation test, it is therefore necessary to define which sensors are active in this stage to detect an illegal flame.

- *NONE*
- *FLAME 1 at terminal 10 (UV sensor or electrode)*
- *FLAME 2 at terminal 11 (UV sensor)*
- *FLAME 1+2 (DEFAULT)*

EN298 § 3.108 – § 7.101.2.9
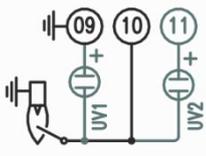
P08 – IGNITOR

The relevant standards require that for oil burners the ignitor is active during prepurge.

- *OFF (DEFAULT)*
- *1 … 25 seconds*

A shared electrode cannot be used for ignition and flame detection when the ignitor is activated during prepurge.
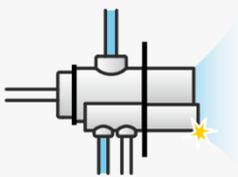
EN298 § 7.101.3.3

22.7. PREIGNITION (STAGE 0)

SETTINGS RELATING TO THE STAGE PRECEDING BURNER IGNITION
EN298 § 3.135.2

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001 – STAGE DURATION

Duration of preignition, before proceeding to ignition.

- *500 milliseconds (DEFAULT)*
- *1 … 25 seconds*
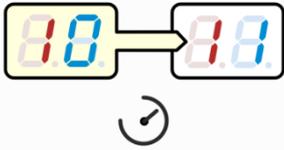
The ignitor is turned on before the start of the ignition stage to check its correct functioning before delivering the fuel.

The time starts after the actuator has reached the predefined position.

For systems that give more than one ignition attempt, set this time as an inter-purge or inter-wait time after an unsuccessful ignition attempt.

EN298 § 7.101.2.8

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002 – AIR VALVE

During this stage the air valve can be:

- *OFF*
- *ON (DEFAULT)*
- *REMOTE CONTROL ONLY*

---
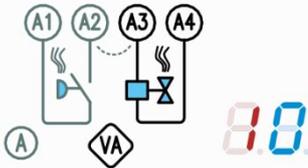
003 – ACTUATOR POSITION

Before starting the ignition stage, it is possible to force the actuator into a predefined position.

- *NO ACTION [3]*
- *LO LIMIT SWITCH POSITION [1] (DEFAULT)*
- *HI LIMIT SWITCH POSITION [1]*
- *POSITION 1 … 99 % [2,3]*

[1] Position cannot be changed by remote control
[2] Potentiometer must be connected
[3] Remote command may require a different position

---

004 – AIR PRESSURE RESPONSE TIME

If the air valve is active during this stage (parameter 002) the contact of the air pressure switch must be closed, if it is open for a time longer than that set with this parameter there will be an air loss lockout.

If the air valve is disabled in this stage, the contact of the air pressure switch must be open, if it closes for a time longer than the one set with this parameter, there will be an air simulation lockout.

- *DISABLED (DEFAULT)*
- *1 … 25 seconds*

---

005 – FUEL PRESSURE RESPONSE TIME

During this stage the pressure switch must detect the fuel, lockout occurs if the fuel pressure is not detected within the time specified with this parameter. The input can also be used to pause the cycle progress while waiting for external consent to proceed with the ignition.

- *DISABLED (DEFAULT)*
- *1 … 25 seconds*

---

006 – IGNITOR

Select if the burner is ignited with a spark generated by a high voltage transformer or if this output should remain inactive during this stage.

- *- OFF*
- *- ON (DEFAULT)*

22.8. IGNITION (STAGE 1)

SETTINGS RELATING TO THE BURNER IGNITION TRIAL
EN298 § 3.135.3 – EN13577-2 § 4.11.4

101 – STAGE DURATION

Duration of the ignition stage.

(First Safety Time / Trial for Ignition Period).

- 1 … 25 seconds (DEFAULT 3)

It must be set according to EN 13577-2 (or other relevant requirements)

Natural draught burners	*≤ 350 kW → 10"*
	> 360 kW → 5"

MAX IGNITION POWER MUST BE ≤ 33% NOMINAL POWER WITH MAXIMUM OF 350 kW

Forced and induced draught burners	*≤ 70 kW → 5"*
	> 70 kW → 3"

MAX IGNITION POWER MUST BE ≤ 120 KW

EN298 § 3.116 – EN13577-2 § 4.11.5 §4.11.6 §4.11.7 – NFPA86 § 3.3.72

### 102 – FUEL VALVES

To adapt operation to different types of process, it is possible to define which fuel valves are active during the ignition trial.

- *- VS at terminal F4 (DEFAULT ON)* [1]
- *- VB at terminal F6 (DEFAULT OFF)*
- *- V1 valve at terminal 06 (DEFAULT ON)*
- *- V2 valve at terminal 04 (DEFAULT OFF)*

[1] For oil burners this could be the heater outlet.

103 – STARTUP ATTEMPTS

When the flame is not detected at the end of the ignition trial, up to 3 attempts can be made as long as the safety of the application is not impaired:

- *- 1 attempt (DEFAULT)*
- *- 2 attempts*
- *- 3 attempts*
- *- 4 attempts*

A lockout will occur if all attempts are completed without flame being detected.

Set parameter 001 properly if an inter-purge or inter-wait time is required after an unsuccessful ignition attempt.

EN676 § 4.4.1.8

104 – AIR VALVE

During this stage the air valve can be:
- *- OFF*
- *- ON (DEFAULT)*
- *- REMOTE CONTROL ONLY*

105 – AIR PRESSURE RESPONSE TIME

If the air valve is active during this stage (parameter 002) the contact of the air pressure switch must be closed, if it is open for a time longer than that set with this parameter there will be an air loss lockout.

If the air valve is disabled in this stage, the contact of the air pressure switch must be open, if it closes for a time longer than the one set with this parameter, there will be an air simulation lockout.
- *- DISABLED (DEFAULT)*
- *- 1 … 25 seconds*

106 – FUEL PRESSURE RESPONSE TIME

During this stage the fuel must flow and therefore the relative pressure switch must be closed. This parameter allows you to define how long the contact can be detected open before a lockout occurs.
- *- DISABLED (DEFAULT)*
- *- 1 … 25 seconds*
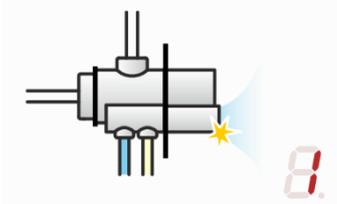
107 – IGNITOR

Select if the burner is ignited with a spark generated by a high voltage transformer or if this output should remain inactive during this stage.
- *- OFF*
- *- ON (DEFAULT)*
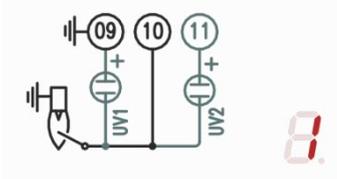
108 – FLAME DETECTORS

At the end of the ignition stage the presence of flame is detected, it is therefore necessary to define which sensors are active in this stage.
- *- FLAME 1 at terminal 10 (UV sensor or electrode) (DEFAULT)*
- *- FLAME 2 at terminal 11 (UV sensor)*
- *- FLAME 1+2*

22.9. STAGE 2 (LOW TEMPERATURE)

SETTINGS RELATING TO THE BEHAVIOR OF THE BURNER
IN ONE OF THE 3 POSSIBLE STAGES IN THE LOW TEMPERATURE MODE
EN 13577-2 § 4.10.2

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201 – STAGE DURATION
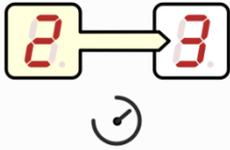
Duration of the current stage, before proceeding to the next.

- *ENDLESS, until shutdown or lockout*
- *1 … 3600 seconds (DEFAULT 3)*

The transition to a different stage can be requested at any time via remote control.

In multi-stage burners this is the pilot or start flame proving period.

Set infinite duration if the transition is handled externally (Qio, Fieldbus).

EN298 § 3.131

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202 – MINIMUM STAGE DURATION

In some processes it is necessary to guarantee the minimum stage duration, it is therefore possible to define a minimum time during which any requests for controlled shutdown will be ignored.

- *0 … 250 seconds (DEFAULT 0)*

---
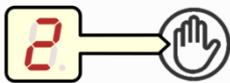
203 – FUEL VALVES

To adapt operation to different types of process, it is possible to define which fuel valves are active during this stage.

In 2-stage burners this is typically the pilot-only condition.
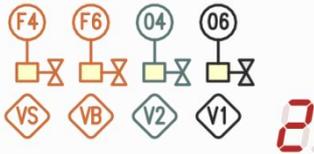
- *VS at terminal F4 (DEFAULT ON)* [1]
- *VB at terminal F6 (DEFAULT OFF)*
- *V1 at terminal 06 (DEFAULT ON)*
- *V2 at terminal 04 (DEFAULT OFF)*

[1] For oil burners this could be the heater outlet.

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204 – AIR VALVE

During this stage the air valve can be:

- *OFF*
- *ON (DEFAULT)*
- *REMOTE CONTROL ONLY*

---
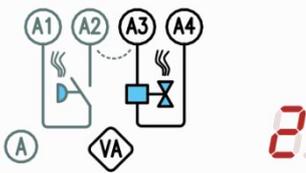
205 – ACTUATOR POSITION

Entering stage 2 it is possible to force the actuator into a predefined position.

- *NO ACTION 3 (DEFAULT)*
- *LO LIMIT SWITCH POSITION* [1]
- *HI LIMIT SWITCH POSITION* [1]
- *POSITION 1 … 99 %* [2] [3]
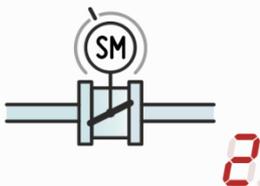
[1] Position cannot be changed by remote control
[2] Potentiometer must be connected
[3] Remote command may require a different position

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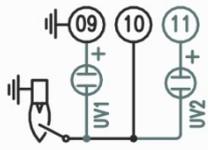
206 – FLAME DETECTORS

Select which sensors monitor the presence of flame during this stage.

- *FLAME 1 at terminal 10 (UV sensor or electrode) (DEFAULT)*
- *FLAME 2 at terminal 11 (UV sensor)*
- *FLAME 1+2*
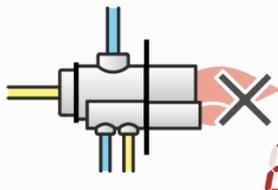
207 – FLAME FAILURE BEHAVIOR

Behavior at flame loss during this stage (after possible postpurge). The setting is to be determined on the basis of burner capacity and relevant application standards.

- *LOCKOUT (DEFAULT)*
- *RESPARK (restarts from pre-ignition) 1*
- *RECYCLE (restarts from pre-operations)*

[1] For oil burners with fuel flow rate > 30kg/h any ignition restoration is not allowed

EN298 § 7.101.2.3 – EN13577-2 § 4.11.9

208 – AIR FAILURE BEHAVIOR

Behavior to the loss of air pressure during this stage (after possible post-combustion and post-purge).

- *LOCKOUT (DEFAULT)*
- *RESPARK (restarts from pre-ignition) [1]*
- *RECYCLE (restarts from pre-operations)*

[1] For oil burners with fuel flow rate > 30kg/h any ignition restoration is not allowed

EN298 § 7.101.2.2

209 – FUEL FAILURE BEHAVIOR

Behavior at fuel loss during this stage (after possible post-combustion and post-purge).

- *LOCKOUT (DEFAULT)*
- *RESPARK (restarts from pre-ignition) [1]*
- *RECYCLE (restarts from pre-operations)*

[1] For oil burners with fuel flow rate > 30kg/h any ignition restoration is not allowed

EN298 § 7.101.2.

210 – FLAME FAILURE RESPONSE TIME

If the flame fails during this stage, the fuel valves are switched off within this safety time which must comply with the relevant standards.

- *1 … 10 seconds (DEFAULT 1)*

EN298 § 3.105.1 – § 7.101.3.4.3 – § 7.101.3.7 – NFPA86 § 3.3.19

211 – AIR PRESSURE RESPONSE TIME

If the air valve is active in this stage (parameter 204) the contact of the air pressure switch must be closed, if it remains open for a time greater than that set with this parameter, the air loss failure will lead to the behavior set with parameter 208.

If the air valve is disabled in this stage (parameter 204) the contact of the air pressure switch must be open, if it remains closed for a time longer than the one set with this parameter, the air simulation failure will lead to the behavior set with parameter 208.

- *DISABLED (DEFAULT)*
- *1 … 25 seconds*

212 – FUEL PRESSURE RESPONSE TIME

During this stage the fuel must flow and therefore the relative pressure switch must be closed, if it remains open for a time longer than the one set with this parameter, the behavior will depend on the settings of parameter 209.

- *DISABLED (DEFAULT)*
- *1 … 25 seconds*

22.10. STAGE 3 (LOW TEMPERATURE)

SETTINGS RELATING TO THE BEHAVIOR OF THE BURNER
IN ONE OF THE 3 POSSIBLE STAGES IN THE LOW TEMPERATURE MODE
EN 13577-2 § 4.10.2

301 – STAGE DURATION

Duration of the current stage, before proceeding to the next.

- *ENDLESS, until shutdown or lockout*
- *1 … 3600 seconds (DEFAULT 3)*
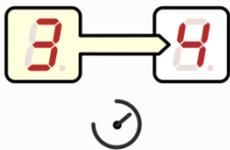
The transition to a different stage can be requested at any time with a remote control.

In 2-stage burners, when both the pilot and main burners are on, this corresponds to the 2nd safety time and must be set according to EN 13577-2 (or other relevant requirements).

By setting unlimited duration, the pilot will be permanent.

Set infinite duration if the transition is handled externally (Qio, Fieldbus).

EN298 § 3.117 – § 3.132 – § 3.133 – EN13577-2 § Table 1 § Table 2 § Table 3

302 – MINIMUM STAGE DURATION

In some processes it is necessary to guarantee the minimum stage duration, it is therefore possible to define a minimum time during which any requests for controlled shutdown will be ignored.

- *0 … 250 seconds (DEFAULT 0)*
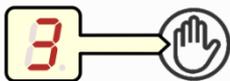
303 – FUEL VALVES

To adapt operation to different types of process, it is possible to define which fuel valves are active during this stage.

In 2-stage burners this is typically the pilot + main condition.
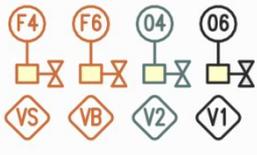
- *VS at terminal F4 (DEFAULT ON)* [1]
- *VB at terminal F6 (DEFAULT OFF)*
- *V1 at terminal 06 (DEFAULT ON)*
- *V2 at terminal 04 (DEFAULT ON)*

[1] For oil burners this could be the heater outlet.
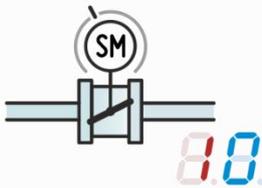
304 – AIR VALVE

During this stage the air valve can be:

- *OFF*
- *ON (DEFAULT)*
- *REMOTE CONTROL ONLY*
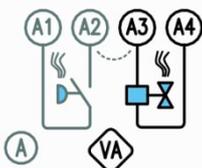
305 – ACTUATOR POSITION

Entering stage 3 it is possible to force the actuator into a predefined position.

- *NO ACTION 3 (DEFAULT)*
- *LO LIMIT SWITCH POSITION [1]*
- *HI LIMIT SWITCH POSITION [1]*
- *POSITION 1 … 99 % [2] [3]*

[1] Position cannot be changed by remote control

[2] Potentiometer must be connected

[3] Remote command may require a different position

306 – FLAME DETECTORS
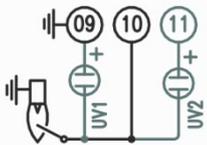
Select which sensors monitor the presence of flame during this stage.

- *FLAME 1 at terminal 10 (UV sensor or electrode)*
- *FLAME 2 at terminal 11 (UV sensor)*
- *FLAME 1+2 (DEFAULT)*

307 – FLAME FAILURE BEHAVIOR

Determines the behavior at flame loss during this stage (after possible post-purge). The setting is to be determined on the basis of burner capacity and relevant application standards.
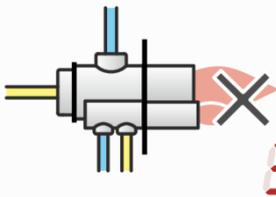
- *LOCKOUT (DEFAULT)*
- *RESPARK (restarts from pre-ignition) [1]*
- *RECYCLE (restarts from pre-operations)*

[1] For oil burners with fuel flow rate > 30kg/h any ignition restoration is not allowed

EN298 § 7.101.2.3 – EN13577-2 § 4.11.9

308 – AIR FAILURE BEHAVIOR

Behavior to the loss of air pressure during this stage (after possible postcombustion and post-purge).

- *LOCKOUT (DEFAULT)*
- *RESPARK (restarts from pre-ignition) [1]*
- *RECYCLE (restarts from pre-operations)*

[1] For oil burners with fuel flow rate > 30kg/h any ignition restoration is not allowed

EN298 § 7.101.2.2

309 – FUEL FAILURE BEHAVIOR

Determines the behavior at fuel loss during this stage (after possible postcombustion and postpurge).

- *LOCKOUT (DEFAULT)*
- *RESPARK (restarts from pre-ignition) [1]*
- *RECYCLE (restarts from pre-operations)*

[1] For oil burners with fuel flow rate > 30kg/h any ignition restoration is not allowed

EN298 § 7.101.2.2
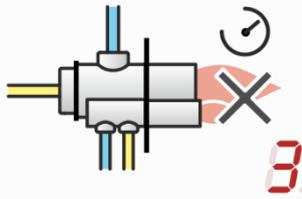
310 – FLAME FAILURE RESPONSE TIME

If the flame fails during this stage, the fuel valves are switched off within this safety time which must comply with the relevant standards.

- *1 … 10 seconds (DEFAULT 1)*

EN298 § 3.105.1 – § 7.101.3.4.3 – § 7.101.3.7 – NFPA86 § 3.3.19

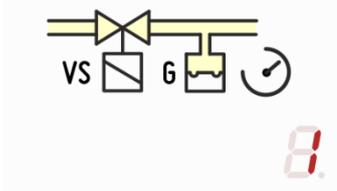### 311 – AIR PRESSURE RESPONSE TIME

If the air valve is active in this stage (parameter 304) the contact of the air pressure switch must be closed, if it remains open for a time greater than that set with this parameter, the air loss failure will lead to the behavior set with parameter 308.

If the air valve is disabled in this stage (parameter 304) the contact of the air pressure switch must be open, if it remains closed for a time longer than the one set with this parameter, the air simulation failure will lead to the behavior set with parameter 308.

- *DISABLED (DEFAULT)*
- *1 … 25 seconds*
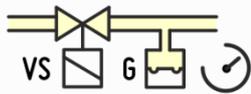
312 – FUEL PRESSURE RESPONSE TIME

During this stage the fuel must flow and therefore the relative pressure switch must be closed, if it remains open for a time longer than the one set with this parameter, the behavior will depend on the settings of parameter 309.

- *DISABLED (DEFAULT)*
- *1 … 25 seconds*

22.11. STAGE 4 (LOW TEMPERATURE)

SETTINGS RELATING TO THE BEHAVIOR OF THE BURNER
IN ONE OF THE 3 POSSIBLE STAGES IN THE LOW TEMPERATURE MODE
EN 13577-2 § 4.10.2
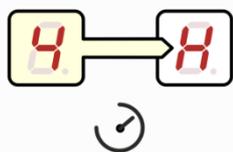
401 – STAGE DURATION

Duration of the current stage, before proceeding to controlled shutdown.

- *ENDLESS, until shutdown or lockout (DEFAULT)*
- *1 … 3600 seconds*

The transition to a different stage can be requested at any time with a remote control.

In 2-stage burners this is typically the main-only condition.

Set infinite duration if the transition is handled externally (Qio, Fieldbus).
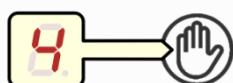
402 – MINIMUM STAGE DURATION

In some processes it is necessary to guarantee the minimum stage duration, it is therefore possible to define a minimum time during which any requests for controlled shutdown will be ignored.

- *0 … 250 seconds (DEFAULT 0)*

403 – FUEL VALVES

To adapt operation to different types of process, it is possible to define which fuel valves are active during this stage.
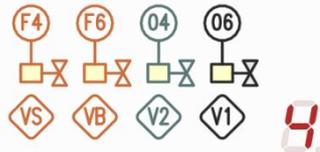
In 2-stage burners this is typically the main-only condition.

- *VS at terminal F4 (DEFAULT ON) [1]*
- *VB at terminal F6 (DEFAULT OFF)*
- *V1 at terminal 06 (DEFAULT OFF)*
- *V2 at terminal 04 (DEFAULT ON)*

[1] For oil burners this could be the heater outlet.

404 – AIR VALVE

During this stage the air valve can be:
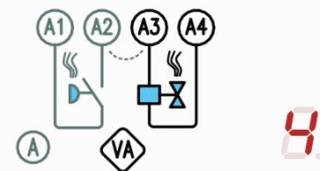
- *OFF*
- *ON (DEFAULT)*
- *REMOTE CONTROL ONLY*

405 – ACTUATOR POSITION

Entering stage 4 it is possible to force the actuator into a predefined position.
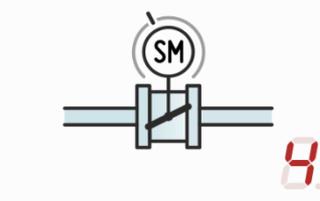
- *NO ACTION 3 (DEFAULT)*
- *LO LIMIT SWITCH POSITION [1]*
- *HI LIMIT SWITCH POSITION [1]*
- *POSITION 1 … 99 % [2] [3]*

[1] Position cannot be changed by remote control
[2] Potentiometer must be connected
[3] Remote command may require a different position

406 – FLAME DETECTORS

Select which sensors monitor the presence of flame during this stage.
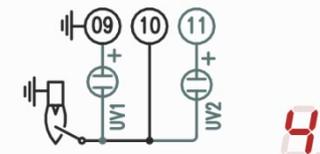
- *FLAME 1 at terminal 10 (UV sensor or electrode)*
- *FLAME 2 at terminal 11 (UV sensor) (DEFAULT)*
- *FLAME 1+2*

407 – FLAME FAILURE BEHAVIOR

Determines the behavior at flame loss during this stage (after possible post-purge). The setting is to be determined on the basis of burner capacity and relevant application standards.
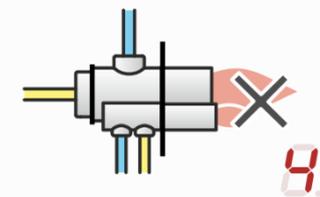
- *LOCKOUT (DEFAULT)*
- *RESPARK (restarts from pre-ignition) [1]*
- *RECYCLE (restarts from pre-operations)*

[1] For oil burners with fuel flow rate > 30kg/h any ignition restoration is not allowed

EN298 § 7.101.2.3 – EN13577-2 § 4.11.9

408 – AIR FAILURE BEHAVIOR

Behavior to the loss of air pressure during this stage (after possible postcombustion and post-purge).

- *LOCKOUT (DEFAULT)*
- *RESPARK (restarts from pre-ignition)* [1]
- *RECYCLE (restarts from pre-operations)*

[1] For oil burners with fuel flow rate > 30kg/h any ignition restoration is not allowed

EN298 § 7.101.2.2

409 – FUEL FAILURE BEHAVIOR

Determines the behavior at fuel loss during this stage (after possible postcombustion and post-purge).

- *LOCKOUT (DEFAULT)*
- *RESPARK (restarts from pre-ignition)* [1]
- *RECYCLE (restarts from pre-operations)*

[1] For oil burners with fuel flow rate > 30kg/h any ignition restoration is not allowed

EN298 § 7.101.2.2

410 – FLAME FAILURE RESPONSE TIME
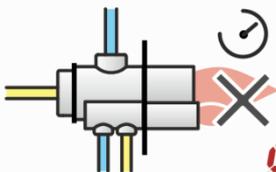
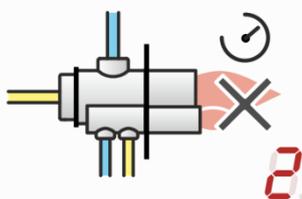If the flame fails during this stage, the fuel valves are switched off within this safety time which must comply with the relevant standards.

- *1 … 10 seconds (DEFAULT 1)*

EN298 § 3.105.1 – § 7.101.3.4.3 – § 7.101.3.7 – NFPA86 § 3.3.19

411 – AIR PRESSURE RESPONSE TIME

If the air valve is active in this stage (parameter 404) the contact of the air pressure switch must be closed, if it remains open for a time greater than that set with this parameter, the air loss failure will lead to the behavior set with parameter 408.

If the air valve is disabled in this stage (parameter 404) the contact of the air pressure switch must be open, if it remains closed for a time longer than the one set with this parameter, the air simulation failure will lead to the behavior set with parameter 408.

- *DISABLED (DEFAULT)*
- *1 … 25 seconds*

412 – FUEL PRESSURE RESPONSE TIME
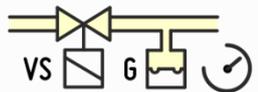
During this stage the fuel must flow and therefore the relative pressure switch must be closed, if it remains open for a time longer than the one set with this parameter, the behavior will depend on the settings of parameter 409.

- *DISABLED (DEFAULT)*
- *1 … 25 seconds*

22.12. STAGE 5 (HIGH TEMPERATURE TRANSITION)

SETTINGS RELATING TO THE BEHAVIOR OF THE BURNER
IN ONE OF THE 2 POSSIBLE STAGES IN THE HIGH TEMPERATURE MODE
EN 13577-2 § 4.10.3

501 – STAGE DURATION

Duration of the current stage, before proceeding to the next.

- *ENDLESS, until shutdown or lockout*
- *1 … 3600 seconds (DEFAULT 3)*

The transition to a different stage can be requested at any time via remote control.

This could be the stage during which all the valves are closed to quench the flame (without the need for a shutdown and recycle) so that when the staged valves open, there is no longer a flame attached to the burner head.

Set infinite duration if the transition is handled externally (Qio, Fieldbus).
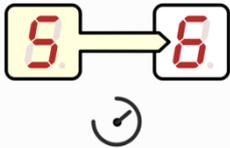
502 – MINIMUM STAGE DURATION

In some processes it is necessary to guarantee the minimum stage duration, it is therefore possible to define a minimum time during which any requests for controlled shutdown will be ignored.

- *0 … 250 seconds (DEFAULT 0)*
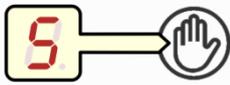
503 – FUEL VALVES

To adapt operation to different types of process, it is possible to define which fuel valves are active during this stage.

This could be an intermediate stage in which different settings are defined before moving on to the high temperature operation stage.
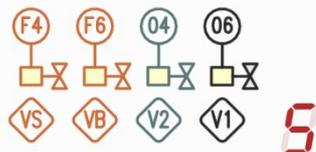
- *VS at terminal F4 (DEFAULT ON)* [1]
- *VB at terminal F6 (DEFAULT OFF)*
- *V1 at terminal 06 (DEFAULT OFF)*
- *V2 at terminal 04 (DEFAULT OFF)*

[1] For oil burners this could be the heater outlet.

504 – AIR VALVE

During this stage the air valve can be:

- *OFF*
- *ON (DEFAULT)*
- *REMOTE CONTROL ONLY*
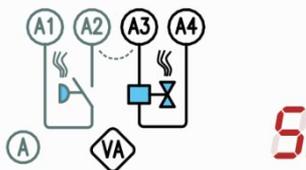
505 – ACTUATOR POSITION

Entering stage 5 it is possible to force the actuator into a predefined position.

- *NO ACTION 3 (DEFAULT)*
- *LO LIMIT SWITCH POSITION* [1]
- *HI LIMIT SWITCH POSITION* [1]
- *POSITION 1 … 99 %* [2] [3]

[1] Position cannot be changed by remote control
[2] Potentiometer must be connected
[3] Remote command may require a different position
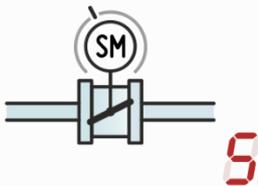
506 – HI-TEMP RELEASE

Behavior on release of the high temperature signal at the HT terminal.
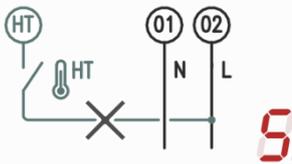
- *GO TO SHUTDOWN (DEFAULT)*
- *Go TO STAGE 1 (ignition)*
- *Go TO STAGE 2*
- *Go TO STAGE 3*
- *Go TO STAGE 4*

EN298 § 7.101.6.2

507 – AIR FAILURE BEHAVIOR

Behavior to the loss of air pressure during this stage (after possible postcombustion and post-purge).

- *LOCKOUT (DEFAULT)*
- *RECYCLE (restarts from pre-operations)*

EN298 § 7.101.2.2

508 – FUEL FAILURE BEHAVIOR

Determines the behavior at fuel loss during this stage (after possible post-combustion and post-purge).

- *LOCKOUT (DEFAULT)*
- *RECYCLE (restarts from pre-operations)*

EN298 § 7.101.2.2

509 – AIR PRESSURE RESPONSE TIME

If the air valve is active in this stage (parameter 504) the contact of the air pressure switch must be closed, if it remains open for a time greater than that set with this parameter, the air loss failure will lead to the behavior set with parameter 507.

If the air valve is disabled in this stage (parameter 504) the contact of the air pressure switch must be open, if it remains closed for a time longer than the one set with this parameter, the air simulation failure will lead to the behavior set with parameter 507.

- *DISABLED (DEFAULT)*
- *1 … 25 seconds*

510 – FUEL PRESSURE RESPONSE TIME

During this stage the fuel must flow and therefore the relative pressure switch must be closed, if it remains open for a time longer than the one set with this parameter, the behavior will depend on the settings of parameter 508.
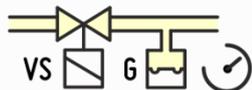
- *DISABLED (DEFAULT)*
- *1 … 25 seconds*

22.13. STAGE 6 (HIGH TEMPERATURE TRANSITION)

SETTINGS RELATING TO THE BEHAVIOR OF THE BURNER
IN ONE OF THE 2 POSSIBLE STAGES IN THE HIGH TEMPERATURE MODE
EN 13577-2 § 4.10.3
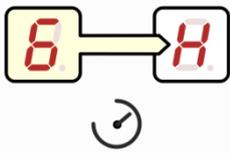
601 – STAGE DURATION

Duration of the current stage, before proceeding to controlled shutdown:

- *ENDLESS, until shutdown or lockout (DEFAULT)*
- *1 … 3600 seconds*

The transition to a different stage can be requested at any time via remote control.

This could be the stage during only the staged valves are open to have a flameless reaction.

Set infinite duration if the transition is handled externally (Qio, Fieldbus).
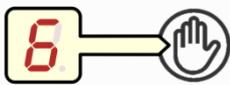
602 – MINIMUM STAGE DURATION

In some processes it is necessary to guarantee the minimum stage duration, it is therefore possible to define a minimum time during which any requests for controlled shutdown will be ignored:

- *0 … 250 seconds (DEFAULT 0)*
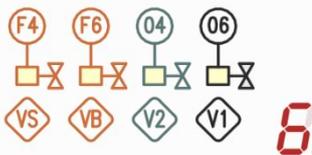
603 – FUEL VALVES

To adapt operation to different types of process, it is possible to define which fuel valves are active during this stage.

- *VS at terminal F4 (DEFAULT ON)* [1]
- *VB at terminal F6 (DEFAULT ON)*
- *V1 at terminal 06 (DEFAULT OFF)*
- *V2 at terminal 04 (DEFAULT OFF)*

[1] For oil burners this could be the heater outlet.
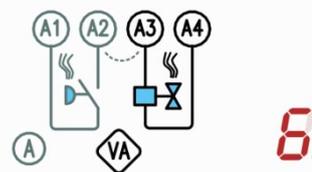
604 – AIR VALVE

During this stage the air valve can be:

- *OFF*
- *ON (DEFAULT)*
- *REMOTE CONTROL ONLY*
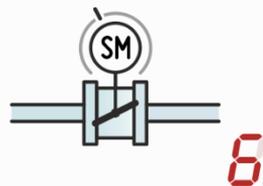
605 – ACTUATOR POSITION

Entering stage 6 it is possible to force the actuator into a predefined position.

- *NO ACTION 3 (DEFAULT)*
- *LO LIMIT SWITCH POSITION* [1]
- *HI LIMIT SWITCH POSITION* [1]
- *POSITION 1 … 99 %* [2][3]

[1] Position cannot be changed by remote control
[2] Potentiometer must be connected
[3] Remote command may require a different position

606 – HI-TEMP RELEASE

Behavior on release of the high temperature signal at the HT terminal.
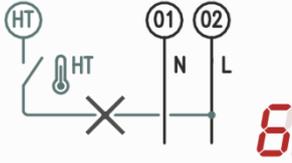
- *- GO TO SHUTDOWN*
- *- Go TO STAGE 1 (ignition)*
- *- Go TO STAGE 2 (DEFAULT)*
- *- Go TO STAGE 3*
- *- Go TO STAGE 4*

EN298 § 7.101.6.2

607 – AIR FAILURE BEHAVIOR

Behavior to the loss of air pressure during this stage (after possible postcombustion and post-purge).

- *- LOCKOUT (DEFAULT)*
- *- RECYCLE (restarts from pre-operations)*

EN298 § 7.101.2.2

608 – FUEL FAILURE BEHAVIOR

Determines the behavior at fuel loss during this stage (after possible postcombustion and post-purge).

- *- LOCKOUT (DEFAULT)*
- *- RECYCLE (restarts from pre-operations)*

EN298 § 7.101.2.2

609 – AIR PRESSURE RESPONSE TIME

If the air valve is active in this stage (parameter 604) the contact of the air pressure switch must be closed, if it remains open for a time greater than that set with this parameter, the air loss failure will lead to the behavior set with parameter 607.

If the air valve is disabled in this stage (parameter 604) the contact of the air pressure switch must be open, if it remains closed for a time longer than the one set with this parameter, the air simulation failure will lead to the behavior set with parameter 607.
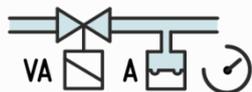
- *- DISABLED (DEFAULT)*
- *- 1 … 25 seconds*

610 – FUEL PRESSURE RESPONSE TIME

During this stage the fuel must flow and therefore the relative pressure switch must be closed, if it remains open for a time longer than the one set with this parameter, the behavior will depend on the settings of parameter 608.

- *- DISABLED (DEFAULT)*
- *- 1 … 25 seconds*

22.14. POSTCOMBUSTION

SETTINGS THAT DEFINE THE BEHAVIOR OF THE DEVICE
AFTER A STOP REQUEST, WAITING FOR THE FLAME TO QUENCH
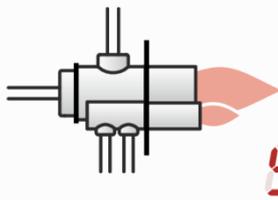
Y01 – ALLOWED POST-COMBUSTION TIME

The flame could still persist after the valves have been closed due to the residual fuel present in the pipes, it is therefore possible to define a period during which the presence of the flame is tolerated:

- *0 … 250 seconds (DEFAULT 20)*
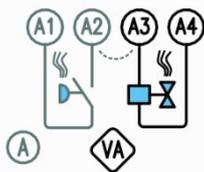
Y02 – AIR VALVE

During this stage the air valve can be:

- *OFF*
- *ON (DEFAULT)*
- *REMOTE CONTROL ONLY*

Y03 – ACTUATOR POSITION

Entering postcombustion, it is possible to force the actuator into a predefined position.

- *NO ACTION 3 (DEFAULT)*
- *LO LIMIT SWITCH POSITION [1]*
- *HI LIMIT SWITCH POSITION [1]*
- *POSITION 1 … 99 % [2][3]*

[1] Position cannot be changed by remote control
[2] Potentiometer must be connected
[3] Remote command may require a different position
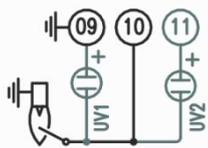
Y04 – FLAME DETECTORS

Select which sensors monitor the presence of flame during postcombustion.

- *FLAME 1 at terminal 10 (UV sensor or electrode)*
- *FLAME 2 at terminal 11 (UV sensor)*
- *FLAME 1+2 (DEFAULT)*

EN298 § 3.108 – § 7.101.2.9
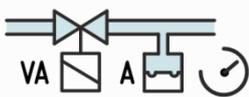
Y05 – AIR PRESSURE RESPONSE TIME

If the air valve is active during this stage (parameter Y02) the contact of the air pressure switch must be closed, if it is open for a time longer than that set with this parameter there will be an air loss lockout.

If the air valve is disabled in this stage, the contact of the air pressure switch must be open, if it closes for a time longer than the one set with this parameter, there will be an air simulation lockout.

- *DISABLED (DEFAULT)*
- *1 … 25 seconds*
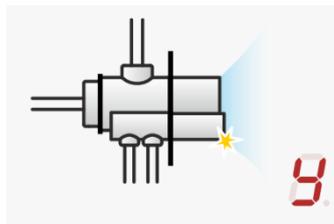
Y06 – IGNITOR

In the case of oil burner, it could be useful to activate the ignitor to ensure the combustion of any fuel residues.

- *OFF (DEFAULT)*
- *ON*

A shared electrode cannot be used for ignition and flame detection when the ignitor is activated during postcombustion.

22.15. TIGHTNESS TEST

SETTINGS THAT DEFINE THE TIGHTNESS TEST MODALITIES OF THE FUEL SOLENOID VALVES - IF DUE - AFTER EACH BURNER SHUTDOWN
EN1643 – EN13577-2 – EN676 – NFPA85 – NFPA86

T11 – FILL VALVE OPENING TIME

Define the time needed to fill with fuel the test volume
This is the activation time of the SAFETY valve at terminal F4.

- *SKIP TEST (DEFAULT)*
- *1 … 25 seconds*

Must be ≤ 3 seconds according to EN 1643 § 7.101.3
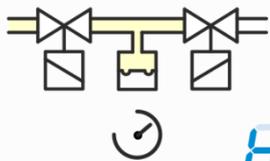
T12 – FILL TEST DURATION

The time during which it occurs that the test volume (sealed filled) does not lose pressure due to a leak in the downstream valve(s) depends on the burner capacity, according to the relevant application standard.

- *5 … 3600 seconds (default 60)*

T13 – DISCHARGE VALVE(S) OPENING TIME

Define the time required to drain the fuel from the test volume: this is the activation time of the discharge valve(s).

- *1 … 25 seconds (DEFAULT 1)*

T14 – DISCHARGE VALVE(S)

The fuel required for the test can be discharged into the combustion chamber or vented into the atmosphere (see relevant standards). Define which valve(s) will be activated during the discharge phase.

- *VB at terminal F6 (DEFAULT OFF)*
- *V1 at terminal 06 (DEFAULT ON)*
- *V2 at terminal 04 (DEFAULT ON)*
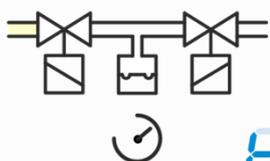
T15 – EMPTY TEST DURATION

The time during which it is verified that the test volume (sealed empty) is not filled with fuel due to a leak in the upstream valve depends on the burner capacity, according to the relevant application standard.

- *5 … 3600 seconds (default 60)*

22.16. POSTPURGE

SETTINGS THAT DEFINE THE BEHAVIOR DURING POSTPURGE OF COMBUSTION CHAMBER
EN298 § 3.115
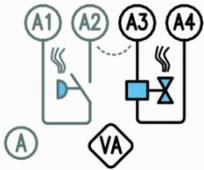
P10 – AIR VALVE

During this stage the air valve can be:
- *OFF*
- *ON (DEFAULT)*

Remote control is disabled.

P11 – ACTUATOR POSITION

When the post-purge starts, it is possible to force the actuator into a predefined position.

The post-purge time starts after reaching the required position.
- *NO ACTION [3]*
- *LO LIMIT SWITCH POSITION [1]*
- *HI LIMIT SWITCH POSITION [1] (DEFAULT)*
- *POSITION 1 … 99 % [2][3]*

[1] Position cannot be changed by remote control
[2] Potentiometer must be connected
[3] Remote command may require a different position

P12 – POSTPURGE TIME

Set post-purge time in forced draught burners according to relevant standards (EN 676).
- *0 … 6000 seconds*

During this time the flame simulation test is carried out.

The time starts when the actuator reaches the required position.

EN298 § 3.124.6
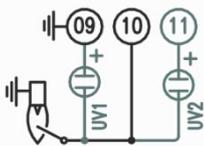
P13 – AIR PRESSURE RESPONSE TIME

If the air valve is active in this stage (parameter P10) the purge time will be counted only when the contact of the air pressure switch is closed for a time longer than that set with this parameter. If the contact is open for a time longer than that set with this parameter there will be an air loss lockout.

If the air valve is disabled in this stage, the contact of the air pressure switch must be open, if it closes for a time longer than the one set with this parameter, there will be an air simulation lockout.

The input can also be used to pause the cycle progress while waiting for external consent to proceed with the post-purge.
- *DISABLED (DEFAULT)*
- *1 … 25 seconds*
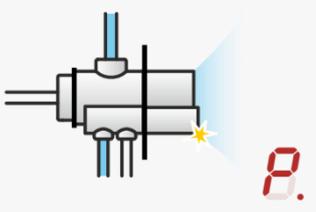
P14 – FLAME DETECTORS

During the post-purge it is possible to carry out the flame simulation test, it is therefore necessary to define which sensors are active in this stage to detect an illegal flame.
- *NONE (DEFAULT)*
- *FLAME 1 at terminal 10 (UV sensor or electrode)*
- *FLAME 2 at terminal 11 (UV sensor)*
- *FLAME 1+2*

EN298 § 3.108 – § 7.101.2.9
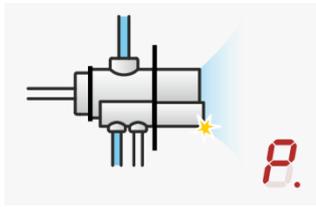
P15 – IGNITOR

The relevant standards require that for oil burners the ignitor is active during postpurge.

- *OFF (DEFAULT)*
- *1 … 25 seconds*

A shared electrode cannot be used for ignition and flame detection when the ignitor is activated during prepurge.

EN298 § 7.101.3.3

22.17. COMMUNICATIONS

SETTINGS RELATED TO THE COMMUNICATION INTERFACES OF THE DEVICE
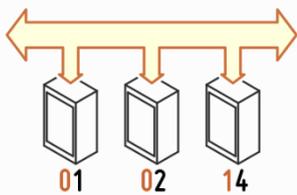
B01 – TRAXBUS ZONE (SEGMENT)

Device identifier for TraxBus: zone assigned to the burner.

- *Any alphanumeric characters (DEFAULT 0)*
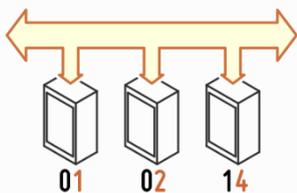
B02 – TRAXBUS UNIT (NODE)

Device identifier for TraxBus: unit assigned to the burner.

- *Any alphanumeric characters (DEFAULT 0)*
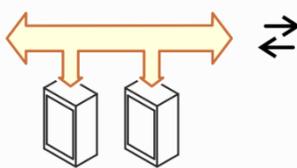
B03 – TRAXBUS BAUD RATE

Communication speed for TraxBus.

- *4800 (DEFAULT)*
- *9600*
- *19200*
- *38400*
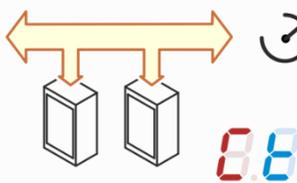
B04 – TRAXBUS TIMEOUT

Time within which the TraxBus supervisor must send a valid message to prevent lockout.

- *0 DISABLED (DEFAULT)*
- *1 … 60 seconds*
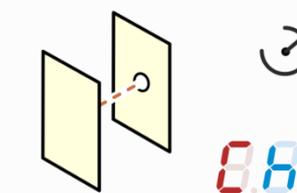
B05 – IR EXPANDER TIMEOUT

Time within which the optional expansion board must send a valid message to prevent lockout.

- *0 DISABLED (DEFAULT)*
- *1 … 60 seconds*

23. SYSTEM INFO

To read information about the operation of Q2:

4. Press the front button to force the MANUAL SHUTDOWN [1] condition.
5. Display code 0 confirm that current status is MANUAL SHUTDOWN.
6. Put the optical jack on the crosshairs between the display and the key, the internal magnet will hold it in place.

Connect the optical jack **Q.link** to a USB port on PC, notebook or Android device and start **Q.Suite** software.

[1] In monitor mode Q2 must be in OFF condition (display 0).
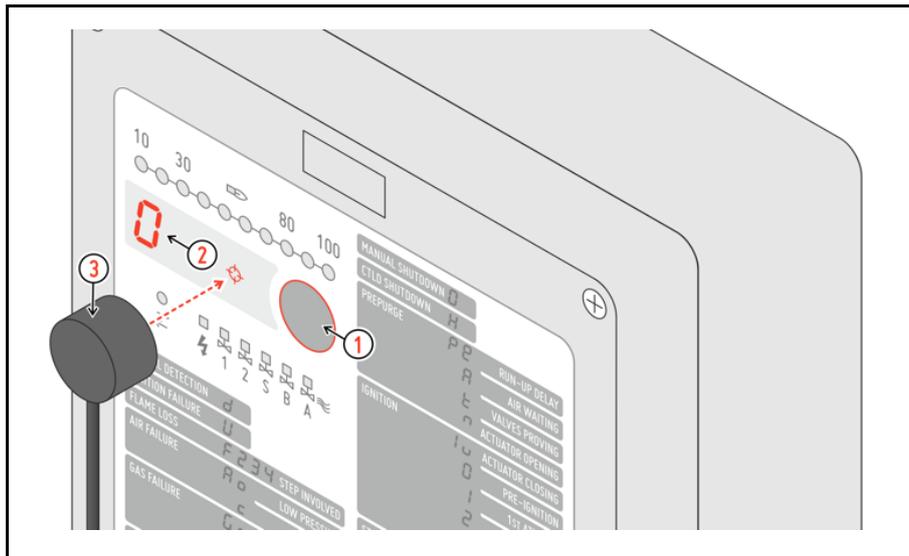
23.1. FACTORY

Below is a list of general information relating to the device equipment.

DEVICE	
POWER SUPPLY VOLTAGE POWER SUPPLY VOLTAGE OF THE DEVICE TERMINALS 01-02	115/230VAC
2nd FLAME INPUT AVAILABILITY OF THE INPUT FOR THE SECOND FLAME SENSOR TERMINAL 11	YES/NO
V2 OUTPUT AVAILABILITY OF THE OUTPUT FOR THE MAIN FUEL VALVE V2 TERMINALS 03-04	YES/NO
VS OUTPUT AVAILABILITY OF THE OUTPUT FOR THE SAFETY FUEL VALVE VS TERMINALS F3-F4 AND ASSOCIATED GAS PRESSURE SWITCH, PROOF OF CLOSURE TERMINAL F2 AND F3	YES/NO
VB OUTPUT AVAILABILITY OF THE OUTPUT FOR THE BYPASS FUEL VALVE VB TERMINALS F5-F6	YES/NO

VA OUTPUT AVAILABILITY OF THE OUTPUT FOR THE AIR VALVE VA TERMINALS A3-A4 AND ASSOCIATED AIR PRESSURE SWITCH TERMINALS A1-A2	YES/NO
ACTUATOR CONTROL AVAILABILITY OF OUTPUT FOR ACTUATOR CONTROL TERMINALS B1-B8	YES/NO
ACTUATOR FEEDBACK AVAILABILITY OF OUTPUT FOR ACTUATOR POTENTIOMETER TERMINALS P1-P3	YES/NO
UV SHUTTER AVAILABILITY OF THE OUTPUT FOR ELECTRO-OPTICAL SHUTTER TERMINALS S1-S2	YES/NO
DOP DEVICE MANUFACTURING DATE	WEEK/YEAR
FIRMWARE VERSION FIRMWARE VERSION (FOR BOTH PROCESSORS)	Mm
NOTES FACTORY NOTES RELATING TO SPECIAL EXECUTIONS OR REPAIR WORK CARRIED OUT ON THE DEVICE.	64 ALPHANUM

23.2. HISTORY

Below is the list of information returned by the device.

DEVICE	
DEVICE OPERATING TIME - H00 THE TOTAL TIME THE DEVICE HAS BEEN OPERATIONAL (POWER ON)	UP TO 99 YEARS
CYCLES DEPLOYED - H01 THE TOTAL NUMBER OF IGNITION CYCLES PERFORMED BY THE DEVICE	UP TO 4294967296
BURNER OPERATING TIME - H02 THE TOTAL TIME DURING WHICH THE BURNER HAS BEEN OPERATING	UP TO 99 YEARS
LAST UNDERVOLTAGE - H03 LAST DEVIATION FROM THE NOMINAL VOLTAGE GREATER THAN -15%	%
LAST OVERVOLTAGE - H04 LAST DEVIATION FROM THE NOMINAL VOLTAGE GREATER THAN +10%	%
CONTROLLER TEMPERATURE - H05 CURRENT TEMPERATURE OF THE MICROCONTROLLER 1 WHICH SUPERVISES THE REGULAR PERFORMANCE OF THE FUNCTIONS PERFORMED BY THE DEVICE	°C
DEPLOYER TEMPERATURE - H06 CURRENT TEMPERATURE OF MICROCONTROLLER 2 WHICH PERFORMS THE FUNCTIONS RELATED TO THE OPERATING CYCLE	°C

CONTROLLER SUPPLY VOLTAGE - H07	mV
CURRENT VALUE OF THE SUPPLY VOLTAGE OF THE MICROCONTROLLER 1 WHICH SUPERVISES THE REGULAR PERFORMANCE OF THE FUNCTIONS PERFORMED BY THE DEVICE	
DEPLOYER SUPPLY VOLTAGE - H08	mV
CURRENT VALUE OF THE SUPPLY VOLTAGE OF THE MICROCONTROLLER 2 WHICH PERFORMS THE FUNCTIONS RELATED TO THE OPERATING CYCLE	
POWER CYCLES - H19	UP TO 4294967296
THE TOTAL NUMBER OF TIMES THE DEVICE HAS BEEN TURNED ON (IT IS THE NUMBER OF TIMES STATISTICAL INFORMATION HAS BEEN WRITTEN TO THE DEVICE'S FLASH MEMORY	

VA - AIR VALVE	
CYCLES DEPLOYED - H09	UP TO 4294967296
THE TOTAL NUMBER OF TIMES THE AIR VALVE HAS BEEN TURNED ON. IT CAN HELP DEVELOP A PREVENTIVE MAINTENANCE PLAN FOR THE VALVE AND ASSOCIATED RELAY, WHICH CAN BE REPLACED BEFORE THEY FAIL	
OPERATING TIME - H10	UP TO 99 YEARS
THE TOTAL WORKING TIME OF THE AIR VALVE (POWERED)	

VS - SAFETY VALVE	
CYCLES DEPLOYED – H11	UP TO 4294967296
THE TOTAL NUMBER OF TIMES THE AIR VALVE HAS BEEN TURNED ON. IT CAN HELP DEVELOP A PREVENTIVE MAINTENANCE PLAN FOR THE VALVE AND ASSOCIATED RELAY, WHICH CAN BE REPLACED BEFORE THEY FAIL	
OPERATING TIME - H12	UP TO 99 YEARS
THE TOTAL WORKING TIME OF THE AIR VALVE (POWERED)	

VB – MULTIFUNCTION BYPASS VALVE	
CYCLES DEPLOYED – H13	UP TO 4294967296
THE TOTAL NUMBER OF TIMES THE AIR VALVE HAS BEEN TURNED ON. IT CAN HELP DEVELOP A PREVENTIVE MAINTENANCE PLAN FOR THE VALVE AND ASSOCIATED RELAY, WHICH CAN BE REPLACED BEFORE THEY FAIL	
OPERATING TIME - H14	UP TO 99 YEARS
THE TOTAL WORKING TIME OF THE AIR VALVE (POWERED)	

V1 - PILOT VALVE	
CYCLES DEPLOYED – H15	UP TO 4294967296
THE TOTAL NUMBER OF TIMES THE AIR VALVE HAS BEEN TURNED ON. IT CAN HELP DEVELOP A PREVENTIVE MAINTENANCE PLAN FOR THE VALVE AND ASSOCIATED RELAY, WHICH CAN BE REPLACED BEFORE THEY FAIL	
OPERATING TIME - H16	UP TO 99 YEARS
THE TOTAL WORKING TIME OF THE AIR VALVE (POWERED)	

V2 - MAIN VALVE	
CYCLES DEPLOYED – H17 THE TOTAL NUMBER OF TIMES THE AIR VALVE HAS BEEN TURNED ON. IT CAN HELP DEVELOP A PREVENTIVE MAINTENANCE PLAN FOR THE VALVE AND ASSOCIATED RELAY, WHICH CAN BE REPLACED BEFORE THEY FAIL	UP TO 4294967296
OPERATING TIME - H18 THE TOTAL WORKING TIME OF THE AIR VALVE (POWERED)	UP TO 99 YEARS

LOCKOUTS LOG	
LIST OF THE LAST 39 LOCKOUTS OR FAULTS THAT HAVE OCCURRED AND THE TIME AT WHICH THEY OCCURRED (REFERRED TO THE DEVICE'S OPERATING TIME	TIME EVENT DETAIL

24. REMOTE CONTROL - TraxBus

Remote control and supervision possible with integrated communication interface with proprietary fieldbus at terminals C1-C2, designed for reliable operation in harsh environments with simplified wiring.
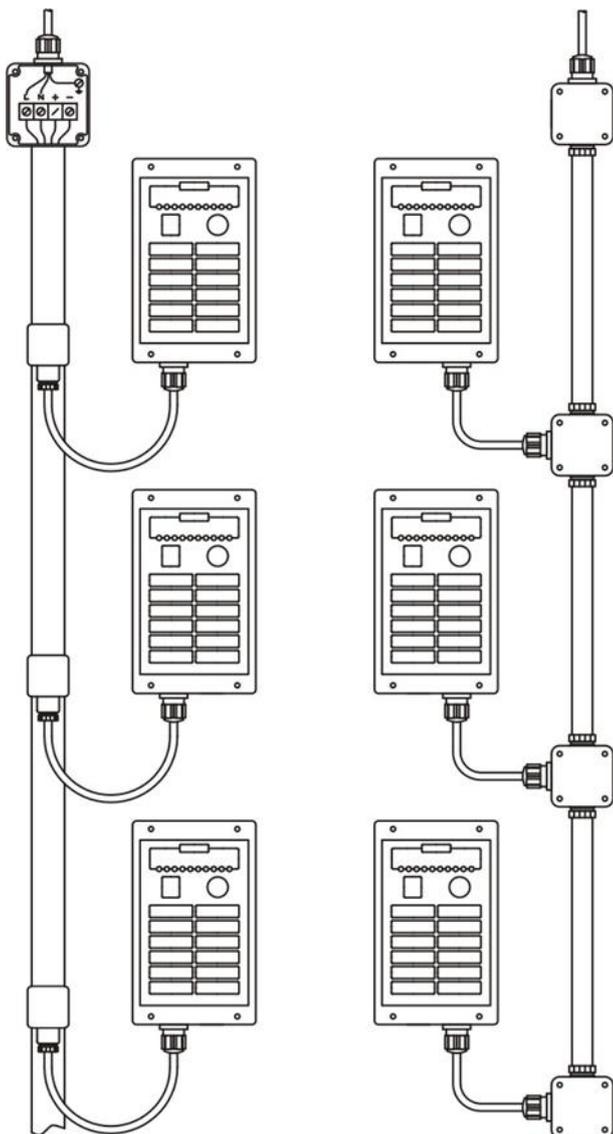
Industrial network system for distributed control using a multi-drop wire pair: digital communication enables improved control capability which can improve product yields.

Near real-time operation is possible, despite the relatively low speed, thanks to an efficient protocol.

TraxBus features high electromagnetic noise immunity and great wiring simplicity, also using busbar trunkets: possible application are in hostile industrial environments where other standard networks does not work.

- Type   ASYN MULTIDROP HALF DUPLEX
- Bus voltage   ≤ 30 VDC
- Allowable voltage dropout   < 3 V
- Allowable line capacitance   < 100nF
- Baud Rate   38400 MAX
- Allowed line length   1000 m MAX

Live connection and disconnection – while the communication is running – are allowed, although a short break in the data flow may result from this operation.

✋ When the optical jack is in position, the control from the other communication ports is inhibited, if they receive a valid command the current state of the device will be returned in response but the command will not be executed.

24.1. PROTOCOL

The communication protocol can be easily implemented in any programmable controller to ensure high efficiency and low cost.

Ready-to-use gateways are available to convert TraxBus into industry standard fieldbus systems.

See below for typical communication times at different baud rates.

Messages must be ASCII characters, 8bits, no parity, 1 stop bit.

COMMAND	RESPONSE
FROM SUPERVISOR TO PERIPHERALS	FROM PERIPHERALS TO SUPERVISOR

Commands issued to peripherals within a single string terminated with Carriage Return

Peripherals will acknowledge all valid command received from supervisor:

< S N C KK ↵			> S N T KK ↵	
<	Preamble (from master)		<	Preamble (to master)
S	Segment, Zone identifier		S	Segment, Zone identifier
N	Node, Unit identifier		N	Node, Unit identifier
C	Command		T	Status
KK	Checksum		KK	Checksum
↵	Carriage return		↵	Carriage return

S and **N** can be any alphanumeric character and must match the settings of the peripheral to be addressed.

The special character * (star) can be used like wild card to send broadcast command: a star character instead of S will address all existing nodes, a star character instead of N will address the whole segment, two star characters will address all the connected units.

No acknowledge answer sent back after broadcast commands.

CHECKSUM CALCULATION

- Commands without valid checksum are ignored.

- The answer includes a valid checksum that can be optionally evaluated by supervisor.

- KK is the ASCII figure of the sum of all characters HEX values, including Carriage Return.

- See example and use only last two characters, ignoring leading ones (if any).

> S N T KK ↵		
<	Equals HEX 3C	+
S	Equals HEX 30	+
N	Equals HEX 30	+
T	Equals HEX 53	+
KK	Equals HEX 0D	=
↵	Equals HEX 3C	+
	ASCII 1**04**	

Any supervisor takes time for internal process, real fieldbus performance should be calculated by adding this delay.

POLLING TIME 1 UNIT [ms]				
BAUD RATE	**4800**	**9600**	**19200**	**38400**
COMMAND	15	8	4	2
Q2 PROCESS	4	4	4	4
ANSWER	15	8	4	2
OVERALL	**34**	**20**	**12**	**8**

POLLING TIME 100 UNITS [ms]				
BAUD RATE	**4800**	**9600**	**19200**	**38400**
COMMAND	1500	800	400	200
Q2 PROCESS	400	400	400	400
ANSWER	1500	800	400	200
OVERALL	**3400**	**2000**	**1200**	**800**

Below are the commands for controlling the device via TraxBus.
Examples are given for identifier 00 (zone=0 unit=0) with relative checksum.

	COMMANDS	EXAMPLE
H	**HALT** GO TO CONTROLLED SHUTDOWN, IF NOT IN LOCKOUT	`<00HF1↵`
R	**RUN** EXIT CONTROLLED SHUTDOWN	`<00RFB↵`
B	**UNLOCK §1** RESET FROM LOCKOUT, TO BE CONFIRMED WITHIN 10 SECONDS	`<00BEB↵`
Y	**CONFIRM §1** IGNORED WHEN NOT RECEIVED AFTER UNLOCK COMMAND B	`<00Y02↵`
a	**AIR OFF** TURN OFF AIR VALVE OUTPUT	`<00a0A↵`
A	**AIR ON** TURN ON AIR VALVE OUTPUT	`<00AEA↵`
o	**OS OFF** TURN OFF OS OUTPUT, IF NOT USED TO DRIVE UV OPTICAL SHUTTER	`<00o18↵`
O	**OS ON** TURN ON OS OUTPUT, IF NOT USED TO DRIVE UV OPTICAL SHUTTER	`<00OF8↵`
f	**HIGH TEMPERATURE CONFIRMATION** ENABLE HT INPUT FOR 5 MINUTES (SEE PARAMETER G08)	`<00f0F↵`
I	**IGNITION TRIAL** GOTO PREIGNITION (FOR THE STAGES THAT ALLOW THE TRANSITION)	`<00IF2↵`
2	**STAGE 2** GOTO STAGE 2 (FOR THE STAGES THAT ALLOW THE TRANSITION)	`<002DB↵`
m	**STAGE 2** SAME AS ABOVE (KEPT FOR COMPATIBILITY)	`<00m16↵`
3	**STAGE 3** GOTO STAGE 3 (FOR THE STAGES THAT ALLOW THE TRANSITION)	`<003DC↵`
M	**STAGE 3** SAME AS ABOVE (KEPT FOR COMPATIBILITY)	`<00MF6↵`
4	**STAGE 4** GOTO STAGE 4 (FOR THE STAGES THAT ALLOW THE TRANSITION)	`<004DD↵`
5	**STAGE 5** GOTO STAGE 5 (FOR THE STAGES THAT ALLOW THE TRANSITION)	`<005DE↵`
6	**STAGE 6** GOTO STAGE 5 (FOR THE STAGES THAT ALLOW THE TRANSITION)	`<006DF↵`
S	**STATUS** NO ACTION, SHORT STATUS REQUEST	`<00SFC↵`

§1   THE SUPERVISOR MUST SEND A RESET CONFIRMATION WITHIN 10 SECONDS FROM PERIPHERAL ACKNOWLEDGE TO RESET COMMAND

For each command received, the device returns a code corresponding to its current status, the status codes are listed below.

	SHORT STATUS CODES		EXAMPLE
S	**STOP §2** LOCKOUT OR FAILURE		>00SFE↵
0	**MANUAL SHUTDOWN** THE UNIT HAS BEEN PUT OUT OF SERVICE USING THE LOCAL BUTTON		>000DB↵
T	**TIGHTNESS FAILURE** UNSUCCESSFUL VALVE PROVING		>00TFF↵
h	**HALT** POWER ON STANDBY, WAITING FOR UNLOCK TO START		>00h13↵
H	**HALT** CONTROLLED SHUTDOWN		>00HF3↵
A	**AIR PRESSURE WAITING** WAITING FOR AIR PRESSURE DURING PREPURGE OR POSTPURGE		>00AEC↵
P	**PRE-OPERATION** PREPURGE / VALVE PROVING (IF ENABLED)		>00PFB↵
1	**IGNITION** INCLUDING PRE-IGNITION		>001DC↵
2	**STAGE 2** BURNER ON, LOW TEMP MODE STAGE 2		>002DD↵
3	**STAGE 3** BURNER ON, LOW TEMP MODE STAGE 3		>003DE↵
4	**STAGE 4** BURNER ON, LOW TEMP MODE STAGE 4		>004DF↵
5	**STAGE 5** BURNER ON, HIGH TEMP MODE STAGE 5		>005E0↵
6	**STAGE 6** BURNER ON, HIGH TEMP MODE STAGE 6		>006E1↵
Y	**POSTCOMBUSTION** WAITING FOR FLAME QUENCHING		>00Y04↵
W	**POST-OPERATION** POSTPURGE / VALVE PROVING (IF ENABLED)		>00W02↵

§2   ALL LOCKOUTS AND FAILURES ARE GROUPED WITHIN A SINGLE CODE TO SIMPLIFY THE PARSING.
DETAILED INFORMATION AVAILABLE FROM THE FRONT PANEL DISPLAY.
ADDITIONAL INFORMATION BY READING THE LOG FILE STORED IN THE UNIT.

A specific command returns the current value of the **FLAME SIGNAL** according to parameter G06:

	COMMAND	EXAMPLE
L	**FLAME SIGNAL** ASK FOR FLAME SIGNAL STRENGTH, KEPT FOR COMPATIBILITY	<00LF7↵

The answer is rendered in a single character

	STATUS CODE	EXAMPLE
a…z	**FLAME SIGNAL** – 0 µA a…y 1…25 µA z 26 µA OR HIGHER	>00y24↵

The **ACTUATOR** can be managed by means of the following specific commands:

	COMMANDS	EXAMPLE
D	**AIR DAMPER POSITION** RETURNS CURRENT ACTUATOR POSITION (%)	<00DED↵
d	**AIR DAMPER POSITION (ABSOLUTE)** RETURNS CURRENT POTENTIOMETER MEASURED VALUE (0000…4095)	<00d94↵
DCL	**CLOSE** ACTIVATE CLOSE OUTPUT PERMANENTLY (UNTIL DST OR LO POSITION)	<00DCL7C↵
DOP	**OPEN** ACTIVATE OPEN OUTPUT PERMANENTLY (UNTIL DST OR HI POSITION)	<00DOP8C↵
DST	**STOP** RELEASE OPEN AND CLOSE OUTPUTS IMMEDIATELY	<00DST94↵
Dxx	**MOVE TO POSITION** SET NEW POSITION FOR THE ACTUATOR: LO | 01…99 | HI	<00D5052↵

The answer is always the current position of the actuator:

	STATUS CODES	EXAMPLE
Dxx	**AIR DAMPER POSITION** THIS IS THE ANSWER TO ALL DAMPER CONTROL COMMANDS EXCEPT d LO 0% (CORRESPONDING TO CLOSED LIMIT SWITCH) 01…99 CURRENT RELATIVE POSITION % HI 100% (CORRESPONDING TO OPEN LIMIT SWITCH)	>00D5054↵
dxx	**AIR DAMPER POSITION (ABSOLUTE)** THIS IS THE ANSWER TO COMMAND d 00…FF ABSOLUTE VALUE READ BY FEEDBACK POTENTIOMETER	>00d006F↵

Request for current actuator settings.

	COMMAND	EXAMPLE
DDR	**AIR DAMPER SETTINGS** RETURNS ACTUATOR LIMITS AND TRAVEL TIME: LO,HI,T,1,99 LO ABSOLUTE POSITION OF LO LIMIT SWITCH (0%) HI ABSOLUTE POSITION OF HI LIMIT SWITCH (100%) T TRAVEL TIME FROM MIN TO MAX (seconds) 1 ABSOLUTE POSITION OF MIN POTENTIOMETER RANGE (1%) 99 ABSOLUTE POSITION OF MAX POTENTIOMETER RANGE (99%)	<00DDR83↵

When the supervisor is able to interpret complex responses, it is possible to use the command which returns an **EXTENDED** status:

	COMMAND	EXAMPLE
S	**STATUS REQUEST (EXTENDED)** NO ACTION, EXTENDED STATUS REQUEST	`<00s1C↵`

The response is rendered in a single string including multiple information, comma delimited :

	EXTENDED STATUS CODE FIELDS	EXAMPLE
	PREAMBLE	>
	IDENTIFIER (SEGMENT + NODE)	00
STEP	SHORT STATUS CODE (SAME AS S RESPONSE)	2
DAMPER	CURRENT POSITION OF THE ACTUATOR (0=LO | 1 … 99 | 100=HI)	30
damper	CURRENT ABSOLUTE POSITION OF THE ACTUATOR (00 … FF)	38
FL1	CURRENT FLAME 1 SIGNAL (0 … 50) [µA]	0
FL2	CURRENT FLAME 2 SIGNAL (0 … 50) [µA]	0
HT	HIGH TEMPERATURE INDIRECT FLAME SURVEILLANCE (0=NO | 1=YES)	1
AIR	AIR PRESSURE SWITCH STATUS (0=OPEN | 1=CLOSED)	1
GAS	FUEL (GAS) PRESSURE SWITCH STATUS (0=OPEN | 1=CLOSED)	1
VA	AIR VALVE OUTPUT (0=OFF | 1=ON)	1
VS	SAFETY FUEL VALVE VS OUTPUT (0=OFF | 1=ON)	0
VB	BYPASS FUEL VALVE VB OUTPUT (0=OFF | 1=ON)	1
V1	PILOT FUEL VALVE V1 OUTPUT (0=OFF | 1=ON)	0
V2	MAIN FUEL VALVE V2 OUTPUT (0=OFF | 1=ON)	0
OS	OS OUTPUT (0=OFF | 1=ON)	0
DISPL1	CONTENT OF RED DISPLAY (ASCII FIGURE OF HEX CODE (00 … FF)	DA
DISPL2	CONTENT OF BLUE DISPLAY (ASCII FIGURE OF HEX CODE (00 … FF)	C4

`>00,2,30,38,0,0,1,1,1,1,0,1,0,0,0,DA,C489↵`

24.2. PROTOCOL CONVERSION

TraxBus can be managed in many ways.

Devices are available to convert the physical interface, use standard fieldbuses, or even control directly with contacts without any programming.

25. PROCESS INPUTS / OUTPUTS

Remote control of Q2 can be achieved with traditional electrical signals.

The easiest way is to control the power supply directly, the contact of a switch or relay will power the device that will start the ignition cycle of the burner (if it was turned off while it was in lockout, the next time it is turned on it will still be in the same lockout).

Full traditional control with electrical signals can be achieved with the optional **Qio** board which is installed in the base of the device.

Communication with Q2 occurs via the optical interface [2] that faces the corresponding one on the Q2 board, operation is guaranteed only when the front part is correctly positioned on the base.
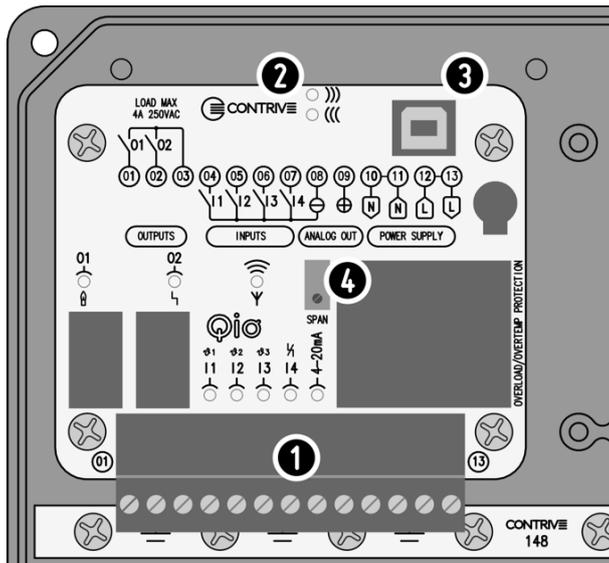
1. TERMINAL BOARD
2. OPTICAL INTERFACE
3. USB-B CONNECTOR
4. LOOP CURRENT ADJUST

25.1. INDICATORS

INPUT 1 BURNER ON / OFF	ϑ1 I1	ϑ2 I2	**INPUT 2** MAIN BURNER ON / OFF
INPUT 3 AIR OUTPUT ON / OFF	ϑ3 I3	ϟ I4	**INPUT 4** REMOTE RESET
OUTPUT 1 BURNER RUNNING	O1	O2	**OUTPUT 2** BURNER LOCKOUT
WiFi STATUS INDICATOR	📶	4-20mA	**ANALOG OUTPUT** CURRENT LOOP

WiFi DISABLED	**OFF**
NOT LINKED TO SSID	**FAST**
LINKED TO SSID	**SLOW**
ACCESS POINT MODE	**ON**

25.2. WIRING

The **BLACK** terminals are for power supply.
To simplify wiring, there are 2 additional terminals for connections that carry power to Q2.

The **ORANGE** terminals are for process control.
The functions indicated refer to the device programmed with the default factory configuration.
The 4-20mA analog output can be programmed to control actuators.

There are 2 SPST contacts available at the **BLUE** terminals.
The functions indicated refer to the device programmed with the default factory configuration.
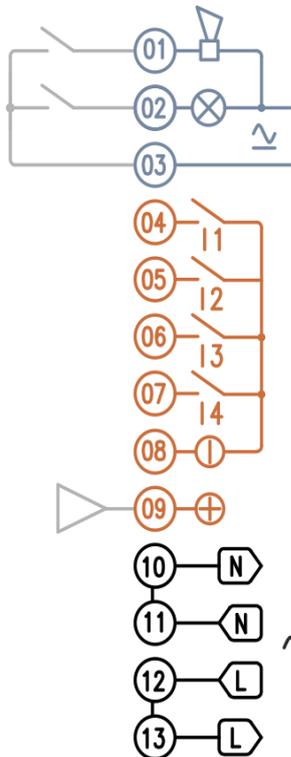
		OUTPUTS
01	OUT	BURNER LOCKOUT
02	OUT	BURNER ON
03	OUT	COMMON RETURN

		CONTROL
04	IN	THERMOSTAT 1 (BURNER ON/OFF)
05	IN	THERMOSTAT 2 (MAIN ON/OFF)
06	IN	AIR CONTROL (ON/OFF)
07	IN	RESET (UPON RELEASE)
09	OUT	COMMON NEGATIVE
09	OUT	4...20 mA

		POWER SUPPLY
10	OUT	NEUTRAL
11	IN	NEUTRAL
12	OUT	PHASE
13	IN	PHASE

With the factory default configuration, each channel is assigned the following functions:
- The burner ignition cycle is started by closing **INPUT 1**, while opening forces a **CONTROLLED SHUTDOWN**.
- When the burner is operating, the **INPUT 2** controls the main valve, activating and releasing the **2nd stage**.
- **INPUT 3** controls the **air valve** output. This control is only effective for stages where it is permitted.
- **INPUT 4** allows remote **UNLOCK**ing of the burner and must be activated for at least 1 second.
  Reset occurs when the input is released.
- **OUTPUT 1** activates when the burner is **RUNNING**.
- **OUTPUT 2** activates while the burner is in **LOCKOUT**.
- When a 4..20mA current loop is connected to the analog output, the relative indicator lights up.
  The span is adjustable with the multi-turn trimmer [4]

The USB connector [3] allows connection to a PC for any WiFi settings.
Expert users can also modify the factory default operating rules.

ⓘ It is advisable to activate TIMEOUT B05 so that in case of absence of Qio control the device goes into lockout (while the burner is on).

25.3. TECHNICAL DATA

POWER SUPPLY

VOLTAGE	100...240Vac
FREQUENCY	47 ... 63 Hz
LINE FUSE	6,3 A EMBEDDED
POWER CONSUMPTION	6 VA MAX

AUTOMATIC OVERTEMPERATURE
AND OVERCURRENT PROTECTION

ENVIRONMENT

OPERATING TEMPERATURE	-20 ... 60 ℃ -4 ... 140 °F
STORAGE TEMPERATURE	-40 ... 85 ℃ -40 ... 185 °F
RELATIVE HUMIDITY	10...90% NO CONDENSATION ALLOWED
DIMENSIONS	80 x 90 mm MAX
WEIGHT	90 g

THIS UNIT IS NOT INTENDED FOR
EXPLOSIVE OR CORROSIVE ENVIRONMENTS

PROCESS INPUTS

MAX CURRENT PER INPUT	5 mA
VOLTAGE PROVIDED BY THE DEVICE	12 VDC

OUTPUTS

MAX RATED VOLTAGE	250 V AC
MAX SWITCHING VOLTAGE	270 V AC
MAX LOAD PER OUTPUT	2 A - cosφ = 0.7

ANALOG OUTPUT

OUTPUT CURRENT	23 mA MAX
LOOP VOLTAGE	12 VDC
SPAN ADJUST	4...19,0 mA 4...22.5 mA
LOOP IMPEDANCE	350 Ω MAX

25.4. APPLICATION

The burner can be managed with a simple electrical interface with contacts.

In the figure below the connections to the burner can be seen in the lower part (Q2 terminal block).

In the upper part you can see the terminal block of Qio, which provides 2 outputs for reporting the status of the burner and 4 inputs for control.

It is possible to simultaneous remote control via TraxBus (terminals C1-C2).

A	AIR PRESSURE SWITCH	V2	2ND STAGE VALVE (MAIN)
VA	AIR VALVE	V1	1ST STAGE VALVE (PILOT)
G	FUEL PRESSURE SWITCH	S	IGNITION / DETECTION ROD
S	PROOF OF CLOSURE SWITCH	U	MAIN FLAME UV DETECTOR
VS	SAFETY VALVE	$\vartheta 1$	BURNER ON/OFF
VB	MULTIFUNCTIONAL VALVE	$\vartheta 2$	MAIN BURNER ON/OFF
OS	ELECTRO OPTICAL SHUTTER	P	AIR OUTPUT ON/OFF
HT	HIGH TEMPERATURE BYPASS	⌐	RESET
🔥	BURNER RUNNING	⌐	BURNER LOCKOUT

25.5. ANALOG ACTUATOR
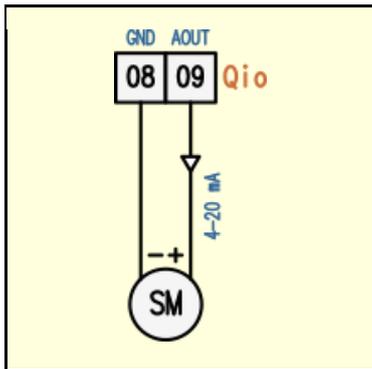
Qio's analog output can control analog actuators or variable speed blowers with a 4-20mA signal.

The trimmer [4] allows you to adjust the **SPAN** in the range 4 -19.0...22.5 mA.

When the actuator is controlled exclusively by Qio, each operating stage is associated with an analog output value, therefore a position / speed.

In this case the actuator is NOT controlled by Q2.

The factory default settings for the various stages are:

STANDBY	0 %
LOCKOUT	0 %
MANUAL SHUTDOWN	0 %
CONTROLLED SHUTDOWN	0 %
PREPURGE	100 %
PREIGNITION / IGNITION	0 %
STAGE 2 (PILOT ONLY)	50 %
STAGE 3 (PILOT + MAIN)	80 %
STAGE 4 (MAIN ONLY)	100 %
STAGE 5 (HI TEMP)	0 %
STAGE 6 (HI TEMP)	0 %
POSTCOMBUSTION	0 %
POSTPURGE	100 %
ADVANCED USERS CAN MODIFY THE OUTPUT BY CHANGING THE OPERATING RULES	

It is possible to use the **HI** and **LO** limit switches inputs to confirm that the purging and ignition positions have been reached before moving on to the next stage.

To achieve this behavior, the following parameters must be set

G01 – ACTUATOR MAX TRAVEL TIME

P03 – ACTUATOR POSITION DURING PREPURGE = HI

003 – ACTUATOR POSITION DURING IGNITION = L0

P11 – ACTUATOR POSITION DURING POSTPURGE = HI

25.6. ACTUATOR MANAGED BY THERMOREGULATOR

Q2 manages 3-point actuators, forcing the positions required for combustion chamber purging and ignition phase. It also allows remote control of the actuator via fieldbus in each phase of operation.

When the actuator is of the analog type with a signal coming from a thermoregulator, it will only be necessary to provide for forcing in the purging and ignition phases.

The 4-20mA analog output of Qio can therefore be used during these phases.

Normally the signal coming from the thermoregulator passes through the **READY** contact of Q28 to control the actuator.

During the purging phases Q28 will divert the control to the analog output of Qio, by opening the **READY** contact and closing the **OPEN** contact, reaching the position will be confirmed by the closing of the HI limit switch.

During ignition Q28 will divert control to the analog output of Qio by opening the **READY** contact and closing the **CLOSE** contact, reaching the position will be confirmed by closing the LO limit switch.

Set the time required for the actuator to complete the entire excursion in parameter G01 of the Q2 device.

In the factory configuration the analog output of Qio provides 20 mA during the purging phases and 4 mA during ignition.

Set the time required for the actuator to complete the entire excursion in parameter **G01** of the Q2 device.

The following figure shows the connection to a generic actuator.
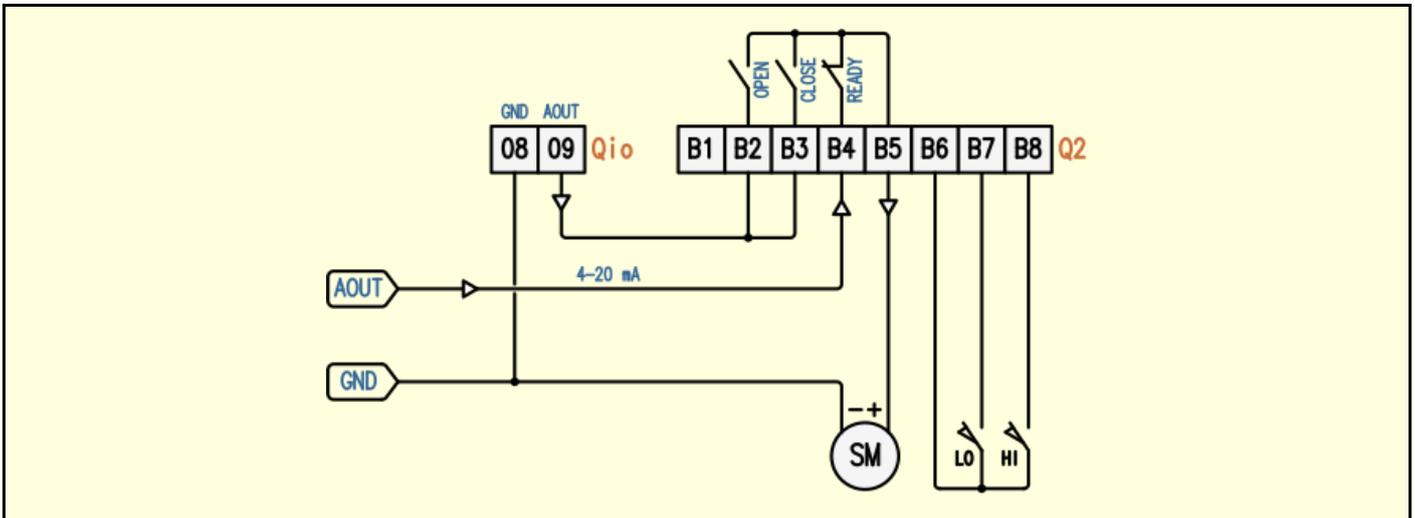
The figure below shows the connection to an **MZ4** actuator (Elektrogas).
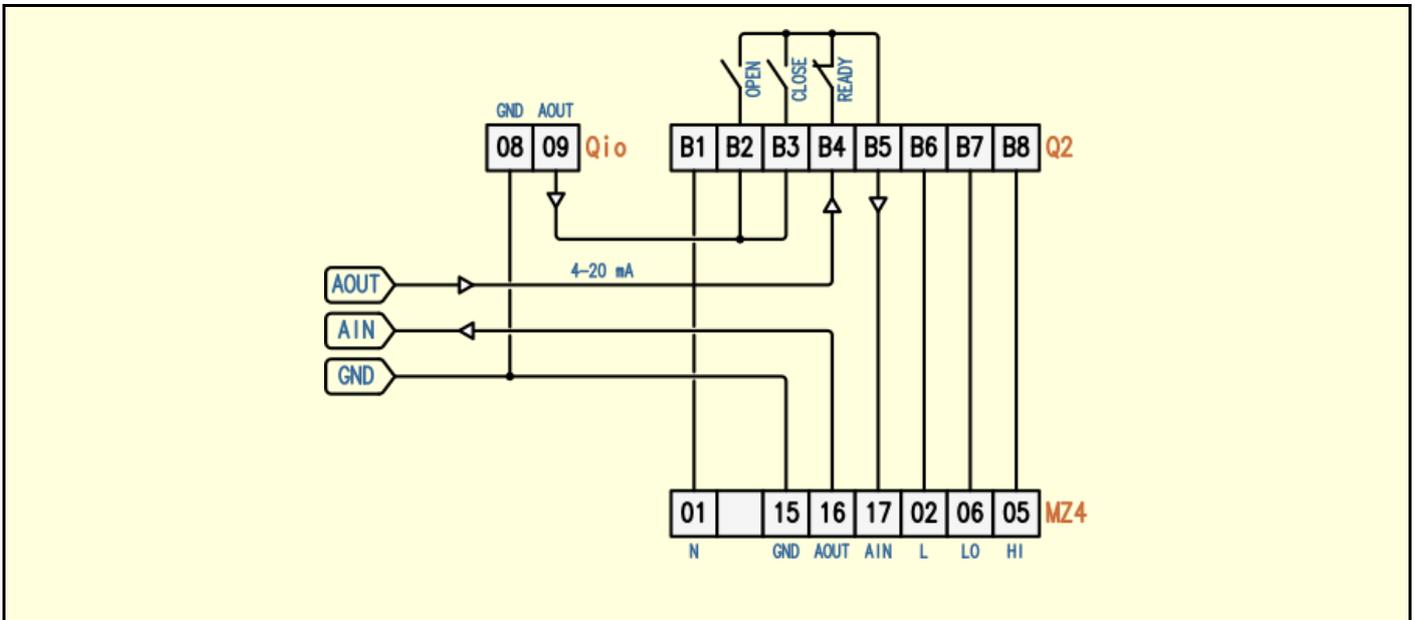
25.7. WIFI

Qio has a WiFi radio interface through which it can be remotely controlled by connecting to an existing network or creating its own.

To activate and configure WiFi proceed as follows:
- Connect Qio to a Personal Computer via the USB interface [3]
- Open a browser (Chrome or Edge) and go to the page *https://www.contrive.mobi/QIO/*
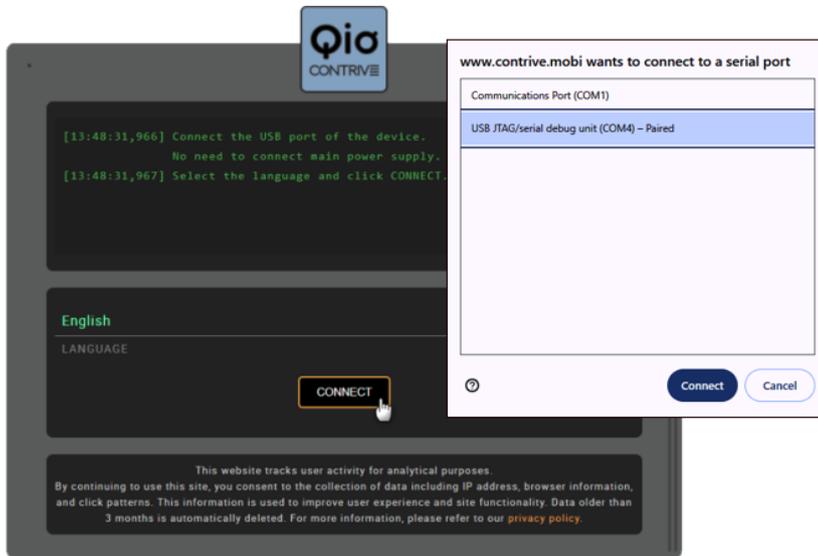
Click on the **CONNECT** button and – in the popup window – select the USB port to which Qio is connected and then *Connect*

Connect to an existing WiFi network:
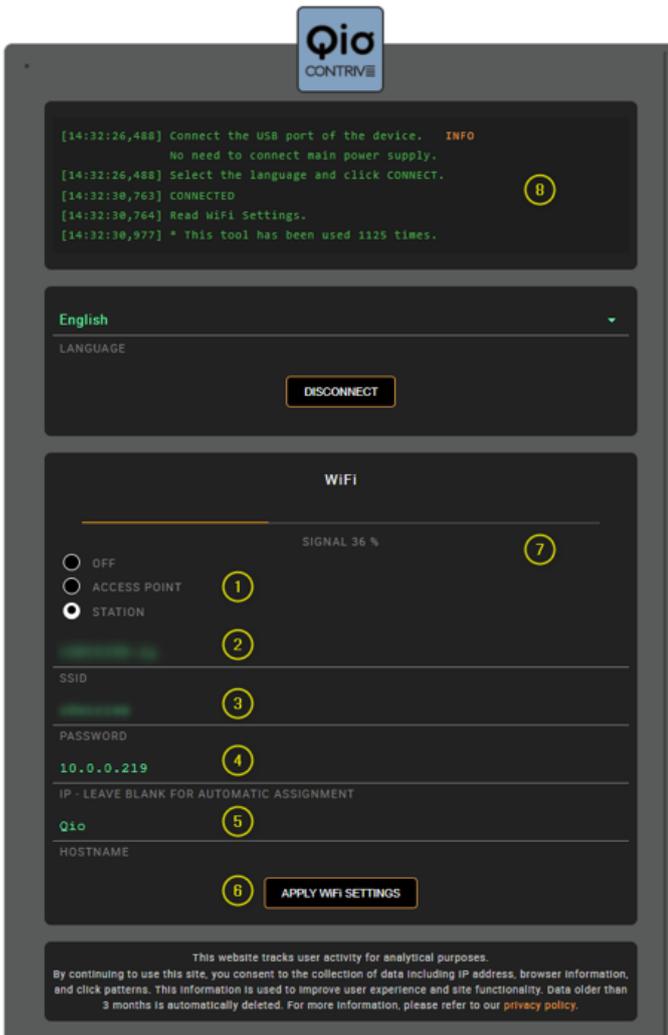
1. Select **STATION** mode.
2. Enter the SSID network name.
3. Enter the SSID access password.
4. Enter the IP address you want to assign to Qio, leave blank for automatic DHCP assignment.
5. Give Qio a name.
6. Press **APPLY WIFI SETTINGS** and wait for Qio to complete registration in the WiFi network.
7. If the connection was successful, the **WIFI STATUS** led on the board blinks slowly, the **SIGNAL** strength is shown, the assigned **IP** address will also be shown.
8. The top panel shows the details of the activities.

If you want Qio to create its own SSID network (like a WiFi hotspot):

1. Select **ACCESS POINT** mode.
2. Name the SSID you want to create.
3. Set a password for SSID.
4. You can set the IP address, if you leave it blank the default **192.168.1.1** will be assigned.
5. Give Qio a name.
6. Press **APPLY WIFI SETTINGS** to activate the WiFi network: the **WIFI STATUS** led will light up steadily.
7. The top panel shows the details of the activities.

25.8. WEBSERVER

From any browser you can access the web server embedded in Qio by specifying as URL the IP address assigned to the device or **<name>.local** where <name> is the name assigned to the device.

Supports up to 4 clients connected simultaneously, performance may degrade as the number of connected clients increases.

To protect data integrity and communication privacy, the web server uses the HTTPS protocol with TLS encryption.

Qio uses a self-signed SSL certificate. Since this certificate is not issued by a recognized Certificate Authority (CA), your browser will display a security warning during the initial login. To proceed, you have two options:

1. **Manual Confirmation:** Continue by bypassing the browser warning and manually confirming that the connection is trusted during each session.

2. **Permanent Installation:** Install the certificate on your workstation to eliminate security warnings and establish a permanent trusted connection. The detailed installation procedure can be found here: https://www.burner-control.com/Vault/QioWSC.pdf

Enter your login password (factory default 0000) and select your preferred language, then press **LOGIN**.

Logout is automatic after 60 minutes of inactivity.

CONTRIVE

Q28.230
8002.40.28

POWER SUPPLY VOLTAGE
230 V

DATE OF PRODUCTION
WEEK 5 YEAR 2025

FIRMWARE VERSION
1.9

AVAILABLE RESOURCES

FUEL VALVE STAGE 1
FUEL VALVE STAGE 2
MULTIFUNCTION BYPASS VALVE
SAFETY FUEL VALVE
VALVE PROVING SYSTEM
PROOF OF CLOSURE
FUEL PRESSURE SWITCH
AIR VALVE
AIR PRESSURE SWITCH
AIR ACTUATOR CONTROL
ACTUATOR FEEDBACK
FLAME SENSOR 1 (ROD/UV)
FLAME SENSOR 2 (UV)
UV SHUTTER CONTROL
HIGH TEMP BYPASS / FLAMELESS

Qio RESOURCES

THERMOSTAT INPUT 1
THERMOSTAT INPUT 2
AIR CONTROL INPUT
REMOTE RESET INPUT
BURNER ON OUTPUT
LOCKOUT OUTPUT

NOTES

PERIODIC FLAME INPUTS TEST INTERVAL
55 min

WiFi

SERVICE
STATION - CONNECTED

SSID
CONTRIVE-2g

RF SIGNAL
4 %

MQTT

SERVICE
OFF - DISCONNECTED

BROKER ADDRESS

CLIENT ID

After logging in, the page containing general information will be displayed, which can be called up and updated every time you press the **INFO** button.

The first box shows the model and the supply voltage.

The second box contains the manufacturing date and firmware version of the device.

AVAILABLE RESOURCES
List of resources available for the specific Q2 model.

Qio RESOURCES
List of resources available for Qio.

NOTES
Q2 may contain production notes or information on any repair work.

PERIODIC FLAME INPUTS TEST INTERVAL
Q2 periodically performs an efficiency check of the flame inputs, from the sensors to the input amplifier to the microprocessors
The time interval between tests is shown here.

WIFI
Information about the WiFi network: the operating mode, the network name and the radio signal.

MQTT
Qio can connect to a MQTT (Message Queuing Telemetry Transport) broker to publish topics related to the burner's operating status.
Information related to the service status is displayed here. These are advanced features intended for expert users.

By clicking on the **CONT** button you go to the control page which shows the operating status of the burner. This page is updated periodically.

FLAME SIGNAL
The first box shows the intensity of the flame signal for the two inputs. The symbol changes if the High Temperature mode is active.

STATUS DISPLAY
Replicates the display on the device that indicates the cycle status or the lockout.
The extended description is shown below.
Click on the button to reset a burner from lockout.

INDICATORS
For each Q2 output there is a status indicator that replicates those present on the device. The status of the fuel and air pressure switches is also reported, followed by the status of the Qio inputs and outputs (associated with the respective functions).

ACTUATOR
Actuator opening percentage indicator.

By clicking on the **HIST** button you access the page containing the history of the last 39 lockouts. Press again every time you want to refresh the page.

For all events, the **TIME** in which they occurred is reported, referring to the operational life of the device, which is reported in the first box.

For each lockout event, there is a **DESCRIPTION** of the cause and any details.

Q2
CONTRIVE

| INFO | CONT | STAT | HIST | EXIT |

OPERATIONAL LIFE

DEVICE
0 HOUR 05 MIN 45 SEC
1 POWER CYCLES

BURNER
0 HOUR 00 MIN 45 SEC
2 IGNITION CYCLES

AIR VALVE (VA)
0 HOUR 01 MIN 00 SEC
4 POWER CYCLES

FUEL SAFETY VALVE (VS)
0 HOUR 00 MIN 45 SEC
1 POWER CYCLES

BYPASS VALVE (VB)
0 HOUR 00 MIN 00 SEC
0 POWER CYCLES

FUEL PILOT VALVE (V1)
0 HOUR 00 MIN 15 SEC
2 POWER CYCLES

FUEL MAIN VALVE (V2)
0 HOUR 00 MIN 45 SEC
0 POWER CYCLES

POWER SUPPLY

OVERVOLTAGE
–

UNDERVOLTAGE
–

SYSTEM

MCU1 TEMPERATURE
29 °C

MCU1 VOLTAGE
3333 mV

MCU2 TEMPERATURE
30 °C

MCU2 (DEPLOYER) VOLTAGE
3339 mV

Clicking on the **STAT** button takes you to the page relating to the operating statistics.
Press again every time you want to refresh the page.

Total operating time and the times the **DEVICE** was powered.

Total operating time (flame present) and how many ignition cycles were made by the **BURNER**.

Total operating time and how many power cycles were made by the **AIR VALVE**.

Total operating time and how many power cycles were made by the **FUEL SAFETY VALVE**.

Total operating time and how many power cycles were made by the **BYPASS VALVE**.

Total operating time and how many power cycles were made by the **PILOT VALVE**.

Total operating time and how many power cycles were made by the **MAIN VALVE**.

Any **OVERVOLTAGE** or **UNDERVOLTAGE** values that caused a lockout.

Current supply **VOLTAGE** and **TEMPERATURE** of the two microprocessors.

26. PROFINET

Remote management of Q2 via Profinet can be achieved with the Qnet board which is installed in the base of the device. Communication with Q2 occurs via the optical interface [2] that faces the corresponding one on the Q2 board, operation is guaranteed only when the front part is correctly positioned on the base
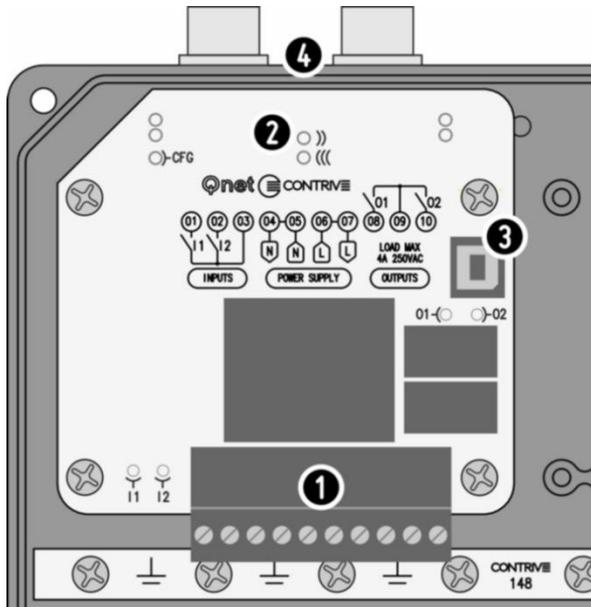
1. TERMINAL BOARD
2. OPTICAL INTERFACE
3. USB-B CONNECTOR
4. M12D FEMALE CONNECTOR
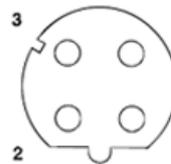
1. TD + YELLOW
2. RD + WHITE
3. TD - ORANGE
4. RD - BLUE

26.1. INDICATORS

INPUT 1			INPUT 2
OUTPUT 1			OUTPUT 2

26.2. WIRING

The **BLACK** terminals are for power supply.
To simplify wiring, there are 2 additional terminals for connections that carry power to Q2.
The **ORANGE** terminals refer to two general-purpose digital inputs that can be monitored via Profinet.
There are 2 remotely controllable general purpose SPST contacts available on the **BLUE** terminals.
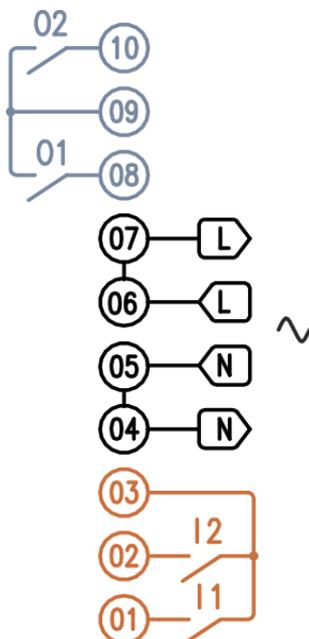
OUTPUTS

10	OUT	OUTPUT 1 SPST CONTACT
09	OUT	COMMON RETURN
08	OUT	OUTPUT 2 SPST CONTACT

POWER SUPPLY

07	OUT	PHASE
06	IN	PHASE
05	OUT	NEUTRAL
04	IN	NEUTRAL

INPUTS

03	OUT	COMMON NEGATIVE
02	IN	INPUT 2
01	IN	INPUT 1

26.3.   CONFIGURATION

With the device powered off, connect USB port [3] to your PC, the orange LED **CFG** will light up.

A removable disk drive will appear on your computer (similar to when you insert a USB stick). Locate and run the config.bat file, which will guide you through configuring the following settings:

- IP address
- Subnet mask
- Gateway address
- Webserver activation/deactivation
- Webserver access user name
- Webserver access password

> (!) It is advisable to activate TIMEOUT B05 so that in case of absence of Profinet control the device goes into lockout (while the burner is on).

26.4.   TECHNICAL DATA

POWER SUPPLY

VOLTAGE	100...240VAC
FREQUENCY	47 ... 63 Hz
LINE FUSE	6,3 A EMBEDDED
POWER CONSUMPTION	6 VA MAX

AUTOMATIC OVERTEMPERATURE
AND OVERCURRENT PROTECTION

ENVIRONMENT

OPERATING TEMPERATURE	-20 ... 60 °C -4 ... 140 °F
STORAGE TEMPERATURE	-40 ... 85 °C -40 ... 185 °F
RELATIVE HUMIDITY	10...90% NO CONDENSATION ALLOWED
DIMENSIONS	80 x 90 mm MAX
WEIGHT	90 g

THIS UNIT IS NOT INTENDED FOR
EXPLOSIVE OR CORROSIVE ENVIRONMENTS

INPUTS

MAX CURRENT PER INPUT	5 mA
VOLTAGE PROVIDED BY THE DEVICE	12 VDC

OUTPUTS

MAX RATED VOLTAGE	250 V AC
MAX SWITCHING VOLTAGE	270 V AC
MAX LOAD PER OUTPUT	2 A - $\cos\varphi$ = 0.7

ETHERNET

CONNECTOR	2 x M12D 100 baseT
CABLE	CAT5 / CAT5e SHIELDED
PROTOCOLS	PROFINET IO HTTP

For M12 connectors, apply a tightening torque of 0.6 Nm.
Unused M12 connectors must be sealed with protective caps.

26.5. PROTOCOL

Profinet is an industry technical standard for data communication over Industrial Ethernet, designed for collecting data from, and controlling equipment in industrial systems, with a particular strength in delivering data under tight time constraints. The standard is maintained and supported by Profibus and Profinet International.

Profinet defines the entire data exchange between controllers (called "IO-Controllers") and the devices (called "IO-Devices"), as well as parameter setting and diagnosis. IO-Controllers are typically PLCs, whereas IO-Devices can be drives, sensors, actuators or general purpose I/O modules.

26.6. CYCLIC COMMUNICATION

The content and scope of the communication between Q2 (device) and the automation system (controller) can be freely defined as required. For this purpose, you can select the individual modules available for data communication from the structure offered in the GSD file.

The modules are placed in the slots predetermined by the system. All modules required for cyclic data communication with Q2 are shown in the following table.

	MODULE	SLOT	INPUT ADDRESS	OUTPUT ADDRESS
1	Control	1	n n+1	n n+1
2	Inputs/outputs	2	n n+1	
3	Flame signal	3	n	
4	Actuator	4	n	n
5	Display	5	n n+1	
6	Configuration	6	n	n

SLOT 1

CONTROL MODULE
DEVICE → CONTROLLER

	BIT	CURRENT STATUS	FORMAT	NOTE
BYTE n	0	DEVICE ON	BOOL	Q2 connected and responding
	1	STANDBY	BOOL	The device is in STANDBY
	2	LOCKOUT	BOOL	The device is in LOCKOUT
	3	VPS FAILURE	BOOL	Lockout due to leakage test failure
	4	MANUAL SHUTDOWN	BOOL	The device has been put out of service locally
	5	CONTROLLED SHUTDOWN	BOOL	The burner was turned off upon request
	6	AIR PRESSURE WAITING	BOOL	The cycle is waiting for air pressure
	7	POST-COMBUSTION	BOOL	Burner off waiting for the flame quenching
BYTE n+1	0	PRE-OPERATION	BOOL	Valve proving and pre-purge in progress
	1	IGNITION	BOOL	Burner ignition in progress
	2	STAGE 2	BOOL	Burner on, stage 2 low temperature
	3	STAGE 3	BOOL	Burner on, stage 3 low temperature
	4	STAGE 4	BOOL	Burner on, stage 4 low temperature
	5	STAGE 5	BOOL	Burner on, stage 5 high temperature
	6	STAGE 6	BOOL	Burner on, stage 5 high temperature
	7	POST-OPERATION	BOOL	Valve proving and post-purge in progress

If communication with the device cannot be established, all bits = 0.

SLOT 1

CONTROL MODULE
CONTROLLER → DEVICE

	BIT	COMMAND	ACTION	FORMAT
BYTE n	0	UNLOCK	Set to1 and then to 0, emulating a push button, to reset from lockout	BOOL
	1	RUN	0 = stop burner 1 = start burner [1]	BOOL
	2	AIR OUTPUT	0 = air valve output OFF 1 = air valve output ON [2]	BOOL
	3	OS OUTPUT	0 = shutter output OFF 1 = shutter output ON [3]	BOOL
	4	HT confirmation	Confirm the request for indirect flame surveillance (high temperature mode) [4]	BOOL
	5	CFG LED	Orange indicator	BOOL
	6	OUTPUT 1	0 = output 1 OFF 1 = output 1 ON	BOOL
	7	OUTPUT 2	0 = output 2 OFF 1 = output 2 ON	BOOL
BYTE n+1	0	NONE	No forced stage, cycle deploys normally	BOOL
	1	STAGE 2	Move to stage 2 [5]	BOOL
	2	STAGE 3	Move to stage 3 [5]	BOOL
	3	STAGE 4	Move to stage 4 [5]	BOOL
	4	STAGE 5	Move to stage 5 [5]	BOOL
	5	STAGE 6	Move to stage 6 [5]	BOOL
	6	NOT USED		BOOL
	7	NOT USED		BOOL

[1]   No effect if the device is on LOCKOUT or MANUAL SHUTDOWN.

[2]   If allowed in the current stage.

[3]   Generic output, if not used for optical shutter control.

[4]   If required by configuration (parameter G08) activate periodically within 5 minutes.

[5]   If bits 1 to 5 are set simultaneously, the priority is always the lower one.

SLOT 2

INPUTS/OUTPUTS MODULE
DEVICE → CONTROLLER

	BIT	DESCRIPTION	FORMAT	NOTE	
BYTE n	0	AIR PRESSURE SWITCH INPUT	BOOL	0 = insufficient air pressure 1 = air pressure OK	**INPUTS (STATUS)**
	1	FUEL PRESSURE SWITCH INPUT	BOOL	0 = insufficient fuel pressure 1 = fuel pressure OK	
	2	HT INPUT	BOOL	0 = High temperature mode 1 = Low temperature mode	
	3	NOT USED	BOOL	always 0	
	4	NOT USED	BOOL	always 0	
	5	NOT USED	BOOL	always 0	
	6	INPUT 1	BOOL	0 = input off 1 = input on	
	7	INPUT 2	BOOL	0 = input off 1 = input on	
BYTE n+1	0	AIR OUTPUT	BOOL	0 = air valve VA off 1 = air valve VA on	**OUTPUTS S (TATUS)**
	1	VS OUTPUT	BOOL	0 = fuel valve VS off 1 = fuel valve VS on	
	2	VB OUTPUT	BOOL	0 = fuel valve VB off 1 = fuel valve VB on	
	3	V1 OUTPUT	BOOL	0 = fuel valve V1 off 1 = fuel valve V1 on	
	4	V2 OUTPUT	BOOL	0 = fuel valve V2 off 1 = fuel valve V2 on	
	5	OS OUTPUT	BOOL	0 = shutter output off 1 = shutter output on	
	6	OUTPUT 1	BOOL	0 = output 1 off 1 = output 1 on	
	7	OUTPUT 2	BOOL	0 = output 2 off 1 = output 2 on	

SLOT 3

FLAME SIGNAL MODULE
DEVICE → CONTROLLER

	BIT	DESCRIPTION	FORMAT	NOTE
BYTE n	0	Flame 1 signal	DEC	0...99 (255) µA
	1			
	2			
	3			
	4			
	5			
	6			
	7			
BYTE n+1	0	Flame 2 signal	DEC	0...99 (255) µA
	1			
	2			
	3			
	4			
	5			
	6			
	7			

SLOT 4

ACTUATOR
DEVICE → CONTROLLER

	BIT	DESCRIPTION	FORMAT	NOTE
BYTE n	0	Current actuator position	DEC	0...100 (255) 0...100%
	1			
	2			
	3			
	4			
	5			
	6			
	7			

SLOT 4

ACTUATOR
CONTROLLER → DEVICE

	BIT	DESCRIPTION	FORMAT	NOTE
BYTE n	0	Required actuator position	DEC	0...100 (255)
	1			
	2			
	3			
	4			
	5			
	6			
	7			

SLOT 5

DISPLAY
DEVICE → CONTROLLER

	BIT	DESCRIPTION	FORMAT	NOTE
BYTE n	0	Current RED display	HEX	00...FF
	1			
	2			
	3			
	4			
	5			
	6			
	7			
BYTE n+1	0	Current BLUE display	HEX	00...FF
	1			
	2			
	3			
	4			
	5			
	6			
	7			

SLOT 6

SETTINGS MODULE
CONTROLLER → DEVICE

	BIT	CURRENT STATUS	FORMAT	NOTE
BYTE n	0	NOT USED	BOOL	0
	1	NOT USED	BOOL	0
	2	PROFINET DISCONNECT	BOOL	0: CONTINUE USING LAST CONDITION
	3	PROFINET NOT CONFIGURED	BOOL	1: BURNER OFF (HALT)
	4	NOT USED	BOOL	
	5	NOT USED	BOOL	
	6	NOT USED	BOOL	
	7	NOT USED	BOOL	

SLOT 6

CONFIGURATION MODULE
DEVICE → CONTROLLER

	BIT	CURRENT STATUS	FORMAT	NOTE
BYTE n	0	NOT USED	BOOL	0
	1	NOT USED	BOOL	0
	2	PROFINET DISCONNECT	BOOL	0: CONTINUE USING LAST CONDITION
	3	PROFINET NOT CONFIGURED	BOOL	1: BURNER OFF (HALT)
	4	TRANSPARENT MODE	BOOL	0: DISABLED 1: ENABLED [1]
	5	NOT USED	BOOL	
	6	NOT USED	BOOL	
	7	NOT USED	BOOL	

[1]   When TRANSPARENT MODE is enabled, inputs to the controller are rendered, but all outputs sent from the controller to the device are ignored. This mode is enabled/disabled from webserver interface.

26.7. ACYCLIC COMMUNICATION

With the help of acyclic communication, it is possible to read information and statistics of the Q2.

This type of data communication is controlled by a dedicated function in the PLC program ("RDREC" pursuant to IEC 61131b3). The available data records differ in terms of their indexes.

Address	Type	Description	Format	Note	
		INDEX 1001 = Device info			
0	BYTE	POWER SUPPLY VOLTAGE	BYTE	1=115V / 2=230V	
1	BYTE	2ND FLAME INPUT	BOOL	0=NO / 1=YES	
2	BYTE	V2 OUTPUT	BOOL	0=NO / 1=YES	
3	BYTE	VS OUTPUT	BOOL	0=NO / 1=YES	
4	BYTE	VB OUTPUT	BOOL	0=NO / 1=YES	BYTE
5	BYTE	VA OUTPUT	BOOL	0=NO / 1=YES	
6	BYTE	ACTUATOR CONTROL	BOOL	0=NO / 1=YES	
7	BYTE	ACTUATOR FEEDBACK	BOOL	0=NO / 1=YES	
8	BYTE	UV SHUTTER	BOOL	0=NO / 1=YES	
9	WORD	DATE OF PRODUCTION	DEC	WEEK/YEAR	
11	WORD	FIRMWARE VERSION	DEC	MAJOR / minor	
13	64 BYTES	NOTES	ASCII	text	

Address	Type	Description	Format	Note
		INDEX 1002 = Device statistic		
0	DWORD	DEVICE OPERATING TIME	HEX	1
4	DWORD	CYCLES DEPLOYED	HEX	
8	DWORD	BURNER OPERATING TIME	HEX	1
12	WORD	LAST UNDERVOLTAGE	HEX	
14	WORD	LAST OVERVOLTAGE	HEX	
16	WORD	CONTROLLER TEMPERATURE	HEX	
18	WORD	DEPLOYER TEMPERATURE	HEX	
20	WORD	CONTROLLER SUPPLY VOLTAGE	HEX	
22	WORD	DEPLOYER SUPPLY VOLTAGE	HEX	
24	DWORD	AIR VALVE CYCLES DEPLOYED	HEX	
28	DWORD	AIR VALVE OPERATING TIME	HEX	1
32	DWORD	VS VALVE CYCLES DEPLOYED	HEX	
36	DWORD	VS VALVE OPERATING TIME	HEX	1
40	DWORD	VB VALVE CYCLES DEPLOYED	HEX	
44	DWORD	VB VALVE OPERATING TIME	HEX	1
48	DWORD	V1 VALVE CYCLES DEPLOYED	HEX	
52	DWORD	V1 VALVE OPERATING TIME	HEX	1
56	DWORD	V2 VALVE CYCLES DEPLOYED	HEX	
60	DWORD	V2 VALVE OPERATING TIME	HEX	1
64	DWORD	POWER CYCLES	HEX	
1 : DATA RENDERED IN FIFTEEN SECONDS 0000...FFFF TO BE CONVERTED INTO MINUTES (DIVIDE BY 4) 0000...3FFF (UP TO 1.073.741.824 MINUTES)				

		INDEX 1003 = Lockouts history			
Address	Type	Description		Format	Note
0	DWORD	LAST LOCKOUT	TIMESTAMP	HEX	1
4	WORD		CODE	HEX	
6	DWORD	2nd LAST LOCKOUT	TIMESTAMP	HEX	1
10	WORD		CODE	HEX	
12	DWORD	3rd LAST LOCKOUT	TIMESTAMP	HEX	1
16	WORD		CODE	HEX	
18	DWORD	4th LAST LOCKOUT	TIMESTAMP	HEX	1
22	WORD		CODE	HEX	
24	DWORD	5th LAST LOCKOUT	TIMESTAMP	HEX	1
28	WORD		CODE	HEX	
30	DWORD	6th LAST LOCKOUT	TIMESTAMP	HEX	1
34	WORD		CODE	HEX	
36	DWORD	7th LAST LOCKOUT	TIMESTAMP	HEX	1
40	WORD		CODE	HEX	
42	DWORD	8th LAST LOCKOUT	TIMESTAMP	HEX	1
46	WORD		CODE	HEX	
48	DWORD	9th LAST LOCKOUT	TIMESTAMP	HEX	1
52	WORD		CODE	HEX	
54	DWORD	10th LAST LOCKOUT	TIMESTAMP	HEX	1
58	WORD		CODE	HEX	
60	DWORD	11th LAST LOCKOUT	TIMESTAMP	HEX	1
64	WORD		CODE	HEX	
66	DWORD	12th LAST LOCKOUT	TIMESTAMP	HEX	1
70	WORD		CODE	HEX	
72	DWORD	13th LAST LOCKOUT	TIMESTAMP	HEX	1
76	WORD		CODE	HEX	
78	DWORD	14th LAST LOCKOUT	TIMESTAMP	HEX	1
80	WORD		CODE	HEX	
82	DWORD	15th LAST LOCKOUT	TIMESTAMP	HEX	1
86	WORD		CODE	HEX	
88	DWORD	16th LAST LOCKOUT	TIMESTAMP	HEX	1
92	WORD		CODE	HEX	
94	DWORD	17th LAST LOCKOUT	TIMESTAMP	HEX	1
98	WORD		CODE	HEX	
100	DWORD	18th LAST LOCKOUT	TIMESTAMP	HEX	1
104	WORD		CODE	HEX	
106	DWORD	19th LAST LOCKOUT	TIMESTAMP	HEX	1
110	WORD		CODE	HEX	
112	DWORD	20th LAST LOCKOUT	TIMESTAMP	HEX	1
116	WORD		CODE	HEX	
118	DWORD	21st LAST LOCKOUT	TIMESTAMP	HEX	1
122	WORD		CODE	HEX	
124	DWORD	22nd LAST LOCKOUT	TIMESTAMP	HEX	1
128	WORD		CODE	HEX	
130	DWORD	23rd LAST LOCKOUT	TIMESTAMP	HEX	1
134	WORD		CODE	HEX	
136	DWORD	24th LAST LOCKOUT	TIMESTAMP	HEX	1

140	WORD	CODE		HEX	
142	DWORD	25th LAST LOCKOUT	TIMESTAMP	HEX	1
146	WORD	CODE		HEX	
148	DWORD	26th LAST LOCKOUT	TIMESTAMP	HEX	1
152	WORD	CODE		HEX	
154	DWORD	27th LAST LOCKOUT	TIMESTAMP	HEX	1
158	WORD	CODE		HEX	
160	DWORD	28th LAST LOCKOUT	TIMESTAMP	HEX	1
164	WORD	CODE		HEX	
166	DWORD	29th LAST LOCKOUT	TIMESTAMP	HEX	1
170	WORD	CODE		HEX	
172	DWORD	30th LAST LOCKOUT	TIMESTAMP	HEX	1
176	WORD	CODE		HEX	
178	DWORD	31st LAST LOCKOUT	TIMESTAMP	HEX	1
182	WORD	CODE		HEX	
184	DWORD	32nd LAST LOCKOUT	TIMESTAMP	HEX	1
188	WORD	CODE		HEX	
190	DWORD	33rd LAST LOCKOUT	TIMESTAMP	HEX	1
194	WORD	CODE		HEX	
196	DWORD	34th LAST LOCKOUT	TIMESTAMP	HEX	1
200	WORD	CODE		HEX	
202	DWORD	35th LAST LOCKOUT	TIMESTAMP	HEX	1
206	WORD	CODE		HEX	
208	DWORD	36th LAST LOCKOUT	TIMESTAMP	HEX	1
212	WORD	CODE		HEX	
214	DWORD	37th LAST LOCKOUT	TIMESTAMP	HEX	1
218	WORD	CODE		HEX	
220	DWORD	38th LAST LOCKOUT	TIMESTAMP	HEX	1
224	WORD	CODE		HEX	
226	DWORD	39th LAST LOCKOUT	TIMESTAMP	HEX	1
230	WORD	CODE		HEX	

1 : DATA RENDERED IN FIFTEEN SECONDS 0000…FFFF (DEVICE OPERATING TIMESTAMP)
TO BE CONVERTED INTO MINUTES (DIVIDE BY 4) 0000…3FFF (UP TO 1.073.741.824 MINUTES)

26.8. LOCKOUT / FAILURE CODES

List of codes returned in the **Lockout history,** associated display and description.

CODE	DISPLAY	DESCRIPTION
EE 3A		AIR FAILURE: PRESSURE NOT DETECTED WHEN AIR OUTPUT IS ON
EE 1A		AIR SIMULATION PRESSURE DETECTED WHEN AIR OUTPUT IS OFF
BC 3A		FUEL FAILURE: PRESSURE NOT DETECTED WHEN GAS OUTPUT IS ON
BC 1A		FUEL SIMULATION PRESSURE DETECTED WHEN GAS OUTPUT IS OFF
BC 9E		INCOHERENT STATUS OF VS VALVE LIMIT SWITCH
3A 2E		FAILURE TO PREHEAT FUEL (OIL) WITHIN MAX ALLOWED TIME
C4 38		ACTUATOR MALFUNCTION: POSITION HAS NOT BEEN REACHED WITHIN TIME
7A 6E		FLAME SIMULATION DURING CONTROLLED SHUTDOWN
7A CE		FLAME SIMULATION DURING PRE-OPERATION
7A CF		FLAME SIMULATION DURING POST-OPERATION
7A 76		FLAME SIMULATION AT THE END OF POST-COMBUSTION
7C 00		UNSUCCESSFUL IGNITION
8E DA		FLAME LOSS DURING 2ND STAGE
8E F2		FLAME LOSS DURING 3RD STAGE
8E 66		FLAME LOSS DURING 4TH STAGE
1E 84		UPSTREAM VALVE LEAKAGE
1E 3A		DOWNSTREAM VALVE(S) LEAKAGE
90 00		MORE THAN 5 REMOTE RESET WITHIN 15 MINUTES
9C 1E		TRAXBUS COMMUNICATION TIMEOUT
9C 2E		HOST COMMUNICATION TIMEOUT
6E 6E		CYBER ATTACK CONFIGURATION PORT
9C 6E		CYBER ATTACK QNET WEBSERVER
9C BC		CYBER ATTACK TRAXGATEWAY WEBSERVER
9C 3A		CYBER ATTACK QIO WEBSERVER

LOCKOUTS

FAILURES	1C C0	*L.1.*	INOPERATIVE – IGNITOR OUTPUT CONTACT
	1C DA	*L2.*	INOPERATIVE – V1 OUTPUT CONTACT
	1C F2	*L3.*	INOPERATIVE – V2 OUTPUT CONTACT
	1C 66	*L4.*	INOPERATIVE – VB OUTPUT CONTACT
	BA C0	*6.1.*	SHORT CIRCUIT – IGNITOR OUTPUT CONTACT
	BA DA	*6 2.*	SHORT CIRCUIT – V1 OUTPUT CONTACT
	BA F2	*6 3.*	SHORT CIRCUIT – V2 OUTPUT CONTACT
	BA 66	*6 4.*	SHORT CIRCUIT – VB OUTPUT CONTACT
	BA 3A	*6 6.*	SHORT CIRCUIT – SAFETY MASTER CONTACT
	E0 C0	*7.1.*	MALFUNCTION – FLAME INPUT 1
	E0 DA	*7 2.*	MALFUNCTION – FLAME INPUT 2
	E0 F2	*7 3.*	MALFUNCTION – UV DETECTOR 1 PERIODIC OPTICAL SHUTTER TEST FAILED
	E0 66	*7 4.*	MALFUNCTION – UV DETECTOR 2 PERIODIC OPTICAL SHUTTER TEST FAILED
	E0 B4	*7 5.*	MALFUNCTION – UV DETECTOR 1 & 2 PERIODIC OPTICAL SHUTTER TEST FAILED
	E0 9E	*7 E.*	MALFUNCTION – FLAME AMPLIFIERS PERIODIC TEST FAILED
	92 EE	*E.A.*	UNRELIABLE INPUT – AIR PRESSURE SWITCH
	92 BC	*E 0.*	UNRELIABLE INPUT – FUEL PRESSURE SWITCH
	92 2E	*E h.*	UNRELIABLE INPUT – HIGH TEMPERATURE
	92 C0	*E.1.*	UNRELIABLE INPUT – IGNITOR FEEDBACK
	92 DA	*E 2.*	UNRELIABLE INPUT – V1 FEEDBACK
	92 F2	*E 3.*	UNRELIABLE INPUT – V2 FEEDBACK
	92 66	*E 4.*	UNRELIABLE INPUT – VB FEEDBACK
	92 B4	*E 5.*	UNRELIABLE INPUT – PROOF OF CLOSURE (VS)
	92 38	*E 0.*	UNRELIABLE INPUT – 0% ACTUATOR LIMIT SWITCH
	92 C4	*E n.*	UNRELIABLE INPUT – 100% ACTUATOR LIMIT SWITCH
	E6 00	*9*	MALFUNCTION – PUSH BUTTON ACTIVATED FOR MORE THAN 10 SECONDS
	4A 00	*2.*	MAIN POWER SUPPLY – OVERVOLTAGE

4A 4A	ə̄.ə̄.	MAIN POWER SUPPLY – SEVERE OVERVOLTAGE
26 00	4	MAIN POWER SUPPLY – UNDERVOLTAGE
78 C0	d̄.1̄.	MICROCONTROLLER 1 – PROGRAM SEQUENCE ERROR
78 DA	d̄.2̄.	MICROCONTROLLER 2 – PROGRAM SEQUENCE ERROR
9E C0	E.1̄.	MICROCONTROLLER 1 – RAM MEMORY CORRUPTION
9E DA	E.2̄.	MICROCONTROLLER 2 – RAM MEMORY CORRUPTION
B4 00	5	CONTRADICTORY BEHAVIOR OF MICROCONTROLLERS
6C C0	H.1̄.	MICROCONTROLLER 1 – FIRMWARE CORRUPTION
6C DA	H.2̄.	MICROCONTROLLER 1 – FIRMWARE CORRUPTION
6C F2	H.3̄.	INVALID CONFIGURATION PARAMETER
6C 4A	H.ə̄.	MICROCONTROLLER OVERVOLTAGE
6C 26	H.4̄.	MICROCONTROLLER UNDERVOLTAGE
6C 1E	H.t̄.	MICROCONTROLLER TEMPERATURE OUT OF RANGE
6C 1C	H.Ē.	LOCKOUT MEMORY MISMATCH

26.9. WEBSERVER

From any browser you can access the web server embedded in Qnet by specifying as URL the IP address assigned to the device.

Supports up to 4 clients connected simultaneously, performance may degrade as the number of connected clients increases

Select your preferred language, then press **CONTINUE**.
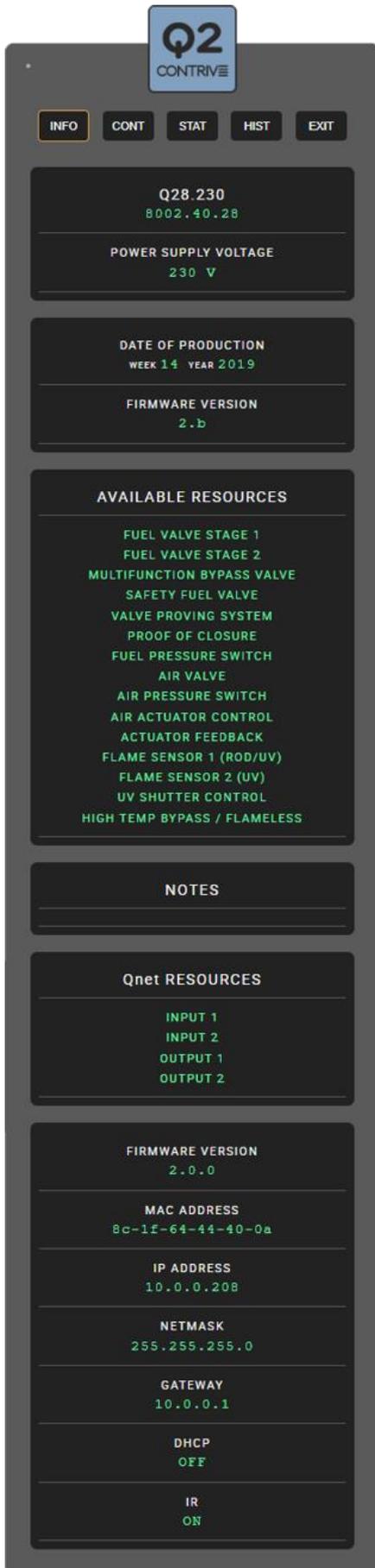
CONTRIVE

Q2
8002.40.28

POWER SUPPLY VOLTAGE
230 V

DATE OF PRODUCTION
WEEK 14 YEAR 2019

FIRMWARE VERSION
2.b

AVAILABLE RESOURCES

FUEL VALVE STAGE 1
FUEL VALVE STAGE 2
MULTIFUNCTION BYPASS VALVE
SAFETY FUEL VALVE
VALVE PROVING SYSTEM
PROOF OF CLOSURE
FUEL PRESSURE SWITCH
AIR VALVE
AIR PRESSURE SWITCH
AIR ACTUATOR CONTROL
ACTUATOR FEEDBACK
FLAME SENSOR 1 (ROD/UV)
FLAME SENSOR 2 (UV)
UV SHUTTER CONTROL
HIGH TEMP BYPASS / FLAMELESS

NOTES

Qnet RESOURCES

INPUT 1
INPUT 2
OUTPUT 1
OUTPUT 2

FIRMWARE VERSION
2.0.0

MAC ADDRESS
8c-1f-64-44-40-0a

IP ADDRESS
10.0.0.208

NETMASK
255.255.255.0

GATEWAY
10.0.0.1

DHCP
OFF

IR
ON

After logging in, the page containing general information will be displayed, which can be called up and updated every time you press the **INFO** button.

The first box shows the model and the supply voltage.

The second box contains the manufacturing date and firmware version of the device.

AVAILABLE RESOURCES
List of resources available for the specific Q2 model.

NOTES
Q2 may contain production notes or information on any repair work.

Qnet RESOURCES
List of resources available for Qnet.

CURRENT Qnet SETTINGS
- Firmware version
- MAC address
- Subnet mask
- Gateway
- DHCP mode
- IR interface (Q2)

By clicking on the **CONT** button you go to the control page which shows the operating status of the burner. This page is updated periodically.

FLAME SIGNAL

The first box shows the intensity of the flame signal for the two inputs. The symbol changes if the High Temperature mode is active.

STATUS DISPLAY

Replicates the display on the device that indicates the cycle status or the lockout.

The extended description is shown below.

Click on the button to reset a burner from lockout.

INDICATORS

For each Q2 output there is a status indicator that replicates those present on the device. The status of the fuel and air pressure switches is also reported, followed by the status of the Qnet general purpose digital inputs and outputs.

ACTUATOR

Actuator opening percentage indicator.

By clicking on the **HIST** button you access the page containing the history of the last 39 lockouts. Press again every time you want to refresh the page.

For all events, the **TIME** in which they occurred is reported, referring to the operational life of the device, which is reported in the first box.

For each lockout event, there is a **DESCRIPTION** of the cause and any details.

Q2
CONTRIVE

INFO | CONT | STAT | HIST | EXIT

OPERATIONAL LIFE

DEVICE
0 HOUR 05 MIN 45 SEC
1 POWER CYCLES

BURNER
0 HOUR 00 MIN 45 SEC
2 IGNITION CYCLES

AIR VALVE (VA)
0 HOUR 01 MIN 00 SEC
4 POWER CYCLES

FUEL SAFETY VALVE (VS)
0 HOUR 00 MIN 45 SEC
1 POWER CYCLES

BYPASS VALVE (VB)
0 HOUR 00 MIN 00 SEC
0 POWER CYCLES

FUEL PILOT VALVE (V1)
0 HOUR 00 MIN 15 SEC
2 POWER CYCLES

FUEL MAIN VALVE (V2)
0 HOUR 00 MIN 45 SEC
0 POWER CYCLES

POWER SUPPLY

OVERVOLTAGE
–

UNDERVOLTAGE
–

SYSTEM

MCU1 TEMPERATURE
29 °C

MCU1 VOLTAGE
3333 mV

MCU2 TEMPERATURE
30 °C

MCU2 (DEPLOYER) VOLTAGE
3339 mV

Clicking on the **STAT** button takes you to the page relating to the operating statistics.
Press again every time you want to refresh the page.

Total operating time and the times the **DEVICE** was powered.

Total operating time (flame present) and how many ignition cycles were made by the **BURNER**.

Total operating time and how many power cycles were made by the **AIR VALVE**.

Total operating time and how many power cycles were made by the **FUEL SAFETY VALVE**.

Total operating time and how many power cycles were made by the **BYPASS VALVE**.

Total operating time and how many power cycles were made by the **PILOT VALVE**.

Total operating time and how many power cycles were made by the **MAIN VALVE**.

Any **OVERVOLTAGE** or **UNDERVOLTAGE** values that caused a lockout.

Current supply **VOLTAGE** and **TEMPERATURE** of the two microprocessors.

27.CYBERSECURITY

IEC 62443-4-2, the NIS 2 Directive, the CRA (Cyber Resilience Act), and the EN 18031 standard represent the pillars of industrial and building automation cybersecurity in Europe, each with a distinct role.

Standard / Provision	Type	Main Subjects	Objective	Relationship with Others
IEC 62443-4-2	Voluntary Standard Technical/Product	Manufacturers of IACS Components (PLCs, RTUs, sensors, software).	To define the technical security requirements that a single industrial component (hardware or software) must implement to achieve a certain Security Level (SL).	It is the technical reference that manufacturers use to comply with the CRA's product requirements.
NIS 2 Directive	Mandatory Law Management/Operator	Operators of Essential Services (OES) and Important Entities (e.g., energy, transport, healthcare, large manufacturers).	To raise the general level of cybersecurity and operational resilience of critical entities through organizational measures (risk analysis, incident management, business continuity).	IEC 62443-2-1 and -3-3 (parts on management and architecture) are the ideal frameworks that Operators use to implement the risk management measures required by NIS 2.
CRA Regulation	Mandatory Law Product/Market	Manufacturers and Importers of products with digital elements (e.g., IACS components).	To ensure that connected products placed on the EU market are secure by design (from the very beginning of the design process) and provide vulnerability management for their entire lifecycle.	The CRA makes it legally mandatory for products to meet security requirements. IEC 62443-4-2 (and -4-1 on the development lifecycle).
EN 18031 (RED)	Mandatory Law Product/Radio Equipment	Manufacturers of radio equipment with internet connectivity, personal data processing, or payment capabilities.	To ensure radio equipment meets specific cybersecurity requirements: network protection, personal data protection and fraud prevention.	EN 18031 complements IEC 62443 for radio-enabled IACS/BACS components and aligns with CRA requirements for wireless communication

The objective of the IEC 62443-4-2 standard for the cybersecurity of IACS (Industrial Automation Control Systems) constitutes the technical tool (framework) of reference aimed at guaranteeing the "safety" of the plant, along with the confidentiality, availability, and integrity of the data used within it, describing 4 security levels:

SL1   Prevent the unauthorized disclosure of information via eavesdropping or casual exposure.

SL2   Prevent the unauthorized disclosure of information to an entity actively searching for it using simple means with low resources, generic skills and low motivation.

SL3   Prevent the unauthorized disclosure of information to an entity actively searching for it using sophisticated means with moderate resources, IACS specific skills and moderate motivation.

SL4   Prevent the unauthorized disclosure of information to an entity actively searching for it using sophisticated means with extended resources, IACS specific skills and high motivation.

The following pages indicate the SECURITY LEVEL CAPABILITY for each of the communication interfaces provided by Q2 and its accessories.

No firmware update by the user is permitted for any of these devices.

⚠️ Any vulnerabilities to cyberattacks found during the normal operation of our products can be reported through the HelpDesk: https://contrive.it/support/

27.1. Q2 TRAXBUS

Security Level	Definition	Estimated Value	Rationale
SL-C Component	Intrinsic security capability of the TraxBus interface	SL0 / SL1	The TraxBus protocol achieves SL1 due to resistance against accidental errors obtained through the use of a checksum.
SL-T Target System	Security level achieved by the Zone/Conduit	SL2	The system reaches SL2 if compensatory measures are adopted at the network level (segregation, Firewall, VPN) that protect against attacks with simple resources and low motivation. SL3 can only be achieved by encapsulating the data in an encrypted communication with end-to-end authentication.

TraxBus (like Modbus), as a "Clear Text" protocol, can achieve a target security level (SL-T) of SL2 if it operates in a segregated network that uses firewalls or VPNs for public access.

Foundational Requirement	SL-C Component Capability	Network Measures	SL-T Target Level Achieved
FR1 - IAC Identification and Authentication Control	Absent Anonymous communication.	VPN/IPsec or TLS on the Conduit to authenticate connecting devices, IP/MAC filtering on the Firewall.	SL2 Implicit network and/or cryptographic authentication
FR2 - UC Use Control	Absent All commands are possible.	Firewall with Deep Packet Inspection (DPI) to filter TraxBus commands.	SL2 Use Control at the network level (Conduit)
FR3 - SI System Integrity	Absent No cryptographic protection.	VPN/IPsec to ensure cryptographic integrity of the message payload (prevention of intentional manipulation).	SL2 Integrity ensured by the transport layer
FR4 - DC Data Confidentiality	Absent No cryptographic protection.	VPN/IPsec to ensure cryptographic integrity of the message payload (prevention of intentional manipulation).	SL2 Integrity ensured by the transport layer
FR5 - RDF Restricted Data Flow	Absent Clear-text data.	VPN/IPsec to encrypt traffic entering/exiting the IACS Zone.	SL2 Confidentiality provided by the Conduit
FR6 - TRE Timely Response to Events	Absent No security logging.	Logging and Monitoring on the Firewall/IPS to record denied access attempts, filtered commands, and other anomalies.	SL2 Provided by perimeter security tools
FR7 - RA Resource Availability	Weak Vulnerable to DoS.	Rate Limiting and Session Management on the Conduit Firewall to block flooding of requests toward devices.	SL2 Protection from simple denial-of-service attacks

The security strategy is defined by the deployment environment:

- **Segregated Industrial Environment**: In the absence of network countermeasures, the TraxBus interface is suitable only for communications within segregated areas (no public network access). In this context, it meets the requirements for SL0 or SL1 levels.
- **External Network Extension**: If control or access is extended to external networks (IT or Cloud), a dedicated Conduit must be implemented to achieve a System Target Security Level (SL-T) of SL2 or SL3.

27.2. Q2 FRONT IR

Infrared/Optical Port used for local configuration via a dedicated USB optical adapter connected to a PC, assuming this interface is inaccessible from external networks.

Foundational Requirement	SL-C Component Capability	SL-C Component Level Achieved
FR1 - IAC Identification and Authentication Control	The requirement is met via password access (something you know) combined with the physical adapter (something you have) and specific procedure (something you know). The password identifies the user/role.	SL2 Authentication is strong enough to resist generic attacks (SL2). Strength depends on password quality enforcement by the device firmware.
FR2 - UC Use Control	The user is identified by the password), the device implements role-based access control (RBAC): specific password for configuration, specific password for commissioning.	SL2/SL3 Relies entirely on the device's internal firmware and configuration tool to enforce role-based privileges based on the entered password.
FR3 - SI System Integrity	The physical optical link provides intrinsic protection against sniffing/tampering on the wire. Integrity is further protected by basic communication protocols (e.g., checksum or redundant data).	SL3 The isolated, point-to-point connection and data redundancy strongly secures integrity against remote or easy internal attacks.
FR4 - DC Data Confidentiality	Data is transmitted via an isolated optical beam. While the data itself might not be encrypted, the physical confinement grants inherent confidentiality (no sniffing on the network).	SL2 Confidentiality is met due to physical isolation.
FR5 - RDF Restricted Data Flow	Absolute Separation: The interface is completely disconnected from the network.	SL4 Physical isolation provides the highest level of flow restriction.
FR6 - TRE Timely Response to Events	The device must log security events locally, including successful and failed login attempts and configuration changes, linked to the identified user/role. The incorrect password attempt is recorded in the device's memory.	SL3 failed access attempts (incorrect password entry) are recorded in the device's log memory
FR7 - RA Resource Availability	Not susceptible to network DoS. Protected by physical access controls and firmware lockout mechanisms for password attempts. If an incorrect password is entered, the device enters lockout that makes the resource unavailable to both attacker and legitimate user upon the first violation.	SL3 Isolation prevents network-based DoS. Availability is protected by lockout mechanisms, with the device entering lockout and signaling with a specific code upon incorrect password entry.

The isolated infrared port design is a highly effective security-by-design strategy for local configuration and commissioning functions.

The interface meets or exceeds SL2 for all analyzed Foundational Requirements.

27.3. Q2 BACK IR

Infrared/Optical Port used for communication with internal expansion boards.

Foundational Requirement	SL-C Component Capability	SL-C Component Level Achieved
FR1 - IAC Identification and Authentication Control	Communication is point-to-point and confined. Identification is implicit (the boards are physically connected). Protocol-level authentication is not necessary.	SL3 Authentication is guaranteed by the main board's unique internal identity (trusted identity) and physical confinement.
FR2 - UC Use Control	The internal protocol is proprietary and restricted to only the necessary functions.	SL3 The restricted protocol inherently implements Use Control by limiting the possible operations.
FR3 - SI System Integrity	The optical point-to-point connection within a protected enclosure is nearly impossible to intercept. Integrity is ensured by checksum mechanisms within the communication protocol.	SL3 Integrity is guaranteed by both the checksum and physical confinement, which eliminates the risk of manipulation by an external attacker.
FR4 - DC Data Confidentiality	Data travels in clear-text (unencrypted), but physical confinement inside the device guarantees absolute confidentiality.	SL3 Confidentiality is ensured at the highest level due to absolute physical segregation. Encryption (SL3) is not necessary if the data does not leave the physical perimeter.
FR5 - RDF Restricted Data Flow	Absolute Separation: Data does not leave the device. Flow is restricted between internal boards.	SL4 Represents the highest level of flow restriction (confinement).
FR6 - TRE Timely Response to Events	The protocol manages errors and failures are stored into non-volatile memory.	SL2/SL3 Event handling is intrinsic to the protocol (diagnostics), and forwarding depends on the parent component.
FR7 - RA Resource Availability	The system is not exposed to external DoS. Low-power optics are inherently resistant to electrical interference.	SL3 Isolation and the nature of the optoelectronic connection protect the power supply and bandwidth from remote DoS attacks.

The internal optical (IR) communication between the main board and expansion boards is an example of a connection that achieves a high Security Level due to Absolute Physical Segregation (the principle of Confined Communication).

The interface meets or exceeds SL3 for all analyzed Foundational Requirements.

27.4. QNET PROFINET INTERFACE

Security Level	Definition	Estimated Value	Rationale
SL-C Component	Intrinsic security capability of the QNET gateway	SL2	By disabling SNMP/DCP and securing the infrared interface, the component can resist simple, intentional misuse. However, it still lacks intrinsic cryptographic features (due to CC-B) needed for full SL-C 3.
SL-T Target System	Security level achieved by the Zone/Conduit	SL2 / SL3	With a robust component configuration (SL-C 2) and the inclusion of network countermeasures (VPN/Firewall), the overall system can confidently achieve SL-T 2 and, with strong cryptographic implementation on the Conduit, potentially reach SL-T 3.

By deactivating weak standard services (SNMP, DCP) and protecting the integrated infrared interface, the key requirements of PROFINET security class 1 (robustness) can be met, can achieve a target security level (SL-T) of SL2 if it operates in a segregated network that uses firewalls or VPNs for public access.

Foundational Requirement	SL-C Component Capability	Network Measures	SL-T Target Level Achieved
FR1 - IAC Identification and Authentication Control	Weak/Implicit PROFINET only has basic device ID.	VPN/IPsec or TLS on the Conduit for strong, cryptographic authentication of connecting clients.	SL2 identification and authentication ensured by Conduit
FR2 - UC Use Control	DCP/SNMP disabled limiting configuration/management access via standard network services.	Deep Packet Inspection (DPI) Firewall filters PROFINET I/O data and prevent unauthorized commands from reaching the gateway's real-time functions.	SL2 DPI for I/O data provided by Conduit
FR3 - SI System Integrity	Robust against simple network attacks (PROFINET Netload Robustness) due to disabling SNMP/DCP.	VPN/IPsec on the Conduit to provide cryptographic integrity checks for all data transmission over the network, preventing intentional manipulation.	SL2 Integrity ensured by the transport layer
FR4 - DC Data Confidentiality	Absent PROFINET/TraxBus data is clear-text by default.	VPN/IPsec: Required to encrypt all traffic entering/exiting the Zone boundary.	SL2 Depends entirely on the Conduit for encryption
FR5 - RDF Restricted Data Flow	Standard PROFINET.	Zone and Conduits Architecture: The segregation (physical/logical) and Firewall rules are the primary control for flow restriction.	SL2/SL3 Achieved by the overall network architecture (IEC 62443-3-3)
FR6 - TRE Timely Response to Events	No SNMP/DCP means fewer network services to monitor, and robust operation is expected.	Logging and Monitoring on the Firewall/IPS to register denied access attempts and filter events related to PROFINET I/O.	SL2 Logging is done by the Conduit, but the cleaner component configuration reduces noise
FR7 - RA Resource Availability	Disabling SNMP/DCP reduces the component's attack surface and increases robustness against simple DoS attacks.	Rate Limiting on the Firewall to block flooding of real-time or management requests aimed at overwhelming the gateway.	SL2 rate limiting required for SL2/3

The interface meets or exceeds **SL2** for all analyzed Fundamental Requirements.
The security strategy is defined by the deployment environment:

- **Segregated Industrial Environment**: When operating within an isolated and protected industrial network, the interface's native features are sufficient. **No additional measures** or external devices are required.
- **External Network Extension**: If control or access is extended to external networks (IT or Cloud), a dedicated Conduit must be implemented to achieve a System Target Security Level (SL-T) of SL2 or SL3.

27.5. QNET HTTP INTERFACE

Security Level	Definition	Estimated Value	Rationale
SL-C Component	Intrinsic security capability of the QNET webserver	SL1	Fails the fundamental requirements for Confidentiality (FR4) and Authentication (FR1) for SL2. Transmitting credentials in clear-text exposes administration to compromise by any attacker with network access.
SL-T Target System	Security level achieved by the Zone/Conduit	SL2	It can achieve SL2 if the Conduit implements mandatory cryptographic protection (VPN/IPsec) to secure the Web Server traffic and DPI management filters. Without network-level encryption, the SL-T is limited to SL1.

Optional webserver for remote supervision, can achieve a target security level (SL-T) of SL2 if it operates in a segregated network, restricted access to authorized personnel only.

Foundational Requirement	SL-C Component Capability	Network Measures	SL-T Target Level Achieved
FR1 - IAC Identification and Authentication Control	Basic Authentication is vulnerable to credential sniffing on the network.	VPN/IPsec for remote access or TLS Proxy on the network path.	SL2 Authentication relies on VPN credentials rather than the weak Basic Auth
FR2 - UC Use Control	Lack of granular roles/privileges in WS; access grants full management control.	DPI/Layer 7 Firewall Rules: Filters specific HTTP management commands (POST) and restricts actions.	SL2 Control over actions is enforced by network inspection, mitigating the risk of intentional misuse by authorized but malicious local user
FR3 - SI System Integrity	No integrity check HTTP commands are vulnerable to on-path tampering.	VPN/IPsec: Provides cryptographic integrity checks for all transmitted management commands and data.	SL2 Protects against command alteration, even if the attacker is an internal employee on the network
FR4 - DC Data Confidentiality	Transmission of credentials and configuration data in clear-text.	VPN/IPsec: Essential to encrypt internal traffic, preventing credential theft via network sniffers used by internal personnel.	SL2 Confidentiality is guaranteed by the cryptographic tunnel, protecting data from compromise
FR5 - RDF Restricted Data Flow	Introduces a management flow (HTTP port 80) that must be controlled.	Strict Firewall Rules: Limits access to port 80 only to specifically authorized administrative hosts.	SL2/3 The Trusted Environment Assumption is formalized by the strict access control list.
FR6 - TRE Timely Response to Events	SL3: Entering the wrong password causes a controlled lockout, and the event is recorded in non-volatile memory.	None	SL3 Requirement for attack detection and logging are satisfied.
FR7 - RA Resource Availability	Protection against DoS attacks is strengthened by the controlled lockout function.	None	SL3 Attack results in a controlled suspension, not a chaotic failure.

Integrated webserver meets or exceeds SL2 security levels across all analyzed Fundamental Requirements. The use of the Web Server depends on the network perimeter in which it is deployed:

- **Segregated Industrial Environment**: It can remain active without additional measures.
- **External Network Access**: The webserver can remain active provided that the system is protected by a Conduit that fulfills the necessary security requirements (VPN/IPsec, DPI).
- **Maximum Protection** (Hardening): If an adequate Conduit cannot be guaranteed, or for high-criticality applications, the webserver can be completely disabled. This action eliminates the attack vector at its source, neutralizing the risk of unauthorized access via the web interface.

27.6.   QNET CONFIGURATION PORT

Internal USB interface, no password required. Access requires enclosure disassembly with specialized tools and a controlled power-down/power-up procedure into configuration mode.

Foundational Requirement	SL-C Component Capability	Network Measures	SL-T Target Level Achieved
FR1 - IAC Identification and Authentication Control	The device technically grants full access upon physical connection. Security relies only on physical barriers (enclosure) and procedure (power cycle), not user identity.	Isolated Interface	SL1
FR2 - UC Use Control	Absence of authentication, no Role-Based Access Control (RBAC). The attacker gains full admin privileges. Disincentive is high because they cannot restore original parameters.	Isolated Interface	SL1
FR3 - SI System Integrity	Integrity is guaranteed by the absolute physical confinement of the USB port and the point-to-point connection. Data transmission cannot be tampered with remotely.	Isolated Interface	SL3 Guaranteed by physical integrity
FR4 - DC Data Confidentiality	Confidentiality is guaranteed by absolute physical segregation. Data is never exposed to a network or clear-text sniffing outside the secure enclosure.	Isolated Interface	SL3 Guaranteed by physical segregation
FR5 - RDF Restricted Data Flow	The interface is permanently isolated from the network. The power-cycle procedure ensures configuration flow is strictly separated from operational flow.	Isolated Interface	SL4 Maximum possible restriction by design
FR6 - TRE Timely Response to Events	The host records the communication failure (lockout event), creating an undeniable audit trail of the physical intrusion attempt.	Isolated Interface	SL3 Logging capability managed by the host.
FR7 - RA Resource Availability	Availability is secured by physical robustness.	Isolated Interface	SL3 Guaranteed by physical segregation.

The overall system is **highly resistant to SL2 or higher attack patterns** despite the interface having inherent weaknesses.

Security is enforced through physical confinement and mandatory procedural logging. An attacker must perform detectable, invasive, and high-risk physical maneuvers. In an industrial setting, these "mechanical" barriers effectively compensate for the lack of local encryption or passwords.

27.7. QIO HTTP INTERFACE

Optional webserver for remote supervision operating in segregated Industrial Network, restricted access to authorized personnel only.

Foundational Requirement	SL-C Component Capability	SL-C Component Level Achieved
FR1 - IAC Identification and Authentication Control	Access requires physical proximity to the device, and dual authentication: 1) WPA3-Personal (link layer) 2) Encrypted credentials via HTTPS (application layer).	SL2 WPA3 and TLS provide multi-layered cryptographic protection.
FR2 - UC Use Control	Control based on firmware RBAC and automatic session closure after 5 minutes of inactivity.	SL3 Inactivity timeout and session management strengthen resource control.
FR3 - SI System Integrity	HTTPS (TLS) provides end-to-end integrity for the application data, preventing tampering.	SL3 The combination of WPA3 and TLS ensures high message integrity.
FR4 - DC Data Confidentiality	Credentials and configuration data are encrypted via HTTPS (Port 443) using a self-signed certificate.	SL3 TLS ensures confidentiality even if the link layer is bypassed.
FR5 - RDF Restricted Data Flow	The device can operate as an AP (creating an isolated logical boundary) or as a STATION (connecting to a segregated Industrial Network).	SL3 Flow restriction is guaranteed by the ability to act as an AP (creating a closed segment) or by relying on the segregation of the external Industrial Network when operating as a STATION.
FR6 - TRE Timely Response to Events	Entering the wrong password 5 consecutive times causes a controlled lockout, and the event is recorded in non-volatile memory.	SL3 Fully satisfied by the lockout and logging function of the host.
FR7 - RA Resource Availability	Protection against DoS is strengthened by WPA3 and the host lockout function. TLS overhead is managed by the host.	SL3 Resilience is maintained through link-layer protection and controlled application suspension.

EN 18031 Risk Assessment

Vulnerability Classes	Level	EN 18031 Requirement
Firmware and Code Integrity	N/A	NOT APPLICABLE - QIO does not support remote firmware updates.
Data Confidentiality / Integrity	LOW	HTTPS guarantees data encryption, no sensitive data or personal credentials are handled.
Communication Integrity / Authenticity	MEDIUM	HTTPS secures the channel. Residual identity risk (spoofing) due to self-signed certificates is accepted in LAN environments.
Protocol Robustness / Validation	LOW	Strict "Allow-list" command parsing prevents code execution, command injection, or unauthorized protocol manipulation.
Credential / Secret Protection	LOW	Session-based auth over encrypted channel. WPA3 credentials are hardware-protected (Secure Element). Meets EN 18031-1 storage standards.
Access and Use Control	LOW	HTTPS prevents session hijacking. The attack surface is minimized by the extremely limited set of supported commands.
DoS (Denial of Service)	MEDIUM	Resource saturation (HTTPS flood) may cause Webserver downtime, but core operational functions remain unaffected and isolated.

The use of the webserver depends on the network perimeter in which it is deployed:

- **Segregated Industrial Environment**: It can remain active **without additional measures**.
- **External Network Access**: The webserver can remain active provided that the system is protected by a Conduit that fulfills the necessary security requirements (VPN/IPsec, DPI).
- **Maximum Protection** (Hardening): If an adequate Conduit cannot be guaranteed, or for high-criticality applications, the webserver can be completely disabled. This action eliminates the attack vector at its source, neutralizing the risk of unauthorized access via the web interface.

27.8. QIO CONFIGURATION PORT

Accessing the internal USB port for configuration requires physical disassembly (tools) and a connection to a local PC, no password or user identification are required.

The Host locks out when the enclosure is opened (communication is interrupted).

Foundational Requirement	SL-C Component Capability	Network Measures	SL-T Target Level Achieved
FR1 - IAC Identification and Authentication Control	The device technically grants full access upon physical connection. Security relies only on physical barriers (enclosure), not user identity.	Isolated Interface	SL1
FR2 - UC Use Control	Absence of authentication, no Role-Based Access Control (RBAC). The attacker gains full admin privileges.	Isolated Interface	SL1
FR3 - SI System Integrity	Integrity is guaranteed by the absolute physical confinement of the USB port and the point-to-point connection. Data transmission cannot be tampered with remotely.	Isolated Interface	SL3 Maximum protection against physical or data tampering
FR4 - DC Data Confidentiality	Confidentiality is guaranteed by absolute physical segregation. Data is never exposed to a network or clear-text sniffing outside the secure enclosure.	Isolated Interface	SL3 Guaranteed by physical segregation
FR5 - RDF Restricted Data Flow	The interface is permanently isolated from the network.	Isolated Interface	SL4 Maximum possible restriction by design
FR6 - TRE Timely Response to Events	The host records the communication failure (lockout event), creating an undeniable audit trail of the physical intrusion attempt.	Isolated Interface	SL3 Logging capability managed by the host.
FR7 - RA Resource Availability	Availability is secured by physical robustness.	Isolated Interface	SL3 Guaranteed by physical segregation.

The overall system is **highly resistant to SL2 or higher attack patterns** despite the interface having inherent weaknesses.

Security is enforced through **physical confinement** and **mandatory procedural logging**. An attacker must perform detectable, invasive, and high-risk physical maneuvers. In an industrial setting, these "mechanical" barriers effectively compensate for the lack of local encryption or passwords.

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