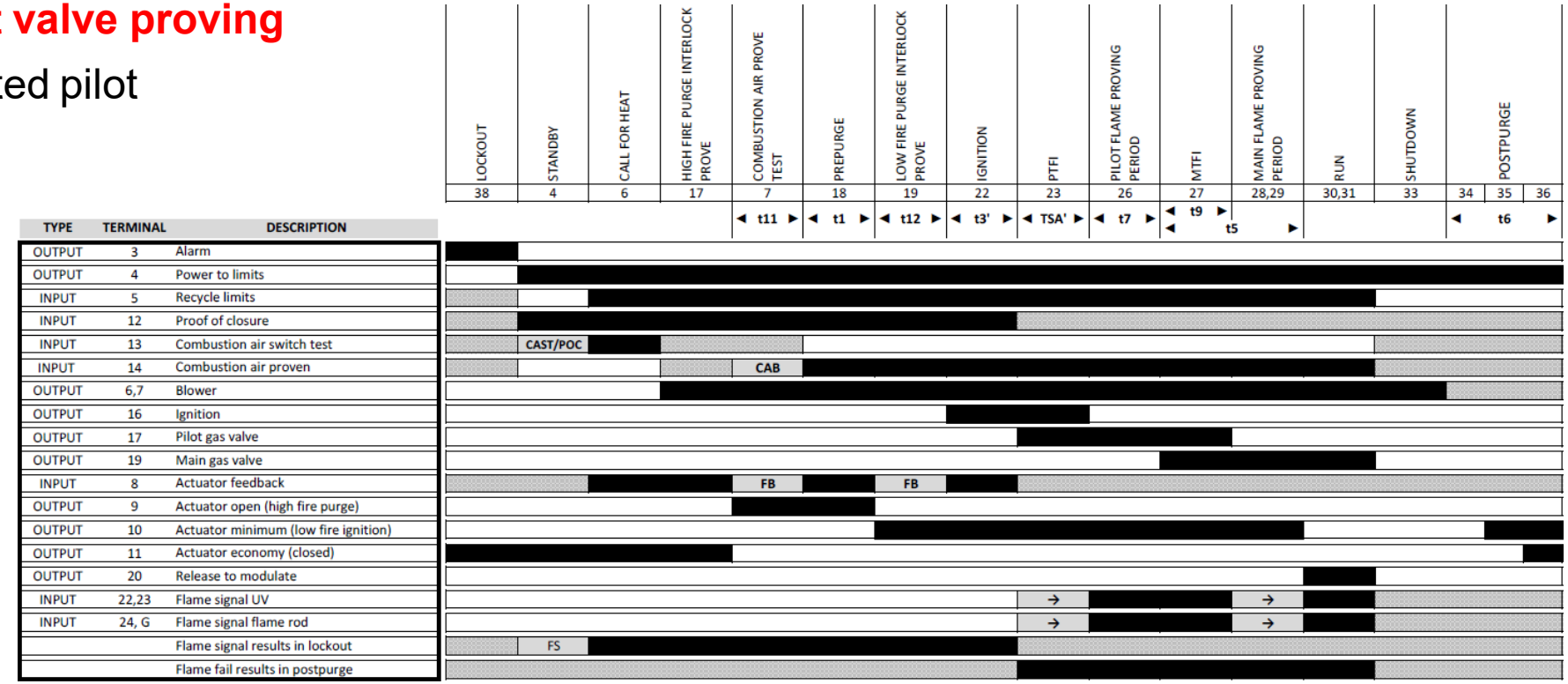
BURNERPRO TROUBLESHOOTING

PR-00-2-0200-0-009-A

Sequence diagram

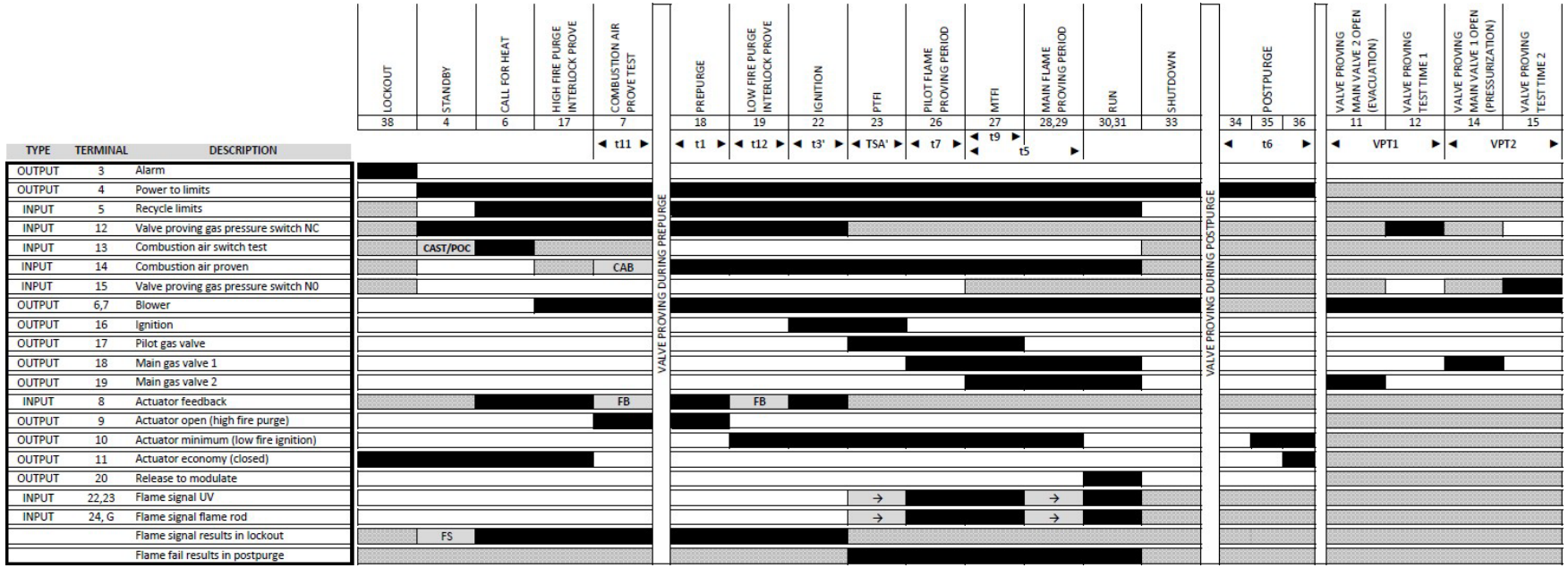
Without valve proving

Interrupted pilot



Sequence diagram

With valve proving



TYPE	TERMINAL	DESCRIPTION
OUTPUT	3	Alarm
OUTPUT	4	Power to limits
INPUT	5	Recycle limits
INPUT	12	Valve proving gas pressure switch NC
INPUT	13	Combustion air switch test
INPUT	14	Combustion air proven
INPUT	15	Valve proving gas pressure switch N0
OUTPUT	6,7	Blower
OUTPUT	16	Ignition
OUTPUT	17	Pilot gas valve
OUTPUT	18	Main gas valve 1
OUTPUT	19	Main gas valve 2
INPUT	8	Actuator feedback
OUTPUT	9	Actuator open (high fire purge)
OUTPUT	10	Actuator minimum (low fire ignition)
OUTPUT	11	Actuator economy (closed)
OUTPUT	20	Release to modulate
INPUT	22,23	Flame signal UV
INPUT	24, G	Flame signal flame rod
		Flame signal results in lockout
		Flame fail results in postpurge

Sequence timings

Standard timings S1-S6

Without valve proving:

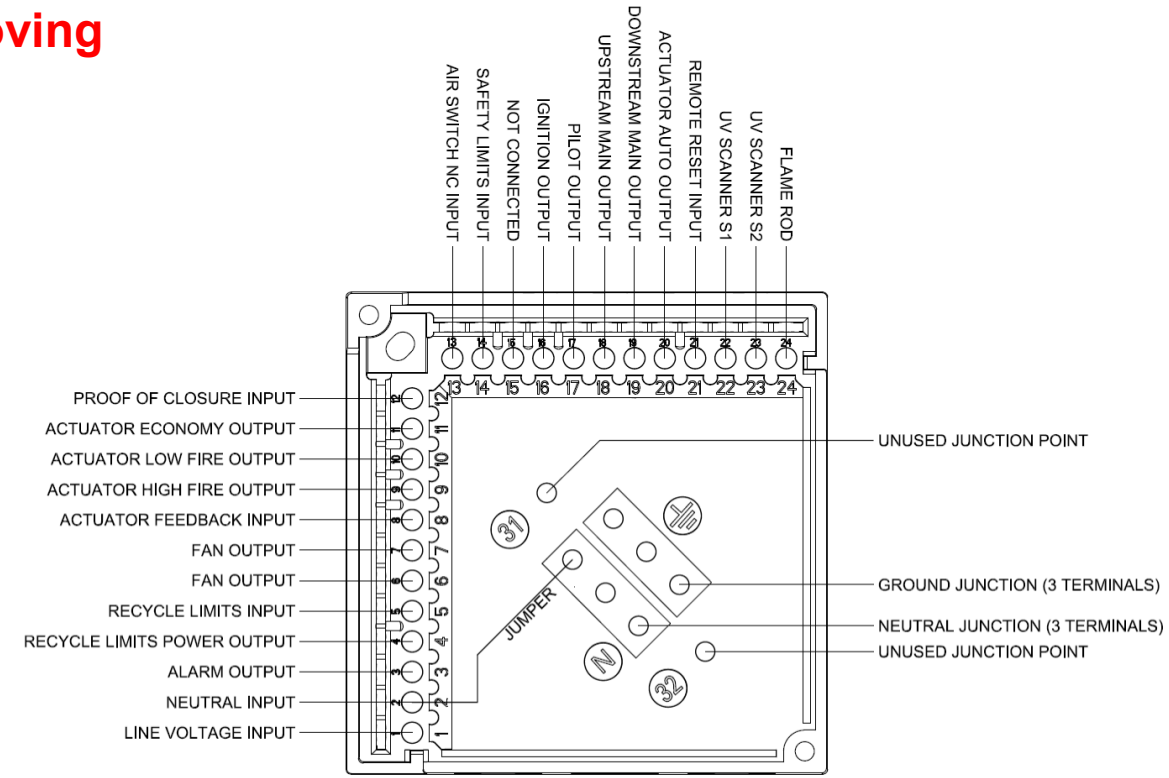
TIMINGS / STATE SEQUENCE												
PRESET	FFRT		t11	t1	t12	t3'	TSA'	t7	t9	t5		t6
S1	1s		Actuator travel time (max = feedback time)	35.5s	Actuator travel time (max = feedback time)	4s	2s	8s	2s	10s		12s
S2	1s			31s		6s	3s	8.5s	3s	11.5s		18s
S3	1s			37s		2.5s	5s	10s	5s	12.5s		15s
S4	1s			60s		2.5s	5s	10s	5s	12.5s		15s
S5	4s			37s		2.5s	5s	10s	5s	12.5s		15s
S6	4s			30s		1s	10s	5s	10s	15s		15s

With valve proving:

TIMINGS / STATE SEQUENCE													
PRESET	FFRT		t11	t1	t12	t3'	TSA'	t7	t9	t5		t6	VPT1	VPT2
S1	1s		Actuator travel time (max = feedback time)	35.5s	Actuator travel time (max = feedback time)	4s	2s	8s	2s	10s		12s	30s	30s
S2	1s			31s		6s	3s	8.5s	3s	11.5s		18s	30s	30s
S3	1s			37s		2.5s	5s	10s	5s	12.5s		15s	30s	30s
S4	1s			60s		2.5s	5s	10s	5s	12.5s		15s	30s	30s
S5	4s			37s		2.5s	5s	10s	5s	12.5s		15s	30s	30s
S6	4s			30s		1s	10s	5s	10s	15s		15s	30s	30s

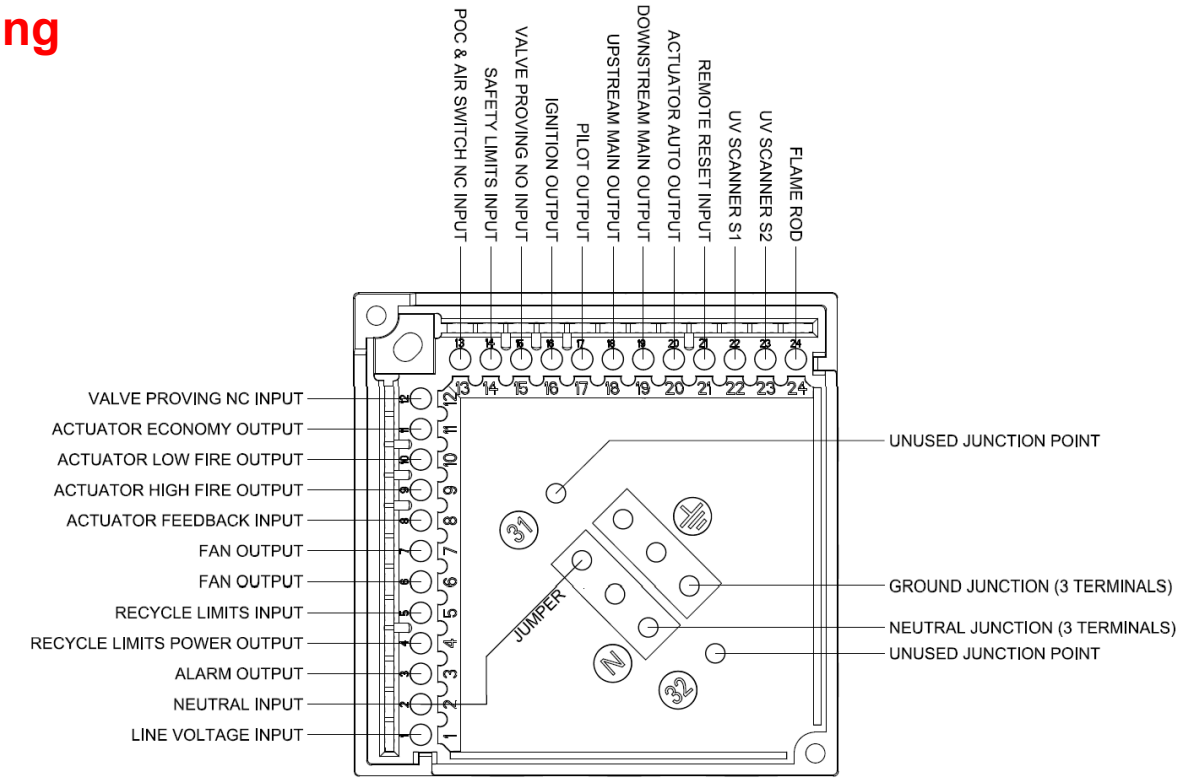
Terminal designations

Without valve proving



Terminal designations

With valve proving

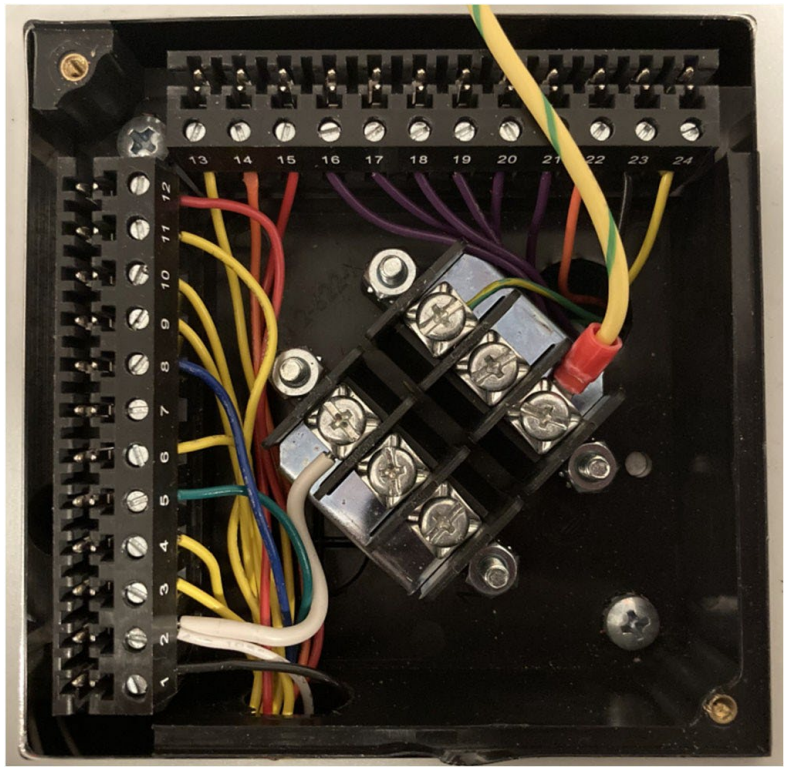


Wiring base

Common to Siemens LFL

The wiring base is common with the Siemens LFL and the BurnerPRO is listed to function as a drop-in replacement for the LFL.

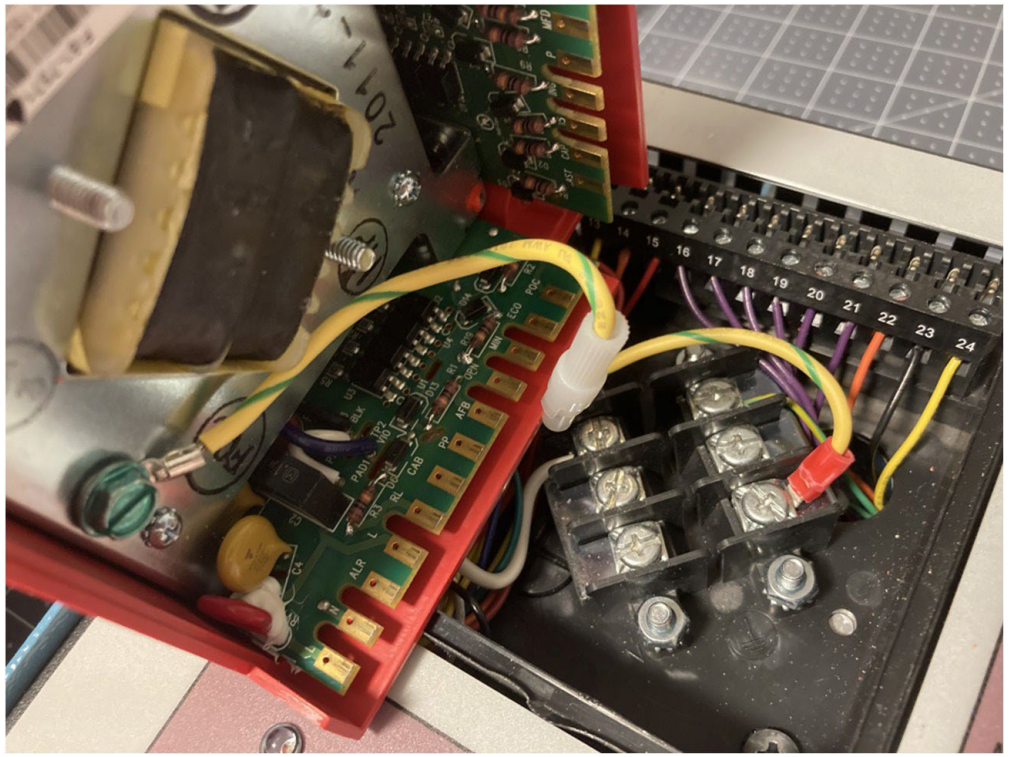
Three common neutral and three common grounding terminals are provided for use in connecting external devices.



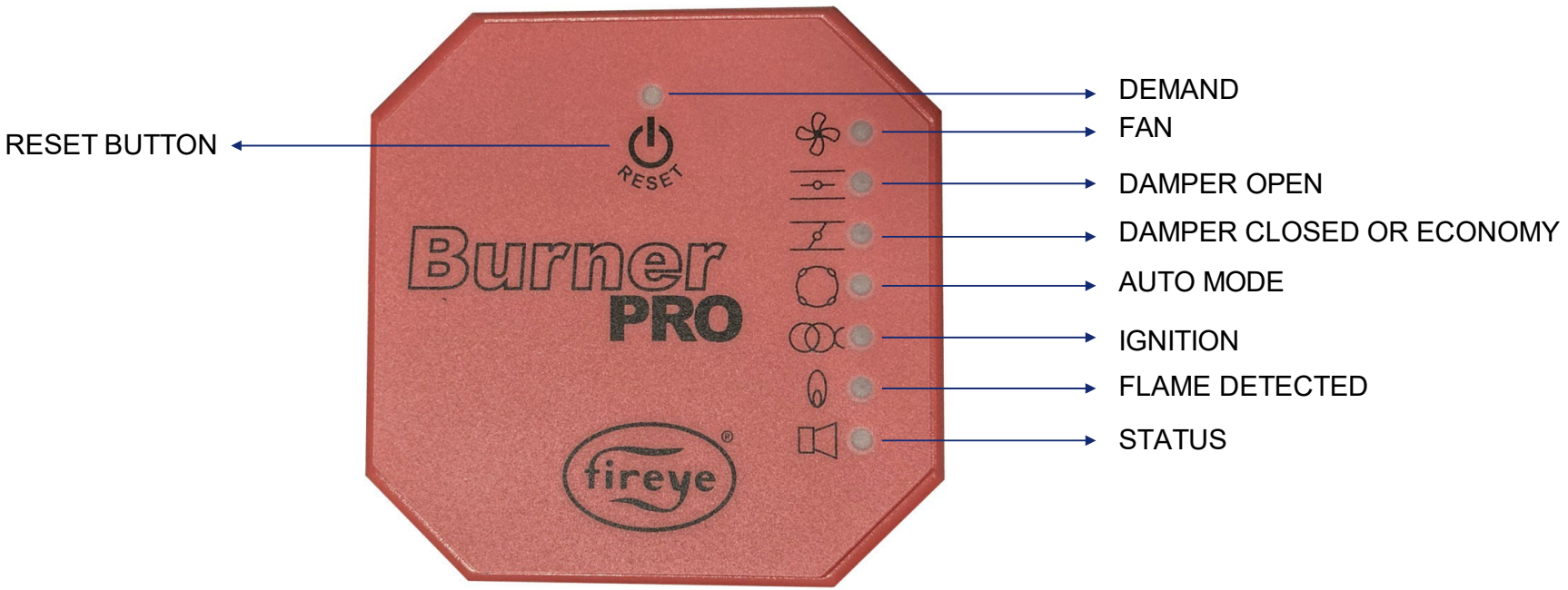
Wiring base

Grounding leash

The BurnerPRO is grounded using a quick-disconnect plug on a wired grounding leash. This provides a more positive ground over a copper spring, which can lose contact over time.



Smart LEDs


RESET BUTTON
RESET
Burner
PRO
fireye
DEMAND
FAN
DAMPER OPEN
DAMPER CLOSED OR ECONOMY
AUTO MODE
IGNITION
FLAME DETECTED
STATUS

Sequence of operation

Standby

LED STATE

The standby state is when there is not a call for heat. Terminal 11 (ACTUATOR ECONOMY OUTPUT) is powered with line voltage in this state.

Sequence of operation

Lockout

LED STATE

When in the lockout state, the combination of LEDs will indicate the lockout code. These codes can be found in the bulletin for the specific model. Shown is the lockout code for STANDBY FALSE FLAME (flame detected while in standby for more than 60 seconds).

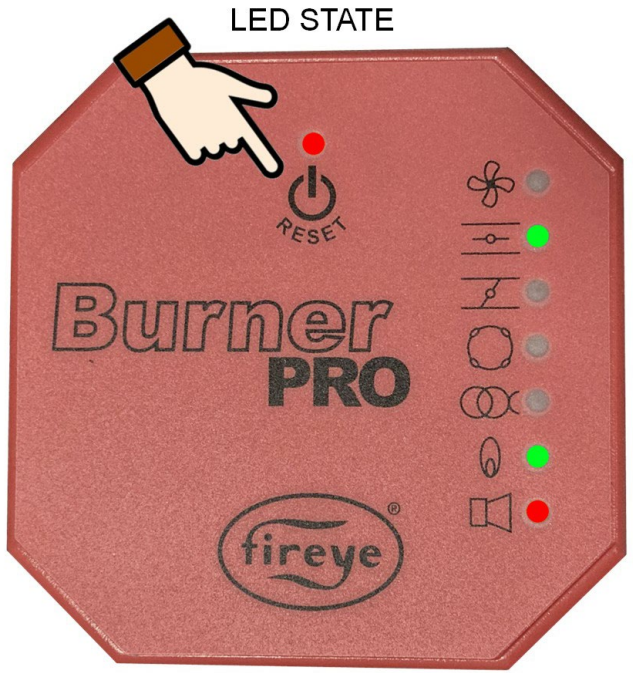
fireye®

BurnerPRO LED ERROR / LOCKOUT CODES

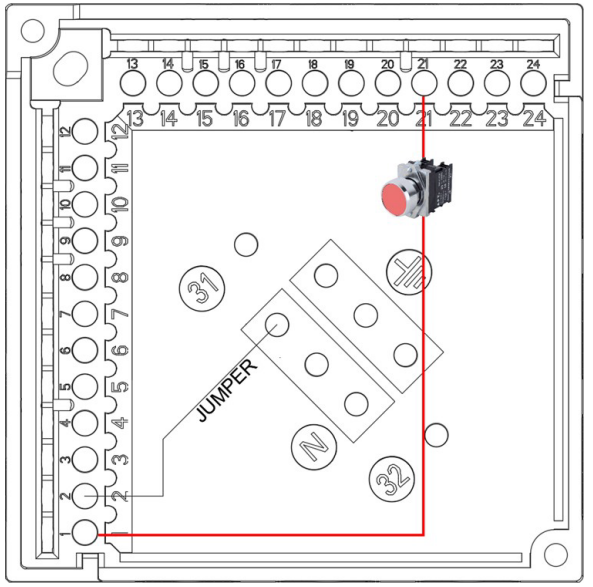
	OPERATION LED • = ON	FAN	OPEN DAMPER	CLOSED DAMPER	AUTO	IGNITION	FLAME	STATUS
	ICON							
1	MODBUS RESET	•						RED
2	LOCAL RESET		•					RED
3	CAB_FAULT	•	•					RED
4	SUPERVISORY MCU INPUT DIAG FAULT			•				RED
5	FLAME ROD FLAME LOSS MTFI	•		•				RED
6	FLAME ROD CIRCUIT FAIL		•	•				RED
7	SPI COMMUNICATION FAULT	•	•	•				RED

Sequence of operation

Lockout reset methods

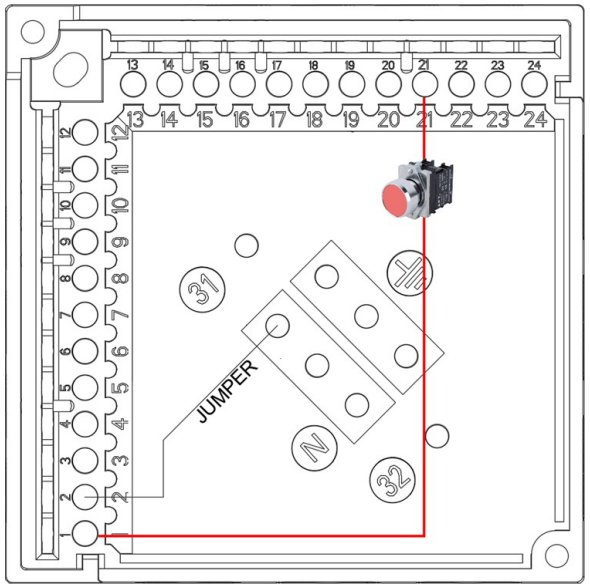


A lockout condition can be reset by either pressing the reset button on the control, or by applying line voltage to terminal 21 (REMOTE RESET INPUT).



Sequence of operation

Manual lockout

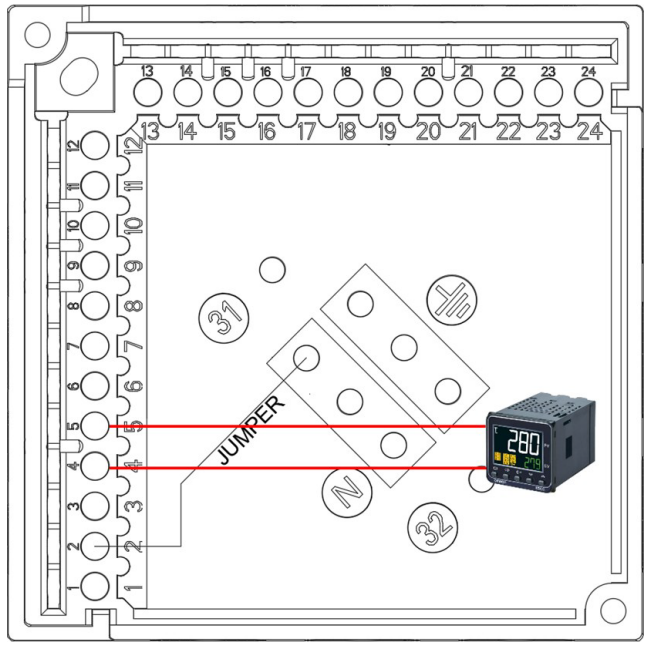


A lockout condition can be manually initiated by either pressing the reset button on the control or by providing voltage to terminal 21. The lockout code (shown here) indicated REMOTE RESET INPUT as the source of the lockout. This can be used as a form of emergency shutdown.

Sequence of operation

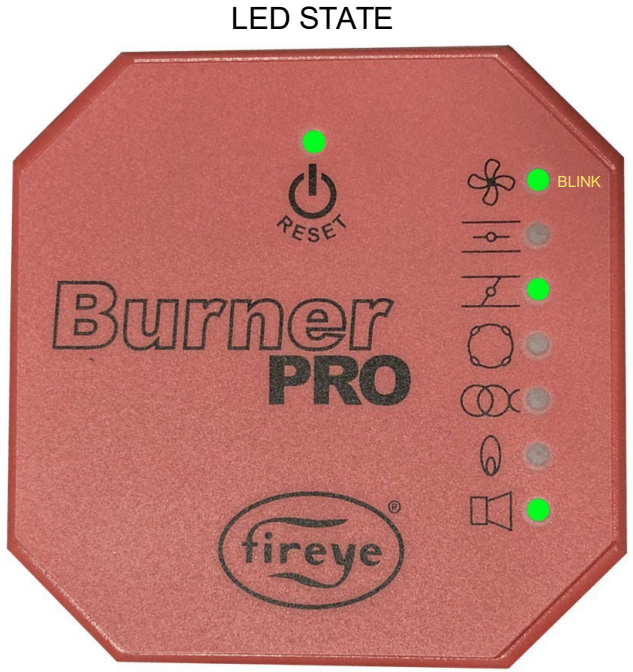
Call for heat input

Terminal 4 provides line voltage that is used to power the operating limit string. After passing through all the limits in series, line voltage is applied to terminal 5 to indicate that the limits are complete and that there is a call for heat.



Sequence of operation

Call for heat, checking air switch and POC



When there is a call for heat, voltage must be detected on both terminals 12 (PROOF OF CLOSURE INPUT) and terminal 13 (AIR SWITCH NC INPUT) within 60 seconds. Failure of either input to prove in time will result in a lockout. For models with valve proving, both functions are wired in series to terminal 13.

The air switch check is performed to verify that the air switch is changing from closed to open (i.e., not jumpered or stuck) between cycles.

Wire terminal 11 to terminals 12 and/or 13 to bypass these checks. This works because terminal 11 (ACTUATOR ECONOMY OUTPUT) provides voltage during this state.

Sequence of operation

Driving actuators to purge

LED STATE

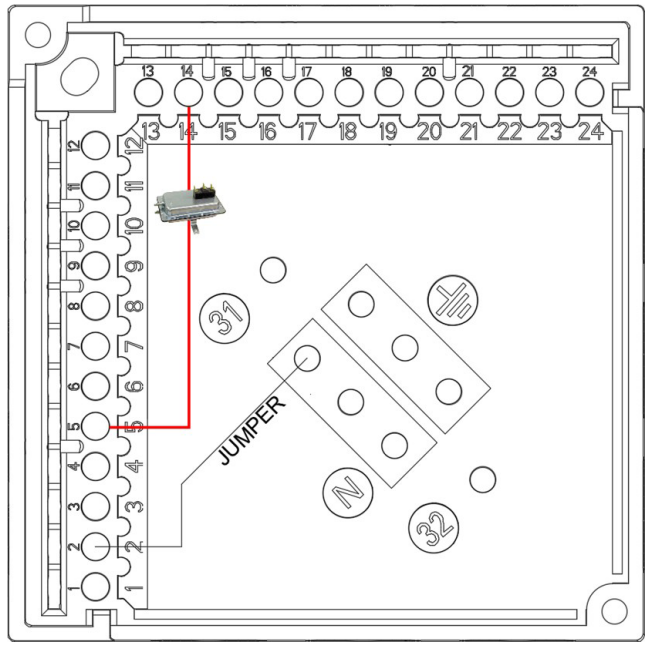
When the air switch check input and proof of closure input prove, the sequence begins. Terminals 6 and 7 (FAN OUTPUT) both energize. The LED above the reset button lights green and the fan LED also lights green. The output for terminal 11 (ACTUATOR ECONOMY OUTPUT) is no longer powered. Instead, terminal 9 (ACTUATOR HIGH FIRE OUTPUT) is powered instead as the BurnerPRO is commanding the actuator to the purge position.

The LEDs for actuator open and actuator closed will alternate as the control waits for feedback on terminal 8 (ACTUATOR FEEDBACK INPUT).

Sequence of operation

Safety limits input

- The safety limits must all be proven within the amount of time specified for actuator travel time (timing t11). The count begins when feedback is received to indicate that the actuator is at the high fire position for purging.
- The BurnerPRO will lockout if this input is not proven within the specified duration.



Sequence of operation

Purge

LED STATE

When feedback is received to confirm that the actuator is at the purge position, input must be received from the air switch on terminal 14 (SAFETY LIMIT INPUT) within the actuator travel time duration (timing t11). If the fan LED is blinking, the control is waiting for this input. If the fan LED is solid, this input has been received and the control is counting the purge time (timing t1).

Sequence of operation

CHECK MODE – purge

LED STATE

Check mode can be applied to hold the burner in purge. To do so, press and hold the reset button until the status LED changes from green to amber. The fan LED will also blink while in check mode.

Check mode in purge can be useful when a longer manual purge is desired, or while checking other devices that require the combustion air fan to run.

To exit check mode, simply press the reset button one time.

Check mode will automatically exit after 20 minutes. Check mode will exit with a lockout (CHECK MODE TIMEOUT).

Sequence of operation

Driving actuators to ignition

After the purge timing is complete, the BurnerPRO will drive the actuator to the ignition position. The output for terminal 9 (ACTUATOR HIGH FIRE OUTPUT) is no longer powered.
Instead, terminal 10 (ACTUATOR LOW FIRE OUTPUT) is
powered instead as the BurnerPRO is commanding the actuator to the ignition position.

The LEDs for actuator open and actuator closed will alternate as the control waits for feedback on terminal 8 (ACTUATOR FEEDBACK INPUT).

Sequence of operation

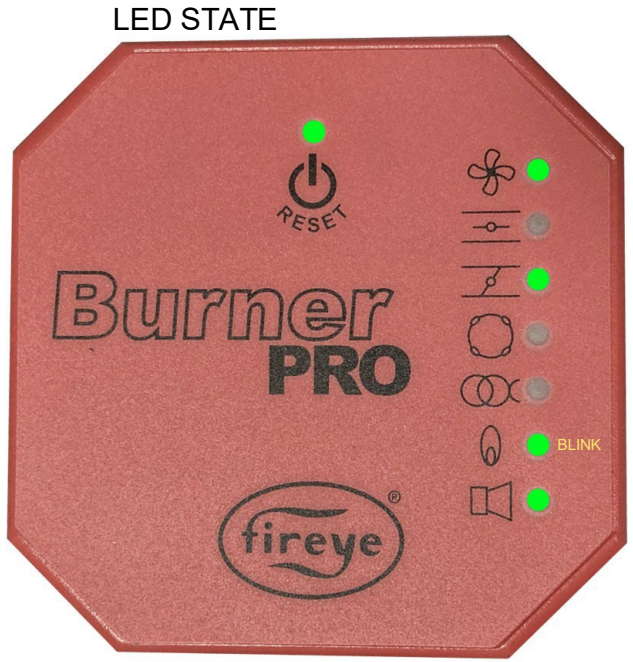
Ignition

LED STATE

When the ignition position is reached, terminal 16 (IGNITION OUTPUT) is powered for the duration of timing t3’ before the pilot output is energized.

Sequence of operation

Pilot trial for ignition (PTFI)

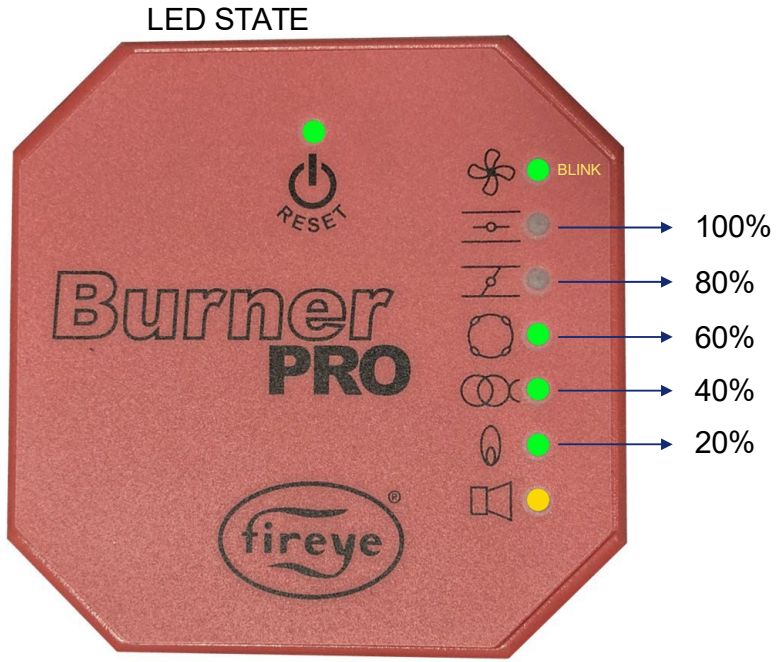


After timing t3’ ends, the state will change to PTFI. PTFI will last for the duration of timings TSA’ plus t7, and a flame signal must be detected during PTFI. The flame signal can be from either the UV flame detector input or from the flame rod input.

Terminal 16 (IGNITION OUTPUT) will remain energized until the end of timing TSA’. Terminal 17 (PILOT OUTPUT) will remain energized past the end of PTFI, for the duration of timing t9 into the MTFI state.

Sequence of operation

Check mode – PTFI



Check mode can be applied to hold the burner in PTFI. To do so, press and hold the reset button until the status LED changes from green to amber. The fan LED will also blink while in check mode.
While in check mode, the flame signal will be indicated by the middle five LEDs to indicate the flame signal in increments of 20%.

Check mode in PTFI is used to adjust the pilot to ensure reliable operation.

To exit check mode, simply press the reset button one time.

Check mode will automatically exit after 20 minutes. Check mode will exit with a lockout (CHECK MODE TIMEOUT).

Sequence of operation

Main trial for ignition (MTFI)

After timing t7 ends, the state will change from MTFI to PTFI. MTFI will last for the duration of timing t5.

Terminal 16 (IGNITION OUTPUT) is not energized during PTFI. Terminal 17 (PILOT OUTPUT) will remain energized for the duration of timing t9. Terminals 18 and 19 (UPSTREAM and DOWNSTREAM MAIN OUTPUT) will
remain energized from the start of MTFI until the sequence ends.

The transition from PTFI to MTFI is indicated by the shift from a blinking flame LED (PTFI) to a solid flame LED (MTFI).

Sequence of operation

Auto state

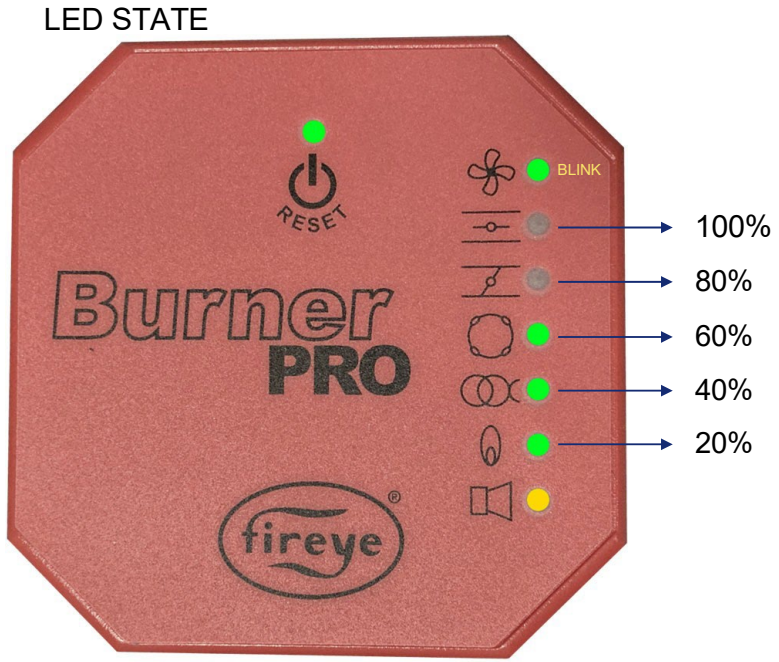
LED STATE

After timing t5 ends, the control transitions from MTFI to AUTO. In auto, the actuator is no longer commanded by the BurnerPRO and can modulate or mode independently if needed to maintain the connected load.

The control will remain in auto until there is no longer a call for heat (loss of voltage on terminal 5) or if there is a lockout condition.

Sequence of operation

Checking flame signal in auto



It is possible to check the flame signal in AUTO. The procedure is the same as outlined for placing the BurnerPRO into check mode during PTFI (press and hold the reset button until the status LED changes from green to amber). The fan LED will blink to indicate that the LEDs are showing flame signal.

The flame signal will be indicated by the middle five LEDs to indicate the flame signal in increments of 20%. To exit flame signal mode, simply press the reset button one time.

Sequence of operation

Postpurge

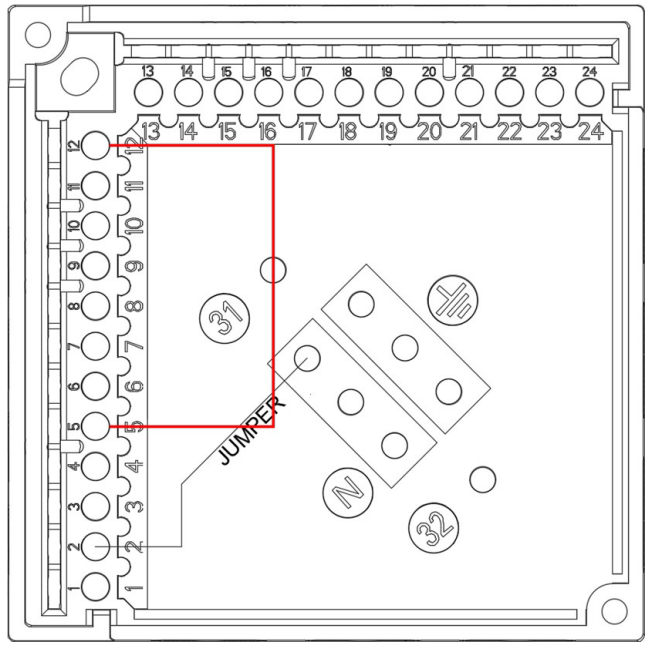
LED STATE

Upon a loss of the call for heat, the control will postpurge for the duration of timing t6. During postpurge, terminals 18 and 19 (UPSTREAM and DOWNSTREAM MIAN OUTPUT) are de-energized. Terminals 6 and 7 (FAN OUTPUT) remain energized until the end of postpurge. Terminal 11 (ACTUATOR ECONOMY OUTPUT) is energized to drive the actuator to the economy position.

Wiring

Disable proof of closure check

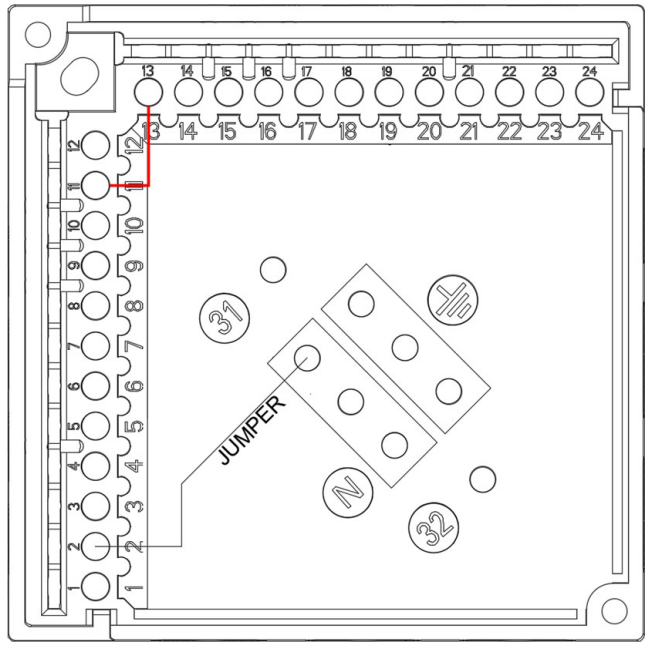
Place a wire jumper from terminal 5 to terminal 12 to disable checking the proof of closure switches. This satisfies the check by applying line voltage to terminal 12 from the call for heat input.



Wiring

Disable air switch check

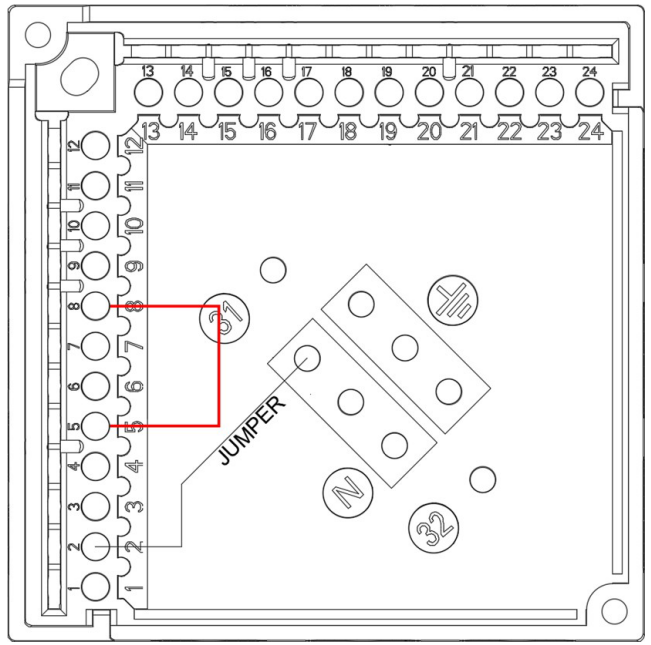
- Place a wire jumper from terminal 11 to terminal 13 to disable the air switch check. This is the check to verify that the air switch is changing states between cycles. This satisfies the check by using the line voltage that is provided by terminal 11 while in standby (to send the actuator to the economy position) to indicate that the air switch normally closed switch position has power.



Wiring

Disable actuator usage

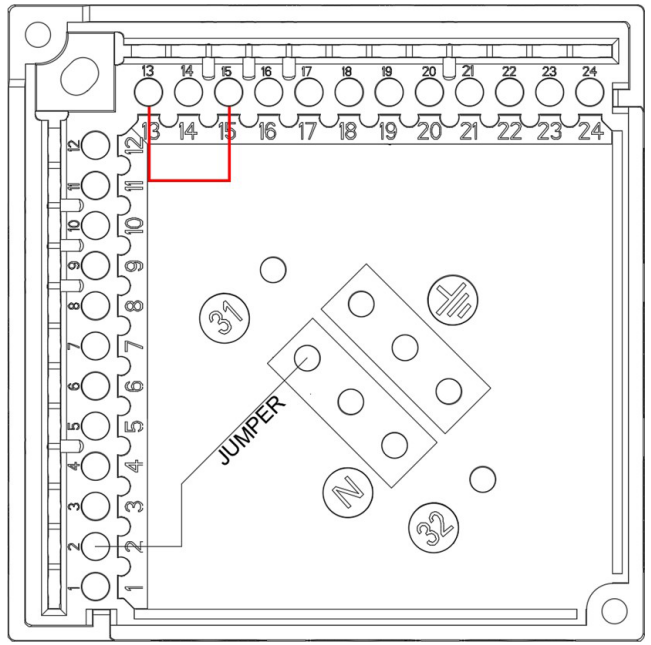
Place a wire jumper from terminal 5 to terminal 8 to disable checking actuator feedback. This is the check to verify that the actuator is moving to the required positions. This satisfies the check by using the line voltage at terminal 5 to indicate constant feedback.



Wiring

Disable prepurge

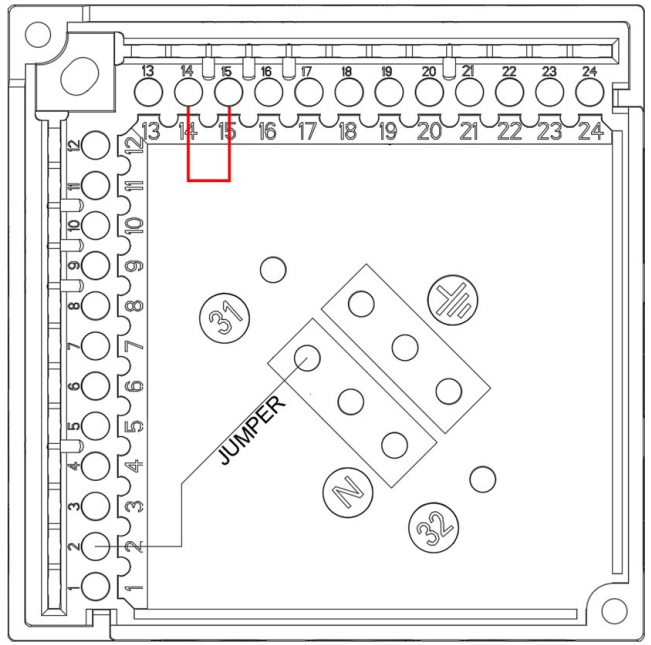
- Place a wire jumper from terminal 13 to terminal 15 to disable prepurge. Applying voltage to terminal 15 at the beginning of the cycle (when terminal 13 is powered) indicates to the BurnerPRO to truncate the prepurge to a minimal time (effectively no prepurge).
- Note that this only applies when valve proving is not used as terminal 15 is used for the valve proving switch input on those models.



Wiring

Disable postpurge

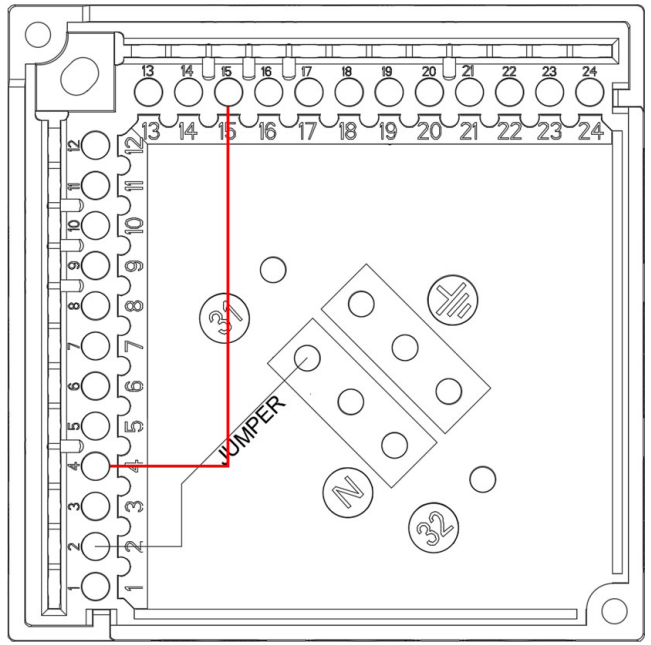
- Place a wire jumper from terminal 14 to terminal 15 to disable prepurge. Applying voltage to terminal 15 at the end of the cycle (when terminal 14 is powered) indicates to the BurnerPRO to truncate the postpurge to a minimal time (effectively no prepurge).
- Note that this only applies when valve proving is not used as terminal 15 is used for the valve proving switch input on those models.



Wiring

Disable all purge

- Place a wire jumper from terminal 4 to terminal 15 to disable all purges. Applying voltage to terminal 15 at the beginning and end of the cycle (terminal 4 is always powered) indicates to the BurnerPRO to truncate both the prepurge and postpurge to a minimal time (effectively no purges).
- Note that this only applies when valve proving is not used as terminal 15 is used for the valve proving switch input on those models.

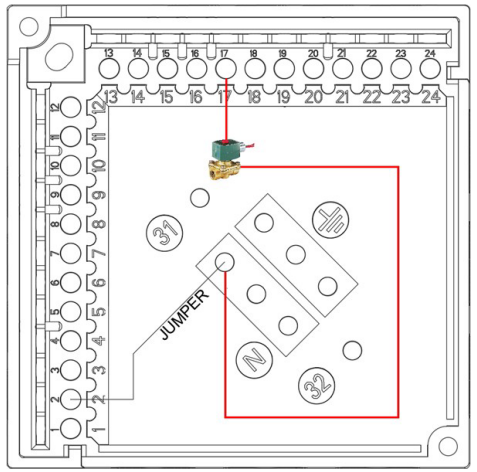


Wiring

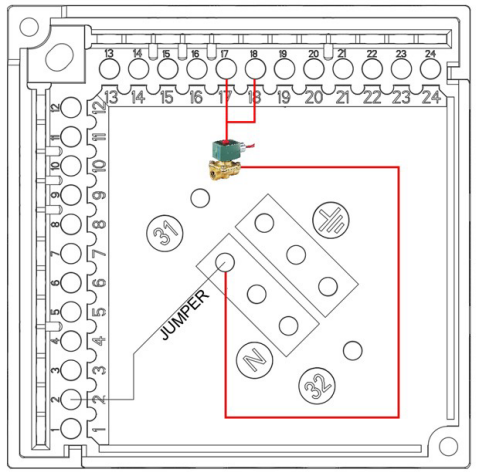
Overlapping outputs

Certain outputs can be grouped to overlap timings. For example, an interrupted (non-continuous) pilot is connected to terminal 17 alone (PILOT OUTPUT). For an intermittent (continuous) pilot, jumper terminals 17 (PILOT OUTPUT) and 18 (UPSTREAM MAIN OUTPUT) to combine the timings of the two outputs. This means the pilot will remain energized from the start of PTFI until the sequence ends.

INTERRUPTED PILOT



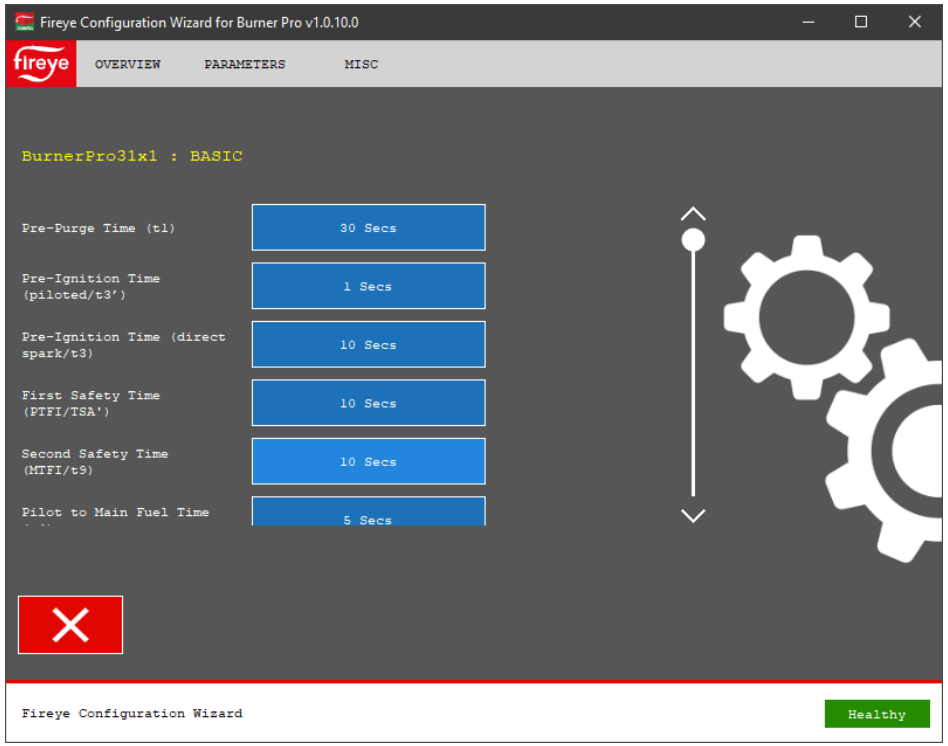
INTERMITTENT PILOT



Wiring

Modbus models

BurnerPRO models that end in “-SxM” have Modbus connectivity as a standard feature. This is available from the onboard RJ45 connector provided. Standard timings are offered (i.e., S1 through S6), but all timings can be customized using the **Config Wizard for BurnerPRO** software.
This software can be connected using the 60-2998 wiring adapter with the 60-3000 USB programming cable.



Wiring

Valve proving

Models ending in “-SxMP” have the valve proving option enabled by default. Valve proving can also be enabled/disabled on any Modbus model using the **Config Wizard for BurnerPRO** software.

When using valve proving, the upstream and downstream gas valves must each be connected to their corresponding terminals. This is terminal 18 for the upstream and terminal 19 for the downstream. A pressure switch is piped between these gas valves and the contact is connected to terminal 15.

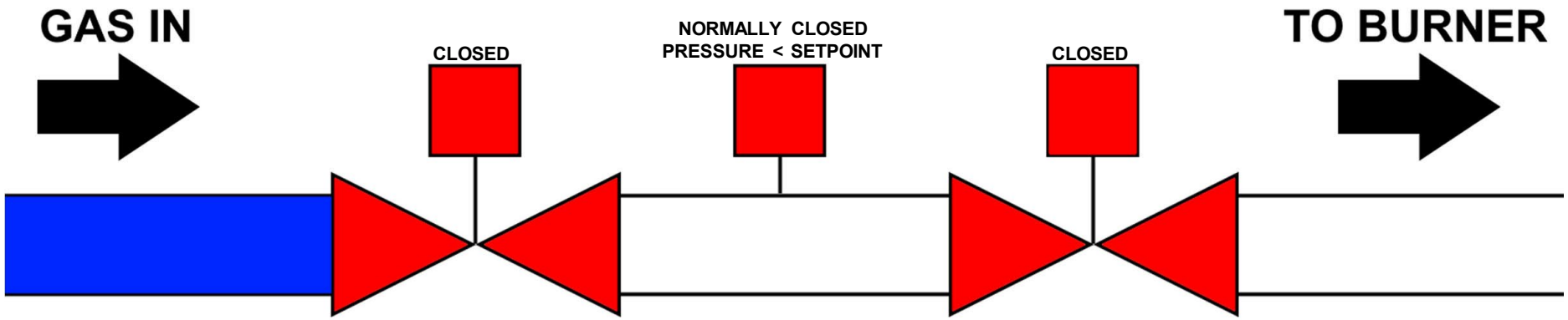
The BurnerPRO does a valve proving test at either prepurge or postpurge, depending upon what is configured.

When using valve proving, terminal 12 is used for the normally closed position of the valve proving switch, so it can’t be used for checking the proof of closure inputs. When this is the case, simply wire the proof of closure inputs in series with the air switch check (normally closed terminal of air switch).

Valve proving

Method

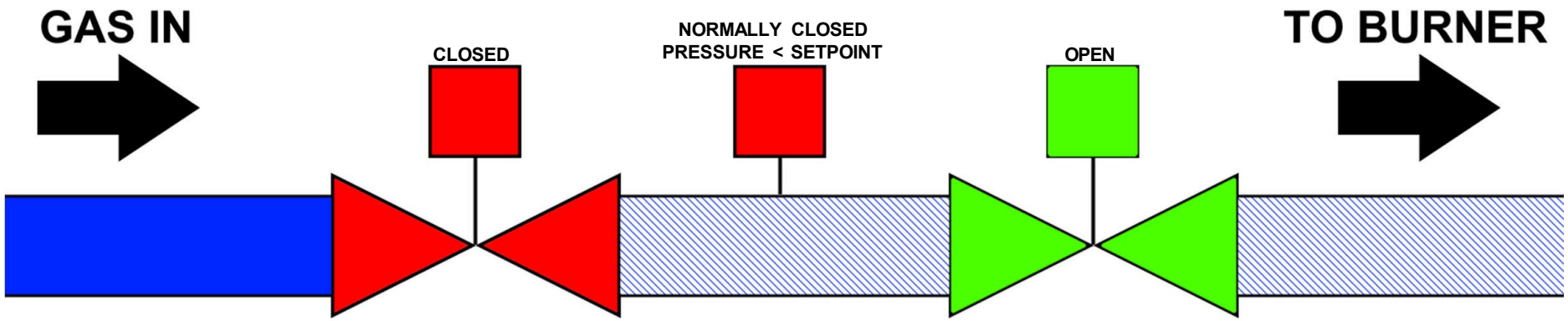
Valve proving can be programmed to occur either at the beginning of the sequence (before the prepurge) or at the end of the sequence (after postpurge). In either case, the valve proving test consists of the same steps. In the following diagrams, blue represents gas is present, red indicates the valve is closed or the switch is in the normally closed state and green indicates the valve is open or the switch is in the normally open state.



Valve proving

Evacuation

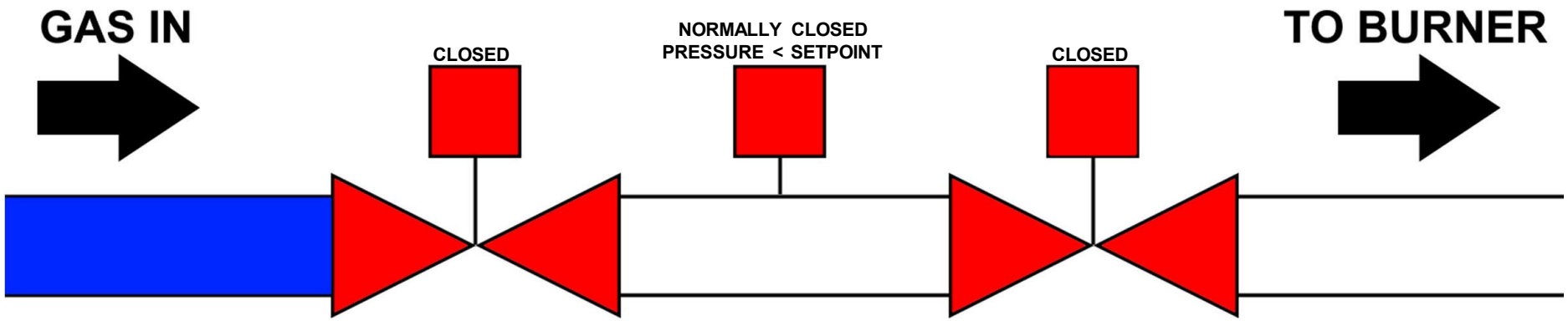
The first step is the evacuation. The downstream valve is opened so any gas that was present in between the valves is evacuated into the combustion chamber (to be then evacuated during prepurge). The length of time the valve remains open may be adjustable but will normally be around five seconds.



Valve proving

Evacuation test time

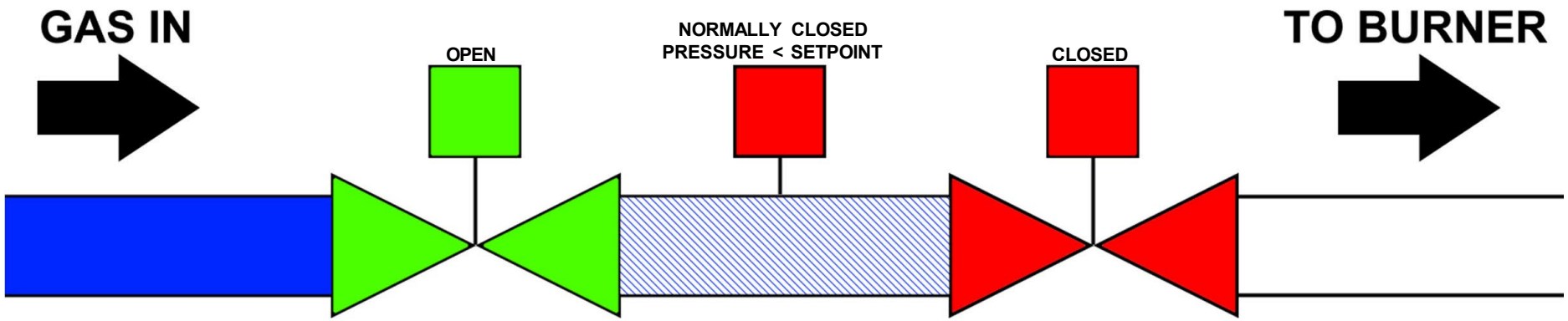
Following the evacuation, a test is performed for a set amount of time to ensure that the gas pressure switch remains in the normally closed state. This time period may be adjustable and is normally around 25 seconds. If the test fails, the flame safeguard will lockout. This lockout indicates that the upstream valve may be leaking since the space in between is pressurizing.



Valve proving

Pressurization

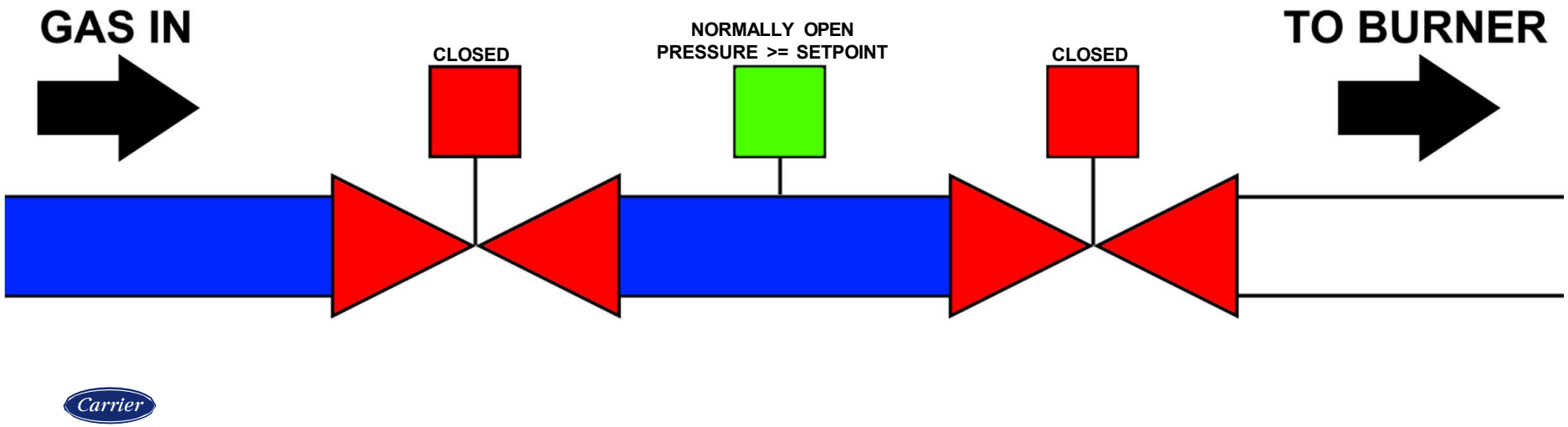
After the evacuation test is passed, the upstream gas valve opens for an adjustable period (normally around five seconds) to pressurize the space between the safety shutoff valves.



Valve proving

Pressurization test time

Following the pressurization, a test is performed for a set amount of time to ensure that the gas pressure switch changes to the normally open state. This time period may be adjustable and is normally around 25 seconds. If the test fails, the flame safeguard will lockout. This lockout indicates that the downstream valve may be leaking since the space in between is losing pressure.



Valve proving

BurnerPRO

The following is a demonstration of the BurnerPRO performing a valve proving test, with a lockout due to a valve proving switch failure (switch didn't change state to off after last test, indicating possible stuck or faulty switch).

Valve proving

BurnerPRO

The Smart LEDs indicate the lockout code.

BurnerPRO LED ERROR / LOCKOUT CODES

	OPERATION LED ● = ON	FAN	OPEN DAMPER	CLOSED DAMPER	AUTO	IGNITION	FLAME	STATUS
	ICON							
1	MODBUS RESET	●						RED
2	LOCAL RESET		●					RED
3	CAB FAULT	●	●					RED
4	SUPERVISORY MCU INPUT DIAG FAULT			●				RED
5	FLAME ROD FLAME LOSS MTFI	●		●				RED
6	FLAME ROD CIRCUIT FAIL		●	●				RED
7	SPI COMMUNICATION FAULT	●	●	●				RED
8	REMOTE RESET				●			RED
9	FLAME ROD DECISION MISMATCH	●			●			RED
10	MAIN PROGRAM SEQ FAULT		●		●			RED
11	RAM TEST	●	●		●			RED
12	VALVE PROVE SWITCH FAILURE			●	●			RED
13	INPUT READING FAULT	●		●	●			RED
14	TIMER2 FAULT		●	●	●			RED

Valve proving

BurnerPRO

The following is a demonstration of the BurnerPRO performing a valve proving test, with a failure during the pressurization test.

Valve proving

BurnerPRO

The Smart LEDs indicate the lockout code.

	OPERATION LED ● = ON	FAN	OPEN DAMPER	CLOSED DAMPER	AUTO	IGNITION	FLAME	STATUS
	ICON							
33	STANDBY FALSE FLAME		●				●	RED
34	LGP SWITCH ACTIVE	●	●				●	RED
35	SW WDT RESET			●			●	RED
36	FR SELF CHECK NOT PERFORMED	●		●			●	RED
37	INPUTS WAITING TIME FAULT		●	●			●	RED
38	VALVE PROVE TEST TIME 1 FAIL	●	●	●			●	RED
39	VALVE PROVE TEST TIME 2 FAIL				●		●	RED
40	HARDWARE RESET	●			●		●	RED
41	ROC LIVE IN AUTO FAULT							RED

Demonstration

Sequence with valve proving

The following is a demonstration of the BurnerPRO performing a successful startup, including a valve proving test.

THANK YOU