HEATEC TEC-NOTE

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FIREYE® BURNER MANAGEMENT CONTROLS

used on Heatec HC and HCS heaters

This document applies to Fireye burner management controls used on Heatec HC and HCS heaters. The controls, known as BurnerLogix™, include three Fireye units located in the heater control panel (Fig. 1):

1. Display Module BLV512
2. Burner control YB110 including Programmer Module YP100
3. Annunciator YZ300

Burner management controls also include Fireye flame scanner UV1A6, which is installed in the burner housing. The display module is mounted on the face of the heater control panel. It is now labeled **BURNER DISPLAY** (Fig. 2), but was previously labeled **FIREYE FLAME MONITOR**. The burner control and annunciator (Fig. 3) are mounted inside the heater control panel. Fireye and BurnerLogix are trademarks of Fireye, a Kidde Company.

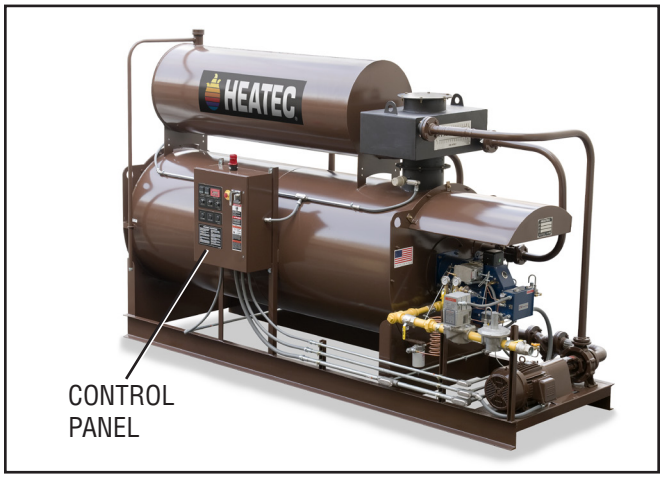


Figure 1. Control panel on Heatec HC heater

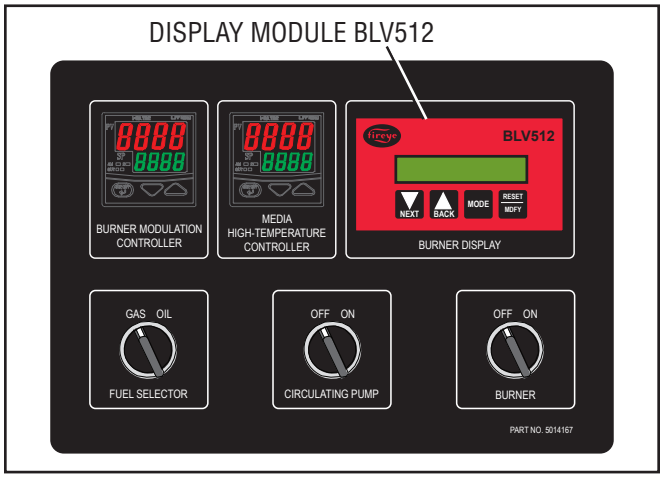


Figure 2. Fireye burner display unit on Heatec control panel.

In late 2008 we made major changes to the Heatec control panel on HC and HCS heaters (Figure 4). The panel no longer has status lights. The lights are no longer needed because the Fireye burner management controls provide more useful status information. Moreover, the Fireye display is mounted on the outside of the heater control panel, so it is not necessary to open the panel in order to access buttons on the Fireye unit

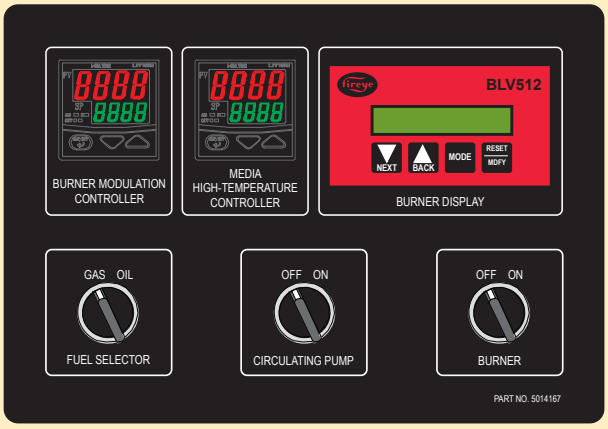
Information in this document covers how the burner management controls work. This information should enable you (an operator at an asphalt plant) to know when your heater is working properly. And it will help you to determine the cause if the heater is not working properly.

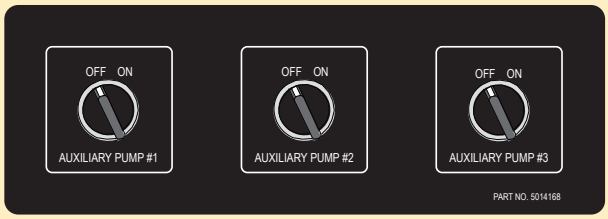
The burner management controls provide important messages about the operating status of your heater. If you have an alarm condition with your heater, the message shown on the display is the *first* thing you should look at. If you phone a service technician at Heatec the first thing he will ask is, "what is the message shown on the display?"

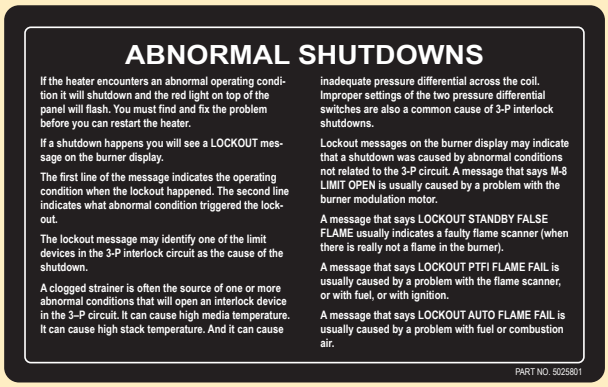
SAFETY

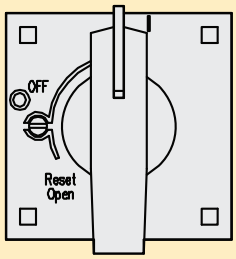
Heatec HC and HCS heaters burn fuels that require safeguards to prevent accidental fires and explosions. Those safeguards are provided by the Fireye burner management controls operating in conjunction with other heater controls. **Operators should never disable any control that has caused the heater to shut off or is preventing a restart.**

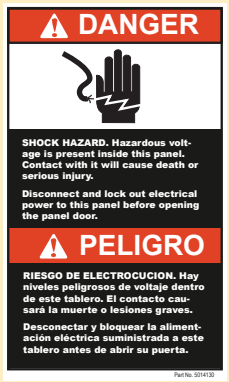
Figure 3. Burner control (left) and annunciator (right).











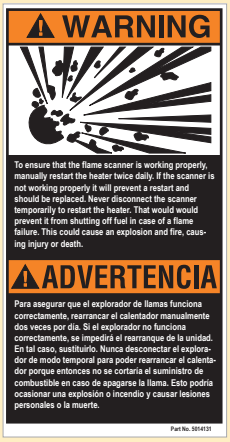


Figure 4. New control panel used on HC and HCS heaters starting late 2008.

⚠ WARNING

If you ever need to replace the Fireye Programmer Module YP100 on a Heatec heater always use one that was programmed at the Heatec factory. New modules obtained directly from Fireye or other suppliers may not be programmed to provide safe operation of Heatec heaters. Inappropriate programming could result in an explosion with serious injuries or death.

In order to comply with safety codes applicable to our heaters we re-program all new Fireye programmer modules that we use on our heaters. We lock the settings to ensure that they cannot be changed accidentally.

If a heater is operated using a new module with *unlocked* settings, those settings will be locked automatically after eight hours of operation. And once those settings are locked, they are permament and cannot be changed.

To make sure that your programmer module has the appropriate Heatec settings, check all of its settings shown in the **Heatec settings** column of Figure 5. Heatec settings that differ from the Fireye factory default settings are shown in red. Heatec settings that are the same as Fireye factory default settings are marked **same as Fireye default.**

Please refer to Fireye Publication BL-1001 for instructions on use of the keypad to check factory default parameters. A printed copy of this document is furnished with Fireye Burner Logix controls. It is also available as a pdf document from the Fireye website at: http://www.fireye.net/pdf/BL-1001.pdf.

Heatec also programs the YP100 module with messages pertaining to the 3–P interlock circuit. These messages identify the specific safety device that may have caused a lockout. A new module that was **not** programmed by Heatec will automatically display Fireye *default* messages. Some of the *default* messages do not apply to Heatec heaters and are misleading.

Figure 5. YP100 Fireye factory settings vs Heatec factory settings.

Parameter	Fireye Factory Default	Heatec settings
Purge time	00:30s	**00:60s**
Count method	DOWN	**Same as Fireye default**
Prove 3-P open at start	NO	**YES**
PTFI*MTFI timing	10/10*10/15	**Same as Fireye default**
Terminal 6 interrupted or intermittent	INTRP	**Same as Fireye default**
Prove M-8 open	NO	**YES**
Prove M-D open	NO	**YES**
Post purge	0:15	**Same as Fireye default**
3-P Recycle	YES	**Same as Fireye default**
M-D WAIT 10m	YES	**Same as Fireye default**
PROVE M-D TFI	NO	**YES**
Baud rate	9600	**Same as Fireye default**
Unit address	00	**Same as Fireye default**
Lock Settings	NO	**YES**
DO IR LEARN	NO	**Same as Fireye default**

WHAT FIREYE BURNER MANAGEMENT CONTROLS DO

The Fireye controls provide proper and safe operation of the burner. The burner control uses a microprocessor for its management functions. The processor provides the proper burner sequencing, ignition and flame monitoring protection.

The Fireye controls continuously monitor the *status* of the following heater components:

- Yokogawa burner modulation controller UT150
- Burner control switch on heater control panel
- Fuel gas proof of closure switch ZS 5-1 in main gas valve
- 3-P interlock or limit circuit
- Low-fire proof switch ZSL 4-1 in modulating actuator TZ 4-1
- High-fire proof switch ZSH 4-1 in modulating actuator TZ 4-1

The Fireye controls provide *control signals* to the following heater components:

- Honeywell modulating actuator TZ 4-1
- Ignition transformer T3-1
- Main fuel gas or oil shutoff valve
- Heater alarm strobe light
- Motor controller MC 4-1 (for blower motor)

3-P INTERLOCK CIRCUIT

The Fireye controls monitor the *overall* status of the 3-P interlock circuit. Moreover, the annunciator enables the unit to indentify *individual* devices in the limit circuit. Consequently, if one of the devices in the 3-P interlock circuit is open, the Fireye display (Fig. 2) will show an abbreviated message that identifies which one of the interlock devices is open. (See Figure 6 on last page.)

MENUS AND MESSAGES

The Fireye display has eight main menu items:

L1-3 OPEN
BNR HOURS
BNR CYCLES
BNR LOCKOUTS
SYS HOURS
PROGRAM SETUP
LOCKOUT HISTORY
SYSTEM INFO

The Fireye system shows up to 87 different messages related to the operating state of the heater. During a normal startup you will see run messages. You will also see a hold message during a normal startup while the damper travels to its open position. You should get familiar with what those messages mean. You need to know when those messages are displayed during the startup sequence. And you need to know what is happening to the heater as the messages are displayed.

Lockout messages, check messages, diagnostic messages and other hold messages appear only when there is an *abnormal* condition. After you understand all the events of a normal startup it will be much easier to understand messages displayed for various other conditions.

It is also possible for you to review historical messages on the Fireye display. Such information includes the total number of burner cycles, burner lockouts, and system hours.

FIRING SEQUENCE—A BRIEF SUMMARY

The firing sequence starts when the burner control is turned ON. Consequently, the Fireye controls do the following:

1. Verify that the fuel gas proof of closure switch in the main gas valve is closed and turns on blower motor.
2. Verify that all heater interlock circuits are closed.
3. Open top damper (open damper purge).
4. Initiate a 60-second purge period allowing blower to clear heater combustion chamber.
5. Close damper to its low-purge position.
6. Initiate Pilot Trial For Ignition. (This turns on the pilot gas and initiates ignition.)
7. Verify presence of pilot flame and initiate a Main Flame Trial For Ignition period of 10 seconds. (The main fuel valve opens at the start of this period.)
8. Verify presence of a flame with adequate signal strength.
9. Turn over control of the modulation motor to the modulating controller.

MESSAGES AND EVENTS DURING A NORMAL STARTUP

You can get a much clearer understanding of these messages by refering to the wiring diagram that is furnished with each heater.

When the door handle on the control panel is set to **ON**, electrical power is connected to terminals L1 and L2 on the Fireye burner control. And while the **BURNER CONTROL** switch on the heater control panel is set to **OFF** the display will show:

STANDBY
BNR SWITCH OFF

Setting the **BURNER CONTROL** switch to **ON** closes the circuit between terminals L1 and 3 of the burner control, causing the burner to start its firing sequence as follows:

1. If fuel-gas proof of closure switch ZS 5-1 is closed (completing the circuit between terminals L1 and 13 on the burner control), terminal M of the burner control will be energized. This energizes motor controller MC 4-1, which powers the blower motor.

2. The Fireye controls will verify that all limit circuit devices connected in the circuit between terminals 3 and P (3-P) on the burner control are closed.

3. The circuit between terminals 10 and X on the burner control closes, causing Honeywell modulating motor TZ 4-1 to provide open damper purge. During the time it takes for the damper to reach its open position the display will show the following message and seconds of the timing starting at 0:60:

HOLD	**01:00**
M-8 LIMIT OPEN	

4. When the modulating motor reaches its open damper position, high fire proof switch ZSH 4-1 closes (completing the circuit between terminals M and 8 on the burner control) and a purge interval of 60 seconds is initiated. The display will show **PRE-PURGE** for 10 seconds and then change to the following message while continuing the count down:

PURGE	**0:50**
HIGH FIRE PURGE	

If high fire proof switch ZSH 4-1 does not close, the program will hold this position for 10 minutes waiting for it to close. If switch ZSH 4-1 is not closed after 10 minutes, the control will lockout, energizing terminal A on the burner control and setting off the heater alarm light.

5. When purge is completed, the circuit between terminals 10 and 12 on the burner control closes, activating the modulating motor so it drives the damper toward the low purge position. The display will show the following message and seconds of the timing starting at 0:30 and counting down:

PURGE	**0:30**
LOW FIRE PURGE	

6. Following a 30-second delay (to permit the modulating motor to get to its low fire position), the program will wait for low-fire proof switch ZSL 4-1 to close the circuit between terminals M and D on the burner control. After the 30 second delay, the trial for ignition sequence will start. If the M to D circuit is not closed after 10 minutes, the program will lockout, energizing terminal A on the burner control and setting off the heater alarm light.

7. The trial for ignition period begins when terminals 5 and 6 of the burner control are energized simultaneously. This is known as PTFI (Pilot Trial For Ignition). The monitor will show the following message and seconds of the timing starting at 0:10 and counting down:

PTFI	**0:10**
IGNITION TIMING	

The PTFI period is 10 seconds in duration. (The **IGNITION TIMING** message appears only for a moment.) If no flame is detected after 10 seconds, the program will de-energize terminals 5 and 6 of the burner control and will lockout, energizing terminal A on the burner control and setting off the heater alarm light. When a flame is detected during the 10-second period, the display will show the following message with a numerical value indicating the strength of the flame signal:

PTFI	**20**
FLAME SIGNAL	

Flame signal values of 20 to 80 are normal. A value of 10 is the minimum acceptable. Values of 0 to 9 are not acceptable.

8. With flame proven at the end of PTFI, the main flame trial for ignition (MFTI) period begins. Terminal 7 on the burner control is energized. The display will show the following message with a numerical value indicating the strength of the flame signal:

MTFI	**20**
FLAME SIGNAL	

Terminal 5 on the burner control is de-energized 10 seconds later and terminal 6 is de-energized after another 5 seconds.

9. Next, the circuit between terminals 10 and 11 of the burner control is energized, sending the modulating motor to the auto mode under the control of the modulating controller. The display will show the following message with a numerical value indicating the strength of the flame signal:

AUTO	**20**
FLAME SIGNAL	

WHEN HEAT DEMAND IS SATISFIED

1. The circuit between terminals L1 and 3 on the burner control opens, de-energizing the main fuel valve. The circuit between terminals 10 and 12 on the burner control closes, activating Honeywell modulating motor TZ4-1 so it drives the damper toward the low purge position.

2. Following a 15-second post purge, the burner blower motor is de-energized. The display will show the following message and seconds of the timing starting at 0:15 and counting down:

POST PURGE 0:15 **CYCLE COMPLETE**

3. The burner is now off and the Fireye display will show:

STANDBY **BNR TEMP OFF**

MANUAL SHUTDOWN

When the burner control switch is set to **OFF** the burner control will initiate the same events as when the heat demand is satisfied as described above.

RUN MESSAGES

STANDBY **BNR SWITCH OFF**

Door handle is set to **ON** and burner control switch is set to **OFF.**

PURGE 0:00 **HIGH FIRE PURGE**

Damper is in high purge open position and purge timing has started. Seconds are shown in upper right-hand corner of display.

PURGE 0:00 **LOW FIRE PURGE**

Damper is closing and low fire purge timing has started. Seconds are shown in upper right-hand corner of display.

PTFI 0:00 **IGNITION TIMING**

PTFI timing has started. Seconds are shown in upper right-hand corner of display. Pilot not proven yet.

PTFI 20 **FLAME SIGNAL**

Pilot flame was proven during PTFI timing. Flame signal strength is shown in upper right-hand corner of display.

MTFI 20 **FLAME SIGNAL**

MTFI was proven during MTFI timing. Flame signal strength is shown in upper right-hand corner of display.

AUTO 20 **FLAME SIGNAL**

Modulating Motor TZ4-1 is under control of the modulating controller. Flame signal strength is shown in upper right-hand corner of display.

POST PURGE 0:00 **CYCLE COMPLETE**

Heat demand has been satisfied. The blower motor will be de-energized in 15 seconds. Seconds are shown in upper right-hand corner of display.

HOLD MESSAGES

All hold messages except one indicate an *abnormal* condition. The most common hold messages are as follows:

HOLD **3-P INTLK CLOSED**

This is an abnormal condition. All devices in the 3-P interlock circuit were closed at the start of the firing cycle. The burner control will hold this position for 60 seconds and then lockout if the 3-P circuit does not open. The timing is shown in upper right-hand corner of display.

Note: low combustion air pressure switch PSL 4-1 is in the 3-P interlock circuit and should remain open at all times except when the blower is operating. It should close and remain closed only when operation of the blower generates an adequate flow of combustion air. Otherwise, the switch may be defective. (All other devices in the interlock circuit should be closed at the start of the firing cycle.)

HOLD 01:00 **M-8 LIMIT OPEN**

This is a normal condition that occurs during a startup. It indicates that the circuit between terminals 10 and X of the burner control has closed, causing the modulating motor to drive the damper toward high purge. The burner control is waiting for the high fire proof switch ZSH 4-1 to close.

(Switch ZSH 4-1 is in the modulating motor and connects the circuit between terminals M and 8 of the burner control.) It will hold this position for 10 minutes and lockout if the switch does not close. The timing is shown in upper right-hand corner of display.

HOLD
M-8 LIMIT CLOSED

This is an abnormal condition. High fire proof switch ZSH 4-1 was closed during the start of the firing cycle, but it should have been open. (This switch is in the modulating motor and connects the circuit between terminals M and 8 of the burner control.) The burner control will hold this position for 30 seconds and lockout if the M-8 circuit does not open. The timing is shown in upper right-hand corner of display. The usual problem is in the operation of the mod motor. Check all terminal connections first.

HOLD 00:00
M-D LIMIT CLOSED

This is an abnormal condition. Low fire proof switch ZSL 4-1 was closed at the end of the high-fire purge and beginning of low fire start, but it should have been open. (This switch is in the modulating motor and connects the circuit between terminals M and D of the burner control.) The burner control will hold this position for 30 seconds and lockout if the M-D circuit does not open. The timing is shown in upper right-hand corner of display. The usual solution is to re-adjust the cams for the low-fire switch in the modulating motor.

HOLD 00:00
M-D LIMIT OPEN

This is an abnormal condition. The burner control has finished purge and the modulating motor is driving the damper to the low-fire position and waiting for low fire proof switch ZSL 4-1 to close. (This switch is in the modulating motor and connects the circuit between terminals M and D of the Fireye unit.) The burner control will hold this position for 10 minutes and lockout if the M to D circuit does not close. The timing is shown in upper right-hand corner of display. The usual problem is in the operation of the mod motor. Check all terminal connections first.

STANDBY 25
FALSE FLAME

This is an abnormal condition. The Fireye flame scanner has sensed a flame while the burner was off or during purge. This message will hold for 60 seconds and then lockout if the scanner continues to sense a flame. A number in the upper right-hand corner of the display indicates flame strength.

If a flame or fire actually exists in the heater while burner controls are off, the cause may be a fuel valve that is malfunctioning and stuck open.

If a flame or fire is not actually present in the heater, but the message on the Fireye display indicates a false flame, the flame scanner is most likely defective.

It is entirely possible for sunlight shining directly into the sight glass of the heater to cause a false flame condition. However, this is rare and unusual.

LOCKOUT MESSAGES

All lockout messages indicate an abnormal condition. The most common lockout messages are as follows:

LOCKOUT STANDBY
3-P INTLK CLOSED

At the start of the firing cycle, the 3-P interlock circuit was closed and the control has waited 60 seconds for the 3-P circuit to open.

LOCKOUT PRE-PURGE
M-8 LIMIT OPEN

The control has held for more than 10 minutes waiting for high fire proof switch ZSH 4-1 connected between terminals M and 8 of the burner control to close.

LOCKOUT PRE-PURGE
M-8 LIMIT CLOSED

At the start of the firing cycle the circuit between terminals M and 8 of the burner control has been closed for 30 seconds.

LOCKOUT PURGE
M-D LIMIT CLOSED

At the end of high purge or at the beginning of low fire start the circuit between terminals M and D of the burner control has been closed for 30 seconds.

LOCKOUT STANDBY
T13 FVES OPEN

These letters stand for *fuel valve end switch*. This message means that the fuel gas proof of closure switch ZS 5-1 in the circuit between terminals L1 and 13 of the burner control opened during purge or at start up.

LOCKOUT PURGE
M-D LIMIT OPEN

The burner control has held for more than 10 minutes waiting for low fire proof switch ZL 4-1 connected between terminals M and D of the burner control to close.

LOCKOUT STANDBY
FALSE FLAME

Flame has been sensed during the burner off time (when the circuit between terminals L1 and 3 of the burner control is open) or during the purge period of 60 seconds.

LOCKOUT PTFI
FLAME FAIL

A flame failure occurred during the pilot trial for ignition period.

LOCKOUT MTFI
FLAME FAIL

A flame failure occurred during the main trial for ignition period.

LOCKOUT AUTO
FLAME FAIL

A flame failure occurred during the main burner on period.

3-P LOCKOUT MESSAGES

Fireye Annunciator YZ300 is used instead of the status lights used on earlier control panels. Thus, if one of the ten limit devices in the 3-P limit circuit opens, a message will appear on Display Module BLV512. That message indentifies which device in the 3-P limit circuit opened to lockout the burner circuit and cause the shutdown.

There are three periods during *start up* of the burner when an abnormal condition could cause a limit device to open. This would cause one of the ten abbreviated messages shown in Figure 6 to appear on the bottom line of the display.

LOCKOUT PRE-PURGE
(See messages in Figure 6)

Interlock circuit 3-P has opened during the purge period or failed to close within the first 10 seconds of purge.

LOCKOUT PTFI
(See messages in Figure 6)

Interlock circuit 3-P has opened during the pilot trial for ignition period.

LOCKOUT MTFI
(See messages in Figure 6)

Interlock circuit 3-P has opened during the main trial for ignition period.

During the burner *run* cycle one of the ten messages shown in Figure 6 would appear if one of the limit devices opened.

LOCKOUT AUTO
(See messages in Figure 6)

Interlock circuit 3-P has opened during the main burner on period.

Figure 6. Messages that identify 3-P interlock devices.

Message	Meaning
LO MEDIA LEVEL	Low media level relay contacts
LO GAS PRES	Low fuel gas pressure switch*
HI GAS PRES	High fuel gas pressure switch*
HI MEDIA TEMP	High media temperature relay
HI STACK TEMP	High flue gas stack temperature switch
CIRC PUMP AUX CT	Circulating pump auxiliary contacts
LO MEDIA DP	Low media differential pressure switch
HI MEDIA DP	High media differential pressure switch
AIR AUX CT	Combustion air auxiliary contacts
LO AIR PRES	Low combustion air switch

*On some heaters this switch (or contacts) is not used. A jumper is used instead. In such cases, the Fireye burner control will never show this switch (or contacts) as the cause of a shutdown.