

HEATEC TEC-NOTE

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BURNER MANAGEMENT CONTROLS Firestorm™ water heaters

SCOPE

This document applies to burner management controls used on Heatec Firestorm water heaters (Fig. 1). It only covers controls of Firestorm heaters in current production. Some earlier heaters have different burner management controls than covered herein. Their display messages will have minor differences from the messages that appear on the current Fireye controls. However, the messages shown for current controls should still be useful despite differences.

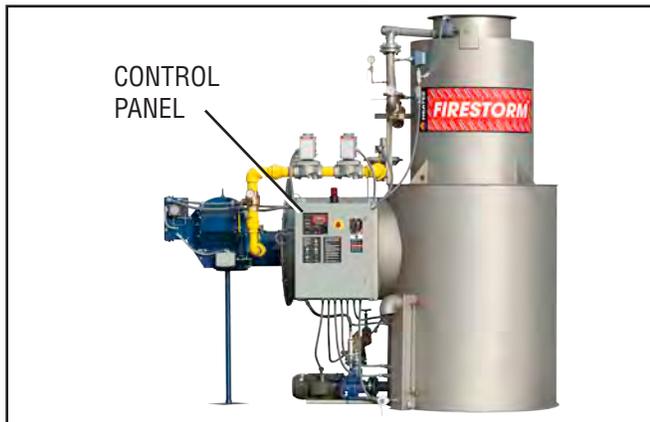


Figure 1. Control panel on Heatec Firestorm heater.



Note: Earlier panel marking FIREYE FLAME MONITOR is now BURNER DISPLAY

Figure 2. Key controls on control panel.

The information covers how the controls work and should enable you to know when your heater is working properly. And it will help you to determine the cause if the heater is not working properly.

KEY CONTROLS

Key controls of the burner management control system are as follows:

1. Fireye Display BLV512 (Fig. 2)
2. Burner control YB110 with Programmer Module YP100 (inside the control panel)
3. Fireye flame scanner UV1A6 (in the burner housing)

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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 burner 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?”

The control panel also has status lights (Fig. 3). The status lights work in conjunction with the Fireye

controls to help you pinpoint the cause of an abnormal shutdown caused by the 3-P interlock circuit. If this happens, the burner display will show a message that includes the words: **LOCKOUT 3-P INTLTK OPEN**. The first status light that is out indicates which one of the interlock devices caused the shutdown.



Figure 3. Status lights.

SAFETY

Firestorm heaters burn fuels that require safeguards to prevent accidental fires and explosions. Those safeguards are provided by the Fireeye burner management controls operating in conjunction with the 3-P interlock circuit.

Never disable any control that has caused the heater to shut off or is preventing a restart.



If you ever need to replace the Fireeye Programmer Module YP110 on a Heatec heater always use one that was programmed at the Heatec factory. New modules obtained directly from Fireeye 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 Fireeye 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 permanent 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 4**. Heatec settings that differ from the Fireeye factory default settings are shown in red. Heatec settings that are the same as Fireeye factory default settings are marked **same as Fireeye default**.

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

Figure 4. YP100 Fireeye factory settings vs Heatec factory settings.

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

*Locked settings cannot be unlocked. Settings should only be locked after all settings have been made and confirmed. Some settings will automatically lock after a few hours of run time.

WHAT FIREYE BURNER MANAGEMENT CONTROLS DO

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

The burner management controls are affected by the *status* of the following heater components:

- Yokogawa burner modulation controller UT150
- Burner 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 burner management controls provide *control signals* to the following heater components:

- Honeywell modulating actuator TZ 4-1
- Ignition transformer IT4-1
- Pilot gas valve
- Main fuel gas valve(s)
- Heater alarm
- Motor controller MC 4-1 (for blower motor)

3-P INTERLOCK CIRCUIT

The burner management controls monitor the *overall* status of the 3-P interlock circuit. However the Fireye controls do not identify *individual* devices in the limit circuit.

Consequently, if one of the devices in the 3-P interlock circuit opens, the burner display (**Fig. 2**) will only show the words: **LOCKOUT 3-P INTLK OPEN**. You will have to look at the status lights (**Fig. 3**) to learn which of the devices in the 3-P interlock circuit caused the shutdown.

The first light out in the series indicates which interlock device caused the shutdown. After the first light goes out, the remaining status lights after it will also go out.

MENUS AND MESSAGES

The burner 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.

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 burner 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 burner management 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. Opens damper to the high-fire position.
4. Initiate a purge period allowing blower to clear heater combustion chamber. The purge period is typically 30 seconds
5. Close damper to its low-fire 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 Trial For Ignition* for 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 referring 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** switch on the heater control panel is set to **OFF** the display will show:

**STANDBY
L1-3 OPEN**

Setting the **BURNER** 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 open the air damper. 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 0:30:

HOLD 00:30
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 30 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 0:20
HIGH FIRE PURGE

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 closed 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.
7. The trial for ignition period begins when terminal 5 of the burner control is energized. 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.) 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.

9. Next, the circuit between terminals 10 and 11 of the burner control is energized, putting the modulating motor 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 closed 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 burner display will show:

**STANDBY
L1-3 OPEN**

MANUAL SHUTDOWN

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

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
M-8 LIMIT OPEN 01:30**

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
M-D LIMIT CLOSED 00:30**

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
M-D LIMIT OPEN 00:00**

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 Fireeye unit.) The burner control will hold this position for 10 minutes and lockout if the M to D circuit does not close. The usual problem is in the operation of the mod motor. Check all terminal connections first.

**STANDBY
FALSE FLAME 25**

This is an abnormal condition. The Fireeye 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 burner display indicates a false flame, the flame scanner is most likely defective.

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 burner control has waited 60 seconds for the 3-P circuit to open.

LOCKOUT PRE-PURGE M-8 LIMIT OPEN

The burner 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

FVES stands 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

There are three periods during *start up* of the burner when an abnormal condition could cause a limit device to open.

LOCKOUT PRE-PURGE 3-P INTLK OPEN

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

LOCKOUT PTFI 3-P INTLK OPEN

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

LOCKOUT MTFI 3-P INTLK OPEN

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

During the *run cycle* of the burner an abnormal condition could cause a limit device to open.

LOCKOUT AUTO 3-P INTLK OPEN

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