

## FIREYE EP380, EP381, EP382, EP390

PROGRAMMER MODULES  
FOR USE WITH THE FIREYE  
FLAME-MONITOR CONTROL

### DESCRIPTION

The Fireye EP380, EP381, EP382, and EP390 Programmer Modules are used with the FLAME-MONITOR™ System. The operational characteristics of the burner management system are determined by the selection of the programmer. These characteristics include timing functions, switching sequences, and display messages.

EP380, EP381, EP382, and EP390 provide start-up programming, safe-start check, and flame monitoring supervision. A running interlock circuit on the FLAME-MONITOR system constantly monitors the limit switches, air flow switches and fuel pressure switches through the Programmer. This programmer will recycle if the running interlock circuit (3-P) is opened during the firing cycle. A modulator (firing rate motor) circuit is not provided on the EP380, EP381, EP382, and EP390 modules.

The Programmer module will de-energize all fuel valve circuits within four seconds following a flame failure or at the end of the pilot trial for ignition period if no flame is detected. An alarm circuit will be energized, following a safety lockout.

The Programmer is the heart of the FLAME-MONITOR System and incorporates a plug-in design for ease of installation. It is microprocessor based and stores the burner cycle and on-time history. If replaced, the new programmer card will begin accumulating a new history.

Refer to Bulletin E-1001 for detailed information on the entire FLAME-MONITOR System.

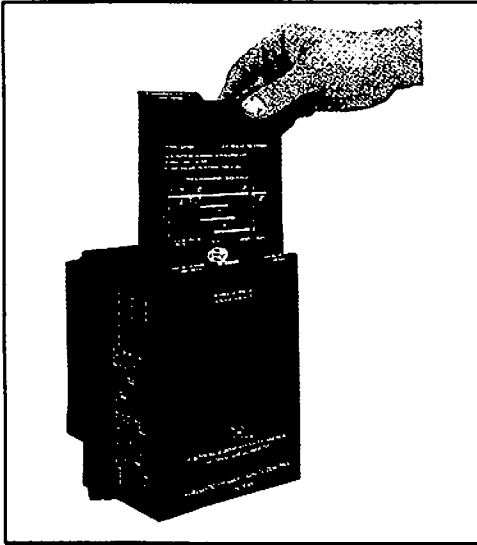
### CAUTION



While all controls are mechanically interchangeable in that they mate with a common wiring base, you should select the correct model for your application. Inappropriate application of a control could result in an unsafe condition hazardous to life and property. Selection of a control for a particular application should be made by a competent professional, such as a Boiler/Burner Service technician licensed by a state or other governmental agency.



## INSTALLATION



[Remove power to the control and remove the FLAME-MONITOR from its wiring base before proceeding.]

Fireye FLAME-MONITOR Program Modules are used with Fireye Series EB700 base chassis. They are installed in the chassis by simply inserting the module into the second slot on the control. This slot is marked "Programmer Module" on the side of the chassis.

Programmer Modules are designed to fit only in the proper slot. They cannot be snapped into place if inserted in the wrong location. **DO NOT FORCE THEM.**

## ORDERING

### Programmer Module

Part No.	Used With	Purge**	Description	FFRT*	Post Purge
EP380	EB700	30 Sec.	Recycle Running Interlock Circuit, 5 & 10 Second TFI, Intermittent Pilot.	4 Sec.	15 Sec.
EP381	EB700	15 Sec.		4 Sec.	15 Sec.
EP382	EB700	0 Sec.		4 Sec.	10 Sec.
EP390	EB700	90 Sec.		4 Sec.	15 Sec.

\*FFRT is the Flame Failure Response Time.

\*\*All Pre-purge times preceded by a 2 second safe start check.

## APPROVALS

UNDERWRITERS LABORATORIES INC.  
LISTED: GUIDE MCCZ  
FILE MP 1537

CANADIAN STANDARDS ASSOCIATION  
FILE # LR7989

ACCEPTABLE BY: INDUSTRIAL RISK INSURERS (I.R.I.)

FACTORY MUTUAL APPROVED

## WARNING



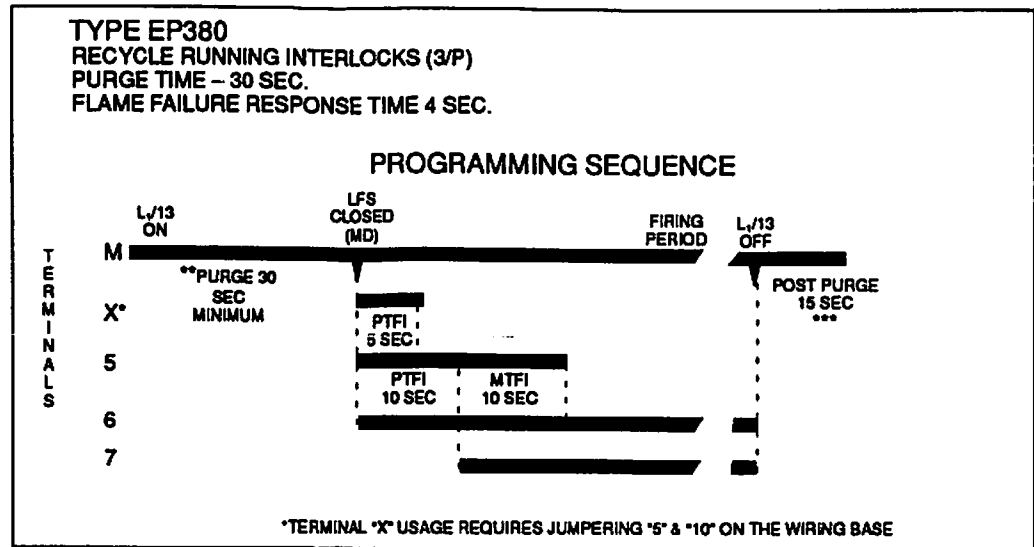
This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures which may be required to correct the interference.

**OPERATION**

Refer to the wiring suggestions shown in Bulletin E-1001 before proceeding to power the Flame-Monitor System. Items such as scanner installation, short circuit tests and safety information should be reviewed.

Note that for direct spark ignited oil burners, substitute the words "main oil valve" for "pilot valve."

**PROGRAMMING SEQUENCE FOR EP380 PROGRAMMER**



**Start-up (Normal Cycle)**

1. Constant 120VAC should be available to the L1-L2 terminals on the wiring base.
  2. The operating control circuits (L1-13) will close, signaling the burner to start its firing sequence.
  3. Assuming the fuel valve end switch (13-3) is closed, the burner/blower motor (Terminal M) circuit is energized. The running interlock (limit) circuit (3-P) will close.
  - \*\*4. The EP380 provides a 30 second purge, the EP381 provides a 15 second purge, the EP382 provides a 0 second purge, and the EP390 provides a 90 second purge. All pre-purge times are preceded by a 2 second safe start check.
  5. When the purge is completed and the low fire start circuit (M-D) is made, the ignition is energized. Terminal "X," "5" and "6" are energized. The pilot trial for ignition (PTFI) period begins.
  6. Five seconds after being energized, Terminal "X" is de-energized
  7. Five seconds following Terminal "X" being de-energized, if flame is proven, the main fuel valve (Terminal "7"), is energized.
  8. Terminal "5" is de-energized 10 seconds later. Terminal "6" will remain energized all during the firing period.
  9. The message center will display the flame signal all during the firing period.
- \*The use of terminal "X" as an ignition terminal requires placing a jumper between Terminals "5" and "10" on the wiring base.

Flame Signal (As read on display)	
0-9	Not Acceptable
10	Minimum Acceptable
20-80	Normal



### Normal Shutdown

1. When the operating control circuit (L1-13) opens, the main fuel valves are de-energized (terminal 6 and 7).
- \*\*\*2. Following the post purge, the burner/blower motor is de-energized. The EP380, EP381, and EP390 provide a 15 second post purge. The EP382 provides a 10 second post purge.
3. The burner is now off and the message center displays the burner operating history until another cycle begins.

**Note:** When flame is detected, the message center will provide a constant readout of the signal strength.

### Safety Shutdown

1. If pilot flame is not detected during the 10 second trial for ignition period, the pilot valve and ignition transformer will be de-energized and the control will lock out on safety.
2. If flame is not detected at the end of the main flame trial for ignition period, all fuel valves will be de-energized and the control will lock out on safety.
3. If the main flame fails during a firing cycle, all fuel valves will be de-energized within 4 seconds after loss of flame signal and the control will lock out on safety.
4. If the low fire circuit (M-D) or the running interlock circuit (3-P) do not close after a specified time (10 minutes for EP380, EP381, and EP390; 2 minutes for EP382), the control will lockout on safety.
5. Manual reset is required following any safety shutdown.

## CAUTION



Care should be taken to see that ignitor cable and scanner cables are routed away from one another on all installations. These cables when crossed or run together may interfere with the proper operation of the flame safeguard control.

## SCANNER WIRING

If you are experiencing erratic operation or inappropriate characters on the display during the trial for ignition period, the cause is likely to be ignitor noise. Check for worn ignitor cable insulation, broken or cut insulation, or loose connectors at the electrode and transformer.

### Description of Functions of Operating Controls

1. **Operating Controls:** Generally pressure or temperature activated, the operating control closes, causing the burner start-up sequence to begin. When the operating control opens, the burner shuts off. The operating control is connected in the L1-13 circuit on the wiring base.
2. **Limit Switches:** These are generally pressure, water level or temperature activated.
  - a. **Recycle** — When it is desired to stop the burner when the limit switch opens and restart it when the limit switch recloses, they re connected between Terminals L1 and 13.
3. **Fuel Valve End Switch Interlock:** This is generally an integral switch mounted on the main fuel valve and activated by the valve stem. It is connected between Terminal 3 and 13. The fuel valve end switch interlock prevents a burner start-up if the valve stem is not in the "valve closed" position.
4. **Running Interlocks:** These generally are air flow switches, high and low fuel pressure switches, oil temperature switches, atomizing media pressure switches, and excess smoke density controls. These interlocks prove proper conditions for normal operation of the burner. They are wired in series and connected between Terminals 3 and P.
5. **Low Fire Start Interlock:** Generally a firing rate motor linkage position switch or a damper position switch, will prove both the linkage and dampers are in their proper positions to begin burner light off. This switch is connected between Terminals M and D.

## CAUTION



The use of a Fuel Valve End Switch is recommended. All FLAME-MONITOR systems have provision to accept the Fuel Valve End Switch Interlock. This will add additional safety to avoid hazardous situations.

**DISPLAY MESSAGES**

The FIREYE FLAME-MONITOR does more than control the burner flame safeguard operation and sequencing. It provides the operator or serviceman with important burner information all the time and it remembers a history of the burner operation.

The following is a complete listing of all the messages which may be displayed on the FLAME-MONITOR. The control has an eight character read-out display. Messages that are greater than eight characters in length will scroll on the display from right to left.

To gain the full usefulness of the FLAME-MONITOR, do not reset the control until you are sure of the message meaning.

**Important:** On initial power-up and on restarts following power failure, the display will scroll a history message for 15 sec. when using a programmer having a date code followed by a number greater than "11." (e.g. date code 8740-12)

EP380, EP381, EP382, EP390 MESSAGES	DESCRIPTION
OFF	The burner operating control circuit (L1 -13) is open and there is power on terminals L1 and L2.
PURGE 00	The unit has begun purge, the terminal M has started the blower/ burner motor and the "00" indicates that the control is counting in seconds, up to the end of purge.
PTFI 00	The control has begun the pilot trial for ignition sequence. The "00" indicates the control will count, in seconds, to the end of the PTFI, (unless flame is proven). If flame is proven, note the next message below.
PTFI FLAME SIGNAL 00	While in PTFI, a flame was sensed and the message changes to include a reading of the signal strength, designated by "00."
MTFI FLAME SIGNAL 00	During the main trial for ignition period (MTFI), the display shows a flame signal reading, designated by "00."
FLAME SIGNAL 00	At the end of MTFI and all during the burner running time, the display message will be a constant read-out of signal strength (designated here by "00").
POST-PURGE 00	When the operating control shut the burner down, the control will post-purge and count up, in seconds, to the end of the post-purge (15 seconds for EP380, EP381, and EP390; 10 seconds for EP382).
BURNER ON 00 HRS. 00 CYCLES	After post-purge, a history message will show the total number of complete cycles the burner has made and the total number of main burner (Terminal 7) On Time in Hrs. The "00" designates these numbers. This message will also be displayed if the reset button is depressed during the burner off period.



## ADDITIONAL MESSAGES

HOLD MESSAGES	DESCRIPTION
HOLD 3-P RUN INTLK OPEN	The running interlock circuit (3-P) has opened during the burner on period. This message will be on the display for the post purge (15 seconds for EP380, EP381, and EP390; 10 seconds for EP382)
HOLD 3-P RUN INTLK OPEN PURGE	The running interlock circuit (3-P) has opened during purge and the control will hold in this position for a specified time (10 minutes for EP380, EP381, and EP390; 10 seconds for EP382). If the 3-P circuit does not close in this specified time, control will lock out.
HOLD 3-P RUN INTLK OPEN MTFI	The running interlock circuit (3-P) has opened during the main trial for ignition period. This message will be on the display for the post purge (15 seconds for EP380, EP381, and EP390; 10 seconds for EP382) and then recycle.
HOLD 3-P RUN INTLK OPEN PTFI	The running interlock circuit (3-P) has opened during the pilot trial for ignition period. This message will be on display for the post purge (15 seconds for EP380, EP381, and EP390; 10 seconds for EP382) and then recycle.
HOLD FALSE FLAME 00	The flame has been sensed sometime during the burner off time. This message will hold for 60 seconds and display Flame Signal (00) strength. This can be used as an aid in trouble shooting scanners and amplifiers.
HOLD FLAME FAIL	A flame failure occurred during the main burner on period. The control will hold this message for the post purge (15 seconds for EP380, EP381, and EP390; 10 seconds for EP382), and then lock out.
HOLD FLAME FAIL MTFI	No flame was proven during the main trial for ignition period. The control will hold this message for the post purge (15 seconds for EP380, EP381, and EP390, 10 seconds for EP382)
HOLD FLAME FAIL PTFI	No flame was proven during the pilot trial for ignition period. The control will hold this message for the post purge (15 seconds for EP380, EP381, and EP390; 10 seconds for EP382) and then lock out.
HOLD CHECK SCANNER	See description on page 9 for "LOCKOUT CHECK SCANNER"
HOLD M-D LOW PURGE OPEN	The control has finished purge and the firing rate motor is driving to the low fire position waiting for that switch (M-D) to close. It will hold in this position for a specified time (10 minutes for EP380, EP381, and EP390; 2 minutes for EP382) and then lockout if the M-D circuit does not close.
HOLD SCANNER NOISE	See description on page 8 for "LOCKOUT SCANNER NOISE."

**NOTE:** Messages more than 8 characters in length will scroll continuously from right to left on the display.

**ADDITIONAL MESSAGES**

**HOLD MESSAGES (CONTINUED)**

**HOLD SHORT CIRCUIT  
TERMINAL 5, 6, OR 7**

**DESCRIPTION**

The control has sensed an excessive current of short circuit external to Terminals 5, 6, or 7. This message will hold for the post purge (15 seconds for EP380, EP381, EP390; 10 seconds for EP382) and then the control will lock out on the second consecutive event and display the appropriate message.

**LOCKOUT MESSAGES**

**LOCKOUT 3-P RUN  
INTLK OPEN PURGE**

**DESCRIPTION**

The running interlock circuit (3-P) has opened during the purge period and remained open for a specified time (10 minutes for EP380, EP381, and EP390; 2 minutes for EP382).

**LOCKOUT 13-3 FUEL VALVE END  
SWITCH OPEN**

The fuel valve end switch wired between Terminals 13 & 3 on the wiring base opened during purge or at initial burner start up.

**LOCKOUT FALSE FLAME**

A flame has been sensed by the scanner for more than 60 seconds during the burner off time.

**LOCKOUT FALSE FLAME PURGE**

A flame has been sensed by the scanner for more than 4 seconds during the purge period.

**LOCKOUT FLAME FAIL**

A flame failure occurred during the main burner on period.

**LOCKOUT FLAME FAIL MTFI**

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

**LOCKOUT FLAME FAIL PTFI**

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

**SYSTEM ERROR**

An internal failure has been detected in the programmer module. Replace it. Check also for scanner wire routing near ignition noise.

**LOCKOUT M-D  
LOW PURGE OPEN**

The control has held for more than a specified time (10 minutes for EP380, EP381, and EP390; 2 minutes for EP382) waiting for the low fire switch (M-D) to make.

**NOTE:** Messages more than 8 characters in length will scroll continuously from right to left on the display.



## ADDITIONAL MESSAGES

### LOCKOUT MESSAGES (CONTINUED)

LOCKOUT SCANNER NOISE

This message appears because of ignition cable noise. Reroute scanner wires away from high voltage ignition cables. Check for proper sparkgap. Check for proper grounding of wiring base and power supply. Replace worn ignition cable and/or faulty connections.

LOCKOUT SHORT CIRCUIT  
TERMINAL 5, 6, OR 7

The control has sensed an excessive current of short circuit external to terminal 5, 6 or 7. The control will lock out when this event is sensed twice in a row.

### CHECK MESSAGES

### DESCRIPTION

CHECK M-D LOW PURGE

The "Run-Check" switch is in the "Check" position and will hold indefinitely. The firing rate motor is being driven to the low purge position.

CHECK FLAME SIGNAL 00

The "Run-Check" switch has been placed in the "Check" position during the pilot trial for ignition period. The flame signal strength will be displayed. The control will lock out on safety only if no flame signal is sensed for a continuous 30 seconds while the control is in this check position. The control will not advance in the cycle until the switch is placed in the "run" position again.

CHECK LOW FIRE  
FLAME SIGNAL 00

The "Run-Check" switch has been placed in the "Check" position following the main trial for ignition period and the firing rate motor has been driven to low fire. The flame signal strength will be displayed as a number from 0-99 and is shown here by the symbols 00.

### DIAGNOSTIC MESSAGES

LOCKOUT CHECK AMPLIFIER

### POSSIBLE CAUSE

### SOLUTION

— High Electric Noise

— Check for proper ground on power supply

— Install noise suppressor on power supply

— Defective Field Wiring

— Make sure line phase on interlock circuits is the same as found on L1/L2 power supply to E100

— Defective Amplifier

— Replace Amplifier

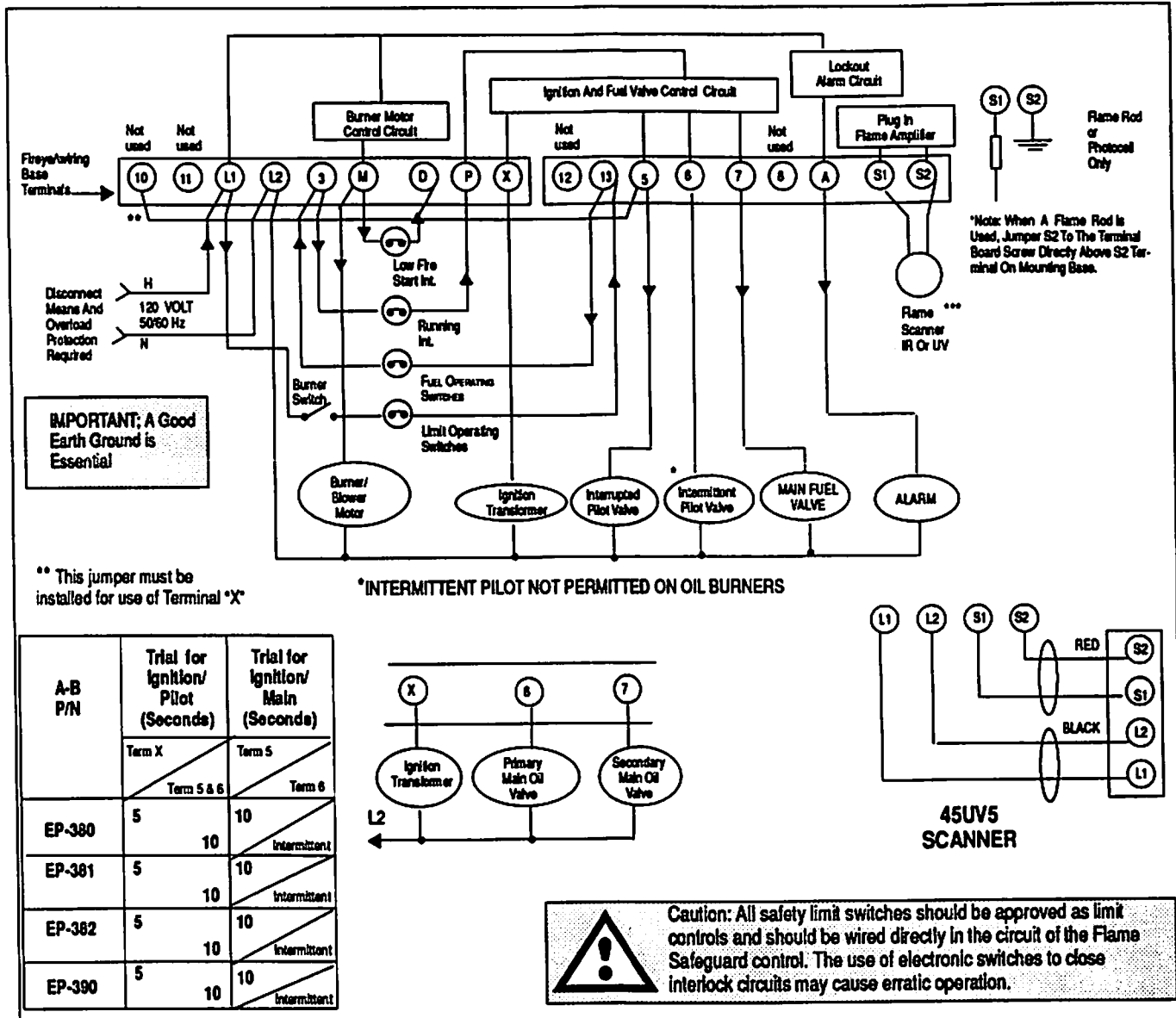
**NOTE:** Messages more than 8 characters in length will scroll continuously from right to left on the display.



**ADDITIONAL MESSAGES**

DIAGNOSTIC MESSAGES	POSSIBLE CAUSE	SOLUTION
<div style="border: 1px solid black; padding: 5px; text-align: center;"> <b>LOCKOUT CHECK CHASSIS</b> </div>	<ul style="list-style-type: none"> <li>— Voltage On Terminal 7 at improper time. Defective field wiring.</li> <li>— Defective Chassis</li> <li>— Defective Programmer</li> </ul>	<ul style="list-style-type: none"> <li>— Check wiring to Terminal 7</li> <li>— Replace Chassis (EB700)</li> <li>— Replace programmer</li> </ul>
<div style="border: 1px solid black; padding: 5px; text-align: center;"> <b>LOCKOUT CHECK PROGRAMMER</b> </div>	<ul style="list-style-type: none"> <li>— Voltage on Terminal 5 or 6 at improper time</li> <li>— High Electrical Noise</li> <li>— Fuel Changeover on Burners with Direct Spark Oil</li> <li>— Defective Programmer</li> <li>— Defective Chassis</li> </ul>	<ul style="list-style-type: none"> <li>— Check field wiring to Terminal 5 and 6</li> <li>— Check for Proper ground on power supply</li> <li>— Install noise suppressor on power supply. See page 10</li> <li>— Reroute scanner wires away from high voltage wiring</li> <li>— Interrupt power when changing fuels</li> <li>— Install time delay relay</li> <li>— Note write-up on page 11 of this bulletin</li> <li>— Replace Programmer</li> <li>— Replace Chassis</li> </ul>
<div style="border: 1px solid black; padding: 5px; text-align: center;"> <b>LOCKOUT CHECK SCANNER</b> </div>	<p>Scanner signal has been detected during the shutter closed time. This can be caused by a faulty UV tube (4-314-1), faulty scanner (45UV5) or lack of power to the scanner.</p>	

## TYPICAL WIRING ARRANGEMENT FOR PILOT IGNITED BURNERS USING THE EP380, EP381, EP382, OR EP390



### FLAME MONITOR ELECTRICAL NOISE

In applications which appear to have excessive electrical noise, it may be helpful to add an electrical noise suppressor to the power supply of the control circuit.

We recommend the following:  
Fireye Noise Line Filter P/N 60-2333

### AUXILIARY DEVICE IN M-D-8 CIRCUIT AT FLAME MONITOR CONTROL

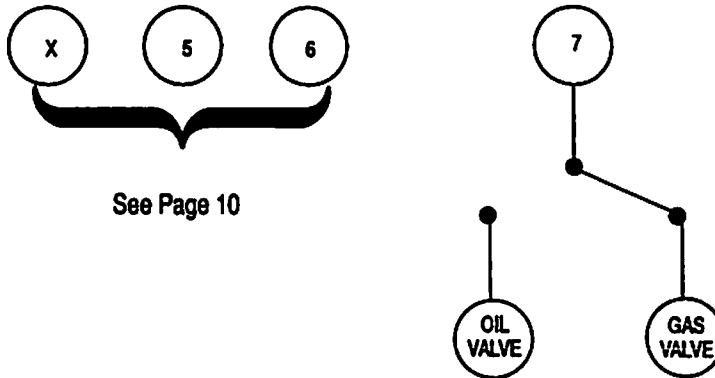
The function of the low fire start interlock circuit internally in a new Fireye Flame Monitor unit is accomplished by highly reliable solid state electronic circuitry. This prohibits the connection of power consuming devices (i.e. lamps, annunciators, relays, timers, etc.) to the D terminal.

\*\*\*When using an infrared scanner (48PT), ground S2 on all EB700's labeled "ENG CODE 00." Subsequent Eng. Code models do not require S2 be grounded.

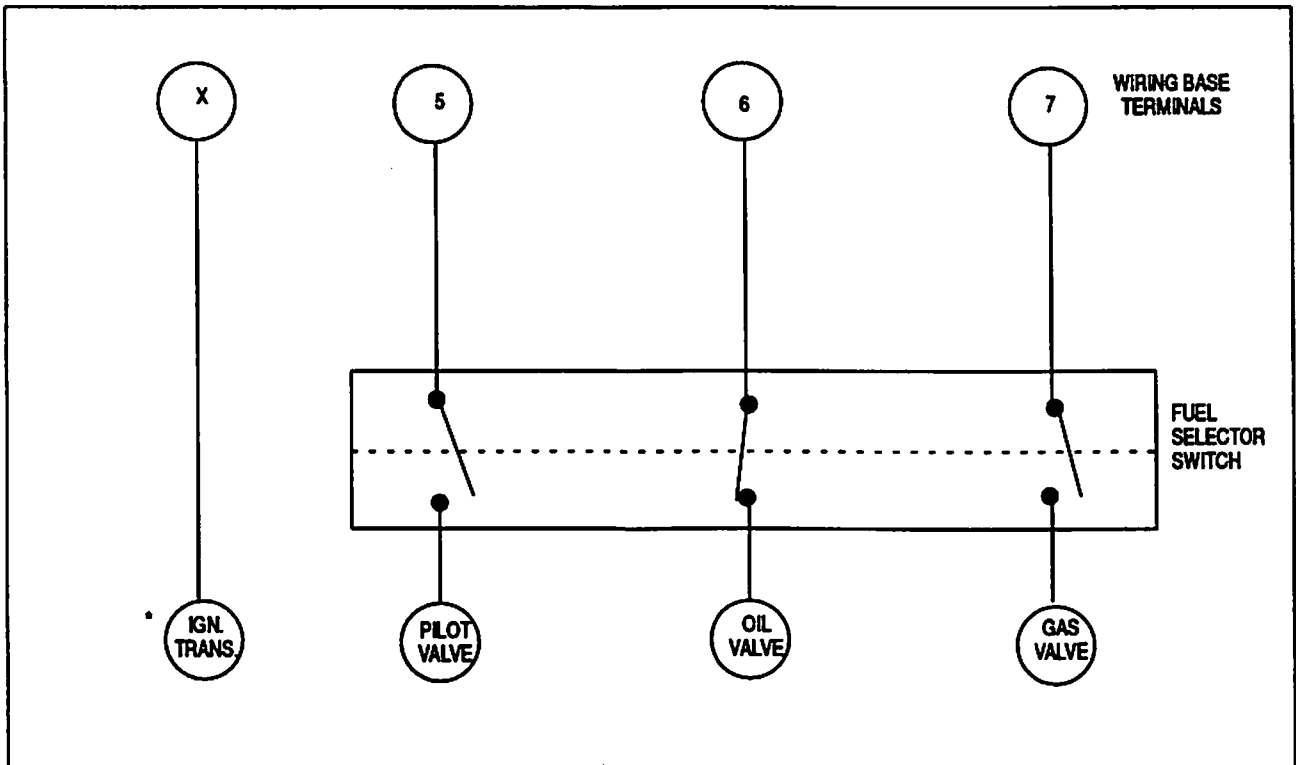
**COMBINATION FUEL BURNERS**

**NOTE:** An important safety feature of the FLAME-MONITOR system is the ability to monitor the proper timed operation of critical terminals, Fuel valve terminals 5, 6 and 7 for instance. Jumpering of these terminals could therefore cause the control to sense an unusual condition and LOCK OUT.

When changing fuels through a gas/oil selector switch and gas pilot is used for both fuels, wire oil and gas main valve through one leg of selector switch as follows:



When changing fuels on combination oil and gas burners, if DIRECT SPARK IGNITION is used on oil and gas pilot is used on gas, wire as follows:



\* As shown, ignition spark on for 5 seconds  
Option for 10 second spark, wire to terminal 5.



**ALLEN-BRADLEY**

A ROCKWELL INTERNATIONAL COMPANY

Presence Sensing Products Division  
265 Winter St., Waltham, Mass 02154

**FIREYE, INC.**  
Minneapolis, MN  
Formerly a product of the  
Allen-Bradley Company

Bulletin EP-3801  
August 1990