



E-1101
OCTOBER 30, 2015



E110 with ED510 Display Module

E110 FIREYE FLAME-MONITOR™

**BURNER MANAGEMENT CONTROL
FOR USE WITH THE
MICROPROCESSOR-BASED
EP AND EPD STYLE
PROGRAMMER MODULES**



DESCRIPTION

The Fireeye® E110 FLAME-MONITOR™ System is a microprocessor based burner management control system designed to provide the proper burner sequencing, ignition and flame monitoring protection on automatically ignited oil, gas, and combination fuel burners. In conjunction with limit and operating controls, it programs the burner/blower motor, ignition and fuel valves to provide for proper and safe burner operation. The control also provides current operating status and lockout information in the event of a safety shutdown. The manner in which this information is displayed is dependent on the type of programmer (EP or EPD) and display module (ED510 or ED500).^{*} Refer to Flame-Monitor PROGRAMMER SELECTION later in this document for the various combinations of programmer and display modules.

The E110 consists of the EB700 chassis, dust cover, and shortened mounting screw (P/N 48-1836). The display module (ED510), if required, must be ordered separately. Interchangeable programmer and flame amplifier modules allow for complete versatility in selection of control function, timing, and flame scanning means. Functions such as pre-purge, recycling interlocks, high fire proving interlock, and trial for ignition timing of the pilot and main flame are determined by the programmer module. The E110 Flame-Monitor can be used with ultra-violet, auto-check infrared, flame rod, or self-check ultraviolet flame scanners by choosing the proper amplifier module.

The eighteen (18) terminal wiring base allows for many functional circuits including motors, valves, and ignition transformers as well as multiple interlocks such as high purge, low purge, fuel valve and running interlock circuits. The E110 uses the same wiring base as the Fireeye E100 Flame-Monitor control, D Series and C Series Controls and is directly interchangeable with most models without rewiring.

Additional functions of the Flame-Monitor system include:

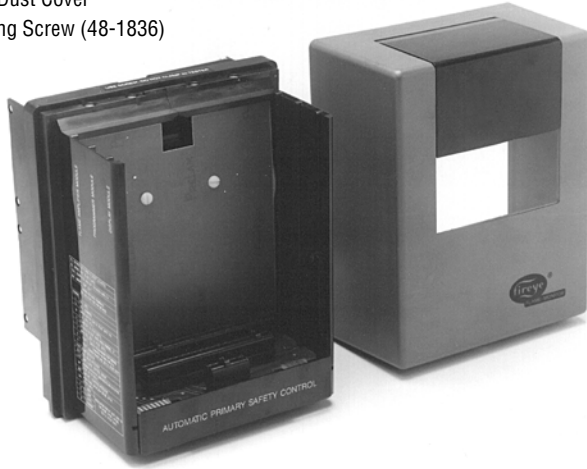
- A non-volatile memory which allows the control to remember its history and present position even when power is interrupted.
- A constant flame signal read-out via display module or 0-10 VDC output (EPD programmers only).
- Read-out of main fuel operational hours and complete cycles via display module.
- Modbus communications via RS485 multi-drop link.
- Dipswitches located on the EP programmer to allow selectable purge time.
- A run/check switch which allows the operator to stop the program sequence in any of three different positions (Purge, PTFI, or Auto).
- Remote Display Capability.
- Annunciate 16 additional interlocks using E300 Expansion Module.

^{*} The ED500 display was the predecessor of the ED510 display and uses an older design. It does not have the latest features of the ED510 display module.

FLAME-MONITOR Ordering Information

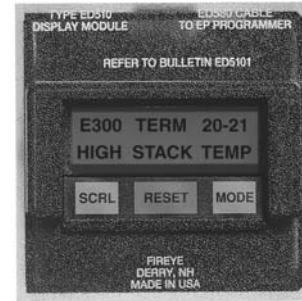
E110 Flame-Monitor (One required)

E110 consists of:
 EB700 Chassis
 EC600 Dust Cover
 Mounting Screw (48-1836)



ED510 Display Module

Required with EP Programmers
 Optional with EPD Programmers



EP programmers must have an Eng. code of 28 or later (e.g. 9414-28). EPD Programmers must have an Eng. code of 02 or later.

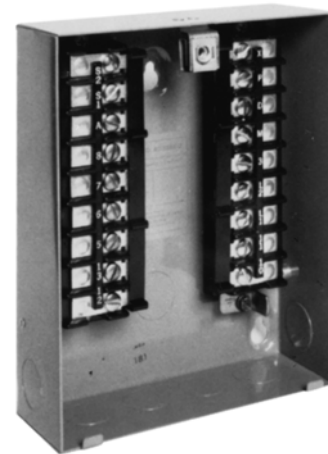
Amplifier Module (One Required)

- E1R1
- E1R2
- E1R3
- EUV1
- EUVS4
- ERT1



Wiring Base (One Required)

60-1386-2
 Surface Mount
 (shown)

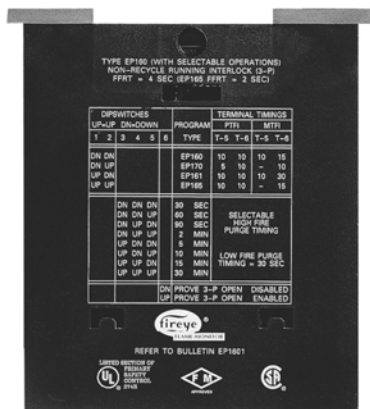


60-1466-2
 Cabinet Mount

Programmer Module (One Required)

EP Programmer

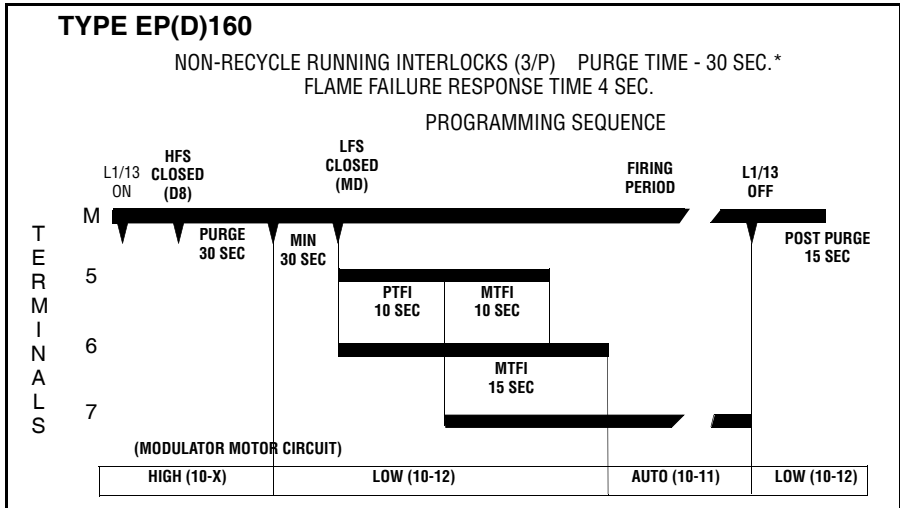
- EP160
- EP161
- EP165
- EP166
- EP170
- EP260
- EP265
- EP270
- EP380
- EP381
- EP382
- EP387
- EP390



or EPD Programmer

- EPD160
- EPD161
- EPD167
- EPD170
- EPD260
- EPD261
- EPD270
- EPD380
- EPD381
- EPD382
- EPD390





DIPSWITCH SETTINGS

1	2	3	4	5	6
INACTIVE		Down	Down	Down	Down

Refer to appropriate programmer bulletin for a complete description of the dipswitch functions.

CAUTION: On initial power-up and on restarts following a power failure, the control will perform self-test diagnostics for 15 seconds.

Start-Up (Normal Cycle)

Note: For direct spark ignited oil burners, substitute the words Main-Oil Valve for Pilot Valve.

1. Constant 120 VAC should be available to the L1-L2 terminals only on the wiring base.
2. The operating control circuits (L1-13) will close, signaling the burner to start its firing sequence.
3. If 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 (e.g. all limits, interlocks, etc. are proven).
4. The firing rate motor (Modulator Motor) is driven toward the high purge open damper position (10-X circuit made).
5. When the firing rate motor reaches its open damper position, the Hi Purge switch closes (D-8) and the prepurge interval of 30* seconds is initiated. The ED510 will display:

**PURGE 0:05
 HIGH FIRE PURGE**

If the D-8 circuit does not close, the program will hold in this position for ten minutes waiting for it to close. If it does not, the control will lockout.

6. When the prepurge is completed, the firing rate motor is driven toward the low purge damper position (10-12 ckt. made). The ED510 will display:

**PURGE 0:35
 LOW FIRE PURGE**

7. Following the minimum 30 second delay (to permit the firing rate motor to get to the low fire position), the control will wait for the low fire switch (M-D) to close. When it closes, the trial for ignition sequence will start. If after ten minutes, the M-D circuit is not closed, the control will lockout. The EPD167 will wait indefinitely for the M-D circuit to close.

* Prepurge timing is selectable via dipswitches.



8. The trial for ignition period begins with Terminal 5 and 6 being energized simultaneously. This is known as PTFI (Pilot Trial for Ignition). The ED510 will display:

PTFI 0:02
IGNITION TIMING

This period is ten seconds in duration. If no flame is detected after ten seconds, the control will de-energize Terminals 5 and 6 and lockout. When flame is detected during this 10 second period, the ED510 will display

PTFI 20
FLAME SIGNAL

FLAME SIGNAL	
0-9	NOT ACCEPTABLE
10	MINIMUM ACCEPTABLE
20-80	NORMAL

9. With flame proven at the end of PTFI, the main flame trial for ignition (MTFI) period begins. Terminal 7 is energized. The ED510 will display:

MTFI 35
FLAME SIGNAL

Terminal 5 is de-energized 10 seconds later and Terminal 6 is de-energized after another 5 seconds.

10. The firing rate motor is now sent to the auto position (10-11 ckt made) and is under the command of the proportional controller. The ED510 will display:

AUTO 40
FLAME SIGNAL

NOTE: Trial-for-Ignition timings depend on the programmer selected. The timing chart on page 9 points out the differences in the EP(D)160, EP161, EP165, and EP(D)170.

Normal Shutdown

1. When the operating control circuit (L1-13) opens, the main fuel valve is de-energized. The firing rate motor is driven to the low purge position (10-12 ckt made).
2. Following a 15 second post purge, the burner/blower motor is de-energized.
3. The burner is now off and the ED510 will display

STANDBY
L1-13 OPEN

Burner history can be displayed by using ED510 keypad. See bulletin ED-5101.

BACKLIT DISPLAY

The ED510 display has a two (2) line by sixteen (16) character backlit LCD display. The backlit function is energized when power is applied to the FLAME MONITOR.

Contrast Control: The contrast for the LCD display is factory set. If the contrast must be adjusted for any reason (e.g.: remote mounting), a potentiometer is provided on the back of the ED510 display board. Refer to bulletin ED-5101 for detailed information.



LOCKOUTS

When a safety shutdown occurs, the control will display a message indicating LOCKOUT and the reason for the lockout. The alarm circuit (Terminal “A”) will be energized. The non-volatile memory will remember the status of the control even if a power failure occurs. By momentarily depressing the reset button on the display, the control can be reset. The button must be held down for one second and then released. Very little force is required to do this. Do not press hard.

Safety Shutdown

1. If the running interlock circuit does not close, the control will lockout and the blower motor will be de-energized. If the interlock circuit opens during a start-up or firing period, all fuel valves will be de-energized and the control will lockout.
2. If the proven high fire circuit (D-8) has not closed after a ten (10) minute “Hold” period at the start of prepurge, the control will lockout.
3. If the low fire start circuit (M-D) has not closed after a ten (10) minute “Hold” period at the end of prepurge, the control will lockout.
4. If dipswitch 6 is in the “Up” position (3-P prove open to start-enabled), and the 3-P circuit is closed at the start of the operating cycle, the control will hold for one (1) minute waiting for the 3-P circuit to open. If, after one (1) minute, the 3-P circuit does not open, the control will lockout.
5. 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 lockout on safety.
6. If main 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 lockout on safety.
7. If the main flame fails during a firing cycle, all fuel valves will be de-energized within 4 seconds maximum, after loss of flame signal and the control will lockout on safety.
8. The EP165 and EP166 programmers will lockout on a power interruption.
9. If flame is detected when the operating control (L1-13) is open, the control will wait sixty (60) seconds and then lockout if flame is still present. If the operating control closes and flame is detected during purge, the blower motor (term M) remains energized and the purge sequence is put on hold. If the flame signal goes away within sixty (60) seconds, the control will proceed with a normal start-up. If flame signal is still present after sixty (60) seconds, the control will lockout.

NOTE: Manual Reset is required following any safety shutdown.

NOTE: Depressing and releasing the reset button during a cycle will cause the control to shut the burner down and recycle.

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 reclosed, they are connected between Terminals L1 and 13.
 - b. Non-Recycle —when it is necessary to stop the burner when the limit switch opens and prevent it from starting until both the limit switch recloses and the manual reset is activated, they are connected between terminals 3 and P.*

* Refer to programmer selection on page 9 to determine which programmers offer non-recycle operation of the running interlock circuit (ckt. 3-P).



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 & 13. The fuel valve end switch interlock prevents a burner start-up if the valve stem is not in the “valve closed” position.
4. **Purge Interlock:** Generally a firing rate motor linkage position switch or a differential air-pressure switch, that proves a maximum purge air flow rate. It is connected between Terminals D and 8. The purge interlock proves that the purge air flow rate is at maximum during the purge.
5. **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.
6. **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.

IMPORTANT INFORMATION — PLEASE READ CAREFULLY

DETECTING AIR FLOW SWITCH (3-P) CLOSED AFTER START

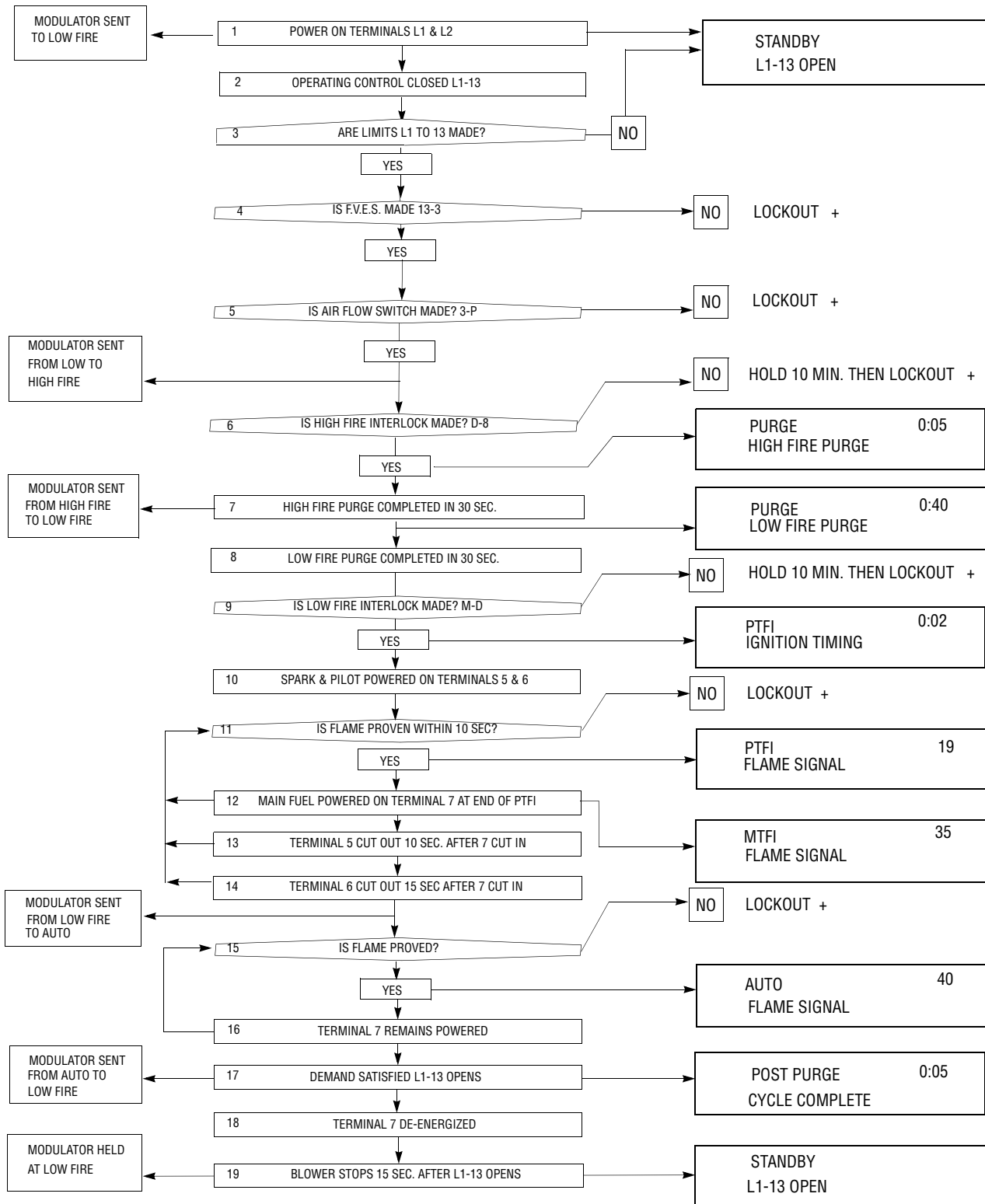
In code 39 programmers and above, the method used to detect the air flow switch closed at the beginning of a cycle has been changed to avoid any nuisance lockouts. Previous to code 39, after the operating control closed, the programmer waited 10 seconds for the air flow switch to close and if not closed would go into lockout. Beginning with code 39, the EP programmers utilize the open damper switch interlock, D-8, to determine the wait time for the air flow switch to close. If, at the start of a cycle after a blower turns on, the D-8 interlock is detected as closed, most likely indicating a jumped high fire switch, the programmer allows 20 seconds for the air flow switch to close. Alternatively, at startup, if the D-8 interlock is open, indicating the firing rate motor is at the low fire position and the damper is closed, the programmer will not check for the air flow switch closed until 10 seconds after the open damper switch has closed and the purge period has begun. This means the programmer will send the mod motor to the high fire position, forcing the high fire damper switch to close, and will then begin its 10 second timer to check for the air flow switch to close.

EP160 - DIP SWITCH 1

When used in conjunction with Nexus PPC5000, dip switch 1 in the UP position provides a 3 second delay between burner cycles. This time period is used to de-energize the blower motor, terminal M. This allows sufficient time for the PPC5000 to realize a new cycle is beginning and it can reset its operating parameters accordingly.

Refer to the specific programming bulletin for additional information regarding dip switch settings.

EP(D)160 LOGIC FLOW DIAGRAM NORMAL CYCLE



+ LOCKOUT AND HOLD MESSAGES ARE EXPLAINED IN THE FOLLOWING PAGES.



ED510 MESSAGES

RUN MESSAGES

STANDBY L1-13 OPEN		The operating control of the FLAME-MONITOR (terminals L1-13) is open.
PURGE HIGH FIRE PURGE	0:05	Firing rate motor sent to high fire (term. 10-X made), purge timing displayed upper right hand corner.
PURGE LOW FIRE PURGE	0:35	Firing rate motor sent to low fire (term. 10-12 made), purge timing displayed in upper right hand corner.
PTFI IGNITION TIMING	0:02	PTFI timing started. Pilot not proven yet. PTFI timing displayed in upper right hand corner.
PTFI FLAME SIGNAL	19	Pilot flame proven during PTFI. Flame signal strength displayed in upper right hand corner.
MTFI FLAME SIGNAL	25	Main flame proven during MTFI. Flame signal strength displayed in upper right hand corner.
AUTO FLAME SIGNAL	40	Modulator motor sent to auto position (term 10-11 made). Flame signal strength displayed in upper right hand corner.
POST PURGE CYCLE COMPLETE	0:05	Demand satisfied. L1-13 open. Blower motor de-energized 15 seconds after L1-13 opens.

HOLD MESSAGES

HOLD STANDBY 3-P INTLK CLOSED	0:23	Dipswitch #6 (3-P Proven Open to Start) is set in the Up position (Enabled). At the start of the cycle, the 3-P circuit was closed. It will hold in this position for 60 seconds and then lockout if the 3-P circuit does not open.
HOLD PURGE D-8 LIMIT OPEN	0:00	The control has driven the firing rate motor to high purge (term. 10-X made) and is waiting for the high fire switch (term. D-8) to close. It will hold this position for ten (10) minutes and then lockout if the D-8 circuit does not close. Applies to EP(D)160, EP(D)161, EP165, EP166, EPD167 and EP(D)170 programmers.
HOLD PURGE D-8 LIMIT CLOSED	0:00	Dipswitch #6 (3-P Proven Open to Start) is set in the Up position (Enabled). At the start of a cycle the D-8 circuit was closed. It will hold in this position for 30 seconds and then lockout if the D-8 circuit does not open. Possible solution is to remove jumper from D-8 circuit or properly set the firing rate motor and switches. Applies to EP(D)160, EP(D)161, EP165, EP166, EPD167 and EP(D)170 programmers
HOLD PURGE M-D LIMIT CLOSED	0:30	Dipswitch #6 (3-P Proven Open to Start) is set in the Up position (Enabled). At the end of high fire purge and beginning of low fire start, the M-D circuit is closed. It will hold in this position for 30 seconds and then lockout if the M-D circuit does not open. The solution is to remove jumper from the M-D circuit or properly set the firing rate motor and switches. Applies to EP(D)160, EP(D)161, EP165, EP166, EPD167 and EP(D)170 programmers



HOLD PURGE
M-D LIMIT OPEN 0:00

The control has finished purge and the firing rate motor is driving to the low fire position (term. 10-12 made) waiting for the low fire start switch (term. M-D) to close. It will hold this position for ten (10) minutes and then lockout if the M-D circuit does not close, excluding the EPD167.

HOLD PURGE
3-P INTLK OPEN 0:10

The running interlock circuit (3/P) has not closed within the first ten (10) seconds of purge. The control will hold for ten (10) minutes and then lockout. **Applies to recycle programmers only.**

HOLD STANDBY
FALSE FLAME 25

Flame has been sensed during the burner off time (term. L1-13 open) or during the purge period. This message will hold for sixty (60) seconds and then lockout if flame is still present. Flame signal strength is displayed in the upper right hand corner.

LOCKOUT MESSAGES

LOCKOUT STANDBY
3-P INTLK CLOSED

Dipswitch #6 (3-P Proven Open to Start) is set in the Up position (Enabled). At the start of the cycle, the 3-P circuit was closed, and the control has waited 60 seconds for the 3-P circuit to open.

LOCKOUT PURGE
D-8 LIMIT OPEN

The control has held for more than 10 minutes waiting for the high fire switch (D-8) to close. **Applies to EP(D)160, EP(D)161, EP165, EP166, EPD167 and EP(D)170 programmers.**

LOCKOUT PURGE
D-8 LIMIT CLOSED

Dipswitch #6 (3-P proven open to start) is set in the Up position (Enabled). The D-8 circuit has been closed for 30 seconds at the start of cycle. **Applies to EP(D)160, EP(D)161, EP165, EP166, EPD167 and EP(D)170 programmers**

LOCKOUT PURGE
M-D LIMIT CLOSED

Dipswitch #6 (3-P proven open to start) is set in the Up position (Enabled). The M-D circuit has been closed for 30 seconds at the end of high purge or at the beginning of low fire start. **Applies to EP(D)160, EP(D)161, EP165, EP166, EPD167 and EP(D)170 programmers**

LOCKOUT PURGE
3-P INTLK OPEN

The running interlock circuit (3-P) has opened during the purge period or failed to close within the first 10 seconds of purge on non-recycle programmers or has not closed within 10 minutes on recycle programmers.

LOCKOUT STANDBY
13-3 FUEL VALVE END SWITCH

The fuel valve end switch wired between terminals 13 and 3 opened during purge or at start up.

LOCKOUT PURGE
M-D LIMIT OPEN

The control has held for more than 10 minutes waiting for the low fire switch (M-D) to close. This does not apply to the EPD167 or EP387.

LOCKOUT PTFI
3-P INTLK OPEN

The running interlock circuit (3-P) has opened during the pilot trial for ignition period. **Applies to non-recycle programmers only.**

LOCKOUT MTFI
3-P INTLK OPEN

The running interlock circuit (3-P) has opened during the main trial for ignition period. **Applies to non-recycle programmers only.**

LOCKOUT AUTO
3-P INTLK OPEN

The running interlock circuit (3-P) has opened during the main burner on period. **Applies to non-recycle programmers only.**



LOCKOUT STANDBY FALSE FLAME	Flame has been sensed during the burner off time (term. L1-13 open) or during the purge period for sixty (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.
LOCKOUT PTFI SCANNER NOISE	This message appears because of ignition cable noise. Reroute scanner wires away from high voltage ignition cables. Check for proper spark gap or cracked porcelain. Check for proper grounding of wiring base and power supply. Replace worn ignition cable and/or faulty connections.
LOCKOUT PURGE SHORT CIRCUIT TERM 5,6,7	Excessive current or short circuit detected on terminals 5, 6, or 7 during PTFI, MTFI, or Auto. The control will lockout upon sensing this condition on two consecutive cycles.
LOCKOUT PTFI FUEL VALVE STATE CHANGE	During pilot trial for ignition period, voltage sensed on terminal 7 is different from the previous cycle. (e.g.: jumper added or removed between term. 7 and 5 or 6).
LOCKOUT AUTO LINE FREQUENCY NOISE DETECTED	Electrical noise detected on terminals L1 and L2.
LOCKOUT AC POWER FAIL	A power interruption to terminals L1 and L2 has caused the control to lockout. Applies to EP165 and EP166 programmers only.

CHECK MESSAGES

CHECK PURGE D-8 HI LIMIT	0:15	The "Run-Check" switch has been placed in the Check position during purge and will hold indefinitely. The firing rate motor is being driven to the high purge position.
CHECK PURGE M-D LOW LIMIT	0:45	The "Run-Check" switch has been placed in the Check position after high fire purge and will hold indefinitely. The firing rate motor is being driven to the low fire position.
CHECK PTFI FLAME SIGNAL	19	The "Run-Check" switch has been placed in the Check position during the pilot trial for ignition period. Flame signal strength is displayed in the upper right hand position. The control will lockout on safety only when no flame signal is sensed for a continuous 30 seconds while the control is in the Check position.
CHECK AUTO LOW FIRE SIGNAL	25	The "Run-Check" switch has been placed in the Check position during the main burner on period. and the firing rate motor is driven to the low fire position. Flame signal strength is displayed in the upper right hand corner.



CHECK STANDBY
UNIT ADDRESS 00

The "Check-Run" switch has been placed in the Check position with the operating control circuit (L1-13) open. Every time the Reset button is depressed and held for one second will increment the Unit Address by one. Refer to programmer bulletin for additional information on Unit Address.

DIAGNOSTIC MESSAGES

LOCKOUT AUTO
CHECK AMPLIFIER

POSSIBLE CAUSE

- High electrical noise
- Defective field wiring.
- Defective amplifier.
- Defective IR scanner.

SOLUTION

- Check for proper ground on power supply.
- Install noise suppressor on power supply.
- Make sure line phase on interlock circuit is the same as found on L1/L2 power supply to E110.
- Replace amplifier.
- Replace IR cell.

LOCKOUT PTFI
CHECK CHASSIS

- Voltage on terminal 7 at improper time.
- Defective Chassis.
- Defective Programmer.

- Check wiring to terminal 7.
- Replace Chassis (EB700).
- Replace Programmer.

LOCKOUT PURGE
CHECK PROGRAMMER

- Voltage on terminal 5 or 6 at improper time.
- High Electrical Noise.
- Failed Programmer.
- Worn Chassis.

- Check wiring to terminals 5 and 6.
- Install noise suppressor on power supply
- Re-route scanner wires away from high voltage wiring.
- Replace Programmer.
- Replace Chassis.

LOCKOUT AUTO
CHECK SCANNER

- Flame signal detected during shutter close time on 45UV5 scanner.

- Stuck scanner shutter. Replace 45UV5 scanner.

LOCKOUT AUTO
CHECK EXPANSION MODULE

- The E300 Expansion Module has a defective optocoupler.

- Replace E300 Expansion Module.

LOCKOUT AUTO
AUTO CHECK AMPLIFIER FAIL

- Amplifier has failed diagnostic checks.

- Replace amplifier.

FIREYE ED510
SYSTEM ERROR

- Defective programmer.

- Replace programmer.



HISTORICAL INFORMATION /SYSTEM SUB-MENUS

At any time the control is powered, the SCRL key will scroll through and display the total number of burner cycles, burner lockouts, and system hours on the bottom line of the ED510 display. The top line will continue to show the current run mode of the control (e.g. PURGE, AUTO, etc.). Following the historical information, the SCRL key will display four (4) System Sub-menus providing the following information and/or functions:

- Lockout History (with burner cycle and burner hour time stamp).
- E300 Message Select (to program messages associated with the E300 Expansion Module).
- Program Setup (to display programmer type, purge timing, FFRT timing, etc.).
- System Information (status of M-D circuit, average pilot flame signal, etc.).

The system sub-menus require the MODE key to gain access to the information associated with each sub-menu. An arrow is displayed in the lower right hand corner of the display to indicate a system sub-menu. Every time the SCRL key is pressed the information is displayed as follows:

AUTO	40
BNR HOURS	823

Number of hours Terminal 7 (main fuel) is energized.*

AUTO	40
BNR CYCLES	385

Number of burner operating cycles. (L1-13 closed).*

AUTO	40
BNR LOCKOUTS	21

Number of burner lockouts.*

AUTO	40
SYS HOURS	1233

Number of hours the control has been powered.*

AUTO	40
LOCKOUT HISTORY	→

Sub-menu to display the cause of the last 6 lockouts. The MODE key is required to display the actual lockouts.

AUTO	40
E300 MSG SELECT	→

Sub-menu to program the messages associated with the operation of the E300 Expansion Module. The MODE key is required to enter the sub-menu.

AUTO	40
PROGRAM SETUP	→

Sub-menu to display various operating parameters of the programmer and amplifier. The MODE key is required to enter the sub-menu.

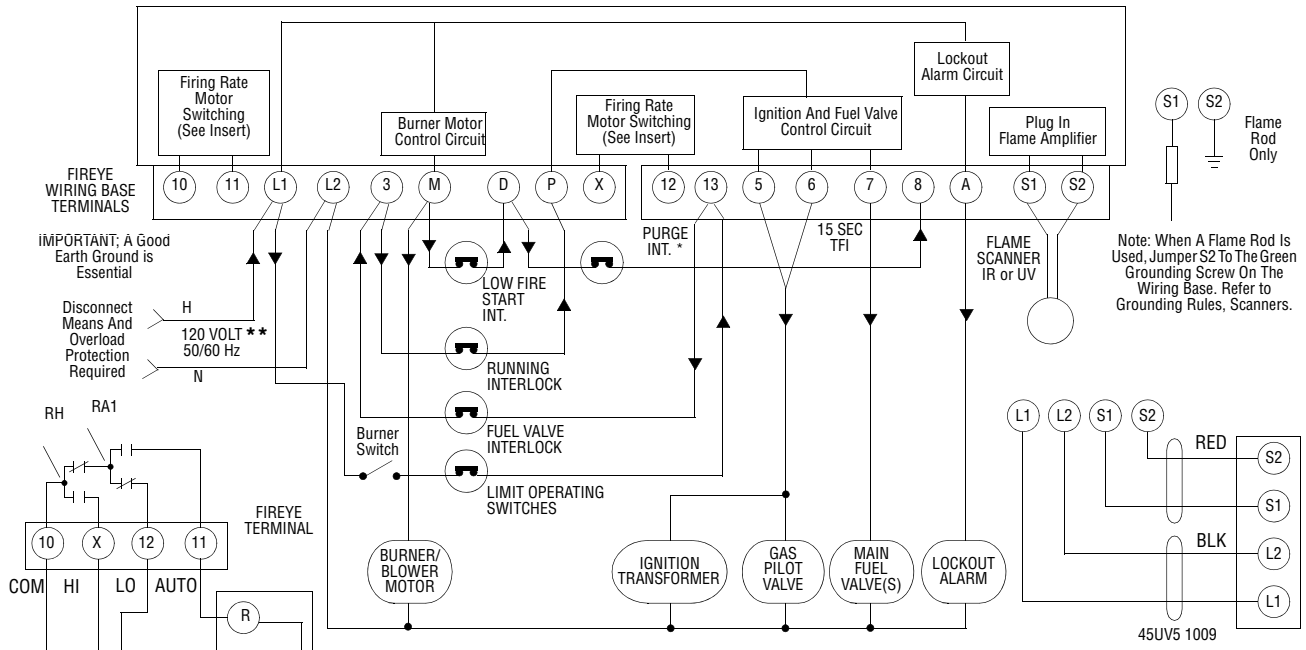
AUTO	40
SYSTEM INFO	→

Sub-menu to display information pertaining to the operation of the control. The MODE key is required to enter the sub-menu.

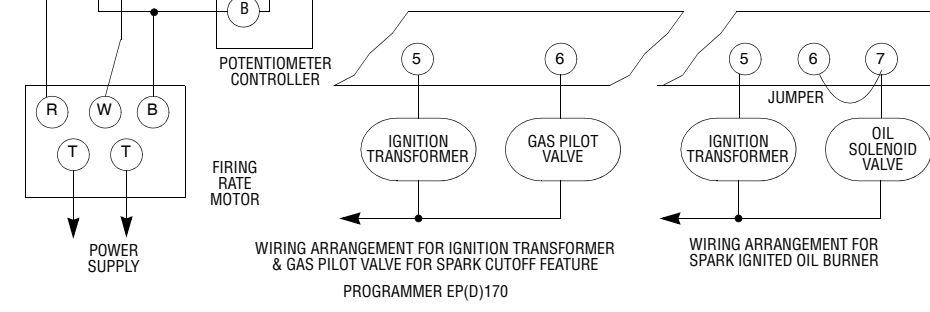
* Refer to SYSTEM INFO to reset value to zero.



SUGGESTED WIRING DIAGRAM FOR EP(D)160, EP161, AND EP(D)170 PROGRAMMERS



TYPICAL WIRING ARRANGEMENT FOR PILOT IGNITED BURNER



FIREYE PART NUMBER	Trial for Ignition/ Pilot (Seconds)		Trial for Ignition/ Main (Seconds)	
	Term 5	Term 6	Term 5	Term 6
EP(D)160	10	10	10	15
EPD167	10	10	10	15
EP(D)161	10	10	10	30
EP165*	10	10	0	10
EP166*	10	10	0	15
EP(D)170	5	10	0	10

Caution: All safety limit switches should be approved as limit controls and should be wired directly in the circuit of the Flame Safeguard control.

The use of electronic switches to close interlock circuits may cause erratic operation.

Refer to Service Note 100 (SN-100) or Suggested Grounding Rules later in this document.

* EP165 AND EP166 INCLUDE 5 SECOND PILOT STABILIZATION PERIOD.
 ** ALL FLAME-MONITOR INTERLOCK INPUTS MUST BE THE SAME AC PHASE

MAINTENANCE

Periodically, the spark electrode should be inspected for proper gapping and cracked ceramics. At ignition time, the high energy from the ignition transformer will attempt to conduct to the point of least resistance and with an improper spark gap, where the conduction takes place will no longer be controlled.

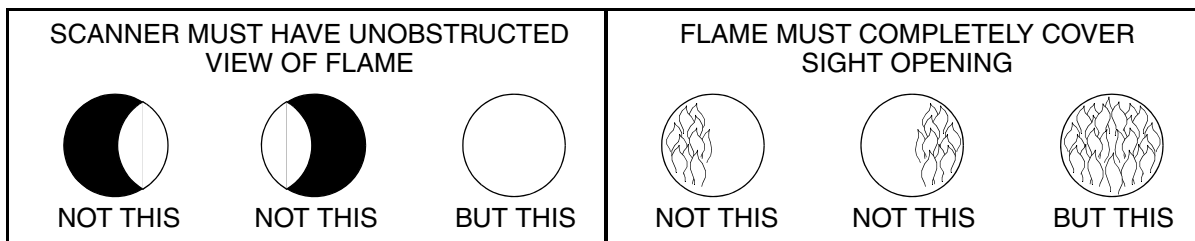
The VA rating of the control transformer must be sized to handle the inrush currents of the pilot solenoid and ignition transformer at PTFI and then the inrush currents of the main fuel valve assembly at MTFI time.

Inspect neatness of wiring in junction boxes and cabinets. It is best to have connections short and direct and also not having wires bunched up and tied off. Also, connections should be periodically inspected for tightness and corrosion.

INSTALLATION - UV SCANNERS

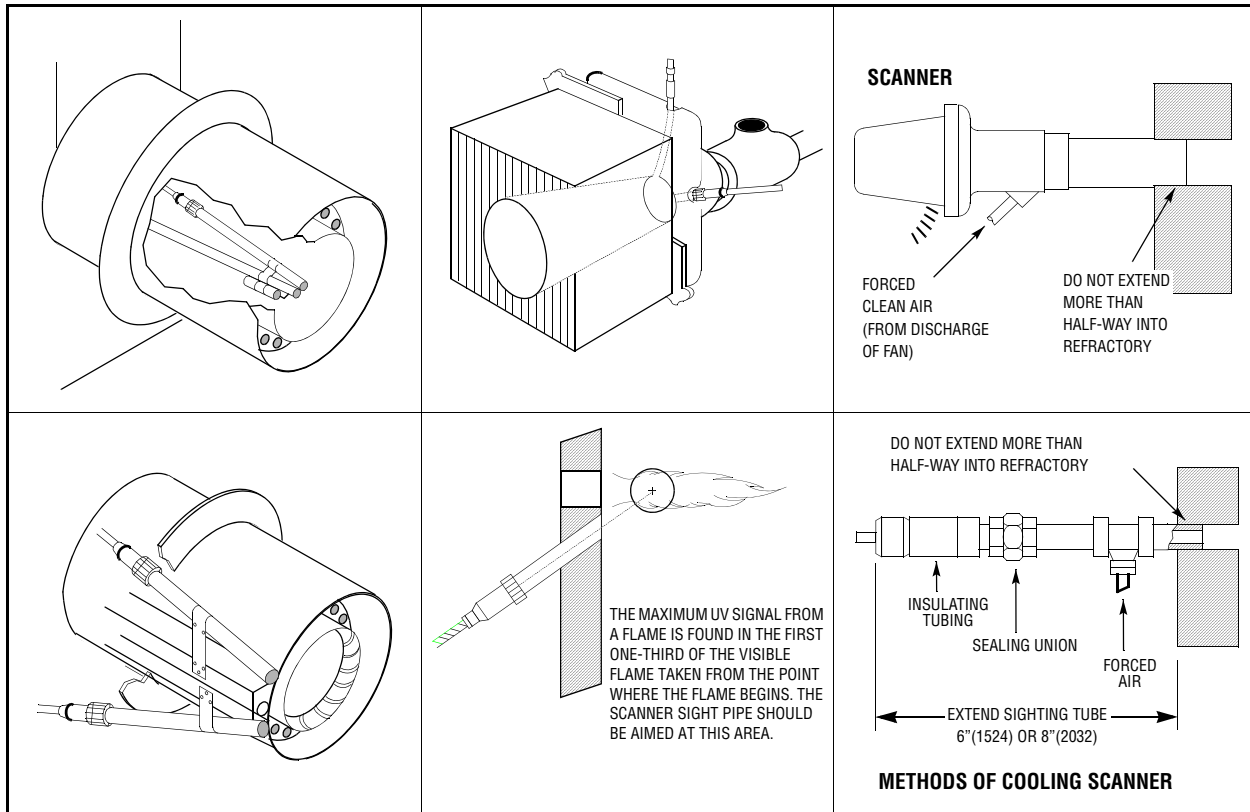
Where possible, obtain the burner manufacturer's instructions for mounting the scanner. This information is available for most standard burners. The scanner mounting should comply with the following general instructions:

1. Position the UV1, UV2 or UV90 Scanner within 30 inches of the flame to be monitored; the 45UV5 within 72 inches, closer if possible.
2. Select a scanner location that will remain within the ambient temperature limits of the UV Scanner. If cooling is required, use an insulating coupling (Fireye #35-69 for UV1, UV2 Scanners, #35-127-1 for 45UV5) to reduce conducted heat.
3. The UV1, UV2, 45UV5 Scanners are designed to seal off the sight pipe up to 1 PSI pressure. Higher furnace pressures should be sealed off. To seal off positive furnace pressure up to 100 PSI for UV1, UV2 Scanners, install a quartz window coupling (#60-1257) For 45UV5 Scanners, use #60-1199 coupling. Add cooling air to reduce the scanner sight pipe temperature.
4. Install the scanner on a standard NPT pipe (UV1: 1/2", UV2: 3/8", 45UV5: 1") whose position is rigidly fixed. If the scanner mounting pipe sights through the refractory, do not extend it more than halfway through. Swivel flanges are available if desired (#60-302 for UV1, UV2 Scanners, #60-1664-3 for 45UV5). The sight pipe must permit an unobstructed view of the pilot and/or main flame, and both pilot and main flames must completely cover the scanner field of view.



5. Smoke or unburned combustion gases absorb ultraviolet energy. On installations with negative pressure combustion chambers, a small hole drilled in the UV1, UV2 sight pipe will assist in keeping the pipe clean and free from smoke. For positive pressure furnaces, provide clean air to pressurize the sight pipe, if necessary.
6. Two UV1, UV2 or UV90 Scanners may be installed on the burner if it is necessary to view two areas to obtain reliable detection of the flame. They should be wired in parallel. Only one repetitive self-checking 45UV5 Scanner may be installed on a burner.
7. To increase scanner sensitivity with UV1, UV2 Scanners, a quartz lens permits location of the scanner at twice the normal distance. Use 1/2" x 1 1/2" pipe nipple between UV1 Scanner and the coupling. Use 3/8" pipe nipple and a 1/2" x 3/8" bushing on UV2 installations.
8. Request the assistance of any Fireye field office for recommendations of a proper scanner installation on a non-standard application.

TYPICAL SCANNER INSTALLATIONS



OPERATION — 45UV5 SELF-CHECKING UV SCANNER

Self-checking ultraviolet scanners should be used in applications where burner firing operation is continuous or where the burner is on for long periods of time without recycling. In addition, ultraviolet self-checking systems are mandatory in some locations.

The operation of this type of system consists of maintaining the flame scanning capability at all times while also proving that the ultraviolet tube is firing properly. This is done periodically by mechanically closing off the sight of the UV tube and checking to make sure that the flame signal goes away. A shutter assembly in the 45UV5 scanner performs this function. The diagram below explains the process further.

If the shutter assembly in the scanner fails, the tube is faulty, or there is insufficient power to the scanner, the Flame-Monitor will LOCKOUT and display the following message LOCKOUT CHECK SCANNER. The ultraviolet tube is replaceable (P/N 4-314-1).

A lockout will result if a minimum signal is detected for three consecutive shutter closed periods.

