

# SOLID STATE BURNER MANAGEMENT CONTROLS SERIES D30



UV90



45UV5



UV8A



45UV3-1050



UV1A



69ND1



48PT2

## DESCRIPTION

Fireye Series D30 Burner Management Controls provide ignition and main flame failure protection for automatically ignited oil, gas and combination fuel burners. In conjunction with limit-operating controls and interlock devices it automatically programs, with solid state timing logic, the burner/blower motor, ignition, and main fuel valve(s). The control cycles automatically when the operating control closes and following a power interruption, but must be manually reset following a safety shutdown.

The start-up programming includes a safe start check on each start. If flame signal (real or simulated) is detected, the ignition will not be energized and safety lockout will occur. Terminals are provided for a main fuel valve proof of closure interlock, which must be closed before start-up and during prepurge. Proof of the low fire start position is required before ignition. An interlock circuit is provided for air flow switches, fuel pressure switches etc. which must be closed during the prepurge and firing period. The control system de-energizes all fuel valves within four seconds following flame failure. An alarm circuit actuates audible and visual alarms following a safety lockout.

Plug-in amplifier modules permit the selection of Ultraviolet, repetitive self-check Ultraviolet, AUTOCHECK infrared, or Rectification methods of flame detection. For increased safety and reliability, Fireye 72D1R1-3 AUTOCHECK infrared amplifiers (using the pulsing flame signal) and 72DUVS-45UV5 Ultraviolet amplifier-scanner (using a scanner shutter) check the function of the flame detecting system for any component failure during each burner firing cycle. Meter test jacks on each amplifier module provide flame signal readout with a DC voltmeter.

The solid state programmer is a plug-in module. A test switch permits the operator to stop the programming before energizing the main fuel valves, for test purposes.

The complete control incorporates plug-in design for easy installation. All flame scanners are miniaturized. Fireye D30 Series controls directly replace similar Fireye C-Series models.



## SPECIFICATIONS

**Supply Voltage:** 120V (Max. 132V, Min. 102V) 50/60 Hz.  
**Power Consumption:** Operating 20VA  
**Maximum simultaneous connected load:** 2000VA  
**Humidity:** 85% RH max. Non-Condensing

OPERATING TEMPERATURE LIMITS:		
PRODUCT	MAX.	MIN.
Control-Amplifier-Programmer	140°F (60°C)	- 40°F/C
UV1A, UV2, UV8A, UV90 Scanner	200°F (93°C)	- 40°F/C
45UV5 Scanner	200°F (93°C)	- 40°F/C
48PT2 Scanner	140°F (60°C)	- 40°F/C
69ND1 Flame Rod (TIP 2460°F)	1500°F (816°C)	- 40°F/C
Humidity 85% RH MAX. NON-Condensing		

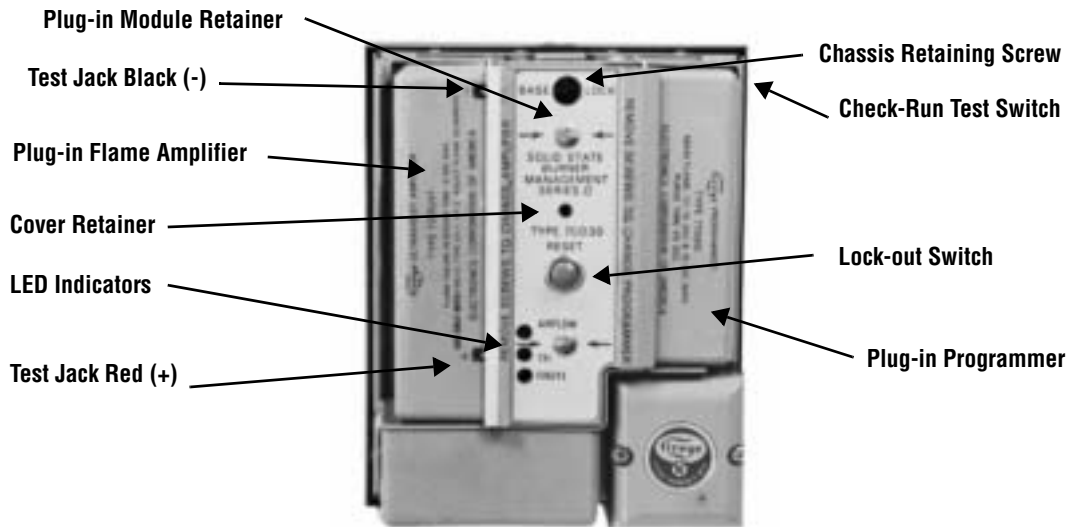
MAXIMUM LOAD RATING FOR SERIES D30 CONTROLS			
Terminal	Typical Load	A Maximum Rating @120V -60Hz	B Alternate Rating @120V -60Hz
X, 5, 6 (Individually or Combined)	Pilot Valve(s) and Ignition Transformers	50VA Pilot Duty (solenoid valves) plus 500VA (Transformer)	125VA Pilot Duty (solenoid valve) plus 250VA (Transformer)
7	Main Fuel Valve(s)	250VA Pilot Duty (Solenoid Valve)	1250VA Opening. 500VA holding (Motorized Valve) plus 65VA Pilot Duty (solenoid valve)
M	Burner/Blower Motor	9.8 F.L.A. 58.8 L.R.A.	250VA Pilot Duty (motor starter coil)
A	Alarm	50VA Pilot Duty	
Terminal ratings may be selected from either column A or B: (selecting the rating from the column for each terminal which best applies to the connected load on that terminal).			

## APPROVALS

**Underwriters Laboratories Inc.** Listed: Guide MCCZ, File Mp1537  
**Underwriters Laboratories, Inc.** Recognized: Guide MCCZ2, File MP1537  
**Canadian Standards Association:** Certified: LR7989  
**Factory Mutual System:** Approved: Report (J.I.) 1C1A1.AF

### Three LED lights on the Fireye chassis provide the following indication:

- Air Flow — lights when interlock circuit is closed.
- TFI — lights during pilot trial-for-ignition period.
- Fireye — lights when flame is detected.



## DESCRIPTION OF FIREYE D-30 SYSTEM COMPONENTS

Control	Part Numbers	
Control Chassis and Cover	70D30	
Plug-in Program Module	71D81-15 Second purge 71D80-30 Second purge 71D90-90 Second purge	
Plug-in Amplifier module and Flame Scanner	Amplifier	Flame Scanner
	72DRT1 Rectification	69ND1-1000K4 1/2" mount - 12" flamerod 69ND1-1000K6 1/2" mount - 18" flamerod 69ND1-1000K8 1/2" mount - 24" flamerod
	72D1R1 infra-red (IR) AUTOCHECK 71DIR3 for specific applications (see note below)	48PT2-1003 1/2" straight mount 96" cable 48PT2-9003 1/2" angle mount 96" cable 48PT2-1007 1/2" straight mount 48" cable 48PT2-9007 1/2" angle mount 48" cable
	72DUV1 Ultraviolet (UV)	UV1A3 1/2" mount 36" cable UV1A6 1/2" mount 72" cable UV2 3/8" mount 36" cable UV8A 90° head 1/2" NPT mount, 72" unshielded leads. UV90-3, -6, -9 90° side opening, 36" (900mm), 72" (1800mm), or 108" (2700mm) cable 45UV3-1050 3/4" mount, cast aluminum housing, 8' wire.
	72DUVS4: Ultraviolet Repetitive Self-Check 2-4 sec. FFRT. 72DUVS1T: Ultraviolet Repetitive Self-check 1 sec. FFRT.	45UV5-1009 1" mount, 72" wire leads
Wiring Base	60-1386-2 Standard base for surface mounting 60-1466-2 Open base for cabinet mounting.	
<p><b>NOTE:</b> Infra-red "Autocheck" amplifier module 72D1R3 may be specified for burner applications firing special fuel such as sawdust, sander dust, low BTU gas.  <b>The 72D1R3 is not to be used on any liquid fuel fired burner since it may result in malfunctions causing damage to property and/or injury to personnel.</b></p>		

## ORDERING INFORMATION

Each complete Fireeye Series D30 system includes:

1. A control chassis and cover.
2. A plug-in Programmer.
3. A plug-in Amplifier.
4. A flame scanner.
5. A wiring base.

To specify a control system which provides 30 seconds prepurge, with infrared (AUTOCHECK) flame detection for surface mounting, select the following:

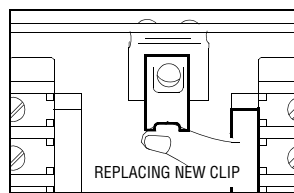
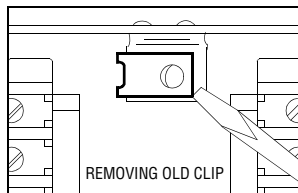
**70D30** Control and Cover

**71D80** Programmer

**72D1R1** Amplifier

**48PT2** Flame Scanner (specify length and mount)

**60-1386** Wiring Base



*Note: When a Fireeye C-Series unit is replaced with a D-Series unit, the chassis retaining clip (for quarter turn fastener) in the wiring base must be replaced with a threaded clip that is supplied with each D-Series control.*

Fireeye Series D30 controls supersede similar Fireeye C-Series controls and are directly plug-in interchangeable.



**CAUTION: While all controls in the D-Series 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



**CAUTION: Installer must be a trained safety control technician. Verify that Electrical Power is disconnected before starting installation.**

Follow the burner manufacturer's instructions, if supplied. Otherwise proceed as follows:

### Wiring Base

Mount the control wiring base on the burner or on a panel. The location should be free from excessive vibration and within the specified ambient temperature rating. The base may be mounted in any angular position.

All wiring should comply with applicable electrical codes and be suitable for 75°C min. The terminals in the wiring base permit a variety of connection methods — wire loop, eyelet, lug or quick connect. A green grounding terminal is provided for equipment bonding. Circuit recommendations are provided later in this document. Consult with the factory for assistance with non-standard applications.

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## ELECTRICAL RATINGS

VA ratings (not specified as pilot duty) permit the connection of transformers and similar devices whose inrush current is approximately the same as their running current.

VA pilot duty ratings permit the connection of relays, solenoid valves, lamps, etc. whose total operating load does not exceed the published rating and whose total inrush current does not exceed 10 times the rating. Running and locked rotor ratings are intended for motors. VA and VA pilot duty loads may be added to a motor load provided the total load does not exceed the published rating.



**CAUTION: Published load ratings assume that no contact be required to handle inrush current more often than once in 15 seconds. The use of control switches, solenoids, relays, etc. which chatter will lead to premature failure of switches in the Fireye control. Similarly, the contacts cannot be expected to handle short circuit currents without damage. It is important to run through a test operation (with fuel shut off) following the tripping of a circuit breaker, a blown fuse or any known instance of chattering.**

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## INSTALLING THE PROGRAMMER AND AMPLIFIER MODULES

To assemble or disassemble a control and its plug-in modules, place the unit on a work bench, remove the two module retainer hold-down screws and lift off the module retainer. The module retainer **cannot** be removed if the control is secured into a wiring base. Insert the appropriate amplifier module in the slots at the left side of the unit and gently push the module into position.

Insert the appropriate programmer module in the slots at the right side of the unit and gently push the module into position. Replace the Module retainer and tighten the two hold-down screws. The unit **cannot** be installed on a wiring base if the module retainer is not in place.



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## BEFORE INSTALLING THE CONTROL

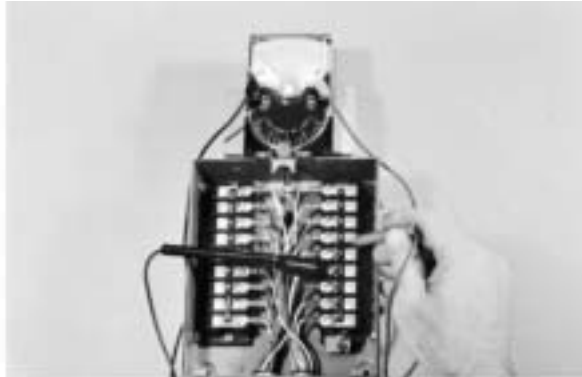
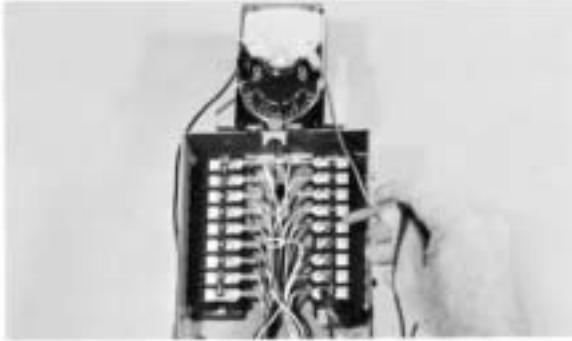


**CAUTION: Assure that electric power is shut off.**

Verify that the supply voltage connected to terminals L1, L2 is 120 volts AC nominal. Test the electrical field wiring for short circuits and grounds. The recommended method requires the use of an ohmmeter set on its **lowest** resistance scale.

1. Touch the meter probes together and calibrate it accurately to assure a reliable test.
2. Disconnect the neutral wire (L2) from the control system at the power source. Clip one meter test lead to the grounded green terminal on the lower right side of the wiring base and with the other probe touch every other terminal. At no time should the meter read other than infinity.

3. Reconnect the neutral wire (L2) at the power source. Remove the test probe from the grounded terminal and reconnect it to terminal L2 in the wiring base. With the other probe, touch each terminal. It is normal to obtain a resistance reading on the meter at some terminals during this test as there are resistive loads (coils-transformers-lamps, etc.) connected whose normal DC resistance may be less than 5 ohms. However, at no time should the test meter read zero ohms.



4. If either a ground or a short circuit is detected, it must be eliminated before the control is plugged into the wiring base and power turned on. Otherwise, the control may be destroyed or improper operation may occur.

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## INSTALLING THE CONTROL



**CAUTION: Assure that electric power is shut off.**

1. Check the electrical tabs on the bottom of the chassis — if they are bent out of position, reposition them with your fingers using the angle on the bottom of the red tag shipped with the control as a guide.
2. Insert the slots at the bottom of the assembled control in the tabs on the wiring base. Push the control into position. Insert a screwdriver through the hole in the top of the control and tighten the retaining screw.



## INSTALLATION - UV SCANNERS

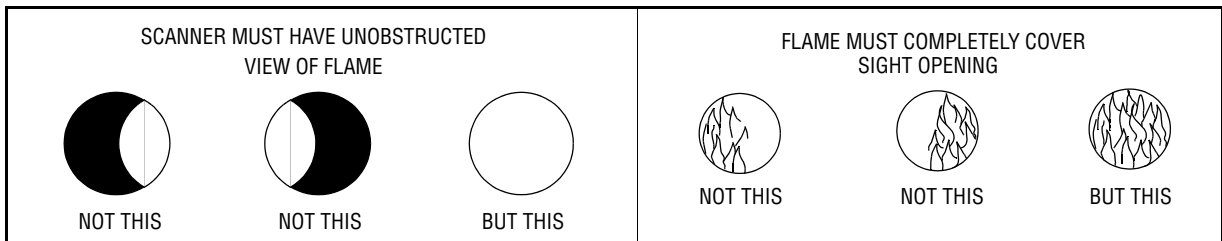
Where possible, obtain the Burner Manufacturer's Instructions for mounting the scanner. This information is available for most standard burners manufactured. The scanner mounting should comply with the instructions that follow.

1. Position the UV1, UV2, UV8A scanner within 36 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 P/N 35-69 for UV1, UV2, UV8A scanners, P/N 35-127-1 for 45UV5) to reduce conducted heat.
3. The UV1, UV2, UV8A, 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 100PSI for UV1, UV2, UV8A scanners, install a quartz window coupling (P/N 60-1257). For 45UV5 scanners, use P/N 60-1199 coupling. Add cooling air to reduce the scanner sight pipe temperature.
4. Install the scanner on a standard NPT pipe (UV1 and UV8A - 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 (P/N 60-302 for UV1, UV2, UV8A scanners, P/N 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.



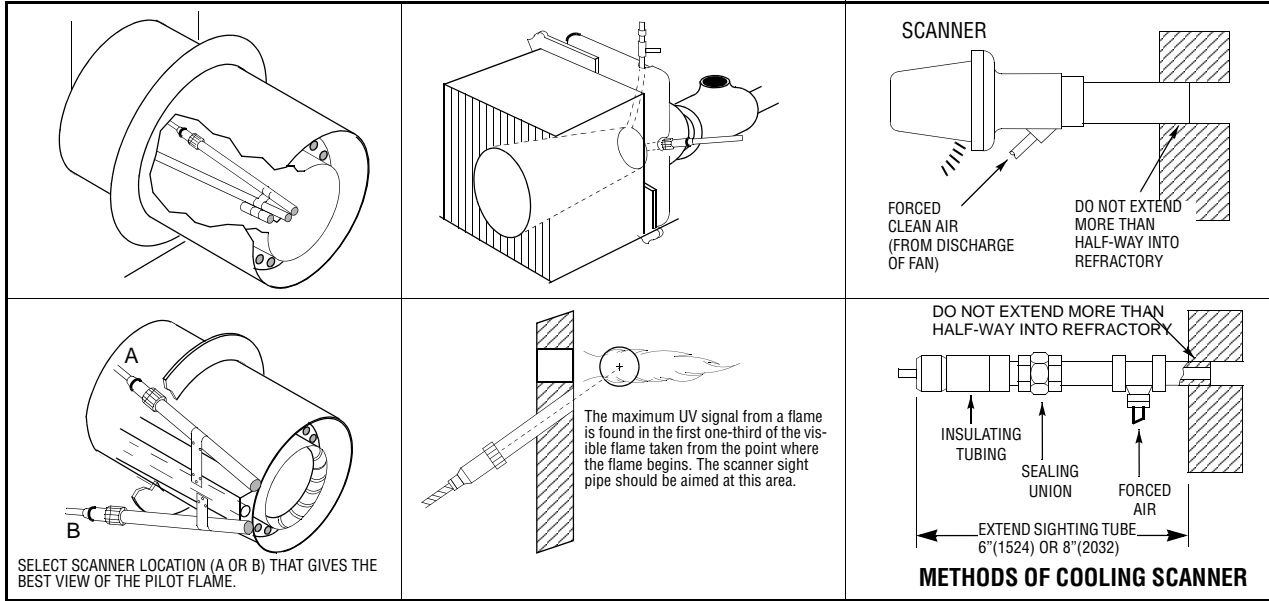
5. **CAUTION: The scanner must not sight the ignition spark directly, or any part of the burner that can reflect the spark back to the scanner. The scanner must not see a pilot flame that is too small to reliably ignite the main flame.**
6. Smoke or unburned combustion gases absorb ultraviolet radiation. On installations having negative pressure combustion chambers, a small hole drilled in the UV1, UV2 and UV8A sight pipe will assist in keeping the pipe clean and free from smoke. The 45UV5 has a 3/8" plug in the mounting flange that can be removed. For positive pressure furnaces, provide clean air to pressurize the sight pipe, if necessary.
7. Two UV1, UV2 and UV8A scanners may be installed on one 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 45UV5-1009 scanner may be installed on a burner.
8. To increase the scanner sensitivity with UV1, UV2 and UV8A scanners, a union with quartz lens (P/N 60-1290) permits location of the scanner at twice the normal distance. Use 1/2" x 3/8" bushing on UV2 installations. Install a 1/2" x 1 1/2" nipple between the scanner and the union.

Request the assistance of any Fireye field office for recommendations on proper scanner installation for a non-standard application



Since oil and gas flames radiate more ultraviolet energy from the base of the flame than from further out in the flame, this fact should be taken into consideration when installing the scanner sight pipe.

## TYPICAL SCANNER INSTALLATIONS



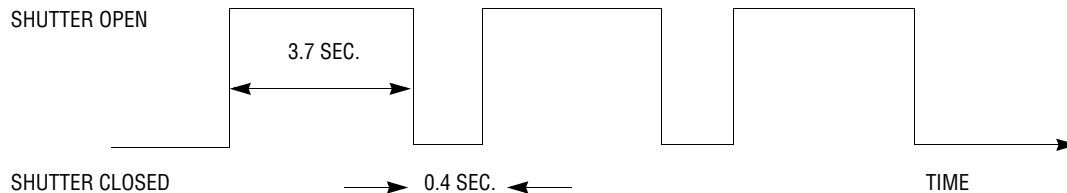
## OPERATION — 45UV5 SELF-CHECKING UV SCANNER

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 control will LOCKOUT. 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.



## Wiring — UV Scanners

To connect the scanner to the control, the UV1 and UV8A scanners are supplied with 36" or 72" of flexible cable. The UV2 comes with 36" of flexible cable, to connect the scanner to the control. The 45UV5-1009 is supplied with four 72" lead wires. Install them in a suitable length of flexible armor cable and connect it to the control. A conduit connector is supplied with the scanner. Connect black wires (shutter) to terminals L1, L2; red wires (UV tube) to terminals S1, S2.

Use the following instructions if the scanner wiring must be extended. Scanner wires should be installed in a separate conduit. The wires from several scanners may be installed in a common conduit.

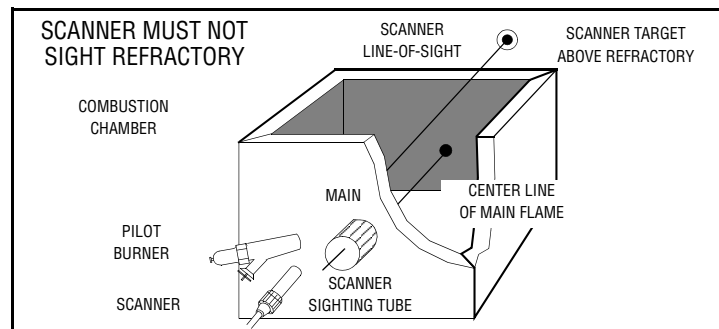


1. Selection of Wire.
  - Use #14, 16 or 18 wires with 75 $\sqrt{C}$ , 600 volt insulation for up to 100 foot distances (signal loss approximately 20% at 100 feet).
  - For extended scanner wiring up to 500 feet, and for shorter lengths to reduce signal loss, use a shielded wire (Belden 8254-RG-62/U coaxial cable, or equivalent) for each scanner wire of UV1, UV2 and UV8A and red wires of 45UV5-1009. The ends of the shielding must be taped and not grounded.
  - Asbestos insulated wire should be avoided.
  - Multiconductor cable is not recommended without prior factory approval.
2. High voltage ignition wiring should not be installed in the same conduit with flame detector wires.

## INSTALLATION — INFRARED SCANNER TYPE 48PT2

Where possible, obtain the burner manufacturer's instructions for mounting the scanner, otherwise proceed as follows. A single scanner is used to detect both pilot and main flames. The sight pipe on which the scanner mounts must be aimed so that the scanner sights a point at the intersection of main and pilot flames. Proper scanner positioning must assure the following:

1. Reliable pilot flame signal.
2. Reliable main flame signal.
3. A pilot flame too short or in the wrong position to ignite the main flame reliably, must not be detected.
4. Scanner must have unobstructed view of flame being monitored.
5. Flame being monitored must completely cover scanner field of view.
6. To avoid nuisance shutdowns, it is important to avoid sighting hot refractory and to keep scanner temperature low (below 125 $\sqrt{F}$ ).
7. When the proper position has been established, drill a hole through the furnace wall and install a 4" to 8" length of threaded black iron pipe on which to mount the 48PT2 scanner.
8. When a satisfactory sighting position has been confirmed by operating tests, the sight tube should be firmly welded in place.



### Wiring

Attach the cable supplied with the scanner to a junction box. Splice the cable wires to a pair of wires not smaller than #18. Install the complete run in a separate conduit to the control. **Continuous conduit bonding between scanner and control is mandatory.** Scanner may be located up to 100 feet from control. Do not pass scanner wiring through any junction box containing other wires. Do not run other wires through scanner conduit. Asbestos insulated wire should be avoided.

### Keeping the Scanner Cool

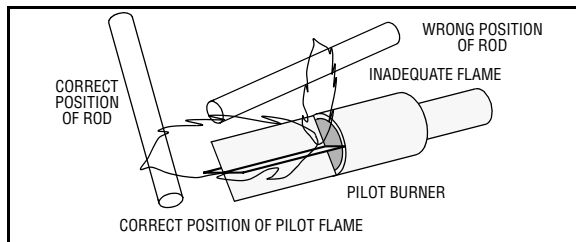
The Firetron Scanner (Temperature limit 125F) should never get too hot to grasp comfortable in the hand. Keep the scanner cool by one or more of the following methods.

1. Use 6" to 8" length of pipe between scanner and hot furnace front plate.
2. Use insulating nipple (Part No. 35-69) on the end of the iron pipe.
3. Force air into sighting tube.
4. Make sure sighting tube does not extend more than halfway into refractory wall.
5. Use Fireye sealing union (part #60-801) when using method 3 above.

## INSTALLATION — 69ND1 FLAME ROD

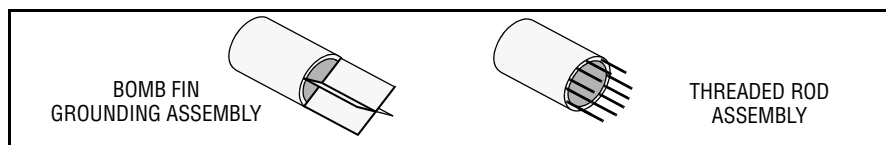
The 69ND1 flame rod proves a gas pilot flame and/or main gas flame. It is a "spark plug" type unit consisting of 1/2" NPT mount, a KANTHAL flame rod, a glazed porcelain insulating rod holder and a spark plug connector for making electrical connection. The 69ND1 is available in 12", 18" or 24" lengths. The flame rod may be located to monitor only the gas pilot flame or both the gas pilot and main gas flames. It is mounted on a 1/2" NPT coupling.

1. Keep flame rod as short as possible.
2. Keep flame rod at least 1/2" from any refractory.
3. Flame rod should enter the pilot flame from the side to safely prove an adequate pilot flame under all draft conditions.
4. If the flame is non luminous (air and gas mixed before burning), the electrode tip should extend at least 1/2" into the flame, but not more than half way through.
5. If the flame is partly luminous, the electrode tip should extend only to the edge of the flame. It is not necessary to maintain absolutely uninterrupted contact with the flame.
6. It is preferable to angle the rod downward to minimize the effect of sagging and to prevent it from coming in contact with any object.
7. An adequate grounding surface for the flame must be provided. The grounding surface in actual contact with the flame must be at least four times greater than the area of the portion of the flame rod in contact with the flame. It is essential to adjust the flame rod and ground area ratio to provide a maximum test meter reading.



**Note:** Interference from the ignition spark can alter the true test-meter reading by adding to or subtracting from it. This trend sometimes may be reversed by interchanging the primary wires (line voltage) to the ignition transformer, and may be made ineffective by the addition of grounded shielding between the flame rod and ignition spark.

8. Proven types of flame grounding adapters as shown below may be used to provide adequate grounding surface. High temperature stainless steel should be used to minimize the effect of metal oxidation. This assembly may be welded directly over the pilot or main burner nozzle.





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## DESCRIPTION OF OPERATION

Fireye control D30 with programmer 71D81 (15 second purge), 71D80 (30 second purge), 71D90 (90 second purge) and with amplifier 72D1R1 (Infrared), 72DUV1 (UV), 72DUVS4 and 72DUVSIT (UV-Self-checking), 72DRT1 (Rectification), provides the following burner operation.

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

### Start Up

1. With power applied, the limit-operating control circuit closed and the main fuel valve interlock closed, the burner/blower motor (Terminal M) is energized.
2. The running interlock circuit closes (air flow, fuel pressure, etc.) and the *Air Flow* indicator (LED) lights.
3. Programmer 71D81 provides a 15 second purge, 71D80 a 30 second purge, 71D90 a 90 second purge.
4. When the purge is completed, and low fire start position proven, the Ignition is energized (Terminals X, 5, 6) and the TFI Indicator (LED) lights.
5. When flame is detected, the Fireye Indicator lights.
6. Five seconds after being energized, Terminal X is deenergized and shuts off the spark ignition. A 5 second pilot stabilization period follows.
7. Following a 10 second trial-for-ignition (if the flame is detected) the main fuel valve (Terminal 7) is energized and the TFI indicator (LED) goes out.
8. Ten seconds later, Terminal 5 de-energizes the interrupted pilot gas valve.
9. Terminal 6 (intermittent pilot), remains energized for the duration of the firing period.
10. End of start up program.

### Normal Shutdown

1. When the operating control opens its circuit, the main fuel valve and the intermittent pilot (if used) is deenergized.
2. Following a 15 second post-purge, the burner/blower motor is deenergized.
3. All indicators go out.

*Note: If the main fuel valve interlock is not closed at the start, the control will not initiate a start up. If it opens during the prepurge and stays open, the programming will stop and the burner/blower motor will be de-energized in 15 seconds. If the running interlock circuit does not close at the start, the programming sequence will not be initiated and the burner/blower motor will continue to be energized. If it opens during the purge, the purge timing will reset. If it opens during a firing cycle, all fuel will shut off immediately and the programming cycle will reset. If the low fire start switch is not closed before ignition, the programming sequence will pause until it closes.*

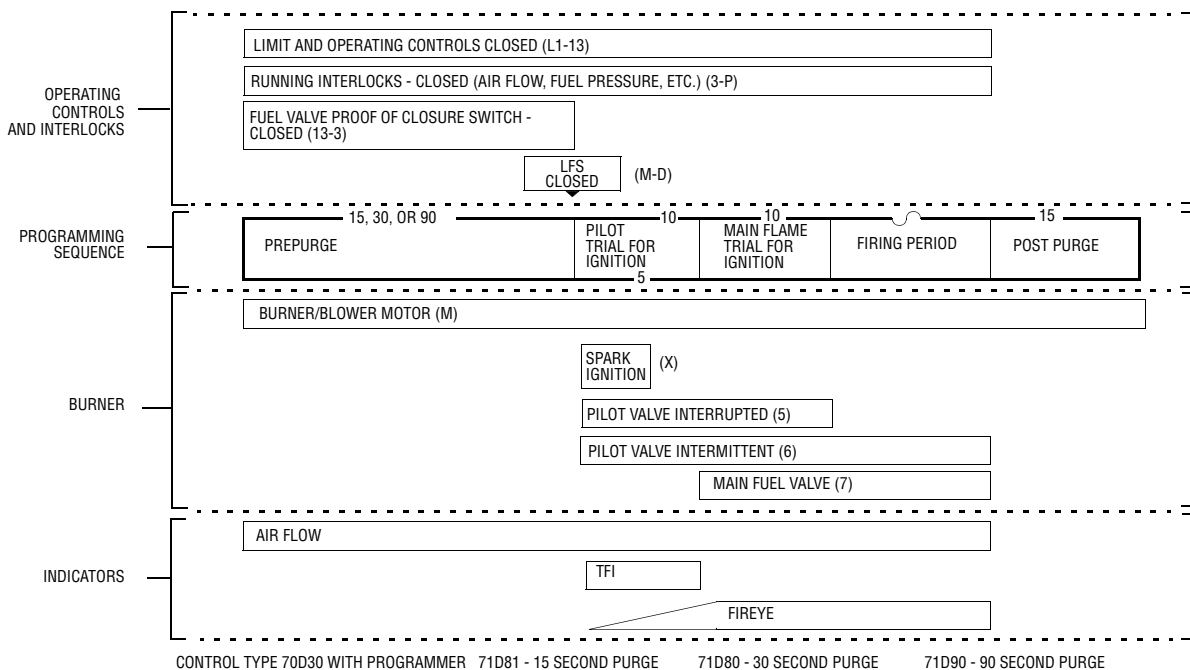
### Safety Shutdown

1. If pilot flame is not detected during the 10 second pilot trial-for-ignition period, the pilot valve and ignition transformer will be deenergized and the control will lockout on safety.
2. If flame is not detected at the end of the 10 second main flame trial-for-ignition period, all fuel valves will be deenergized and the control will lockout on safety.
3. If the main flame fails during a firing cycle, all fuel valves will be deenergized within four seconds after loss of flame signal and the control will lockout on safety.
4. Manual reset is required following any safety lockout.

### Description of Functions of Operating Controls

1. **Operating Controls.** Generally pressure or temperature activated. Normally, when the operating control closes, the burner start-up programming starts. When the operating control opens, the burner shuts off. They are connected between Terminals L1 and 13.
2. **Limit switches.** Generally pressure, water level or temperature activated. These devices stop the burner when the limit switch opens and restarts it when the limit switch recloses. They are connected between Terminals L1 and 13.
3. **Fuel Valve Proof of Closing Interlocks.** 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 valve proof of closure interlock prevents a burner start-up if the valve stem is not in the *valve closed* position.
4. **Running Interlocks.** Generally air flow switches, high and low fuel pressure switches, oil temperature switches, atomizing medium pressure switches, and excess smoke density controls. These interlocks prove proper conditions for normal operation of the burner. They are connected between Terminals 3 and P.
5. **Low Fire Start Interlocks.** Usually a firing rate motor linkage position switch, or a damper position switch, that prove the linkage and dampers are in their proper position for burner light off. They are connected between terminals M and D.

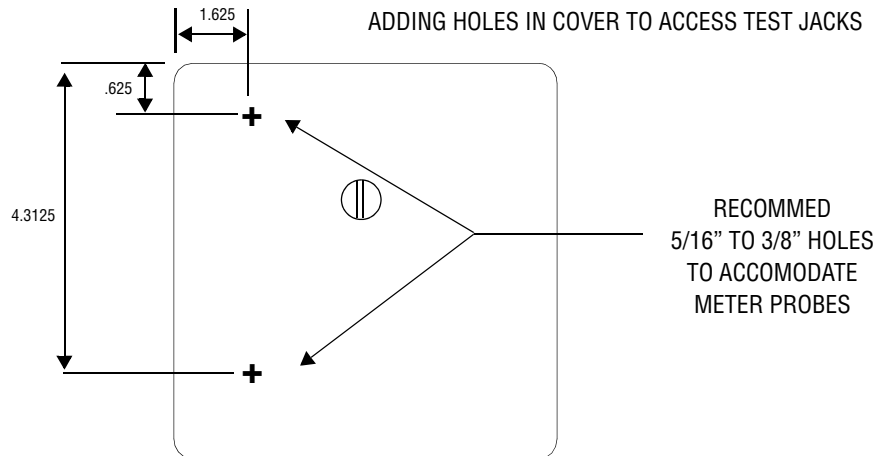
**FIGURE 1. PROGRAMMING SEQUENCE CHART, SERIES D30**



## EXTERNAL METER CONNECTIONS

The test jacks are located on the amplifier card. If external access is desired for a panel meter the figure shown below will assist you in locating the position to drill through the front cover. The hole sizes should be large enough to accommodate the body of the meter probes. The test jacks accept meter probes up to .080" or 2mm in diameter.

FIGURE 2.



## INSTALLATION TESTING



**CAUTION:** Before testing the control operation on the boiler, close the manual main fuel supply. Failure to do this may cause injury or property damage.

1. Close the manual main shut-off fuel valve.
2. Recheck all limit circuit wiring for proper operation and correct connection.
3. Confirm that the automatic main fuel valves are wired to terminal 7.
4. Power the control and electrically check the proper sequence of operation according to the operation section in this bulletin.
5. After assuring that all interlocks and valves are properly wired and that the sequence of operation is correct, open the manual main shut-off valve and proceed cautiously through the boiler light off process. Check all safety interlocks for proper shut down of the boiler.

To measure the Series D30 control's flame signal strength, use a 1,000 ohm/volt (or greater) DC voltmeter or a Digital meter with input impedance of 500K ohms or greater. **Set the meter scale to read a normal flame signal of 18-25 volts DC.**

*Note: The Fireye 45UV5-1009 is a repetitive self-check scanner that contains a highly reliable shutter that closes every 4 seconds to initiate a system check. When the shutter closes, the test jack voltage should go down to approximately zero, and then back to the normal reading in about 2 seconds.*

To assure sufficient flame signal margin to hold in the flame relay during random momentary downward fluctuations of flame signal, it is recommended that a signal close to normal be obtained.

*Note: The leads from the test meter plug into the red and black test jacks on the amplifier (red + black -).*

### Normal Pilot Flame Test



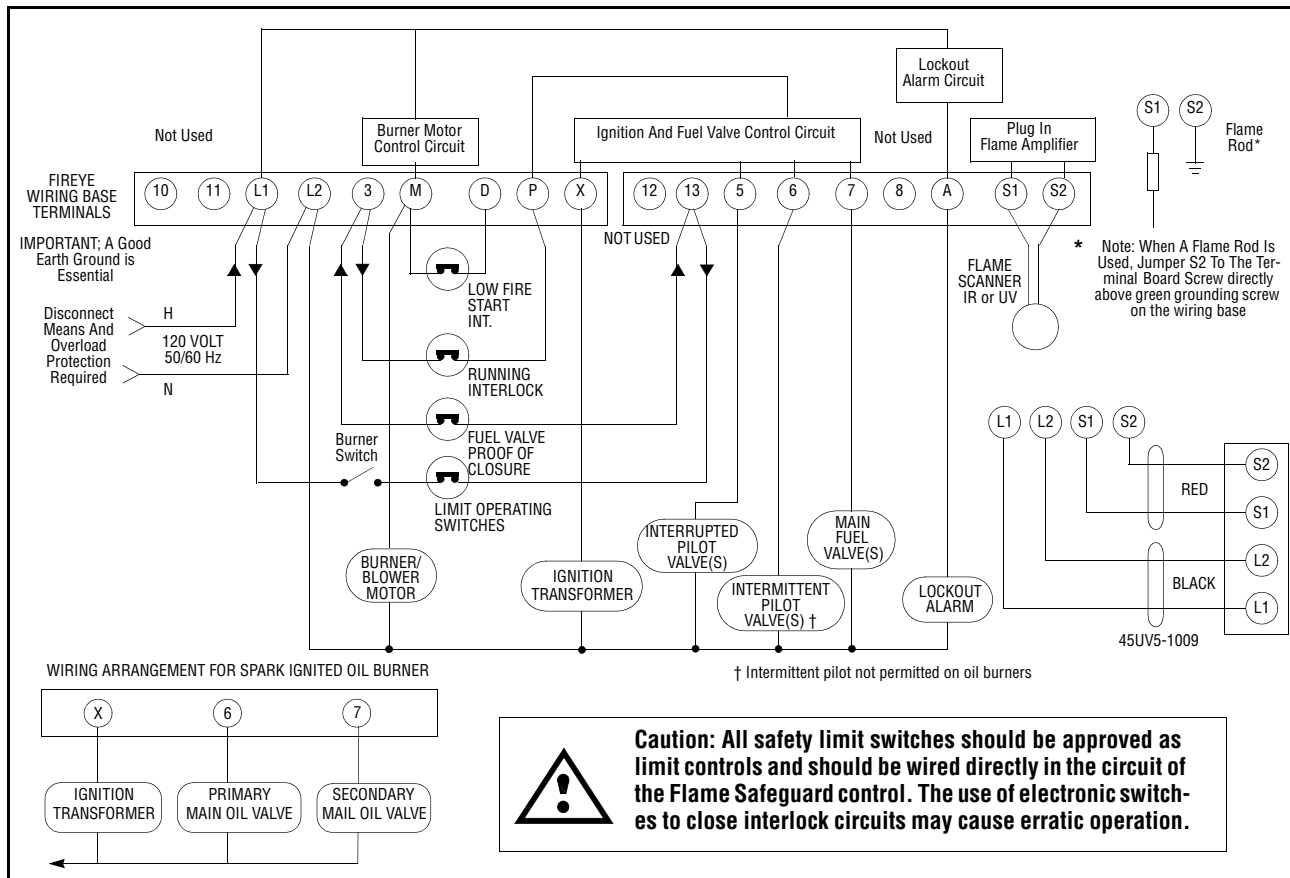
1. **CAUTION:** Before making a pilot flame test, manually shut off the fuel supply to the main burner.
2. Place the *check-run* switch on the programmer in the *check* position. A small tool such as a screwdriver is required.
3. Turn power on and initiate a normal start-up.

4. Observe the pilot flame signal on the test meter. If the average voltage is below normal, re-adjust the pilot flame or re-align the detector.
5. During the pilot flame test and adjustment period, if flame is not detected, the control will lockout. To re-establish the pilot flame trial-for-ignition (TFI) manually reset the lockout switch, and re-purge the boiler.

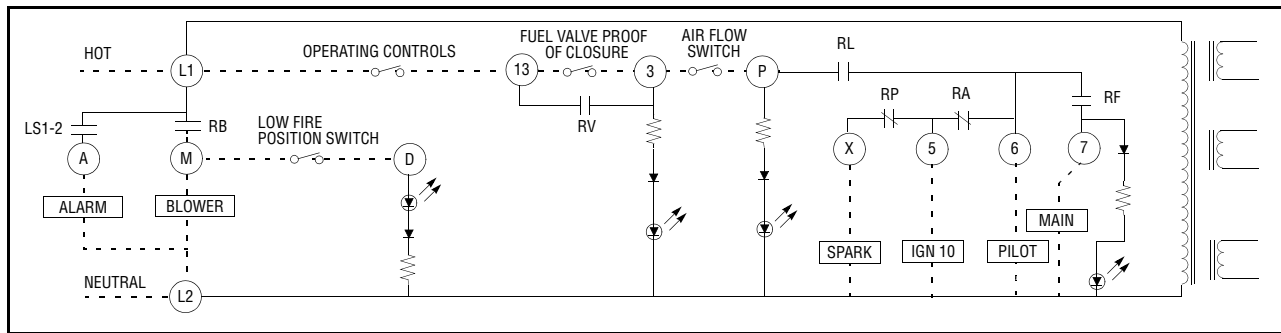


6. When UV flame detection is used, a test is required to verify that UV radiation from the ignition spark is not being detected. To accomplish this, manually shut off both pilot and main fuels. Initiate a normal start-up and when the TFI light comes on, observe the test meter which should read no more than 1 volt. If more than 1 volt is observed, realign the UV scanner, and/or shield the spark from the scanner's view. Programmers 71D80, 71D81, 71D90 provide ignition spark cutoff prior to pilot flame proving (when the ignition transformer is connected to Terminal X), to assist with installations where UV radiation from spark ignition is difficult to eliminate from the view of the UV scanner.
7. With all methods of flame detection, check pilot flame failure response by manually shutting off the pilot fuel and then initiate a normal start-up. With no pilot flame present, the control will de-energize the pilot assembly at the end of the trial-for-ignition interval, and the control will lockout. The check-run switch must be in the "run" position for this test.

**FIGURE 3. TYPICAL WIRING ARRANGEMENT FOR PILOT IGNITED BURNER**



**FIGURE 4. SIMPLIFIED SCHEMATIC DIAGRAM 70D30 CONTROL**



### Main Flame Test

1. Proceed through a normal startup. After the pilot flame is shut off, observe the reading on the test voltmeter. If the voltmeter reading is low, readjust main flame or realign detector.
2. Check main flame failure protection by manually shutting off the main fuel supply. Within 4 seconds after main flame goes out, the fuel valve will be deenergized. The alarm circuit will be energized following safety lockout.

*Note: This test requires an interrupted pilot.*

### Minimum Pilot Test

This test assures that the flame detector will not detect a pilot flame too small to reliably light off the main flame. This test should be made on every new installation, as well as after the following:

1. A change-out of the control and/or flame detector
2. Any repositioning of the flame detector.
3. Any air/fuel ratio adjustment or other change that may interfere with reliable light-off of the main fuel.

This procedure should not be used on a direct spark ignited burner.



**CAUTION: The minimum pilot test must be accomplished by a trained and qualified burner technician.**

1. Manually turn off the main fuel supply.
2. Place the *check-run* switch in the *check* position.
3. Turn power on and initiate a normal start-up.
4. Reduce the fuel supply to the pilot until the "Fireye" light goes out. (If a test meter is used, the DC test jack voltage will be below 5 volts).
5. Slowly increase the fuel to the pilot until the DC test jack voltage reads about 16-20 volts. This is the minimum pilot flame that the flame detector will reliably detect.
6. Place the *Check-Run* switch in the *Run* position. When the main fuel safety shut-off valve is energized, slowly open the manual main fuel valve.
7. Observe the light-off of the main flame. It must be smooth and normal.



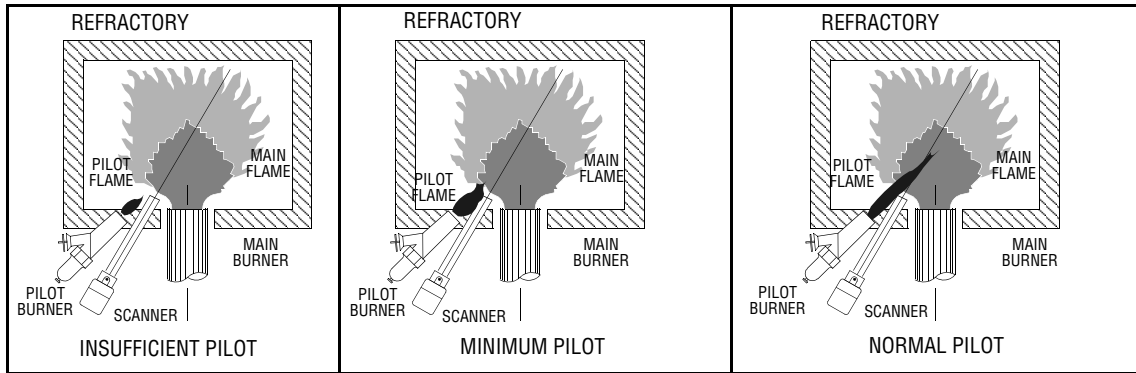
**8. CAUTION: If the main flame does not ignite immediately, shut off the main fuel. Realign the detector to require a larger minimum pilot flame.**

9. Repeat the test until reliable, smooth light-off occurs with the minimum pilot.
10. After this test is completed, increase the fuel to the pilot to its normal setting.

### Operational Test

When the installation and all burner adjustments are completed, the entire burner control system should be tested in accordance with the burner manufacturer's instructions. The procedure should verify the correct operation of:

1. Each operating control (temperature, pressure, etc.).
2. Each limit switch (temperature, pressure, low water cutoff, etc.).
3. Each interlock switch (air flow switch, high and low fuel pressure or temperature switches, low fire start switches, fuel valve proof of closure interlock, etc.).
4. Pilot flame failure response and lockout.
5. Main flame failure response and lockout.
6. Tight shutoff of all fuel valves.
7. *Note: Before attempting to reset the lockout switch, wait approximately 2 minutes for the lockout switch heater to cool.*





## SERVICING



**CAUTION: Only trained and qualified Safety Control Technicians should attempt to service Flame Safeguard control installations.**



Special care must be exercised in troubleshooting a burner control system. Electrically live parts are exposed when covers of devices are removed. Additionally, safety interlocks and limit switches (air flow, fuel pressure, LWCO, etc.) should not be jumpered out during troubleshooting, nor should any attempt be made to eliminate or alter any portion of the programming sequence beyond use of the *Run-check* switch during the pilot trial-for-ignition period of pilot ignited burners.

Servicing Fireye D-Series units is facilitated by the use of plug-in programmer and amplifier modules.

Trouble with installations equipped with Fireye D30 controls can be readily isolated by following the procedure in the sequence listed below. An AC-DC test meter is required. Test points are located on the chassis board to assist with measuring line and load voltages. Test jacks are located on the amplifier for measuring flame signal strength. The LED indicators are a useful service tool.

Voltage at terminals S1, S2 should read approximately 560 volts AC for 72DUV1, 72DUVS4, and 72DUVSIT amplifiers, 7 volts DC for 72DIRI amplifier, and 280 volts AC for 72DRT1 amplifier, with power on and burner off.

Before troubleshooting check the following:

1. Installation and wiring have been made in accordance with the installation instructions.
2. Contact tabs on bottom of chassis are not bent out of position.
3. Chassis is properly secured to the wiring base.
4. The programmer is securely plugged in and the *run-check* switch is in the *run* position.
5. The correct amplifier for the method of flame detection desired is securely plugged in.
6. The flame detector is clean.
7. The lockout switch is reset.

## TROUBLESHOOTING

In the following tabulation, trouble symptoms appear in bold type and possible causes for that symptom are listed below the bold type.

*Note: For direct spark ignited oil burners, substitute the words **main** oil valve for **pilot** valve.*

### **Zero volts at terminals L1-L2. All indicators off.**

- Electrical disconnect switch off.
- Blown fuse or tripped circuit breaker.
- Bent tab on bottom of control.
- Broken wire, loose connection or wiring error.

### **Low volts at terminals L1-L2. All indicators off.**

- Minimum operating voltage 102 volts.

### **Zero volts at terminals 13-L2. All indicators off.**

- Burner on-off switch off.
- Open limit switch or operating control.
- Bent tab on bottom of control.
- Broken wire, loose connection or wiring error.



**Zero volts at terminals 3-L2. All indicators off.**

- Fuel valve proof of closure switch open (or jumper wire not installed at terminals 13-3).
- Bent tab on bottom of control.
- Broken wire, loose connection or wiring error.
- Replace 70D30 control.

**Burner, Blower motor does not start. All indicators off.**

- Motor electrical power off.
- Blown fuse or tripped circuit breaker.
- Broken wire, loose connection or wiring error.
- Defective motor or motor contactor.
- Bent tab on bottom of control.
- Replace 70D30 control if no voltage at terminals M-L2., (and control is **not** in “lockout”).
- Control is in “LOCKOUT,” depress reset button.

**Burner, Blower motor starts. Air flow indicator off.**

- Running interlock circuit open (terminals 3-P).
- Broken wire, loose connection or wiring error.
- Bent tab on bottom of control.
- Replace 70D30 control.

**Burner, Blower motor runs. Air flow and Fireeye indicators on (controls locks out).**

- Flame scanner is detecting actual flame.
- Replace flame scanner or correct scanner wiring.
- Replace 72D series amplifier module.
- Replace 70D30 control.

**Pilot not energized at the end of purge. Air Flow indicator on, TFI and FIREYE indicators off.**

- Low fire start switch open (or jumper wire not installed at terminals M-D).
- Broken wire, loose connection or wiring error.
- Bent tab on bottom of control.
- Replace 70D30 control.

**Pilot flame not established. Air Flow, TFI indicators on. Fireeye indicator off.**

- Defective pilot valve, ignition transformer, electrode or adjustment.
- Improper gas pressure or burner adjustment.
- Broken wire, loose connection or wiring error.
- Bent tab on bottom of control.
- Replace 70D30 control.

**Pilot flame lights, but is not detected. Air Flow, TFI indicators on. Fireeye indicator off. (No test jack voltage).**

- Scanner does not see adequate pilot flame.
- Broken scanner wire, loose connection or wiring error.
- Bent tab on bottom of control.
- Replace 72D series amplifier module.
- Replace flame scanner.
- Replace 70D30 control.
- With UV units, remove factory installed grounding wire (if present) from terminal S2 on the wiring base.



**Main flame not established following 10 second pilot flame TFI. Air Flow, Fireye indicators on.**

- Run check switch in check position.
- Inadequate main fuel supply.
- Defective main fuel valve.
- Main burner improperly adjusted.
- Broken wire, loose connection or wiring error.
- Bent tab on bottom of control.
- Replace 70D30 control.

**Main flame lights and then goes out. Air Flow indicator on.**

- Main flame and pilot blown out.
- Limit-operating control circuit (terminal L1-3) or running interlock circuit (terminals 3-P) opens momentarily.

**Main flame lights normally, but goes out when pilot flame is shut off. Air flow indicator on. Control locks out.**

- Flame scanner does not see main flame.
- Main burner improperly adjusted.

**Pilot flame does not shut off following main flame TFI. Pilot connected to terminal 5. Air flow, Fireye indicators on.**

- Pilot valve stuck open.
- Wiring error.
- Replace 70D30 control.

**Flame signal drops off while main burner fires. Air Flow indicator on Fireye indicator goes off.**

- Main burner improperly adjusted.
- Flame scanner loses sight of flame.
- Control or scanner subjected to excessive temperature.

**Main fuel valve does not shut off when operating control opens. Fireye indicator on.**

- Main fuel valve stuck open.
- Wiring error.

**Burner, Blower motor does not stop following post purge. All indicators off.**

- Defective motor contactor.
- Wiring error.

*Note: If operating control recloses during the post purge period, a complete restart is initiated. Do not momentarily depress the lockout reset button to recycle the unit because it will cause some units to lockout. Open and reclose the burner control switch instead.*

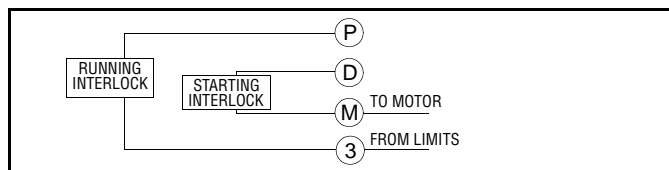
### Special Note

1. When changing the
  - 24CJ5, Model 3000 to the 70D30-71D80-72DRT1
  - 24CU6 Model 1050 to the 70D30-71D80-72DUV1
  - 26CF6, Model 1000 to the 70D30-71D80-72DIR1
 do the following:
  - Replace the wiring base with P/N 60-1386-2 or P/N 60-1466-2.
  - Replace wires on corresponding terminals except as noted below.
  - The existing STARTING INTERLOCK circuit (3 to D) must be changed to M to D.
  - The existing RUNNING INTERLOCKS remain between 3 and P.

**IMPORTANT: The STARTING INTERLOCKS and RUNNING INTERLOCKS must be isolated from one another.**

FIGURE 5.

### COMPLETED CONVERSION



2. When changing the
  - 24CJ5, Model 3010 or 3011 to the 70D30-71D80, 71D90-72DRT1
  - 25CU6, model 1062 or 1063 to the 70D30-71D80, 71D90-72DIR1
 do the following:
  - Replace the wiring base with P/N 60-1386-2 or P/N 60-1466-2.
  - Replace wires on corresponding terminals.

## MAINTENANCE

### Type 48PT2 Infrared and Type UV1, UV8A, UV2, and 45UV5-1009 UltraViolet Scanners

The viewing area of the scanner must be kept clean. Even a small amount of contamination will reduce the flame signal reaching the detector by a measurable amount. Wipe the viewing area routinely using a soft cloth dampened with concentrated detergent.

Type 48PT2 scanners include a replaceable #4-263-1 Firetron cell.

Type 45UV5-1009 scanners include a replaceable #4-314-1 UV tube.

**Type 69ND1 Flame Rod.** The flame rod and its insulator should be kept clean by washing routinely with soap and water. Rods should be routinely replaced as they oxidize.

**Flame Signal Strength.** Routine observation of the flame signal strength on a DC test meter plugged into the test jack of the Amplifier will forewarn of any deterioration in the capability of the flame detector or its application.

**Contacts.** There are no accessible contacts in the Fireeye D30 Series control. Where contacts are used, their design assures long trouble-free life when the load circuits are maintained within the published load ratings.

**Humidity.** In areas of high humidity, the control chassis should be removed and placed in a dry atmosphere when the system is expected to be out of service for an extended period.

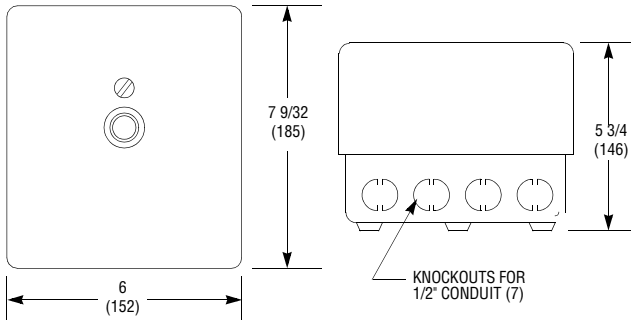
**Periodic Safety Check.** A procedure should be established to test, at least once a month, the complete flame safeguard system. This test should verify the proper operation of all limit switches and safety interlocks as well as flame failure protection and fuel safety shutoff valve tightness.

**Rotation.** It is recommended that control and scanner units purchased as spares be installed periodically.

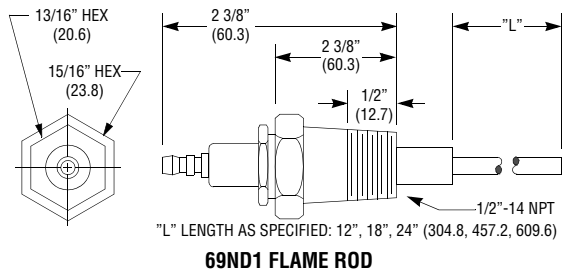
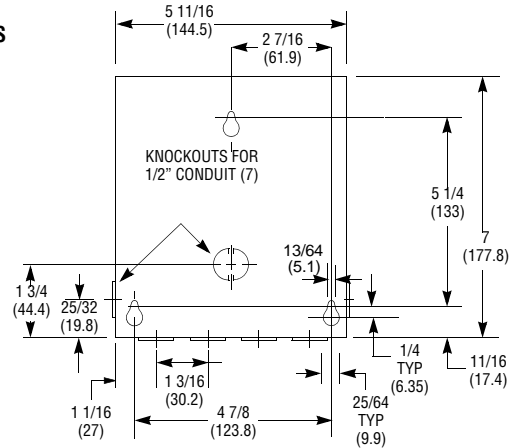
**Suggested Specifications for a Programming Flame Safeguard for Automatically Ignited Oil or Gas or Combination Fuel Burners.**

1. Each burner shall be equipped with an electronic programming flame safeguard control that is approved by UL, FM, CSA.
2. The programming sequence shall be completely controlled by solid state timing logic. The programmer shall be a plug-in module.
3. The control shall provide direct connection of limit and operating controls. Fuel valve interlock, low fire start interlock, running interlocks such as air flow, fuel pressure and temperature and Burner Motor, Ignition, Main fuel valves and lockout alarm.
4. Operational test facilities shall be provided for measuring flame signal strength and line and load voltages.
5. The control shall be a plug-in design.
6. Plug-in solid state flame amplifiers shall be provided for the rectification, Infrared (AUTOCHECK), Ultraviolet or ultraviolet repetitive self-check flame detection.
7. The burner management controls shall be Fireye series D-30.

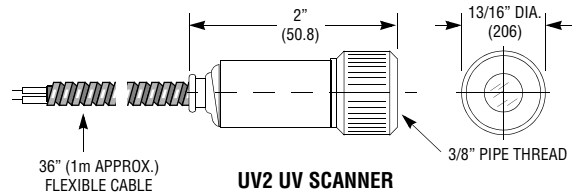
**CONTROL WITH COVER AND WIRING BASE**



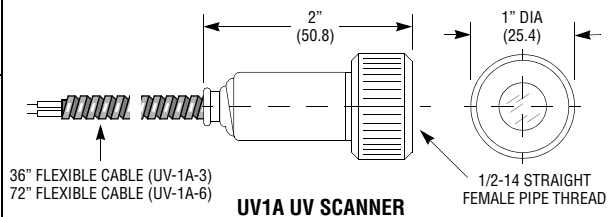
**WIRING BASE MOUNTING HOLES**



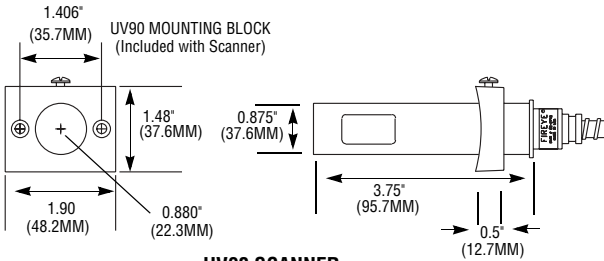
**69ND1 FLAME ROD**



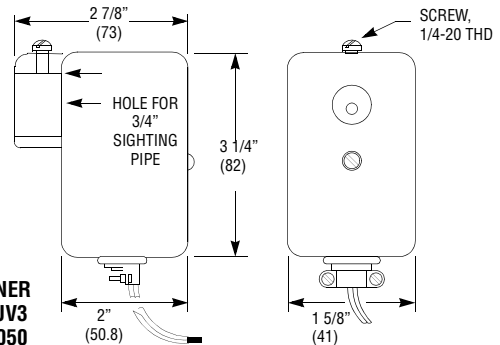
**UV2 UV SCANNER**



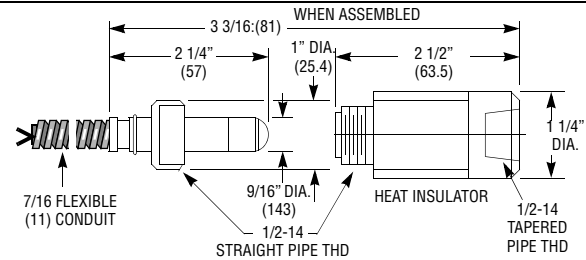
**UV1A UV SCANNER**



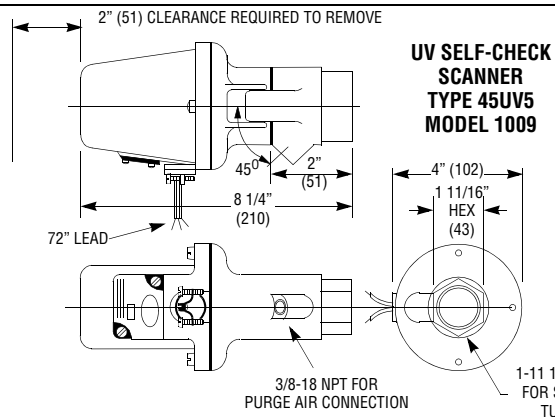
**UV90 SCANNER**



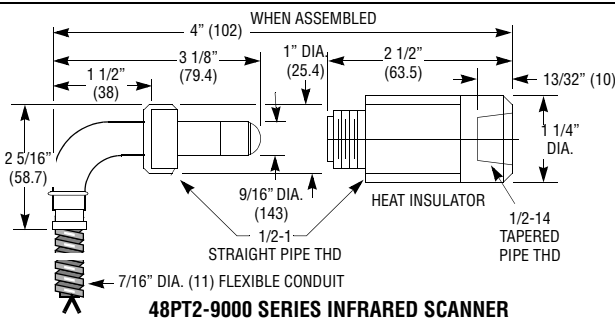
**UV SCANNER  
Type: 45UV3  
Model: 1050**



**48PT2-1000 SERIES INFRARED SCANNER**



**UV SELF-CHECK  
SCANNER  
TYPE 45UV5  
MODEL 1009**



**48PT2-900 SERIES INFRARED SCANNER**





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## NOTICE

When Fireeye products are combined with equipment manufactured by others and/or integrated into systems designed or manufactured by others, the Fireeye warranty, as stated in its General Terms and Conditions of Sale, pertains only to the Fireeye products and not to any other equipment or to the combined system or its overall performance.

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## WARRANTIES

FIREEYE guarantees for *one year from the date of installation or 18 months from date of manufacture* of its products to replace, or, at its option, to repair any product or part thereof (except lamps, electronic tubes and photocells) which is found defective in material or workmanship or which otherwise fails to conform to the description of the product on the face of its sales order. **THE FOREGOING IS IN LIEU OF ALL OTHER WARRANTIES AND FIREEYE MAKES NO WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED.** Except as specifically stated in these general terms and conditions of sale, remedies with respect to any product or part number manufactured or sold by Fireeye shall be limited exclusively to the right to replacement or repair as above provided. In no event shall Fireeye be liable for consequential or special damages of any nature that may arise in connection with such product or part.



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