



133-721
MAY 6, 2013



55UV5 SCANNER MODEL 1010

NEMA 4X, IP66
CLASS I, DIV 2, GROUPS A, B, C, D
CLASS II, CLASS III, DIV 2, GROUPS F and G



This bulletin is directed to the licensed boiler service technicians and professional combustion engineers who are experienced in the installation and operation of Fireeye flame safeguard controls. Persons not experienced with Fireeye flame safety products should contact the nearest Fireeye representative, or a qualified service group for assistance. **IMPROPER INSTALLATION OF THESE PRODUCTS MAY BE HAZARDOUS TO LIFE AND PROPERTY.**

DESCRIPTION

Fireeye Type 55UV5 scanners are self-checking, flame sensing devices. When powered by a compatible, self-checking Fireeye control, the scanners detect the presence or absence of flames which emit ultraviolet radiation (UV). Typical fossil fuels which emit UV include natural gas, propane, methane, butane, kerosene, light petroleum distillates and diesel fuels. For burners firing steam-atomized oil or pulverized coal, Fireeye recommends the use of infrared (IR) scanners. Fireeye offers a complete line of infrared scanners best suited for these applications.

APPLICATION

When used with a Fireeye amplifier, the 55UV5 scanner provides flame failure protection on single and multi-burner industrial applications such as electric utility boilers, power boilers and large furnaces or incinerators. The 55UV5 scanner monitors the flame(s) of only one burner. The pilot and main flames may be monitored individually (2 scanners) or in combination (1 scanner). When properly sighted, the scanner should discriminate between the burner being monitored and all other burners and any background flames.

Note: Scanner response is dependent on burner configuration as well as the turbulence and spectral characteristics of the flames. Application assistance is available on request.



PRINCIPLES OF OPERATION

The 55UV5 scanner employs a detector which is a sealed, gas filled, ultraviolet-transmitting special glass envelope containing two electrodes connected to an AC voltage source. The detector responds only to a portion of the ultraviolet spectrum from common flames.

When ultraviolet radiation of sufficient energy (at wavelengths shorter than those in sunlight at the earth's surface) falls upon the electrodes, electrons are released and the inter-electrode gas becomes conductive. This results in an electric current flow from one electrode to the other.

The current flow in the detector starts and ends abruptly and is known as an "avalanche." A very intense source of UV radiation will produce several thousand avalanches or pulses per second. Less radiation will produce fewer pulses per second. Upon total loss of flame, the detector output ceases except for very infrequent single pulses caused by cosmic rays. The circuitry does not respond to these infrequent pulses. Thus, the presence or absence of pulses is an indication of the presence or absence of flame; the frequency of the pulses is a measure of flame intensity. Pulses generated by the scanner are transmitted to a compatible Fireeye control via scanner wiring.

FEATURES

The UV tube, quartz lens, power transformer and related electronic components are contained in an aluminum enclosure which is sealed with an oil-resistant gasket. The quartz lens is a planoconvex design, resulting in increased sensitivity. The scanner has a 1" fitting for mounting to a threaded sight pipe and a 3/4" threaded connection for purge air.

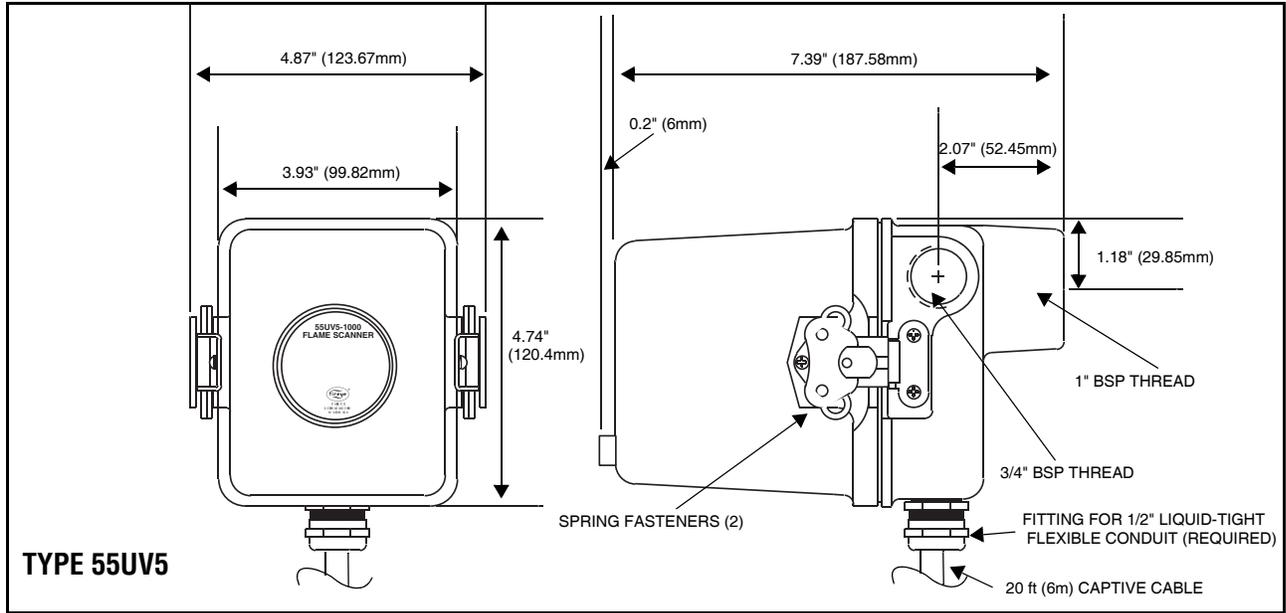
Also included in the Type 55UV5 scanner is an electromagnetic shutter that permits a self-checking circuit within an associated Fireeye control to verify that the scanner and signal circuits are producing valid flame presence or absence information. During the shutter closed period the detector's optical path is blocked from flame radiation. While the shutter is open, flame presence or absence is detected. The resultant scanner output, while flame is detected, is a continuous, periodically interrupted pulsed flame signal. This is a prerequisite for energizing the associated Fireeye control's flame relay.

The 55UV5 scanner is equipped with a fitting to accept 1/2" liquid-tight flexible conduit, and 20 feet (6 meters) of captive cable to connect to its associated 25SU3 or 25SU5 control.

NOTE: *The installation of liquid-tight flexible conduit is mandatory in all installations, and is furnished by the installer.*



FIGURE 1. 55UV5-1010 SCANNER DIMENSIONS



CAUTION: Spring fasteners should be clipped and tightened to ensure a good bond to housing and maintain the integrity of the NEMA 4X rating.

SPECIFICATIONS

MOUNTING:

Models are provided with 1" female thread mounting, British Whitworth (BSP).

HOUSING:

Material Cast Aluminum with grey epoxy coat finish

Environmental: NEMA 4X, IP66

Weight:

Temperature Rating:

CONDITION	MIN.	MAX.
Non-hazardous	-40°F (-40°C)	+199°F (93°C)
Class I, Div 2, Groups A, B, C, D Class II, Class III, Div 2, Groups F and G Using Anaconda 1/2" Type H.V.T.A. liquid tight	-40°F (-40°C)	+140°F (60°C) T6 Rating
Class I, Div 2, Groups A, B, C, D Class II, Class III, Div 2, Groups F and G Using customer supplied conduit or liquid tight connection	-40°F (-40°C)	+199°F (93°C) T4A Rating

Optical Range: 190 to 250 nanometers. No response to infrared radiation or visible light.

ELECTRICAL:

Power Requirement: 4 VA AC from associated Fireye control (see note below).

Frequency: 60 HZ

Electrical Connection: Flexible -conduit fitting and 20 ft (6m) of five conductor cable

NOTE: Cable must be installed in 1/2" liquid-tight flexible conduit.



INTEGRAL CABLE SPECIFICATION:

Individual Conductors

Four (4) Conductors:	#18 AWG (16x30) strand tinned copper
Diameter:	0.110" Nominal O.D.
Colors:	Green, White, Black and Red (Red not used)
Two (2) Conductors:	#22 AWG (7x30) strand tinned copper
Diameter:	0.093" Nominal O.D.
Colors:	Blue and Yellow
Insulation Material:	EXAR 150A .074" nominal O.D.
Cable:	
Jacket Material:	EXAR 150A .074" pressure extruded
Wall Thickness:	.045" NOM.
Finished Diameter:	.418" NOM.
Temperature:	-40°F (-40°C) to 257°F (125°C)

Table 1:

MODEL 55UV5	FREQUENCY HZ	MOUNTING THREADS	FM
1010	60	BSP	YES

Specifications subject to change without notice.

IMPORTANT NOTE: The AC power source must be sinusoidal for proper scanner operation. The application of any waveform other than a sine wave (e.g. square wave) will damage the 55UV5 scanner.

PURGE AIR

Source:	Clean ambient
Volume:	4 SCFM (113 L/min. @ 4" water column above furnace pressure minimum) at 3/4 inch threaded housing inlet or 4 SCFM at 1 inch wye fitting on scanner sight pipe. Temperature near the upper limit of the scanner operating range and/or use with dirty fuels may require up to 15 SCFM (425 L/min.).

INSTALLATION

1. The best scanner sighting results are obtained when the scanner is aimed so that the scanner (viewing) center line intersects the burner center line at a slight angle, as shown in Figure 2. The area of maximum ultraviolet radiation is near the base of the flame envelope. If only one scanner is used per burner, the intersection should be made so the line of sight or viewing angle can also see the igniter flame. Consideration must be given to burner air rotation (burners have clockwise or counterclockwise air rotation). Figure 3 illustrates how scanner location is influenced by the igniter position and air circulation. Physical obstructions such as air register blades should not fall within the scanner's line of sight.

FIGURE 2. SINGLE BURNER SCANNER SIGHTING

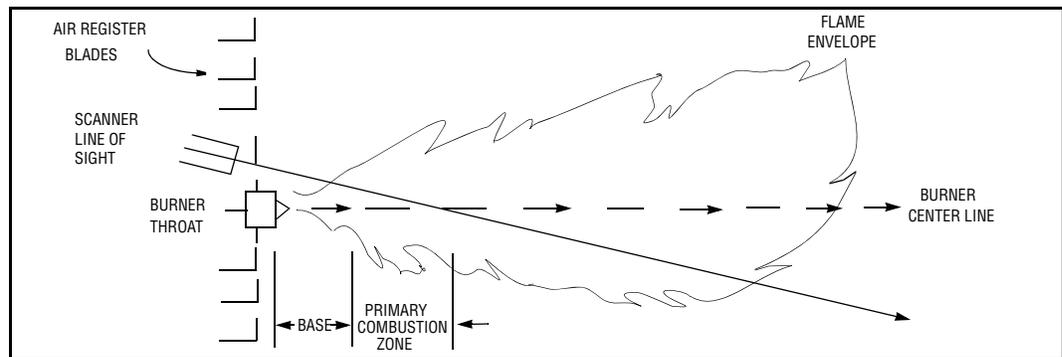
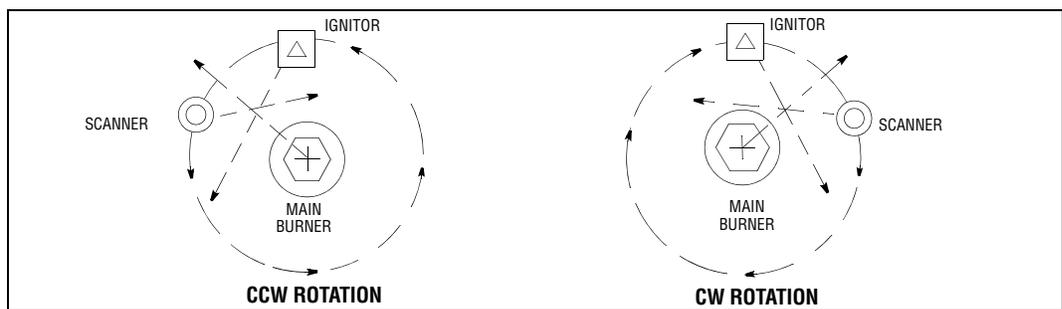


FIGURE 3. SCANNER LOCATION VS. SECONDARY AIR ROTATION

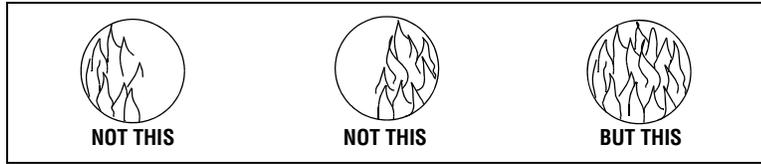


2. An acceptable scanner location must ensure the following:
 - Reliable igniter flame detection.
 - Reliable main flame detection.
 - Rejection of igniter flame too short or in the wrong position to ignite the main flame reliably.

Note: Reliable signals must be obtained at all air flows, furnace loads (ranges of fuel firing) and desirable fuel air ratios.

3. If combustion air enters the furnace with a rotational movement of sufficient velocity to deflect igniter flame in the direction of rotation, position the scanner 0 to 30 degrees downstream of the igniter and near the periphery of the throat where the ultraviolet radiation is at a maximum. (see figures 2 and 3).
4. Having determined an approximate location for the sight tube, cut a clearance hole for a 2 inch pipe through the burner plate. If register vanes interfere with the desired line-of-sight, the interfering vane(s) should be trimmed to assure an unobstructed viewing path at all firing levels.
5. Mount scanner sight pipe by either:
 - Centering a swivel mount, P/N 60-1664-3 (NPT) or 60-1664-4 (BSP) over the hole and installing the sight pipe on the swivel mount, or
 - Inserting the end of the sight pipe into the hole, aligning the pipe to the desired viewing angle and tack welding. Welding must be adequate to temporarily support the weight of the installed scanner. The sight pipe should be arranged to slant downward so that dirt and dust will not collect in it.
6. When a satisfactory sighting position has been confirmed by an operating test, (see section on alignment), the sight pipe should either be firmly welded in place or, if the swivel mount is used, the ball position should be secured by tightening the three hex head cap screws located on the swivel mount ring. In certain older style swivel mounts, tack welding may be required.

FIGURE 4. FLAME MUST COMPLETELY COVER SIGHT OPENING

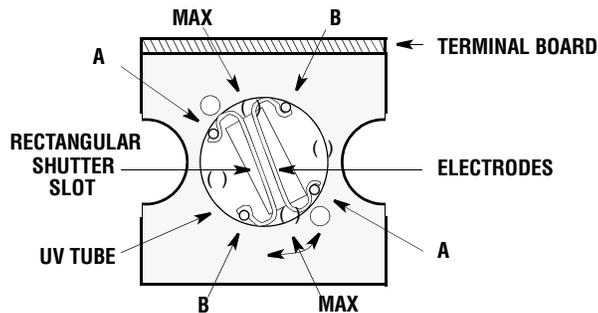


- The scanner viewing window must be kept free of contaminants (oil, ash, soot, dirt) and the scanner temperature must not exceed the maximum rating. Both requirements will be satisfied by continuous injection of air at either the 3/4" housing inlet or at a 1" wye ahead of the swivel mount, as shown in Figure 6.

Purge air may be supplied through the 3/4" or 1" wye connection. Normally only one of the two connections is provided with purge air and the other connection is plugged. When a Fireeye sealing coupling is used as shown in Figure 6, the 1" wye connection is used for the purge air (plug 3/4" opening).

Under normal conditions, with clean burning fuels and moderate ambient temperature conditions, purge air flow of approximately 4 SCFM (113 L/min.) @ 4" water column above furnace pressure is generally adequate. Up to 15 SCFM (425 L/min.) may be required for fuels that may produce high levels of flash or soot or for hot environments to maintain scanner internal temperature within specification.

FIGURE 5. UV TUBE POSITION



Note: To change UV Tube position, pull tube out and rotate to desired position. Then insert.

- Excessive flame signal can affect flame discrimination and prevent the control connected to the scanner from performing properly. Weak signals may cause unnecessary burner shutdown or alarms. To change the signal level of the tube, remove the UV tube, rotate it, and replace it in the eight pin (octal) socket.

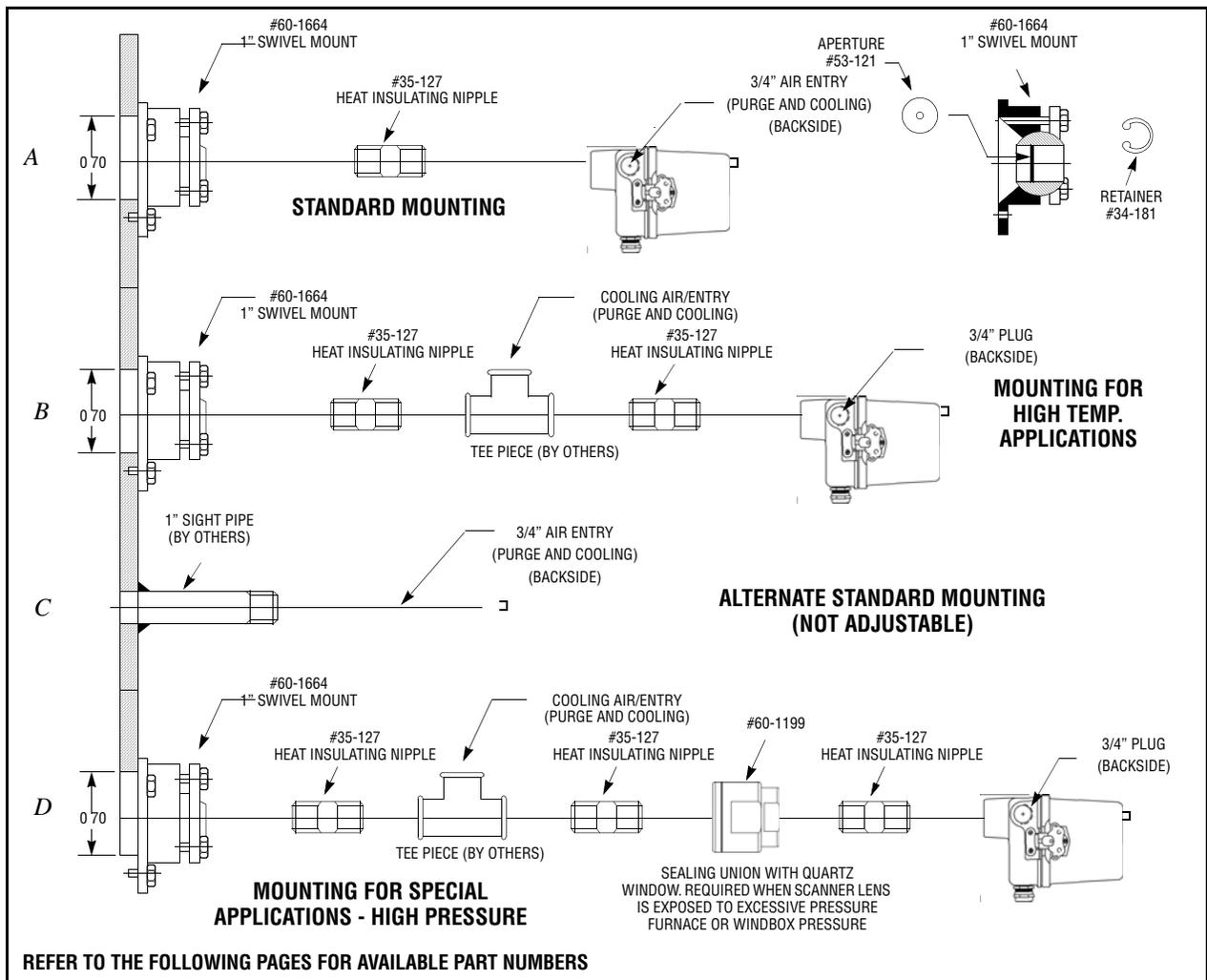
The tube has four different significant positions as shown in Figure 5. When the electrodes are almost perpendicular to the Terminal Board and approximately parallel to the shutter slot, the detector tube will generate maximum signal. This is the "Maximum Position" shown in Figure 5. When the electrodes are 90° from the maximum position, minimum signal will be generated. The intermediate positions, "A and B" (as indicated in Figure 5) will yield intermediate signals. Position "A" will yield a slightly higher signal than the intermediate position "B" since more electrode will be exposed to the radiation entering the shutter slot. To adjust the signal intensity further, use the appropriate sensitivity adjustment in the control unit selected for use with this scanner. Refer to the appropriate control bulletin for further information. **The detector is positioned in the maximum signal orientation at the factory.**

If the tube position is changed in the field, and the scanner is later replaced, verify that the signal strength is not excessive.

9. The scanner sight pipe should be as large as is practical. Ideally, the sight pipe should increase one inch in diameter (ID) for every foot in length. Under most circumstances, a sight pipe diameter increase of one inch should be adequate for an increase in length of three feet (1m). When applying the scanner to long sight tubes (more than three feet), minimize the use of one inch pipe. Avoid using pipe less than one inch (ID), and avoid using stainless steel sight pipes.
10. Where separate scanners are used to monitor main and igniter flames, the main flame scanner should be sighted to not detect the igniter flame. If it *does* detect the igniter flame, re-aim the main flame scanner.

PIPING ARRANGEMENTS

FIGURE 6.



ALIGNMENT AND ADJUSTMENTS

Before installing or adjusting scanners, thoroughly plan the scanning objectives in reference to the boiler/furnace mode of operation.

The following procedures are recommended to ensure optimum flame detection and discrimination. Flame discrimination is the ability to see the flame of only one burner or one igniter with other burners or igniters operating nearby.

These procedures should be used whenever parts are replaced, when the scanner has been moved, when the flame shape is altered (additional fuels, new burners, burner/register modifications) as well as on all new installations. Signal readings referred to in this procedure are as displayed on a 0-3 VDC Fireye flame signal meter. (P/N 38-54, 38-55, 38-56, 38-62).^{1,2}

Igniter Flame Scanner

1. Apply power to scanner and associated control.
2. Start Igniter.
3. Adjust scanner sighting to detect igniter flame in the manner shown in Figure 2.
4. When flame is properly sighted and the control sensitivity properly adjusted (see Caution below) the signal meter should register between 4 and 16. If readings fluctuate widely, readjust scanner sighting until highest steadiest reading is obtained.
5. When the proper signal reading has been obtained, make sure that the scanner and the associated control do not respond to the ignition spark. This is accomplished by cutting off the fuel to the igniter and attempting to start the igniter using the spark igniter. If the system responds to the spark, the sighting should be realigned.



CAUTION: Do not increase sensitivity any more than necessary to provide proper detection of the minimum igniter flame. Minimum igniter flame is the minimum flame required to ignite the main burner reliably. Be sure to test for reliable signals under maximum air flow conditions when the igniter flame may be deflected outside the line of sight. If this occurs, resighting is required.

Main Flame Scanner

1. Apply power to scanner and control.
2. Start igniter.
3. Adjust scanner sighting so that ignition spark and igniter flame are not detected. Test should be conducted with **maximum** igniter flame and with both minimum and maximum air flow.

Note: This step may not be practical with Class 1 igniters, but may be desirable with Class 3.

4. Start main burner.
5. Adjust scanner sighting to detect main burner flame. When sighting is correct (see Figure 4), the signal should read between 4 and 32 on a Flame Signal Meter, Fireye P/N 38-54 or 38-55, without extreme fluctuations in the signal reading.
6. When proper signal is established, manually close off the main burner fuel supply. When burner flame becomes unstable or is extinguished, the associated Fireye control should register a “No Flame” condition.
7. Start an adjacent burner and vary its firing rate under normal air flow conditions. Make certain that the main flame scanner on the burner *not in service* does not respond to the adjacent burner.

¹ If using analog bargraph meter (P/N 38-88), the flame will be properly sighted when there are 5-8 LEDs illuminated.

² When used with the 25SU3-2000 series amplifiers and appropriate power supply, the required flame signal strength (in terms of “pulses-per-second,” will be determined by the “Flame-On” and “Flame-Off” thresholds programmed into the amplifier. Refer to bulletin CU-34 for additional information.

FIGURE 7.

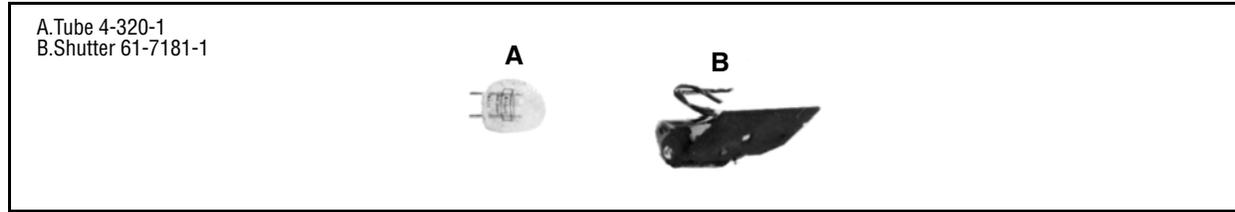


FIGURE 8.

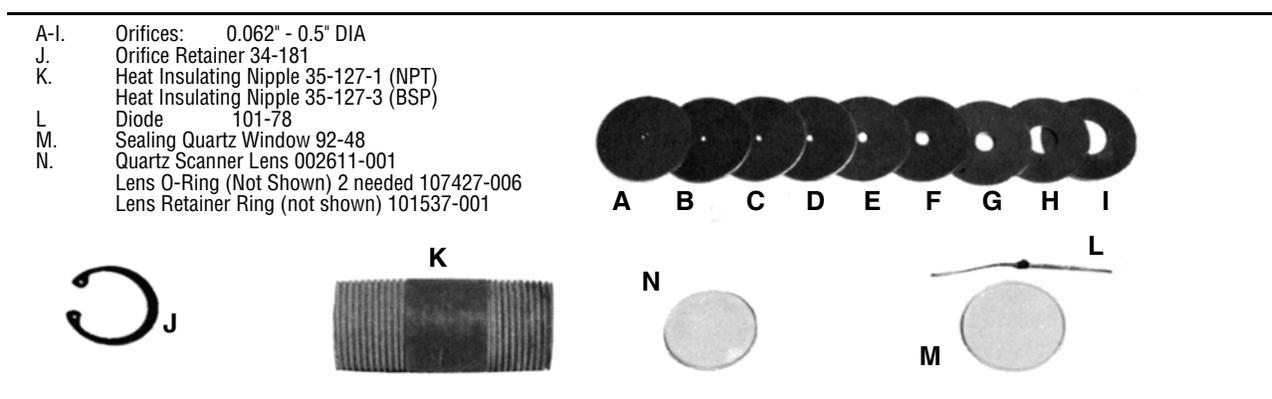
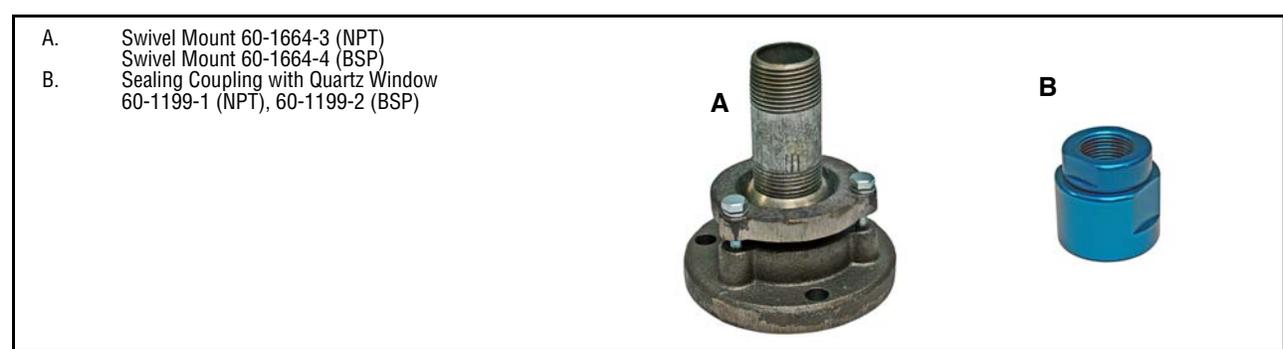


FIGURE 9.



ACCESSORIES

Swivel Mount

The scanner swivel mount (P/N 60-1664-3, -4) is used to adjust the scanner sighting angle after the scanner has been installed. The swivel mount is used as indicated in Figure 6.

Orifices

The orifice is used to restrict field of view (target area), reduce air flow, maintain air block, and increase discrimination between flame and background radiation. The orifice is secured within the ball of a swivel mount with an orifice retainer or the orifice can be placed within a 1 inch coupling (not provided).

The scanner should ideally sight a target area of 4 to 25 square inches (25-250cm²) of the flame front. The flame front is a plane within the combustion space separating the region of unburned fuel from the burning fuel. For example, if a 1/2 inch diameter orifice is placed within a mounting swivel one foot from the scanner lens, and the swivel mount is located on the surface of a 4 foot deep windbox, and if the range of stable flame is 5 feet beyond the windbox, the flame front target area is 19.6 square inches as shown in Figure 10.

ORIFICES

Figure	Qty.	Part Number	Description
8	1	53-121	Orifice Kit: Contains following items:
8A	1	53-121-2	Orifice: Diameter = 0.062"
8B	1	53-121-3	Orifice: Diameter = 0.078"
8C	1	53-121-4	Orifice: Diameter = 0.093"
8D	1	53-121-5	Orifice: Diameter = 0.109"
8E	1	53-121-6	Orifice: Diameter = 0.125"
8F	1	53-121-7	Orifice: Diameter = 0.187"
8G	1	53-121-8	Orifice: Diameter = 0.250"
8H	1	53-121-9	Orifice: Diameter = 0.375"
8I	1	53-121-10	Orifice: Diameter = 0.500"
8J	2	34-181	Orifice Retainer

FIGURE 10.

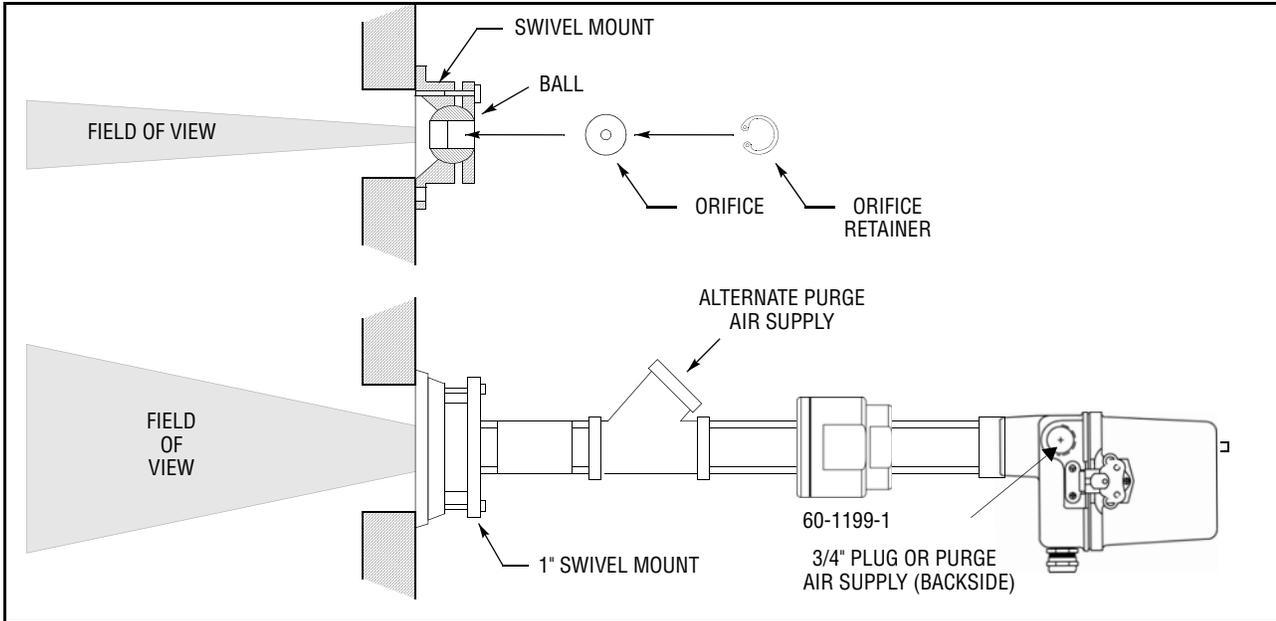
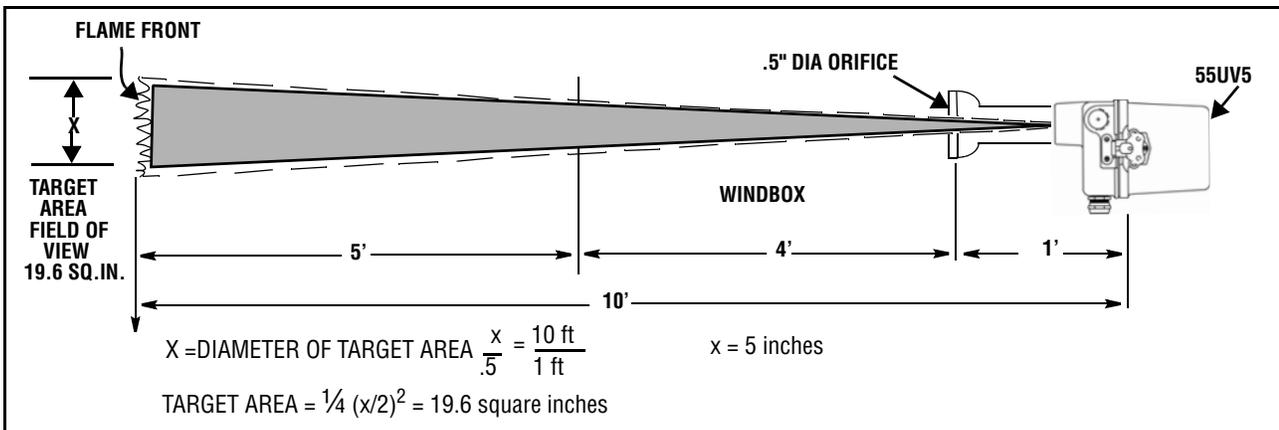


FIGURE 11. Scanner with Orifice



Note: There is an inverse relationship between discrimination and sensitivity.

Heat Insulating Nipple

The heat insulating nipple (P/N 35-127-1, -3) is used to prevent heat transfer from the hot sight pipe to the scanner head.

Sealing Coupling with Quartz Window

The sealing coupling, PN 60-1199-1 is used whenever a coupling or seal is required for scanner piping. The quartz window blocks furnace pressure, heat, gases and soot from coming in contact with the scanner and contaminating the lens. The size is one inch U.S. standard taper pipe thread (Schedule 40, 1" NPT). When the sealing coupling is used, a 1" wye fitting must be used downstream from it for connection of a purge air supply (plug 3/4" opening).

MAINTENANCE



CAUTION: Disconnect or shut off electric power when working on scanner.

1. The Fireye (25SU3 or 25SU5) control and scanner should be powered at all times (except for repair, cleaning or replacement) to reduce any harmful effects of atmospheric humidity.
2. The scanner and sight pipe must be kept clean to prevent overheating and assure optical qualities.
3. When replacing or cleaning the UV tube, note the position of the tube electrodes in relation to the rectangular slot in the shutter assembly. Replace tube in the same slot location.
4. Clean the quartz lens with glass detergent or glass cleaning agents which contain no abrasives. After cleaning remove all cleaning films with a soft lint-free cloth.
5. Use original Fireye repair parts to maintain optimum operation

RECOMMENDED SPARE PARTS		
FIGURE	PART NUMBER	DESCRIPTION
7A	4-320-1	UV TUBE
7B	61-7181-1	SHUTTER ASSEMBLY
	002608-001	FLANGE GASKET
7N	002611-001	LENS
	107427-006	LENS O- RING (2 REQUIRED)
	101537-001	LENS RETAINING RING
8M	92-48	QUARTZ WINDOW (Part of Sealing Coupling 60-1199)

CONTROL AND SCANNER WIRING

The 55UV5 scanner is equipped with a fitting to accept 1/2" liquid-tight flexible conduit.

NOTE: The installation of liquid-tight flexible conduit is mandatory in all installations, and is furnished by the installer.

The 55UV5 scanner is equipped with 20 feet (6 meters) of captive cable to connect to its associated 25SU3 or 25SU5 control. If a longer length is required, Fireye six-conductor cable p/n 59-470 (600V / 90C, 4 conductors 18 AWG, 2 conductors 22 AWG, common shield with drain wire) should be used to extend the distance up to 1000 feet (305 meters) total.

If 59-470 scanner extension cable is used, the cable splice should be made on a terminal block in a junction box suitable for use in its intended environment (see Figure 12).

NOTE: The 55UV5-1010 scanner has a unique cable color code per figures 12 -14.

FIGURE 12. 55UV5-1010 SCANNER WIRING

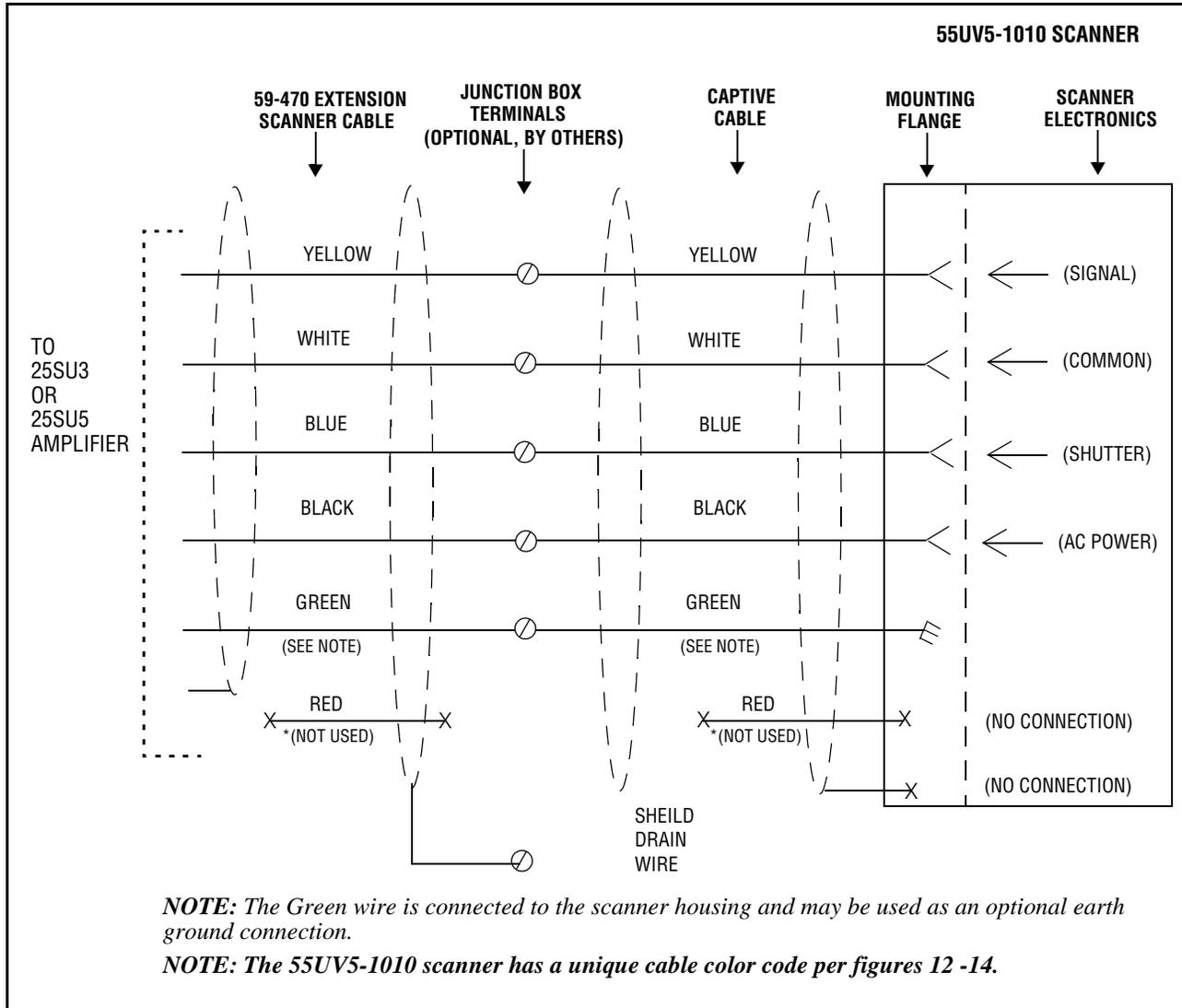


FIGURE 13. WIRING, 25SU3-5166; 25SU5-5011, -5012, -5013 AMPLIFIERS

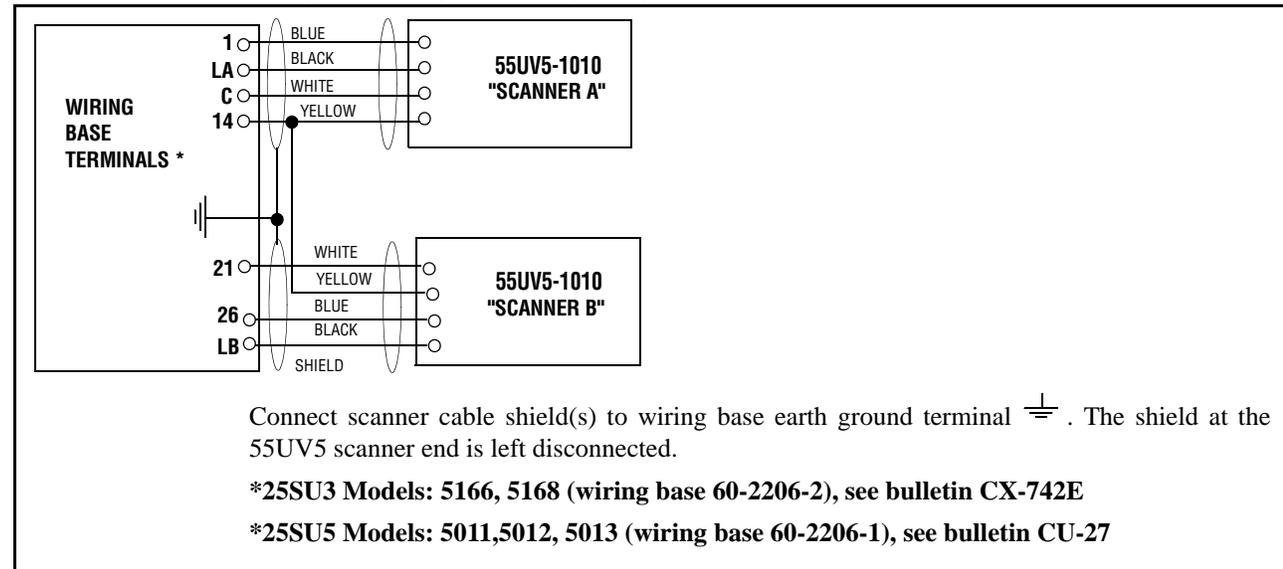
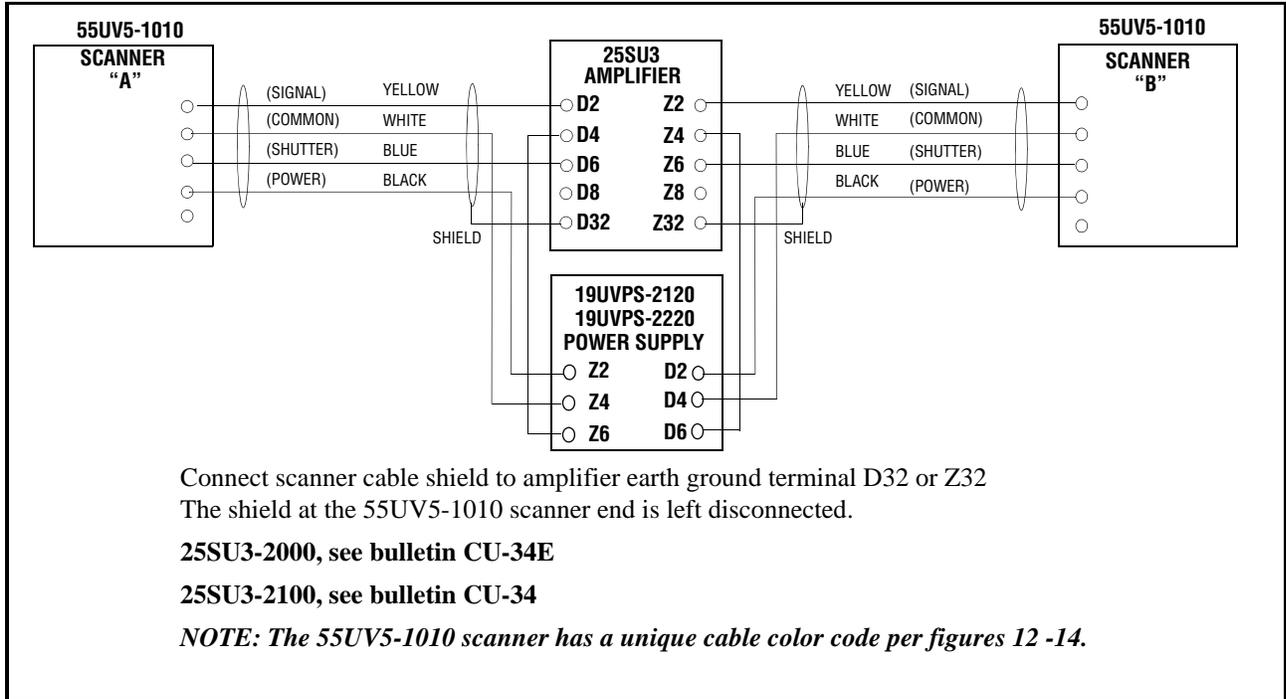


FIGURE 14. WIRING, 25SU3-2000, -2100 AMPLIFIERS





55UV5 SCANNER COMPATIBILITY CHART

FIREYE CONTROL		55UV5 MODEL	FIREYE CONTROL		55UV5 MODEL
TYPE	MODEL	1010 (60 HZ)	TYPE	MODEL	1010 (60 HZ)
25SU3	1157(T)	X	25SU3	4171	X
	1158(T)			5166	X
	1160	X		5168	X
	1161			5170	X
	1162	X		5171	X
	Series 2000	X		5172	X
	1166			5173	X
	4157	X		SYSTEM 126	X
	4158				
	4162	X	25SU5	1011	X
	4163(T)	X		1111(T)	X
	4164(T)			1112(T)	
	4165			1117	
	4166	X		4011	X
	4167(T)	X		4012	
	4168(T)	X		4117	X
	4169T	NOTE 2		5011	X
	4170	X		5012	X

NOTE 1: Scanner and control frequency must be compatible with frequency of power line.
 NOTE 2: For 25SU3 Model 4169T code 18 and later use 55UV5 Model 1010 (60HZ). 25SU3 Model 4169T code 17 and earlier should not be used with 55UV5-1010.
 NOTE 3: With 25SU3-2000 series controls, the 120 VAC to the scanner must be provided by a separate Fireye power supply, or modernization adapter.
 NOTE 4: The AC power source must be sinusoidal for proper scanner operation. The application of any waveform other than a sine wave (e.g. square wave) will damage the 55UV5 scanner.



TROUBLESHOOTING

The following steps should be performed if flame is not detected:

NOTE: *Wear protective filtered lenses when viewing flame.*

1. Check scanner wiring for breaks and proper connections.
2. Look down the sight pipe.
 - Scanner should have an unrestricted view for all firing conditions.
 - The flame's primary combustion zone (first 1/3 of flame) should be within the scanner's field of view for all firing loads.
3. Clean the scanner lens with a glass detergent or glass cleaning agent which contains no abrasives. After cleaning remove all cleaning films with a soft lint-free cloth. (Some cleaning films may reduce or filter UV).
4. Measure voltage across scanner terminals.
 - Between yellow and white wires there should be 70 VAC pulses of 6 microseconds (use oscilloscope). Between black and white wires there should be 130 to 150 VAC.
5. Scanner operation can be checked by aiming the scanner at a source of ultra-violet radiation, (lighter or propane torch). The meter on the associated control should indicate flame.
6. Check to see that an external selector switch is connected to the associated control's sensitivity/threshold select or scanner enable terminals.
7. Reposition scanner so it is properly aligned for best flame signal.
8. If the scanner still does not indicate the presence of flame (DC voltage on Flame Signal Meter) replace the UV tube and repeat steps 4 through 7.



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.

WARRANTIES

FIREYE 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 FIREYE 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.



FIREYE®
3 Manchester Road
Derry, New Hampshire 03038 USA
www.fireeye.com

133-721
MAY 6, 2013
Supersedes April 28, 2011