

# Eclipse Self-Check UV Scanner

Model 5602-91  
Version 1



## Introduction

The self-check UV Scanner is used for continuous gas or oil flames. A mechanical shutter in the scanner closes briefly every ten seconds, at which time the scanner's internal circuit checks for a flame signal. If a signal is present, indicating a failed sensor, the output signal to the flame safeguard is stopped and the system shuts down. The scanner features a high quality fused silica quartz lens, machined alloy housing with seals and a long life push-pull electromagnetically driven photo shutter. This scanner operates with the series 5600 and VF56 series Veri-Flames, the series 6000 Multi-Flame, Series 6500 Bi-Flame controllers, and series 7000 Peek-A-Flame.

Factory Mutual (FM) recommends these scanners be used when any fired equipment is operated continuously (more than 24 hours without shutdown).

## Mechanical Specifications

Parameter	Specification
Overall Length	7-3/4" (197mm)
Diameter	3-1/4" (83mm)
Housing Material	Aluminum
Finish	Clear anodized
Sight Tube Entrance	1" NPT
Purge Air Entrance	1/4" NPT
Purge Air Flow	5 cfm, 10 psi maximum (140 lpm, 0.7mbar)

## Electrical Specifications

Parameter	Specification
Supply Voltage	120V +10/-15%, 50/60 Hz
Supply Current	0.04A
Output	Pulse frequency modulated transistor
Required Accessory	Cable with connector, 10 feet (3m), model 5602-91-7, Part 49602-91-7
Wiring Extension	Instrumentation cable with two pairs of individually shielded #18 AWG conductors, 300V minimum, BELDEN #9368 or equivalent.
Temperature Range	0°F to 140°F (-20° to +60°C) case temperature
Shipping Weight	4.5 lbs (2 kg)
Optical	Angle of view @ 2.5° depending on sight pipe size and length  Spectral Sensitivity: 185 to 260 nanometers; scanner is solar blind
Option	Non-Magnifying lens part 18165

property damage. Be certain that the flame sensor detects only the pilot and/or main flame of the intended burner by testing the control system under varying operating conditions and firing rates. Follow the test procedures given in this manual and the equipment provider's instructions after installation and at regularly scheduled maintenance intervals.

### Sensor Wiring

Route sensor wiring a sufficient distance from ignition and other high voltage wiring to avoid electrical interference. To reduce interference, ground both shields.

If sensor wiring is to extend beyond the supplied 10 ft (305cm) lengths, use wiring extension as shown in specifications.

Tables 1 - 4 illustrate how the sensor should be wired to appropriate controls. Near the end of each of the four cable leads is a letter tag for identifications. The scanner is only available for 120V supply. Refer to Figure 1 to use with a 230 VAC supply.

**NOTE:** The shield wire terminals shown in the tables provide a convenient attachment point. A panel ground wire must also be run to these points.

### Sensor Installation



- Incorrect sensor installation may cause the sensor to generate a false flame signal. This can cause unburned fuel to collect in the combustion chamber, resulting in explosions, injuries, and



- Cable lead "B" should only be connected to power (120 VAC); connecting it to any other terminal will bypass the safe-start check of the scanner.

Table 1 - Wiring to Multi-Flame

5602-91 Scanner Connector Pin	5602-91-7 Cable Wire	Function	Multi-Flame J4 Terminal		Multi-Flame J5 Terminal		Expansion Board J3, J4, J5, J6 Terminals	
			Scanner #1	Scanner #3	Scanner #2	Scanner #4	Scanner #5, 6, 9, 10 (also #13, 14, 17, 18)	Scanner #7, 8, 11, 12 (also #15, 16, 19 20)
A	red	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral
B	white	120 VAC	120 VAC	120 VAC	120 VAC	120 VAC	120 VAC	120 VAC
C	black	UV	3	9	3	9	3	9
D	green	Gnd Return	2	8	2	8	2	8
-	shields	Ground	4	10	4	10	4	10

Table 2 - Wiring to Bi-Flame				
5602-91 Scanner Connector Pin	5602-91-7 Cable Wire	Function	Bi-Flame	
			J4 Terminal Scanner #1	J5 Terminal Scanner #2
A	red	Neutral	Neutral	Neutral
B	white	120 VAC	120 VAC	120 VAC
C	black	UV	3	1
D	green	Gnd Return	2	2
-	shields	Ground	4	4

Table 3 - Wiring to Veri-Flame			
5602-91 Scanner Connector Pin	5602-91-7 Cable Wire	Function	Veri-Flame Terminal
A	red	Neutral	2
B	white	120 VAC	1
C	black	UV	S1
D	green	Gnd Return	S2
-	shields	Ground	Gnd

Table 4 - Wiring to Peek-A-Flame			
5602-91 Scanner Connector Pin	5602-91-7 Cable Wire	Function	Peek-A-Flame Terminal
A	red	Neutral	1
B	white	120 VAC	3
C	black	UV	7
D	green	Gnd Return	8
-	shields	Ground	2

## Sensor Installation

In most cases, the location for this scanner will be pre-determined by the burner manufacturer. However, proper application of this scanner requires knowledge of the burner, the combustion chamber, and the process. Opposing burners, flame swirl patterns, and substance in the line-of-sight may require special mounting techniques.



- **The UV tube is fragile. Handle carefully and avoid dropping or sharp blows.**

Consult the burner manufacturer's instructions for mounting location. The scanner should view the intersection of the pilot and main flames. It typically should be aimed at the first third of the flame closest to the burner nozzle, see Figure 2. Certain unburned hydrocarbons, oil mist, recirculated flue gas or other contaminants may mask and absorb the ultraviolet radiation.

Position the scanner within 30 inches (762 mm) of the flame.

For temperatures higher than specified, provide clean cooling air to the 1/4" NPT purge tap on the housing.

Maximum furnace pressure is 60 psig.

To assist in sighting the scanner, a swivel mount (#10042584) may be used.

Keep the scanner lens and line-of-sight free of contamination. Be aware that scanners looking up are susceptible to dirt and dust settling. Soot, steam, and unburned hydrocarbons may reduce or even mask the radiation from the flame. A purging assembly as described above may alleviate these problems.

Some burners have an open construction allowing the scanner to view into a furnace. Avoid sighting background sources of UV light. If necessary, mask the offending background source by use of an orifice.

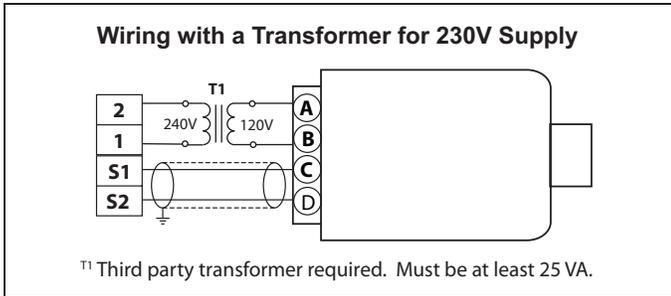


Figure 1.

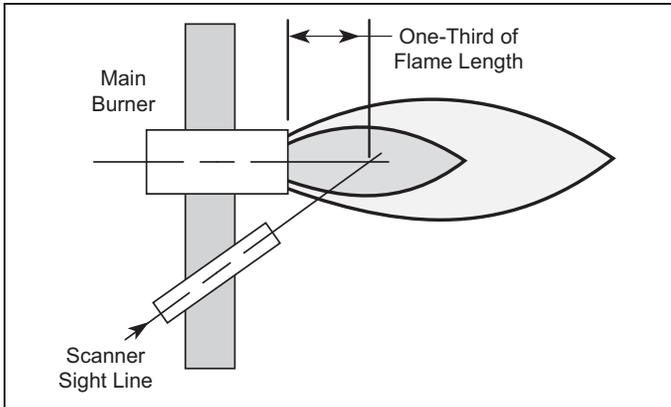


Figure 2. UV Scanner Sighting

## Test Procedures

Perform the following tests for every new installation and at periodic maintenance intervals. Depending on the burner equipment (such as pilot versus direct spark), some of the tests may not be possible.

### Measuring Flame Signal Strength

Insert the positive probe of a 0-15 VDC voltmeter (100k ohm minimum input impedance) into the test point on the control cover. Connect the negative probe to the GND or terminal for the "D" (green) wire. Readings greater than 4 VDC are adequate.

### Minimum Pilot Test

Run this test on pilot ignited burners to ensure that the sensor will not detect a pilot flame too small to reliably light the main flame.

1. Manually shut off the fuel supply to the burner, but not to the pilot.
2. Put the control in the pilot test mode. On the Veri-Flame push the Test/Reset button in the Test position (button in). On the Bi-Flame and Multi-Flame press the Reset and Enter buttons together then release the Reset and after a few seconds release the Enter.
3. Start the system normally. The control will hold the operating sequence at the pilot flame step.

4. Measure the flame signal strength as described above.
5. Slowly reduce the pilot fuel until the signal drops out. Increase the pilot fuel slightly and restart the system. Observe the flame signal and adjust the pilot fuel as required to prevent flame failure. This is the minimum pilot.
6. Take the control out of the pilot test mode and begin the start-up sequence again. On the Veri-Flame push the Test/Reset button again so that it pops out to the Run position. On the Bi-Flame and Multi-Flame press the Reset button.
7. When the sequence reaches the main flame trial for ignition, smoothly restore the fuel supply to the main burner. If the main burner does not light within five seconds, immediately shut off the burner fuel supply, stop the control and purge the system. Attempt to light the burner again before proceeding with adjustments in the next step.
8. For burners with an adjustable scanner sighting assembly, adjust the sighting assembly further away from the nozzle of the pilot flame thus requiring a larger minimum pilot for adequate signal strength. For burners with fixed sighting, increase the pilot flame. Repeat steps 1 through 8 until the main burner lights off smoothly and reliably.

### Ignition Interference Test

Test the effect of the ignition system (transformer, spark plug, wiring and grounding) on the flame signal and control. Ignition interference can decrease or increase the flame signal strength or can cause erratic operation of the control. The scanner placement on some burners allows direct sighting of the spark, creating a strong but false flame signal. The Eclipse flame control sequence does not interrupt the spark upon flame detection until after the trial for ignition period. Therefore spark detection is not a problem; however ignition interference should still be reduced or eliminated where possible.

1. Manually shut off the fuel supply to the burner.
2. Start the system normally. Observe the flame signal during ignition to see if it responds during the spark. Readings above 2 VDC indicate spark interference or spark sighting.
3. On pilot ignited burners, manually shut off the fuel supply to the main burner. For direct spark burners, lock the burner firing-rate at the start position.
4. Put the control in the pilot test mode (see step 2 of Minimum Pilot Test above).

5. Start the system normally. Observe the flame signal during spark and after the trial for ignition. Spark interference causes the signal during the spark to differ more than 2 VDC from the signal after the spark.
6. If spark interference is observed, try to minimize its affect:
  - a. Ensure proper grounding for the ignition circuit.
  - b. Isolate the scanner from ground and/or remove the shield connection from ground.
  - c. Check for proper spark gap.
  - d. Clean, repair, or replace faulty wiring and connectors.
  - e. Separate or shield the scanner wiring from the ignition wiring.
  - f. Reverse the wires feeding the primary to the ignition transformer.
  - g. Move the location of the ignition transformer.

### **Pilot Flame Failure Test**

1. Put the control in the pilot test mode (see step 2 of Minimum Pilot Test above).
2. Start the system normally.
3. After the pilot has lit, manually turn off the fuel supply. The controller should lock out of flame failure. If not, then the controller is detecting a false flame signal. Find the problem and correct it before resuming normal operation.

### **Main Flame Failure Test**

1. Put the control in the "Run" position (see step 6 of Minimum Pilot Test above).
2. Start the system normally.
3. After the sequence lights the main flame, manually shut off the fuel supply. If the control does not shut down in less than 4 seconds after visually observing that the flame extinguished, it may be detecting a false flame signal. Find the problem and correct it before resuming normal operation.

### **Process Conditions Test**

1. Start the system normally.
2. Observe the flame signal as the system operates at various firing rates under process (at temperature) conditions.
3. Perform the Main Flame Failure Test under these conditions and verify that the control shuts down in less than 4 seconds after visually observing that the flame extinguished.

### **Limit & Interlock Tests**

Periodically check all interlock and limit switches by manually tripping them during burner operation to make sure they cause a system to lock out.



- **Never operate a system that is improperly adjusted or has faulty interlocks or limit switches. Always replace faulty equipment with new equipment before resuming operation. Operating a system with defective safety equipment can cause explosions, injuries, and property damage.**

### **Maintenance**



- **High voltage, turn off power before disconnecting or installing sensors or controls.**

All burner systems must be maintained to ensure their safe operation. The operator of this equipment must be trained in safe operating procedures. The owner and operator must set a regularly scheduled maintenance interval based on recommendations from the equipment manufacturers, environmental conditions, and their own operational history.

### **System Checks**

Periodically test the sensors as described in the Test Procedure section.

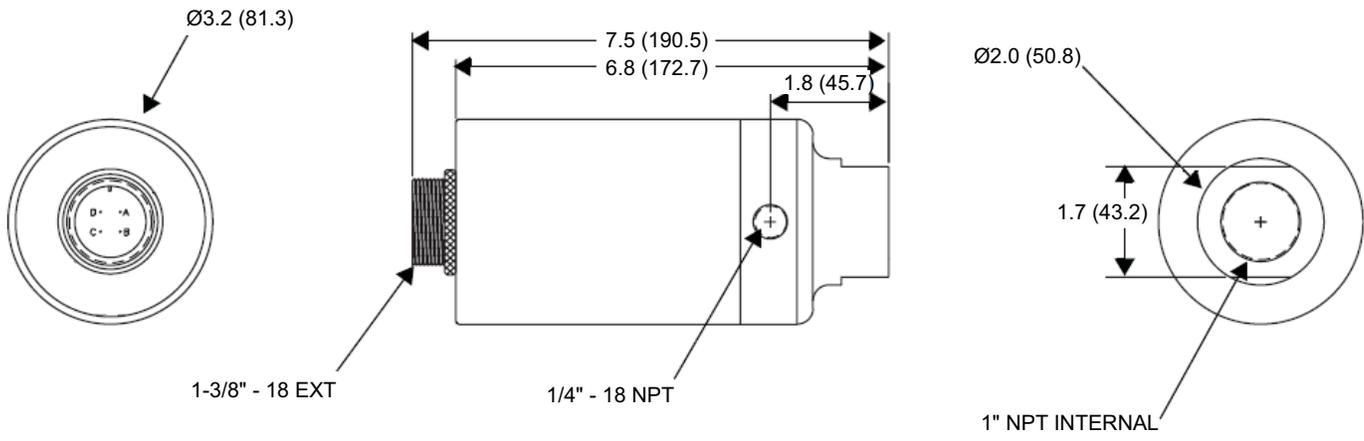
### **Sensor Lens**

Clean the glass lens regularly with a soft, damp cloth. The presence of foreign material will measurably reduce the flame signal strength.

### **Rotation**

To ensure operability of stored items and to reduce the possibility of extended down-time, periodically swap spare sensors and control units with active ones.

**Dimensions in inches (mm)**





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