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Model 40 (Ionization Duct Detectors) Product Information

Statitrol Corporation

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LOW VOLTAGE — 24 VDC
Includes:
102-040 Ionization Fire Detector
103-0044 Duct Housing Assembly

LINE VOLTAGE — 120 VAC
(or 24 VAC) 50-60 Hz
Includes:
104-040 Ionization Fire Detector
103-0045 Duct Housing Assembly

EARLY WARNING SMOKE CONTROL
Fan Shutdown — Damper Control — and Alarm Signals

The Statitrol Model 40 samples air moving through an air duct to detect products of combustion and smoke. Its main function is to shut down a fan to prevent distribution of smoke in a building.

Duct detectors should not be used as a substitute for "area" fire detection, however, they may be connected to actuate the central alarm system upon fan shutdown.

A "sample" of air from a cross section of the air duct is forced into the airtight casing, past the detector and back into the air duct.
• Listed by Underwriters' Laboratories, Inc.
• Self-monitoring—a pulsed light-emitting diode, visible through the airtight housing, provides alarm or trouble indication—plus an instant sensitivity monitor—without the need for meters.
• Built-in Power Regulation—
  Low Voltage—for use with any listed power supply or control unit with 20-42 VDC filtered, or 15-30 VDC unfiltered output; OR—
  Line Voltage—120 VAC, or 24 VAC
• Low Current—
  Low Voltage—25 MA supervisory, or 65 MA in alarm.
  Line Voltage—less than 6 watts in supervisory or alarm.
• Relay Contacts—
  Alarm—One set normally open
  —One set SPDT
  —0.5 amp, 120 volt, inductive
  Trouble—One set normally open (closed in standby)
  —0.1 amp, 120 volts, inductive
• Velocities (Air Duct)
  500 to 3000 feet per minute (without manometer adjustment)
• Temperatures—0°F to 150°F
• Humidities—0 to 95% RH
• Adjustable sensitivity
• Built-in Smoke Testing
• Accessible push button reset
• Remote "TEST" Switch Feature
• Fail Safe—Provides independent trouble signal on power or component failure.
• Includes factory-built sampling tubes in six packages to 12 ft. duct widths.
• Complete with mounting hardware, instructions and duct template.
Typical wiring connections—for total fan shutdown—Local and Remote Test/Reset Switch—Trouble and Alarm Signals—Connection to Supervised Control Circuit—And Auxiliary Switching.

Typical Smoke Damper Control
*Alternates—use special electrically released fusible link or special electric damper motor.

Ordering Information: Specify duct widths
Shipping weight—Housing: 10 lbs.
Tube packages: 2 lbs.
Housing Finish — Red Texture.
Smoke Detection in Air Ducts
General Recommendations

Listings by Underwriters' Laboratories, Factory Mutual or others certify that the detectors operate properly at a "sensitivity" with reference to smoke obscuration. They also certify the equipment meets certain electrical construction standards for safety.

Such listings do not recommend air volume limits nor location in the air system. They do not allow the use of air duct detectors as a fire alarm system, but rather certify their application as a fan shutdown device, as required under Pamphlet 90A of the National Fire Protection Association—and may be connected to the fire alarm system.

There are no recommended application limits available through the test agencies nor the fire alarm associations. It is the responsibility of the design engineer to exercise good judgment in their application.

The following are general recommendations:

An air duct smoke, or products of combustion, detector should be used for the primary purpose of fan shutdown or damper closure to stop smoke distribution. Smoke may cause property damage in areas not normally affected by the fire. More important, however, smoke distribution may cause panic and prevent rapid evacuation of the building.

Although the detector is intended for fan shutdown and damper closure, it may under existing regulations be connected to the general alarm system. Preferably, it should be connected to a pre-signal system rather than the general alarm.

In the case of power failure, fans will shut down and the duct detector becomes useless, therefore, battery standby for this type of detection is not necessary.

Detector Locations

Generally, to comply with the requirements of Pamphlet 90A, two detectors per supply fan are required; one located in the main return air just upstream of a point where it is being returned or exhausted. As an example, at the inlet to a return air fan. Avoid locations where closure of the return air dampers will cause the detector to be in a "dead air" space.

It is desirable to locate additional detectors in the exhaust system if the exhaust outlet is remote from the supply fans, or if the system uses 100 per cent outside air. Every attempt should be made to locate the detector where the air temperature and humidity is relatively constant.

The second location required under Pamphlet 90A is in the supply, or "downstream of the air filters." The purpose in this location is to sense either smoke recirculated from the building or smoke being drawn in from outside. Locating this detector is more difficult in order to avoid those locations where temperatures (particularly when the fan is off) may reach extremes. Air velocity at the detector location is not critical since the sampling air tubes may be adjusted to compensate for extremely high velocities (even in excess of 3,000 feet per minute). The detector should normally be located on the discharge side of the supply fan unless there is a more convenient and stable environment location between the downstream side of the filters and the inlet to the supply fan.

Volume versus smoke distribution within air ducts

For the primary purpose of fan shutdown, and to comply with the intent of Pamphlet 90A, only one detector would be sufficient for fan systems of 100,000 cfm. In other words, there would be no volume limit—if the detector were sampling a truly average smoke condition. However, this is almost never possible and we therefore recommend some simple rules of application.

It is well known that air of different temperatures will stratify in a horizontal duct with the warm air moving to the upper portion of the duct. Stratification may still persist even after the air has passed through the fan.
Smoke will generally follow the path of warm air since smoke particles are the visible and more buoyant products of combustion. However, the largest per cent of products of combustion are small, quite mobile, and mostly invisible. These products move much like moisture in a confined duct and do not stratify, but become quite homogenous within an air duct in a reasonably short distance of approximately six duct widths.

**Some Basic Rules of Application**

Only one detector is required per location, regardless of volume of air, if—

1) The sampling tube extends at least ¾ of the total width of the duct and is located approximately at the center of the vertical dimension of the duct; and

2) There is no air inlet to the duct within six duct widths upstream.

If, however, there is an air inlet within a distance of six duct widths upstream, then:

a) Use one detector for each four foot of vertical height (lower sampling tube located two feet above the bottom of the duct and additional sampling tubes mounted four feet on center of vertical height).

b) For ducts wider than 12 feet use two detectors for each position, mounted on opposite sides of the duct.

The above recommended detector limits should apply to both the return air and supply air locations as required. The above recommendations are only suggestions in an attempt to supplement good engineering judgment.

**Caution**

If the above limitations are not specified, only one detector will be provided. Since the primary purpose of smoke detection of this type is to life safety, there should be no compromise.

**Detector Annunciation, Service and Access**

If the detector is connected to an alarm system, specify a remote lamp to indicate which air duct is affected.

Service access to the equipment must be provided. Service, in this case, usually means periodic testing for smoke and checking sensitivity levels. The detector must be accessible. If the duct is more than approximately three feet in width, an access door should be specified next to the detector, preferably upstream. If the detector is located in the duct above a furred ceiling, a ceiling access door must also be provided.

**Installation Follow-up**

Since smoke detection equipment is installed to protect life safety, specifications should include complete owner instruction and complete system check out with the owner following occupancy. A follow-up should be made for owner instruction again at approximately 90 days from occupancy, and again at the end of the year’s warranty. Since the smoke detection equipment will shut down the entire air conditioning or heating systems, the owner or user must thoroughly understand the operation. In addition, specifications should include printed instructions on or near the equipment.

**Summary**

In general, the use of duct smoke detectors is relatively new. The above suggestions are intended to provide some direction to the specifying engineer where there is little published information to date.
The Statitrol Model 40 Air Duct Detector is designed to "sample" the air moving through an air system to detect smoke or products of combustion. Its main purpose is to shut down fans or close dampers to control smoke. It should not be used as a substitute for area fire detection.

Low Voltage Assembly Includes:
- Detector #102-040
- Housing #103-0044

Line Voltage Assembly Includes:
- Detector #104-040
- Housing #103-0045
PRIOR TO INSTALLATION

Before selecting a specific location, check the following points:

1. The National Fire Codes require one detector in the supply air (downstream of air filters, or in the fan discharge) and one in the return-exhaust air.

2. Be sure the detector sampling tube and reference tube are located in an air stream which is always moving when the fan is on. Avoid dead air locations caused by control dampers, etc.

3. The sample tube (upper left) should extend at least three-fourths the duct width and positioned approximately in the center of the vertical height of the duct. Where possible, to insure good mixing of smoke in the air stream, locate the detector a minimum of six duct widths downstream from the nearest branch duct inlet. In general, use good engineering judgment to be sure the detector samples air at a location representing the average condition in the duct. Note that warm air tends to rise and products of combustion and smoke, generally warmer, will favor the upper portion of the duct.

4. The detector location must always allow access for service.

5. Accessory parts furnished with the duct housing assembly are:

   1. Adhesive-backed template
   2. 1¾" O.D. neoprene washers
   3. #10 by ¾" sheet metal washers
   4. #10 flat washers
   5. 1¾" nickel-plated hole plug
   6. Auxiliary tube ¼" O.D.
   7. 8-32 x ½" machine screws

6. A special lead and plug connector is installed in the duct housing. If a connector is furnished with the detector, it should not be used.

7. Sampling tubes are made from ½" electrical metallic tubing and furnished in standard packages. The lengths of the tubes are determined by the duct width—(refer to Fig. 2).

8. A watch with a second hand, preferably a stop watch, and a volt ohmmeter are necessary to complete the checkout procedure.

9. Electrical Characteristics

**Low Voltage (Detector Mod. 102-040)** is designed for use with a U. L. listed nominal 24 VDC power supply. Specifications for the supply are as follows:

a. The output of the supply is to be 15-30 VDC (unfiltered), or 20-42 VDC (filtered) with allowance for fluctuations in the primary power of +10%, -15% and a load current as determined by number of detectors to be connected to supply.

b. The power supply must also have an ON-OFF switch on the output if it is desirable to remotely reset the entire system of detectors when an alarm condition occurs. Individual detectors can be locally reset from alarm by use of the detector reset switch located in the wiring compartment.

c. Power Consumption—

<table>
<thead>
<tr>
<th>Operation Mode</th>
<th>Maximum/Detector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supervisory</td>
<td>24 ma</td>
</tr>
<tr>
<td>Alarm</td>
<td>65 ma</td>
</tr>
</tbody>
</table>

The use of #16 or #14 AWG wire is recommended for the DC supply line to the detectors. Wiring should always be in conduit, grounded at one central point in the system. When excessively long lines are required, increase wire sizes to keep total line resistance per circuit less than 10 ohms.

**Line Voltage (Detector Mod. 104-040)** is designed for use with either 120 Volts AC or 24 Volts AC, 50 or 60 Hz. Tolerances allowed are -15% or +10% from rated voltages.

a. Power Consumption—

<table>
<thead>
<tr>
<th>Operation</th>
<th>Maximum/Detector</th>
</tr>
</thead>
<tbody>
<tr>
<td>120 Vac, 60 Hz</td>
<td>24 Vac, 50/60 Hz</td>
</tr>
<tr>
<td>Supervisory, 50 ma</td>
<td>160 ma</td>
</tr>
</tbody>
</table>

b. The AC supply line to the detectors must also have an ON-OFF switch if it is desirable to remotely reset the entire system of detectors when an alarm condition occurs. Individual detectors can be locally reset from alarm by use of the detector reset switch located in the wiring compartment.

**DUCT MOUNTING**

1. At the selected location, place the stick-on drill template on the duct and drill four ⅛" dia. mounting holes for #10 sheet metal screws.

2. Drill or punch ⅛" holes for the sample and reference tube. Remove template from the duct. Remove housing assembly front cover and wiring compartment cover.

3. Slide the 1¼" O.D. neoprene washers over the tubes. Insert the notched end of the tubes into the housing—sample tube in upper left corner of housing—reference tube in lower right.

4. The sample tube extension inside the housing is to be ¼"-1", and the reference tube extension ¼"-⅛".

5. The upper, or sample, tube should be placed so the drilled holes face directly upstream. Note: The notch on the end of the tube inside the housing is in line with the drilled holes.

6. The lower, or reference, tube should be placed so the drilled holes are positioned at 90 degrees to air flow.

7. Secure tube positions using setscrews on sides of housing.

8. Insert the tubes into the duct and secure the housing with the four sheet metal screws, flat metal washers, and flat neoprene washers.

9. Run the wiring to the wiring chamber of the housing and put the ⅛" hole plug into the unused conduit opening.

10. Connect the wiring to the plug-in connector according to the job drawing. (See Table 1 or the Installation Wiring Diagram inside the wiring compartment cover.)

11. Plug the connector into the detector and mount the detector in the housing using the two 8-32 x ⅛" mounting screws supplied with the housing assembly.

12. a. Assemble the detector decorator ring by positioning the three slots on ring I.D. in between the three locking tabs on spring retainer cap. Press the ring down and over the center casting until the three retainer tabs lock in place.

   b. The decorator ring may be removed by turning to right or left until the three retainer tabs on the groove between ring and center support are aligned with ring slots.

13. Fit auxiliary tube over end of sample tube and push down against housing. Rotate auxiliary tube until indicator mark on closed end is aligned with indicator mark on housing.

14. Replace the housing front cover and tighten securely.

**START-UP**

After verifying the supply wiring is correct, apply power to detectors.

When a detector is in a supervisory condition, the pilot light should flash on and off about 60 times a minute. When the detector is in alarm, the pilot light should remain on. A de-energized pilot light indicates a trouble condition. Note that the detector "locks" into an alarm condition and remains in alarm until the unit is reset.
The detector sensitivity is factory set and normally should not be changed. Before attempting to read the flashing rate of the detectors, be sure they have been given a 1/2-hour warm-up time and the applied voltage is within the rated limits.

**DETECTOR CHECKOUT**

1. If the detectors are pulsing normally, proceed to Step 2. If any pilot light is on, reset the detector using switch on wiring compartment. If the pilot light remains on (does not flash) replace the detector. If the pilot light is out, remove the detector from its mounting and disconnect the socket between the detector and the connector. Measure the applied voltage. If the lamp remains out and the voltage is normal, replace the detector.

2. With the fan off, check the detector for normal operation. Using a watch with a second hand, count the number of pulses the pilot light makes in 1 minute; record this number. If the number is between 60 and 90, the detector is operating normally. If the number of pulses is greater than 90 or less than 60, replace the detector.

Repeat the test with the fan on. The difference should be no greater than five pulses per minute. If this difference is exceeded, slightly rotate sampling tube until the criteria is met.

**NOTES**

1. For periodic testing, remove smoke test hole plug on housing; insert a 3/8" I.P.S. x 1/4" poly-flo fitting or equal, with plastic tube attached, and blow smoke into housing. When the detector alarms, the pilot lamp will remain on. Replace hole plug—tighten securely.

2. To reset the detector from alarm, purge housing of smoke and reset by momentarily depressing pushbutton on wiring compartment.

**PERIODIC MAINTENANCE**

In very dusty duct applications, it is recommended that on an annual basis, the front cover be removed, and the duct accumulated in the detector ion chamber area be blown out using an air hose connected to a portable tank.

### TABLE 1

<table>
<thead>
<tr>
<th>Leadwire Coding &amp; Contact Rating</th>
<th>Function</th>
<th>Leadwire Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Line Volt</td>
<td>Supervisory Ratings</td>
</tr>
<tr>
<td>(104-040)</td>
<td>120 Vac</td>
<td>Contact Ratings</td>
</tr>
<tr>
<td></td>
<td>24 Vac</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Common</td>
<td></td>
</tr>
<tr>
<td>Low Volt (102-040)</td>
<td>24 Vdc</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Red + Black</td>
<td>Inductive @ 120 Vac</td>
</tr>
<tr>
<td></td>
<td>Brown + Black</td>
<td>Open</td>
</tr>
<tr>
<td></td>
<td>Orange</td>
<td>Inductive @ 120 Vac</td>
</tr>
<tr>
<td></td>
<td>Yellow</td>
<td>Common</td>
</tr>
<tr>
<td></td>
<td>Brown</td>
<td>Closed</td>
</tr>
<tr>
<td></td>
<td>Red/White</td>
<td>Connect to +24 Vdc</td>
</tr>
</tbody>
</table>

**FIG. 2**

**SAMPLE TUBE PACKAGES FOR AIR DUCT DETECTION**

Sample tube is always inserted in upper left mounting hole of detector casting. May be more than one section of tube. Holes always face directly upstream—or into the air flow for maximum air pressure, unless otherwise noted on sample tube installation instructions.

Reference tube—insert in lower right mounting hole. Always 2 ft. long with 12-3/4" diameter holes. Holes always face at 90 degrees to air flow for minimum air pressure.

### TABLE OF DUCT WIDTHS

<table>
<thead>
<tr>
<th>PKG.</th>
<th>MIN.</th>
<th>MAX.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PKG. #1</td>
<td>2'</td>
<td>3 1/2'</td>
</tr>
<tr>
<td>PKG. #2</td>
<td>3'</td>
<td>5'</td>
</tr>
<tr>
<td>PKG. #3</td>
<td>4'</td>
<td>7'</td>
</tr>
<tr>
<td>PKG. #4</td>
<td>6'</td>
<td>10'</td>
</tr>
<tr>
<td>PKG. #5</td>
<td>9'</td>
<td>12'</td>
</tr>
<tr>
<td>PKG. #6</td>
<td></td>
<td>FOR OTHER THAN ABOVE—SPECIFY DUCT WIDTH.</td>
</tr>
</tbody>
</table>
INSTALLATION AND WIRING DIAGRAMS.

1. CONTACTS SHOWN ARE IN NORMAL SUPERVISORY CONDITION—AUX. RELAYS "A" & "B" ENERGIZED.
2. AUX. RELAY "A" IS REQUIRED WHEN USING MOTOR CONTROLLERS LARGER THAN NEMA SIZE 1, OR WITH OPERATING COILS RATED OVER 120 VAC.

FIG. 3
TYPICAL WIRING FOR MULTIPLE SIGNALS AND FAN SHUTDOWN.

FIG. 4
TYPICAL WIRING FOR MODEL 40 DETECTORS WHEN USED IN A FOUR-WIRE DETECTION CIRCUIT.