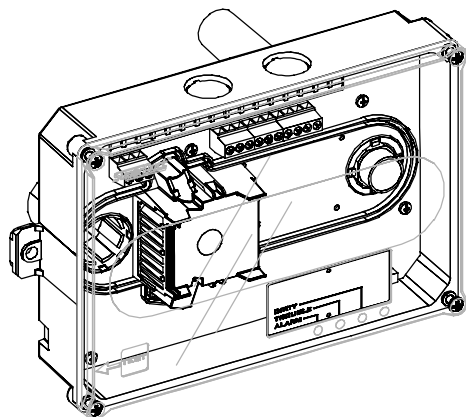


# SuperDuct Conventional Two-Wire Duct Smoke Detector

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## Introduction

This document provides technical information for the SuperDuct Conventional Two-Wire Duct Smoke Detector (referred to simply as duct smoke detector for the remainder of this document.)

This document applies to the following duct smoke detector models: ESD-2W and SD-2W.

## Related documents

In addition to this document, important information regarding the proper installation and maintenance of duct smoke detectors is provided in the following standards:

- NFPA 70 *National Electrical Code*
- NFPA 72 *National Fire Alarm Code*
- NFPA 90A *Installation of Air Conditioning and Ventilating Systems*
- UL 268A *Smoke Detectors for Duct Applications*
- ULC 529 *Smoke Detectors for Fire Alarm Systems*
- NEMA *Guide for Proper Use of Smoke Detectors in Duct Applications*

## Duct smoke detector limitations

SuperDuct duct smoke detectors will not operate without electrical power.

SuperDuct duct smoke detectors will not operate as designed outside of the listed electrical and environmental specifications.

SuperDuct duct smoke detectors will not sense smoke unless the ventilation system is operating and the sensor's cover is properly installed.

SuperDuct duct smoke detectors may not operate as designed unless installed in accordance with these instructions and all applicable national and local codes as determined by the local authority having jurisdiction.

## Product description

### Overview

The duct smoke detector is used to detect smoke in the protected premises' HVAC system under extended temperature ranges. It can be installed in self-contained commercial rooftop HVAC systems where the HVAC components (compressor, condensing unit, heating coils, etc.) are enclosed in a single package to protect them from adverse

environmental conditions. Hinged or removable service panels typically provide access to the equipment.

The duct smoke detector's primary purpose is to provide early warning of an impending fire and shut down the HVAC unit in order to prevent smoke from circulating throughout the building. It is typically used to detect smoke in the supply side of the HVAC system but can provide supervision of the return side as well (see Figure 1.)

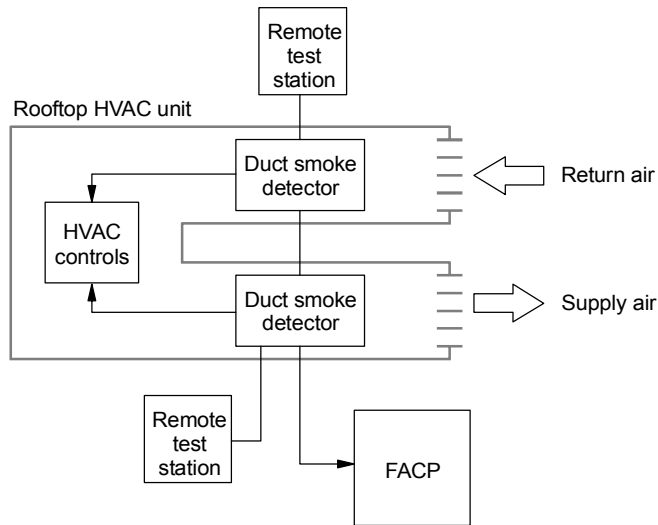


Figure 1: Duct smoke detector application diagram

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**WARNING:** SuperDuct duct smoke detectors are not intended as substitutes for open area protection.

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**Note:** Install supply-side detectors at a point downstream from the supply fan and air filters and return-side detectors at a point before the return air is diluted by outside air.

In installations where the duct smoke detector's controls and indicators are hidden from view, a remote test station or an LED indicator can be connected to the detector to provide these functions.

The duct smoke detector uses differential sensing to prevent gradual environmental changes from triggering false alarms. A rapid change in environmental conditions, such as smoke from a fire, causes the detector to automatically signal an alarm condition but dust and debris accumulated over time does not.

Air is introduced to the duct smoke detector's sensing chamber through a sampling tube that extends into the HVAC

duct and is directed back into the ventilation system through an exhaust tube. The difference in air pressure between the two tubes pulls the sampled air through the sensing chamber. When a sufficient amount of smoke is detected in the sensing chamber, the duct smoke detector notifies the fire alarm control panel.

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**Caution:** Excess temperature differentials between the ambient air and the sampled air can produce unwanted condensation inside the detector, which may cause the detector to function improperly. Precautions should be taken to limit the temperature range and the amount of condensation to which the detector is exposed.

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## Description

The duct smoke detector (see Figure 2) comprises a plastic housing, a printed circuit board, a clear plastic cover, an exhaust tube, and a sampling tube. The exhaust tube and sampling tube are attached during installation. The sampling tube varies in length depending on the size of the HVAC duct and is ordered separately.

The clear plastic cover permits visual inspections without having to disassemble the detector. The cover attaches to the detector housing using four captive screws and forms an airtight chamber around the sensing electronics.

## Features

The duct smoke detector incorporates the following features:

- Environmental compensation with differential sensing for reliable, stable, and drift-free sensitivity
- Magnet-activated test switch
- PCB mounted photoelectric detector with onboard intelligence
- Cover tamper switch for added security
- Sampling tube can be installed with or without the cover in place and can be rotated in 45-degree increments to ensure proper alignment with duct airflow
- Alarm, Trouble, and Dirty status LEDs
- Extended temperature and air velocity ranges
- One Form C auxiliary alarm relay for controlling ancillary equipment (e.g., HVAC controls)

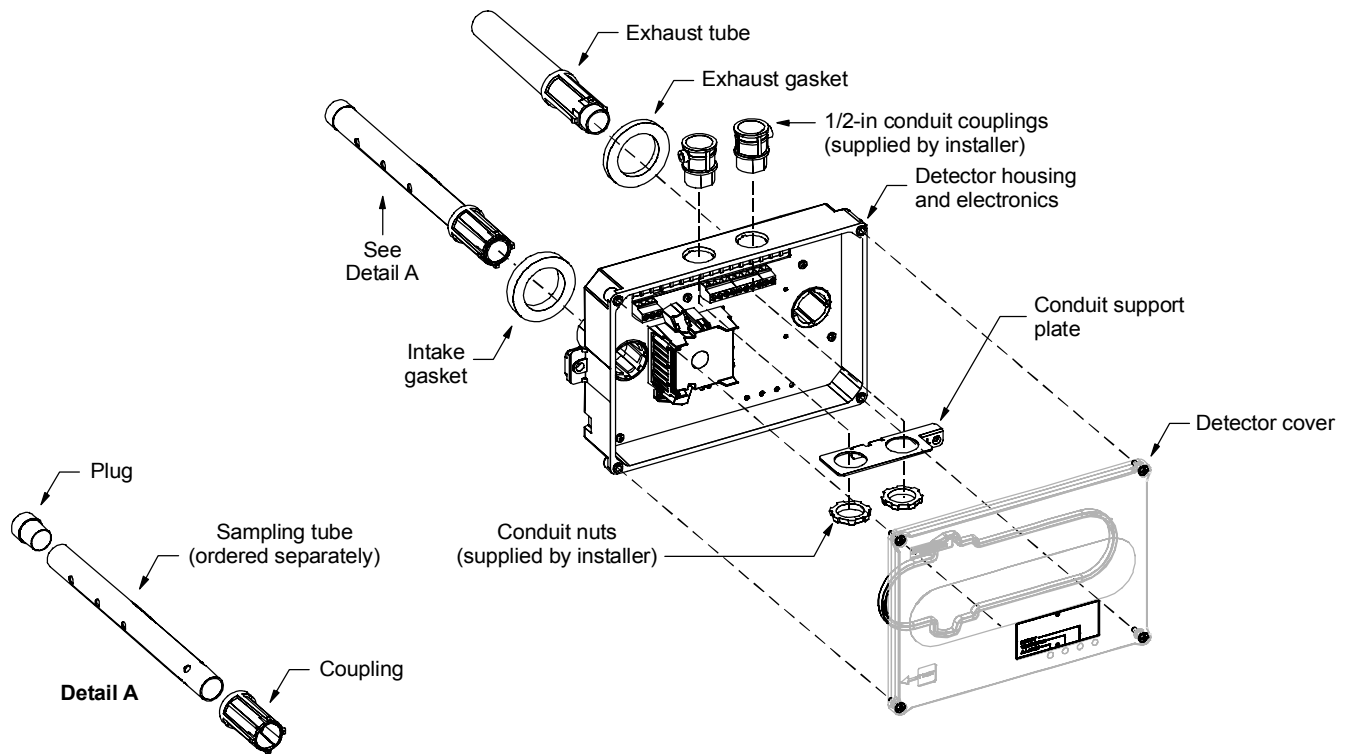


Figure 2: Duct smoke detector exploded view

## Specifications

Dimensions: 8.70 x 5.45 x 1.90 inches

Wire size: 14 to 22 AWG

Smoke detection method: Photoelectric (light scattering principle)

Air velocity rating: 100 to 4,000 ft/min

Air pressure differential: 0.005 to 1.00 inches of water

Sensitivity: 0.79 to 2.46 %/ft obscuration

Reset time: 1 second, max.

Power up time: 30 seconds, max.

Alarm test response time: 5 seconds

LED indicators: Alarm (red), Trouble (yellow), Dirty (yellow)

Zone alarm relay

Unsupervised and power-limited

Quantity: 1

Type: Form C

Ratings: 2.0 A at 30 Vdc (resistive)

Detector operating voltage: 16 to 30 Vdc

Detector operating current

Startup: 200  $\mu$ A

Standby: 70  $\mu$ A

Alarm: 5 to 100 mA

Alarm impedance: 50 to 750  $\Omega$

Accessory operating voltage: 3.3 Vdc, minimum

Accessory operating current: 1.5 mA, minimum

Operating environment

Temperature (UL): -29 to 70 °C (-20 to 158 °F)

Temperature (ULC): -29 to 49 °C (-20 to 120.2 °F)

Humidity (UL and ULC): 93% RH, noncondensing

Compatibility ID

0.0: IDC short circuit current  $\leq$  100 mA

1.0: IDC short circuit current  $>$  100 mA

**Note:** Refer to the fire alarm control panel's documentation for system compatibility details.

## Accessories

The accessories that you can use with the duct smoke detector are listed below.

Model	Description
SD-T8	8-inch sampling tube
SD-T18	18-inch sampling tube
SD-T24	24-inch sampling tube
SD-T36	36-inch sampling tube
SD-T42	42-inch sampling tube
SD-T60	60-inch sampling tube
SD-T78	78-inch sampling tube
SD-T120	120-inch sampling tube
SD-TRM	Remote test-reset station, magnetic
SD-TRK	Remote test-reset station, keyed

Model	Description
SD-MAG	Test magnet kit
SD-VTK	Air velocity test kit

## Operation

### Controls and indicators

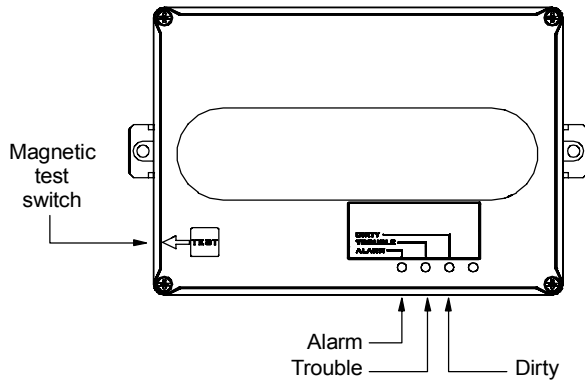


Figure 3: Duct smoke detector controls and indicators

The controls and indicators on the duct smoke detector (see Figure 3) are as follows:

Control or indicator	Description
Magnetic test switch	Used to alarm test the detector, determine its dirty level, and determine if the detector is in the trouble state
Alarm LED	Indicates the detector is in the alarm state
Trouble LED	Flashes once to indicate the detector is in the trouble state. Requires manual activation from user.
Dirty LED	Flashes 1 to 4 times to indicate the detector's dirtiness level. Requires manual activation from user.

### Normal state

The duct smoke detector operates in the normal state in the absence of any trouble conditions and when its sensing chamber is free of smoke or an alarm test is initiated.

### Alarm state

The duct smoke detector enters the alarm state (is activated) when the amount of smoke in its sensing chamber exceeds its alarm threshold setting or when an alarm test is initiated. Upon entering the alarm state, the duct smoke detector's:

- Alarm LED turns on
- Common alarm relay contact switches position
- Remote alarm LED output turns on (is activated)

In addition, the duct smoke detector places a low impedance short across the initiating device circuit. The low impedance short causes the control panel's IDC input to generate an alarm or supervisory event message depending on the device type with which it is configured.

### Trouble state

The duct smoke detector enters the trouble state under the following conditions:

- Its cover is removed and 20 minutes pass before it is properly secured
- Its environmental compensation limit is reached
- The detector is 100% dirty
- An internal detector fault is present

The duct smoke detector does not automatically indicate trouble conditions. Instead, you must test whether a trouble is present. For more information, see "Troubleshooting."

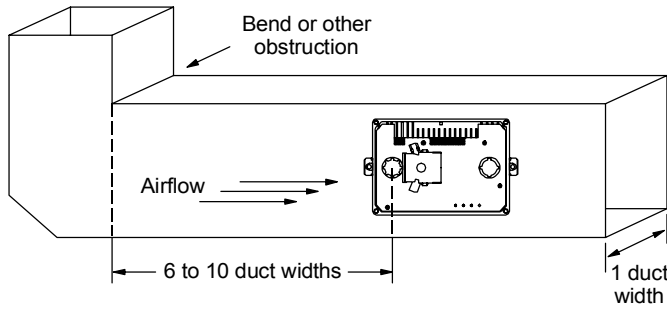
**Note:** All troubles are latched by the duct smoke detector. You must clear the trouble condition then reset the control panel in order to restore the detector to its normal state.

## Installation

### Installation guidelines

To ensure correct operation, install the duct detector using the following guidelines:

- Locate the detector so its sampling tube is positioned in a straight length of square duct between six and ten duct widths from any bends or obstructions as shown in the diagram below. See Figure 7 for detector dimensions.



- For detection of smoke in the supply air system, install the duct smoke detector in the supply air duct at a point downstream from the supply fan and air filters
- For detection of smoke in the return air system, install the duct smoke detector in the return air duct at a point before the return air stream is diluted by outside air
- Extend sampling tubes at least two-thirds across the width of the HVAC duct with the air inlet holes pointed into the direction of airflow
- Support sampling tubes longer than 36 inches at the end farthest from the detector to avoid excessive vibration
- Upon installation, perform an air pressure differential test to ensure the duct smoke detector is capable of sampling the air stream

### Installation sequence

The steps required to install the duct smoke detector are described below. The order in which these steps are performed may vary depending installation requirements.

1. Verify the duct airflow direction and velocity.
2. Drill the mounting holes using the drill template provided.
3. Assemble the detector.
4. Mount the detector on the HVAC duct.
5. Verify the detector pressure differential.

### Installing the sampling tube from the front of the detector

The sampling tube is normally installed from the rear, but it can also be installed from the front of the detector as shown in Figure 4. This method requires that you remove the detector cover.

**Note:** Sampling tubes are ordered separately.

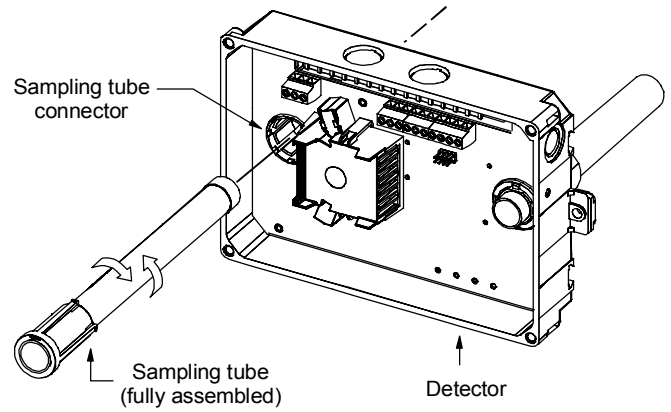


Figure 4: Sampling tube installed from the front

### Supporting sampling tubes greater than 36 inches long

NFPA requirements state that sampling tubes must extend at least two-thirds of the way into the duct and those that are greater than 36 inches long must be supported at both ends. To meet this requirement, drill a 3/4-inch hole on the opposite side of the duct. Extend the sampling tube through the hole as shown in Figure 5. Cut off the excess sampling tube and seal the opening around the tube with an approved sealant.

**Note:** For ducts greater than or equal to 36 inches, use the next longest sampling tube available.

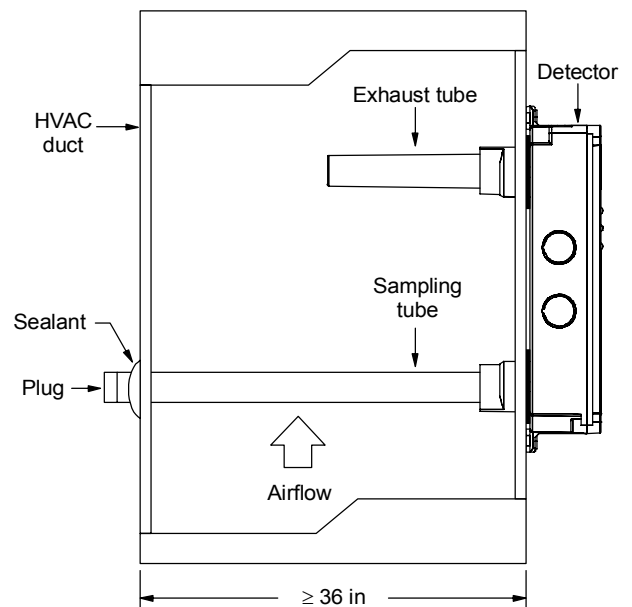


Figure 5: Installation with sampling tubes longer than the width of the duct

## Wiring

Figure 8 and Figure 9 show how to wire the duct smoke detector and its accessories. The duct smoke detector's IDC wiring differs depending on the control panel's short circuit current specification. Run all field wiring into the detector through the knockouts located at the top of the detector housing.

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**Caution:** Incorrectly wiring the duct smoke detector to the control panel's IDC circuit can damage the equipment.

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## Maintenance and service

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### Recommended service schedule

Perform a visual inspection upon installation and once every six months thereafter.

Perform an alarm test upon installation and once every twelve months thereafter.

### Testing the duct smoke detector

Before testing the duct smoke detector, notify the proper authorities that the system is undergoing maintenance and, unless part of the test, disconnect all auxiliary equipment from its common alarm relay contacts.

**Note:** You can't initiate an alarm test if the duct smoke detector is in the trouble state.

To test the duct smoke detector's ability to report an alarm condition:

- Using an SD-MAG, hold the SD-MAG where indicated on the side of the duct smoke detector for more than 5 seconds
- Using an SD-TRK, turn the key switch to the TEST position for more than 5 seconds
- Using an SD-TRM, hold the SD-MAG test magnet to the target area for more than 5 seconds

Once activated, verify the following:

- The detector's Alarm LED is on
- If connected, the Alarm LED on the remote test station or LED indicator is on
- The appropriate event message or visual indication is reported on the fire alarm control panel

After you have finished testing the duct smoke detector, reset the control panel in order to restore the detector to its normal state.

## Troubleshooting

You can troubleshoot problems while the duct smoke detector is in operation. However, be careful not to place the duct smoke detector in the alarm state since the procedure for troubleshooting and alarming the detector is similar.

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**Caution:** Before troubleshooting the duct smoke detector, notify the proper authorities that the fire alarm system is undergoing maintenance and take steps to prevent the control panel from responding to a false alarm.

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To test whether a trouble is present:

- Using an SD-MAG, hold the SD-MAG where indicated on the side of the duct smoke detector for 1 to 4 seconds
- Using an SD-TRK, turn the key switch to the TEST position for 1 to 4 seconds
- Using an SD-TRM, hold the SD-MAG test magnet to the target area for 1 to 4 seconds

If a trouble exists, the duct smoke detector's Trouble LED will flash once. The most common troubles are described below.

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Problem	Solution
The cover is not properly secured	Make sure the cover is attached and secured properly then reset the control panel
The detector is greater than 100% dirty	Clean the duct smoke detector then reset the control panel

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**Note:** After correcting a problem, test the detector again to verify the problem was solved.

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If securing the cover and cleaning the detector did not fix the problem, you should replace the duct smoke detector's printed circuit board (model number SD-2WPCB, ordered separately.)

If the duct smoke detector is normal (not in trouble), the Dirty LED flashes as shown below.

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Flashes	Description
1	0 to 24% dirty (typical on a newly installed duct smoke detector)
2	25 to 49% dirty
3	50 to 74% dirty
4	75 to 99% dirty

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### Cleaning the duct smoke detector

Clean the duct smoke detector when it becomes 75% to 99% dirty or sooner if conditions warrant.

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**Caution:** Before cleaning the duct smoke detector, notify the proper authorities that the fire alarm system is undergoing maintenance and take steps to prevent the control panel from responding to a false alarm.

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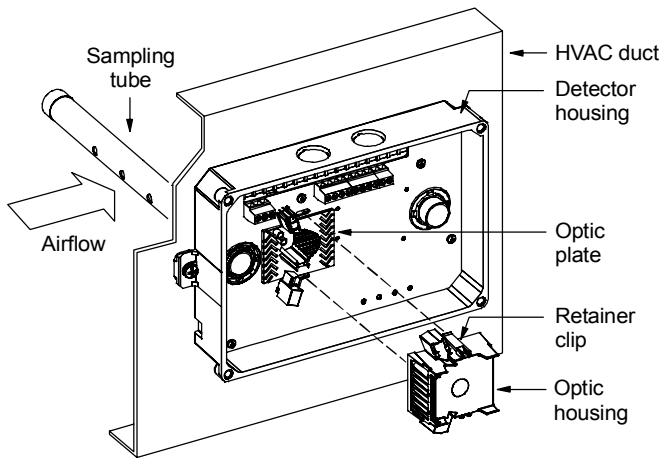


Figure 6: Detector cleaning diagram

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**To clean the duct smoke detector:**

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1. Remove the detector's cover then power down the detector by disconnecting the initiating device circuit wiring.
2. Using a vacuum cleaner, clean compressed air, or a soft bristle brush, remove loose dirt and debris from inside the detector housing and cover.  
  
Use isopropyl alcohol and a lint-free cloth to remove dirt and other contaminants from the gasket on the detector's cover
3. Squeeze the retainer clips on both sides of the optic housing then lift the housing away from the printed circuit board.
4. Gently remove dirt and debris from around the optic plate and inside the optic housing.
5. Replace the optic housing and detector cover.

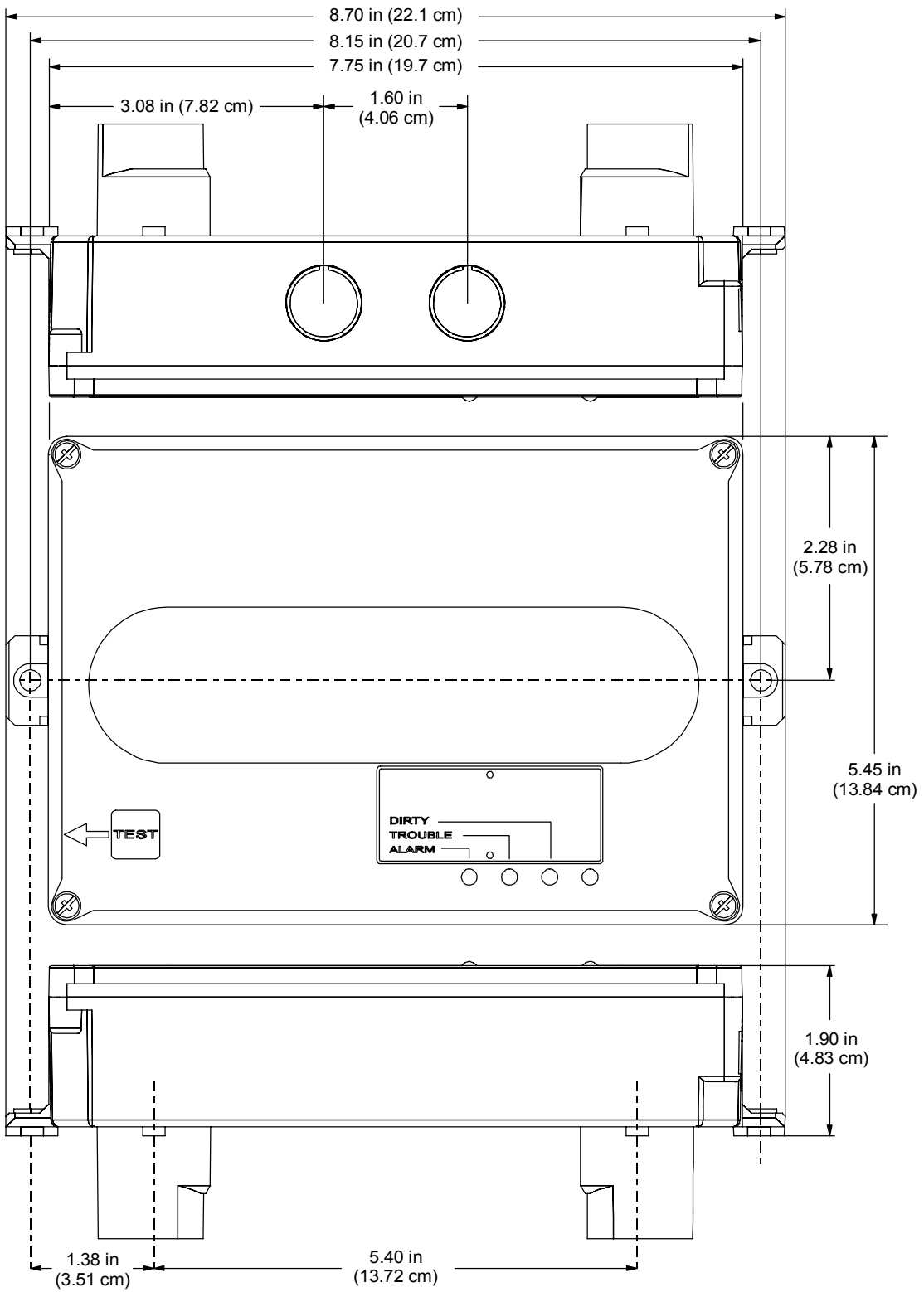


Figure 7: Mechanical dimensions

**Notes**

[1] End-of-line resistor is required on the last detector only. The value is determined by the fire alarm control panel's initiating device circuit.

[2] No more than one remote test station can be connected at the same time. Wiring is unsupervised. Maximum wire resistance is 10 ohms per wire.

[3] Only the first detector to go into alarm operates its alarm relay. Operation of the alarm relay can't be guaranteed if a manual initiating device on the same circuit is activated.

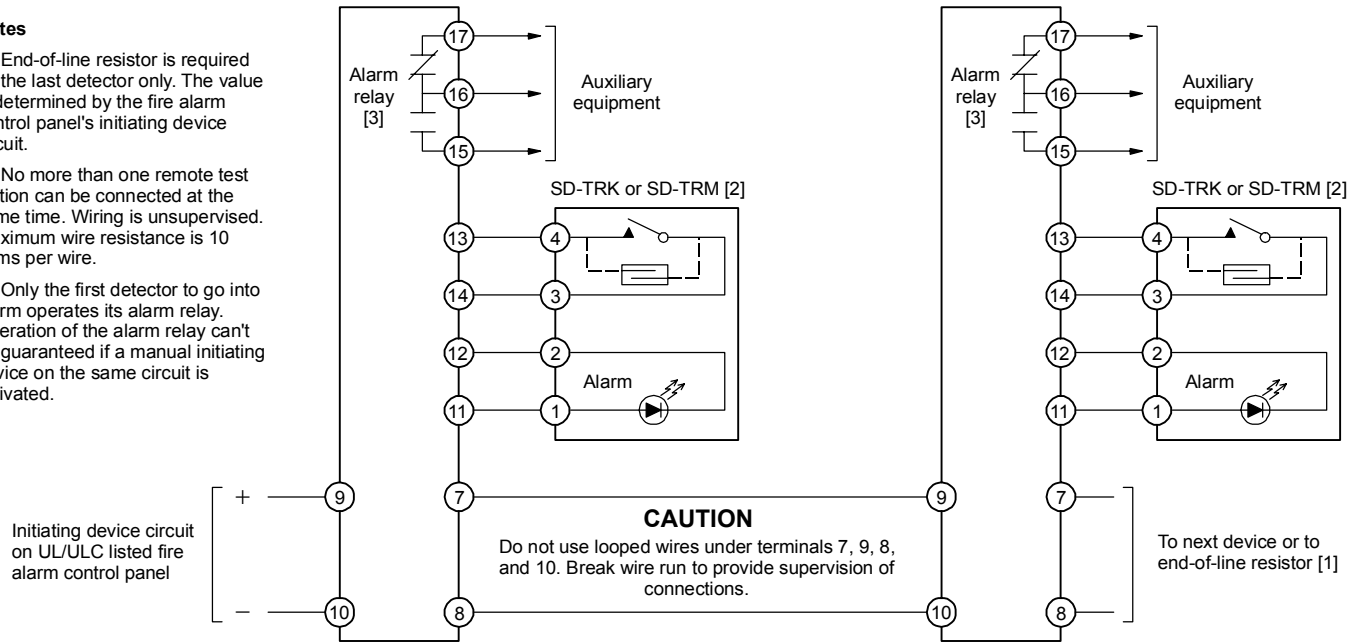


Figure 8: Installation wiring diagram (IDC short circuit current  $\leq 100$  mA)

**Notes**

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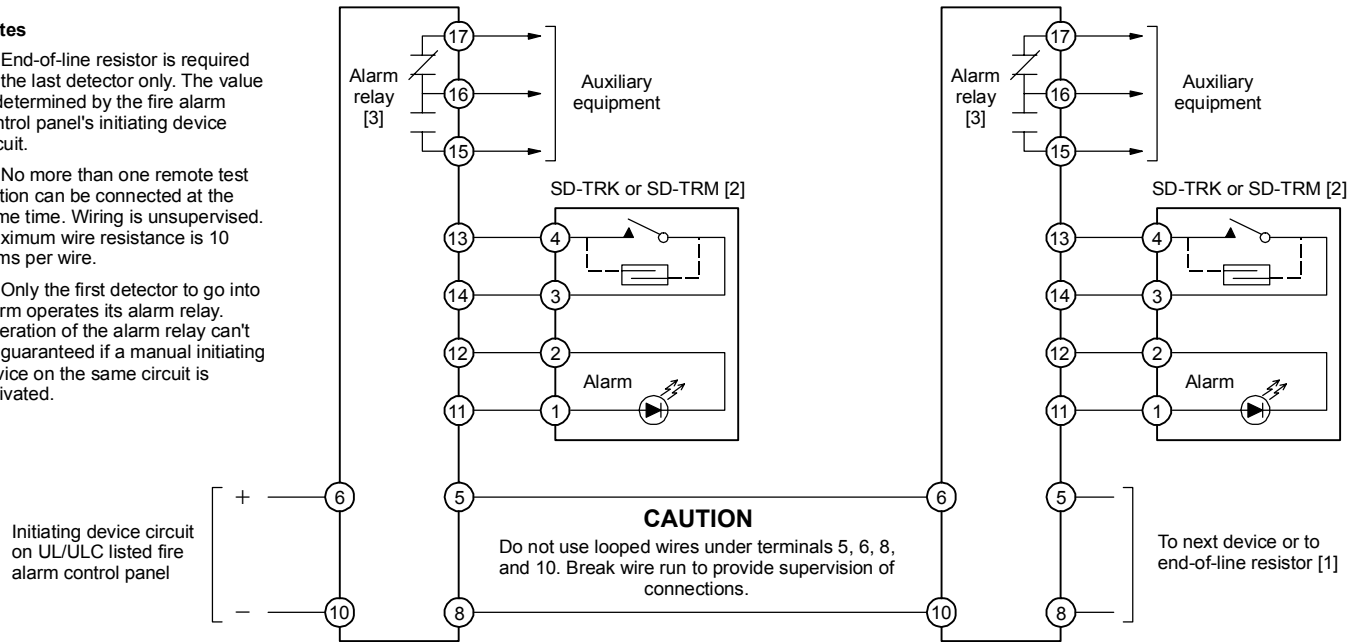


Figure 9: Installation wiring diagram (IDC short circuit  $> 100$  mA)

