Before Installing
Please thoroughly read the System Sensor manual I56-407-XX, *Guide for Proper Use of System Smoke Detectors*. This manual provides detailed information on detector spacing, placement, zoning, wiring, and special applications. Copies of this manual are available at no charge from System Sensor. (For installation in Canada, refer to CAN/ULC-S524, *Standard for the Installation of Fire Alarm Systems* and CEC Part 1, Sec. 32.)

General Description
System Sensor 1400 dual-chamber ionization smoke detectors utilize state-of-the-art, unipolar sensing chambers. These detectors are designed to provide open area protection, and to be used with compatible UL-listed, 2-wire control panels only. The detector’s operation and sensitivity can be tested in place.

Each detector includes an LED that provides a local visual indication of the detector’s status. The LED blinks every ten seconds as an indication that power is applied to the detector and lights continuously in alarm. These detectors also have the latching alarm feature. The alarm can be reset only by a momentary power interruption.

The detector also has provision for the connection of an optional Model RA400Z Remote Annunciator. The RA400Z provides a visual indication of an alarm and mounts to a single gang box.

Spacing
NFPA 72 defines the spacing requirements for smoke detectors. Typically, this is 30 feet when the detectors are installed on a smooth ceiling. However, all installations must comply with NFPA 72 and/or special requirements of the authority having jurisdiction.
Mounting
Each 1400 detector is supplied with a mounting bracket kit that permits the detector to be mounted:
1. Directly to a 3-1/2 inch or 4 inch octagonal, 1-1/2 inch deep electrical box, or
2. To a 4 inch square electrical box by using a plaster ring with the supplied mounting bracket kit.

Installation Wiring Guidelines
All wiring must be installed in compliance with the National Electrical Code and all applicable local codes and any special requirements of the authority having jurisdiction, using the proper wire size. The conductors used to connect smoke detectors to control panels and accessory devices should be color-coded to reduce the likelihood of wiring errors. Improper connections can prevent a system from responding properly in the event of a fire.

For signal wiring (the wiring between interconnected detectors), it is recommended that the wire be no smaller than AWG 18. However, the screws and clamping plate can accommodate wire sizes up to AWG 12. The use of twisted pair wiring for the power (+ and -) loop is recommended to minimize the effects of electrical interference.

Smoke detectors and alarm system control panels have specifications for allowable loop resistance. Consult the control panel manufacturer’s specifications for the total loop resistance allowed for the control panel being used before wiring the detector loops.

Begin electrical connections by stripping about 3/8" insulation from the end of the wire. Then, slide the bare end of the wire under the clamping plate and tighten the clamping plate screw. A wiring diagram for a typical 2-wire detector system is shown in Figure 3.

NOTE: Break the wire at each terminal to ensure that the connections are supervised. Do NOT loop the wire under the terminals.

System Sensor smoke detectors are marked with a compatibility identifier located as the last digit of a five digit code stamped on the back of the product. Connect detectors only to compatible control units as indicated in System Sensor’s compatibility chart which contains a current list of UL-listed control units and detectors. A copy of this list is available from System Sensor upon request.

Tamper-resistant Feature
This detector includes a tamper-resistant feature that effectively prevents removal of the detector without the use of a tool. To make the detector tamper-resistant, break off the smaller tab at the scribed line on the tamper resistant tab, on the detector mounting bracket (see Figure 2), then install the detector. To remove the detector from the bracket once it has been made tamper resistant, use a small screwdriver to depress the tamper-resistant tab located in the slot on the mounting bracket and turn the detector counterclockwise for removal.

Installation

Disconnect the power to the alarm system control unit before installing detectors.

1. Wire the detector following the installation guidelines.
2. Line up arrows on the detector with the arrows on the mounting bracket.
3. Rotate the detector clockwise until it clicks into place.
4. After all detectors have been installed, apply power to the control unit.
5. Test the detector as described under TESTING.
6. Reset the detector at the system control panel.
7. Notify the proper authorities that the system is in operation.
Dust covers can be used to help limit dust entry to the detector, but they are not a substitute for removing the detector during building construction. Remove any dust covers before placing system in service.

**Testing**

Before testing the detector, look for the presence of the flashing LED. If it does not flash, power has been lost to the detector (check the wiring), or it is defective (return for repair – refer to Warranty).

Detectors must be tested after installation and following periodic maintenance. Notify the proper authorities that the system is undergoing testing. The 1400 may be tested as follows:

A. **Recessed Test Switch**
   
   1. A test switch is located on the detector housing (See Figure 4).

   2. Push and hold the recessed test switch with a 0.1 inch maximum diameter tool.

   3. The LED on the detector should light within 5 seconds.

B. **Test Module (System Sensor Model No. MOD400R)**

   The MOD400R is used with an analog or digital voltmeter to check the detector sensitivity as described in the test module manual.

C. **Aerosol Generator (Gemini 501)**

   Set the generator to represent 4%/Ft. to 5%/Ft. obscuration as described in the Gemini 501 manual. Using the bowl shaped applicator, apply aerosol until the unit alarms.

   Notify the proper authorities that the system is back online.

   Detectors that fail these tests should be cleaned as described under MAINTENANCE and retested. If the detectors still fail these tests, they should be returned for repair.

---

**Figure 3. Wiring diagram for 1400 smoke detector used with two-wire control panel:**

---

**Figure 4. Bottom and side views showing position of test switch:**
Maintenance

NOTE: Before starting, notify the proper authorities that the smoke detector system is undergoing maintenance and, therefore, will be temporarily out of service. Disable the zone or system undergoing maintenance to prevent unwanted alarms.

The 1400 is cleaned as follows:
1. Remove the detector screen and cover assembly by depressing the three lock prongs on the top of the cover, rotating the cover clockwise, and pulling the cover and screen assembly away from the detector (see Figure 5). Use of the System Sensor CRT400 cover removal tool is recommended.
2. Remove the screen from the cover.
3. Use a vacuum cleaner to remove dust from the screen, the cover, and the sensing chamber.
4. After cleaning, snap the screen into the cover, then place the cover and screen assembly on the detector turning clockwise until it is locked in place.
5. Test the detector as described in TESTING.
6. Notify the proper authorities that the system is back on line.

Figure 5. Removal of cover and screen for cleaning:

This smoke detector is designed to activate and initiate emergency action, but will do so only when it is used in conjunction with an authorized fire alarm system. This detector must be installed in accordance with NFPA standard 72.

Smoke detectors will not work without power. AC or DC powered smoke detectors will not work if the power supply is cut off.

Smoke detectors will not sense fires which start where smoke does not reach the detectors. Smoldering fires typically do not generate a lot of heat which is needed to drive the smoke up to the ceiling where the smoke detector is usually located. For this reason, there may be large delays in detecting a smoldering fire with either an ionization type detector or a photoelectric type detector. Either one of them may alarm only after flaming has initiated which will generate the heat needed to drive the smoke to the ceiling.

Smoke from fires in chimneys, in walls, on roofs or on the other side of a closed door(s) may not reach the smoke detector and alarm it. A detector cannot detect a fire developing on another level of a building quickly or at all. For these reasons, detectors shall be located on every level and in every bedroom within a building.

Smoke detectors have sensing limitations, too. Ionization detectors and photoelectric detectors are required to pass fire tests of the flaming and smoldering type. This is to ensure that both can detect a wide range of types of fires. Ionization detectors offer a broad range of fire sensing capability but they are somewhat better at detecting fast flaming fires than slow smoldering fires. Photoelectric detectors sense smoldering fires better than flaming fires which have little, if any, visible smoke. Because fires develop in different ways and are often unpredictable in their growth, neither type of detector is always best, and a given detector may not always provide early warning of a specific type of fire.

In general, detectors cannot be expected to provide warnings for fires resulting from inadequate fire protection practices, violent explosions, escaping gases which ignite, improper storage of flammable liquids like cleaning solvents which ignite, other similar safety hazards, arson, smoking in bed, children playing with matches or lighters, etc. Smoke detectors used in high air velocity conditions may have a delay in alarm due to dilution of smoke densities created by frequent and rapid air exchanges. Additionally, high air velocity environments may create increased dust contamination, demanding more frequent maintenance.

Smoke detectors cannot last forever. Smoke detectors contain electronic parts. Even though smoke detectors are made to last over 10 years, any part can fail at any time. Therefore, smoke detectors shall be replaced after being in service for 10 years. The smoke detector system that this detector is used in must be tested regularly per NFPA 72. This smoke detector should be cleaned regularly per NFPA 72 or at least once a year.

The Limitations of Property Protection Smoke Detectors

System Sensor warrants its enclosed smoke detector to be free from defects in materials and workmanship under normal use and service for a period of three years from date of manufacture. System Sensor makes no other express warranty for this smoke detector. No agent, representative, dealer, or employee of the Company has the authority to increase or alter the obligations or limitations of this Warranty. The Company’s obligation of this Warranty shall be limited to the repair or replacement of any part of the smoke detector which is found to be defective in materials or workmanship under normal use and service during the three year period commencing with the date of manufacture. After phoning System Sensor’s toll free number 800-SENSOR2 (736-7672) for a Return Authorization number, send defective units postage prepaid to: System Sensor, Repair Department, RA #__________, 3825 Ohio Avenue, St. Charles, IL 60174. Please include a note describing the malfunction and suspected cause of failure. The Company shall not be obligated to repair or replace units which are found to be defective because of damage, unreasonable use, modifications, or alterations occurring after the date of manufacture. In no case shall the Company be liable for any consequential or incidental damages for breach of this or any other Warranty, expressed or implied whatsoever, even if the loss or damage is caused by the Company’s negligence or fault. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This Warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Three-Year Limited Warranty

© System Sensor 1996
1412 and 1424 Direct Wire Ionization Smoke Detectors

Specifications

- Diameter: 5.5 inches (14 cm)
- Height: 3.12 inches (8.0 cm)
- Weight: 0.7 lb (310 gm)
- Operating Temperature: 0°F to +49°F (32°C to 120°F)
- Operating Humidity: 10% to 93% Relative Humidity Non-condensing

Relay Contact Ratings

Resistive or Inductive (60% power factor) load
- Form A: 2.0A @ 30VAC/DC
- Form C*: 0.6A @ 110VDC, 2.0A @ 30VDC
  1.0A @ 125VAC, 2.0A @ 30VAC

*For Canadian installations, relay contact rating is 2.0A @ 30VAC/DC

Electrical Ratings:

- System Voltage: 12V DC (4V Maximum Ripple)
- Supply Voltages: 11.3 20VDC, 17.3 29VDC
- Reset Voltages: .73 .8 VDC Minimum
- Standby Current: 100 100 µA Maximum
- Alarm Currents: 35.2 21.3 mA Minimum
  77.0 40.6 mA Maximum

The alarm and auxiliary relay operate within the specified voltage ratings.

- Reset Time: 0.3 0.3 Seconds
- Start-up Time: 30 30 Seconds

Before Installing

Please thoroughly read the System Sensor manual I56-407-XX, Guide for Proper Use of System Smoke Detectors, which provides detailed information on detector spacing, placement, zoning, wiring, and special applications. Copies of this manual are available at no charge from System Sensor. (For installation in Canada, refer to CAN/ULC-S524, Standard for the Installation of Fire Alarm Systems and CEC Part 1, Sec. 32.)

General Description

System Sensor 1412 and 1424 dual-chamber ionization smoke detectors utilize state-of-the-art, unipolar sensing chambers. These detectors are designed to provide open area protection, and to be used with UL-listed 4-wire control panels. The 1412 for 12 volt panels operates at 12VDC, and the 1424 for 24 volt panels operates at 24VDC. The detectors’ operation and sensitivity can be tested in place. These detectors are listed to UL 268 and are latching type system detectors. When latched in alarm, the detectors must be reset by a momentary power interruption.

An LED on the detector provides a local indication of the detector’s status. If power is applied to the detector, and the detector is functioning properly in standby, the status LED will blink every 10 seconds. In alarm, the LED will be latched on continuously until the detector is reset.

Each detector contains one Form A (SPST-NO) contact for connection to the alarm-initiating circuit, and one Form C (SPDT-NO/NC) set of auxiliary contacts. Supervision of detector power is accomplished by installing a Power Supervisory End-of-Line Relay Module (A77-716) at the end of the detector power loop. When power is applied to and through the detectors, the EOL Power Supervisory Module is energized. Its relay contacts close and provide a closed series circuit in the control panel’s alarm-initiating loop. A power failure or a break in the detector power loop de-energizes the EOL Module. The relay contacts open and trigger a trouble signal at the control panel.
Mounting
Each 1412 and 1424 detector is supplied with a mounting bracket kit that permits the detector to be mounted:
1. Directly to a 3-1/2 inch or 4 inch octagonal, 1-1/2 inch deep electrical box, or
2. To a 4 inch square electrical box by using a plaster ring with the supplied mounting bracket kit.

Spacing
Spacing of 30 ft. on a smooth ceiling as per NFPA 72E. Where conditions or response requirements vary, other spacing may apply.

Wiring Installation Guidelines
All wiring must be installed in compliance with the National Electrical Code and the applicable local codes, and any special requirements of the local authority having jurisdiction. Proper wire gauges should be used. The conductors used to connect smoke detectors to control panels and accessory devices should be color-coded to prevent wiring mistakes. Improper connections can prevent a system from responding properly in the event of a fire.

NOTE: Refer to releasing device manufacturer’s installation instruction for proper connections.
NOTE: Contacts are shown in stand-by mode and will transfer in alarm condition.

CAUTION
For system supervision: for terminals 1, 2, 7, and 8, do not use looped wire under terminals. Break wire run to provide system supervision of connections.

For signal wiring (the wiring between interconnected detectors), it is recommended that the wire be no smaller than 18 gauge. Wire sizes up to 12 gauge wire may be used. For best system performance, the power (+) and (-) loop wires should be twisted pair and installed in separate grounded conduit to protect the loop from extraneous electrical interference.

Smoke detectors and alarm system control panels have specifications for allowable loop resistance. Consult the control panel manufacturer’s specifications for the total loop resistance allowed for the particular model control panel being used before wiring the detector loops.

Figure 1. Flush mounting of detector on 4 inch octagonal box:

Figure 2. Detector mounting bracket:

Figure 3. Wiring diagram for models 1412 and 1424 detectors used with Class A or Class B four-wire control panels.
Wire connections are made by stripping about 3/8" of insulation from the end of the wire (use strip gauge molded in base), sliding the bare end of the wire under the clamping plate, and tightening the clamping plate screw. A typical wiring diagram for a 4-wire detector system is shown in Figure 3.

Tamper-proof Feature
This detector includes a tamper-proof feature that, when activated, prevents removal of the detector without the use of a tool. To activate this feature, break off the smaller tab at the scribed line on the tamper-proof tab, located on the detector mounting bracket (see Figure 2), then install the detector. To remove the detector from the bracket once the tamper-proof feature has been activated, depress the tamper-proof tab located in the slot on the mounting bracket (see Figure 4) and turn the detector counterclockwise for removal.

Installation

**WARNING**
Remove power from initiating-device circuits before installing detectors.

1. Wire detector per installation guidelines.
2. Line up arrows on the detector with arrows on the mounting bracket.
3. Turn the detector clockwise until it clicks into place.
4. After all detectors have been installed, apply power to the control unit.
5. Test the detector as described under TESTING.
6. Reset the detector at the system control panel.
7. Notify the proper authorities the system is in operation.

**CAUTION**
Dust covers can be used to help limit dust entry to the detector, but they are not a substitute for removing the detector during building construction. Remove any dust covers before placing system in service.

**Figure 4. Bottom and side view showing position of test switch:**

Before testing the detector, look for the presence of the flashing LED. If it does not flash, power has been lost to the detector (check the wiring), or it is defective (return for repair, see warranty information).

Detectors must be tested after installation and following periodic maintenance. The 1412 and 1424 may be tested as follows:

A. Recessed Test Switch
   1. A test switch is located on the detector housing (see Figure 4).
   2. Push and hold the recessed test switch with a 0.1 inch maximum diameter tool.
   3. The LED on the detector should light within 30 seconds.
   4. Reset the detector at the system control panel.

B. Test Module (System Sensor Model No. MOD400R)
   The MOD400 or MOD400R is used with an analog or digital voltmeter to check the detector sensitivity as described in the test module’s manual.

C. Aerosol Generator (Gemini 501)
   Set the generator to represent 4%/ft. to 5%/ft. obscuration as described in the Gemini 501 manual. Using the bowl shaped applicator, apply aerosol until unit alarms.

Notify the proper authorities the system is back on line.

Detectors that fail these tests should be cleaned as described under MAINTENANCE and retested. If the detectors still fail these tests, they should be returned for repair.
**Maintenance**

NOTE: Before starting, notify the proper authorities that the smoke detector system is undergoing maintenance, and therefore will temporarily be out of service. Disable the zone or system undergoing maintenance to prevent unwanted alarms.

The 1412 and 1424 are cleaned as follows:

1. Remove the detector screen and cover assembly by depressing the three lock prongs on the top of the cover, rotate the cover counterclockwise, and pull the screen and cover assembly away from the detector (see Figure 5). Usage of System Sensor CRT400 cover removal tool is recommended.
2. Remove the screen from the cover.
3. Use a vacuum cleaner to remove dust from the screen, the cover, and the sensing chamber.
4. After cleaning, snap the screen into the cover, then place the cover and screen assembly on the detector, turning clockwise until it is locked in place.
5. Test detector as described under TESTING.
6. Notify the proper authorities that the system is back on line.

---

**WARNING**

This smoke detector is designed to **activate and initiate** emergency action, but will do so only when it is used in conjunction with an authorized fire alarm system. This detector must be installed in accordance with NFPA standard 72.

Smoke detectors will not work without power. AC or DC powered smoke detectors will not work if the power supply is cut off.

Smoke detectors will not sense fires which start where smoke does not reach the detectors. Smoldering fires typically do not generate a lot of heat which is needed to drive the smoke up to the ceiling where the smoke detector is usually located. For this reason, there may be large delays in detecting a smoldering fire with either an ionization type detector or a photoelectric type detector. Either one of them may alarm only after flaming has initiated which will generate the heat needed to drive the smoke to the ceiling.

Smoke from fires in chimneys, in walls, on roofs or on the other side of a closed door(s) may not reach the smoke detector and alarm it. A detector cannot detect a fire developing on another level of a building quickly or at all. For these reasons, detectors **shall be located on every level and in every bedroom within a building**.

Smoke detectors have sensing limitations, too. Ionization detectors and photoelectric detectors are required to pass fire tests of the flaming and smoldering type. This is to ensure that both can detect a wide range of types of fires. Ionization detectors offer a broad range of fire sensing capability but they are somewhat better at detecting fast flaming fires than slow smoldering fires. Photoelectric detectors sense smoldering fires better than flaming fires which have little, if any, visible smoke. Because fires develop in different ways and are often unpredictable in their growth, neither type of detector is always best, and a given detector may not always provide early warning of a specific type of fire.

In general, detectors cannot be expected to provide warnings for fires resulting from inadequate fire protection practices, violent explosions, escaping gases which ignite, improper storage of flammable liquids like cleaning solvents which ignite, other similar safety hazards, arson, smoking in bed, children playing with matches or lighters, etc. Smoke detectors used in high air velocity conditions may have a delay in alarm due to dilution of smoke densities created by frequent and rapid air exchanges. Additionally, high air velocity environments may create increased dust contamination, demanding more frequent maintenance.

Smoke detectors cannot last forever. Smoke detectors contain electronic parts. Even though smoke detectors are made to last over 10 years, any part can fail at any time. Therefore, smoke detectors shall be replaced after being in service for 10 years. The smoke detector system that this detector is used in must be tested regularly per NFPA 72. This smoke detector should be cleaned regularly per NFPA 72 or at least once a year.

---

**Three-Year Limited Warranty**

System Sensor warrants its enclosed smoke detector to be free from defects in materials and workmanship under normal use and service for a period of three years from date of manufacture. System Sensor makes no other express warranty for this smoke detector. No agent, representative, dealer, or employee of the Company has the authority to increase or alter the obligations or limitations of this Warranty. The Company’s obligation of this Warranty shall be limited to the repair or replacement of any part of the smoke detector which is found to be defective in materials or workmanship under normal use and service during the three year period commencing with the date of manufacture. After phoning System Sensor’s toll free number 800-SENSOR2 (736-7672) for a Return Authorization number, send defective units postage prepaid to: System Sensor, Repair Department, RA #________, 3825 Ohio Avenue, St. Charles, IL 60174. Please include a note describing the malfunction and suspected cause of failure. The Company shall not be obligated to repair or replace units which are found to be defective because of damage, unreasonable use, modifications, or alterations occurring after the date of manufacture. In no case shall the Company be liable for any consequential or incidental damages for breach of this or any other Warranty, expressed or implied whatsoever, even if the loss or damage is caused by the Company’s negligence or fault. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This Warranty gives you specific legal rights, and you may also have other rights which vary from state to state.
**Installation and Maintenance Instructions**

**2400 and 2400TH Direct Wire**

**Photoelectronic Smoke Detectors**

### Specifications

- **Diameter:** 5.5 inches (140 mm)
- **Height:** 3.14 inches (80 mm)
- **Weight:** 0.7 lb. (310 gm)
- **Operating Temperature Range:**
  - Model 2400 — 0° to +49° C (32° to 120° F)
  - Model 2400TH — 0° to 38° C (32° to 100° F)
- **Operating Humidity Range:** 10% to 93% Relative Humidity Non-condensing
- **Maximum Air Velocity:** 3000 ft/min (15m/s)
- **Locking Alarm:** Reset by momentary power interruption

### Electrical Ratings

- **System Voltage:** 12/24 VDC
- **Maximum Ripple Voltage:** 4 Volts peak-to-peak
- **Start-up Capacitance:** 0.02 µF Maximum
- **Standby Ratings:** 8.5 VDC Minimum; 35 VDC Maximum
- **120 µA Maximum**
- **Alarm Ratings:**
  - 4.2 VDC Minimum at 10 mA
  - 6.6 VDC Maximum at 100 mA
- **Reset Voltage:** 2.5 VDC Minimum
- **Reset Time:** 0.3 S Maximum
- **Start-up Time:** 34 S Maximum

### Before Installing

Please thoroughly read the System Sensor manual I56-407-XX, Guide for Proper Use of System Smoke Detectors. This manual provides detailed information on detector spacing, placement, zoning, wiring, and special applications. Copies of this manual are available at no charge from System Sensor (For installations in Canada refer to CAN4-S524, Standard for the Installation of Fire Alarm Systems and CEC Part 1, Sec. 32).

**NOTICE:** This manual should be left with the owner/user of this equipment.

**IMPORTANT:** This sensor must be tested and maintained regularly following NFPA 72 requirements. This sensor should be cleaned at least once a year.

### General Description

System Sensor 2400 photoelectronic detectors use state-of-the-art, optical sensing chambers. These detectors are designed to provide open area protection, and are intended for use with compatible UL-listed 2-wire control panels only. The detector’s operation and sensitivity can be tested in place. Model 2400TH has the same specifications as model 2400, but also features a restorable, built-in, fixed temperature (135°F) thermal detection unit.

These detectors are listed to UL 268 and are latching type system detectors. When latched in alarm, the detectors must be reset by a momentary power interruption.

An LED on the detector provides a local indication of the detector’s status. This LED blinks every 10 seconds when the detector is receiving power and ready in standby and is latched on continuously in alarm until the detector is reset. The detector provides an output for connection to an optional Remote Annunciator (Model RA400Z). The Remote Annunciator mounts to a single gang box and provides a supplementary alarm indication.

### Spacing

NFPA 72E defines the spacing requirements for smoke detectors, typically 30 feet when detectors are installed on a smooth ceiling. However, ALL installations must comply with NFPA 72E and/or special requirements of the authority having jurisdiction.
Mounting
Each 2400 detector is supplied with a mounting bracket kit that permits the detector to be mounted:
1. Directly to a 3 1/2-inch or 4-inch octagonal, 1 1/2-inch deep electrical box, (See Figure 1) or:
2. To a 4-inch square electrical box by using the plaster ring with the supplied mounting bracket kit.

Installation Wiring Guidelines
All wiring must be installed in compliance with the National Electrical Code and all applicable local codes, and any special requirements of the local authority having jurisdiction. Proper wire gauges should be used. The conductors used to connect smoke detectors to control panels and accessory devices should be color-coded to reduce the likelihood of wiring errors. Improper connections can prevent a system from responding properly in the event of a fire.

For signal wiring (wiring between interconnected detectors), wire be no smaller than AWG 18 is recommended. However, the screws and clamping plate, in the base can, accommodate wire sizes up to AWG 12. The use of twisted pair wiring for the power (+ and -) loop is recommended to minimize the effects of electrical interference.

Smoke detectors and alarm system control panels have specifications for allowable loop resistance. Consult the control panel manufacturer’s specifications for the total loop resistance allowed for the control panel being used before wiring the detector loops.

Tamper-resistant Feature
This detector includes a tamper-resistant feature that prevents removal of the detector without the use of a tool. To make the detector tamper-resistant, break off the smaller tab at the scribed line on the tamper resistant tab, on the detector mounting bracket (see Figure 2), then install the detector. To remove the detector from the bracket once it has been made tamper resistant, use a small screwdriver to depress the tamper-resistant tab located in the slot on the mounting bracket and turn the detector counterclockwise for removal.
**Installation**

**WARNING**
Disable the power from initiating device circuits before installing detectors.

1. Wire each detector following installation guidelines.
2. Line up arrows on the detector with arrows on the mounting bracket.
3. Turn the detector clockwise until it clicks into place.
4. After all detectors have been installed, apply power to the control unit.
5. Test the detector as described under TESTING.
6. Reset the detector at the system control panel.
7. Notify the proper authorities the system is in operation.

**CAUTION**

Dust covers can be used to help limit dust entry to the detector. However, these covers are not a substitute for removing the detector during building construction. Remove any dust covers before placing the system in service.

**Testing**

Before testing, notify the proper authorities that the smoke detector system is undergoing maintenance, and the system will be temporarily out of service. Disable the zone or system undergoing maintenance to prevent unwanted alarms.

Before testing the detector, look for the presence of the flashing LED. If it does not flash, power has been lost to the detector (check the wiring), or it is defective (return for repair – refer to Warranty information).

Detectors must be tested after installation and following periodic maintenance. The 2400/2400TH may be tested as follows:

**A. Functional Tests**

**Recessed Test Switch**
1. A test switch is located on the detector housing (See Figure 4).
2. Press and hold the recessed test switch with a 0.1 inch maximum diameter tool.
3. The detector’s LED should light within 5 seconds.
4. **Calibrated Test Card (R59-18-00)**
   1. Remove the detector cover by placing a small bladed screwdriver in the side slot of the detector cover, twisting it slightly until the cover can be turned counterclockwise for removal.
   2. Insert the NO ALARM end of the test card fully into the test slot (See Figure 5) then slide it counterclockwise until it stops.
   3. The detector should not alarm after 20 seconds.
   4. Remove the test card by sliding it clockwise before removing, then insert the ALARM end.
   5. The LED should latch on within 20 seconds. An alarm should also be initiated at the panel.

**B. Calibrated Test Card (R59-18-00)**
1. Remove the detector cover by placing a small bladed screwdriver in the side slot of the detector cover, twisting it slightly until the cover can be turned counterclockwise for removal.
2. Insert the NO ALARM end of the test card fully into the test slot (See Figure 5) then slide it counterclockwise until it stops.
3. The detector should not alarm after 20 seconds.
4. Remove the test card by sliding it clockwise before removing, then insert the ALARM end.
5. The LED should latch on within 20 seconds. An alarm should also be initiated at the panel.
6. Put the cover back by gently rotating it clockwise until it locks in place.

**C. Test Module (System Sensor No. MOD400R/MOD400).**
The MOD400R or MOD400Test Module is used with an analog or digital voltmeter to check the detector sensitivity as described in the test module’s manual.

**D. Aerosol Generator (Gemini 501).**
Set the aerosol generator to represent 4%/Ft to 5%/Ft obscuration as described in the Gemini 501 manual. Using the bowl shaped applicator, apply aerosol until unit alarms.

**E. Direct Heat Test (2400TH only).**
To test the bi-metallic thermal collector on the 2400TH, use a low powered heat gun or blow dryer, aiming the heat source across the detector. Hold the heat source about 12 inches (30 cm) from the detector to avoid damaging the plastic. When the heat rises to greater than 135°F, the detector will latch in alarm. After the test, the bi-metallic collector will self-restore.

Notify the proper authorities that the system is back on line. Detectors that fail these tests should be cleaned as described under MAINTENANCE and retested. If the detectors still fail these tests, they should be returned for repair.

Notify the proper authorities the system is back on line.

---

**Figure 4. Top and side views showing position of test switch:**

![Figure 4. Top and side views showing position of test switch](image-url)
Maintenance

NOTE: Before removing the detector, notify the proper authorities the smoke detector system is undergoing maintenance and, therefore, will be temporarily out of service. Disable the zone or system undergoing maintenance to prevent unwanted alarms.

1. Remove the detector cover by placing a small bladed screwdriver in the side slot of the detector cover, twisting it slightly until the cover can be turned counterclockwise for removal.

2. Vacuum the screen carefully without removing it. If further cleaning is required continue with step 3, otherwise skip to step 6.

3. See Figure 5. Remove the screen by pulling it straight out. Vacuum the inside.

4. Clean the vaned chamber piece by vacuuming or blowing out dust and particles.

5. To replace the screen, orient it so that the arrow on top aligns with the test module socket of the detector. Carefully push the screen onto the base, making sure it fits tightly to the chamber.

6. Replace the cover by gently rotating it clockwise until it locks in place.

7. Notify the proper authorities the system is back on line.

**Figure 5. Removal of cover and screen for cleaning:**

![Image of smoke detector parts](image)

**WARNING**

This smoke detector is designed to activate and initiate emergency action, but will do so only when it is used in conjunction with an authorized fire alarm system. This detector must be installed in accordance with NFPA standard 72.

Smoke detectors will not work without power. AC or DC powered smoke detectors will not work if the power supply is cut off.

Smoke detectors will not sense fires which start where smoke does not reach the detectors. Smoldering fires typically do not generate a lot of heat which is needed to drive the smoke up to the ceiling where the smoke detector is usually located. For this reason, there may be large delays in detecting a smoldering fire with either an ionization type detector or a photoelectric type detector. Either one of them may alarm only after flaming has initiated which will generate the heat needed to drive the smoke to the ceiling.

Smoke from fires in chimneys, in walls, on roofs or on the other side of a closed door(s) may not reach the smoke detector and alarm it. A detector cannot detect a fire developing on another level of a building quickly or at all. For these reasons, detectors shall be located on every level and in every bedroom within a building.

Smoke detectors have sensing limitations, too. Ionization detectors and photoelectric detectors are required to pass fire tests of the flaming and smoldering type. This is to ensure that both can detect a wide range of types of fires. Ionization detectors offer a broad range of fire sensing capability but they are somewhat better at detecting fast flaming fires than slow smoldering fires. Photoelectric detectors sense smoldering fires better than flaming fires which have little, if any, visible smoke. Because fires develop in different ways and are often unpredictable in their growth, neither type of detector is always best, and a given detector may not always provide early warning of a specific type of fire.

In general, detectors cannot be expected to provide warnings for fires resulting from inadequate fire protection practices, violent explosions, escaping gases which ignite, improper storage of flammable liquids like cleaning solvents which ignite, other similar safety hazards, arson, smoking in bed, children playing with matches or lighters, etc. Smoke detectors used in high air velocity conditions may have a delay in alarm due to dilution of smoke densities created by frequent and rapid air exchanges. Additionally, high air velocity environments may create increased dust contamination, demanding more frequent maintenance.

Smoke detectors cannot last forever. Smoke detectors contain electronic parts. Even though smoke detectors are made to last over 10 years, any part can fail at any time. Therefore, smoke detectors shall be replaced after being in service for 10 years. The smoke detector system that this detector is used in must be tested regularly per NFPA 72. This smoke detector should be cleaned regularly per NFPA 72 or at least once a year.

**Three-Year Limited Warranty**

System Sensor warrants its enclosed smoke detector to be free from defects in materials and workmanship under normal use and service for a period of three years from date of manufacture. System Sensor makes no other express warranty for this smoke detector. No agent, representative, dealer, or employee of the Company has the authority to increase or alter the obligations or limitations of this Warranty. The Company’s obligation of this Warranty shall be limited to the repair or replacement of any part of the smoke detector which is found to be defective in materials or workmanship under normal use and service during the three year period commencing with the date of manufacture. After phoning System Sensor’s toll free number 800-SENSOR2 (736-7672) for a Return Authorization number, send defective units postage prepaid to: System Sensor, Repair Department, RA #__________, 3825 Ohio Avenue, St. Charles, IL 60174. Please include a note describing the malfunction and suspected cause of failure. The Company shall not be obligated to repair or replace units which are found to be defective because of damage, unreasonable use, modifications, or alterations occurring after the date of manufacture. In no case shall the Company be liable for any consequential or incidental damages for breach of this or any other Warranty, expressed or implied whatsoever, even if the loss or damage is caused by the Company’s negligence or fault. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This Warranty gives you specific legal rights, and you may also have other rights which vary from state to state.
INSTALLATION AND MAINTENANCE INSTRUCTIONS

2400AT and 2400AIT Direct Wire Photoelectronic with Fixed Heat Smoke Detectors

Specifications
- Size: Diameter: 5.5 inches (140 mm)
- Height: 3.19 inches (81 mm); add 0.5 inches (13 mm) for thermal units
- Weight: 0.7 lb. (310 g)
- Air Velocity: 3000 ft/min (15 M/s)
- Operating Temperature: 0°C to 38°C (0°F to 100°F)
- Operating Humidity: 10% to 93% Relative Humidity, noncondensing
- Visual Indicator: Solid State LED
- Latching Alarm: Reset by Momentary Power Interruption
- Audible Signal: 85dBA minimum interrupted tone when in alarm or supply voltage polarity is reversed
- Fixed Temperature Thermal: 135°F (57°C)

Electrical Ratings
- System Voltage: 24 VDC
- Maximum Ripple Voltage: 4 Volts peak-to-peak
- Start-up Capcitance: .02 µF Maximum
- Start-up Time: 36 Sec. Maximum
- Voltage Limits: 10 – 32 VDC
- Current Limits
  - Standby: 120 µA Maximum; 100 µA Nominal
  - Alarm Current: 15mA at 10V; 67mA at 32V; 48mA at 24V
  - Reversed Supply: 5mA at 10V; 19mA at 32V; 15mA at 24V (Detector not in Alarm)
  - Alarm Impedance: 666 ohms Maximum; 478 ohms Minimum
  - Alarm Signal: 15mA Minimum in Alarm

Before Installing
Please thoroughly read the System Sensor manual I56-407-XX, Guide for Proper Use of System Smoke Detectors. This manual provides detailed information on detector spacing, placement, zoning, wiring, and special applications. It is available at no charge from System Sensor. (For installations in Canada refer to CAN/ULC-S524, Standard for the Installation of Fire Alarm Systems and CEC Part 1, Sec. 32.)

General Description
System Sensor 2400AT and 2400AIT photoelectronic smoke detectors, listed to UL 268, provide open area protection and are intended for use with UL-listed, compatible, 2-wire control panels. The sensor in this detector operates on the light scattering principle and features a unique photo-optic sensing chamber that optimizes smoke entry while minimizing the effects of ambient light.

These detectors also provide restorable, 135°F fixed-temperature heat detection. The 2400AT heat detection unit is integrated with the photoelectronic sensor while the 2400AIT's heat detection unit is isolated from the photoelectronic smoke sensor and can be monitored separately. In addition, a piezoelectric horn in each detector produces an interrupted, 85 dBA tone when the individual detector alarms or when the supply voltage polarity is reversed.

An LED on each detector lights to provide a local alarm indication and will remain on until the supply polarity is reversed. A screw terminal is provided for a remote LED annunciator optional accessory (RA400Z). These detectors also have the latching feature. The alarm can be reset only by momentary power interruption.

Mounting
Each 2400 Series detector is supplied with a mounting bracket kit to permit mounting in either of two ways:
1. Directly to a 3- or 4-inch octagonal, 1½-inch deep electrical box (See Figures 1 and 2).
2. To a 4-inch square electrical box by using a plaster ring with the mounting bracket kit supplied.

Spacing
NFPA 72E defines the spacing requirements for smoke detectors. Typically, this is 30 feet when the detectors are installed on a smooth ceiling. However, ALL installations must comply with NFPA 72E and/or special requirements of the authority having jurisdiction.
Installation Wiring Guidelines

All wiring must comply with the National Electrical Code and the applicable local codes, and any special requirements of the authority having jurisdiction, using the proper wire gauges. The conductors used to connect smoke detectors to control panels and accessory devices should be color-coded to reduce the likelihood of wiring errors. Improper connections can prevent a system from responding properly in the event of a fire.

For signal wiring (wiring between interconnected detectors), wiring no smaller than AWG 18 is recommended. The clamping plates in the base can accept wire sizes up to AWG 12. For best system performance, the power (+ and –) loop wires should be twisted pair and installed in separate grounded conduit or shielded cable to protect the loop from extraneous electrical interference. If a cable shield is provided, the shield connection to and from the detector must be made continuous by using wire nuts, crimping, or soldering, as appropriate for a reliable connection.

Wire connections are made by stripping about 3/8” insulation from the end of the wire, sliding the bare end of the wire under the clamping plate, and tightening the clamping plate screw. Do NOT loop the wire under the terminals.

Dust covers provide limited protection against airborne dust particles during shipping. Dust covers MUST be removed before the smoke detectors can sense smoke. Remove sensors before beginning remodeling or heavy construction.

Tamper-resistance Feature

The Tamper Resistant Tab, in the detector mounting bracket, can make the detector tamper-resistant by making it necessary to use a pocket screwdriver, or similar tool, to detach the detector from the bracket.

To make the detector tamper-resistant, use needle-nose pliers to break the smaller tab at the scribed line on the Tamper Resistant Tab. Figure 2 shows the location of this tab on the detector mounting bracket.

To remove a detector from the bracket after it has been made tamper-resistant, use a pocket screwdriver, or other similar tool, to depress the Tamper Resistant Tab, in the slot on the mounting bracket, and rotate the detector counterclockwise.

Testing

NOTE: Before testing, notify the proper authorities that the smoke detector system is undergoing maintenance and, therefore, the system will be temporarily out of service. Disable the zone or system undergoing maintenance to prevent unwanted alarms.
Detectors must be tested after installation and periodic maintenance. System Sensor 2400AT and 2400AIT Smoke Detectors can be tested in the following five ways:

**NOTE:** Before testing the detector, check for the presence of the flashing LED. If it does not flash, power has been lost (check the wiring), or it is defective (return for repair – refer to the Warranty).

A. Recessed Test Switch
1. Push and hold the recessed test switch with a 0.1 inch maximum diameter tool, such as a pocket screwdriver.
2. The LED on the detector should light within 5 seconds. The p-horn should also sound.

B. Calibrated Test Card (R59-18-00)
1. Remove the detector cover by placing a small bladed screwdriver in the side slot of the detector cover, twisting it slightly until the cover can be turned counterclockwise for removal.
2. Insert the NO ALARM end of the test card fully into the test slot (see Figure 6) and slide it counterclockwise until it stops.
3. The detector should not alarm (wait at least 20 seconds).
4. Remove the test card by sliding it clockwise before removing, then repeat with the ALARM end of the test card.
5. The LED should latch on within 20 seconds, indicating alarm and annunciating the panel.
6. Replace the cover by gently rotating it clockwise until it locks in place.

C. Test Module (System Sensor Model No. MOD400R)
The MOD400R is used with an analog or digital voltmeter to check the detector sensitivity as described in the test module’s manual.

D. Aerosol Generator (Gemini 501)
Set the generator to represent 4%/Ft. to 5%/Ft. obscuration as described in the aerosol generator manual. Using the bowl shaped applicator, apply aerosol until the unit alarms.

E. Direct Heat Method (Hair dryer of 1000-1500 watts)
Direct the heat toward the bimetallic collector. Hold the heat source about 12 inches from the detector in order to avoid damage to the plastic. When the heat rises to greater than 135°F the detector will latch in alarm.

The detector will reset only after it has had sufficient time to cool and the power source has been temporarily interrupted. Both smoke and heat detection testing are recommended for verifying system protection capability.

Detectors that fail these tests should be cleaned as described under MAINTENANCE and retested. If the detectors still fail these tests, they should be returned for repair. Notify the proper authorities the system is back on line.

**Maintenance**

**NOTE:** Before cleaning, notify the proper authorities that the smoke detector system is undergoing maintenance and, therefore, will be temporarily out of service. Disable the system undergoing maintenance to prevent unwanted alarms.

1. Remove the detector cover by placing a small-bladed screwdriver in the side slot of the detector cover, twisting it until the cover can be turned counterclockwise for removal.
2. Vacuum the screen carefully without removing it. If further cleaning is required, continue with step 3, other-
3. Remove the screen by pulling it straight out. Vacuum the inside.
4. Clean the vaned chamber piece by vacuuming out dust and particles.
5. To replace the screen, orient it so that the arrow on top aligns with the field test socket on the base of the detector. Carefully push the screen onto the base making sure it fits tightly to the chamber.
6. Replace the cover by gently rotating it clockwise until it locks in place.

Figure 6:

![Image of smoke detector with labels: REMOVABLE COVER, TEST SLOT, CLEANABLE SCREEN, REMOVAL SLOT]

** WARNING **

**The Limitations of Property Protection Smoke Detectors and Sounders**

The sounder in this detector will not operate if the power is cut off for any reason.

**The sounder may not be heard.** The loudness of the sounder meets or exceeds the current standards. However, the sounder may not alert a sound sleeper or one who has recently used drugs or has been drinking alcoholic beverages. This sounder may not be heard if it is placed in an area which is separated by a closed door, or if it is located on a different floor from the person in a hazardous situation, or if it is placed too far away to be heard over the ambient noise such as traffic, air conditioners, machinery, or musical appliances that may prevent alert persons from hearing the alarm.

The sounder may not be heard by persons who are hearing impaired. In this case, a visual indicator shall also be used.

This smoke detector used with this base is designed to activate and initiate emergency action, but will do so only when used in conjunction with an authorized fire alarm system. This detector must be installed in accordance with NFPA standard 72.

**Smoke detectors will not work without power.** AC or DC powered smoke detectors will not work if the power supply is cut off.

**Smoke detectors will not sense fires which start where smoke does not reach the detectors.** Smoldering fires typically do not generate a lot of heat which is needed to drive smoke up to the ceiling where the smoke detector is usually located. For this reason, there may be large delays in detecting a smoldering fire with either an ionization-type detector or a photoelectronic-type detector. Either one of them may alarm only after flaming has initiated, which will generate the heat needed to drive the smoke to the ceiling.

Smoke from fires in chimneys, in walls, on roofs, or on the other side of a closed door may not reach the smoke detector and alarm it. A detector cannot quickly detect, or sense at all, a fire developing on another level of a building. For this reason, **detectors shall be located on every level and in every bedroom within a building.**

**Smoke detectors have sensing limitations, too.** Ionization detectors and photoelectronic detectors are required to pass fire tests of the flaming and smoldering types. This is to ensure that both can detect a wide range of fires. Ionization detectors offer a broad range of fire-sensing capability, but they are somewhat better at detecting fast-flaming fires than slow-smoldering fires. Photoelectronic detectors sense smoldering fires better than flaming fires, which have little, if any, visible smoke. Because fires develop in different ways, and are often unpredictable in their growth, neither type of detector is always best, and a given detector may not always provide early warning of a specific type of fire.

In general, detectors cannot be expected to provide warnings for fires resulting from inadequate fire protection practices, violent explosions, escaping gases that ignite, improper storage of flammable liquids like cleaning solvents that ignite, other similar safety hazards, arson, smoking in bed, children playing with matches or lighters, etc. Smoke detectors used in high air velocity conditions may have a delay in alarm due to dilution of smoke densities created by frequent and rapid air exchanges. Additionally, high air velocity environments may create increased dust contamination, demanding more frequent detector maintenance.

**Smoke detectors cannot last forever.** Smoke detectors contain electronic parts. Even though detectors are made to last over 10 years, any part can fail at any time. Therefore, smoke detectors shall be replaced after being in service for 10 years. The smoke detector system that this detector is used in must be tested regularly per NFPA 72. This smoke detector should be cleaned regularly per NFPA 72 or at least once a year.

**Three-Year Limited Warranty**

System Sensor warrants its enclosed smoke detector to be free from defects in materials and workmanship under normal use and service for a period of three years from date of manufacture. System Sensor makes no other express warranty for this smoke detector. No agent, representative, dealer, or employee of the Company has the authority to increase or alter the obligations or limitations of this Warranty. The Company’s obligation of this Warranty shall be limited to the repair or replacement of any part of the smoke detector which is found to be defective in materials or workmanship under normal use and service during the three year period commencing with the date of manufacture. After phoning System Sensor’s toll free number 800-SENSOR2 (736-7672) for a Return Authorization number, send defective units postage prepaid to: System Sensor, Repair Department, RA #__________, 3825 Ohio Avenue, St. Charles, IL 60174. Please include a note describing the malfunction and suspected cause of failure.

The Company shall not be obligated to repair or replace units which are found to be defective because of damage, unreasonable use, modifications, or alterations occurring after the date of manufacture. In no case shall the Company be liable for any consequential or incidental damages for breach of this or any other Warranty, expressed or implied whatsoever, even if the loss or damage is caused by the Company’s negligence or fault. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This Warranty gives you specific legal rights, and you may also have other rights which vary from state to state.
2412AT, 2424AT, and 2424AIT
Direct Wire Photoelectronic with Fixed Heat Smoke Detectors

Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>2412AT</th>
<th>2424AT or 2424AIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter:</td>
<td>5.5 inches</td>
<td>5.5 inches</td>
</tr>
<tr>
<td>Height, with Thermal:</td>
<td>3.19 inches</td>
<td>3.19 inches</td>
</tr>
<tr>
<td>Weight:</td>
<td>0.7 lb.</td>
<td>0.7 lb.</td>
</tr>
<tr>
<td>Operating Temperature:</td>
<td>0°F to 38°F (32°F to 100°F)</td>
<td>0°F to 38°F (32°F to 100°F)</td>
</tr>
<tr>
<td>Operating Humidity:</td>
<td>10% to 95% Relative Humidity Non-condensing</td>
<td>10% to 95% Relative Humidity Non-condensing</td>
</tr>
<tr>
<td>Locking Alarm:</td>
<td>Reset by momentary power interruption</td>
<td>Reset by momentary power interruption</td>
</tr>
<tr>
<td>Audible Signal:</td>
<td>85dBA minimum interrupted tone when individual unit is in alarm or when the supply voltage is reversed.</td>
<td>85dBA minimum interrupted tone when individual unit is in alarm or when the supply voltage is reversed.</td>
</tr>
</tbody>
</table>

Electrical Ratings:

- Operating Voltage: 12VDC 24VDC
- Current
  - Standby: 120 µA Max. 120 µA Max.
  - Alarm: 51mA 43mA
  - (Add 7mA Maximum with RA400Z Remote Annunciator LED)
- Reversed Supply: 8mA 15mA
- Start-up Time: 36 seconds maximum
- Relay Characteristics: One Form A (SPST-NO) for alarm initiation 1.25A at 30 VAC/DC

Before Installing

Please thoroughly read the System Sensor manual I56-407-XX, Guide for Proper Use of System Smoke Detectors, which provides detailed information on detector spacing, placement, zoning, wiring, and special applications. Copies of this manual are available at no charge from System Sensor. (For installations in Canada refer to CAN/ULC-S524, Standard for the Installation of Fire Alarm Systems and CEC Part 1, Sec. 32.)

An LED on each detector lights to provide a local alarm indication and will remain on when the supply polarity is reversed. A screw terminal is provided for a remote LED annunciator optional accessory (RA400Z). These detectors are listed to UL268 and are latching type system detectors. The alarm can be reset only by momentary power interruption. For testing, these detectors have a test switch or may be tested by inserting a calibrated test card in a test slot after removing the detector’s cover.

Each detector contains one Form A (SPST-NO) contact for connection to an alarm-initiating circuit. Supervision of the detector power is accomplished by installing a Power Supervisory End-of-Line Relay Module (A77-716) at the end of the detector power loop. When power is applied to and through the detectors, the EOL Power Supervisory Module is energized. Its relay contacts close and provide a closed series circuit in the control panel’s alarm-initiating loop. A power failure or break in the detector power loop de-energizes the EOL Module. The relay contacts open and trigger a trouble signal at the control panel.
Mounting Instructions
Each 2400 Series detector unit is supplied with a mounting bracket kit that permits several mounting techniques:
1. Units may be mounted directly to a 3-inch or 4-inch octagonal, 1 1/2 inch deep electrical box. (See Figures 1 and 2.)
2. Units may be mounted to a 4-inch square electrical box by using plaster ring with the supplied mounting bracket kit.

Tamper-proof Feature
This detector includes a tamper-proof feature that, when activated, prevents removal of the detector without the use of a tool. To activate this feature, cut off smaller tab at the scribe line on tamper-proof tab located on the detector mounting bracket (see Figure 2). Install the detector. To remove the detector from the bracket once the tamper-proof feature has been activated, depress the tamper-proof tab located in the slot on the mounting bracket and turn the detector counterclockwise for removal.

Installation In Australia Only
The installation temperature range for Australia is 5° to 45°C and has been tested per the Australian Standard. Ignore installation temperatures specified for all other applications when installing detectors in Australia. Detectors should be installed by qualified technicians. Installation of a mains connected power supply unit must be performed by qualified electricians only. The primary power will be provided by a panel type system. A rechargeable battery is required as a backup to the external power supply in case of a mains failure. In standby operation, the backup battery (fully charged) must be capable of providing uninterrupted power for at least 7 days to the system and all smoke alarms before the panel gives the required battery-low signal. When the battery-low signal is given, the battery should be capable of providing power for another 7 days, after which the backup battery should have enough energy left to allow a 4-minute alarm signal to be given by all connected smoke alarms.

Wiring Installation Guidelines
All wiring must be in compliance with the National Electrical Code and the applicable local codes, and any special requirements of the local authority having jurisdiction. Proper wire gauges should be used. The conductors used to connect smoke detectors to control panels and accessory devices should be color-coded to prevent wiring mistakes. Improper connections can prevent a system from responding properly in the event of a fire. For signal wiring (the wiring between interconnected detectors), wire no smaller than 18 AWG is recommended. Wire sizes up to 12 AWG may be used. For best system performance, the power (+ and –) loop wires should be twisted pair and installed in separate grounded conduit or shielded cable to protect the loop from extraneous electrical interference. If a cable shield is provided, the shield connection to and from the detector must be continuous by using wire nuts, crimping, or soldering as appropriate for a reliable connection.

Wire connections are made by stripping about 3/8" of insulation from the end of the wire (use strip gauge molded in base), sliding the bare end of the wire under the clamping plate, and tightening the clamping plate screw. Do not loop the wire under the clamping plate.

Figure 1. Flush mounting of detector on 4-inch octagon box:

Figure 2. Detector mounting bracket:

Figure 3. Class A or Class B wiring diagram for model 2412AT and 2424AT detectors used with four-wire control panels:
Dust covers are an effective way to limit the entry of dust into smoke detector sensing chambers. However, they may not completely prevent airborne dust particles from entering the detector. Therefore, System Sensor recommends the removal of detectors before beginning construction or other dust producing activity. Be sure to remove dust covers from any sensors that were left in place during construction as part of returning the system to service.

TESTING

NOTE: Before testing, notify the proper authorities that the smoke detector system is undergoing maintenance, and therefore will temporarily be out of service. Disable the zone or system undergoing maintenance to prevent unwanted alarms.

Detectors must be tested after installation and periodic maintenance. The 2412AT, 2424AT or 2424AIT may be tested in the following ways:

NOTE: Before testing the detector check for the presence of the flashing LED. If it does not flash, power has been lost to the detector (check the wiring), or it is defective (return for repair, see Warranty information).

A. Recessed Test Switch
1. Push and hold the recessed test switch with a .1 inch maximum diameter tool.
2. The LED should latch within 5 seconds indicating alarm and annunciating the panel. The horn should also sound.

B. Calibrated Test Card (System Sensor No. R59-18-00)
1. Remove the detector cover by placing a small bladed screwdriver in the side slot of the detector cover, twisting it slightly until the cover can be turned counterclockwise for removal.
2. Insert the NO ALARM end of the test card fully into the test slot (see Figure 6) then slide it counterclockwise until it stops.
3. The detector should not alarm (wait at least 20 seconds).
4. Remove the test card by sliding it clockwise before removing, then repeat with the ALARM end of test card.
5. The LED should latch on within 20 seconds indicating alarm and annunciating the panel.
6. Put the cover back by gently rotating it clockwise until it locks in place.

C. Test Module (System Sensor Model No. MOD400R)
The MOD400R is used with an analog or digital voltmeter to check the detector sensitivity as described in the test module's manual.

D. Aerosol Generator (GEMINI 501)
Set the generator to represent 4% to 5% obscuration as described in the Gemini 501 manual. Using the bowl shaped applicator, apply aerosol until unit alarms.

E. Direct Heat Method (Hair dryer of 1000–1500 watts)
Direct the heat toward the bi-metallic collector. Hold the heat source about 12 inches from the detector in order to avoid damage to the plastic. When the heat rises to greater than 135°F, the detector should latch in alarm. The detector will reset only after it has had sufficient time to cool and the power source has been momentarily interrupted.

Notify the proper authorities that the system is back on line.

Figure 4. Additional wiring needed for the isolated thermal unit of the 2424AIT detector thermal units are wired to a separate loop:

![Additional wiring needed for the isolated thermal unit of the 2424AIT detector thermal units are wired to a separate loop.]

Figure 5. Bottom and side views showing position of test switch:
Detectors that fail these tests should be cleaned as described under MAINTENANCE and retested. If the detectors still fail these tests they should be returned for repair.

**Maintenance**

**NOTE:** Before cleaning, notify the proper authorities that the smoke detector system is undergoing maintenance, and will be temporarily out of service. Disable the system undergoing maintenance to prevent unwanted alarms.

1. Remove the detector cover by placing a small bladed screwdriver in the side slot of the detector cover, twisting it slightly until the cover can be turned counterclockwise for removal.
2. Vacuum the screen carefully without removing it. If further cleaning is required continue with Step 3, otherwise skip to Step 6.
3. Remove the screen by pulling it straight out. Vacuum the inside.
4. Clean the vaned chamber piece by vacuuming out dust and particles.
5. To replace the screen, orient it so that the arrow on top

![Figure 6:](Image 353x447 to 518x666)

The Limitations of Property Protection Smoke Detectors

Smoke detectors are designed to activate and initiate emergency action, but will do so only when used in conjunction with other equipment. These detectors are designed for installation in accordance with NFPA standard 72.

**Smoke detectors will not work without power.** AC or DC powered smoke detectors will not work if the power supply is cut off for any reason.

**Smoke detectors will not sense fires which start where smoke does not reach the detectors.** Smoke from fires in chimneys, in walls, on roofs, or on the other side of closed doors may not reach the smoke detector and alarm it.

A detector may not detect a fire developing on another level of a building. For this reason, detectors should be located on every level of a building.

**Smoke detectors have sensing limitations, too.** Ionization detectors offer broad range fire-sensing capability, but they are better at detecting fast, flaming fires than slow, smoldering fires. Photoelectronic detectors sense smoldering fires better than flaming fires. Because fires develop in different ways, and are often unpredictable in their growth, neither type of detector is always best, and a given detector may not always provide warning of a fire. In general, detectors cannot be expected to provide warnings for fires resulting from inadequate fire protection practices, violent explosions, escaping gas, improper storage of flammable liquids like cleaning solvents, other safety hazards, or arson. Smoke detectors used in high air velocity conditions may fail to alarm due to dilution of smoke densities created by such frequent and rapid air exchanges. Additionally, high air velocity environments may create increased dust contamination, demanding more frequent maintenance.

**Smoke detectors cannot last forever.** Smoke detectors contain electronic parts. Even though detectors are made to last over 10 years, any of these parts could fail at any time. Therefore, test your smoke detector system per NFPA 72E at least semiannually. Clean and take care of your smoke detectors regularly. Taking care of the fire detection system you have installed will measurably reduce your product liability risks.

**Three-Year Limited Warranty**

System Sensor warrants its enclosed smoke detector to be free from defects in materials and workmanship under normal use and service for a period of three years from date of manufacture. System Sensor makes no other express warranty for this smoke detector. No agent, representative, dealer, or employee of the Company has the authority to increase or alter the obligations or limitations of this Warranty. The Company’s obligation of this Warranty shall be limited to the repair or replacement of any part of the smoke detector which is found to be defective in materials or workmanship under normal use and service during the three year period commencing with the date of manufacture. After phoning System Sensor’s toll free number 800-SENSOR2 (736-7672) for a Return Authorization number, send defective units postage prepaid to: System Sensor, Repair Department, RA #__________, 3825 Ohio Avenue, St. Charles, IL 60174. Please include a note describing the malfunction and suspected cause of failure. The Company shall not be obligated to repair or replace units which are found to be defective because of damage, unreasonable use, modifications, or alterations occurring after the date of manufacture. In no case shall the Company be liable for any consequential or incidental damages for breach of this or any other Warranty, expressed or implied whatsoever, even if the loss or damage is caused by the Company’s negligence or fault. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This Warranty gives you specific legal rights, and you may also have other rights which vary from state to state.
INSTALLATION AND MAINTENANCE INSTRUCTIONS

2412, 2412TH, 2424, and 2424TH
Direct Wire Photoelectronic Smoke Detectors

Specifications

Diameter: 5.5 inches (14 cm)
Height: 3.19 inches (81 mm); Add 0.5 inches (1.3 cm) for thermal units
Weight: 0.7 lb (310 g)
Operating Temperature Range: 2412 and 2424 — 0° to +49°C (32° to 120°F)
2412TH and 2424TH — 0° to +38°C (32° to 100°F)
Operating Humidity Range: 10% to 93% Relative Humidity
Maximum Air Velocity: 3000 Ft./Min. (15 M/S)
Latching Alarm: Reset by momentary power interruption.

Electrical Ratings

<table>
<thead>
<tr>
<th>System Voltage:</th>
<th>12</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Voltage:</td>
<td>11.3</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>17</td>
<td>29</td>
</tr>
<tr>
<td>Reset Voltage:</td>
<td>.73</td>
<td>.8</td>
</tr>
<tr>
<td>Standby Current:</td>
<td>120</td>
<td>120</td>
</tr>
<tr>
<td>Alarm Currents:</td>
<td>35</td>
<td>21.3</td>
</tr>
<tr>
<td></td>
<td>77</td>
<td>40.6</td>
</tr>
</tbody>
</table>

The alarm and auxiliary relay operate within the specified voltage ratings.

Start-up Time: 34 S Maximum
EOL Relay: A77-716
Reset Time: 0.3
Relay Contacts – resistive or inductive (60% power factor) load:
Form A: 2.0A @ 30VAC/DC
Form C:* 0.6A @ 110VDC; 2.0A @ 30VDC
1.0A @ 125VAC; 2.0A @ 30VAC

(*For Canadian installations, relay contact rating is 2.0A @ 30VAC/DC)

Before Installing

Please thoroughly read the System Sensor manual I56-407-XX, Guide for Proper Use of System Smoke Detectors, which provides detailed information on detector spacing, placement, zoning, wiring, and special applications. Copies of this manual are available at no charge from System Sensor. (For installation in Canada, refer to CAN/ULC-S524, Standard for the Installation of Fire Alarm Systems and CEC Part 1, Sec. 32.)

General Description

System Sensor 2412 and 2424 photoelectronic smoke detectors utilize state-of-the-art, optical sensing chambers. These detectors are designed to provide open area protection, and to be used with compatible UL-listed 4-wire control panels only. The 2412 applies to 12 volt panels and operates at 12VDC, and the 2424 applies to 24 volt panels and operates at 24VDC. Operation and sensitivity can be tested in place. Models 2412TH and 2424TH have the same specifications as models 2412 and 2424, but in addition feature a built-in fixed temperature (135°F) thermal detection unit.

An LED on each detector lights to provide a local alarm indication. It flashes every ten seconds indicating that power is applied to the detector. The LED lights continuously in alarm. These detectors also have the latching alarm feature that resets only by a momentary power interruption.

Each detector contains one set of Form A contacts for connection to the alarm-initiating circuit, and one set of Form C auxiliary contacts. Supervision of detector power is accomplished by installing a Power Supervisory End-of-Line Relay Module (A77-716 Series) at the end of the detector power loop. When power is applied to and through the detectors, the EOL Power Supervisory Module is energized. Its relay contacts close and provide a closed series circuit in the control panel’s alarm-initiating loop. A power failure or a break in the detector power loop de-energizes the EOL Module. The relay contacts open and trigger a trouble signal at the control panel.
Mounting
Each 2412 and 2424 detector is supplied with a mounting bracket kit that permits the detector to be mounted:
1. Directly to a 3-1/2 inch or 4 inch octagonal, 1-1/2 inch deep electrical box, (see Figure 1) or
2. To a 4 inch square electrical box by using a plaster ring with the supplied mounting bracket kit.

Installation Wiring Guidelines
NOTE: Refer to releasing device manufacturer’s installation instruction for proper connections.
All wiring must be installed in compliance with the National Electrical Code and all applicable local codes and any special requirements of the authority having jurisdiction, using the proper wire size. The conductors used to connect smoke detectors to control panels and accessory devices should be color-coded to reduce the likelihood of wiring errors. Improper connections can prevent a system from responding properly in the event of a fire.
For signal wiring (the wiring between interconnected detectors), it is recommended that the wire be no smaller than AWG 18. However, the screws and clamping plate, in the base, can accommodate wire sizes up to AWG 12. The use of twisted pair wiring for the power (+ and –) loop is recommended to minimize the effects of electrical interference.
Smoke detectors and alarm system control panels have specifications for allowable loop resistance. Consult the control panel manufacturer’s specifications for the total loop resistance allowed for the particular model control panel being used before wiring the detector loops.

Tamper-resistance Feature
This detector includes a tamper-resistant feature that prevents removal of the detector without the use of a tool. To make the detector tamper-resistant, break off the smaller tab at the scribed line on the Tamper Resistant Tab, on the detector mounting bracket (see Figure 2), then install the detector. To remove the detector from the bracket once it has been made tamper-resistant, use a small screwdriver to depress the tamper-resistant tab located in the slot on the mounting bracket and turn the detector counterclockwise for removal.

Installation
WARNING
Remove power from initiating-device circuits before installing detectors.

1. Wire detector per installation guidelines.

Wire connections are made by stripping about 3/8 inch of insulation from the end of the wire, sliding the bare end of the wire under the clamping plate, and tightening the clamping plate screw.
2. Line up arrows on the detector with arrows on the mounting bracket.
3. Turn the detector clockwise until the detector clicks into place.
4. After all detectors have been installed, apply power to the control unit.
5. Test the detector as described under TESTING.
6. Reset the detector at the System Control Panel.
7. Notify the proper authorities the system is in operation.

**CAUTION**

Dust covers provide limited protection against airborne dust particles during shipping. Dust covers MUST be removed before the smoke detectors can sense smoke. Remove sensors before beginning heavy remodeling or construction.

**Testing**

Before testing, notify the proper authorities that the smoke detector system is undergoing maintenance, and therefore the system will temporarily be out of service. Disable the zone or system undergoing maintenance to prevent unwanted alarms.

Before testing the detector, look for the presence of the flashing LED. If it does not flash, power has been lost to the detector (check the wiring), or it is defective (return for repair).

Detectors must be tested after installation and following periodic maintenance. The 2412 and 2424 may be tested as follows:

**A. Recessed Test Switch**

1. A test switch is located on the detector housing (see Figure 4).
2. Push and hold the recessed test switch with a 0.1 inch maximum diameter tool.
3. The detector’s LED should light within 5 seconds.

**B. Calibrated Test Card (Model R59-18-00)**

1. Remove the detector cover by placing a small-bladed screwdriver in the side slot of the detector cover, twisting slightly until the cover can be turned counterclockwise for removal.
2. Insert the NO ALARM end of the test card fully into the test slot (see Figure 5), then slide it counterclockwise until it stops.
3. The detector should not alarm after 20 seconds.
4. Remove the test card by sliding it clockwise before removing, then insert the ALARM end.
5. The LED should latch on within 20 seconds, indicating alarm and annunciating the panel.
6. Put the cover back by gently rotating it clockwise until it locks in place.

**C. Test Module (System Sensor Model No. MOD400R)**

The MOD400R is used with an analog or digital voltmeter to check the detector sensitivity as described in the MOD400R manual.

**D. Aerosol Generator (Gemini 501)**

Set the generator to represent 4%/Ft. to 5%/Ft. obscuration as described in the Gemini 501 manual. Using the bowl shaped applicator, apply aerosol until unit alarms. Detectors that fail these tests should be cleaned as described under MAINTENANCE and retested. If the detectors still fail these tests, they should be returned for repair.

**E. Direct Heat Test (Models 2412TH & 2424TH only)**

To test the bi-metallic thermal collector on the Models 2412TH and 2424TH, use a low powered heat gun or blow dryer, aiming the heat source across the detector. Hold the heat source about 12 inches (30 cm) from the detector to avoid damaging the plastic. When the heat rises to greater than 135°F, the detector will latch in alarm. After the test, the bi-metallic collector will self-restore.

Notify the proper authorities that the system is back on line when tests are complete.

**Figure 4. Top and side views showing position of recessed test switch:**

Maintenance

NOTE: Before removing the detector cover, notify the proper authorities that the smoke detector system is undergoing maintenance, and therefore the system will be temporarily out of service. Disable the zone or system undergoing maintenance to prevent unwanted alarms.

1. Remove the detector cover by placing a small-bladed screwdriver in the side slot of the detector cover, twisting it slightly until the cover can be turned counterclockwise for removal.

2. Vacuum the screen carefully without removing it. If further cleaning is required, continue with step 3, otherwise skip to step 6.

3. Remove the screen by pulling it straight out (see Figure 5). Vacuum the inside.

4. Clean the vaned chamber piece by vacuuming or blowing out dust and particles.

5. To replace the screen, orient it so that the arrow on top aligns with the test module socket of the detector. Carefully push the screen onto the base, making sure it fits tightly to the chamber.

6. Replace the cover by gently rotating it clockwise until it locks in place.

7. Notify the proper authorities the system is back on line.

Figure 5. Removal of cover and screen for cleaning:

![](image)

WARNING

The Limitations of Property Protection Smoke Detectors

This smoke detector is designed to activate and initiate emergency action, but will do so only when it is used in conjunction with an authorized fire alarm system. This detector must be installed in accordance with NFPA standard 72.

Smoke detectors will not work without power. AC or DC powered smoke detectors will not work if the power supply is cut off.

Smoke detectors will not sense fires which start where smoke does not reach the detectors. Smoldering fires typically do not generate a lot of heat which is needed to drive the smoke up to the ceiling where the smoke detector is usually located. For this reason, there may be large delays in detecting a smoldering fire with either an ionization type detector or a photoelectric type detector. Either one of them may alarm only after flaming has initiated which will generate the heat needed to drive the smoke to the ceiling.

Smoke from fires in chimneys, in walls, on roofs or on the other side of a closed door(s) may not reach the smoke detector and alarm it. A detector cannot detect a fire developing on another level of a building quickly or at all. For these reasons, detectors shall be located on every level and in every bedroom within a building.

Smoke detectors have sensing limitations, too. Ionization detectors and photoelectric detectors are required to pass fire tests of the flaming and smoldering type. This is to ensure that both can detect a wide range of types of fires. Ionization detectors offer a broad range of fire sensing capability but they are somewhat better at detecting fast flaming fires than slow smoldering fires. Photoelectric detectors sense smoldering fires better than flaming fires which have little, if any, visible smoke. Because fires develop in different ways and are often unpredictable in their growth, neither type of detector is always best, and a given detector may not always provide early warning of a specific type of fire.

In general, detectors cannot be expected to provide warnings for fires resulting from inadequate fire protection practices, violent explosions, escaping gases which ignite, improper storage of flammable liquids like cleaning solvents which ignite, other similar safety hazards, arson, smoking in bed, children playing with matches or lighters, etc. Smoke detectors used in high air velocity conditions may have a delay in alarm due to dilution of smoke densities created by frequent and rapid air exchanges. Additionally, high air velocity environments may create increased dust contamination, demanding more frequent maintenance.

Smoke detectors cannot last forever. Smoke detectors contain electronic parts. Even though smoke detectors are made to last over 10 years, any part can fail at any time. Therefore, smoke detectors shall be replaced after being in service for 10 years. The smoke detector system that this detector is used in must be tested regularly per NFPA 72. This smoke detector should be cleaned regularly per NFPA 72 or at least once a year.

Three-Year Limited Warranty

System Sensor warrants its enclosed smoke detector to be free from defects in materials and workmanship under normal use and service for a period of three years from date of manufacture. System Sensor makes no other express warranty for this smoke detector. No agent, representative, dealer, or employee of the Company has the authority to increase or alter the obligations or limitations of this Warranty. The Company’s obligation of this Warranty shall be limited to the repair or replacement of any part of the smoke detector which is found to be defective in materials or workmanship under normal use and service during the three year period commencing with the date of manufacture. After phoning System Sensor’s toll free number 800-SENSOR2 (736-7672) for a Return Authorization number, send defective units postage prepaid to: System Sensor, Repair Depart-