Requirements and recommendations for proper use of fire alarm systems including smoke detectors and other fire alarm devices:

Early fire detection is best achieved by the installation and maintenance of fire detection equipment in all rooms and areas of the house or building in accordance with the requirements and recommendations of the current edition of the National Fire Protection Association Standard 72, National Fire Alarm Code (NFPA 72), the manufacturer’s recommendations, State and local codes and the recommendations contained in Guide for the Proper Use of System Smoke Detectors, which is made available at no charge to all installing dealers. For specific requirements, check with the local Authority Having Jurisdiction (or Fire Chief) for fire protection systems.

Requirements and Recommendations include:

- For residential applications, smoke detectors shall be installed outside of each separate sleeping area in the immediately adjacent vicinity of the family living unit, including basements and excluding crawl spaces and unfinished attics.
- Smoke detectors shall be installed in sleeping rooms in new construction and it is recommended that they shall also be installed in sleeping rooms in existing construction.
- It is recommended that more than one smoke detector shall be installed in a hallway if it is more than 30 feet long.
- It is recommended that there shall never be less than two smoke detectors per apartment or residence.
- It is recommended that smoke detectors be located in any room where an alarm control is located, or in any room where alarm control connections to an AC source or phone lines are made.
- If detectors are not so located, a fire within the room could prevent the control from reporting a fire.
- All fire alarm systems require notification devices, including sirens, bells, horns, and/or strobes. In residential applications, each automatic alarm initiating device when actuated shall cause the operation of an alarm notification device that shall be clearly audible in all bedrooms over ambient or background noise levels (at least 15dB above noise) with all intervening doors closed.
- It is recommended that a smoke detector with an integral sounder (smoke alarm) be located in every bedroom and an additional notification device be located on each level of a residence.
- To keep your fire alarm system in excellent working order, ongoing maintenance is required per the manufacturer’s recommendations and UL and NFPA standards. At a minimum the requirements of Chapter 7 of NFPA 72 shall be followed. A maintenance agreement should be arranged through the local manufacturer’s representative. Maintenance should be performed annually by authorized personnel only.
- The most common cause of an alarm system not functioning when a fire occurs is inadequate maintenance. As such, the alarm system should be tested weekly to make sure all sensors and transmitters are working properly.
- Although designed for long life, fire alarm devices including smoke detectors may fail at any time. It is recommended that residential smoke detectors shall be replaced every 10 years.
- Any smoke detector, fire alarm system or any component of that system which fails shall be repaired or replaced immediately.

Typical System Installations per NFPA 72

DH400ACDCPX and DH400ACDCPS

Air Duct Smoke Detector

Before Installing

Please thoroughly read the System Sensor Guide for Proper Use of Smoke Detectors in Duct Applications (AOS-1004), which provides detailed information on detector spacing, placement, zoning, wiring, and special applications. Copies of this manual are available online at www.systemsensor.com or via System Sensor’s toll free fax-back service, Documents on Demand at 800/736-7672. NFPA Standards 72 and 90A should also be referenced for detailed information.

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

Table of Contents

- [1] General Description
- [2] Exploded View of Duct Detector Components
- [3] Contents of the Duct Detector Kit
- [4] Limitations of Duct Detectors
- [5] Installation Sequence
- [6] Duct Detector Maintenance and Test Procedures
- [7] Detector Cleaning Procedures
- [8] Specifications
- [9] Warranty
- [10] List of Tables and Figures

List of Tables and Figures

- Fig. 1: Duct Detector Exploded View
- Table 1: Inlet Sampling Tube Selection
- Fig. 2: Inlet Sampling Tube
- Fig. 3: Sampling Tube Mounting Configurations
- Fig. 4: Wiring Diagram
- Fig. 5: Wiring Diagram – No Control Panel
- Fig. 6: Wiring Diagram – Accessories
- Fig. 7: Sampling Tube Filter Installation
- Fig. 8: Testing Detector Alarm
- Fig. 9: Detector Head Removal
- Fig. 10: Photo Head Exploded View

As of January 2000, this document supersedes any previous liability information enclosed with this product.
**Limitations of Fire Alarm Systems**

Manufacturer recommends that smoke and/or heat detectors be located throughout a protected premise following the recommendations of the current edition of the National Fire Protection Association Standard 72, National Fire Alarm Code (NFPA 72), manufacturer’s recommendations, state and local codes, and the recommendations contained in *Guide for the Proper Use of System Components* which is made available at no charge to all installing dealers. A study by the Federal Emergency Management Agency (an agency of the United States government) indicated that smoke detectors may not give early warning in as many as 85% of all fires. While fire alarm systems are designed to provide warning against fire, they do not guarantee warning or protection against fire. Any alarm system is site specific with conditions such as egress.

This device does not sense smoke unless the ventilation system is operating. For this detector to function properly, it **MUST** be installed according to the instructions in this manual. Furthermore, the detector **MUST** be protected from the elements and any other environment. Failure to comply with these requirements may prevent the detector from activating when smoke is present in the air duct.

In general, smoke detectors on one level of a structure cannot be expected to sense fires developing on another level. The amount of “smoke” present may be insufficient to alarm smoke detectors. Smoke detectors are designed to alarm at various levels of smoke density. If such density levels are not created by a developing fire at the location of detectors, the detectors will not go into alarm.

Smoke detectors, even when working properly, have limitations. Detectors that have photoelectric sensing chambers tend to detect smoldering fires better than flaming fires, which have little visible smoke. Detectors that have ionizing type sensing chambers tend to detect flaming fires better than smoldering fires. Because fires develop in different ways and are often unpredictable in their growth, neither type of detector is necessarily best and a given type of detector may not provide adequate warning of a fire.

Smoke detectors are subject to false alarms and nuisance alarms. For example, a smoke detector located in or near a kitchen may go into nuisance alarm during normal operation of kitchen appliances. In addition, dusty or steamy environments may cause a smoke detector to falsely alarm. If the location of a smoke detector causes an abundance of false alarms or nuisance alarms, do not disconnect the smoke detector, call a professional to analyze the situation, and/or move the detector.

Smoke detectors cannot be expected to provide adequate warning of fires caused by arson, children playing with matches (especially within bedrooms), smoking in bed, violent explosions (caused by escaping gas, improper storage of flammable materials, etc.).

Heat detectors do not sense particles of combustion and are designed to alarm only when heat on their sensors increase at a predetermined rate or reaches a predetermined level. Heat detectors are intended to detect property damage.

Warning devices (including horns, sirens, and bells) may not alert people or wake up sleepers who are located on the other side of closed or partially open doors. A warning device that activates on a different floor or a level of a dwelling or structure is less likely to awaken or alert people. Even persons who are awake may not notice the warning if the alarm is muted by noise from a stereo, radio, air conditioner or other appliance, or by passing traffic. Audible warning devices may not alert the hearing impaired. Smoke or other devices should be provided to warn these people. Any warning device may fail to alert people with a disability, deaf sleepers, people who have recently used alcohol or drugs, or people on medication or sleeping pills.

- Please note that:
  - i) Stoves can, under certain circumstances, cause seizures in people with epilepsy.
  - ii) Studies have shown that certain people, even when they hear a fire alarm signal, do not respond or comprehend the meaning of the signal. It is the property owner’s responsibility to conduct fire drills and other training exercises to make people aware of fire alarm signals and instruct the proper reaction to alarm signals.
  - iii) In rare instances, the sounding of a warning device can cause temporary or permanent hearing loss.

Telephone lines needed to transmit alarm signals from a premises to a central station may be out of service or temporarily out of service. For added protection against telephone line failure, backup radio transmission systems are recommended.

- System components, though designed to last many years, can fail at any time. As a precautionary measure, it is recommended that smoke detectors be checked, maintained, and replaced per manufacturer’s recommendations.
- System components will not work without electrical power. If system batteries are not serviced or regularly replaced, they may not provide battery backup when AC power fails.
- Environments with high air velocity or that are dusty or dirty require regular maintenance.

To keep your fire alarm system in excellent working order, ongoing maintenance is required per the manufacturer’s recommendations and UL and NFPA standards. At a minimum the requirements of Chapter 7 of NFPA 72 shall be followed. A maintenance agreement should be arranged through the local manufacturer’s representative. Maintenance should be performed annually by authorized personnel only.

- The most common cause of an alarm system not functioning when a fire occurs is inadequate maintenance. As such, the alarm system should be tested weekly to make sure all sensors and transmitters are working properly.
- Although designed for long life, fire alarm devices including smoke detectors may fail at any time. It is recommended that smoke detectors be replaced every 10 years.
- Any alarm detector is only one component of that system which fails shall be repaired or replaced immediately.

In general, fire alarm systems and devices will not work without power and will not function properly unless they are maintained and tested regularly.

While installing a fire alarm system may make the owner eligible for a lower insurance rate, an alarm system is not a substitute for insurance. Property owners should continue to act prudently in protecting the premises and the people in the premises and should properly insure life and property and buy sufficient amounts of liability insurance to meet their needs.

**[3] Contents of the Duct Detector Kit**

1. Complete housing base and cover assembly
2. One sampling tube filter
3. Two #6 self-tapping mounting screws for sampling tube
4. One inlet tube end plug

**[4] Limitations of Duct Detectors**

The National Fire Protection Association has established that **DUCT DETECTORS MUST NOT BE USED AS A SUBSTITUTE FOR OPEN AREA DETECTOR PROTECTION** as a means of providing life safety. Nor are they a substitute for the detector housing.

This device will not operate without electrical power. Frequently, fire situations may cause an interruption of power. The system safeguards should be discussed with your local fire protection specialist.

**[5] Installation Sequence**

**[5.1] Verify Duct Air Flow Direction and Velocity**

Model DH400/ACDCPX and DH400/ACDCPS detectors are designed to be used in air handling systems having air velocities of 500 to 4000 feet per minute. Be sure to check engineering specifications to ensure that the air velocity in the duct falls within these parameters. If necessary, use a velocity meter (anemometer) to check the air velocity in the duct.

**[5.2] Select Mounting Location**

The DH400/ACDCPX and DH400/ACDCPS are intended for mounting on ductwork and/or brackets which have been pre-drilled with appropriate mounting holes. While other applications are possible, they are not covered within this manual.
**Electrical Ratings**

<table>
<thead>
<tr>
<th>Power Supply Voltage</th>
<th>20 - 25 VDC</th>
<th>24 VAC 50 - 60 Hz</th>
<th>120 VAC 50 - 60 Hz</th>
<th>220/240 VAC 50 - 60 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CURRENT REQUIREMENTS USING NO ACCESSORIES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. standby current</td>
<td>25 mA</td>
<td>25 mA AC avg.</td>
<td>20 mA AC avg.</td>
<td>20 mA AC avg.</td>
</tr>
<tr>
<td>Max. current</td>
<td>95 mA</td>
<td>55 mA AC avg.</td>
<td>35 mA AC avg.</td>
<td>30 mA AC avg.</td>
</tr>
<tr>
<td><strong>CONTACT RATINGS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alarm initiation contacts (SPST)</td>
<td>2.5A @ 30 VAC (0.5 power factor)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alarm auxiliary contacts (DPDT)</td>
<td>10A @ 30 VDC</td>
<td>10A @ 230 VAC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Note: Alarm auxiliary contacts must switch 500 mA minimum at 24VDC. Alarm auxiliary contacts shall not be connected to initiating circuits of control panels. Use the alarm initiation contact for this purpose.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trouble contacts (SPST)</td>
<td>0.3A @ 30 VDC (resistive)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 1. Sampling tubes required for different duct widths:**

<table>
<thead>
<tr>
<th>Outside Duct Width</th>
<th>Inlet Tube Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 2 ft.</td>
<td>ST-1.5</td>
</tr>
<tr>
<td>2 to 4 ft.</td>
<td>ST-3</td>
</tr>
<tr>
<td>4 to 8 ft.</td>
<td>ST-5</td>
</tr>
<tr>
<td>8 to 12 ft.</td>
<td>ST-10</td>
</tr>
</tbody>
</table>

**NOTE:** The sampling tube end cap is critical to the proper operation of the duct smoke detector. The end cap is needed to create the proper air flow to the sensor of the duct smoke detector.

**Figure 2. Air duct detector sampling tube:**

**Figure 3. Tube mounting configurations with varying air flow direction:**

**Three-Year Limited Warranty**

System Sensor warrants its enclosed air duct smoke detector to be free from defects in materials and workmanship under normal use and service for a period of three years from the date of manufacture. System Sensor makes no other express warranty of any kind, and (with the exception of nonsystem parts) this warranty is the sole and exclusive warranty of System Sensor. Any and all implied warranties, including without limitation, warranties of merchantability or fitness for a particular purpose, are hereby limited in duration to said three-year period commencing with the date of manufacture. After phoning System Sensor’s toll-free number 800-SENSOR2 (776-7462) for a Return Authorization number, send defective unit postage prepaid to: System Sensor, Repair Department, R.A. __________ 5825 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 manufacturer’s negligence or fault. In no case shall the Company be liable for any consequential or incidental damages, or for indirect damages for breach of this or any other Warranty, expressed or implied whatsover, 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.
Figure 4. System wiring diagram for duct detectors using a UL listed control panel (see Figure 8 for wiring of optional accessories):

**CAUTION**

Do not loop wire under terminals when wiring detectors. Break wire runs to provide system supervision of connections.

---

**[8] Model DH400ACDCPX and DH400ACDCPS Air Duct Smoke Detector Specifications**

HVAC air duct mounted photoelectric smoke detector for separately powered systems or stand alone systems. Auxiliary alarm relay contacts provide fan contractor shutdown to prevent HVAC circulation of smoke.

**Environmental Limits**

- **Temperature:** 32°F to 120°F
  0°C to 49°C
- **Humidity:** 10% to 93% R.H. non-condensing
- **Air Velocity:** 500 to 4000 Ft/min.
  2.54 to 20.3 m/sec.

**Test Features**

Magnetic test switch, magnetic reset switch, MOD400R test module (optional), RTS451 Remote Test Station with Key Switch (optional).

**Mechanical Specifications**

- **Length:** 14.5 inches 37 cm
- **Width:** 5 inches 13 cm
- **Depth (installed):** 4 inches 10 cm
- **Weight:** 4 pounds 1.8 kg

**Sampling (Inlet) Tubes**

<table>
<thead>
<tr>
<th>Outside Duct Width</th>
<th>Inlet Tube Required</th>
</tr>
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<tbody>
<tr>
<td>1 to 2 ft. (0.3 to 0.6 m)</td>
<td>ST-1.5</td>
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<td>2 to 4 ft. (0.6 to 1.2 m)</td>
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<tr>
<td>4 to 8 ft. (1.2 to 2.4 m)</td>
<td>ST-5</td>
</tr>
<tr>
<td>8 to 12 ft. (2.4 to 3.7 m)</td>
<td>ST-10</td>
</tr>
</tbody>
</table>

**Electrical Specifications**

- **Power supply voltage:** 20-29 VDC 24 VAC 50-60-Hz 120 VAC 50-60 Hz 220/240 VAC 50-60 Hz
- **Input capacitance:** 270 µF max. 270 µF max. N/A N/A
- **Reset voltage:** 1.0 VDC min. 2.0 VAC min. 10 VAC min. 20 VAC min.
- **Reset time (with RTS451):** .03 to 0.3 sec. .03 to 0.3 sec. .03 to 0.3 sec. .03 to 0.3 sec.
- **Reset time (by power down):** .6 sec. max. .6 sec. max. .6 sec. max. .6 sec. max.
- **Power up time:** 34 sec. max. 34 sec. max. 34 sec. max. 34 sec. max.
- **Alarm response time:** 2 to 17 sec. 2 to 17 sec. 2 to 17 sec. 2 to 17 sec.
- **Sensitivity Test:** See head label See head label See head label See head label

---

**AVA \[8\] Model DH400ACDCPX and DH400ACDCPS Air Duct Smoke Detector Specifications**

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- **Power up time:** 34 sec. max. 34 sec. max. 34 sec. max. 34 sec. max.
- **Alarm response time:** 2 to 17 sec. 2 to 17 sec. 2 to 17 sec. 2 to 17 sec.
- **Sensitivity Test:** See head label See head label See head label See head label
[7.1] **Air Filters**
1. Turn off power to the system.
2. Remove and inspect the sampling tube filters.
3. If the filters are heavily coated with dirt, replace them with new filters. If they are not heavily coated, use a vacuum cleaner or compressed air nozzle to remove dust, then reinstall the filters.

[7.2] **Photo Heads**
1. Remove the detector cover by inserting a small bladed screwdriver into the slot located 90 degrees from the field test port. Rotate the cover counterclockwise to remove (see Figure 10).
2. Lift the screen from the photo chamber. Vacuum the screen and cover before using clean, compressed air to loosen and blow out any remaining debris. Replacement screens (RS24) are available.
3. Vacuum the photo chamber. Use clean compressed air to blow it clean.
4. Replace the screen by aligning the arrow on top with the field test port on the detector. Press the screen into place. It should fit tightly on the chamber.
5. Replace the detector cover and rotate it clockwise to lock it in place.

[7.4] **Reinstallation**
1. Reinstall the detector in its housing.
2. Restore system power.
3. Perform Detector Check, Section [5.7].
4. Notify the proper authorities testing has been completed and the smoke detector system is back in operation.

---

**Figure 9. Detector head removal:**

**Figure 10. Photo head exploded view:**

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**Figure 5. Wiring diagram for duct detector systems equipped without a control panel (see Figure 8 for wiring of additional optional accessories):**

**Figure 6. Wiring diagram for duct detector systems equipped with a control panel (see Figure 8 for wiring of additional optional accessories):**

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**[5.5] Field Wiring**

**Installation Guidelines**

All wiring must be installed in compliance with the National Electrical Code and the local codes 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, the wiring between interconnected detectors or from detectors to auxiliary devices, it is usually recommended that single-conductor wire be no smaller than 18 gauge. The duct detector terminals accommodate wire sizes up to 14 gauge. The last foot of conduit should be flexible steel conduit (available in electrical supply houses), which facilitates installation and puts less strain on the conduit holes in the housing. Solid conduit connections may be used, if desired.

---

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 loop.

**Wiring Instructions**

The DH400ACDLPX and DH400ACDCPS detectors are designed for easy wiring. The housing provides a terminal strip with clamping plates. Wiring connections are made by stripping about 3/8-inch of insulation from the end of the wire, sliding the bare end under the plate, and tightening the clamping plate screw.

The DH400ACDLPX and DH400ACDCPS duct detector are designed to operate from 24 VDC, 24 VAC, 120 VAC, or 240 VAC.
Filters require periodic cleaning or replacement, depending on the amount of dust and dirt accumulated. Visually inspect the filters at least quarterly, inspect them more often if the dust accumulation warrants it. See Section [6] for more information. Replacement filters can be ordered from System Sensor, 3825 Ohio Ave., St. Charles, IL 60174. (Exhaust tube filter P/N F36-09-31, Inlet sampling tube filter P/N F36-08-00).

[6.1] Smoke Entry Tests

[6.1.1] Air Flow

To verify sufficient sampling of duct air, use a manometer to measure the differential pressure created from air flow across the sampling tubes. The pressure should measure no less than 0.6 inches of water and no greater than 1.20 inches of water.

[6.1.2] Smoke Response

To determine if smoke is capable of entering the sensing chamber, visually identify any obstructions. Plug the exhaust and inlet tube holes to prevent duct air from carrying smoke away from the detector head, then blow smoke such as cigarette, cotton wick, or punk directly at the head to cause an alarm. REMOVE THE PLUGS AFTER TESTING OR THE DETECTOR WILL NOT FUNCTION PROPERLY.

[6.1.3] Filter Replacement

The filters do not substantially affect smoke behavior even when they are up to 90% clogged. Quarterly visual inspection is usually often enough to determine if filters should be replaced because only a high percentage of contamination affects duct detector performance.

[6.2] Standby, Alarm, and Sensitivity Tests

[6.2.1] Standby and Trouble

Standby - Check for the presence of the blinking red LEDs (blinks about every 10 seconds) through the transparent housing cover. If the APA451 accessory is used, its green Power LED should be illuminated continuously.

Trouble - If the detector LEDs do not blink or if the APA451 Power LED is not illuminated, the detector lacks power (check wiring, panel, or power supply), the head is missing (install), or the unit is defective (return for repair)

Test - The trouble condition can be caused intentionally to verify correct operation of the system. Remove power to the unit, remove the detector head (see Figure 9), or place the M02-04-00 magnet into the Reset locator, as shown in Figure 8. These actions should cause a trouble condition locally and at the system control panel.

[6.2.2] Sensitivity Test

[6.2.2.1] M02-04-00 Magnet Test

1. Place the painted surface of the magnet into the Test locator molded into the side of the housing (see Figure 8). This should clear the latched alarm condition at the detector. If a system control panel is used, the panel may also require resetting.

[6.2.3] MOD400R Sensitivity Test

After verification of alarm capability, use the MOD400R test module with a voltmeter to check detector sensitivity as described in the test module’s manual. The housing cover must be removed to perform this test.

If test module readings indicate that the detector head is outside of the acceptable range that is printed on the back of the detector head, the detector head requires cleaning per Section [7].