MXBASE AND MX916/926/936 PRODUCT APPLICATION AND DESIGN DOCUMENT

29011152R002

Rev 002

Software version

29011152R002

Contents

Cautions, warnings, and regulatory information

READ AND SAVE THESE INSTRUCTIONS Follow the instructions in this installation manual. These instructions must be followed to avoid damage to this product and associated equipment. Product operation and reliability depend upon proper installation.

DO NOT INSTALL ANY PRODUCT THAT APPEARS DAMAGED Upon unpacking your Tyco product, inspect the contents of the carton for shipping damage. If damage is apparent, immediately file a claim with the carrier and notify an authorized product supplier.

ELECTRICAL HAZARD Disconnect electrical field power when making any internal adjustments or repairs. All repairs should be performed by a representative or an authorized agent of your local Tyco product supplier.

STATIC HAZARD Static electricity can damage components. Handle as follows:

- Ground yourself before opening or installing components.
- Prior to installation, keep components wrapped in anti-static material at all times.

Introduction

Use this guide when designing a fire detection system using addressable detectors, or replacing addressable detectors in an existing system. This document includes information about detector features, choosing detectors, and choosing detector locations. It is an overall guide to the Photo-Heat, Photo, Heat, and Photo-Heat-CO addressable detectors, and includes only information that is common to all of them. Refer to document 29011151R001: MX916/926/936 FIRE DEVICES INSTALLATION INSTRUCTIONS for information about ordering and installing the detectors.

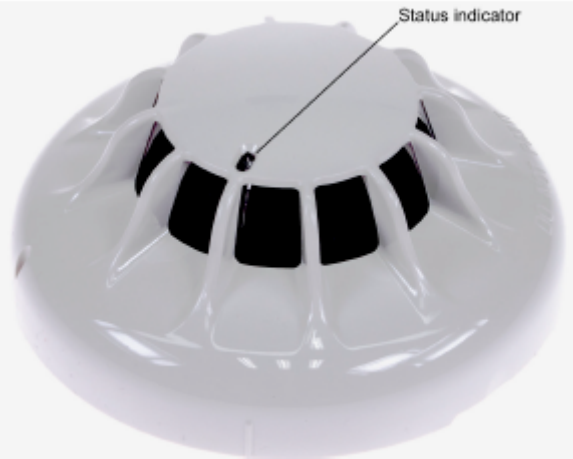
ⓘ **Note:** There are a number of system level guides available for download from the DSC website: www.dsc.com. These support the design, installation and use of fire alarm systems.

Detector overview

The function of the detector is to quantify environmental variables and provide the resulting numerical value to the fire alarm control panel (FACP). The FACP then processes the detector values and assesses whether an alarm needs to be issued. Depending on the detector variant, the environmental variables monitored are combinations of the following:

- Temperature
- Smoke density

Figure 1: Detector communications



Detector operation modes

Table 1 lists the operation modes that are applicable to each detector type.

Table 1: Detector operation modes

PID	Detector name	UL-listed smoke sensitivity	Modes of operation
MX916	Photo-Heat	2.26 ± 0.42%/ft	Optical or Fixed alarm level temperature 135°F (57°C) *
MX926	Photo	2.26 ± 0.42%/ft	Optical
MX936	Heat		Fixed alarm level temperature 135°F (57°C) or Rate of rise 15°F (8.4°C) *
* Device trips under either condition. It's not programmable option.			

Table 2: Documents list

Detector type		Document
MX916	Photo-Heat	29011151R001: MXBASE & MX916/926/936 FIRE DEVICES INSTALLATION INSTRUCTIONS ENG
MX926	Photo	
MX936	Heat	

Detector specifications

Table 3 displays the specifications for each of the detectors.

Table 3: Detector specifications

	MX916 Photo-Heat	MX926 Photo	MX936 Heat
Environment	Indoor application only		
Relative humidity	93% non-condensing		
Dimensions	Height: 42 mm (1.653 in.) Diameter: 108 mm (4.252 in.)		
Weight	76 g		81 g
Operating temperature	-25°C to +70°C (-13°F to +158°F)	+1°C to +49°C (+33.8°F to +120.2°F)	-25°C to +70°C (short term to +90°C) (-13°F to +158°F (short term to 194°F))
Storage temperature	-30°C to +70°C (-22°F to +158°F)	-30°C to +70°C (-22°F to +158°F)	-30°C to +70°C (-22°F to +158°F)
Operating voltage	20 VDC to 40 VDC maximum		
Stand-by current	350 uA		
Alarm current	4 mA		

Detector functions

Table 4 displays the detector functions that are provided with the types of detectors.

Self-monitoring

Self-monitoring refers to the design features of the detector to detect problems. The features for each detector type follow:

- For the heat (temperature) sensor, a normal output level around ambient temperature is expected.
- For the optical (smoke) sensors, the optical chamber is periodically stimulated.

ⓘ **Note:** When the Photo detector is dirty, you must replace it.

Table 4: Detector functions

Function	Detector types		
	MX916 Photo-Heat	**MX926 Photo**	**MX936 Heat**
Self-monitoring	X	X	X
Self-test	X	X	X
LED Status indicator	X	X	X
Remote LED	X	X	X
Threshold compensation	X	X	

Note:

Please refer to 29011151R001: MXBASE & MX916/926/936 FIRE DEVICES INSTALLATION INSTRUCTIONS ENG for more details on the configuration options for the detector features.

Self-test

The self-test feature simulates a fire condition within the detector. The detector then reacts as if there is an actual fire.

LED Status indicator

The LED status indicator is configurable by the installer (ON/OFF). The LED has the following variations:

- A flashing yellow LED indicates a detector fault or isolation.
- A flashing red LED indicates normal operation (flashes on detector poll).
- A continuous red LED indicates the detector is in alarm.

Remote LED

The detectors are capable of driving a remote LED. Please refer to 29011151R001: MXBASE & MX916/926/936 FIRE DEVICES INSTALLATION INSTRUCTIONS ENG for remote LED wiring details.

Short-circuit line isolator

A detector with a built-in short-circuit line isolator continues to operate when a single short circuit fault occurs in a loop.

Detector Address

Each detector will be assigned an address automatically during the MX devices enrollment process.

Note: The detectors should be wired into the MX loop before the start of the auto-enroll process.

Threshold compensation

The detectors support the ability to compensate for the effects of contamination due to dust and dirt. This prevents an increase of false alarms and extends the operational life of the detector. Threshold compensation applies only to detectors with smoke (photo) sensors.

Detector mode selection

Selection guidelines

Choose detectors based on the demands of the application.

The tables below are guidelines. Specific situations are likely to require variations on the suggested detector types. Real-life situations may require detector combinations to cover all likely risks. The chief difference is a higher resistance to false alarms and slower response to aerosol test gas. Consider customer knowledge of relative impact of false alarm versus undetected fires.

The Night and Day columns represent low false alarm risk and high false alarm risk. Although this usually follows a day/night pattern, it may be configured for any time. For example, the car deck of a ferry would be configured for day during vehicle loading and night after all the passengers had left the car deck, thus achieving optimum protection for that area.

Detector key		Mode key	
PH	= MX916	HPO	= Heat enhanced optical
P	= MX926	P	= Optical (Photoelectric)
H	= MX936	135F	= 135F Fixed temperature
		200F	= 200F Fixed temperature
		Ror	= 15F Rate of rise of temperature
		X	= Use manual call point

Note: Bold text indicates most likely detector and mode to meet user's requirements. Sensitivity settings may require adjustment depending on the environment.

Table 5: Variations on suggested detector types

Variations																		
Environment	Very clean and dry			Benign, moderately clean, regulated temperature			Dirty or smoking during the day			Dusty or humid			Hot and smoky when in use			Open areas		
For example	Clean room, data processing suite			Offices, hospitals, light industrial, residential, passenger cabin			Warehouse with diesel fork-lifts or similar vehicles, heavy industrial, ferry car deck			Livestock pen, mill, laundry, changing room			Kitchen, engine room, test beds			Atrium, theatre, hanger, oil rigs, turbine hall		
	Type	**Mode**		**Type**	**Mode**		**Type**	**Mode**		**Type**	**Mode**		**Type**	**Mode**		**Type**	**Mode**	
Fire loading		**Night**	**Day**		**Night**	**Day**		**Night**	**Day**		**Night**	**Day**		**Night**	**Day**		**Night**	**Day**
Electronic equipment, electrical switchgear, electric motors, cable conduit	**PH** **P**	**HPO**	**H**	**PH** P	**HPO**	**H**	PH	HPO	H	PH	HPO	H	PH H	HPO Ror	X 200F	**Flame**		
Fabrics, clothes, soft furnishings, paper, cardboard, plastic foams, animal bedding, wood shavings	**PH** **P**	**HPO**	**H**	PH	HPO	H	PH	HPO	H	PH	HPO	H						
Flammable liquids, paints, solvents, flammable gasses, unstable chemicals	**PH** P	**HPO**	**HPO**	**PH**	**HPO**	**HPO**	H	Ror	135F	H	Ror	135F	H Flame	Ror	200F X	**Flame** X		
Food stuffs, general organic waste, animal fodder, wooden structures, solid fuels	**PH** P H	**HPO** Ror	**H** Ror	**PH**	**HPO**	**HPO**	**PH** H	**HPO** Ror	**H** Ror	PH H	HPO Ror	H Ror	H	Ror	200F			
Plastic, chemicals, machinery, building materials, unknown contents	PH	HPO	H	PH P H	HPO Ror	H Ror	**PH** P H	**HPO** Ror	**H** Ror	**P**	P	P	H	Ror	200F			

Detector selection and placement guidelines

Important: The sections that follow provide information in accordance with NFPA 72. Use the standards applicable to your location if you are not in NFPA jurisdiction.

General considerations

Before installing the detectors, survey the area to be covered in accordance with information provided in NFPA 72 (an excerpt is provided in the note of Table 6). For additional information, refer to NFPA 72 and the NEMA Guide for Proper Use of System Smoke Detectors.

See Table 6 for various considerations when choosing detector locations and types:

Table 6: Detector selection considerations

Considerations		
Possibility of human occupancy	Contents to be protected	Type of construction and use
Contents fire characteristics	Air movement - stratification	Deflections and obstructions
Ceiling heights	Ceiling surface conditions	Ceiling construction types
Total area	Vent locations - velocities - dilution	
Note: Each detector is capable of providing up to 900 sq. ft. (84 m^2) of coverage, depending on the local code requirements and engineering evaluation results.		

Code compliance rules

Underwriters Laboratories (UL) has three smoke detector standards. Use the detectors only in applications for which they are specifically listed. The three standards are as follows:

1. UL 268A standard for duct detectors
2. UL 217 standard for single and multiple station detectors
3. UL 268 standard for system-type detectors

The NFPA 101 Life Safety Code states that single station detectors shall sound an alarm only within an individual living unit or similar area and shall not actuate the building fire alarm system. It also states, “All systems and components shall be approved for the purpose for which they are installed”.

In addition to possible code noncompliance, the following deficiencies would exist in a series of residential detectors connected in a fire alarm system mode:

- Because the fire alarm system is not supervised, vandals or others could disconnect a detector or the entire system, leaving a building without protection. The residents would be unaware of the serious life threatening condition.
- Residential detectors do not latch in alarm. In other words, the detector self-resets. One detector in alarm sounds all the detectors connected together. It would be difficult to identify or locate a specific detector that initially put the system into alarm after the alarm condition was cleared.

System detectors latch in alarm. They do not reset until power is momentarily disconnected. This makes it convenient to identify the location of the detector that caused the control panel to alarm. In addition, system detectors are specifically designed to connect to a supervised control panel. Twowire detectors require a UL compatibility review to verify that the detector and panel properly operate together. A typical life safety fire alarm system for an apartment complex would be to use system detectors and manual fire alarm stations in the hallways and common areas of the complex and residential single station type detectors and heat detectors in the individual apartments. The

system detectors, manual stations and heat detectors would be connected to a supervised control panel, sound a general alarm and automatically notify the proper authorities that a fire condition exists. The residential detectors located in the apartments would be interconnected only within the individual living quarters of each apartment. These residential units would sound an alarm only in the apartment unit.

Detector spacing rules

Table 7 lists the detector spacings required:

Table 7: Detector spacing requirements

Agency	Program selection	Spacing
UL	135ºF / 200ºF (57ºC / 93ºC)	50 ft. x 50 ft. (15.24 m x 15.24 m) ceiling 30 ft. x 30 ft. (9.15 m x 9.15 m) wall

Correct detector locations

Important: The guidelines in this section are adapted from standards published by the National Fire Protection Association, Quincy, Massachusetts, U.S.A. These standards include NFPA 72, “National Fire Alarm and Signaling Code”; NFPA 70, “National Electrical Code”, Article 760; and NFPA 90A, “Standard for the Installation of Air Conditioning and Ventilating Systems".

To provide effective early warning of a developing fire situation, detectors should be installed in all areas of the protected premises. Total coverage as defined by NFPA 72 should include all rooms, halls, storage areas, basements, attics, lofts, and spaces above suspended ceilings (including plenum areas utilized as part of the HVAC system). In addition, this should include all closets, elevator shafts, enclosed stairways, dumbwaiter shafts, chutes and other subdivisions and accessible spaces.

Fire detection systems installed to meet local codes or ordinances may not be adequate for early warning of the fire. Some codes or ordinances have minimum objectives such as capturing elevators or preventing circulation of smoke through HVAC systems, instead of early detection of fire.

You should weigh the costs against the benefits of installing a complete fire detection system when any detection system is being installed. The location, quantity and zoning of detectors should be determined by what objectives are needed rather than the minimum requirements of any local codes or ordinances. Detectors may be omitted from combustible blind spaces when any of the conditions in Table 8 prevail.

Table 8: Conditions for when detectors can be omitted from combustible blind spaces

Ommission from compustible blind spaces
The ceiling is attached directly to the underside of the supporting beams of a combustible roof or floor deck.
The concealed space is entirely filled with noncombustible insulation. In solid joist construction, the insulation need fill only the space from the ceiling to the bottom edge of the joist of the roof or floor deck.
There are small concealed spaces over rooms, provided the space in question does not exceed 50 sq. ft. (4.6 m^2).
The spaces formed by sets of facing studs or solid joists in walls, floors, or ceilings where the distance between the facing studs or solid joists does not exceed 6 in. (15 cm).
The space is not accessible for storage purposes. It is protected against the entrance of unauthorized persons and against the accumulation of windblown debris.
The space contains no equipment or structures (such as steam pipes, electrical wiring, ducts, shafts, or conveyors) that could potentially ignite or conduct the spread of fire.
The floor over the space is tight.
Non flammable liquids are processed, handled, or stored on the floor above the space.

Detectors are usually required or recommended underneath open loading docks or platforms and their covers, and in accessible under-floor areas in buildings without basements. Detectors can also be omitted from below open grid ceilings where all of the conditions in Table 9 are met.

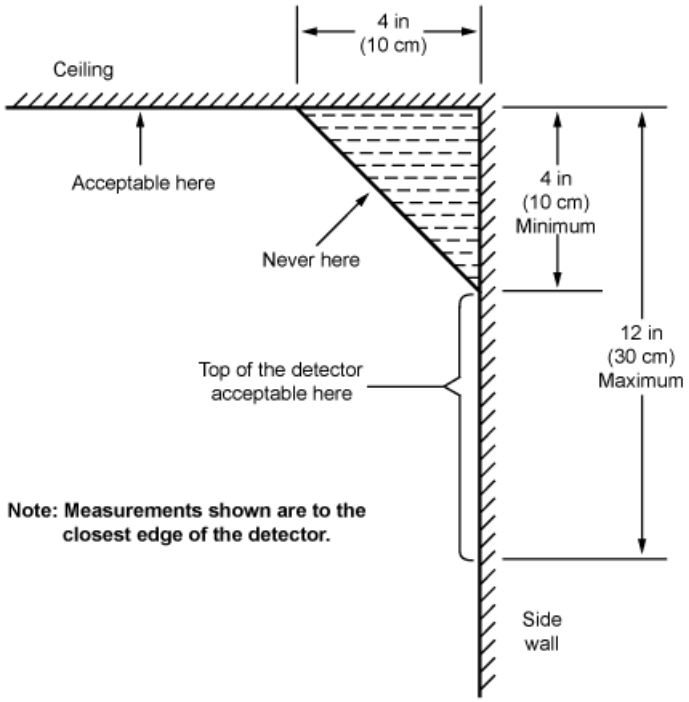
Table 9: Conditions for detector omissions

Conditions for detector ommissions
The openings of the grid are at least 1/4 in. (6 mm) in the smallest dimension.
The thickness of the material does not exceed the smallest of the grid openings.
The openings constitute at least 70% of the area of the ceiling material.

“Total coverage” as described in NFPA 72 is the definition of a complete fire detection system. In some of the specified areas of coverage, such as attics, closets, under open loading docks or platforms, a heat detector may be more appropriate than a smoke detector. Give careful consideration to the detector manufacturer’s instructions, and the recommendations in this guide.

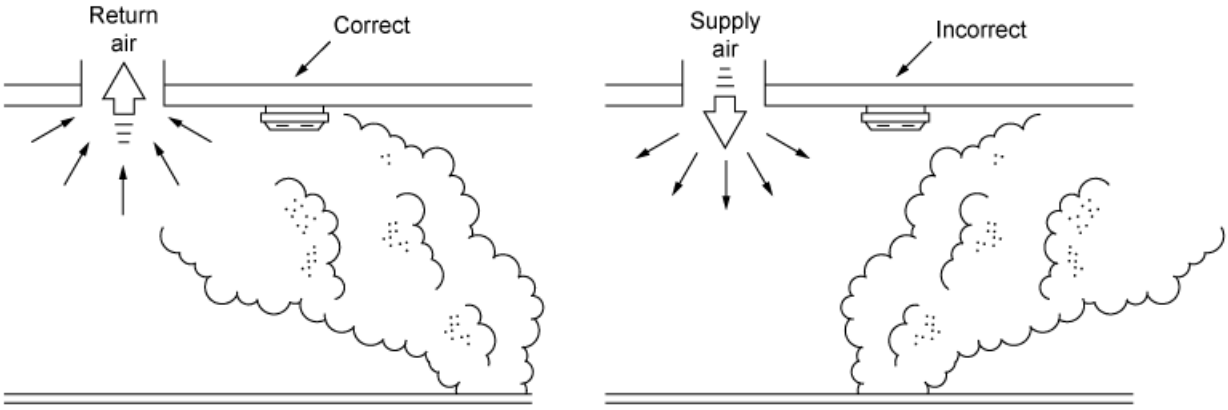
Generally, when only one detector is required in a room or space, place it as close to the center of the ceiling as possible. Central location of the detector is best for sensing smoke and/or fire in any part of the room. If a center location is not possible, it may be placed no closer than 4 in. (10 cm) from the wall, or if listed for wall mounting, it may be mounted on the wall. Wall mounted detectors must have a distance between 4 in. and 12 in. (10 cm to 30 cm) from the ceiling to the top of the detector, and at least 4 in. (10 cm) from any corner wall junction, see Figure 2.

Figure 2: Wall and ceiling-mounted detector



When an air supply and/or an air return duct opening is present in a room or space, place the detectors in the path of the air flow toward the return air duct opening, see Figure 3.

Figure 3: Detector placement - air supply and/or return ducts



Use smoke tests to determine correct detector placement. Give special attention to smoke velocity and travel direction because either can affect detector performance.

Placing a detector near air conditioning or incoming air vents can lead to excessive accumulation of dust and dirt on the detector causing it to malfunction and trigger nuisance alarms. Do not locate detectors closer than 3 ft. (0.9 m) from an air supply diffuser.

Spot-type detectors in properly engineered systems may also be placed in return air ducts, or in approved duct detector housings designed for this application. Although duct detectors are not a substitute for open area detectors, they provide an effective method of initiating building control functions to prevent smoke from being transported from the fire area to other parts of a building.

Incorrect detector locations

One of the major causes of nuisance alarms is incorrect detector placement. The best way to avoid nuisance alarms is to avoid installing detectors in environments that cause them to malfunction. See Table 10 for examples of unsuitable detector locations, Table 11 for environmental conditions that affect the detectors.

Table 10: Examples of improper detector locations

Examples of improper detector locations
Excessively dusty or dirty areas, such as feed rooms and steel mills. Dust and dirt can accumulate on the detector's sensing chamber and make it overly sensitive. It can also block the air entrances to the sensing chamber and make the detector less sensitive to smoke. ➤ **Important:** Avoid areas where fumigants, fog or mist-producing materials, or sweeping and cleaning compounds are used. These substances may cause nuisance alarms.
Outdoors, in stables, open storage sheds, or other open structures affected by dust, air currents, or excessive humidity and temperature.
Damp or excessively humid areas, such as next to bathrooms with showers. The moisture entering the sensing chamber can cool and condense into water droplets, making the detector overly sensitive and causing a nuisance alarm.
In elevator lobbies over ashtrays or where people smoke while waiting for the elevator.
Very cold or hot environments, such as in unheated buildings and rooms where the temperature can fall below or exceed the operating temperature range of the detector. At temperatures below 32 °F (0 °C), ice crystals or condensation can appear inside the sensing chamber, make it overly sensitive, and cause a nuisance alarm. The internal components of the detectors may not function properly at temperatures above the maximum value of the operating range.
In or near areas where combustion particles are normally present. Examples include: • Kitchens or other areas with ovens and burners. • Garages, where particles of combustion are present in vehicle exhausts. • Within 5 ft. (1.5 m) of any cooking appliance. • Within 15 ft. (4.5 m) of any type of furnace, hot water heater, or gas space heater. • Welding shops or other types of work areas where some form of combustion is used in the activity normally conducted in that area. ⓘ **Note:** When a detector must be located in or adjacent to such an area, a fixed temperature heat detector may be appropriate.
In air streams passing by or through kitchens. Air often enters a residence or a residential unit of an apartment building through cracks around the front and/or back doors. If the air return is in the bedroom hallway or in the bathroom, and if air from the kitchen easily enters the air stream going from the door to the air return, combustion particles from cooking can cause nuisance alarms. ⓘ **Note:** Install detectors so that they protect the bedrooms, but so they are out of the air stream.
In or near manufacturing areas, battery rooms, or other areas where substantial quantities of vapors, gases or fumes may be present. Strong vapors, like excessive humidity, can make detectors overly sensitive or less sensitive than normal. In very large concentrations, gases heavier than air, such as carbon dioxide, can make detectors more sensitive, while gases lighter than air, such as helium, may make them less sensitive. Aerosol particles can collect on chamber surfaces and cause nuisance alarms.
Insect-infested areas. If insects enter a detector's sensing chamber, they can cause a nuisance alarm. Take appropriate pest control actions prior to installing detectors in such locations. If spraying is done, do not allow insect spray to enter the detectors.
Near fluorescent light fixtures. Electrical noise generated by fluorescent light fixtures can cause nuisance alarms. ⓘ **Note:** Install detectors at least 1 ft. (0.3 m) away from such light fixtures.

Table 11: Environmental conditions influencing detector response*

Detector protection	Air velocity >300 ft. (91.4 m)/min	Atm. pressure 300 ft. (914 m) above sea level	Humidity >93% RH	Temp. <32 °F (0 °C) >100 °F (38 °C)	Smoke color
Ion	X	X	X	X	O
Photo	O	O	O	X	X

Table 11: Environmental conditions influencing detector response*

Detector protection	Air velocity >300 ft. (91.4 m)/min	Atm. pressure 300 ft. (914 m) above sea level	Humidity >93% RH	Temp. <32 °F (0 °C) >100 °F (38 °C)	Smoke color
Beam	O	O	X	X	O
Air sampling	O	O	X	X	O
*Refer to Table A-5-3.6.1.1 in NFPA 72. X = May affect detector response O = Generally does not affect detector response					

Maintenance, testing and cleaning

Maintenance

The minimal requirement for detector and sensor maintenance consists of clearing surface dust by using a vacuum cleaner. Ensure cleaning programs comply with NFPA and local environments. Cleaning of the internal chamber must be done only by a qualified technical representative. For service, contact your local branch office.

Testing

Smoke sensor sensitivities are set and continuously monitored by the FACP. Dirty or out-of-range sensors are annunciated by the FACP. This functionality complies with NFPA 72.

ⓘ **Note:** When testing detectors or sensors, refer to NFPA 72, or contact your local branch office.

⚠ **CAUTION:** Before functionally testing the detectors, be sure to disconnect the city connection, releasing devices, extinguishing systems, and place the detectors in Walktest mode using the HSM3105MX panels.

Detector testing method

NFPA minimally requires annual functional testing of smoke detectors/sensors at their installed location. To perform this annual test, see Table 12 for a list of available equipment.

Table 12: Test equipment

Product	Function
Solo 336 Aerosol Smoke Dispenser	Attached to either the Solo 100 (15 ft. (4.572 m)) telescopic fiberglass pole or the Solo 101 (4 ft. (1.219 m)) fiberglass pole.
Testifire 2000-024	Smoke, Heat and CO Detector Tester.
Testifire 2001-024	Smoke, Heat and CO Detector Test Kit (includes two battery batons and AC/DC charger).
TS3-024 Smoke Capsule	For use with Testifire Smoke, Heat and CO Detector Tester.

ⓘ **Note:** Refer to the user's manual provided with each device for user instructions.

Cleaning

No user serviceable parts inside. If the device's sensitivity is other than what is marked on the device's label, replace the device.

⚠ **CAUTION:** Notify appropriate building personnel before removing any detectors.

Important: After replacement, test the detector or sensor with smoke in accordance with NFPA 72.