

# ESL 429/449 & 428/448 SERIES

## Self-Diagnostic Photoelectric Smoke Detectors

### Installation Instructions

Part Number 14153

California State Fire Marshal Approved  
 MEA (New York City) Approved



LISTED 429/449



428/448

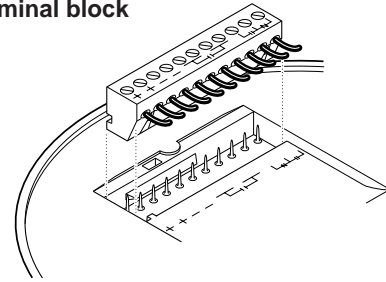
#### GENERAL DESCRIPTION

The ESL 429/449 and 428/448 Series low-profile, self-diagnostic, two- and four-wire smoke detectors work on the light scattering principle. A pulsed infrared light-emitting diode serves as the light source, and a high-speed photo-diode as the sensing element. This design has superior protection against false alarms caused by dust, insects, RF and ambient-light.

These Series of smoke detectors are especially suited for residential occupancies, including hotels, motels and dormitories, as well as other commercial and industrial fire-system applications. This Series is designed for 2-wire and 4-wire connection, respectively, to 6-24 V DC fire alarm control panels, UL Listed for commercial or household fire protection.

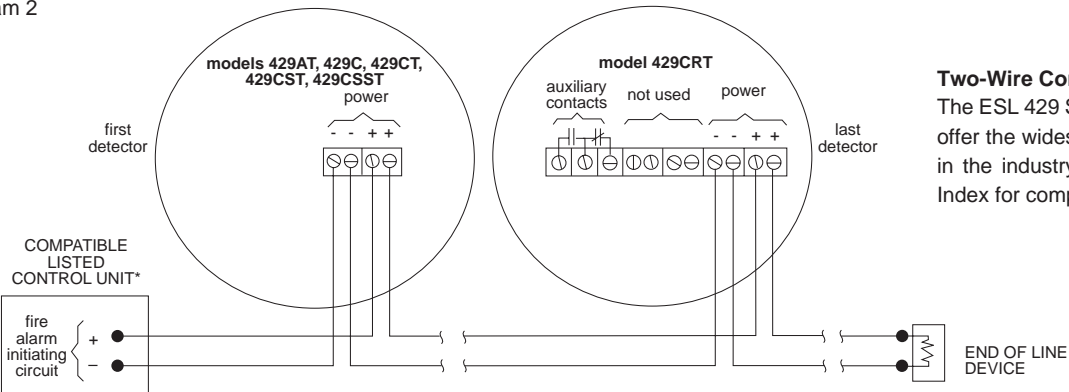


Plug-in terminal block  
 Diagram 1



#### 429 & 428 Series Wiring Diagram

Diagram 2

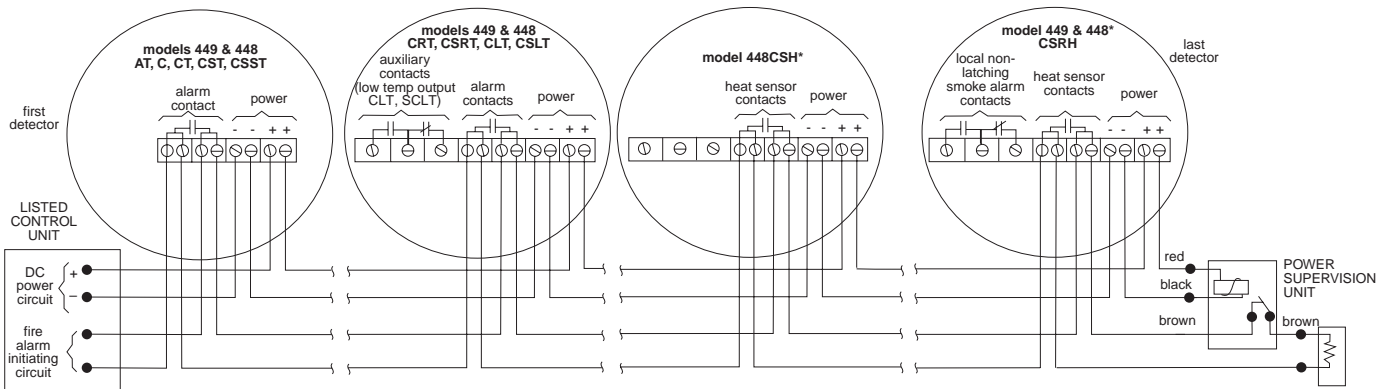


#### Two-Wire Compatibility

The ESL 429 Series two-wire, smoke detectors offer the widest range of two-wire compatibility in the industry. Refer to ESL's Compatibility Index for compatible control panel listings.

#### 449 & 448 Series Wiring Diagram

Diagram 3



\*448CSH and 448CSRH are smoke alarms.

## Optional Features

This Series includes a wide range of options, as shown in the Product Selection Guide (Diagram 9) on back page. These options include a built in sounder, an auxiliary relay, an integral heat detector, and an isolated heat detector, to meet almost any application.

## Self-Diagnostics Includes Automatic Sensitivity Testing

Each detector in the Series continually monitors its own sensitivity and operational status. Once a day it performs a full diagnostic test that includes dynamically testing the sensing chamber and internal electronics. If a detector drifts out of its UL Listed sensitivity range or fails internal diagnostics, the alarm LED will flash once every second to indicate trouble. This meets NFPA 72 field sensitivity testing requirements without the need for external meters.

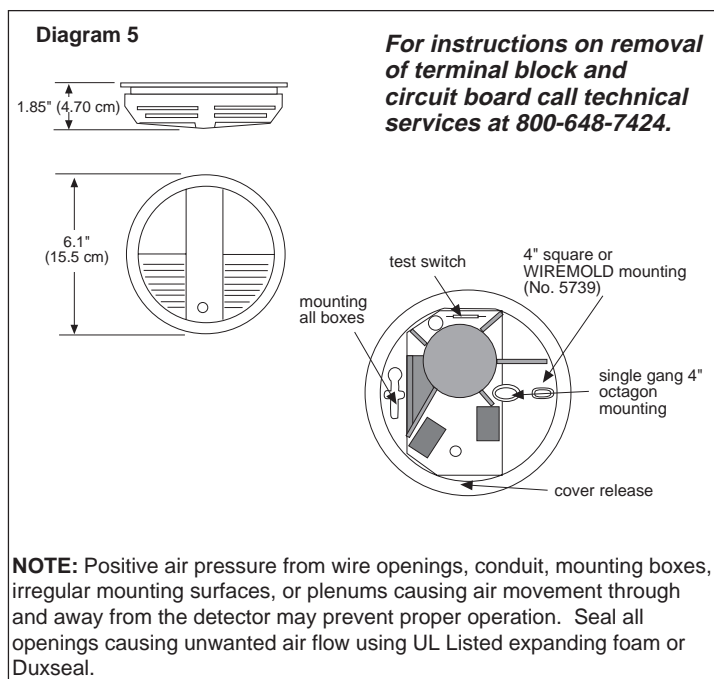
**NOTE:** Connect to a power supply that will not automatically reset. Since the self-diagnostics only indicate trouble after 27 hours, if the power supply automatically resets every 24 hours the self-diagnostic indication will never be signaled. (The smoke detector will still signal alarm correctly.)

## INSTALLATION

This Series of detectors mount to standard single-gang electrical boxes, four-inch octagonal or four-inch square electrical boxes, or on WIREMOLD No. 5739 fixture boxes. These detectors may also be mounted directly to walls or ceilings where local codes/jurisdictions permit.

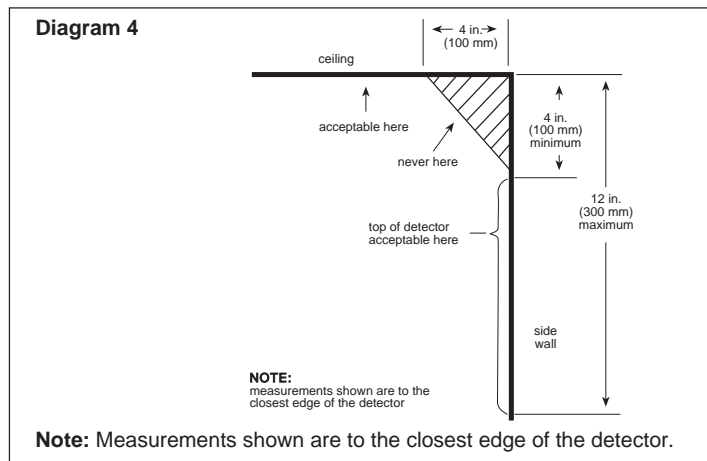
First, pull wire through the electrical box and connect to the plug-in terminal block supplied, one wire per terminal (see Diagrams 1, 2 and 3). Second, dress wiring neatly and snap the terminal block into the back of the detector. Note: The detector cover must be closed completely, to support the circuit board, while installing the terminal block. Now, open the cover and mount the detector, using the mounting holes provided (see Diagram 5).

All ESL smoke detectors are shipped with a plastic dust cover for use in areas where construction is on-going. Smoke detectors will not work with the dust cover in place. Remove the dust cover when installation is completed, prior to testing.



## Smoke Detector Placement and Spacing

In general ceiling mounted smoke detectors should be located near the center of the room or hall whenever possible, or more than 4 inches (100 mm) from any wall. When the detector is wall mounted, the top of the



detector should be 4 to 12 inches (100-300 mm) from the ceiling (see Diagram 4). Refer to NFPA 72 for further mounting instructions.

When more than one detector is required, spacing of 30 feet (9.1 meters) may be used as a guide on smooth ceilings (as defined in NFPA 72). Other spacing may be used depending on ceiling height, high air movement, and other conditions or response requirements.

## Low Temperature Output Models (CLT, CSLT Models)

These models have a separate relay output that will be energized when the ambient temperature around the detectors falls to approximately 43°F. Note: this detector continues to have the same operating temperature range as standard models – 32°F (0°C) to 120°F (50°C). Run 6 conductor fire wire from a combination burglar/fire alarm panel to smoke detector. Connect low temperature relay contact to a separate non-fire zone on a combination burglar/fire alarm control panel. **Warning: Do not connect low temperature output relay to fire alarm zone.**

## Where NOT To Place Detectors

One of the major causes of nuisance alarms is improper placement of detectors. Avoid locating detectors too close to kitchens or wood stoves, where smoke can be generated. Garages and furnace rooms are also poor locations, due to exhaust fumes. Placing detectors too close to bathrooms can cause problems from steamy baths or showers. Also do not install detectors where normal ambient temperature can be over 100°F (37.8°C), such as attics. Refer to NFPA 72 for more information.

## Supervision of System Wiring

Power wiring in four-wire systems is required by NFPA 72 to be supervised. This is accomplished by installing a power supervision relay at the end of the detector power circuit. The contacts of the supervision relay are wired in series with the system's alarm initiating circuit, and are closed when energized (see Diagram 3). A break in the detector power circuit or a loss of power de-energizes the power supervision relay, opening the contacts and causing a trouble annunciation at the fire alarm control unit.

ESL Models 204-6 V and 204-12/24 V are relays UL Listed for 4-wire power supervision. ESL Model 204-12/24 V CAN is a relay ULC Listed for 4-wire power supervision. Models 449/448CTE, 449CSST, and 449CSSTE are smoke detectors with a built-in end-of-line power supervision relay, and can be used to supervise a circuit in place of a power supervision relay. The 449CTE, 449CSST, and 449CSSTE will also automatically send a trouble signal to the control panel whenever the detector needs maintenance. Proceed with sensitivity testing on all detectors as outlined on next page.

## Testing the Installation

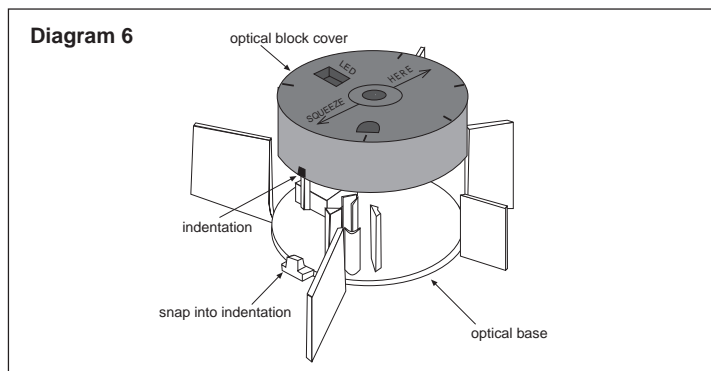
After all connections are complete and the wiring is checked for errors, apply power to the system. There should be no alarm. If an alarm is reported, determine if a detector is latched in alarm or if there is a problem with the wiring.

All smoke detectors shall be tested at least annually in accordance with NFPA 72. The preferred method for functional testing is with Smoke! in a can®, available from ESL. Follow the instructions on the can carefully to ensure proper testing. Other brands of canned smoke are not recommended due to potential for contamination. Other acceptable testing methods are; a smoldering punk stick or a cotton wick.

The detector samples for smoke about every 9 seconds, while flashing its LED. If smoke is detected, the sampling increases to every 4.5 seconds. Excessive smoke must be detected in three consecutive samples for the alarm to activate. Therefore, when testing the detector with smoldering punks or cotton wicks, hold the smoke source near the smoke entry and gently direct smoke into the detector for 20 seconds or until alarm is indicated. **BE SURE TO PROPERLY EXTINGUISH THE SMOKE SOURCE AFTER TESTING!**

This is a go/no-go test and is not a reliable indication of detector sensitivity. If it is successful, the LED will remain lit. To reset the detector, operate the system reset switch to remove power from the detectors. Control unit alarm and all auxiliary functions should be verified for a complete test of each detector.

Models with heat sensors sample for heat every 3 seconds. Test heat sensors by using a hot air gun. Aim at heat sensor from 6-10" away. Detector should go into alarm in less than 30 seconds. Be careful not to melt plastics.



## MAINTENANCE, CLEANING and SENSITIVITY TESTING

This series of self-diagnostic smoke detectors is designed for easy field service and maintenance. If a detector drifts beyond its approved sensitivity range for more than 24 hours, or fails internal diagnostic tests, the unit automatically indicates trouble by flashing its LED every second. This meets NFPA 72 field sensitivity testing requirements

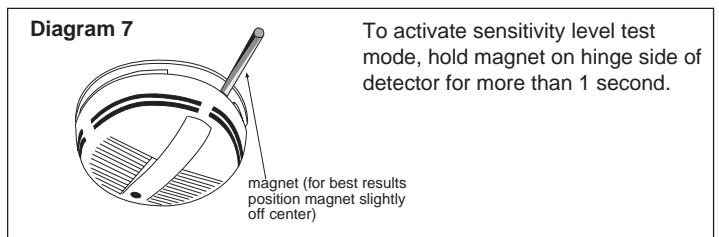
without the need for external meters. In accordance with NFPA 72, smoke detector sensitivity should be checked within one year after installation and every alternate year thereafter, in commercial installations, or every three years in residential sites.

The replaceable sensing chamber of the 400 series photoelectric detector unsnaps for easy field cleaning and service. Whenever the status LED indicates cleaning is necessary, open the detector cover, unsnap and throw away optical block chamber. Then thoroughly blow off the optical base and snap a new optical block chamber (part #211) back in place. **NOTE: Be sure new optical block chamber is seated all the way down.** Close detector cover and verify sensitivity with the sensitivity level test (below).

### Sensitivity Level Test Mode

Each detector includes a sensitivity test mode that is activated by holding a magnet near the integral reed switch for more than one second (see Diagram 7). This initiates the self-diagnostic routine and provides visual indication if service is required. The alarm LED provides the indication listed in Diagram 8.

After the sequence of blinks, if the sensitivity is found to be within limits and if all other tests pass, the detector will go into alarm until reset by the panel. If the sensitivity is not within limits, or an unserviceable hardware fault has been detected, the alarm LED will continue to flash



once per second until the detector is reset by

the panel. If sensitivity test indicates an unacceptable level, take action recommended above. If action does not result in acceptable sensitivity, replace unit.

### Approvals

The smoke detector is for use in commercial fire protective signaling systems and in household fire warning systems. (NFPA 72).

#### 429/449 Series

Listed by Underwriters Laboratories Inc.; California State Fire Marshal approved (Listing #7272-0447-128); MEA approved [New York City] (Listing #MEA 64-94-E) Factory Mutual approved.

#### 449CLT/449CSLT Series

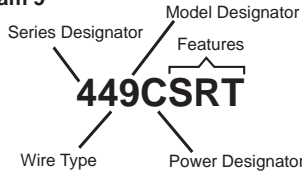
Listed by Underwriters' Laboratories, Inc.

#### 428/448 Series

Listed by Underwriters' Laboratories of Canada (Listing # CS205).

Approximate obscuration (%/ft.)		Blinks	Indication	Action
429/449	428/448	1	Unserviceable hardware fault is detected	Reset unit and re-run sensitivity test, if indication remains the same, replace unit.
2.69	3.05			
2.46	2.75	2	The detector is not sensitive enough	Clean per instructions. Reset unit and re-run sensitivity test, if indication remains the same, replace unit.
2.23	2.50	3		
2.00	2.15	4	<b>Detector is within sensitivity limits</b>	<b>None</b>
1.77	1.85	5		
1.54	1.50	6		
1.31	1.25	7	Detector is too sensitive	Check to be sure optical block cover is snapped down completely. Clean per instructions.
1.08	0.90	8		
		9		

**Product Selection Guide**  
Diagram 9



**Model Designator**

Designator	Listing
449	UL
448	ULC

**Wire Type**

Number	Description
2	Two-wire only
4	Four-wire only

**Model Designator**

Designator	Power
A	6/12 V DC
C	12/24 V DC

**Features**

Designator	Feature	Description
E	End-of-Line Power Supervisory and Sensitivity Status Relay	Built-in end-of-line relay that also acts as a sensitivity status output. For four wire only. Fail-safe relay trips upon loss of power or if smoke detector is outside the approved sensitivity range for more than one day. End of line resistor is easily connected to terminal with no extra wiring, or relay contacts can be connected to a separate trouble loop.
H	Isolated Fixed Temp. and Rate of Rise Heat Detector	Isolated fixed 135°F (57°C) and rate of rise heat detector, independently trips the LED and alarm relay output. Smoke detector activates internal sounder (local alarm) and auxiliary relay, but does not latch. Approved as both single station smoke alarm and system heat detector. Ideal for hotel, motel and dormitory rooms where smoking is allowed.
R	Auxiliary Relay	Used to activate other devices such as elevator recall, door hangers, etc. UL Listed for releasing services.
S	Built-in Sounder	85db built-in sounder alarms when smoke is detected or when power wiring polarity is reversed.
SS	Built-in Sounder with Sensitivity Status Output	85db built-in sounder alarms when smoke is detected or when power wiring polarity is reversed. Also, chirps when unit goes outside the approved sensitivity range for more than one day. Resetting detector will silence chirp for one day, until unity is restored to proper sensitivity.
T	Integrated Fixed Temp. and Rate of Rise Heat Detector	Integrated fixed 135°F (57°C) temperature and rate of rise heat detector offers double protection. Either heat detector or smoke detector can trip and latch LED and alarm relay outputs.
L	Low-Temperature Output	Non latching, low temperature output for temperatures below 43°F ± 5°F (°C).

**Electrical Specifications**

Model	2-Wire	4-Wire	Min. Volt.	Max. Volt.	Max. Ripple (PK To PK) (V)	Typ. Ave. Stby. Cur. (12-24V) (uA)	Typ. Alarm Cur. (12-24V) (mA)	Typ. Ave. Pol. Rev. Cur. (mA)	Alarm Relay Contacts (A)	Other Relay Contacts (A)
429AT, 428AT	•		6.5	20	10%	70	*see S09A	—	—	—
429C, 428C	•		8.5	33	10%	70	*see S10A	—	—	—
429CT, 428CT	•		8.5	33	10%	70	*see S10A	—	—	—
429CRT	•		8.5	33	10%	70	*see S11A	—	—	2
429CST, 428CST, 429CSST	•		8.5	33	10%	70	*see S11A	10	—	—
449C, 448C		•	8.5	33	10%	70	15	—	0.5	—
449CT, 448CT		•	8.5	33	10%	70	15	—	0.5	—
449CRT		•	8.5	33	10%	70	31	—	0.5	2
449CLT, 448CLT		•	8.5	33	10%	70	15	—	0.5	—
449AT, 448AT		•	5.1	27	10%	70	15	—	0.5	—
449CST, 448CST		•	8.5	33	10%	70	40	10	0.5	—
449CSRT		•	8.5	33	10%	70	51	10	0.5	2
449CSLT, 448CSLT		•	8.5	33	10%	70	40	10	0.5	—
449CSRH		•	8.5	33	10%	70	51	10	0.5	2
449CSST		•	8.5	33	10%	70	40	10	0.5	—
449CSTE, 449CSSTE		•	8.5	33	10%	23mA	51	33	0.5	2
449CTE, 448CTE		•	8.5	33	10%	23mA	31	23	0.5	2
448CSH**		•	8.5	33	10%	70	51	10	0.5	—
448CSRH**		•	8.5	33	10%	70	51	10	0.5	2
<b>Power Supervision Units</b>										
204-6V (UL Listed)			5.1	15	—	33 mA @ 6V DC	—	—	0.5	—
204-12/24V (UL Listed)			8.5	33	—	14 mA @ 12V DC 28mA @ 24V DC	—	—	0.5	—
204-12/24V CAN (ULC Listed)			8.5	33	—	14 mA @ 12V DC 28mA @ 24V DC	—	—	0.5	—

\* 429 models draw up to a maximum of 60mA alarm current if not limited by panel.

**Product Data**

**Sensitivity**

428/448 - minimum ..... 2.0 + 0.50%/Ft.  
 - maximum ..... 2.0 - 0.50%/Ft.  
 429/449 - minimum ..... 2.0 + 0.37%/Ft.  
 - maximum ..... 2.0 - 0.39%/Ft.

Operating temp .... 32°F to 120°F (0°C to 50°C)

Operating humidity range ..... 0 to 95% RH

Sounder specifications ..... 85 dB at 10 Ft.

Color ..... white cover/white base

Field wiring size ..... 14-24 AWG

Heat detector specifications ... fixed temperature - 135°F, 50 ft. spacing

rate of rise - 15°F/min. & > 105°F (8.3°C/min. & > 40.6°C)

Low temp specifications ..... 43°F (°C) ± 5°F (°C)

Auxiliary relay contacts ..... 2A @ 28 V DC or 120 V AC (resistive)

Alarm contacts ..... 500 mA @ 36 V DC (resistive)

Detector size ..... 6.1 in. (15.5 cm) x D 1.85 in. (4.69 cm) x 8.8 oz. (0.25 kg) W

Packaging ..... 10 detectors are packed in a carton

Self-diagnostic indication ..... typically 27 hours after reset (do not connect to power supply that resets every 24 hours)

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