



# UL 985

## STANDARD FOR SAFETY

### Household Fire Warning System Units

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UL Standard for Safety for Household Fire Warning System Units, UL 985

Sixth Edition, Dated May 15, 2015

### **Summary of Topics**

***This revision to ANSI/UL 985 dated October 7, 2022 is being issued to update the title page to reflect the most recent designation as a Reaffirmed American National Standard (ANS). No technical changes have been made.***

Text that has been changed in any manner or impacted by UL's electronic publishing system is marked with a vertical line in the margin.

The requirements are substantially in accordance with Proposal(s) on this subject dated August 19, 2022.

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1

## **UL 985**

### **Standard for Household Fire Warning System Units**

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**May 15, 2015**

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The most recent designation of ANSI/UL 985 as a Reaffirmed American National Standard (ANS) occurred on October 7, 2022. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at <https://csds.ul.com>.

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## INTRODUCTION

### 1 Scope

1.1 These requirements cover household fire warning system control units intended to be installed in accordance with the National Fire Alarm Code, ANSI/NFPA 72, and the National Electrical Code, ANSI/NFPA 70.

1.2 A household fire warning system control unit consists of a unit assembly of electrical parts having provision for connection of power supply and initiating device circuits. Provision for connection of a notification appliance circuit is also required unless an alarm sounding device is integral with the control unit. Additional terminals may be provided for the connection of supplementary devices, such as annunciators, remote switches, and the like. A secondary supply, consisting of a rechargeable battery, shall be provided integral with the control unit or provision may be provided for its connection to the control unit.

1.3 Provision for the connection to the control unit of at least one smoke detector is required unless reference is made on the installation diagram for the use of a self-contained smoke detector, such as a single- or multiple-station fire alarm device.

1.4 These requirements also apply to the use of combination systems, such as a combination fire-burglar alarm system control unit, which uses circuit wiring common to both systems. When common wiring is used for combination systems, it shall be connected in such a manner that internal fault conditions (shorts, opens, grounds) in the nonfire alarm (burglary) system circuit wiring, or faults between the fire and nonfire alarm system circuits, will not interfere with the supervision of the fire alarm system or prevent intended alarm signal transmission.

1.5 These requirements do not cover single- or multiple-station fire alarm devices, automatic fire detectors, or alarm notification appliances, such as bells, horns, carbon monoxide alarm devices, emergency initiating devices, non-emergency initiating devices, and the like. They do cover accessories which are external to the control unit and are dependent upon the control unit function, such as end-of-line devices, annunciators, and remote switches.

1.6 If a digital alarm communicator transmitter is used to transmit signals to a remote location and it is to be included as a component of the system, it shall comply with the applicable requirements in the Standard for Digital Alarm Communicator System Units, UL 1635. Otherwise the user must be notified that the off-premises transmission method has not been so investigated.

1.7 Where a unit employs security functions, it shall comply with the Standard for Household Burglar-Alarm System Units, UL 1023. Units employing medical alert functions shall comply with the Standard for Home-Health Care Signaling Equipment, UL 1637. A unit utilizing non-fire and/or non-carbon monoxide emergency and/or non-emergency signaling functions shall meet the requirements of the Standard for General-Purpose Signaling Devices and Systems, UL 2017.

### 2 General

#### 2.1 Components

2.1.1 Except as indicated in [2.1.2](#), a component of a product covered by this standard shall comply with the requirements for that component. See Appendix [A](#) for a list of standards covering components used in the products covered by this standard.

2.1.2 A component is not required to comply with a specific requirement that:

a) Involves a feature or characteristic not required in the application of the component in the product covered by this standard, or

b) Is superseded by a requirement in this standard.

2.1.3 A component shall be used in accordance with its rating established for the intended conditions of use.

2.1.4 Specific components are incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits, and shall be used only under those specific conditions.

## 2.2 Units of measurement

2.2.1 Values stated without parentheses are the requirement. Values in parentheses are explanatory or approximate information.

## 2.3 Undated references

2.3.1 Any undated reference to a code or standard appearing in the requirements of this standard shall be interpreted as referring to the latest edition of that code or standard.

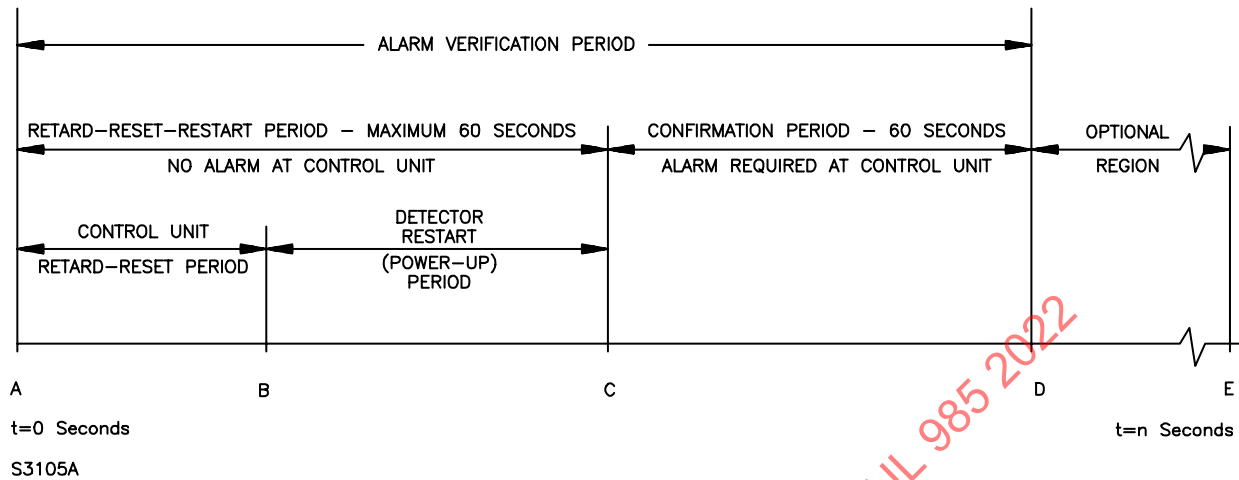
## 3 Glossary

3.1 For the purpose of this standard the following definitions apply.

3.2 ALARM SIGNAL – An audible signal indicating an emergency fire condition requiring immediate action, as an alarm initiated from a manual box, smoke, or heat detector.

3.3 ALARM VERIFICATION – Operation of a control unit in conjunction with a related smoke monitoring head or an initiating device circuit in which an alarm signal from a smoke detector is confirmed one or more times over a predetermined period before the control unit will indicate an alarm. This predetermined period consists of an alarm retard-reset period and an alarm confirmation period. The alarm retard period is the delay time designed in the control unit while the alarm reset period is the power-up time for the detector. See [Figure 3.1](#).

**Figure 3.1**  
**Alarm verification – timing diagram**



A – Smoke detector goes into alarm.

AB – RETARD-RESET PERIOD (Control Unit) – Control unit senses detector in alarm and retards (delays) alarm signal, usually by de-energizing power to the detector. Length of time varies with design.

BC – RESTART PERIOD (Detector Power-Up Time) – Power to the detector is reapplied and time is allowed for detector to become operational for alarm. Time varies with detector design.

AC – RETARD-RESET-RESTART PERIOD – No alarm obtained from control unit. Maximum period of time is 60 seconds.

CD – CONFIRMATION PERIOD – Detector is operational for alarm at point C. If detector is still in alarm at point C, control unit will alarm. If detector is not in alarm, system returns to standby. If the detector realarms at any time during the confirmation period the control unit will alarm.

DE – OPTIONAL REGION – Either an alarm can occur at control unit or restart of the alarm verification cycle can occur.

AD – ALARM VERIFICATION PERIOD – Consists of the retard-reset-restart and confirmation periods.

3.4 ANNUNCIATOR – An externally-connected electrically-operated visual indicating device containing two or more identified targets or indicator lamps in which each target or lamp indicates the circuit condition and/or location.

3.5 CIRCUITS, ELECTRICAL –

a) High-Voltage – A circuit involving a potential of not more than 600 volts and having circuit characteristics in excess of those of a low-voltage power-limited circuit.

b) Low-Voltage – A circuit involving a potential of not more than 30 volts AC rms, 42.4 volts DC or AC peak.

c) Power-Limited – A circuit wherein the power and current are limited as specified in [Table 48.1](#) and [Table 48.2](#).

3.6 CONTROL UNIT ACCESSORY – A device or appliance externally connected to a control unit which is used to ensure the intended operation of a system or to provide supplementary signaling and/or annunciation. Examples of control unit accessories are annunciators, end-of-line resistors or diodes, auxiliary relays, and remote switches.

3.7 DISTINCTIVE SIGNALS – Signals obtained from different sounding appliances, such as bells, horns, sirens, and buzzers, or from a single appliance, such as an electronic horn, where a continuous signal is obtained under one condition and a pulsing signal under another.

3.8 END-OF-LINE RESISTOR – A resistor installed at the end of an initiating or indicating device circuit to limit the amount of supervisory current.

3.9 FAULT – An open or ground condition on any line extending from a control unit.

3.10 INDICATING DEVICE – Any audible signal used to indicate a fire, supervisory, or trouble condition. Examples of audible signal appliances are bells, horns, sirens, electronic horns, buzzers, and chimes.

3.11 INDICATING DEVICE CIRCUIT – Circuit to which indicating devices are connected.

3.12 INITIATING DEVICE – A manually- or automatically-operated device whose operation results in a fire alarm indication from the control unit. Examples of alarm signal initiating devices are thermostats, manual boxes, and smoke detectors.

3.13 INITIATING DEVICE CIRCUIT – Circuit to which automatic or manual initiating devices are connected.

3.14 MESSAGE – Communicated data that contains specific information relating to the status of the product and is transmitted via a wired or wireless pathway from an origin to a destination.

3.15 TRAINED INSTALLER – An individual knowledgeable in the product operation and received instruction on installing the product.

3.16 TROUBLE SIGNAL – A visual or audible signal indicating a fault condition of any nature, such as an open or ground or other trouble condition, occurring in the device or connected wiring.

## 4 Instructions and Drawings

4.1 A copy or draft of the operating and installation instructions and related schematic wiring diagrams and installation drawings intended to be furnished with each product are to be used as a basis for the examination and testing of the control unit.

4.2 The instructions and drawings shall include such directions and information as deemed by the organization responsible for the product to be adequate for attaining the intended and safe installation, maintenance, and operation of the control unit. See Installation Drawing, General, Section [79](#), and Instructions, General, Section [80](#).

4.3 In addition to the information given in [4.1](#) and [4.2](#), the manufacturer shall provide an evacuation plan as specified in [80.2](#).

## 5 Compatibility Information

### 5.1 General

5.1.1 Compatibility between a two-wire smoke detector that receives its power from the initiating device circuit of a fire alarm control unit is dependent upon the interaction between the circuit parameters, such as voltage, current, frequency, and impedance, of the detector and the initiating device circuit.

5.1.2 A detector that does not receive its power from the initiating device circuit of a control unit (conventionally a detector having four or more wires for field connection) may be used with any electrically compatible fire alarm system control unit without the need for compatibility consideration, as its connection does not impose any load on the initiating circuit. Under an alarm condition, the four-wire detector acts as a switch (similar to a manual station or heat detector) to place the system in alarm.

5.1.3 As a two-wire detector obtains its power from the initiating device circuit of a system control unit, its operation is dependent on the characteristics of the circuit to which it is connected, as the detector imposes a resistive and capacitive load on the circuit. Similarly, the load imposed upon the initiating device circuit by a connected detector shall not prevent alarm response by a control unit to a detector in alarm, nor prevent a trouble response to an open circuit after the last detector.

5.1.4 The connection of a two-wire smoke detector shall be restricted to the specific control units or initiating device circuits with which a compatibility evaluation has been made.

5.1.5 A supplementary signaling device [such as an audible appliance, relay, or annunciator lamp (LED-type)] that is integral with a two-wire smoke detector, and that is also powered from an initiating device circuit of a fire alarm system control unit, may be used if its operation, including level of audibility and light output, is not inhibited under the maximum normal standby and alarm loading conditions specified in the detector and control unit installation wiring diagrams.

### 5.2 Method of evaluation

5.2.1 In accordance with [5.1.1](#) – [5.1.5](#), to determine whether any combination of control unit and smoke detector or detectors is compatible, and whether the detectors are the same model or a mixture of one or more models or types, the tests indicated in (a) – (h) are to be conducted:

- a) Operating voltage determination, as described in [43.1.1](#) – [43.1.3](#).
- b) Alarm threshold impedance, as described in [43.2.1](#) – [43.2.3](#).
- c) Maximum current limitation, as described in [43.3.1](#) and [43.3.2](#).

- d) Multiple detector alarm capacity, as described in [43.4.1](#).
- e) Detectors with optional components, as described in [43.5.1](#) and [43.5.2](#).
- f) Dynamic load immunity, as described in [43.6.1](#) and [43.6.2](#).
- g) Electrical supervision, as described in [43.7.1](#) and [43.7.2](#).
- h) Detector reset, as described in [43.9.1](#) and [43.9.2](#).

### 5.3 Changes affecting compatibility

5.3.1 If the compatibility integrity of a previously installed compatible combination may be affected by replacement detectors or a modification of either the detectors or the control unit, the product that is changed shall be assigned a different model number, or change in compatibility identification marking.

## CONSTRUCTION

### 6 General

6.1 A control unit shall be intended and constructed for use with recognized signal initiating and indicating devices, and other equipment intended for connection to it to form a household fire alarm system of the type indicated by the installation wiring diagram.

6.2 Except where indicated otherwise, the construction requirements specified for control units shall apply also to control unit accessories.

6.3 Products that currently meet all the requirements of the Standard for Information Technology Equipment – Safety – Part 1: General Requirements, UL 60950-1, or the Standard for Audio, Video, and Similar Electronic Apparatus-Safety Requirements, UL 60065, need only be evaluated to the following construction requirements: [7.1.3](#), [7.1.4](#), [36.3](#), and Sections [10](#), [20](#), [21](#), [22](#), [23](#), [25](#), [26.1](#), [27](#), [28](#), and [32](#).

### 7 Frame and Enclosure

#### 7.1 General

7.1.1 The frame and enclosure shall be sufficiently strong and rigid to resist total or partial collapse with attendant reduction of spacings, loosening or displacement of parts and development of other conditions which impairs its operation and increase the risk of fire, electric shock, or injury to persons.

7.1.2 All electrical parts of a control unit shall be enclosed to provide protection against contact with uninsulated live parts.

7.1.3 Space shall be provided within a terminal or wiring compartment for completing all wire connection as specified by the installation wiring diagram.

7.1.4 An enclosure shall have means for mounting, which shall be accessible without disassembling any operating part of the unit. Removal of a completely assembled panel or printed wiring board to mount the enclosure is not considered to be disassembly of an operating part.

7.1.5 A compartment enclosing electrical parts shall not be open to the floor or other support on which a unit rests.

## 7.2 Cast metal enclosures

7.2.1 The thickness of cast metal for an enclosure shall be as indicated in [Table 7.1](#).

*Exception: Cast metal having a thickness 1/32 inch (0.8 mm) less than that indicated in the table, if the surface under consideration is curved, ribbed, or otherwise reinforced, or if the shape or size, or both, of the surface is such that equivalent mechanical strength is provided, complies with this requirement.*

**Table 7.1**  
**Cast metal electrical enclosures**

Use, or dimensions of area involved	Minimum thickness			
	Die-cast metal		Cast metal of other than the die-cast type	
	inch	(mm)	inch	(mm)
Area of 24 square inches (155 cm <sup>2</sup> ) or less and not having a dimension greater than 6 inches (152 mm)	1/16	(1.6)	1/8	(3.2)
Area greater than 24 square inches (155 cm <sup>2</sup> ) or having any dimension greater than 6 inches (152 mm)	3/32	(2.4)	1/8	(3.2)
At a threaded conduit hole	1/4	(6.4)	1/4	(6.4)
At an unthreaded conduit hole	1/8	(3.2)	1/8	(3.2)

7.2.2 If threads for the connection of conduit are tapped all the way through a hole in an enclosure wall, or if an equivalent construction is used, there shall not be fewer than 3-1/2 nor more than five threads in the metal, and the construction shall be such that a standard conduit bushing is capable of being attached.

7.2.3 If threads for the connection of conduit are tapped only part of the way through a hole in an enclosure wall, there shall not be fewer than five full threads in the metal, and there shall be a smooth, well-rounded inlet hole for the conductors which shall afford protection to the conductors equivalent to that provided by a standard conduit bushing.

## 7.3 Sheet metal enclosures

7.3.1 The thickness of sheet metal used for the enclosure of a control unit shall not be less than that indicated in [Table 7.2](#).

*Exception: Sheet metal two gage sizes smaller, if the surface under consideration is curved, ribbed, or otherwise reinforced, or if the shape or size, or both, of the surface is such that equivalent mechanical strength is provided, complies with this requirement.*

**Table 7.2**  
**Sheet metal electrical enclosures**

Maximum enclosure dimensions				Minimum thickness of sheet metal					
				Steel				Brass or aluminum	
Any linear dimension		Area of any surface		Zinc coated		Uncoated		inch	
inches	(mm)	inches <sup>2</sup>	(cm <sup>2</sup> )	inch [GSG]	(mm)	inch [MSG]	(mm)	[AWG]	(mm)
12	(305)	90	(584)	0.035 [20]	(0.86)	0.032 [20]	(0.81)	0.045 [16]	(1.14)
24	(610)	360	(2322)	0.045 [18]	(1.14)	0.042 [18]	(1.07)	0.058 [14]	(1.47)
48	(1219)	1200	(7742)	0.056 [16]	(1.42)	0.053 [16]	(1.35)	0.075 [12]	(1.91)
60	(1524)	1500	(9678)	0.070 [14]	(1.78)	0.067 [14]	(1.70)	0.095 [10]	(2.41)
Over 60	(Over 1524)	Over 1500	(Over 9678)	0.097 [12]	(2.46)	0.093 [12]	(2.36)	0.122 [8]	(3.10)

7.3.2 At any point where conduit or metal-clad cable is to be attached, sheet metal shall be of such thickness or shall be formed or reinforced so that it will have stiffness at least equivalent to that of uncoated flat sheet steel having a minimum thickness of 0.053 inch (1.35 mm).

7.3.3 A plate or plug for an unused conduit opening or other hole in the enclosure shall have a minimum thickness of:

- a) 0.014 inch (0.36 mm) for steel or 0.019 inch (0.48 mm) for nonferrous metal for a hole having a 1/4-inch (6.4-mm) maximum dimension.
- b) 0.027 inch (0.69 mm) for steel or 0.032 inch (0.81 mm) for nonferrous metal for a hole having a 1-3/8-inch (34.9-mm) maximum dimension.

7.3.4 A closure for a larger hole shall have a thickness equal to that required for the enclosure of the device, or a standard knockout seal shall be used. Such plates or plugs shall be mechanically secure as mounted.

7.3.5 A knockout in a sheet-metal enclosure shall be secured but shall be capable of being removed without deformation of the enclosure.

7.3.6 A knockout shall be provided with a flat surrounding surface adequate for proper seating of a conduit bushing, and shall be located so that installation of a bushing at any knockout likely to be used during installation will not result in spacings between uninsulated live parts and the bushing of less than the requirements in this standard.

## 7.4 Nonmetallic enclosures

7.4.1 A nonmetallic enclosure or enclosure part shall have mechanical strength and durability at least equivalent to a sheet-metal enclosure of the minimum thickness specified in [Table 7.2](#). The enclosure or enclosure part shall protect persons from the risk of electric shock.

7.4.2 Among the factors taken into consideration when determining the acceptability of a nonmetallic enclosure are:

- a) Mechanical strength;
- b) Resistance to impact;
- c) Moisture-absorptive properties;
- d) Combustibility and resistance to ignition from electrical sources;
- e) Dielectric strength, insulation resistance, and resistance to arc tracking; and
- f) Resistance to distortion and creeping at temperatures to which the material is subjected under conditions of intended or abnormal usage. All these factors are considered with respect to aging.

7.4.3 The continuity of the grounding system shall not rely on the dimensional integrity of the nonmetallic material.

## 8 Electric Shock

8.1 Any part that is exposed only during operator servicing shall not present the risk of electric shock. See Electric Shock Current Test, Section [57](#).

8.2 Each terminal provided for the connection of an external antenna shall be conductively connected to the supply circuit grounded conductor. The conductive connection shall have a maximum resistance of 5.2 megohms, a minimum wattage rating of 1/2 watt, and shall be effective with the power switch in either the on or off position.

*Exception: The conductive connection need not be provided if:*

- a) *Such a connection is established in the event of electrical breakdown of the antenna isolating means;*
- b) *The breakdown does not result in a risk of electric shock; and*
- c) *In a construction using an isolating power transformer, the resistance of the conductive connection between the supply circuit and chassis does not exceed 5.2 megohms.*

8.3 The maximum value of 5.2 megohms mentioned in [8.2](#) is to include the maximum tolerance of the resistor value used; that is, a resistor rated 4.2 megohms with 20 percent tolerance or a resistor rated 4.7 megohms with a 10 percent tolerance may be used. When component comprised of a capacitor with a built-in shunt resistor that complies with the requirements for antenna isolating capacitors, it shall be rated a minimum of 1/4 watt.

8.4 The insertion in any socket of any vacuum tube or its glass or metal equivalent of like designation used in the product shall not result in a risk of electric shock.

## 9 Enclosure Openings

### 9.1 General

9.1.1 An enclosure intended for recessed mounting and whose front panel is to be flush with the surface of the wall shall have no openings that vent into concealed spaces of a building structure, such as into hollow spaces in the wall, when the product is mounted as intended.