EST2
Installation and Service Manual

P/N 270186 • Rev 5.0 • 16AUG00

DEVELOPED BY	Edwards Systems Technology 6411 Parkland Drive Sarasota, FL 34243 (941) 739-4300
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CREDITS	This manual was designed and written by the EST Technical Services - Documentation Department, Sarasota.

DOCUMENT HISTORY

Date	Revision	Reason for change
31 May 1995	1.0	Initial Release.
01 August 1995	2.0	Revised: Figure 3.5; IOP-3 info; 2-MCM circuit resistance specs.; misc. editorial corrections. Added: Download ground fault note. DL2 Dialer
October 1995	2.5	Revised specification tables and LED/Switch Module number switch settings.
December 1995	3.0	Added CMDN, SAN, and APSB Power Supply information. Changed DL2 Information.
March 1997	3.5	Added information about CDR-3, 2-SMK, 2-CTM, and 2-PPS/6A.

DOCUMENT HISTORY

Date	Revision	Reason for change
September 1997	4.0	Added: 2-WB3(R); 2-WB&(R); SIGA-APS; SIGA-AA30;SIGA-AA50; 2-AAC; 2-MIC; 2-TEL; Audio NAC calculation information; Initial & re-acceptance test procedure; Personality code 18; compatible telephones Revised: PL Wiring Information; DL2 Specifications; Display DIP Switch settings
December 1997	4.1	Added: 2-LSRA Revised: RACCR installation; Chapter 4 layout
16 August 2000	5.0	Included service information and updated content to reflect programming changes.

Contents

Important information

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This product has been designed to meet the requirements of NFPA Standard 72, 1996 Edition; Underwriters Laboratories, Inc., Standard 864, 7th Edition; and Underwriters Laboratories of Canada, Inc., Standard ULC S527. Installation in accordance with this manual, applicable codes, and the instructions of the Authority Having Jurisdiction is mandatory. EST, Inc. shall not under any circumstances be liable for any incidental or consequential damages arising from loss of property or other damages or losses owing to the failure of EST, Inc. products beyond the cost of repair or replacement of any defective products. EST, Inc. reserves the right to make product improvements and change product specifications at any time.

While every precaution has been taken during the preparation of this manual to ensure the accuracy of its contents, EST assumes no responsibility for errors or omissions.

FCC warning

This equipment can generate and radiate radio frequency energy. If this equipment is not installed in accordance with this manual, it may cause interference to radio communications. This equipment has been tested and found to comply within the limits for Class A computing devices pursuant to Subpart B of Part 15 of the FCC Rules. These rules are designed to provide reasonable protection against such interference when this equipment is operated in a commercial environment. Operation of this equipment is likely to cause interference, in which case the user at his own expense, is required to take whatever measures may be required to correct the interference.

FCC information

1. The dialer complies with Part 68 of the FCC rules. The Dialer' FCC registration number and the Ringer Equivalence Number (REN) are on the back of the dialer. This

information must be provided to the telephone company, if requested.

2. An FCC compliant telephone cord and modular plug cord is supplied with the dialer. The dialer is designed to be connected to the telephone network using the supplied cord and an RJ31X or RJ38X jack, which must also comply with FCC Part 68 rules.
3. The REN is used to determine the quantity of devices which may be connected to the telephone line. Excessive RENs on the telephone line may result in the devices not ringing in response to an incoming call. In most, but not all areas, the sum of RENs should not exceed five (5). To be certain the number of devices that may be connected to a line, as determined by the total RENs, contact the local telephone company.
4. If the dialer causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. If advance notice isn't practical, the telephone company will notify you as soon as possible. You will also be advised of your right to file a complaint with the FCC, if you believe it is necessary.
5. The telephone company may make changes in it's facilities, equipment, operations, or procedures that could affect the operation of the dialer. If this happens, the telephone company will provide advance notice in order for you to make necessary modifications to maintain uninterrupted service.
6. If trouble is experienced with the dialer, for repair or warranty information, contact Edwards Systems Technology, 6411 Parkland Drive, Sarasota, Florida, USA 34243 Telephone: 1-800-655-4497. If the dialer is causing harm to the telephone network, the telephone company may request you disconnect the dialer until the problem is resolved.
7. No repairs may be performed on the dialer by the user.
8. The dialer cannot be used on public coin phone or party line service provided by the telephone company.

Canada DOC information

Note: The Industry Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational, and safety requirements. The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines, and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

Caution: Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate

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Note: The Load Number (LN) assigned to each terminal device denotes the percentage of the total load to be connected to a telephone loop which is used by the device, to prevent overloading. The termination on a loop may consist of any combination of devices subject only to the requirements that the sum of the Load Numbers of all the devices does not exceed 100.

Getting the most out of this manual

Finding EST2 documentation

A library of related documents supports the EST2 product line. Here is a complete list of the EST2 library:

- *EST2 Installation and Service Manual* (P/N 270186)
- *EST2 Network Site Manual* (P/N 270895)
- *EST2 Network Supplement Manual* (P/N 270894)
- *EST2 System Operations Manual* (P/N 270188)
- *EST2 System Programming Manual* (P/N 270187)
- *EST2 Installation Sheets* (P/N 3100060)
- *2-SDU Help* (P/N180902)

Our technical writers constantly update the information in this manual. Your comments during our training classes, technical support phone calls, and field trips improve this document.

Finding related documentation

The *Signature Series Intelligent Smoke and Heat Detectors Applications Bulletin (P/N 270145)* provides instructions and illustrations for various arrays of smoke and heat detectors.

The *Signature Series Component Installation Manual* (P/N 270497) supports the installation of the Signature Series detectors and modules.

The *Serial Number Log Book* (P/N 270267) provides a convenient means for recording the serial number of each Signature device installed in the fire alarm system.

The *SAN Annunciator Installation Guide* (P/N 250084) supports the SAN annunciators mentioned in this manual.

The *EST Speaker Application Guide* (P/N 85000-0033) provides information about the placement and layout of speakers for fire alarm signaling and emergency voice communications.

The *EST Strobe Applications Guide* (P/N 85000-0049) provides information for the placement and layout of strobes for fire alarm signaling.

The *Microline 182 Turbo Printer Handbook*, by Okidata provides all the necessary information for the maintenance and configuration of the PT1-S Form Printer. The Okidata handbook comes with the Form Printer.

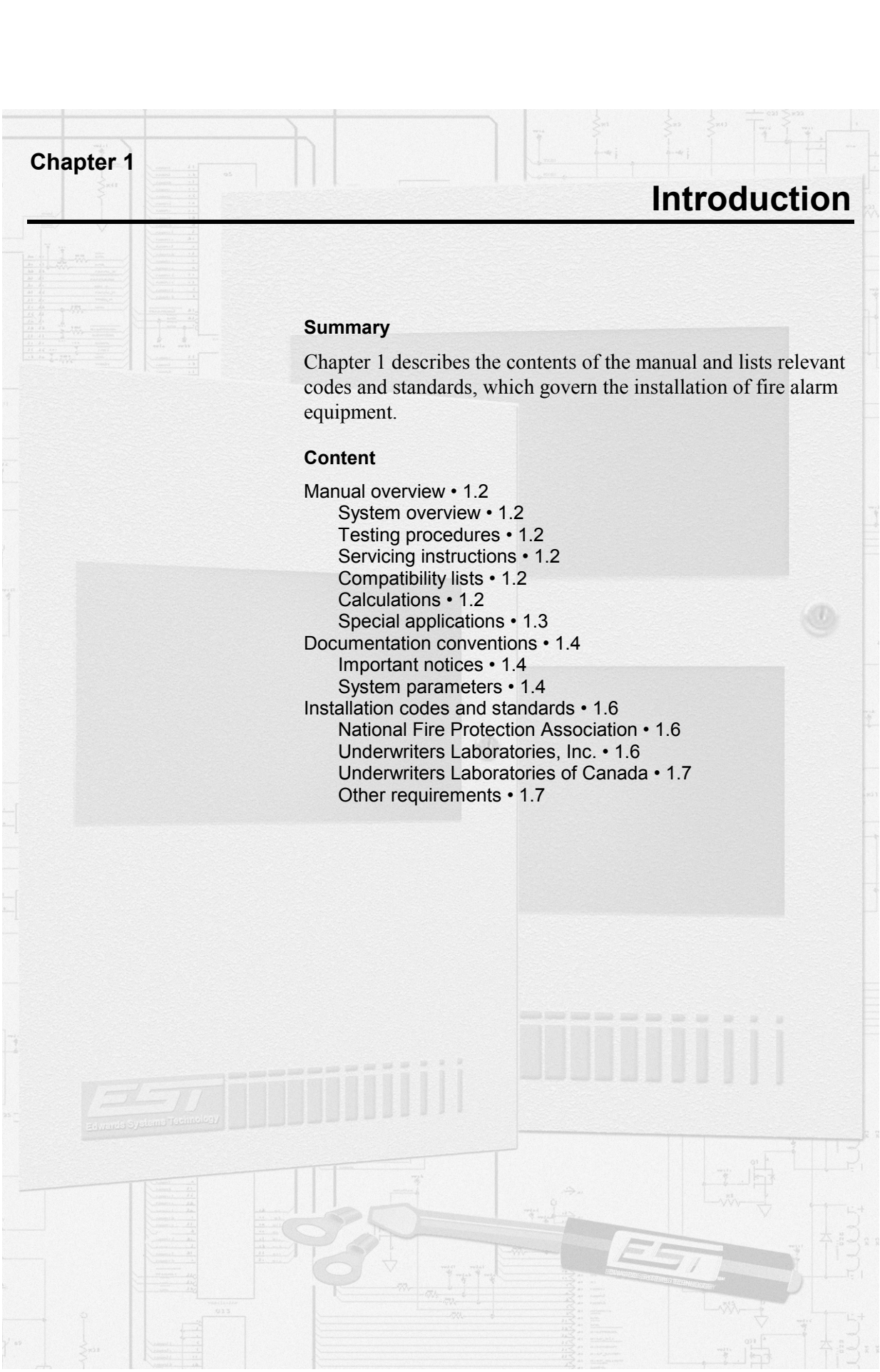
Chapter 1

Introduction

Summary

Chapter 1 describes the contents of the manual and lists relevant codes and standards, which govern the installation of fire alarm equipment.

Content



Manual overview

The *EST2 Installation and Service Manual* provides an overview of the EST2 fire alarm system and instructions for its installation, testing, and servicing. This manual also contains compatible device listings and calculations for batteries and wiring.

System overview

The system overview presents the fire alarm system in several variations. The size of the equipment enclosure, the wiring class, and the components installed make up the configuration of the system.

Testing procedures

The testing procedures will guide you through the activation and testing of your system in the following progression:

1. Simulate off-normal conditions at the panel.
2. Simulate off-normal conditions at the devices.

The testing procedures conclude with instructions for completing and posting a master copy of the Certificate of Completion.

Servicing instructions

The servicing of the system entails everything from preventive maintenance practices to troubleshooting difficult problems. Preventive maintenance practices include the proper installation and care of fire alarm components. For example, detectors require periodic cleaning to avoid nuisance alarms. Troubleshooting problems on the system requires an understanding of the system fault messages, which appear on the front panel display.

Compatibility lists

The compatibility lists include UL-approved initiating devices that work with the fire alarm system. Initiating devices include bells, horns, and strobes.

Calculations

The system wiring requires a calculation to prevent over extension. Worksheets, along with instructions, provide a means for determining the maximum wire length for your fire alarm system. The batteries that power the fire alarm system in the event of a power failure or brownout also require a special set of

calculations. A set of procedures explains the steps for calculating the ampere-hour requirement for the batteries.

Special applications

The system requires surge protection from one building to another. The Ditek Surge Protection Module provides the required surge protection.

Some applications require coded signals. The CDR-3 provides march time and unique coded outputs for separate zones.

Documentation conventions

Important notices

Notices throughout this manual inform the reader of practices and conditions, which will affect physical safety, occupant safety, equipment performance, and time consumption. Notices appear as warnings, cautions, and notes.

Warnings

Warnings appear throughout the manual where injury or loss of life may occur through the neglect of safe practices and conditions. Warnings appear in the following format:

WARNING: Testing the system disables the alarm contact. The system will not notify the fire department in the event of a fire alarm condition during a test. See the system administrator for detailed information.

Cautions

Cautions are posted in the manual to prevent damage to the equipment. A typical caution concerns the prevention of electrostatic discharge (ESD). Cautions appear in the following format:

Caution: Observe static-sensitive handling practices.

Notes

Notes instruct the reader to avoid practices or conditions, which may result in wasted time and effort. For example, a download will not work unless the programmer disconnects the printer from the RS-232 port on the 2-MCM. Notes appear in the following format:

Note: Disconnect the printer when downloading to the 2-MCM.

System parameters

2-LCD keypad entries and fault messages require knowledge of the system parameters.

Keypad entry parameters

To understand the parameters for 2-LCD keypad entries, see *Making keypad entries* in the *EST2 System Operations Manual*.

Fault message parameters

To understand the parameters for reading fault messages, see *System service procedures* in the *Installation and Service Manual*.

Installation codes and standards

The Signature series fire detection devices are designed to meet the requirements of NFPA Standard 72, 1996 Edition; Underwriters Laboratories, Inc. Standard 864, 7th Edition and Underwriters Laboratories of Canada, Inc. Standard ULC S527. Other related codes and standards are listed below.

Information contained in this document is intended to serve as a guide. Installation in accordance with the instruction sheets (provided with Signature Series devices), applicable codes, and the instructions of the Authority Having Jurisdiction is mandatory.

National Fire Protection Association

NFPA®	**National Fire Protection Association (NFPA) 1 Batterymarch Park PO Box 9101 Quincy, MA 02269-9101**
NFPA 70	National Electric Code
NFPA 72	National Fire Alarm Code

Underwriters Laboratories, Inc.

UL®	**Underwriters Laboratories, Inc. (ULI) 333 Pfingsten Road Northbrook, IL 60062-2096**
UL 38	Manually Actuated Signaling Boxes
UL 217	Smoke Detectors, Single and Multiple Station
UL 228	Door Closers/Holders for Fire Protective Signaling Systems
UL 268	Smoke Detectors for Fire Protective Signaling Systems
UL 268A	Smoke Detectors for Duct Applications
UL 346	Waterflow Indicators for Fire Protective Signaling Systems
UL 464	Audible Signaling Appliances
UL 521	Heat Detectors for Fire Protective Signaling Systems
UL 864	Standard for Control Units for Fire Protective Signaling Systems

	Underwriters Laboratories, Inc. (ULI) 333 Pfingsten Road Northbrook, IL 60062-2096
UL 1481	Power Supplies for Fire Protective Signaling Systems
UL 1638	Visual Signaling Appliances
UL 1971	Visual Signaling Appliances

Underwriters Laboratories of Canada

	Underwriters Laboratories of Canada (ULC) 7 Crouse Road Scarborough, Ontario M1R 3A9
ULC S527	Standard for Control Units for Fire Alarm Systems
ULC S524	Standard for the Installation of Fire Alarm Systems
ULC S536	Standard for the Inspection and Testing of Fire Alarm Systems
ULC S537	Standard for the Verification of Fire Alarm Systems

Other requirements

Other requirements that affect the installation of this system include:

- State and local building codes
- Authority having jurisdiction (AHJ)

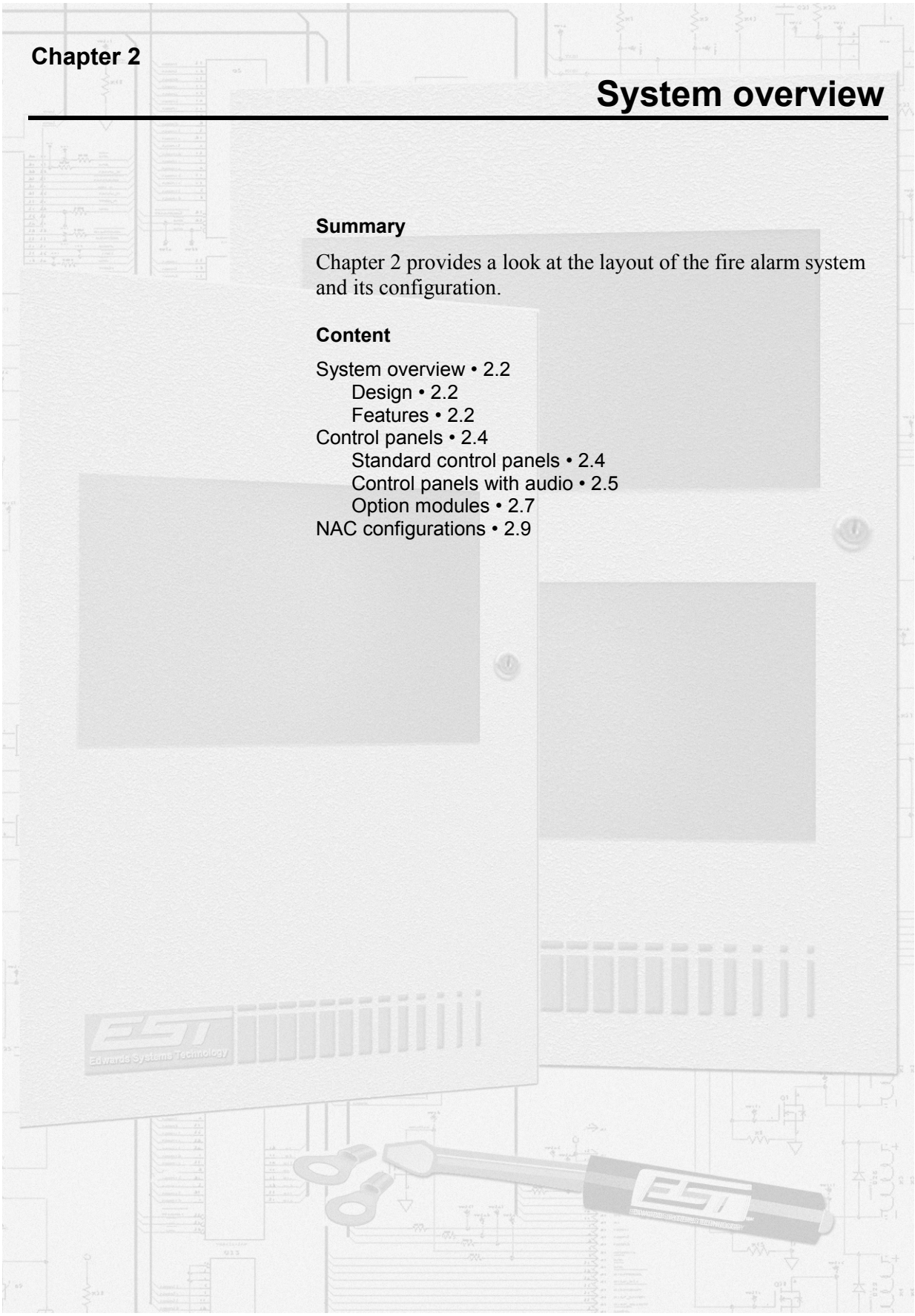
Chapter 2

System overview

Summary

Chapter 2 provides a look at the layout of the fire alarm system and its configuration.

Content



System overview

Design

The control panel consists of a multiplexed fire alarm system, which supports up to 96 Signature series detectors and 94 Signature series modules on an addressable Signature Data Circuit (SDC). Two hard-wired Notification Appliance Circuits (NACs) are provided for audible and visual devices. An Expander Loop Module may be added to the panel, providing two more NACs and a second SDC, which supports an additional 96 Signature detectors and 94 Signature modules.

The audio sub-system consists of a two-channel audio control center, which provides a microphone, 15 available signal tones, and firefighter paging capability. Audio amplifiers complement the audio system.

Features

- Autoprogramming
- Advanced power management
- Custom programmable
- Transient-protected field wiring
- User-friendly front panel
- Emergency audio control center
- Firefighter telephone system
- 30 and 50 Watt audio amplifiers
- Optional dead-front construction
- Class A (Style D) Initiating Device Circuits (IDC)
- Class B (Style B) Initiating Device Circuits (IDC)
- Ground fault detection LED
- Monitor mode
- Local and remote power supplies
- Class A (Style Z) Notification Appliance Circuits (NACs)
- Class B (Style Y) Notification Appliance Circuits (NACs)
- Optional supplementary front panel led/switch modules
- Optional expander loop module
- March time module
- Class A RS-485 external annunciator port
- Class B RS-485 external annunciator port
- Off-premises: Reverse Polarity Module or Dialer
- RS-232 external peripheral device port
- Form C alarm and trouble contacts
- Form A supervisory contacts

Table 2-1: Minimum system requirements

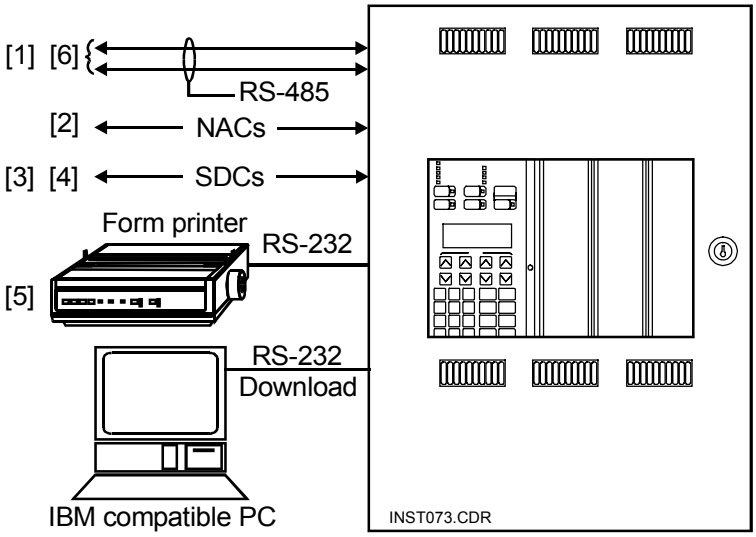
NFPA 72 System classification	Required control equipment	
Protected premises, local (Chapter 3)	2-WB(S)	Enclosure
	2-MCM	Main Controller Module
	2-PPS(/6A)	Primary Power Supply
	2-LCD	LCD Annunciator
	5 Ah batteries, minimum	Battery calculation required
Auxiliary (Chapter 4-7)	Add RPM module to protected premises system.	
Remote station (Chapter 4-5)	Add RPM or DL2 module (dialer) to protected premises system.	
Proprietary protected premises (Chapter 4-4)	Connect to a protected premises system. Connect a listed printer with a 120 Vac uninterruptable power supply.	

Control panels

Standard control panels

A standard control panel (Figure 2-1) includes the following:

- 2-WBS surface mount or 2-WB semi-flush Wallbox
- 2-PPS/6A Primary Power Supply (6A)
- 2-MCM Main Controller Module
- 2-LCX Expander Loop Module
- Backup batteries (24 Vdc @10 Ah)



Notes

[1] The RS-485 lines support SAN annunciators, 2-LSRA(-C)s, 2-CMDN(-C)s, and 2-SMDN(-C)s.

[2] The 2-MCM and the 2-LCX have two NACs each for a total of four NACs.

[3] The 2-MCM and the 2-LCX have two SDCs each for a total of four SDCs.

[4] See the *Signature Series Component Installation Manual* for information on specific detectors and modules.

[5] Locate the form printer in the same room, within 50 feet of the Main Controller Module.

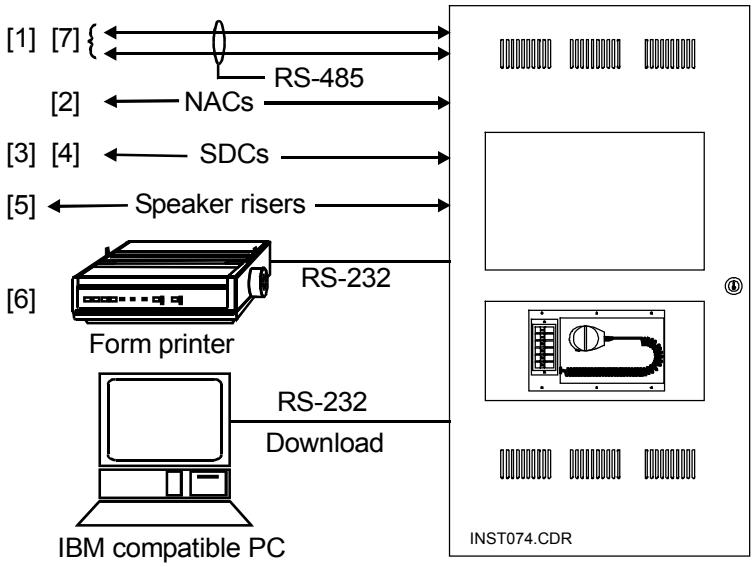
[6] Any wiring that exits one building and enters another requires a Ditek Surge Protector Module at each end. See *Special Applications*, in the Appendix, for more information.

Figure 2-1: 2-WBS(R) and 2-WB(R) wallboxes

Control panels with audio

A control panel with emergency audio includes the following:

- 2-WB3 (Figure 2-2) or 2-WB7 (Figure 2-3)
- 2-PPS/6A Primary Power Supply
- SIGA-APS Auxiliary power supply
- 2-MCM Main Controller Module
- 2-LCX Expander Loop Module
- 2-AAC Audio Control Module
- SIGA-AAXX Amplifiers
- Backup batteries (24 Vdc @10 Ah)



Notes

[1] The RS-485 lines support SAN annunciators, 2-LSRA(-C)s, 2-CMDN(-C)s, and 2-SMDN(-C)s.

[2] The 2-MCM and the 2-LCX have two NACs each for a total of four NACs.

[3] The 2-MCM and the 2-LCX have two SDCs each for a total of four SDCs.

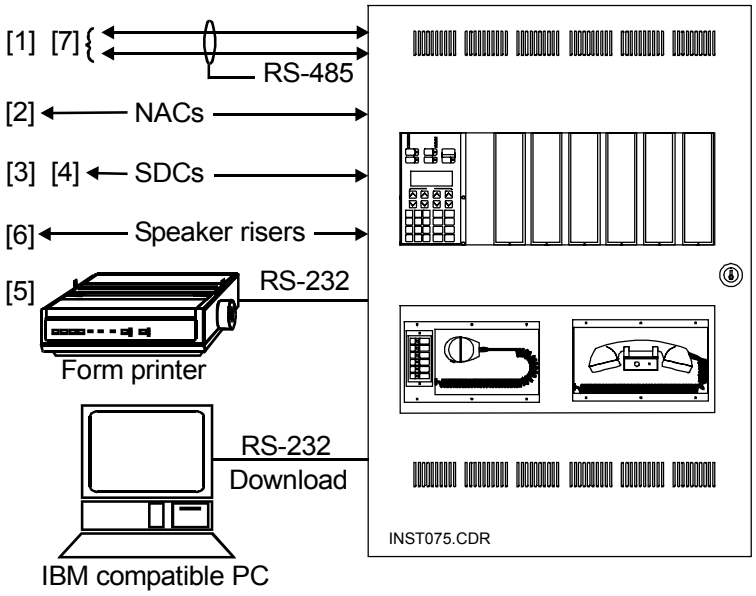
[4] See the *Signature Series Component Installation Manual* for information on specific detectors and modules.

[5] 2-AAC Audio Control Module and SIGA-AAXX amplifiers

[6] Locate the form printer in the same room, within 50 feet of the Main Controller Module.

[7] Any wiring that exits one building and enters another requires a Ditek Surge Protector Module at each end. See *Special Applications*, in the Appendix, for more information.

Figure 2-2: 2-WB3(R) Wallbox



Notes

[1] The RS-485 lines support SAN annunciators, 2-LSRA(-C)s, 2-CMDN(-C)s, and 2-SMDN(-C)s.

[2] The 2-MCM and the 2-LCX have two NACs each for a total of four NACs.

[3] The 2-MCM and the 2-LCX have two SDCs each for a total of four SDCs.

[4] See the *Signature Series Component Installation Manual* for information on specific detectors and modules.

[5] Locate the form printer in the same room, within 50 feet of the Main Controller Module.

[6] This control panel can support a fifth SIGA-AAXX instead of an extra MCM. The amplifier must have a dedicated output on the auxiliary power supply or power from another cabinet.

[7] Any wiring that exits one building and enters another requires a Ditek Surge Protector Module at each end. See *Special Applications*, in the Appendix, for more information.

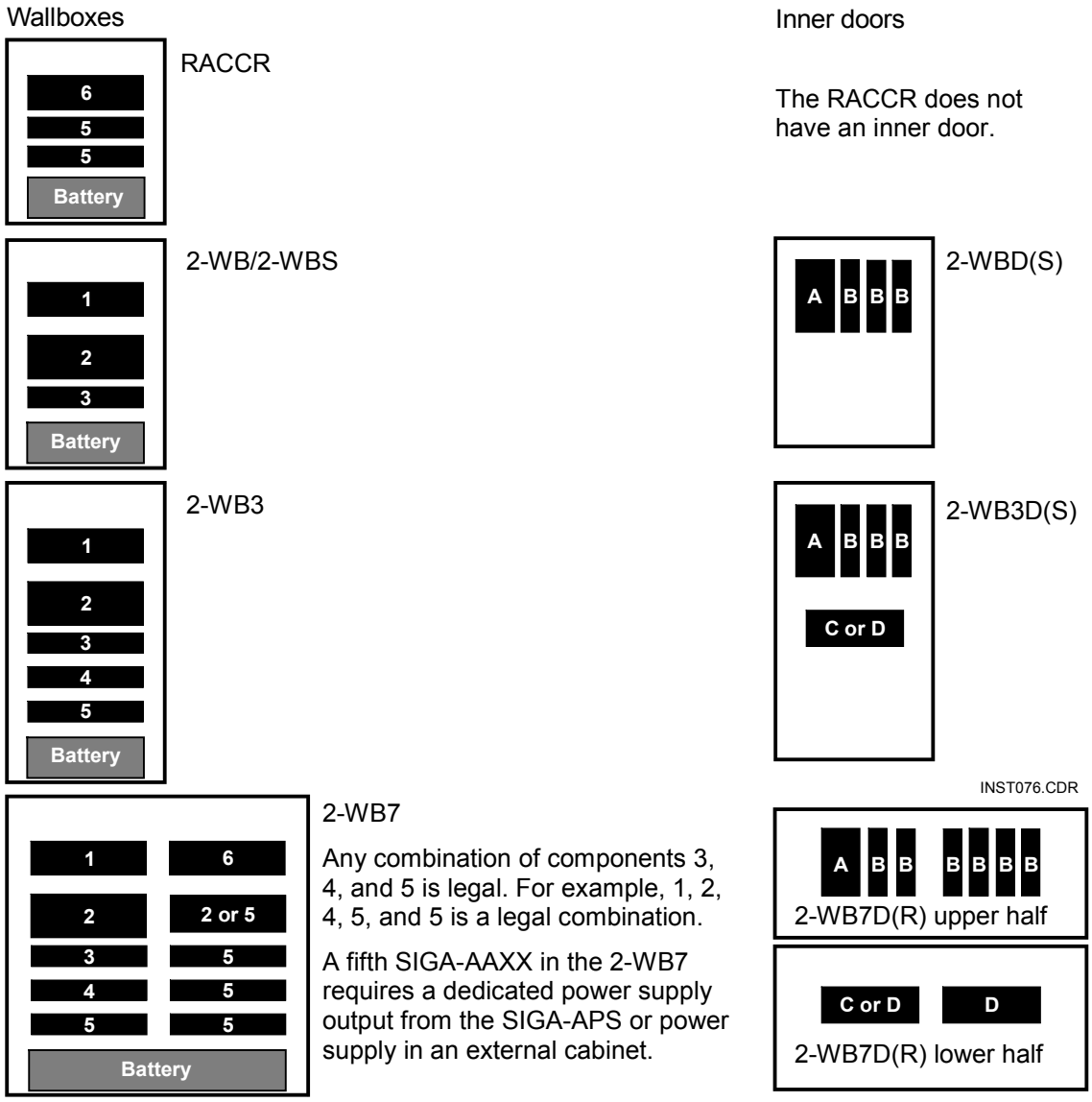
Figure 2-3: 2-WB7(R) Wallbox

Option modules

Each control panel may house the following option modules:

- CDR-3 Coder
- DL2 Dialer
- IOP-3A Isolation Module
- MTM March Time Module
- 2-CTM City Tie Module
- 2-SMK Smoke Power Module
- SIGA-MDM Digital Voice Message Module
- SIGA-UIO2R Universal Input/Output Motherboard
- SIGA-UIO6(R) Universal Input/Output Motherboard

Figure 2-4 shows the different locations and combinations of system modules in the wallboxes and inner doors.



Any combination of components 3, 4, and 5 is legal. For example, 1, 2, 4, 5, and 5 is a legal combination.

A fifth SIGA-AAXX in the 2-WB7 requires a dedicated power supply output from the SIGA-APS or power supply in an external cabinet.

Figure 2-4: Wallboxes and inner doors

Wallbox components

ID	component
1	Primary Power Supply
2	Main Controller Module
3	Expander Loop Module (optional module)
4	Audio Control Module (optional module)
5	Audio Amplifier (up to 5 optional modules)
6	Auxiliary Power Supply

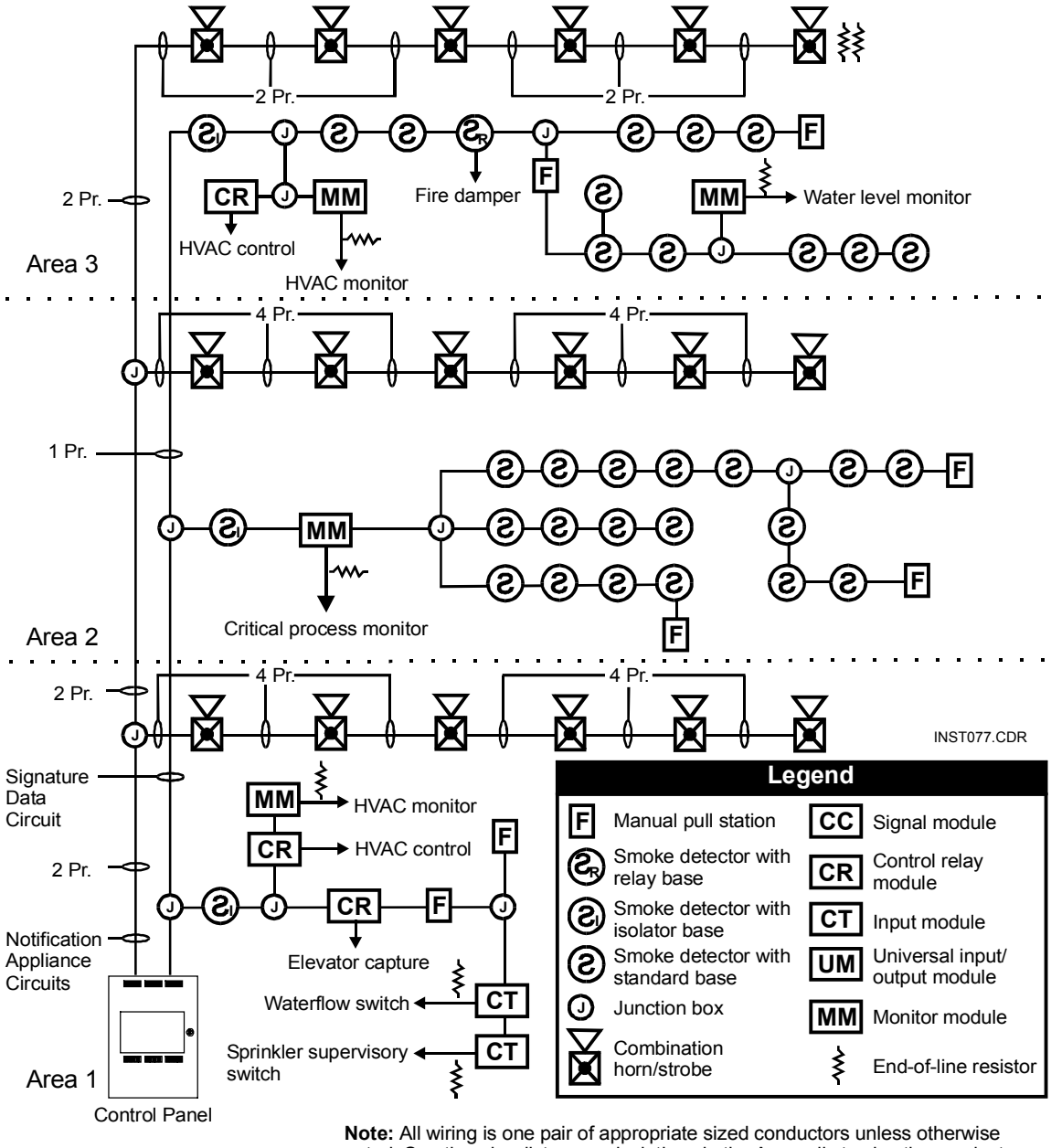
Inner door components

ID	component
A	Liquid Crystal Display
B	LED/Switch Module
C	Microphone Module
D	Telephone Module

NAC configurations

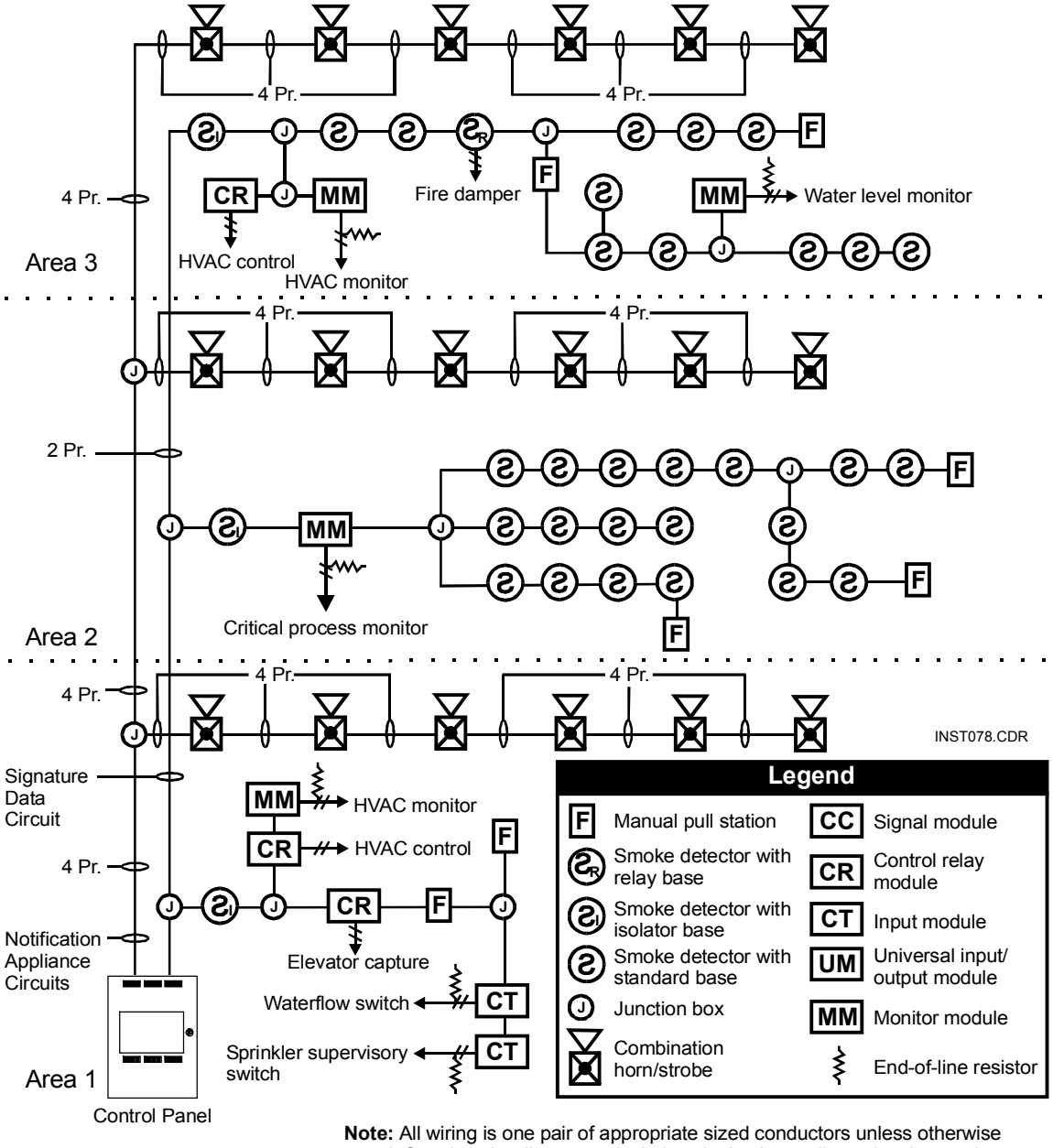
The system supports the following NAC circuits:

- Class B (Figure 2-5)
- Class A (Figure 2-6)
- Class A multiplexed-switched (Figure 2-7)



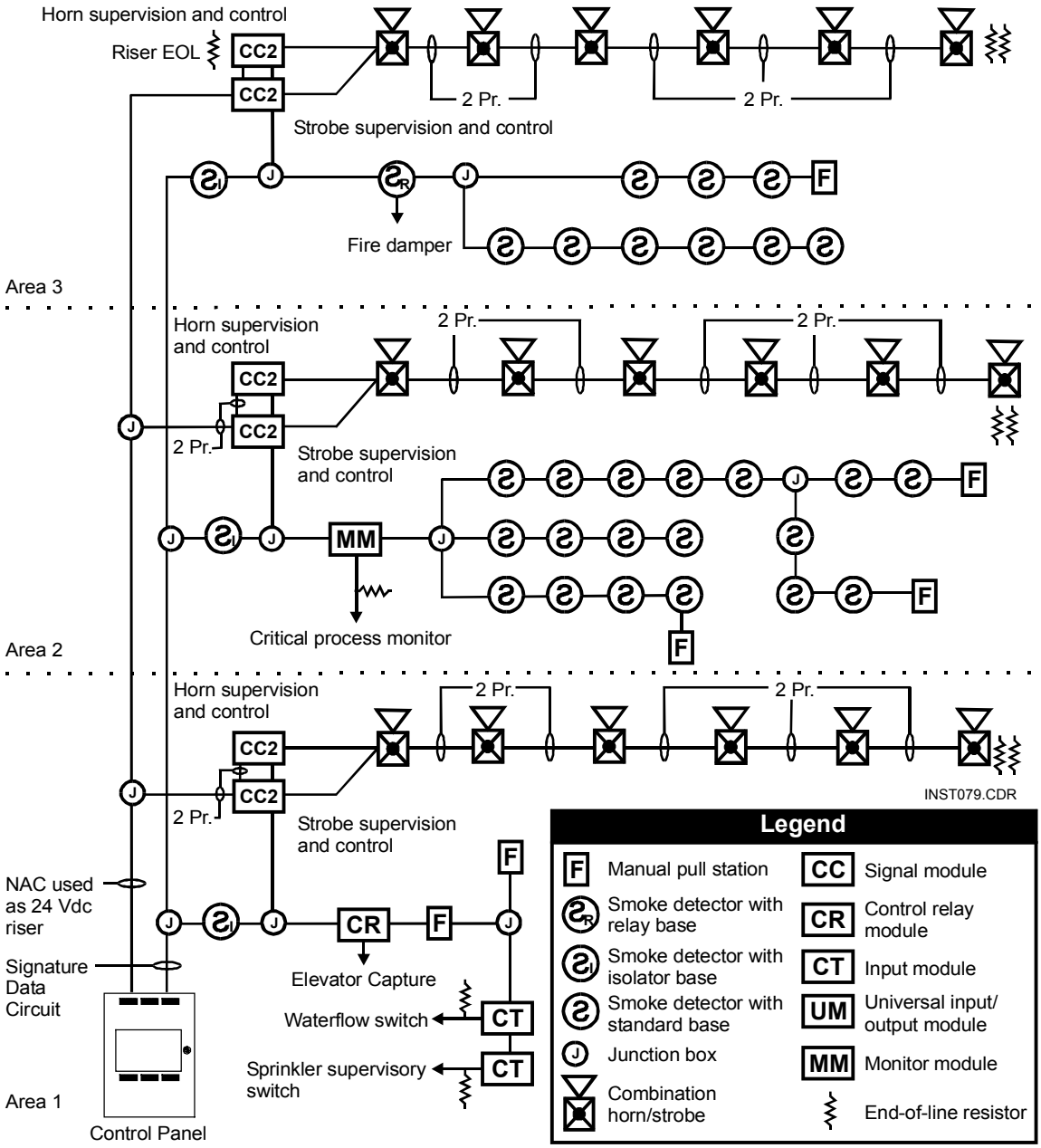
Note: All wiring is one pair of appropriate sized conductors unless otherwise noted. See the wire distance calculations in the Appendix to size the conductors according to their application.

Figure 2-5: Typical Class B NAC wiring



Note: All wiring is one pair of appropriate sized conductors unless otherwise noted. See the wire distance calculations in the Appendix to size the conductors according to their application.

Figure 2-6: Typical Class A NAC wiring



Note: All wiring is one pair of appropriate sized conductors unless otherwise noted. See the wire distance calculations in the Appendix to size the conductors according to their application.

Figure 2-7: Typical multiplexed switched NAC wiring

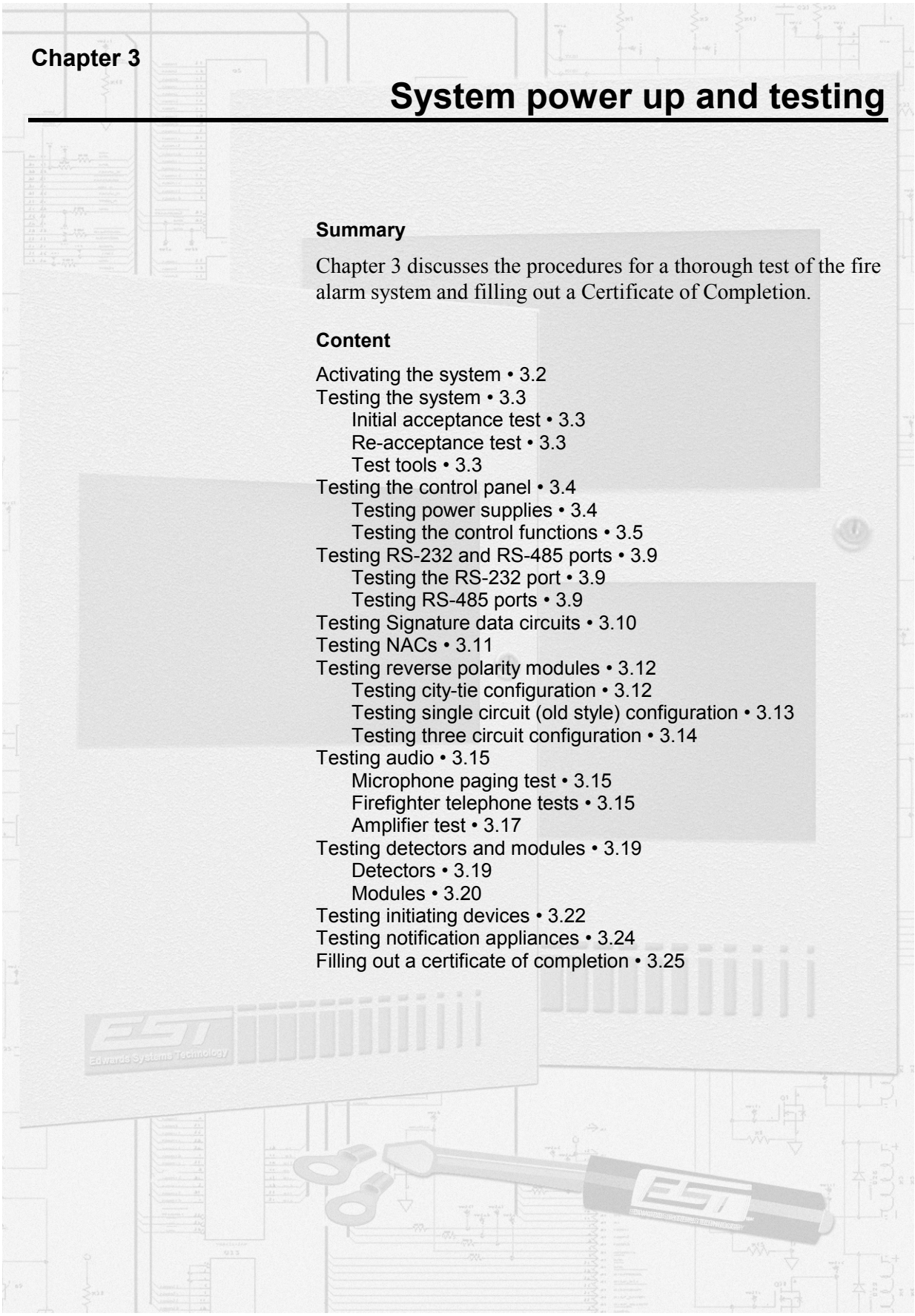
Chapter 3

System power up and testing

Summary

Chapter 3 discusses the procedures for a thorough test of the fire alarm system and filling out a Certificate of Completion.

Content



Activating the system

To activate the system:

1. Connect batteries to the power supply terminals.
2. Energize ac power at the primary and auxiliary power supplies.

The 2-LCD and the system annunciators will indicate all off-normal conditions. See the *System Operations Manual* for descriptions of the indicators and messages on the 2-LCD. The *Installation and Service Manual* explains the faults messages that appear on the 2-LCD in greater detail. Instructions for finding and correcting power supply and battery problems also appear in the *Installation and Service Manual*.

Testing the system

Test all of the components as a system once it has been:

- Wired
- Programmed
- Cleared of circuit faults

WARNING: Before you test the system, notify all areas that receive alarm signals that testing is in progress. Inform any off-premises locations that receive alarm and trouble transmissions of the test.

All of the procedures in this chapter apply to initial and re-acceptance testing.

Initial acceptance test

The initial system check verifies that every component of the system is installed and operating according to design. Verification of the system design and installation requires the testing of every aspect of the system. Test results that differ from expected outcomes require corrective action.

Note: Records of all testing and maintenance shall be kept on the protected premises for a period of at least five (5) years.

Re-acceptance test

A complete check of installed field wiring and devices should be made at regular intervals, in accordance with NFPA 72 and ULC 524 requirements.

Test tools

Any test of the system requires the following tools:

- Slotted screwdriver, insulated
- Digital multi-meter
- 12-inch (30.5 cm) jumper lead with alligator clips
- Panel door key

Testing the control panel

Perform the test procedures listed on the equipment installed in each cabinet connected to the system. These procedures will test the installation of the hardware.

Note: Download the system configuration information into the panel, using the 2-SDU, before you begin testing the system.

Before you test any power supply, verify that your system conforms to:

- Accepted installation practices
- Job specifications
- The battery capacity requirements for the application
- Safe routing practices for power-limited and nonpower-limited wires

Testing power supplies

Primary power supply

To test the primary power supplies:

1. Disconnect the batteries.
2. Connect the positive battery terminal to the positive auxiliary output of the power supply to verify that it can sustain its full alarm load without batteries.
3. Disconnect the positive battery terminal from the positive auxiliary output of the power supply.
4. Reconnect the batteries.
5. Disconnect ac power to verify that the 2-LCD annunciates a power supply trouble. The batteries should also sustain the supply's full alarm load.
6. Verify that the battery charger properly charges the batteries connected to 80% capacity within 24 hours.

Auxiliary power supplies

To test the auxiliary supplies:

1. Disconnect the batteries to verify that the power supply can sustain its full alarm load without the batteries connected.
2. Reconnect the batteries.
3. Disconnect ac power to verify that the 2-LCD annunciates a power supply trouble. The batteries should also sustain the supply's full alarm load.

4. Verify that the battery charger properly charges the batteries connected to 80% capacity within 24 hours.

Testing the control functions

Testing the 2-LCD

To test the 2-LCD:

1. Verify that the 2-LCD is properly mounted and secured.
2. Verify the proper seating of the ribbon cable between the 2-LCD and the Main Controller Module.
3. Verify that the 2-LCD displays the correct date and time and that its Power LED is on.
4. Press the Trouble Silence and Alarm Silence switches simultaneously to perform the lamp test function.
5. Verify that each function switch performs according to specification.

Note: See the *System Operations Manual* for 2-LCD switch functions.

Verifying the installation of panel components

To verify the proper installation of panel components:

1. Make sure that all ribbon cables are firmly seated in their connectors and that all wiring is secure.
2. Verify that all components are installed according to the specifications of the job.

Verifying 2-LCD message queues

During this phase of the system test, you will need to initiate several off-normal conditions. The off-normal conditions will test the 2-LCD's handling of messages in its queue. The message queue test requires:

- 4 Alarm tests
- 1 Monitor condition test
- 2 Supervisory condition tests
- 2 Trouble condition tests

To run the first fire alarm test:

1. Initiate a fire alarm.
2. Check the 2-LCD to see if the internal buzzer sounds and the Alarm LED flashes.
3. Verify that the 2-LCD message for the alarm matches the programmed message in the 2-SDU.
4. Press the Local Silence switch to verify that it silences the buzzer, stops the Alarm LED from flashing (but keeps it lit), and turns on the Local Silence LED.
5. Press the Alarm Review switch to verify that you can scroll through all the messages in the alarm queue.
6. Press the Alarm Silence switch to verify that it silences the active notification appliances.
7. Print a history report to verify that all of the information appears on the printer.

To run the second fire alarm test:

1. Initiate a second fire alarm.
2. Check the 2-LCD to see if the internal buzzer sounds and the Alarm LED turns on.
3. Verify that the 2-LCD message for the alarm matches the programmed message in the 2-SDU.
4. Press the Local Silence switch to verify that it silences the buzzer, stops the Alarm LED from flashing (but keeps it lit), and turns on the Local Silence LED.
5. Press the Alarm Review switch to verify that you can scroll through all the messages in the alarm queue.

To run the third fire alarm test:

1. Initiate a third fire alarm.
2. Check the 2-LCD to see if the internal buzzer sounds and the Alarm LED turns on.
3. Verify that the 2-LCD message for the alarm matches the programmed message in the 2-SDU.
4. Press the Local Silence switch to verify that it silences the buzzer, stops the Alarm LED from flashing (but keeps it lit), and turns on the Local Silence LED.
5. Press the Alarm Review switch to verify that you can scroll through all the messages in the alarm queue.

6. Press the Reset switch.
7. Verify that all initiating devices reset and all panel indicators clear except the green Power LED.

To run a monitor condition test:

1. Initiate a monitor condition.
2. Verify that the 2-LCD Monitor LED turns on.
3. Verify that the internal buzzer does not sound.
4. Restore the monitor point.

To run a trouble test:

1. Initiate an active trouble condition.
2. Check the 2-LCD to see if the internal buzzer sounds and the Trouble LED flashes.
3. Verify that the 2-LCD message for the trouble condition matches the programmed message in the 2-SDU.
4. Press the Local Silence switch to verify that it silences the buzzer, stops the Trouble LED from flashing (but keeps it lit), and turns on the Local Silence LED.
5. Press the Trouble Review switch to verify that you can scroll through all the messages in the trouble queue.
6. Restore the trouble condition.
7. Press the Reset switch at the 2-LCD.

To complete the trouble test:

1. Initiate a second active trouble condition.
2. Verify that the second trouble message appears in the display.
3. Restore the trouble point.
4. Press the Reset switch at the 2-LCD.

To run a supervisory test:

1 Initiate an active supervisory condition.

2. Check the 2-LCD to see if the internal buzzer sounds and the Supervisory LED flashes.
3. Verify that the 2-LCD message for the supervisory condition matches the programmed message in the 2-SDU.

4. Press the Local Silence switch to verify that it silences the buzzer, stops the Supervisory LED from flashing (but keeps it lit), and turns on the Local Silence LED.
5. Press the Supervisory Review switch to verify that you can scroll through all the messages in the supervisory queue.
6. Restore the supervisory condition.
7. Press the Reset switch at the 2-LCD.

To complete the supervisory test:

1. Initiate a second active supervisory condition.
2. Verify that the second supervisory message appears in the display.
3. Restore the supervisory point.
4. Press the Reset switch at the 2-LCD.

To run the fourth fire alarm test:

1. Initiate a fourth fire alarm.
2. Check the 2-LCD to see if the internal buzzer sounds and the Alarm LED turns on.
3. Verify that the 2-LCD message for the alarm matches the programmed message in the 2-SDU.
4. Press the Local Silence switch to verify that it silences the buzzer, stops the Alarm LED from flashing (but keeps it lit), and turns on the Local Silence LED.
5. Press the Alarm Review switch to verify that you can scroll through all the messages in the alarm queue.
6. Press the Reset switch.
7. Verify that all initiating devices reset and all panel indicators clear except the green Power LED.

Testing RS-232 and RS-485 ports

Testing the RS-232 port

This test will verify the operation of peripheral devices connected to the Main Controller Module's RS-232 port.

To test the RS-232 Port:

1. Verify that the baud rate of the peripheral device matches the setting in the 2-SDU.
2. Check the printer operation by generating a system report at the 2-LCD keypad.
3. Check the laptop function by uploading data in the 2-SDU *Communication* menu.

Testing RS-485 ports

Two RS-485 lines (Ch 0 and Ch 1) support the system in a Class B (Style 4) or a Class A (Style 7) configuration. The RS-485 lines support annunciators like 2-LSRA(-C)s, 2-SMDN(-C)s, and SAN annunciators.

To test the Class B (Style 4) RS-485 ports:

1. Verify that the 2-LCD indicates normal operations.
2. Use the System Status switch to verify that all connected devices are communicating over the system.
3. Disconnect the RS-485 wiring from the Main Controller Module (MCM).
4. Verify that all the other devices connected to the system appear in the Trouble queue.

To test the Class A (Style 7) RS-485 ports:

1. Verify that the 2-LCD indicates normal operations.
2. Use the System Status switch to verify that all connected devices are communicating over the system.
3. Disconnect the RS-485 wiring from the MCM, Ch 0.
4. Verify that the 2-LCD annunciates a Class A communications fault.
5. Repeat step 2 to verify that all connected devices still communicate over the RS-485 lines.

Testing Signature data circuits

The signature data circuit (SDC) consists of Signature series devices connected to the MCM on a data circuit. A complete test of the SDC looks at:

- Wiring on the circuit
- Mapping in the 2-SDU
- Messages on the 2-LCD

To verify the proper SDC mapping:

1. Visually inspect the wiring on the SDC to ensure proper wiring practices.
2. In the 2-SDU, map the SDC by uploading device data from the MCM.
3. Commit devices on the SDC as required.
4. Download the new data back to the MCM and upload it again back into the 2-SDU.
5. In the 2-SDU, open the Signature data map to verify that actual data matches the expected data.

To test the SDC:

1. With no map errors displayed, put an input device on the SDC into the active mode.
2. Verify that the 2-LCD displays the appropriate message.
3. Put the input device into the Trouble mode.
4. Verify that the 2-LCD displays the appropriate Trouble message.

Testing NACs

To test NACs at the 2-LCD:

1. Verify that all components are installed according to the specifications of the job.
2. Activate an output on the 2-LCD.
3. Verify that the devices activate properly.
4. Restore the circuit.
5. Disconnect the circuit or EOL resistor.
6. Verify that the appropriate trouble message appears on the 2-LCD.

To test NACs on site:

1. Verify that all components are installed according to the specifications of the job.
2. Inspect each notification appliance to verify proper operation.
3. Remove one leg of the notification appliance wiring.
4. Verify that the 2-LCD displays the appropriate trouble message.

Testing reverse polarity modules

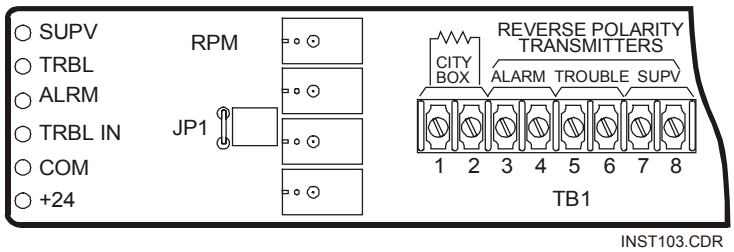


Figure 3-1: Reverse Polarity Module

Note: See the MCM installation sheet for more details on the RPM.

The Reverse Polarity Module (RPM) may support any one of three different configurations:

- City-tie configuration
- Single circuit (old style) configuration
- Three circuit configuration

Each of the configurations requires a different approach to testing the RPM. Before you test the RPM in any configuration, however, you have to ensure that the proper test conditions exist.

To ensure the proper test conditions:

1. Verify the proper wiring of the RPM.
2. If the RPM is connected to a municipal box or central monitoring station, advise the appropriate parties of the upcoming test.

Testing city-tie configuration

Note: You can temporarily substitute a 15 Ω, 2 W resistor for the municipal box. If you activate the municipal box, it will indicate Trouble until it is rewound.

To test for trouble conditions:

1. With the municipal box connected to TB1-1 and TB1-2, open the circuit.
2. Verify that the open circuit activates the appropriate Trouble message in the 2-LCD message queue.
3. Reconnect the circuit at the conclusion of the test.

To test for fire alarms:

1. Initiate a fire alarm.
2. With a voltmeter, verify that 20 to 25 Vdc sits across TB1-1 (+) and TB1-2 (-) in the correct polarity.
3. Press the Reset switch and wait for the system to reset.
4. Verify the receipt of the alarm at the municipal receiving station.

Testing single circuit (old style) configuration

To test for trouble conditions:

1. Make sure that JP1 is not installed.
2. With a voltmeter, verify that 20 to 25 Vdc sits across TB1-3 (+) and TB1-4 (-).
3. Create a Trouble condition on the panel.
4. With a voltmeter, verify that 0 Vdc sits across TB1-3 (+) and TB1-4 (-).
5. Verify that the:
   - Panel's trouble relay activates
   - 2-LCD message queue displays the correct message
   - Municipal receiving station receives a trouble indication
6. Open the circuit wired between TB1-3 and TB1-4.
7. Verify that municipal receiving station receives a trouble indication.

To test for fire alarms:

1. Initiate an active fire alarm.
2. With a voltmeter, verify that 20 to 25 Vdc sits across TB1-5 (+) and TB1-6 (-) and look for any polarity change.
3. Verify the receipt of the alarm at the municipal receiving station.

Testing three circuit configuration

To test for trouble conditions:

1. Make sure that JP1 is installed.
2. With a voltmeter, confirm that 20 to 25 Vdc (in the correct polarity) sits across the following terminals:
   - TB1-3 (+) and TB1-4 (-)
   - TB1-5 (+) and TB1-6 (-)
   - TB1-7 (+) and TB1-8 (-)
3. Create a Trouble condition on the panel.
4. With a voltmeter, confirm that 20 to 25 Vdc sits across TB1-5 (+) and TB1-6 (-).
5. Verify that the:
   - Panel's trouble relay activates
   - 2-LCD message queue displays the correct message
   - Receiving station receives a trouble indication
6. See if the municipal receiving station receives a circuit fault indication when you open the circuit wired between:
   - TB1-3 (+) and TB1-4 (-)
   - TB1-5 (+) and TB1-6 (-)
   - TB1-7 (+) and TB1-8 (-)

To test for fire alarms:

1. Initiate an active fire alarm.
2. With a voltmeter, verify that 20 to 25 Vdc sits across TB1-3 (+) and TB1-4 (-) and look for any polarity change.
3. Verify the receipt of the alarm at the municipal receiving station.

To test for supervisory conditions:

1. Initiate a supervisory condition.
2. With a voltmeter, verify that 20 to 25 Vdc sits across TB1-7 (+) and TB1-8 (-) and look for any polarity change.
3. Verify the receipt of a supervisory condition at the municipal receiving station.

Testing audio

The audio system includes the following components:

- 2-AAC Audio Controller Module
- SIGA-AAXX Audio Amplifier
- 2-MIC Microphone Module
- 2-TEL Firefighter Telephone

Note: Before any test, check all of the audio components against the job specifications and the installation sheets. Ensure the proper installation and wiring of each component.

WARNING: Inform building occupants of any fire alarm test before you perform it.

Microphone paging test

To test the 2-AAC and the 2-MIC:

1. Disconnect the 2-MIC from the 2-AAC and make sure that the 2-LCD displays the appropriate message.
2. Reconnect the 2-MIC to the 2-AAC.
3. Remove each audio riser from the 2-AAC and make sure that the 2-LCD trouble queue displays the correct message.
4. Reconnect the audio risers.
5. At the 2-MIC, press the Page-to-Alarm switch.
6. At the front panel LED/Switch module, select all floors and issue a page to verify that all locations receive the page.

Firefighter telephone tests

The firefighter telephone test consists of several phases because telephone jacks are distributed throughout the building. In addition, the 2-TEL comes with a 2-TEL option board, which needs its own test.

Note: The CC1 wired to the 2-TEL should be programmed with a personality code 6.

To test the first firefighter telephone circuit:

1. Take a firefighter telephone off the hook.
2. Plug a firefighter telephone into a firefighter telephone jack.

3. Verify that an incoming call buzzer sounds, and that the appropriate LED lights on the front panel LED/Switch module.
4. Press the Call-in Silence switch and verify that the buzzer silences.
5. Press the appropriate switch on the front panel LED/Switch module to connect the incoming call.
6. Talk over the firefighter telephone connection to verify clear, noise-free communications.

To test the second firefighter telephone circuit:

1. Take a second firefighter telephone, on a different branch circuit, off the hook.
2. Verify that the incoming call buzzer re-sounds, and that the appropriate LED lights on the front panel LED/Switch module.
3. Press the Call-in Silence switch and verify that the buzzer silences.
4. Press the appropriate switch on the front panel LED/Switch module to connect the incoming call.
5. Talk over the firefighter telephone connection to verify clear, noise-free communications.

To test multiple telephone jacks:

1. Connect five firefighter telephones at the same time.
2. Verify that the incoming call buzzer re-sounds, and that the appropriate LEDs light on the front panel LED/Switch module.
3. Press the Call-in Silence switch and verify that the buzzer silences.
4. Press the appropriate switch on the front panel LED/Switch module to connect each incoming call.
5. Talk over the firefighter telephone connection to verify clear, noise-free communications.
6. Disconnect all but one firefighter telephone.

To test the Page by Phone switch:

1. Press the Page by Phone switch on the 2-MIC.
2. At the front panel LED/Switch module, select a page destination.

3. Speak into the telephone still connected to the circuit from the last test.
4. Verify the distribution of the telephone's audio throughout the facility.

To test the telephone option board:

1. Disconnect each of the telephone risers from the 2-TEL option board.
2. Verify that the 2-LCD displays the appropriate trouble message.
3. Restore the connections.

To test the firefighter telephone jacks:

1. Disconnect each firefighter telephone jack/station.
2. Verify that the 2-LCD trouble queue displays the correct message.
3. Restore the connections.

Amplifier test

The amplifier test will measure the responsiveness of the SIGA-AA30 and SIGA-AA50 amplifiers.

To test the audio amplifiers:

1. Ensure that the wattage of any backup amplifier equals or exceeds the wattage of any primary amplifier it will replace.
2. Create an alarm condition to verify that EVAC signal shows up at the alarm output.
3. Create an amplifier fault to see if the backup amplifier takes over.

To test Class B output configurations:

1. Disconnect the amplifier's audio output wiring.
2. Verify that the 2-LCD trouble queue displays the correct message.
3. Restore the connections.

To test Class A output configurations:

1. Disconnect the amplifier's primary audio output wiring.
2. Verify that the 2-LCD trouble queue displays the correct message.

3. Verify that the amplifier output is available on Class A wiring.
4. Restore the connections.

Testing detectors and modules

These procedures are designed to test the application and programming of detectors, input modules, and output modules for initial approval and re-acceptance.

Note: Download the Signature data circuit (SDC) configuration to the panel from the 2-SDU before you start testing.

Detectors

Signature detectors

Signature Series detectors and bases reside on an SDC, which is controlled by a Main Controller Module (MCM) or an Expander Loop Module (LCX).

To test Signature detectors:

1. Ensure that all the detectors are located and mounted according to accepted installation practices and the specifications of the job.
2. Activate each detector individually.
3. Verify that the device initiates the appropriate system responses.
4. Check the 2-LCD for the appropriate circuit type and device location message.
5. Remove the detector from its base.
6. Verify that the 2-LCD displays the appropriate trouble message and location.
7. After you replace the detector, press the Reports switch on the 2-LCD to run a sensitivity report.

If the detector is installed in a relay base, verify that the base's relay function operates according to design. If the detector is installed in an isolator base, verify that the base isolates the required circuit segments.

Conventional detectors

Conventional detectors and bases work in conjunction with Signature series universal modules (UMs).

Note: Before you test conventional detectors, verify the following:

- A 2-SMK module is installed between the panel power supply and the UM, terminal 9 (smoke power)
- JP1, on each UM, jumps pins 1 and 2

To test conventional detectors:

1. Ensure that all the detectors are located and mounted according to accepted installation practices and the specifications of the job.
2. Activate each detector individually.
3. Verify that the UM initiates the appropriate system responses.
4. Check the 2-LCD for the appropriate circuit type and device location message.
5. Remove the detector from its base.
6. Verify that the 2-LCD displays the appropriate trouble message and location.

If the detector is installed in a relay base, verify that the base's relay function operates according to design. If the detector is installed in an isolator base, verify that the base isolates the required circuit segments.

Duct detectors

Test duct detectors to verify that they meet the minimum and maximum airflow requirements.

See the following documents for detailed specifications and instructions on Signature Series detectors:

- *Signature Series Technical Reference* (P/N 270144)
- *Signature Series Component Installation Manual* (P/N 270497)
- *Intelligent Smoke and Heat Detectors Applications Bulletin* (P/N 270145)

Modules

Input modules

To test input modules

1. Ensure that all the modules are located and mounted according to accepted installation practices and the specifications of the job.
2. Activate each module individually.
3. Verify that the device initiates the appropriate system responses.
4. Check the 2-LCD for the appropriate circuit type and device location message.

5. Open the circuit.
6. Verify that the 2-LCD displays the appropriate trouble message and location.

Output modules

To test output modules:

1. Ensure that all the modules are located and mounted according to accepted installation practices and the specifications of the job.
2. At the 2-LCD, activate each module individually with the Activate Output command.
3. Verify that the device initiates the appropriate system responses.
4. Check the 2-LCD for the appropriate circuit type and device location message.
5 Open the circuit (for supervised output circuits).
6. Verify that the 2-LCD displays the appropriate trouble message and location.

If the output is activated by one or more system inputs, activate these inputs and verify that the output function operates appropriately.

Testing initiating devices

The procedures for testing initiating devices are the same for initial and re-acceptance testing. These procedures test the initiating devices and their programming. Initiating devices include:

- Manual pull stations
- Non-restorable heat detectors
- Restorable heat detectors
- Waterflow switches

Caution: Do not test a nonrestorable heat detector. Nonrestorable heat detectors activate only one time, and require replacement afterwards.

Perform the tests along with the procedures for testing Signature detectors and input modules.

To test manual pull stations:

1. Inspect the initiating device for visual indications of non-conformance.
2. Pull the lever to activate the pull station.
3. Verify that the device initiates the appropriate system responses.
4. Check the 2-LCD for the appropriate circuit type and device location message.
5. Open the circuit.
6. Verify that the 2-LCD displays the appropriate trouble message and location.

To test restorable heat detectors:

1. Inspect the initiating device for visual indications of non-conformance.
2. Activate the detector.
3. Verify that the device initiates the appropriate system responses.
4. Check the 2-LCD message for the appropriate circuit type and device location.
5. Open the circuit.
6. Verify that the 2-LCD displays the appropriate trouble message and location.

To test waterflow switches:

1. Inspect the initiating device for visual indications of non-conformance.
2. Activate the sprinkler test valve.
3. Verify that the device initiates the appropriate system responses.
4. Check the 2-LCD message for the appropriate circuit type and device location.
5. Open the circuit.
6. Verify that the 2-LCD displays the appropriate trouble message and location.

Testing notification appliances

The procedures for testing notification appliances are the same for initial and re-acceptance testing.

These procedures test the notification appliances and their programming. Notification appliances include:

- Visual devices
- Speakers
- Bells
- Horns

The procedures for testing notification appliances are the same for visual and audible devices. Perform the tests along with the procedures for testing Signature detectors and output modules.

To test notification appliances:

1. Inspect the notification appliance for visual indications of non-conformance.
2. Activate the circuit.
3. Verify that all indicating appliances operate according to specification.
4. Open the circuit.
5. Verify that the 2-LCD displays the appropriate trouble message and location.

Filling out a certificate of completion

When you have tested the system and found it to operate satisfactorily, it is time to submit a Certificate of Completion.

Note: Do not use the master copy to report your work.

To fill out a certificate of completion:

1. Reproduce the master copies of the Certificate of Completion on the following pages (Figure 3-2 and Figure 3-3).
2. Supply the information requested on the Certificate of Completion.
3. Give the Certificate of Completion to the building representative.

Fire Alarm System Certificate of Completion

Page 1 of 2

Protected Property

Name: _____

Address: _____

_____

Representative: _____

Phone: _____

Authority Having Jurisdiction: _____

Address: _____

_____

Phone: _____

Certificate of System Installation

This system has been installed in accordance with the NFPA standards listed below, was inspected by _____ on _____ , and includes the devices listed below, and has been in service since _____ .

_____ NFPA 72, Ch 1 3 4 5 6 7 (Circle all that apply)

_____ NFPA 70, National Electric Code, Article 760

_____ Manufacturer's Instructions _____ Other (Specify) _____

Certificate of System Operation

All operational features and functions of this system were tested by _____ on _____ and found to be operating properly and in accordance with the requirements of:

_____ NFPA 72, Ch 1 3 4 5 6 7 (Circle all that apply)

_____ NFPA 70, National Electric Code, Article 760

_____ Manufacturer's Instructions _____ Other (Specify) _____

Signed: _____ Dated: _____ Organization:

System Software

System Firmware

Installed Revision: _____ Checksum: _____ Date: _____

Application Programming

Initial Program Installation: _____ Date: _____

Revisions & Reasons: _____ Date: _____

_____ Date: _____

_____ Date: _____

Programmed by (name): _____

Date of Programmer's Latest Factory Certification: _____

Data Entry Program Revision Used: _____

Maintenance

Frequency of routine tests and inspections, if other than in accordance with the referenced NFPA standards: _____

System deviations from the referenced standards are: _____

_____

_____

_____

(signed) for Central Station or Alarm Service Company (title) (date)

_____

(signed) for representative of the Authority Having Jurisdiction (title) (date)

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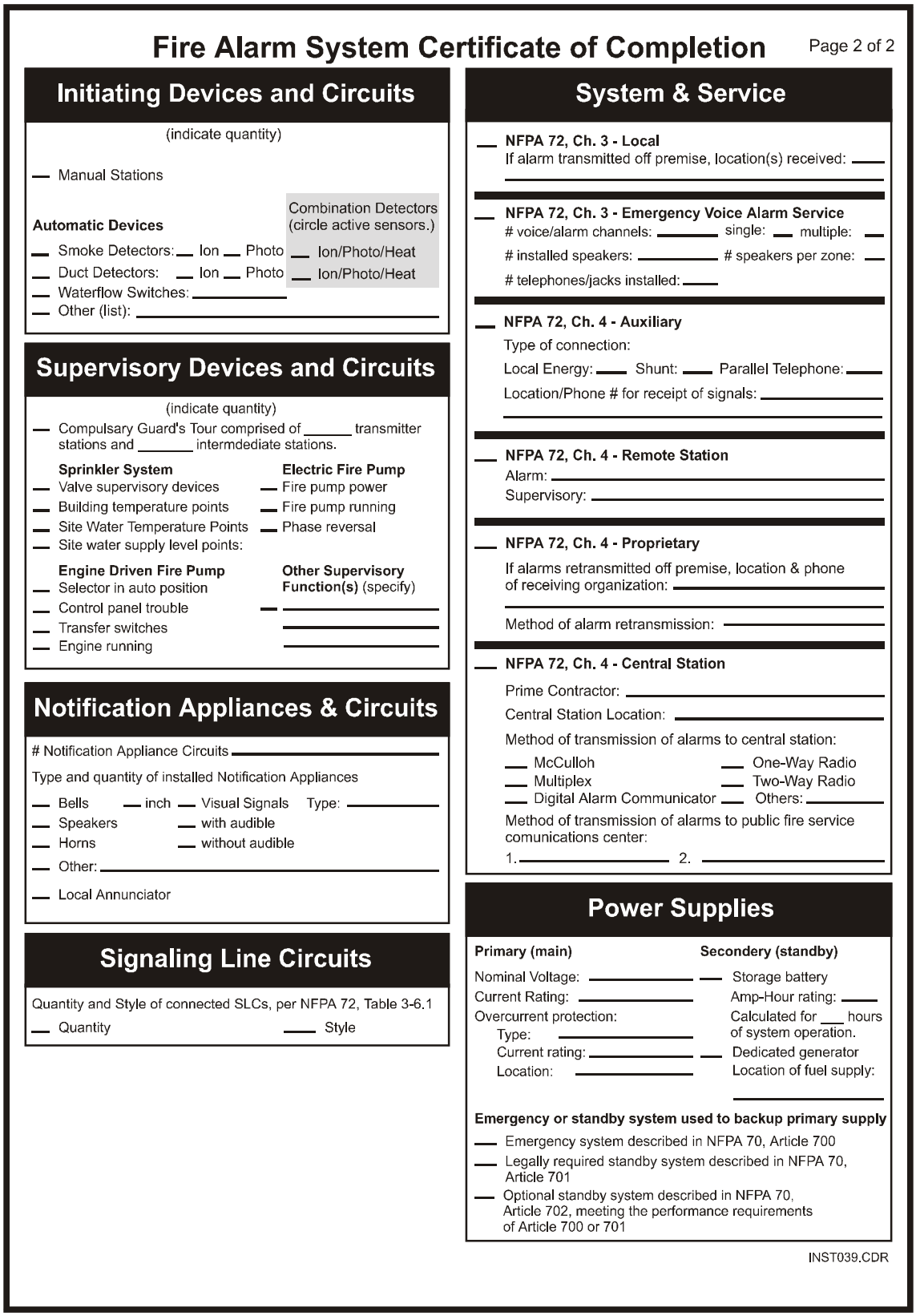
Figure 3-2: Certificate of Completion, Page 1



Fire Alarm System Certificate of Completion

Page 2 of 2

Initiating Devices and Circuits

(indicate quantity)

__ Manual Stations

Automatic Devices — Combination Detectors (circle active sensors.)

__ Smoke Detectors: __ Ion __ Photo __ Ion/Photo/Heat

__ Duct Detectors: __ Ion __ Photo __ Ion/Photo/Heat

__ Waterflow Switches: _____

__ Other (list): _____

Supervisory Devices and Circuits

(indicate quantity)

__ Compulsary Guard's Tour comprised of _____ transmitter stations and _____ intermdediate stations.

Sprinkler System

__ Valve supervisory devices

__ Building temperature points

__ Site Water Temperature Points

__ Site water supply level points:

Electric Fire Pump

__ Fire pump power

__ Fire pump running

__ Phase reversal

Engine Driven Fire Pump

__ Selector in auto position

__ Control panel trouble

__ Transfer switches

__ Engine running

Other Supervisory Function(s) (specify)

__ _____

_____

_____

Notification Appliances & Circuits

Notification Appliance Circuits _____

Type and quantity of installed Notification Appliances

__ Bells __ inch __ Visual Signals Type: _____

__ Speakers __ with audible

__ Horns __ without audible

__ Other: _____

__ Local Annunciator

Signaling Line Circuits

Quantity and Style of connected SLCs, per NFPA 72, Table 3-6.1

__ Quantity ____ Style

System & Service

__ **NFPA 72, Ch. 3 - Local**
If alarm transmitted off premise, location(s) received: _____

__ **NFPA 72, Ch. 3 - Emergency Voice Alarm Service**
voice/alarm channels: _____ single: __ multiple: __
installed speakers: _____ # speakers per zone: __
telephones/jacks installed: _____

__ **NFPA 72, Ch. 4 - Auxiliary**
Type of connection:
Local Energy: ____ Shunt: ____ Parallel Telephone: ____
Location/Phone # for receipt of signals: _____

__ **NFPA 72, Ch. 4 - Remote Station**
Alarm: _____
Supervisory: _____

__ **NFPA 72, Ch. 4 - Proprietary**
If alarms retransmitted off premise, location & phone of receiving organization: _____
Method of alarm retransmission: _____

__ **NFPA 72, Ch. 4 - Central Station**
Prime Contractor: _____
Central Station Location: _____
Method of transmission of alarms to central station:
__ McCulloh __ One-Way Radio
__ Multiplex __ Two-Way Radio
__ Digital Alarm Communicator __ Others: _____
Method of transmission of alarms to public fire service comunications center:
1. _____ 2. _____

Power Supplies

Primary (main)

Nominal Voltage: _____

Current Rating: _____

Overcurrent protection:
Type: _____
Current rating: _____
Location: _____

Secondery (standby)

__ Storage battery
Amp-Hour rating: ____
Calculated for ___ hours of system operation.

__ Dedicated generator
Location of fuel supply: _____

Emergency or standby system used to backup primary supply

__ Emergency system described in NFPA 70, Article 700

__ Legally required standby system described in NFPA 70, Article 701

__ Optional standby system described in NFPA 70, Article 702, meeting the performance requirements of Article 700 or 701

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Figure 3-3: Certificate of Completion, Page 2

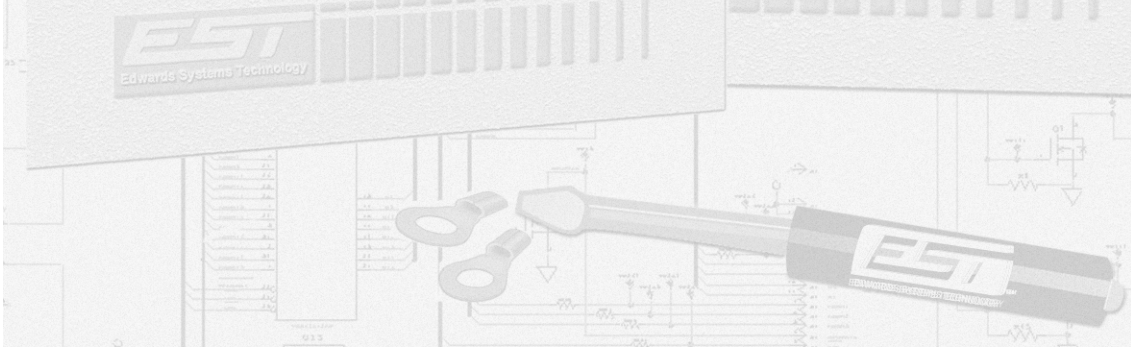
Chapter 4

System service procedures

Summary

Chapter 4 provides detailed instructions for identifying system faults on the 2-LCD and the system components.

Content



Recommended maintenance practices

Electrical safeguards

Personal safety

WARNING: Disconnect ac power to the control panel before installing or removing any components. Failure to remove ac power may result in serious injury or loss of life.

Follow the recommendations for the routing of power-limited and nonpower-limited wiring to avoid dangerous confusion of wire types. See the wallbox installation sheets for the details.

Electro-static precautions

The components of the fire alarm control panel are extremely sensitive to small amounts of static electricity. Make sure you are properly grounded before you handle any module. Provide a static-free storage environment for any module you remove from the control panel.

Wire stripping

Strip 1/4 inch (6.4 mm) from the ends of all wires that connect to the terminal blocks of the module. Exposing more than 1/4 inch of wire may cause a ground fault. Exposing less than 1/4 inch of wire may result in a faulty connection. Observe the wire stripping whenever you perform maintenance on the system or troubleshoot a problem.

Preventive maintenance

There are two standards you need to follow for preventive maintenance. NFPA 72 (1996 edition) provides guidance for inspection, testing, and maintenance in Chapter 7. The other standard to follow is the authority having jurisdiction for your municipality.

Documenting system service

Document your maintenance activities and any problems that arise on the system. The more documentation you have, the easier it is to track problems on the system. See, *Documenting system service*, at the end of this chapter for a sample maintenance log. Photocopy the sample and use it for system maintenance activities.

Use the Reports menu in the 2-SDU to generate and print reports on the configuration of the system for any changes. When

problems arise on the system, you will have a reliable record for comparison.

System faults

Reading 2-LCD messages

The standalone system provides valuable data to help the technician find and correct problems. Whenever a problem arises, the 2-LCD indicates both audibly and visually that something is wrong. See the *System Operations Manual* for detailed information on the LED indications of the 2-LCD.

The 2-LCD also displays fault messages to locate and identify the problem. Each fault message consists of a 4-digit address. The first two digits represent the panel address. If the panel address is 00, the last two digits will be pseudo-point IDs (01 through 99). If the panel address is 01 through 63, the last two digits will represent the device address (01 through 96). Table 4-1 lists the system addresses. All devices and accessories connected to the RS-485 circuit have four-digit addresses between 10xx and 63xx.

Table 4-1: System addressing

Panel address	Function	Device addresses		References
00	Primary Power Supply and system faults Table 4-6 (2-PPS) Table 4-7 (2-PPS/6A)	0001 to 0014 System faults 0015 to 0019 2-MCM faults 0020 to 0024 2-LCX faults 0025 to 0029 DL2 faults		Table 4-2
01 and 02	Main Controller Module See *Signature device problems*.	0101 to 0196 Signature detectors 0201 Dedicated NAC (default) 0202 Dedicated NAC (default) 0203 to 0296 Signature modules		
03 and 04	Expander Loop Module See *Signature device problems*.	0301 to 0396 Signature detectors 0401 Dedicated NAC (default) 0402 Dedicated NAC (default) 0403 to 0496 Signature Modules		
05	LED/switch modules 1st module 2nd module 3rd module 4th module 5th module 6th module	LEDs 0501 to 0516 0517 to 0532 0533 to 0548 0549 to 0564 0565 to 0580 0581 to 0596	Switches (0501 to 0508) (0509 to 0516) (0517 to 0524) (0525 to 0532) (0533 to 0540) (0541 to 0548)	Table 4-16

Table 4-1: System addressing

Panel address	Function	Device addresses	References
	User-defined switch	0096	
06, 07, 08, 09	Future use		
41,	2-AAC Audio Control Module	4110 to 4115, and 4197	Table 4-19 Table 4-20 Table 4-21 Table 4-22
42, 43	Not available		

Fault messages also contain pre-programmed descriptions for the conditions or events that prompt them.

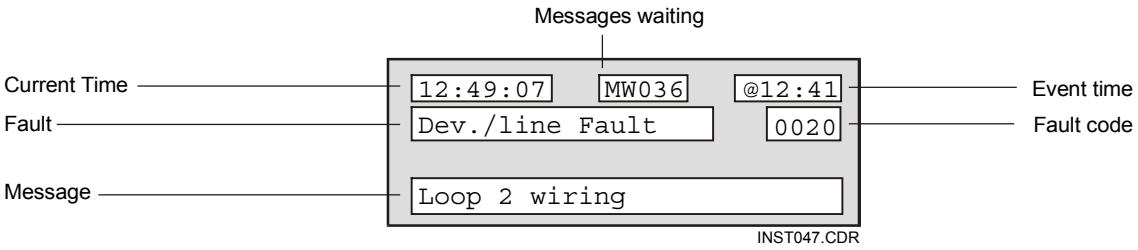


Figure 4-1: Typical fault message

The message in (Figure 4-1) indicates that the current time is 12:49 (PM) and the queue contains thirty-six messages. The Expander Loop Module has a short circuit or open on its SDC, which occurred at 12:41. Table 4-2 provides the meanings of other messages that appear on the 2-LCD.

Table 4-2: System fault messages

Message	Description
0001 / Short fault, NAC power	Over-current condition at the 2-PPS(/6A) Primary Power Supply NAC PWR terminal repaired by reducing the NAC current load.
0002 / Short Fault, Smoke or auxiliary power (Table 4-11)	Over-current condition at the 2-PPS(/6A) SMK/AUX PWR terminal repaired by reducing the smoke power current load.
0003 / Open Fault, Battery or Wiring	Battery problem on the 2-PPS(/6A) caused by: • Low or missing battery • Open battery fuse (F2) • Open or poor connection on battery leads

Table 4-2: System fault messages

Message	Description
0004 / Open fault, 2-PPS(/6A)	Brownout or loss of ac power caused by an: • Input voltage below 85% of rating • Open on the ac input fuse (F1)
0005 / Ground Fault, System Ground	• Pinched wire between device and electrical box • Nicked wire insulation
0006 / Internal Fault	Abnormal internal voltage due to a 2-PPS(/6A) failure.
0007 / Communications Fault, Local Controller (See Table 4-12 for LED indications on the 2-MCM.)	Main Controller Module (2-MCM) not communicating with the 2-PPS(/6A), caused by a: • Loose or defective ribbon cable* • Defective 2-MCM * Check J1 on the 2-MCM and the 2-PPS(/6A).
0008 / Communications Fault, Expansion Controller (See Table 4-13 for LED indications on the 2-LCX.)	Expander Loop Module (2-LCX) not communicating with the 2-PPS(/6A), caused by a: • Loose or defective ribbon cable* • Defective 2-LCX *Check J1 on the 2-LCX and the 2-MCM.
0009 / Internal Fault, Watch-dog Time-out	Watch-dog timer restart failure: 2-MCM failure
0010 / Internal Fault, LCD Display Table 4-15	Communication failure between the 2-LCD and the 2-MCM, caused by a: • Loose or defective ribbon cable* • Defective 2-LCD *Check J1 on the 2-LCD and J2 on the 2-MCM.
0011 / Internal Fault, Local Annunciator	Front panel annunciator module not communicating with the 2-MCM
0012 / Internal Fault, Dialer	Fault on dialer module or associated wiring caused by: • Improper programming of the dialer • Telephone line problems
0013 / Internal fault, printer or external command port (ECP)	Problem on RS-232 port or device caused by: • Off-line status of the printer or ECP • Incorrect device wiring (Pins 2 and 3 on the printer cable)
0014 / Communication fault, 2-PPS(/6A)	Communication failure between the 2-MCM and the 2-PPS(/6A), caused by a: • Loose or defective ribbon cable* • Defective 2-PPS(/6A) *Check J1 on the 2-PPS(/6A) and the 2-MCM.

Table 4-2: System fault messages

Message	Description
0015 / Class A fault, Loop 1 Wiring	Open or short on one path of the 2-MCM Signature data circuit (SDC)
0016 / Internal Fault, Loop 1 Device Mapping Error	The 2-MCM SDC is in the process of mapping the circuit. This fault should clear itself when mapping is complete. Mapping may take up to 30 minutes per circuit.
0017 / Internal Fault, L1 Dev. Personality	A personality code mismatch exists on the 2-MCM SDC.
0018 / Internal Fault, Loop 1 autoconfigure	The 2-MCM SDC could not properly configure the circuit.
0019 / Internal Fault, Loop 1 Int. Memory	A memory mismatch exists between the actual data from the SDC and the expected data in the 2-MCM.
0020 / Class A fault, Expansion Loop	Open or short on one path of the 2-LCX SDC.
0021 / Internal Fault, Loop 2 Device Mapping Error	The 2-LCX SDC is in the process of mapping the circuit. This fault should clear itself when mapping is complete. Mapping may take up to 30 minutes per circuit.
0022 / Internal Fault, L2 Dev. Personality	A personality code mismatch exists on the 2-LCX SDC.
0023 / Internal Fault, Loop 2 autoconfigure	The 2-LCX SDC could not properly configure the circuit.
0024 / Internal Fault, Loop 2 Int. Memory	A memory mismatch exists between the actual data from the SDC and the expected data in the 2-LCX.
0025 / Dialer Internal Memory Fault (See Table 4-17.)	An internal error has occurred. Turn the power off and on again. Replace the DL2 if the fault remains.
0026 / Dialer Phone Line 1 fault	An electrical fault on telephone line 1 caused by: • A bad connection between J1 and the telephone jack • An inoperative telephone line Note: The fault may take up to two minutes to clear after the repair.
0027 / Dialer Phone Line 2 fault	An electrical fault on telephone line 2 caused by: • A bad connection between J2 and the telephone jack • An inoperative telephone line • A configuration error* *If the DL2 is configured for 1-line operation, this error means J2 is connected to a good phone line. Disconnect the line to clear the error. The fault may take up to two minutes to clear after the repair.

Table 4-2: System fault messages

Message	Description
0028 / Call-out Not Completed By Dialer	• The dialer reached the maximum number of call attempts. • The telephone company has technical problems. • The receiver is down.
0029 / Dialer manually disabled	The dialer disconnect switch was pressed or: • The dialer is new and needs programming • The dialer is in the programming mode See the DL2 installation sheet for programming instructions on the DL2.
0030 / Test Mode Active	Someone initiated a test by pressing the 2-LCD Test switch. The message will go away when the test ends. See the *System Operation Manual* for more information.
0101 to 0196 - Device/line Fault or Device communications fault	Trouble on Signature detector wired to the 2-MCM having an address from 0101 to 0196
0201 and 0202 - Open fault (See Table 4-14.)	An open on the 2-MCM NAC caused by: • An incorrect or missing EOL resistor • A miswired circuit or intermittent connections • A broken conductor
0201 and 0202 - Short fault	2-MCM NAC shorted because of a: • Polarized device reversed on the circuit • Defective notification appliance • Miswired circuit
0203 to 0296, Device/line Fault or Device communications fault	Trouble on a Signature module wired to the 2-MCM having an address from 0203 to 0296
0301 to 0396 - Device/line Fault or Device communications fault	Trouble on Signature detector wired to the 2-LCX having an address from 0301 to 0396
0401 and 0402 - Open fault	An open on the 2-LCX NAC caused by: • An incorrect or missing EOL resistor • A miswired circuit or intermittent connections • A broken conductor
0401 and 0402 - Short fault	2-LCX NAC shorted because of a: • Polarized device reversed on the circuit • Defective notification appliance • Miswired circuit
0403 to 0496 - Device/line fault or Device communications fault	Trouble on Signature module wired to the 2-LCX having an address from 0403 to 0496
XX97*	Comm Fault Primary Comm Channel (xx = 10-40 or 44-63)
XX98*	Comm Fault Secondary Comm Channel (xx = 10-40 or 44-63)

Table 4-2: System fault messages

Message	Description
XX99*	Internal Fault Card/Supervision (xx = 10-40 or 44-63)
41XX 2-AAC Audio Controller faults	See Table 4-19

Checking LEDs on the 2-LCD

The 2-LCD also indicates problems with LEDs and an internal buzzer. The internal buzzer provides an audible indication that the system has a problem. Table 4-3 lists the LEDs to look for when the internal buzzer sounds.

Table 4-3: System fault messages

Fault	Possible Causes
AC Power LED off	The ac power is off or below 85% of the rated voltage.
TROUBLE LED on	The system has detected a problem with the wiring or a device on the loop. Check the display for more details and look for other lit LEDs.
CPU FAIL LED on	• 2-MCM CPU watch-dog time-out • LED/Switch module CPU watch-dog time-out
All LEDs off	The system has had an ac power failure and the batteries below minimum allowable voltage

Another way of finding problems is to look for improper device responses. For example, the disable function fails to disable the desired Signature device or disables another one. An improper device response may result from any of the following conditions:

- Conflicting device types
- Conflicting serial numbers
- An incorrect personality code loaded into a module
- Incorrect country code
- An incorrect jumper setting on a Signature series universal module (SIGA-UM)

Check the devices by looking at their LEDs and comparing their serial numbers with the ones configured in the 2-SDU.

Checking system status

A level 1, 2, or 3 password is required to use the 2-LCD status function. Press the STATUS switch to access the first status screen, and follow its instructions (Figure 4-2).

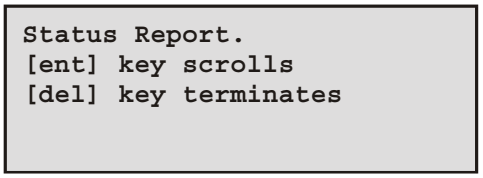


Figure 4-2: First status screen

Press the ENTER switch a second time to advance the LCD display to the general status screen (Figure 4-3).

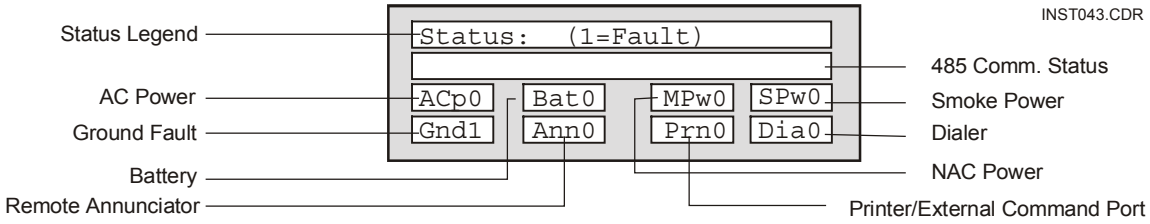


Figure 4-3: General status screen

The general status screen in Figure 4-3 indicates a ground fault in the system. Table 4-4 lists the indications that appear on the general status screen and the events they represent.

Table 4-4: General status legend

Indication	Event
ACp	Ac power
Gnd	Ground fault
Bat	Battery
Ann	Remote annunciator
MPw	NAC power
Prn	Printer
Spw	Smoke power
Dia	Dialer

Press the ENTER switch again to reveal the loop status screens.

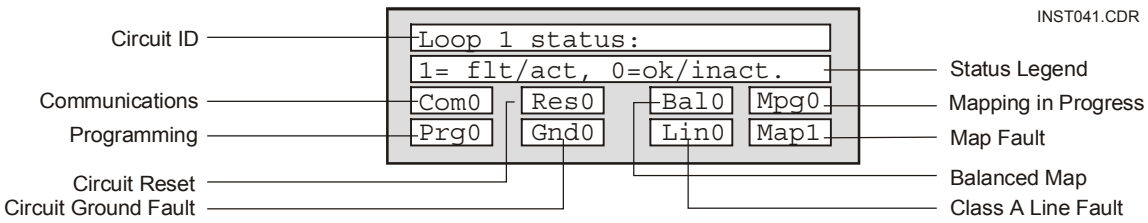


Figure 4-4: Loop Status Screen

The loop status screen in (Figure 4-4) shows a map fault on the SDC connected to the Main Controller Module (loop 1). The next loop status screen displays the status of the SDC on the Loop Expander Module. Table 4-5 lists the indications that appear on the loop status screen the events they represent.

Table 4-5: Loop status legend

Legend	Cause
Com	Communications fault between loop electronics and Main Controller Module
Res	SDC is resetting
BAL	SDC is balanced
Mpg	SDC is actively mapping
Prg	Writing to Signature memory
Gnd	Ground Fault on SDC
Lin	Class A fault on SDC
Map	Map fault on SDC

Panel modules

2-PPS Primary Power Supply

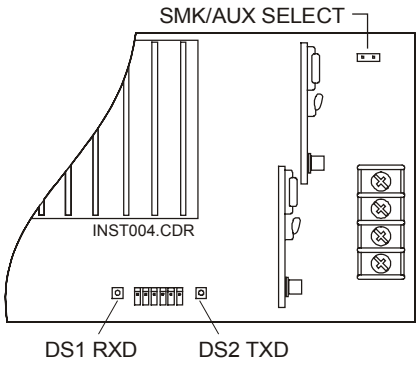


Figure 4-5: Primary Power Supply

Table 4-6: Primary Power Supply LEDs

LED	Color	Pattern	Indication
DS1	Amber	Flickering	The 2-PPS successfully receives data from the 2-MCM.
DS2	Amber	Flickering	The 2-PPS successfully transmits data to the 2-MCM.

2-PPS/6A 6 Amp Primary Power Supply

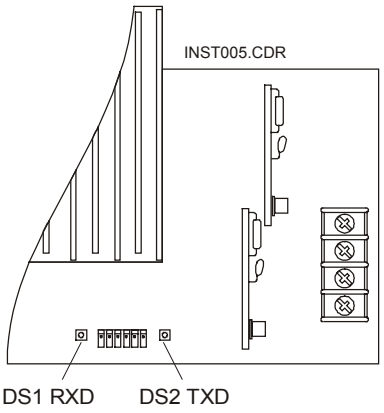


Figure 4-6: Primary Power Supply (6 Amp)

Table 4-7: 6 Amp Primary Power Supply LEDs

LED	Color	Pattern	Indication
DS1	Amber	Flickering	The 2-PPS/6A successfully receives data from the 2-MCM.
DS2	Amber	Flickering	The 2-PPS/6A successfully transmits data to the 2-MCM.

Table 4-8 lists the most common symptoms and causes of primary power supply problems.

Table 4-8: Primary power supply problems

Problem	Cause(s)
RXD LED (DS1) off (Figure 4-5 and Figure 4-6)	A communication failure from the 2-MCM, caused by a: • Loose or defective ribbon cable* • Defective 2-MCM *Check J1 on the 2-PPS(/6A) and the 2-MCM
TXD LED (DS2) off (Figure 4-5 and Figure 4-6)	A communication failure from the 2-MCM, caused by a: • Loose or defective ribbon cable* • Defective 2-PPS(/6A) *Check J1 on the 2-PPS(/6A) and the 2-MCM
Voltage low at NAC PWR	An excessive load is causing the 2-PPS(/6A) to fold back (3.6 A max).
Voltage low at SMK/AUX PWR	An excessive load is causing the 2-PPS(/6A) to fold back (1 A max).
4-Wire smoke detectors will not reset	The SMK/AUX SELECT jumper is installed.
Batteries will not charge	• The system is in the alarm mode. • The 7 Amp battery fuse (F2) is open.
System will not operate on batteries	• The batteries are low. • The 7 Amp battery fuse (F2) is open. Note: The system automatically turns off when batteries are too low to operate system.
System ground fault	• Internal or field wiring is in contact with earth ground • The download computer is feeding ground to the panel.

SIGA-APS Auxiliary Power Supply

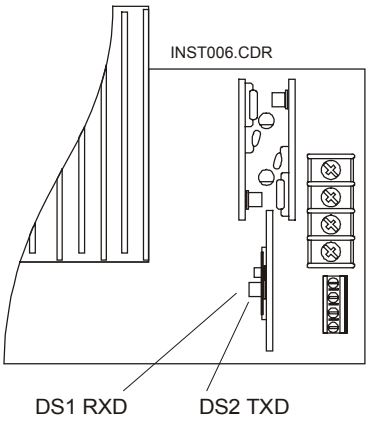


Figure 4-7: Auxiliary Power Supply

Table 4-9: Auxiliary Power Supply LEDs

LED	Color	Pattern	Indication
DS1	Amber	Flickering	The SIGA-APS Auxiliary Power Supply successfully receives data from the 2-AAC.
DS2	Amber	Flickering	The SIGA-APS successfully transmits data to the 2-AAC.

Table 4-10: Auxiliary power supply trouble conditions

Address	Status	Description
Low (1st zone)	Open	AC failure or battery loss
High (2nd zone)	Open	• NAC short • Internal fault • Ground fault

Table 4-11: Auxiliary power supply problems

Problem	Cause(s)
DS1 and DS2 do not flash and the SDC does not communicate. (See Figure 4-7 and Table 4-9.)	• Defective or poor connection on the SDC • The SIGA-APS does not appear as a supervisory SIGA-CT2 in the database
No ac power to the APS (See Table 4-10)	• The ac power is turned off. • The SIGA-APS is unplugged. • The ac power cord is not connected.
Voltage low at NAC1 or NAC2	An excessive load is causing the 2-PPS(/6A) to fold back (3.2 A max).

Table 4-11: Auxiliary power supply problems

Problem	Cause(s)
Batteries will not charge	• The installed battery is greater than the 10 Ah capacity. • The 7 Amp battery fuse (F2) is open.
System will not operate on batteries	• The batteries are low. • The 7 Amp battery fuse (F2) is open. Note: The system automatically turns off when batteries are too low to operate system.
System ground fault	Internal or field wiring is in contact with earth ground.

2-MCM Main Controller Module

Note: See the 2-MCM installation sheet for detailed drawings and information about terminals, cables, and wiring.

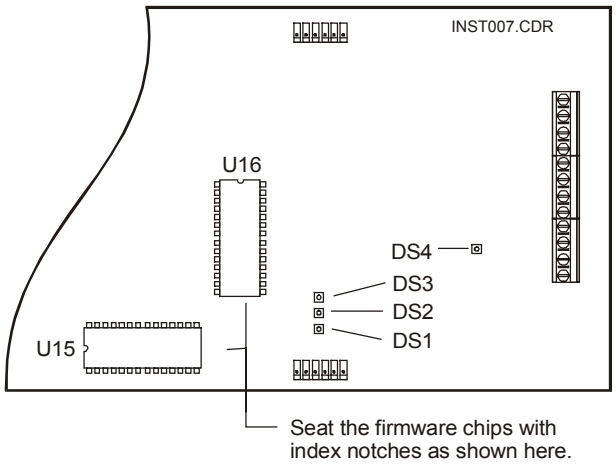


Figure 4-8: Main Controller Module

Reading 2-MCM LEDs

The lower RS-485 LED (Figure 4-8 and Table 4-12) should flicker if the RS-485 port circuit has been configured for Class B operation. The lower and upper RS-485 LEDs should flicker if the RS-485 port circuit has been configured for Class A operation.

Table 4-12: Main Controller Module LEDs

LED	Color	Pattern	Indication
DS1	Green	Flickering	Internal communications normal
DS2	Green	Flickering	RS-485 TX1 active
DS3	Green	Flickering	RS-485 TX0 active
DS4	Green	Flickering	Signature data circuit (SDC) active

Replacing 2-MCM firmware chips

Caution: Remove ac and battery power before installing the chip. When handling the chips, observe all anti-static precautions.

The EPROM firmware chips (U15 and U16) may be replaced with upgrade firmware revisions.

To replace U15 and U16:

1. Remove ac and battery power to the Main Controller Module.
2. Ground yourself to prevent electrostatic discharge.
3. Note the position of the index notches on U15 and U16.
4. Remove the old firmware chips.
5. Take the upgrade chips out of the static-protective bag.
6. Seat the upgrade chips with index notches in the same position as the replaced firmware chips.

Substituting Main Controller Modules

You can substitute a dependable 2-MCM for a suspect 2-MCM, but the substitute 2-MCM requires a download from the 2-SDU. The substitute 2-MCM does not contain the original map information, which it requires to watch the integrity of the system loop(s). See the 2-SDU Help for complete instructions on uploading and downloading to the 2-MCM.

2-LCX Expander Loop Module

Note: See the 2-LCX installation sheet for detailed drawings and information about terminals, cables, and wiring.

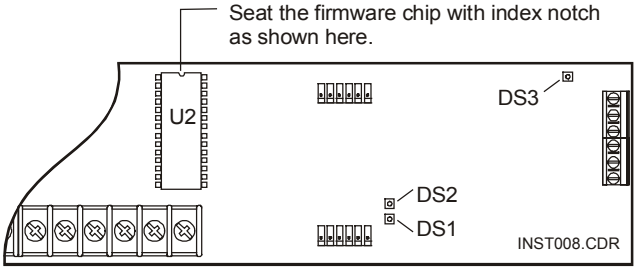


Figure 4-9: Expander Loop Module

Reading 2-LCX LEDs

Table 4-13: Expander Loop Module LEDs

LED	Color	Pattern	Indication
DS1	Green	Flickering	Internal communications normal (Figure 4-9)
DS2	Green	Flickering	½ on/off active LED
DS3	Green	Flickering	SDC activity

Replacing 2-LCX firmware chips

Caution: Remove ac and battery power before installing the chip. When handling the chips, observe all anti-static precautions.

The EPROM firmware chip (U2) may be replaced with upgrade firmware revisions.

To replace U2:

1. Remove ac and battery power to the Expander Loop Module.
2. Ground yourself to prevent electrostatic discharge.
3. Note the position of the index notch on U2.
4. Remove the old firmware chip.
5. Take the upgrade chip out of the static-protective bag.
6. Seat the upgrade chip with index notch in the same position as the replaced firmware chip.

Substituting the Expander Loop Module

You can substitute a dependable 2-LCX for a suspect 2-LCX, but the substitute 2-LCX requires a download from the 2-SDU. The substitute 2-LCX does not contain the original map information, which it requires to watch the integrity of the

system loop(s). See the 2-SDU Help for complete instructions on uploading and downloading to the 2-LCX.

Table 4-14: 2-MCM/2-LCX problems

Problem	Cause(s)
NAC open	• Incorrect or missing EOL resistor • Miswired circuit or intermittent connections • Broken conductor
NAC shorted	• A polarized device reversed on the circuit • A defective notification appliance • A miswired circuit
NAC ground fault	• A pinched wire between device and electrical box • Nicked wire insulation
SDC open	• Miswired circuit • Defective base • Broken conductor • Device not installed on the circuit • Class A configuration: circuit open
SDC shorted and the protection relay keeps on cycling	• Miswired circuit • Defective base • Nicked insulation • Class A or B: circuit shorted
SDC ground fault	• Pinched wire • Nicked insulation • Class A: one or both of the two circuits has a fault
RS-232 port inoperative (2-MCM only)	• TXD and RXD wires reversed • Improper baud rate on the peripheral device • Off-line or improperly configured peripheral device
RS-485 port inoperative (2-MCM only)	• Positive and negative wires reversed • Improper circuit termination • Crossed channel 0 and Channel 1 circuits • Improper wire type

2-LCD Display Module

Note: See the 2-LCD installation sheet for detailed drawings and information about terminals, cables, and wiring.

Table 4-15: 2-LCD problems

Problem	Cause(s)
The Power LED is off, no characters appear on the display, and the switches do not work.	• No power to the panel • Loose or defective ribbon cable between the 2-MCM and the 2-PPS(/6A) • Loose or defective ribbon cable between the 2-LCD and the 2-MCM • Defective 2-LCD • Defective 2-MCM

LED/Switch Modules

Note: See the LED/Switch module installation sheet for detailed drawings and information about terminals, cables, and wiring.

Table 4-16: LED/switch module problems

Problem	Possible Cause(s)
The module LEDs, the module switches, and the 2-LCD are inoperative.	• No power to the panel • Loose or defective ribbon cable between the 2-MCM and the 2-PPS(/6A) • Loose or defective ribbon cable between the 2-LCD and the 2-MCM • Loose or defective ribbon cable between the 2-LCD and the LED/Switch modules • Defective 2-LCD • Defective 2-MCM
The 2-LCD works, but the LED/Switch modules do not work.	• Loose or defective ribbon cable between the 2-LCD and the LED/Switch modules • Incorrect setting of the module address switch • LED/switch module(s) not defined in the 2-SDU • Defective LED/switch module
Module 1 acts like module 2 and module 2 acts like module 1.	Module 1's address switches were set to the module 2's address. Module 2's address switches were set to the module 1's address.

DL2 Dialer

Note: See the DL2 installation sheet for detailed drawings and information about terminals, cables, and wiring.

Verify the following for the DL2:

Central Monitoring Station (CMS)

- Incoming receiver phone numbers for the CMS
- Site ID (account) codes
- Proper entry of all information into the dialer

To verify information:

1. Press the "*" key and enter the respective programming item number into the dialer using the programming phone.
2. Press the "#" key.

The phone will sound out the programming item's contents. See the DL2 installation sheet for more information (P/N387132).

Table 4-17: DL2 Dialer trouble conditions

Problem	Possible Cause
Status LED: single amber flash	• Phone Line problems: jack miswired • Cable between dialer and wall jack open or shorted • Telco line problems
Status LED: double amber flash	• Disconnect switch activated • Module not completely programmed • Awaiting entry of 24-hour test offset in programming mode
Dialer not communicating with the CMS	• Incorrect phone numbers entered in the dialer • Incorrect site ID (account) numbers entered in the dialer • 2-MCM not configured for dialer • Long distance prefix (1) not entered in phone number* • Incompatible receiver *The long distance prefix is not always required.
Garbage signal received at the CMS	• Incorrect protocol selected at receiver • Defective dialer module
Telephone line problems	• Loop start line not furnished • Line wired through PBX board • Line voltage less than 10 Vdc • T-tap on phone line before RJ31X jack • Dialer not wired to seize line upon operation

CDR-3 Coder

Note: See the CDR-3 installation sheet for detailed drawings and information about terminals, cables, and wiring.

The Coder trouble contacts close approximately 3 minutes after a CPU failure or a loss of RS-232 communications. The temporal output on TB1-1 and 2 delivers a continuous tone. Table 4-18 lists the CDR-3 LEDs and the their indications.

Table 4-18: CDR-3 LED Indications

LED	Color	Description
D1	Red	Bell code relay active
D2	Red	Temporal relay active
D3	Red	Duration relay active
D5	Yellow	Module trouble
D8	Green	Power on

2-AAC Audio Controller Module

Note: See the 2-AAC installation sheet for detailed drawings and information about terminals, cables, and wiring.

Table 4-19 lists the 2-AAC fault messages that may appear on the 2-LCD.

Table 4-19: 2-AAC troubles

Problem Link	Possible Cause
4110: 2-AAC pre-amp Ch 1 output	• Pre-amp output wiring open, shorted, or incorrect • Incorrect or missing EOL resistor
4111: 2-AAC pre-amp Ch 2 output	• Pre-amp output wiring open, shorted, or incorrect • Incorrect or missing EOL resistor
4114: Channel 1 is not functioning properly.	• Incorrect output wiring • Incorrect or missing EOL resistor • Incorrect setting of dip switches S1 or S2 • Incorrect programming of Ch 1
4115: Channel 2 is not functioning properly.	• Incorrect output wiring • Incorrect or missing EOL resistor • Incorrect setting of dip switches S3 or S4 • Incorrect programming of Ch 2
4197: The 2-AAC is unresponsive. DS1 is not flashing	• Incorrect RS-485 wiring at TB1 • Incorrect database definition for the 2-AAC* • Power/data cable on J2 loose *Program the 2-AAC as an audio panel at address 41.
Auxiliary 1 input not functioning properly	• Incorrect programming for output 4119 • Auxiliary source level too low (below 1 Vrms) • Incorrect wiring at the auxiliary input (TB4)
Auxiliary 2 input not functioning properly	• Incorrect programming of output 4121 • Auxiliary source level too low (below 1 Vrms) • Incorrect wiring at the auxiliary input (TB4)
Incorrect EVAC and Alert tones	• Incorrect setting of switches S1 or S3 • EVAC and Alert input or output wiring switched

Table 4-19: 2-AAC troubles

Problem Link	Possible Cause
No pre-announce tone	Dip switches S2 and/or S4 not set to mode 4
The supervisory tone pulses when the system is inactive, and does not detect missing EOL resistors.	Dip switches S2 and/or S4 set to mode 5
Low output level	• Driving in excess of 15 amplifiers per channel • Short on riser wiring or incorrect EOL value

2-MIC Microphone

Note: See the 2-MIC installation sheet for detailed drawings and information about terminals, cables, and wiring.

The 2-MIC requires the 2-AAC for operation. Table 4-20 lists the possible causes of a 4112 error on the 2-LCD.

Table 4-20: 2-MIC troubles

Problem	Cause(s)
4112: 2-MIC trouble	• Loose or defective ribbon cable* • Loose or open microphone connection to J2 • Defective 2-MIC • Paging switch pressed in standby condition • Incorrect setting of mode 6 on the 2-AAC *Check J1 on the 2-MIC and J1 on the 2-AAC.

2-TEL Firefighter Telephone

Note: See the 2-TEL installation sheet for detailed drawings and information about terminals, cables, and wiring.

Table 4-21: 2-TEL problems

Problem	Cause(s)
4113: 2-TEL trouble	• Improper seating of the 2-TEL option board on the 2-AAC • Loose or defective modular cable* • Defective 2-TEL • Defective 2-TEL option board • Open telephone riser wiring • Missing or wrong value EOL resistor on telephone riser • Incorrect setting of phone supervision jumper *Check the RJ45 connector on the 2-TEL and J2 on the 2-TEL option board.

SIGA-AAXX amplifiers

Note: See the SIGA-AAXX installation sheet for detailed drawings and information about terminals, cables, and wiring.

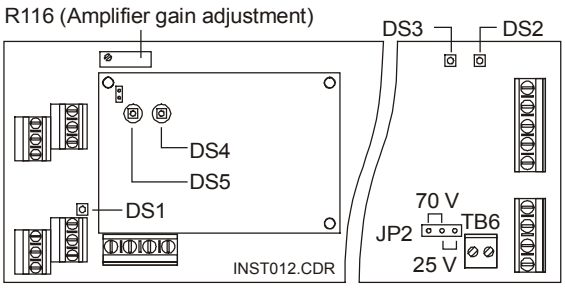


Figure 4-10: SIGA-AA30 or SIGA-AA50 Audio Amplifier

Reading LEDs

Table 4-22: SIGA-AAXX LEDs

LED	Color	Pattern	Indication
DS1	Green	Steady	Power amp disabled (Figure 4-10)
DS2	Yellow	Steady	Backup mode)
DS3	Green	Steady	Amplifier active
DS4	Green	Flashing	Normal communications (daughterboard)
DS5	Red	Flashing	Active condition (daughterboard)

Adjusting amplifier gain

To adjust the amplifier gain:

1. Connect the amplifier to the speaker load.
2. Connect 1 Vrms, 1 kHz tone to the amplifier input.
3. Set JP2 for 25 Vrms or 70 Vrms.
4. Adjust R116 to 25 Vrms or 70 Vrms (Figure 4-10).

If you use an oscilloscope to adjust levels, set it to the following peak-to-peak voltage levels:

- 25 Vrms: 71 Vpp
- 70 Vrms: 200 Vpp

Note: The amplifier must be connected to a load to adjust it for the proper gain. If the actual speaker circuit cannot be used, use Table 4-23 to construct a dummy load. The wattage rating of the

dummy load must exceed the output power rating of the amplifier.

Caution: Do not operate the amplifier with the speaker circuit and the dummy load connected at the same time.

Table 4-23: Amplifier Dummy Load Values

Output Power	25 Vrms Output	70 Vrms Output
30 Watts	20.8 Ω @ 30W	163.3 Ω @ 30 W
50 Watts	12.5 Ω @ 50W	98.0 Ω @ 50 W

To keep the amplifier out of trouble during the gain adjustment:

1. Connect a 47 kΩ EOL resistor across the NAC B output.
2. Connect the dummy load to the NAC A output.

Troubleshooting the amplifiers

Table 4-24 lists some common problems on the SIGA-AAXX amplifiers and provides some of the causes.

Table 4-24: Audio amplifier troubleshooting

Problem	Cause(s)
No output	• 24 Vdc power or input signal missing • Incorrect wiring of output circuits • Improper seating of Daughterboard • Incorrect database definition for the amplifier • In backup mode with backup amplifier/wiring problem • Incorrectly programming of branch circuits • Inoperative branch circuit control modules
Backup 1 kHz tone sounding	Incorrect or missing input wiring
Low output	• 70 Vrms speakers with 25 Vrms jumper setting • Overloaded circuit* • Gain setting on R116 too low *Too many SIGA-CC1s and SIGA-CC2s will cause the amplifier to shut down.

Remote alphanumeric annunciators

Note: See the applicable installation sheets of the remote alphanumeric annunciators for detailed drawings and information about terminals, cables, and wiring.

The remote alphanumeric annunciators include the following models:

- 2-CMDN(-C)
- 2-SMDN(-C)
- 2-LSRA(-C)

Troubleshooting remote alphanumeric annunciators

Table 4-25 lists problems common to all of the remote alphanumeric annunciators. The table also lists problems unique to each class of annunciator.

Table 4-25: Remote alphanumeric annunciator problems

Common problems	Possible cause(s)
Point is displayed without a message	• No message for the point in the database • Routing set to all messages
No message when change of state initiated	Incorrect setting of the display filter
Incorrect header type but correct message	Wrong type selected for message
LCD display's internal database corrupted	Download process interrupted
2-CMDN(-C) and 2-SMDN(-C)	**Possible cause(s)**
Display indicates a fault at the control panel	• Mismatched baud rate • Faulty connection • Improper wiring
Front panel switches inoperative	• Key switch in disable position • Improper programming of the key switch filter
2-LSRA(-C)	**Possible cause(s)**
Garbled characters on the display	Mismatched baud rate
Front panel switches inoperative	• Key switch in disable position • Improper programming of the key switch filter • Password not entered

Printers

PT-1S(-220) form printer

Note: See the *Microline 182 Turbo Printer Handbook*, by Okidata, for detailed technical information about the PT-1S(-220). The handbook comes with the printer. See the 2-MCM installation sheet for wiring the form printer to the Main Controller Module.

RSAN-PRT strip printer

Note: See the RSAN-PRT (Strip Printer) installation sheet for detailed drawings and information about terminals, cables, FCOM cards, jumper settings, and wiring.

Table 4-26: Strip printer problems

Problem	Possible cause
Gibberish from printer	• Printer baud rate does not match the source's baud rate • Printer not defined as a strip printer in the 2-SDU • Paper jammed in the printer
Printer not working at all	• Printer out of paper • 24 Vdc off • FCOM card incorrectly installed/wired • FCOM jumpers incorrectly set
Paper Out LED on	• Out of paper • Paper Out sensor out of adjustment
Trouble LED on	• Internal printer trouble • Trouble on a printer downline • Trouble on a communications circuit
Light printing	Old ribbon
Paper take-up reel inoperative	Take-up reel On/Off switch (top of take-up reel frame) in the off position

Cleaning detectors

Signature series detectors require periodic cleaning to ensure reliable performance. The Detector Cleaning Tool, with a conventional vacuum cleaner, provides the means for cleaning the detectors. The tool creates a high velocity vortex scrubbing action around the detector to remove loose dust and debris.

Caution: Disable the detector before you clean it to avoid false alarms.

To clean a Signature series detector:

1. At the 2-LCD, disable the detector to prevent false alarms.
2. Vacuum cobwebs and other loose objects from the immediate area of the detector.
3. Install the Detector Cleaning Tool on the vacuum hose (Figure 4-11).
4. Place the Detector Cleaning Tool over the detector head for approximately 1 minute.
5. When the detector is clean, restore it to proper operation.
6. At the 2-LCD, check the detector's sensitivity to verify that it is clean.

Note: See the *System Operations Manual* for instructions on checking detectors sensitivity level.

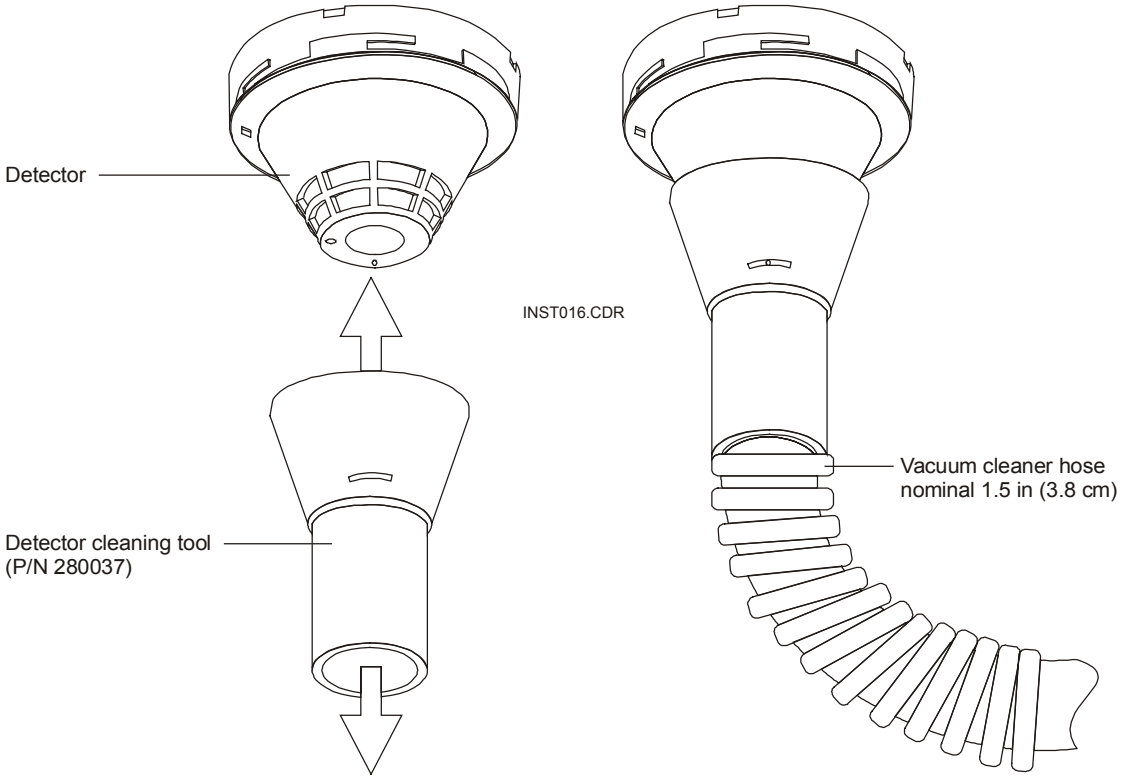


Figure 4-11: Detector cleaning tool

Fire alarm trouble and maintenance log

Date	Time	Event	Initials

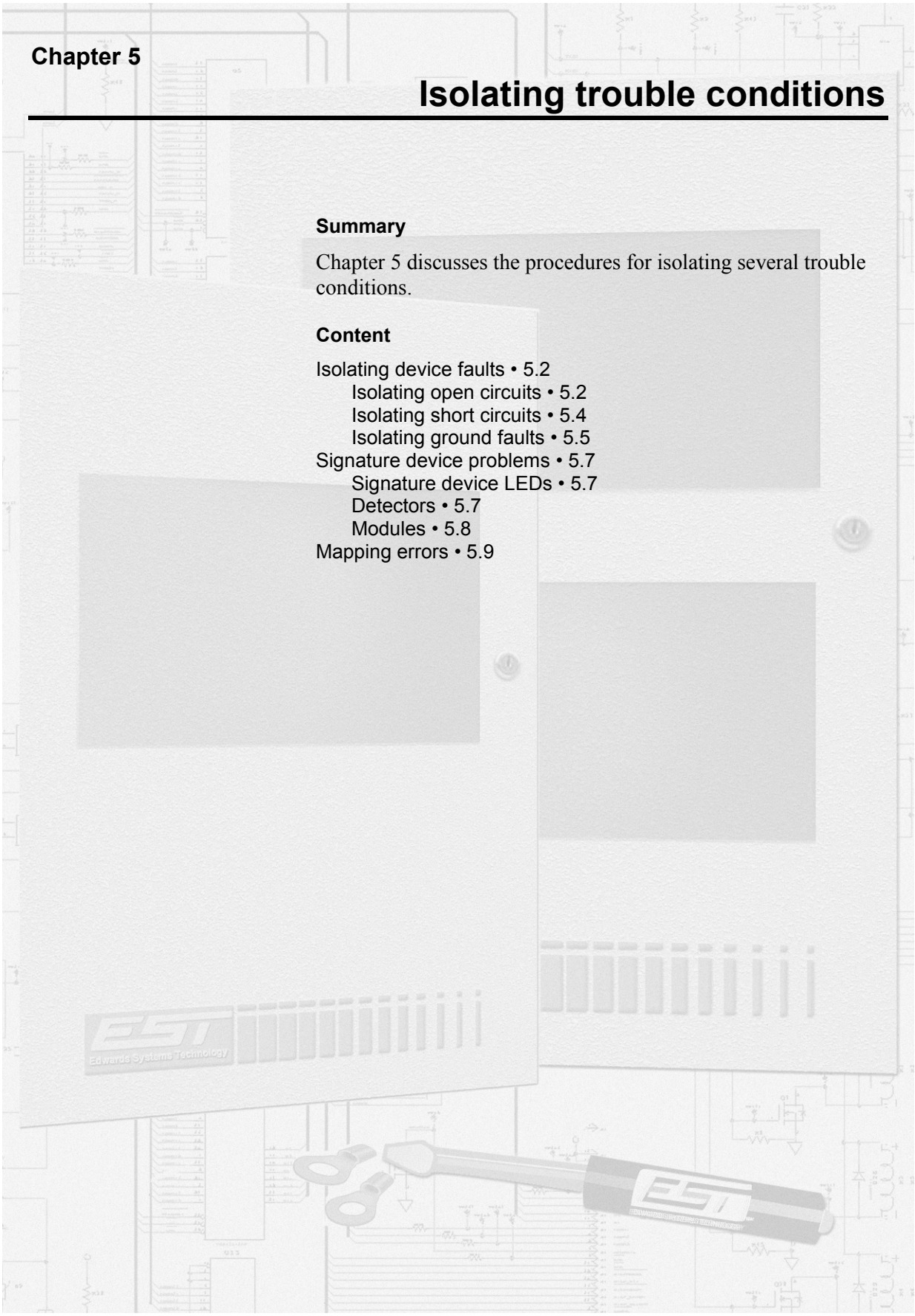
Chapter 5

Isolating trouble conditions

Summary

Chapter 5 discusses the procedures for isolating several trouble conditions.

Content



Isolating device faults

Methods for isolating Signature device faults differ according to the problem. Still, some tools may prove helpful in many situations. An accurate and complete wiring diagram of the Signature data circuit (SDC) will prove useful in all circumstances. The 2-SDU features a mapping tool, which provides valuable information about the condition of each circuit and its devices. You can read about the mapping tool in the 2-SDU help. Your own documentation is another useful tool. Document your maintenance activities and make the records available. If you know the last thing that happened to a device or the system, you may not have to spend a lot of time isolating a problem.

Isolating open circuits

The most common electrical problems with fire alarm systems are open circuits, short circuits, and ground faults (Figure 5-2). An open circuit disrupts communications on the SDC. Consequently, the 2-LCD will report an open circuit as a communications fault (Figure 5-1).

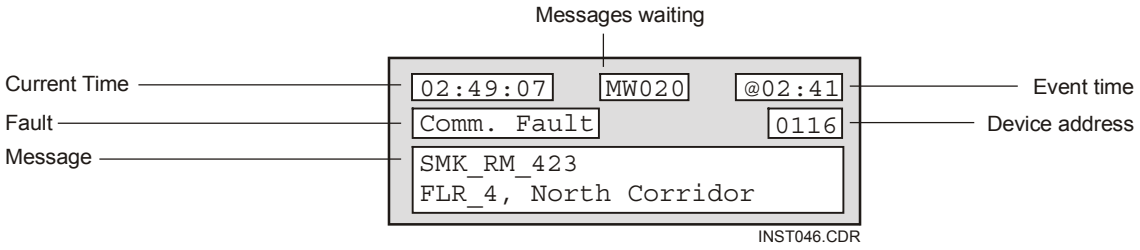


Figure 5-1: 2-LCD message for an open condition

In a trouble-free SDC, all devices are properly:

- Wired
- Installed
- Programmed
- Maintained

An open on the SDC may indicate:

- A break in the line
- A missing connection
- A loose connection
- A programming error
- A poorly seated detector
- An improper device

A short on the SDC may indicate:

- Reversed wiring
- A defective device
- A faulty wire

A ground fault on the SDC may indicate that the circuit has:

- Multiple ground references
- Nicked wiring
- Pinched wiring
- Mixed wiring types

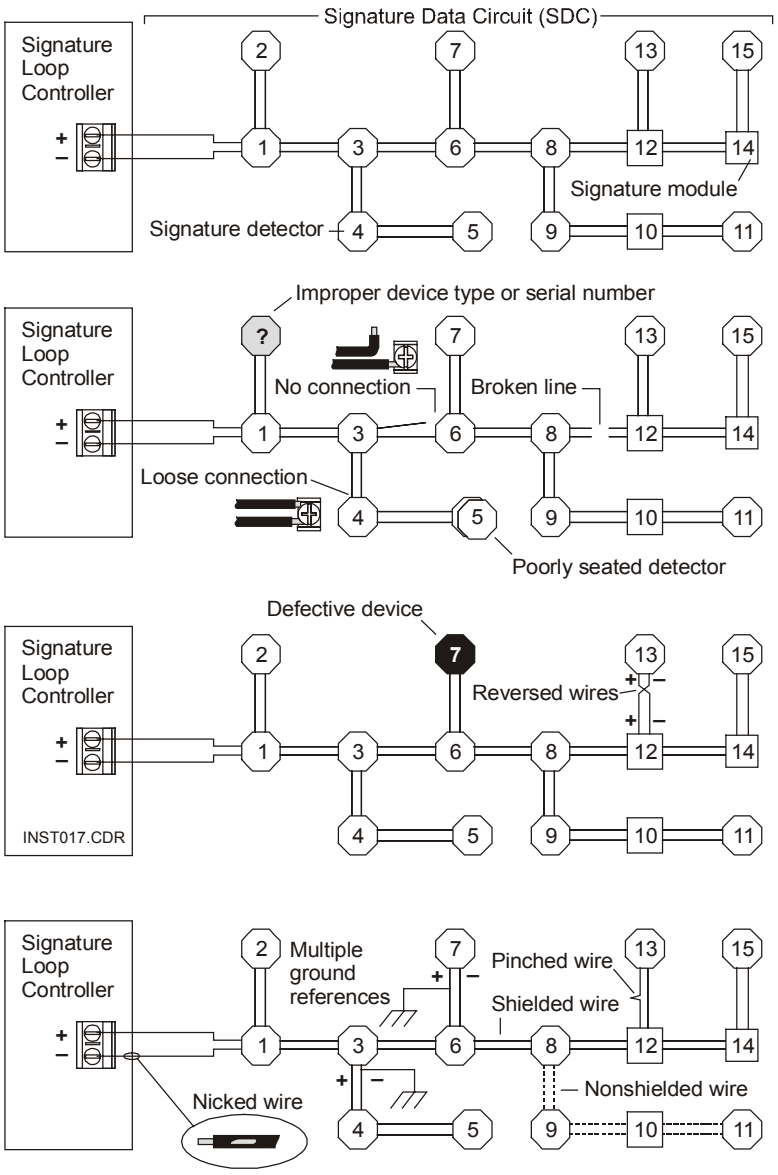


Figure 5-2: SDC problems

To isolate an open circuit:

1. Read the fault message at the 2-LCD to find out which devices are not communicating.
2. If your company has a maintenance log, check it for any work recently performed on or around the suspect device.
3. Go to the device and examine it for the potential problems of an open condition.
4. Check the device's LEDs for communications activity.

5. Check the serial number of the device against the serial number entered in the *Serial Number Log Book*.
6. Check the 2-SDU for other programming information about the device to see if it matches the one in trouble.

Isolating short circuits

The 2-LCD reports a short circuit as a device/line fault because it may arise from a problem with the line or the device (Figure 5-3).

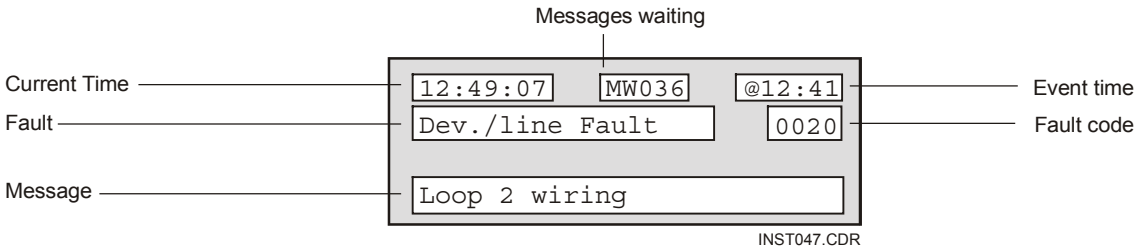


Figure 5-3: 2-LCD message for a short circuit

The 2-LCD also reports communications faults for every device on the SDC. Listen for the constant clicking of a relay on the primary power supply, which frequently accompanies a short circuit.

Isolating a short circuit requires more patience than isolating an open circuit. The 2-LCD provides indications of a short circuit, but you may have to isolate portions of the circuit to find the cause.

To isolate a short circuit:

1. Look for a device/line fault and several communication faults on the 2-LCD.
2. Listen for a clicking relay at the Primary Power Supply.
3. If your company has a maintenance log, check it for any work recently performed on or around the suspect device.
4. Isolate portions of the SDC to locate the cause (Figure 5-4).
5. Investigate the problem area for potential wiring or device faults.

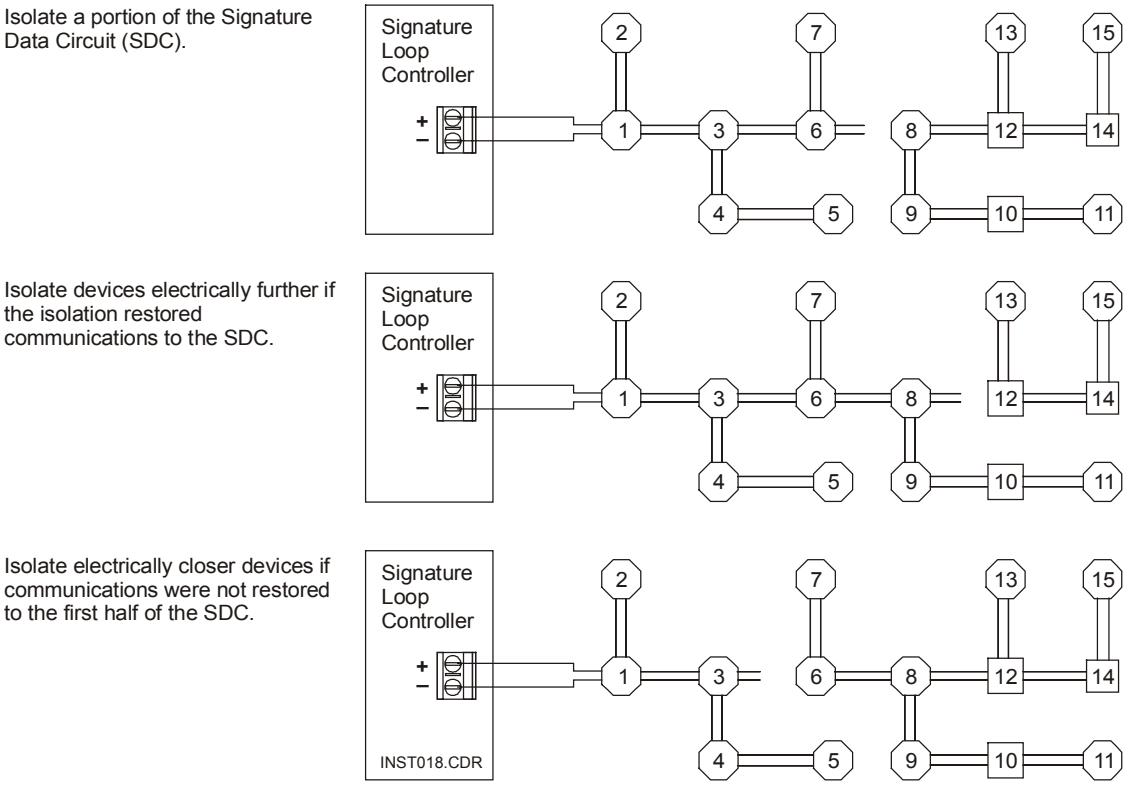


Figure 5-4: Typical isolation procedure

Isolating ground faults

A ground fault occurs when a device or a line has more than one ground reference. The 2-LCD indicates a ground fault condition for the system and communication faults for every device on the affected SDC (Figure 5-5).

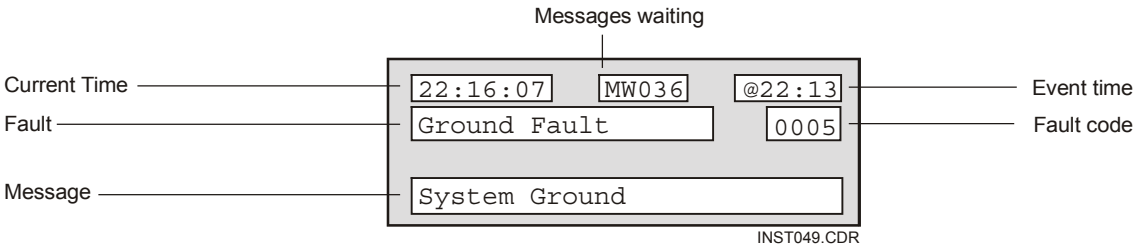


Figure 5-5: 2-LCD message for a ground fault

As with short circuits, the cause of a ground fault may prove elusive. The isolation procedure for short circuits also applies to ground faults.

To isolate a ground fault:

1. Look for a ground fault and several communication faults on the 2-LCD.
3. If your company has a maintenance log, check it for any work recently performed on or around the suspect device.
4. Isolate portions of the SDC to locate the cause (Figure 5-4).
5. Investigate the problem area for potential wiring or device faults.

Signature device problems

Signature device LEDs

Signature series detectors and modules feature LEDs that indicate the status of the device. Table 5-1 provides a description for each LED color and pattern.

Table 5-1: Signature device LEDs

LED	Device status
Green flashing	Normal communications
No flashing	No communications
Red flashing	Alarm/Active(either input of dual input modules)
Red and green steady	Standalone Alarm/Active (either input of dual input modules)

Detectors

Incorrect response

A detector may exhibit an incorrect response for the following reasons:

- Incorrect detector address
- Detector not in database
- Incorrect programming of device responses

Trouble condition

A detector may cause a trouble condition for the following reasons:

- Missing or incorrectly wired
- Not in the database
- Ground fault
- Internal fault

Nuisance alarms

A detector may cause nuisance alarms or active conditions under the following conditions:

- Extremely high airflow*
- High ambient smoke
- Defective detector

*High airflow affects ionization detectors.

Modules

Incorrect response

A module may exhibit an incorrect response for the following reasons:

- Wrong location
- Incorrect address
- Missing from the database
- Wrong personality code
- Ground fault on the SDC or negative side of the input/output

Incorrect module responses may also originate from issues specific to personality codes. For example, modules with:

- Personality codes 1, 2, 3, 4, 8, 13, 14, 16, and 18 will not accept a personality code other than zero (0) for an unused module address.
- Personality code 8 will cause problems for the wrong setting of setting of the jumper on dual channel modules.
- Personality codes 13, 14, 18, 20, and 21 will have problems if 24 Vdc for smoke power low or missing.
- Personality codes 1, 2, 3, and 4 will have problems if inputs 1 and 2 are swapped.
- Personality code 7 will fail if signal sources 1 and 2 are swapped.

Trouble condition

A module may cause a trouble condition on the host controller under the following circumstances

- Wrong location
- Incorrect address
- Missing from the database
- Ground fault on the SDC or negative side of the input/output
- Output circuit open, short, or incorrectly wired
- Polarized device installed in reverse

Note: An incorrect or missing EOL will also cause modules with personality codes 1, 2, 3, 4, 7, 13, 14, 16, 18, 20, and 21 to indicate a trouble condition to the host controller.

Nuisance alarm

A module may cause nuisance alarms or active conditions if the:

- Initiating device has a short circuit
- Initiating device was installed wrong
- EOL resistor value is too low

Mapping errors

Several things may cause mapping errors. Figure 5-6 shows how the 2-LCD displays a mapping error.

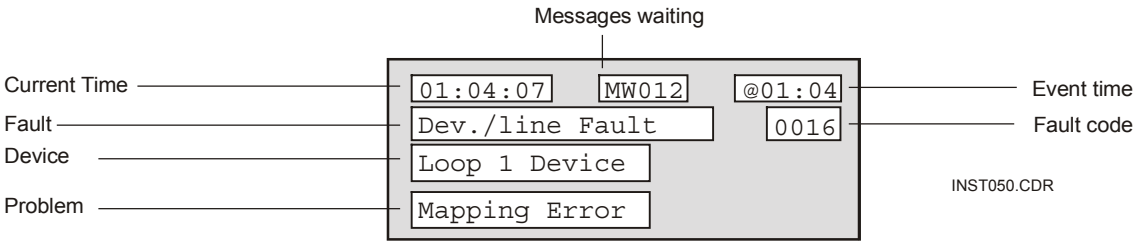


Figure 5-6: 2-LCD message for a mapping error

To isolate a mapping error:

1. Read the mapping error message on the 2-LCD to determine which loop and device has the mapping error.
2. Check the maintenance log for any work recently performed on the device or panel.
3. Go to the suspect device and examine it for the potential problems of a mapping error.
4. Check the device's LEDs for communications activity.
5. Check the serial number of the device against the serial number entered in the *Serial Number Log Book*.
6. Check the 2-SDU for other programming information about the device to see if it matches the one in trouble.

Table 5-2: Mapping errors

Problem	Cause(s)
Mapping error	• Conflicts between actual and expected data* • Loose or defective ribbon cable** • Device ID entered incorrectly into database • More than 63 T-taps on an SDC • Excessive circuit resistance • Excessive circuit capacitance *The 2-MCM's internal map does not reflect the devices actually installed on the SDC (serial number, personality code, or device type). **Check J5 on the 2-MCM and J3 on the 2-LCX.
System continues to re-map data circuit	• An intermittent connection* • A defective device or detector base *The intermittent connection will cause one or more devices to loose then re-establish communication with the 2-LCX.
Device type error	A discrepancy between the device type recorded on the 2-MCM or 2-LCX internal map and the device installed on the SDC

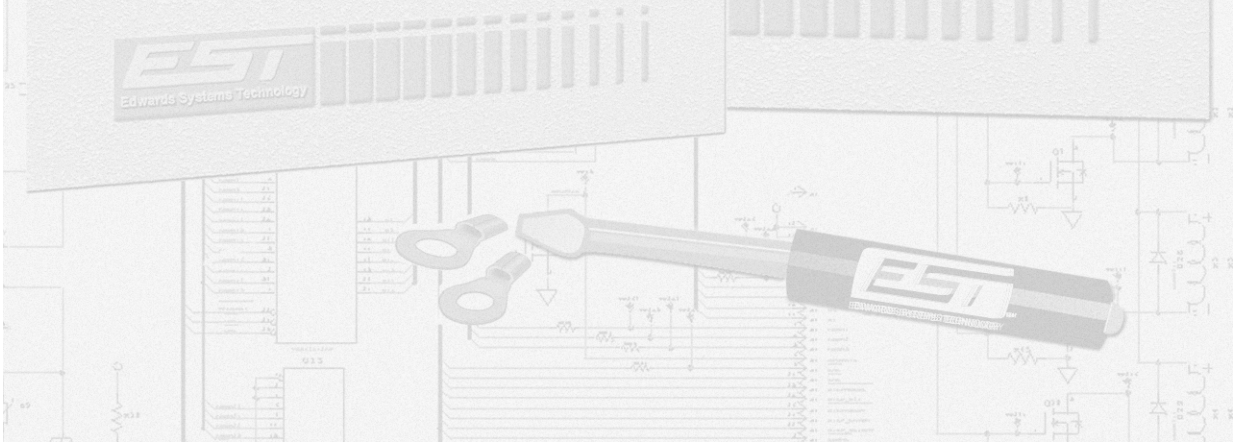
Appendix A

Compatibility listings

Summary

Appendix B presents compatibility lists for the EST2 system.

Content



Underwriters Laboratories, Incorporated (ULI)

Controllers and initiating devices

Loop controllers include the 2-MCM and the 2-LCX.

Table A-1: ULI panel compatibility for loop controllers and Signature Series devices

Model	Description	Devices (1)
SIGA-IS (2)	Ionization smoke detector	96
SIGA-PS (2)	Photoelectric smoke detector	96
SIGA-PHS (2)	Combination photoelectric smoke and fixed temperature detector	96
SIGA-IPHS (2)	Combination ionization, photoelectric smoke, and fixed temperature detector	96
SIGA-HFS (2)	Fixed temperature detector	96
SIGA-HFS (2)	Combination fixed temperature and rate-of-rise heat detector	96
SIGA-IM	Isolator module	96
SIGA-AA30	Audio amplifier, 30 Watt	47
SIGA-AA50	Audio amplifier, 50 Watt	47
SIGA-APS	Auxiliary power supply	47
SIGA-CC1	Single input signal module	94
SIGA-CC2	Dual input signal module	47
SIGA-CT1	Single input module	94
SIGA-CT2	Dual input module	47
SIGA-CR	Control relay module	94
SIGA-CRR	Control reversing relay module	94
SIGA-MM1	Monitor module	94
SIGA-WTM	Waterflow/tamper module	47
SIGA-UM	Universal module	47
SIGA-MDM	Signature digital message module	47

Notes

(1) Maximum number of devices per Signature data circuit (SDC)

(2) Includes SB(4), RB(4), IB(4), and AB(4) detector bases

Notification appliances

Table A-2: ULI compatible notification appliances

Model	Description
202-3A-T	Strobe, self-synchronized
202-3A-TW	Strobe, self-synchronized
202-5A-T	Strobe, self-synchronized
202-5A-TW	Strobe, self-synchronized
202-6A-T	Strobe, self-synchronized
202-6A-TW	Strobe, self-synchronized
202-7A-T	Strobe, self-synchronized
202-7A-TW	Strobe, self-synchronized
202-8A-T	Strobe, self-synchronized
202-8A-TW	Strobe, self-synchronized
323D-10AW	AdaptaBel, single-stroke
323D-10AW-R	AdaptaBel, single-stroke
329D-AW	Chime with diode
403-3A-R	Bell/strobe Plate
403-5A-R	Bell/strobe Plate
403-7A-R	Bell/strobe Plate
403-8A-R	Bell/strobe Plate
405-3A-R	Strobe, self-synchronized
405-5A-R	Strobe, self-synchronized
405-7A-R	Strobe, self-synchronized
405-8A-R	Strobe, self-synchronized
405-6A-T	Strobe, self-synchronized
405-6A-TW	Strobe, self-synchronized
405-7A-T	Strobe, self-synchronized
405-7A-TW	Strobe, self-synchronized
405-8A-T	Strobe, self-synchronized
405-8A-TW	Strobe, self-synchronized
439D-6AW	Bell, vibrating
439D-6AW-R	Bell, vibrating
439D-10AW	Bell, vibrating
439D-10AW-R	Bell, vibrating

Table A-2: ULI compatible notification appliances

Model	Description
439DEX-6AW	Bell, explosion-proof
439DEX-8AW	Bell, explosion-proof
439DEX-10AW	Bell, explosion-proof
5520D-AW	Horn/siren, duotronic, diode-polarized
5522D-AW	Horn, explosion-proof duotronic
5523D-AW	Siren, explosion-proof duotronic
5524D-AW	Horn, explosion-proof duotronic
5525D-AW	Siren, explosion-proof duotronic
5530BD-AW	Signal, electronic, multi-tone
5533BD-AW	Signal, electronic, multi-tone, explosion-proof
5534BD-AW	Signal, electronic, multi-tone, explosion-proof
682-1A-HR	Mini-horn
682-1A-HW	Mini-horn
692-5A-HSR	Mini-horn/strobe
692-5A-HSW	Mini-horn/strobe
692-7A-HSR	Mini-horn/strobe
692-7A-HSW	Mini-horn/strobe
692-8A-HSR	Mini-horn/strobe
692-8A-HSW	Mini-horn/strobe
757-1A-C	Chime
757-1A-CW	Chime, white
757-1A-R25	Speaker, re-entrant type
757-1A-R25W	Speaker, re-entrant type
757-1A-R70	Speaker, re-entrant type
757-1A-R70W	Speaker, re-entrant type
757-1A-S25	Speaker, cone-type
757-1A-S25W	Speaker, cone-type
757-1A-S70	Speaker, cone-type
757-1A-S70W	Speaker, cone-type
757-1A-T	Horn, temporal, self-synchronized
757-1A-TW	Horn, temporal, self-synchronized
757-3A-CS	Chime/strobe

Table A-2: ULI compatible notification appliances

Model	Description
757-3A-CSW	Chime/strobe
757-3A-RS25	Speaker/strobe, re-entrant type
757-3A-RS25W	Speaker/strobe, re-entrant type
757-3A-RS70	Speaker/strobe, re-entrant type
757-3A-RS70W	Speaker/strobe, re-entrant type
757-3A-SS25	Speaker/strobe, cone-type
757-3A-SS25W	Speaker/strobe, cone-type
757-3A-SS70	Speaker/strobe, cone-type
757-3A-SS70W	Speaker/strobe, cone-type
757-3A-T	Horn/strobe, temporal
757-3A-TW	Horn/strobe, temporal
757-5A-CS	Chime/strobe
757-5A-CSW	Chime/strobe
757-5A-SS25	Speaker/strobe, cone-type
757-5A-SS25W	Speaker/strobe, cone-type
757-5A-SS70	Speaker/strobe, cone-type
757-5A-SS70W	Speaker/strobe, cone-type
757-5A-T	Horn, temporal/strobe
757-5A-TW	Horn, temporal/strobe
757-7A-CS	Chime/strobe
757-7A-CSW	Chime/strobe
757-7A-RS25	Speaker/strobe, re-entrant type
757-7A-RS25W	Speaker/strobe, re-entrant type
757-7A-RS70	Speaker/strobe, re-entrant type
757-7A-RS70W	Speaker/strobe, re-entrant type
757-7A-SS25	Speaker/strobe, cone-type
757-7A-SS25W	Speaker/strobe, cone-type
757-7A-SS70	Speaker/strobe, cone-type
757-7A-SS70W	Speaker/strobe, cone-type
757-7A-T	Horn/strobe, temporal
757-7A-TW	Horn/strobe, temporal
757-8A-CS	Chime/strobe

Table A-2: ULI compatible notification appliances

Model	Description
757-8A-CSW	Chime/strobe
757-8A-RS25	Speaker/strobe, re-entrant type
757-8A-RS25W	Speaker/strobe, re-entrant type
757-8A-RS70	Speaker/strobe, re-entrant type
757-8A-RS70W	Speaker/strobe, re-entrant type
757-8A-SS25	Speaker/strobe, cone-type
757-8A-SS25W	Speaker/strobe, cone-type
757-8A-SS70	Speaker/strobe, cone-type
757-8A-SS70W	Speaker/strobe, cone-type
757-8A-T	Horn/strobe, temporal
757-8A-TW	Horn/strobe, temporal
889D-AW	Horn, explosion-proof, diode-polarized
890RDA	Lamp station, supervised
890RDB-G5	Lamp station, supervised
890WDA-G5	Lamp station, supervised
890WDB-G5	Lamp station, supervised
964-1A-4RR	Cone speaker
964-1A-4RW	Cone speaker
964-1A-8RW	Cone speaker
964-1A-8SW	Cone speaker
964-5A-4RR	Cone speaker
964-5A-4RW	Cone speaker
964-5A-8RW	Cone speaker
964-5A-8SW	Cone speaker
964-7A-4RR	Cone speaker
964-7A-4RW	Cone speaker
964-7A-8RW	Cone speaker
964-7A-8SW	Cone speaker
964-8A-4RR	Cone speaker
964-8A-4RW	Cone speaker
964-8A-8RW	Cone speaker
964-8A-8SW	Cone speaker

Table A-2: ULI compatible notification appliances

Model	Description
965-1A-4RR	Speaker/strobe
965-1A-4RW	Speaker/strobe
965-1A-8RW	Speaker/strobe
965-1A-8SW	Speaker/strobe
965-5A-4RR	Speaker/strobe
965-5A-4RW	Speaker/strobe
965-5A-8RW	Speaker/strobe
965-5A-8SW	Speaker/strobe
965-7A-4RR	Speaker/strobe
965-7A-4RW	Speaker/strobe
965-7A-8RW	Speaker/strobe
965-7A-8SW	Speaker/strobe
965-8A-4RR	Speaker/strobe
965-8A-4RW	Speaker/strobe
965-8A-8RW	Speaker/strobe
965-8A-8SW	Speaker/strobe
97DEXC-GW	Strobe, explosion-proof

System accessories

Table A-3: ULI compatible accessories

Model	Description
MR-101/C	1-SPDT relay with LED in metal enclosure
MR-101/T	1-SPDT relay with LED in track mounting
MR-104/C	4-SPDT relay with LEDs in metal enclosure
MR-104/T	4-SPDT relay with LEDs in track mounting
MR-201/C	1-DPDT relay with LED in metal enclosure
MR-201/T	1-DPDT relay with LED in track mounting
MR-204/C	4-DPDT relay with LED in metal enclosure
MR-204/T	4-DPDT relay with LED in track mounting
PAM-1	1-SPDT relay with LED in adhesive tape mounting

Table A-4: ULI Compatible Receivers for the DL2 Dialer Module

Model	Manufacturer	Location
685	Alarm Device Manufacturing Co., Div. Of Pittway Corp.	Syosett, NY 11791
CP220	Fire Burglary Instruments, Div. Of Pittway Corp.	Syosett, NY 11791
Quick Alert	Osborne – Hoffman	Point Pleasant Beach, NJ 08742
D6500	Radionics Inc.	Salinas, CA 93912
9000	Silent Knight Security Systems, Div. Of Willknight Inc.	Maple Grove, MN 55369

Table A-5: 2-Wire Smoke Detector Compatibility

Manufacture: Edwards Systems Technology

Zone module number	UL smoke detector compatibility ID	Electrical data				
		Standby voltage at detector	Ripple voltage	Maximum standby detector load		EOL
				Style B	Style D	
UM with 2-SMK	0.0	17.85 - 26.4 Vdc	400 mV	1.0 mA @ 22.3 Vdc	1.0 mA @ 22.3 Vdc	15KΩ

Table A-6: 2-Wire Smoke Detectors and Bases

Model	Type	Base	UL Identifier	Max. qty/zone
6249B	Ionization		001	50
6250B	Ionization	6251B-001A	001/001	50
6269B	Photoelectric		001	45
6270B	Photoelectric	6251B-001A	001/001	45
6269B-003	Photo/Heat		001	45
6270B-003	Photo/Heat	6251B-001A	001/001	45
6264B-001	Ionization	6251B-001A [6260A1-100]	001/001	50
6266B-001	Photoelectric	6251B-001A [6260A1-100]	001/001	45

Underwriters Laboratories of Canada (ULC)

Controllers and initiating devices

Loop controllers include the 2-MCM and the 2-LCX.

Table A-7: ULC panel compatibility for loop controllers and Signature Series devices

Model	Description	Devices (1)
SIGA-IS (2)	Ionization smoke detector	96
SIGA-PS (2)	Photoelectric smoke detector	96
SIGA-PHS (2)	Combination photoelectric smoke and fixed temperature detector	96
SIGA-IPHS (2)	Combination ionization, photoelectric smoke, and fixed temperature detector	96
SIGA-HFS (2)	Fixed temperature detector	96
SIGA-HFS (2)	Combination fixed temperature and rate-of-rise heat detector	96
SIGA-IM	Isolator module	96
SIGA-AA30	Audio amplifier, 30 Watt	47
SIGA-AA50	Audio amplifier, 50 Watt	47
SIGA-APS	Auxiliary power supply	47
SIGA-CC1	Single input signal module	94
SIGA-CC2	Dual input signal module	47
SIGA-CT1	Single input module	94
SIGA-CT2	Dual input module	47
SIGA-CR	Control relay module	94
SIGA-CRR	Control reversing relay module	94
SIGA-MM1	Monitor module	94
SIGA-WTM	Waterflow/tamper module	47
SIGA-UM	Universal module	47
SIGA-MDM	Signature digital message module	47

Notes

(1) Maximum number of devices per Signature data circuit (SDC)

(2) Includes SB(4), RB(4), IB(4), and AB(4) detector bases

Notification appliances

Table A-8: ULC compatible notification appliances

Model	Description
128D-AWC	Mini-horn
128D-AWCR	Mini-horn
200E-CULC-24	Strobe
200E-RULC-24	Strobe
200E1-CULC-24	Strobe
200E1-RULC-24	Strobe
202-3A-T	Strobe, self-synchronized
202-3A-TW	Strobe, self-synchronized
202-5A-T	Strobe, self-synchronized
202-5A-TW	Strobe, self-synchronized
202-6A-T	Strobe, self-synchronized
202-6A-TW	Strobe, self-synchronized
202-7A-T	Strobe, self-synchronized
202-7A-TW	Strobe, self-synchronized
202-8A-T	Strobe, self-synchronized
202-8A-TW	Strobe, self-synchronized
323D-10AW	AdaptaBel, single-stroke
323D-10AW-R	AdaptaBel, single-stroke
329D-AW	Chime with diode
333D-4G1	AdaptaBel, single-stroke bell, 4 inch
333D-6G1	AdaptaBel, single-stroke bell, 6 inch
333D-10G1	AdaptaBel, single-stroke bell, 10 inch
339D-G1	Chime
403-3A-R	Bell/strobe Plate
403-5A-R	Bell/strobe Plate
403-7A-R	Bell/strobe Plate
403-8A-R	Bell/strobe Plate
405-3A-R	Strobe, self-synchronized
405-5A-R	Strobe, self-synchronized
405-7A-R	Strobe, self-synchronized
405-8A-R	Strobe, self-synchronized

Table A-8: ULC compatible notification appliances

Model	Description
405-6A-T	Strobe, self-synchronized
405-6A-TW	Strobe, self-synchronized
405-7A-T	Strobe, self-synchronized
405-7A-TW	Strobe, self-synchronized
405-8A-T	Strobe, self-synchronized
405-8A-TW	Strobe, self-synchronized
439D-6AW	Bell, vibrating
439D-6AW-R	Bell, vibrating
439D-10AW	Bell, vibrating
439D-10AW-R	Bell, vibrating
439DEX-6AW	Bell, explosion-proof
439DEX-8AW	Bell, explosion-proof
439DEX-10AW	Bell, explosion-proof
5520D-AW	Horn/siren, duotronic, diode-polarized
5522D-AW	Horn, explosion-proof duotronic
5523D-AW	Siren, explosion-proof duotronic
5524D-AW	Horn, explosion-proof duotronic
5525D-AW	Siren, explosion-proof duotronic
5530BD-AW	Signal, electronic, multi-tone
5533BD-AW	Signal, electronic, multi-tone, explosion-proof
5534BD-AW	Signal, electronic, multi-tone, explosion-proof
682-1A-HR	Mini-horn
682-1A-HW	Mini-horn
692-5A-HSR	Mini-horn/strobe
692-5A-HSW	Mini-horn/strobe
692-7A-HSR	Mini-horn/strobe
692-7A-HSW	Mini-horn/strobe
692-8A-HSR	Mini-horn/strobe
692-8A-HSW	Mini-horn/strobe
732-7A-006	Strobe/chime
732-7A-106	Strobe/chime
732-8A-006	Strobe/chime

Table A-8: ULC compatible notification appliances

Model	Description
732-8A-106	Strobe/chime
757-1A-C	Chime
757-1A-CW	Chime
757-1A-R25	Speaker, re-entrant type
757-1A-R25W	Speaker, re-entrant type
757-1A-R70	Speaker, re-entrant type
757-1A-R70W	Speaker, re-entrant type
757-1A-S25	Speaker, cone-type
757-1A-S25W	Speaker, cone-type
757-1A-S70	Speaker, cone-type
757-1A-S70W	Speaker, cone-type
757-1A-T	Horn, temporal, self-synchronized
757-1A-TW	Horn, temporal, self-synchronized
757-3A-CS	Chime/strobe
757-3A-CSW	Chime/strobe
757-3A-RS25	Speaker/strobe, re-entrant type
757-3A-RS25W	Speaker/strobe, re-entrant type
757-3A-RS70	Speaker/strobe, re-entrant type
757-3A-RS70W	Speaker/strobe, re-entrant type
757-3A-SS25	Speaker/strobe, cone-type
757-3A-SS25W	Speaker/strobe, cone-type
757-3A-SS70	Speaker/strobe, cone-type
757-3A-SS70W	Speaker/strobe, cone-type
757-3A-T	Horn/strobe, temporal
757-3A-TW	Horn/strobe, temporal
757-5A-CS	Chime/strobe
757-5A-CSW	Chime/strobe
757-5A-SS25	Speaker/strobe, cone-type
757-5A-SS25W	Speaker/strobe, cone-type
757-5A-SS70	Speaker/strobe, cone-type
757-5A-SS70W	Speaker/strobe, cone-type
757-5A-T	Horn, temporal/strobe

Table A-8: ULC compatible notification appliances

Model	Description
757-5A-TW	Horn, temporal/strobe
757-7A-CS	Chime/strobe
757-7A-CSW	Chime/strobe
757-7A-RS25	Speaker/strobe, re-entrant type
757-7A-RS25W	Speaker/strobe, re-entrant type
757-7A-RS70	Speaker/strobe, re-entrant type
757-7A-RS70W	Speaker/strobe, re-entrant type
757-7A-SS25	Speaker/strobe, cone-type
757-7A-SS25W	Speaker/strobe, cone-type
757-7A-SS70	Speaker/strobe, cone-type
757-7A-SS70W	Speaker/strobe, cone-type
757-7A-T	Horn/strobe, temporal
757-7A-TW	Horn/strobe, temporal
757-8A-CS	Chime/strobe
757-8A-CSW	Chime/strobe
757-8A-RS25	Speaker/strobe, re-entrant type
757-8A-RS25W	Speaker/strobe, re-entrant type
757-8A-RS70	Speaker/strobe, re-entrant type
757-8A-RS70W	Speaker/strobe, re-entrant type
757-8A-SS25	Speaker/strobe, cone-type
757-8A-SS25W	Speaker/strobe, cone-type
757-8A-SS70	Speaker/strobe, cone-type
757-8A-SS70W	Speaker/strobe, cone-type
757-8A-T	Horn/strobe, temporal
757-8A-TW	Horn/strobe, temporal
889D-AW	Horn, explosion-proof, diode-polarized
890RDA	Lamp station, supervised
890RDB-G5	Lamp station, supervised
890WDA-G5	Lamp station, supervised
890WDB-G5	Lamp station, supervised
964-1A-4RR	Cone speaker
964-1A-4RW	Cone speaker

Table A-8: ULC compatible notification appliances

Model	Description
964-1A-8RW	Cone speaker
964-1A-8SW	Cone speaker
964-5A-4RR	Cone speaker
964-5A-4RW	Cone speaker
964-5A-8RW	Cone speaker
964-5A-8SW	Cone speaker
964-7A-4RR	Cone speaker
964-7A-4RW	Cone speaker
964-7A-8RW	Cone speaker
964-7A-8SW	Cone speaker
964-8A-4RR	Cone speaker
964-8A-4RW	Cone speaker
964-8A-8RW	Cone speaker
964-8A-8SW	Cone speaker
965-1A-4RR	Speaker/strobe
965-1A-4RW	Speaker/strobe
965-1A-8RW	Speaker/strobe
965-1A-8SW	Speaker/strobe
965-5A-4RR	Speaker/strobe
965-5A-4RW	Speaker/strobe
965-5A-8RW	Speaker/strobe
965-5A-8SW	Speaker/strobe
965-7A-4RR	Speaker/strobe
965-7A-4RW	Speaker/strobe
965-7A-8RW	Speaker/strobe
965-7A-8SW	Speaker/strobe
965-8A-4RR	Speaker/strobe
965-8A-4RW	Speaker/strobe
965-8A-8RW	Speaker/strobe
965-8A-8SW	Speaker/strobe
97DEXC-GW	Strobe, explosion-proof

Table A-8: ULC compatible notification appliances

Model	Description
MBG6-24-R-ULC	Bell, motor
MBG10-24-R-ULC	Bell, motor
MBSG6-24-WHFR-ULC	Strobe/bell, motor
MBSG10-24-WHFR-ULC	Strobe/bell, motor

System accessories

Table A-9: ULC Compatible Accessories

Model	Description
MR-101/C	1-SPDT relay with LED in metal enclosure
MR-101/T	1-SPDT relay with LED in track mounting
MR-104/C	4-SPDT relay with LEDs in metal enclosure
MR-104/T	4-SPDT relay with LEDs in track mounting
MR-201/C	1-DPDT relay with LED in metal enclosure
MR-201/T	1-DPDT relay with LED in track mounting
MR-204/C	4-DPDT relay with LED in metal enclosure
MR-204/T	4-DPDT relay with LED in track mounting
PAM-1	1-SPDT relay with LED in adhesive tape mounting

Table A-10: ULC Compatible Receivers for the DL2 Dialer Module

Model	Manufacturer	Location
685	Alarm Device Manufacturing Co., Div. Of Pittway Corp.	Syosett, NY 11791
CP220	Fire Burglary Instruments, Div. of Pittway Corp.	Syosett, NY 11791
Quick Alert	Osborne - Hoffman	Point Pleasant Beach, NJ 08742
D6500	Radionics Inc.	Salinas, CA 93912
9000	Silent Knight Security Systems, Div. of Willknight Inc.	Maple Grove, MN 55369

Circuit compatibility listings

Circuit compatibility matrix

Figure A-1 lists the restrictions for circuits that occupy the same conduit. Check local codes for additional restrictions.

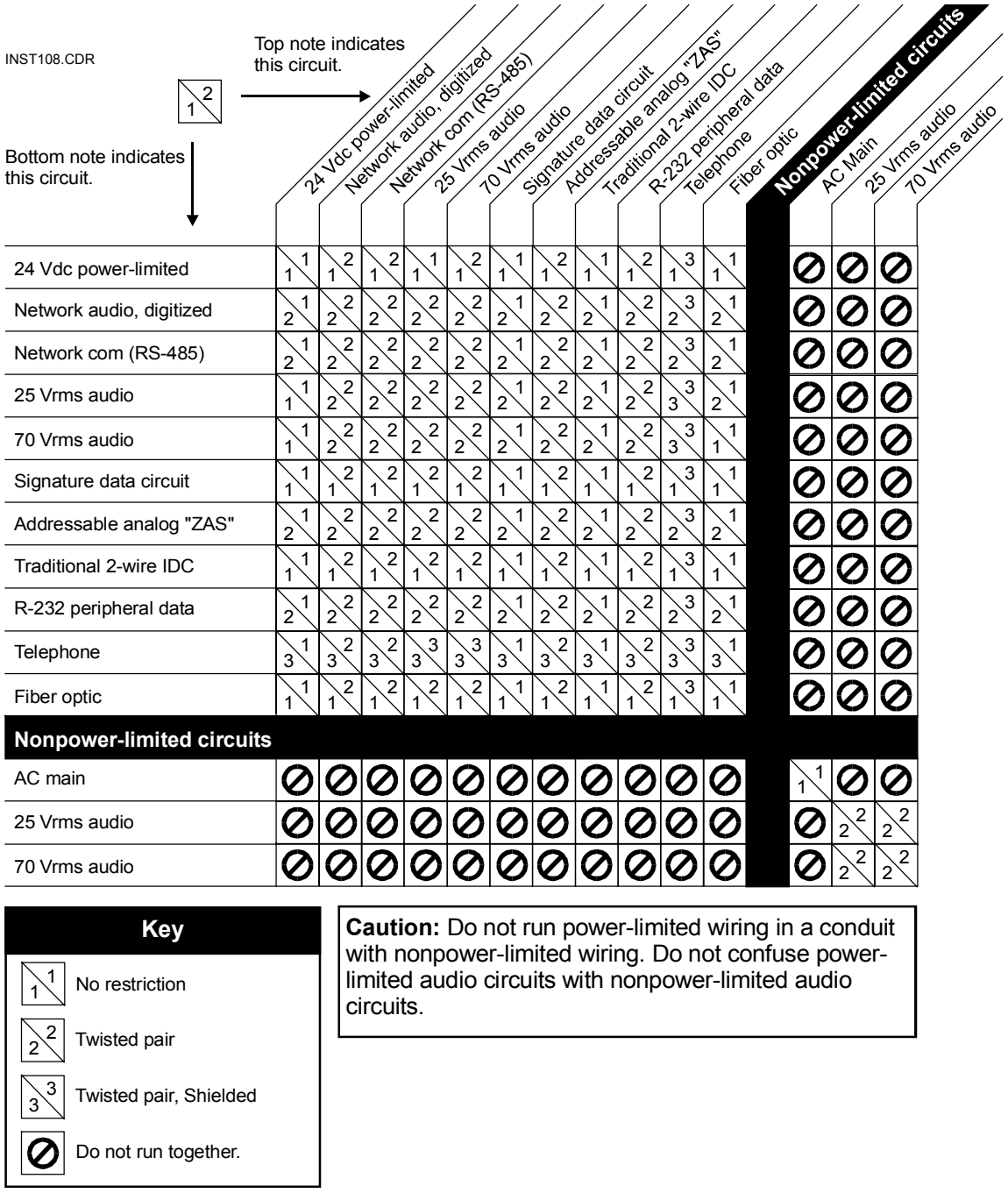


Figure A-1: Circuit compatibility matrix

Circuit specifications

Table A-11 lists the specifications for each type of power-limited circuit in Figure A-1. Table A-12 lists the specifications for each type of nonpower-limited circuit in Figure A-1.

Table A-11: Specifications for power-limited circuits

Circuit	Specifications(s)
24 Vdc	Size conductors per acceptable voltage drop.
Network audio, digitized	No T-taps Maximum circuit resistance: 90 Ω Maximum circuit capacitance: 0.3 μF
Network com (RS-485)	No T-taps Maximum circuit resistance: 70 Ω Maximum circuit capacitance: 0.07 μF
25 Vrms audio	Size conductors per acceptable voltage drop.
70 Vrms audio	Size conductors per acceptable voltage drop.
Signature data	No T-taps Maximum circuit resistance: 76 Ω Maximum circuit capacitance: 0.5 μF
Addressable analog “ZAS”	Maximum circuit resistance with RZB: 36 Ω Maximum circuit resistance without RZB: 50 Ω Maximum circuit capacitance: 0.2 μF
Traditional 2-wire IDC	Maximum circuit resistance: 100 Ω
RS-232 peripheral data	Maximum length: 50 ft (15.2 m) in the same room as the main controller module if not connected to a modem
Telephone	Maximum distance: 4,000 ft (1,200 m) #18 AWG (0.75 mm^2)
Fiber optic cable	Jacket material must be rated for application.

Table A-12: Specifications for nonpower-limited circuits

Circuit	Specifications(s)
AC main	230 Vac, 20 A max.
25 Vrms audio	Size conductors per acceptable voltage drop.
70 Vrms audio	Size conductors per acceptable voltage drop.

Recommended cable manufacturers

Use the cable manufacturers listed in Table A-13.

Table A-13: Recommended cable manufacturers

Manufacturer	Address	Telephone/Fax
Atlas Wire & Cable Corp.	133 S. Van Norman Road Montebello, CA 90640	(213) 723-2401
West Penn Wire Corp.	2833 West Chestnut Street P.O. Box 762 Washington, PA 15301	(412) 222-7060
Belden Wire & Cable Corp.	P.O. Box 1980 Richmond, IN 47375	(317) 983-5200
BSCC	233 Florence Street Leominster, MA 01453	(508) 537-9138 (508) 537-8392
Remee Product, Inc.	186 North Main Street Florida, NY 10921	Not listed

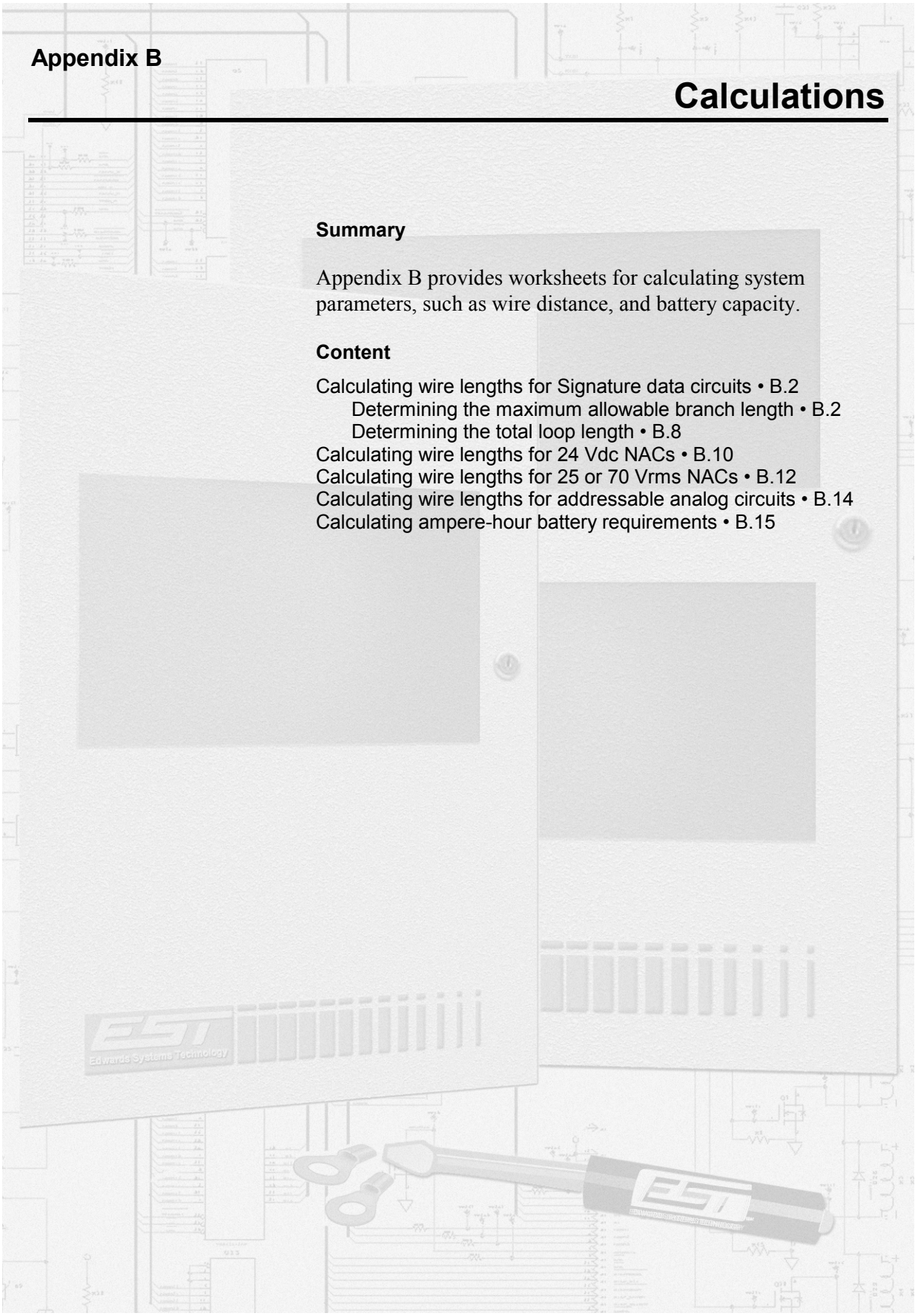
Appendix B

Calculations

Summary

Appendix B provides worksheets for calculating system parameters, such as wire distance, and battery capacity.

Content



Calculating wire lengths for Signature data circuits

Circuit resistance and capacitance determines the maximum length of a Signature data circuit. Circuit resistance affects the wire length of the longest circuit branch. Circuit capacitance affects the total amount of wire that can be used on the circuit.

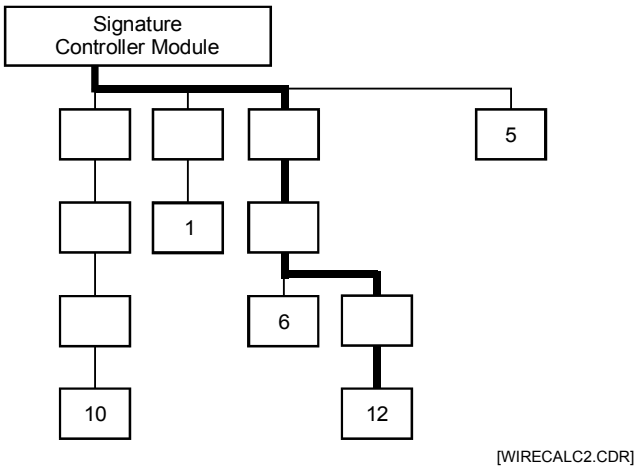
Notes

The design of the Signature data circuit must not exceed either of the two measurements.

There are no restrictions placed on the wiring used for the Signature data circuit. Longer wire runs may be obtained using standard (non-twisted, non-shielded) wire pairs.

Determining the maximum allowable branch length

The maximum branch length is the wire distance measured from the Signature controller module to the last device on the longest circuit path as shown below.



Several factors influence the maximum allowable branch length:

- Wire gauge and type
- Number of Signature detectors and modules installed on the branch
- Number of SIGA-UMs configured for 2-wire smoke detectors installed on the branch

Table B-1 through Table B-4 provide the maximum allowable branch length for any detector, module, SIGA-UM, and wire gauge combination. Using the wire distances specified in the tables ensures that the circuit does not exceed the maximum circuit resistance of the Signature data circuit.

Note: To calculate the wire distance with respect to circuit resistance, the tables assume that the circuit is end-loaded (all devices are clustered more towards the end of the circuit) and the circuit uses standard, non-shielded wire.

To determine the maximum allowable length of a Signature data circuit branch:

1. Identify the device located farthest from the Signature controller.
2. Determine the number of Signature detectors, modules, and SIGA-UMs configured for 2-wire smokes that lie on the same conductive path between the device identified in step 1 and the Signature controller.
3. Calculate the number of detector and module addresses. Some Signature modules require two addresses.
4. Determine the size of the wire used to construct the circuit.
5. Find the maximum allowable wire distance for the longest branch in the lookup tables as follows:

   If no SIGA-UMs are installed, use Table B-1.

   If 1–5 SIGA-UMs are installed, use Table B-2.

   If 6–10 SIGA-UMs are installed, use Table B-3.

   If 11–15 SIGA-UMs are installed, use Table B-4.

Table B-1: Maximum branch length without SIGA-UMs configured for 2-wire smokes

Signature detector addresses	Signature module addresses	Maximum allowable wire distance using non-twisted, non-shielded wire pairs					
		18 AWG		16 AWG		14 AWG	
		ft	m	ft	m	ft	m
1–25	0	7437	2267	11815	3601	13157	4010
26–50	0	7038	2145	11180	3408	13157	4010
51–75	0	6638	2023	10545	3214	13157	4010
76–96	0	6302	1921	10722	3268	13157	4010
0	1–25	7267	2215	11544	3519	13157	4010
1–25	1–25	6867	2093	10909	3325	13157	4010
26–50	1–25	6467	1971	10275	3132	13157	4010
51–75	1–25	6068	1849	9640	2938	13157	4010
76–96	1–25	5732	1747	9106	2776	13157	4010
0	26–50	6697	2041	10639	3243	13157	4010
1–25	26–50	6297	1919	10004	3049	13157	4010
26–50	26–50	5897	1798	9369	2856	13157	4010
51–75	26–50	5498	1676	8734	2662	13157	4010
76–96	26–50	5162	1593	8200	2499	13043	3975
0	51–75	5906	1800	9383	2860	13157	4010
1–25	51–75	5250	1600	8340	2542	13157	4010
26–50	51–75	4633	1412	7360	2243	11707	3568
51–75	51–75	4051	1235	6435	1961	10235	3120
76–96	51–75	3585	1093	5695	1736	9058	2761
0	76–94	4323	1318	6867	2093	10723	3329
1–25	76–94	3774	1150	5995	1827	9536	2906
26–50	76–94	3249	990	5162	1573	8210	2303
51–75	76–94	2747	837	4364	1330	6940	2115
76–96	76–94	2340	713	3717	1133	5913	1802

Table B-2: Maximum branch length with 1–5 SIGA-UMs configured for 2-wire smokes

Signature detector addresses	Signature module addresses	Maximum allowable wire distance using non-twisted, non-shielded wire pairs					
		18 AWG		16 AWG		14 AWG	
		ft	m	ft	m	ft	m
1–25	0	6778	2066	10768	3282	13157	4010
26–50	0	6131	1869	9741	2969	13157	4010
51–75	0	5501	1677	8739	2664	13157	4010
76–96	0	4982	1519	7915	2413	12589	3837
0	1–25	5353	1632	8504	2592	13157	4010
1–25	1–25	4720	1439	7498	2286	11926	3635
26–50	1–25	4100	1250	6513	1985	10359	3157
51–75	1–25	3491	1064	5546	1691	8821	2689
76–96	1–25	2988	911	4748	1447	7551	2302
0	26–50	3776	1151	5999	1829	9542	2908
1–25	26–50	3153	961	5009	1527	7966	2428
26–50	26–50	2539	774	4034	1230	6416	1956
51–75	26–50	1935	590	3075	937	4890	1491
76–96	26–50	1435	437	2280	695	3626	1105
0	51–75	2491	759	3957	1206	6293	1918
1–25	51–75	1868	569	2967	904	4720	1439
26–50	51–75	1254	382	1992	607	3168	966
51–75	51–75	648	198	1030	314	1638	499
76–96	51–75	145	44	231	70	368	112
0	76–84	2076	633	3298	1005	5245	1599
1–25	76–84	1453	443	2308	703	3670	1119
26–50	76–84	837	255	1330	405	2116	645
51–75	76–84	230	70	366	111	582	177
76–84	76–84	13	4	21	7	34	10

Table B-3: Maximum branch length with 6–10 SIGA-UMs configured for 2-wire smokes

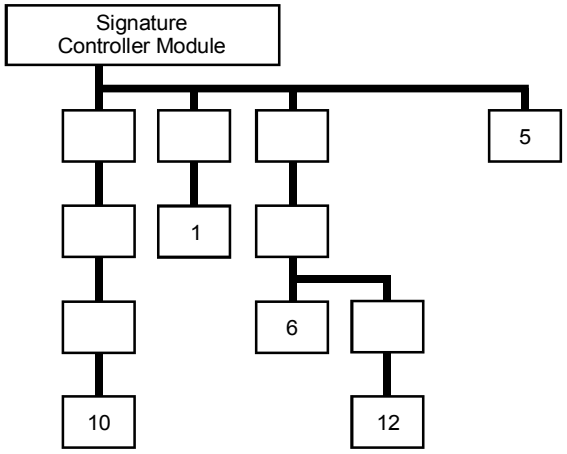
Signature detector addresses	Signature module addresses	Maximum allowable wire distance using non-twisted, non-shielded wire pairs					
		18 AWG		16 AWG		14 AWG	
		ft	m	ft	m	ft	m
1–25	0	5045	1538	8015	2443	12748	3886
26–50	0	4494	1370	7139	2176	11355	3461
51–75	0	3950	1204	6275	1913	9981	3042
76–96	0	3499	1066	5559	1694	8841	2695
0	1–25	4106	1252	6523	1988	10375	3162
1–25	1–25	3542	1080	5627	1715	8950	2728
26–50	1–25	2985	910	4742	1445	7542	2299
51–75	1–25	2435	742	3868	1179	6152	1875
76–96	1–25	1978	603	3142	958	4997	1523
0	26–50	2869	874	4557	1389	7248	2209
1–25	26–50	2296	700	3648	1112	5802	1768
26–50	26–50	1730	527	2749	838	4372	1332
51–75	26–50	1170	357	1859	567	2957	901
76–96	26–50	705	215	1120	341	1781	543
0	51–74	1836	560	2914	2917	4639	1414
1–25	51–74	1255	382	1993	608	3171	966
26–50	51–74	680	207	1080	329	1717	323
51–75	51–74	110	34	175	53	279	85
76–79	51–74	20	6	31	10	50	15

Table B-4: Maximum branch length with 11–15 SIGA-UMs configured for 2-wire smokes

Signature detector addresses	Signature module addresses	Maximum allowable wire distance using non-twisted, non-shielded wire pairs					
		#18 AWG		#16 AWG		#14 AWG	
		ft	m	ft	m	ft	m
1–25	0	3931	1198	6245	1903	9932	3027
26–50	0	3427	1045	5444	1659	8659	2639
51–75	0	2928	892	4651	1418	7397	2255
76–96	0	2511	765	3989	1216	6345	1934
0	1–25	3247	990	5158	1572	8204	2501
1–25	1–25	2722	830	4324	1318	6878	2096
26–50	1–25	2202	671	3498	1066	5563	1696
51–75	1–25	1686	514	2678	816	4259	1298
76–96	1–25	1256	383	1995	608	3173	867
0	26–50	2204	672	3502	1067	5570	1698
1–25	26–50	1664	507	2644	806	4205	1282
26–50	26–50	1129	344	1793	547	2852	869
51–75	26–50	598	182	950	289	1511	460
76–96	26–50	155	47	246	75	392	119
0	51–64	1667	508	2648	807	4212	1284
1–25	51–64	1119	341	1778	542	2828	862
26–50	51–64	576	176	915	279	1456	444
51–75	51–64	37	11	59	18	94	29
76	51–64	16	5	25	8	40	12

Determining the total loop length

The total loop length equals the sum length of all the wire segments installed in the data circuit.



[WIRECALC3.CDR]

The total length of all the cable installed in the Signature data circuit can not exceed the values listed below:

Wire type	14 AWG		16 AWG		18 AWG	
	ft	m	ft	m	ft	m
Twisted pair	13,157	4,010	13,888	4,233	20,000	6,096
Twisted-shielded pair	5,952	1,814	6,098	1,859	8,621	2,628
Non-twisted, non-shielded pair	20,000	6,096	20,000	6,096	20,000	6,096

If the cable manufacturer's data indicates the capacitance per foot of the cable, use the following method to determine the maximum total loop length.

Note: In no case may the total loop length of a Signature data circuit exceed 20,000 feet (6,096 meters).

$$L_{Max} = \frac{500{,}000}{C_{pf/Ft}}$$

where:

- L_{Max} = maximum total cable length in feet
- $C_{pf/Ft}$ = Cable capacitance in picofarads per foot

Note: Install SIGA-IM Isolator modules at strategic points in the Signature data circuit to limit the effect of an electrical short.

Calculating wire lengths for 24 Vdc NACs

The 24 Vdc notification appliance circuits (NACs) must be a minimum of 18 AWG (0.75 mm^2) pair. The maximum allowable circuit resistance and cable manufacturer's specifications determine the limits for circuit length.

Table B-5: Wire resistance ratings

Wire size	Resistance per 1000 ft pair
18 AWG (0.75 mm^2)	13.0 Ω
16 AWG (1.0 mm^2)	8.0 Ω
14 AWG (1.50 mm^2)	5.2 Ω
12 AWG (2.5 mm^2)	3.2 Ω

The following restrictions apply to the calculation of wire sizes for 24 Vdc NACs:

- Minimum supply voltage available is 20.4 Vdc
- Minimum required circuit voltage at any notification appliance is 17.0 Vdc

According to Ohm's Law, the maximum allowable NAC resistance equals the voltage drop divided by the NAC current.

$$R_{Max} = \frac{V_{drop}}{I_{Max}}$$

where:

- R_{Max} = Maximum allowable NAC resistance
- V_{drop} = Maximum allowable voltage drop of 3.4 volts from power supply to the last notification appliance (20.4 - 17)
- I_{Max} = Maximum NAC requirement (Total current of all installed notification appliances. *See* Table B-6.)

The maximum permissible circuit resistance for a fully loaded (3.5 A) NAC using 14 AWG wire is 0.97 Ω.

$$0.97\Omega = \frac{3.4V}{3.5A}$$

Use Table B-5 to determine the maximum allowable distance (D) of any listed wire gauge pair.

$$D = \frac{R_{Max}}{R_{/1000'\ PAIR}} X1000$$

where:

- D = Distance in feet
- R_{Max} = Maximum permissible wire resistance
- R/1000 ft pair = Wire resistance per 1000 ft (305 m) pair [Table B-5]

The maximum distance of a fully loaded (3.5 A) NAC using a pair of 14 AWG wires is 187 ft (57 m).

$$187' = \frac{0.97}{5.2} \times 1000$$

Use the same method to calculate other loads and wire sizes. Table B-6 lists the allowable distances for selected current draws and wire sizes.

Table B-6: Load vs Distance NAC (3.4V drop)

Load current	Maximum distance to last appliance							
	12 AWG (2.50 mm^2)		14 AWG (1.50 mm^2)		16 AWG (1.00 mm^2)		18 AWG (0.75 mm^2)	
	ft	m	ft	m	ft	m	ft	m
0.1 A	10,625	3,239	6,538	1,993	4,250	1296	2,615	797
0.25 A	4,250	1,296	2,615	797	1,700	518	1,046	319
0.5 A	2,125	648	1,308	399	850	259	523	159
0.75 A	1,406	429	865	264	563	172	346	105
1.0 A	1,062	324	654	199	425	130	262	80
2.0 A	531	162	327	100	213	65	131	40
3.0 A	353	108	217	66	141	43	87	27
3.5 A	303	92	187	57	121	37	75	23

Calculating wire lengths for 25 or 70 Vrms NACs

The maximum allowable wire length is the greatest distance from the amplifier to the last speaker on the NAC. The wire pair must have no more than 0.5 dB loss over its entire length. Calculating the maximum allowable wire length using this method ensures that each speaker operates at its full potential. Several factors influence the maximum allowable wire length:

- Wire size
- Output signal level of the amplifier driving the circuit
- Number of speakers installed on the circuit

To calculate the maximum allowable wire length for a 0.5 dB loss, use the following formula:

$$\text{Max length} = \frac{59.25 \times \text{Amplifier output}^2}{\text{Wire resistance} \times \text{Circuit load}}$$

where:

- Amplifier output is the signal level in Vrms supplied by the amplifier driving the circuit
- Circuit load is the total watts required by the audio circuit
- Wire resistance is the resistance rating of the wire per 1000 ft pair (*See* Table B-5.)

For example, the maximum allowable wire length for an audio circuit consisting of one 40-Watt (25 Vrms) amplifier, thirty 1-Watt speakers, and 18-gauge wire equals 95 feet.

$$94.95 = \frac{59.25 \times 25^2}{13 \times 30}$$

Use Table B-7 for amplifiers set for 25 Vrms output. Use Table B-8 for amplifiers set for a 70 Vrms output.

Table B-7: Maximum allowable length at 25 Vrms, 0.5 dB loss

	Circuit load requirement											
Wire Size	**15 W**		**20 W**		**30 W**		**40 W**		**90 W**		**120 W**	
	ft	**m**	**ft**	**m**	**ft**	**m**	**ft**	**m**	**ft**	**m**	**ft**	**m**
18 AWG (0.75 mm^2)	190	58	142	43	95	29	71	22	Over max current limit		Over max current limit	
16 AWG (1.0 mm^2)	309	94	231	70	154	47	116	35	51	16	39	12
14 AWG (1.5 mm^2)	475	145	356	109	237	72	178	54	79	24	59	18
12 AWG (2.5 mm^2)	772	235	579	176	386	118	289	88	129	39	96	29

Table B-8: Maximum allowable length at 70 Vrms, 0.5 dB loss

	Circuit load requirement											
Wire Size	**15 W**		**20 W**		**30 W**		**40 W**		**90 W**		**120 W**	
	ft	**m**	**ft**	**m**	**ft**	**m**	**ft**	**m**	**ft**	**m**	**ft**	**m**
18 AWG (0.75 mm^2)	1489	454	1117	340	744	227	558	170	248	76	186	57
16 AWG (1.0 mm^2)	2420	738	1815	553	1210	369	907	276	403	123	302	92
14 AWG (1.5 mm^2)	3722	1134	2792	851	1861	567	1396	426	620	189	465	142
12 AWG (2.5 mm^2)	6049	1844	4537	1383	3024	922	2268	691	1008	307	756	230

Calculating wire lengths for addressable analog circuits

Table B-9 lists the maximum wire distances allowed for Addressable Analog circuits.

Notes

- Maximum wire resistance can not exceed 50 Ω.
- Maximum wire capacitance can not exceed 0.05 µF.

Table B-9: Maximum allowable wire distance for addressable analog circuits

Wire gauge	Max loop capacitance	Twisted, non-shielded		Twisted, shielded		Non-twisted, non-shielded	
		ft	m	ft	m	ft	m
18	0.01 µF	4000	1219	1724	525	5000	1524
	0.02 µF	8000	2438	3448	1051	10000	3048
	0.03 µF	12000	3658	5172	1576	15000	4572
	0.04 µF	16000	4877	6896	2102	20000	6096
	0.05 µF	20000	6096	8620	2627	25000	7620
16	0.01 µF	2777	846	1219	372	5000	1524
	0.02 µF	5555	1693	2439	743	10000	3048
	0.03 µF	8333	2540	3658	1115	15000	4572
	0.04 µF	11111	3387	4878	1487	20000	6096
	0.05 µF	13888	4233	6097	1858	25000	7620
14	0.01 µF	2631	802	1190	363	5000	1524
	0.02 µF	5263	1604	2380	725	10000	3048
	0.03 µF	7894	2406	3571	1088	15000	4572
	0.04 µF	10526	3208	4761	1451	20000	6096
	0.05 µF	13157	4010	5952	1814	25000	7620

Calculating ampere-hour battery requirements

Use the following method to calculate the minimum ampere-hour capacity of a battery required for the operation of a panel in the absence of ac power. Perform battery calculations separately for each cabinet in the system.

To calculate the ampere-hour capacity:

1. Determine the total amount of current in milliamps required by all of the components that derive power from the battery while the panel is in standby mode.
2. Multiply the total amount of standby current by the number of hours that the panel is required to operate in standby mode while on battery power.
3. Determine the total amount of current in milliamps required by all of the components that derive power from the battery while the panel is in alarm mode.
4. Multiply the total amount of alarm current by the number of minutes that the panel is required to operate in alarm mode while on battery power.
5. Divide the result by 60 to convert minutes to hours.
6. Add the total amount of standby current and the total amount of alarm current then divide the result by 1000 to convert to ampere-hours.
7. Multiply this number by 1.2 to add a 20% safety factor to the calculations.

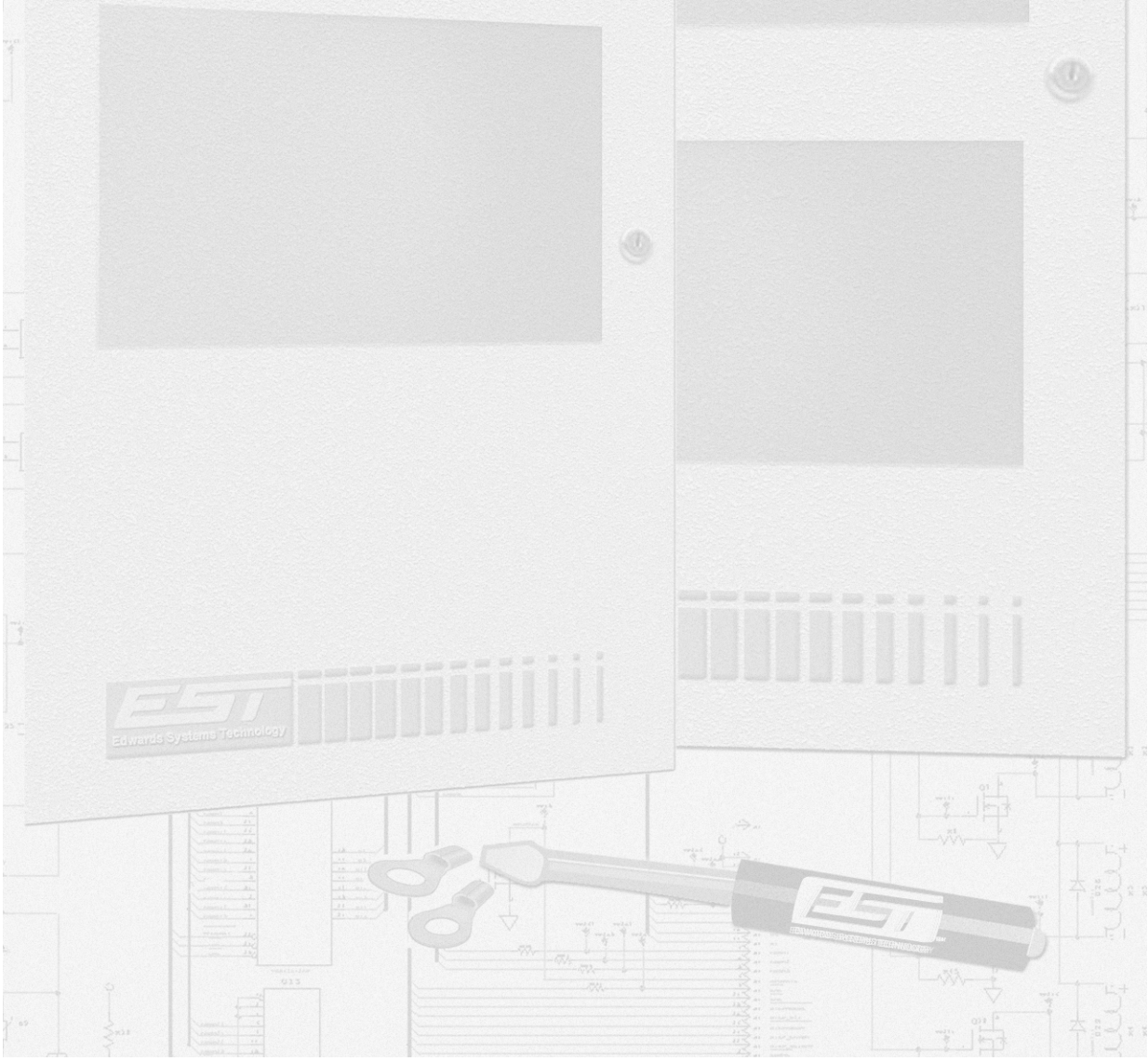
Appendix C

Special applications

Summary

Chapter 6 illustrates the wiring of the Ditek Surge Protector Module and the CDR-3 Bell Coder.

Content



Ditek surge protector module

Description

Any time a wire exits a building and enters another, it must have surge and amperage protection at each end. The Ditek surge protector module (Figure C-1) provides protection to circuits, fuses, and wiring. The surge protector is mounted in a standard grounded metal electrical box and comes in a 2, 4, 6, or 8-wire version. The following are part numbers for the Ditek surge protectors:

- 2 Wire Protector: (P/N - DTK-1LVLPSCP)
- 4 Wire Protector: (P/N - DTK-2LVLPSCP)
- 6 Wire Protector: (P/N - DTK-3LVLPSCP)
- 8 Wire Protector: (P/N - DTK-4LVLPSCP)

These surge protectors can be ordered from Ditek at 12345-A Starkey Road, Largo, Florida 34643. Ditek also has a toll-free number (1-800-753-2345).

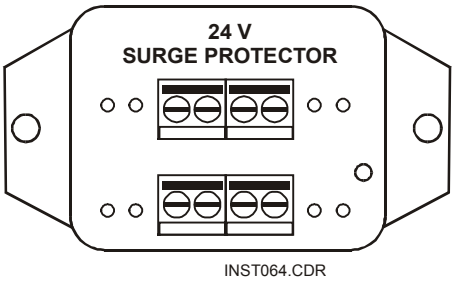


Figure C-1: Ditek Surge Protector Module

Wiring the surge protector module

Figure C-2 illustrates the typical application for surge protector modules. Wiring must include a surge protector when it exits one building and another surge protector when it enters the next building.

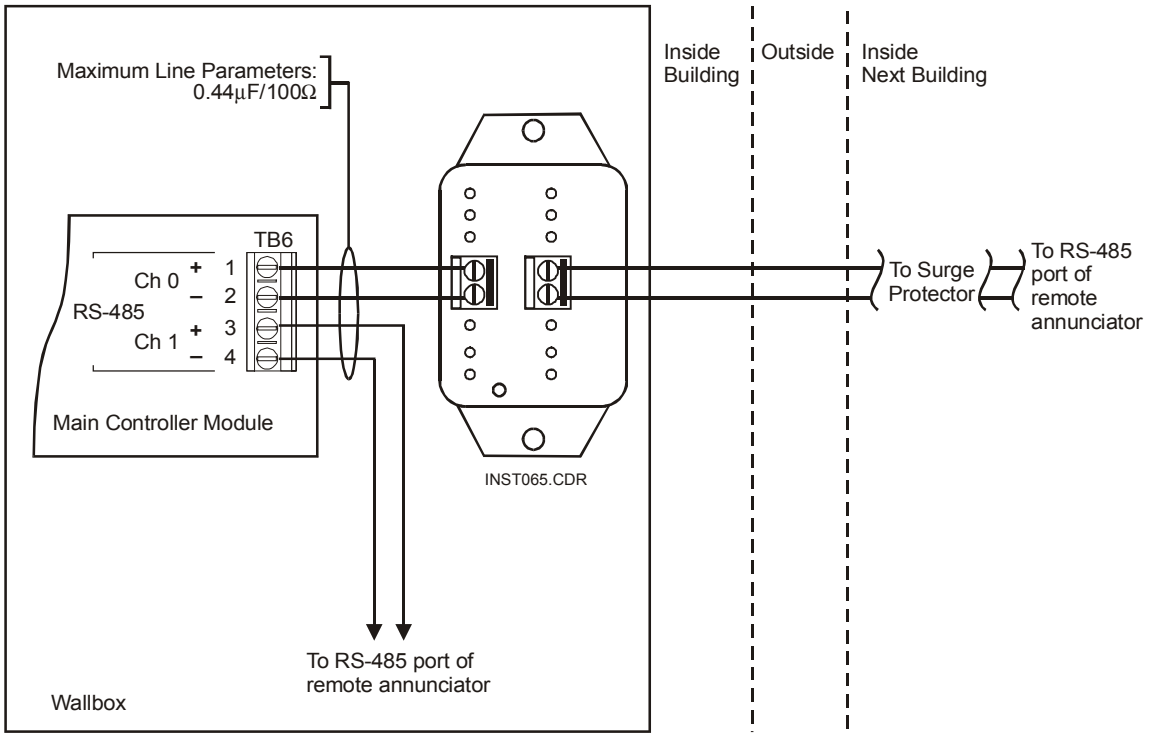


Figure C-2: Surge protector wiring

Wiring the CDR-3 Bell Coder

Some applications require coded fire alarm signals. The CDR-3 Bell Coder provides march time or unique coded outputs for separate zones. Figure C-3 illustrates the wiring for a typical coded signal. Figure C-4 shows how to wire a CDR-3 to an audio circuit. Figure C-5 pictures the wiring of a CDR-3 to NACs on the Main Controller Module.

Note: See the CDR-3 installation sheet (P/N 3100023) for more details about the installation and wiring of the bell coder.

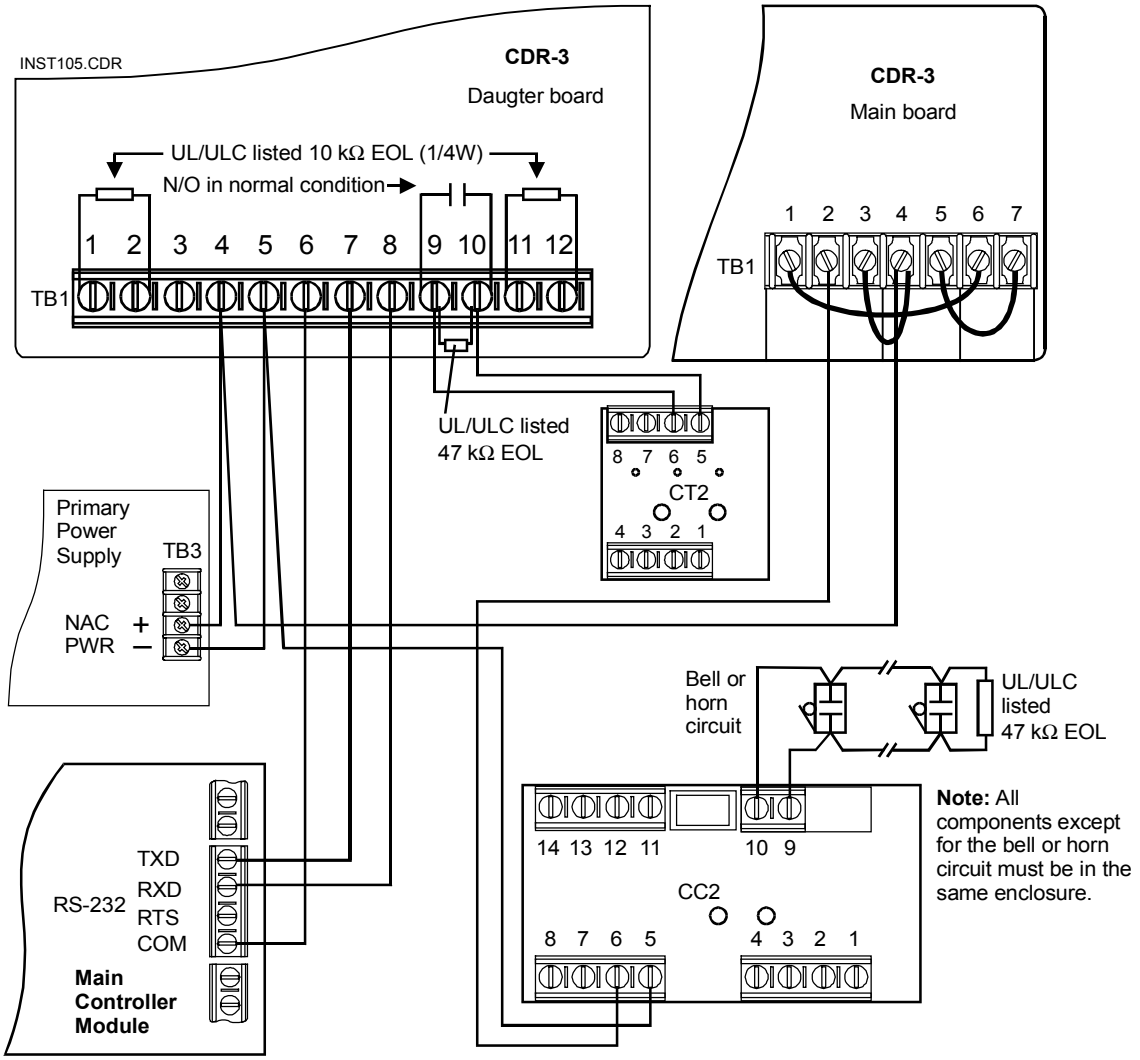


Figure C-3: Coded signal wiring

Note: All components must be in the same enclosure.

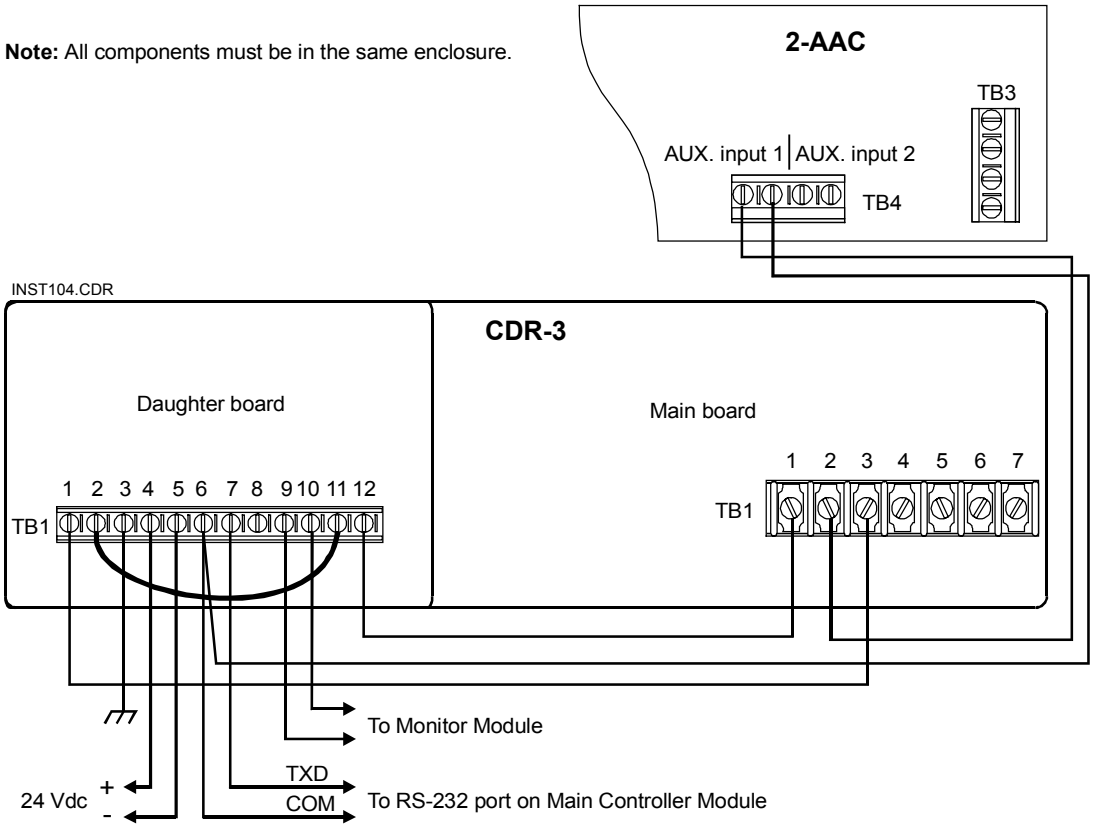


Figure C-4: 2-AAC with coded tone auxiliary output

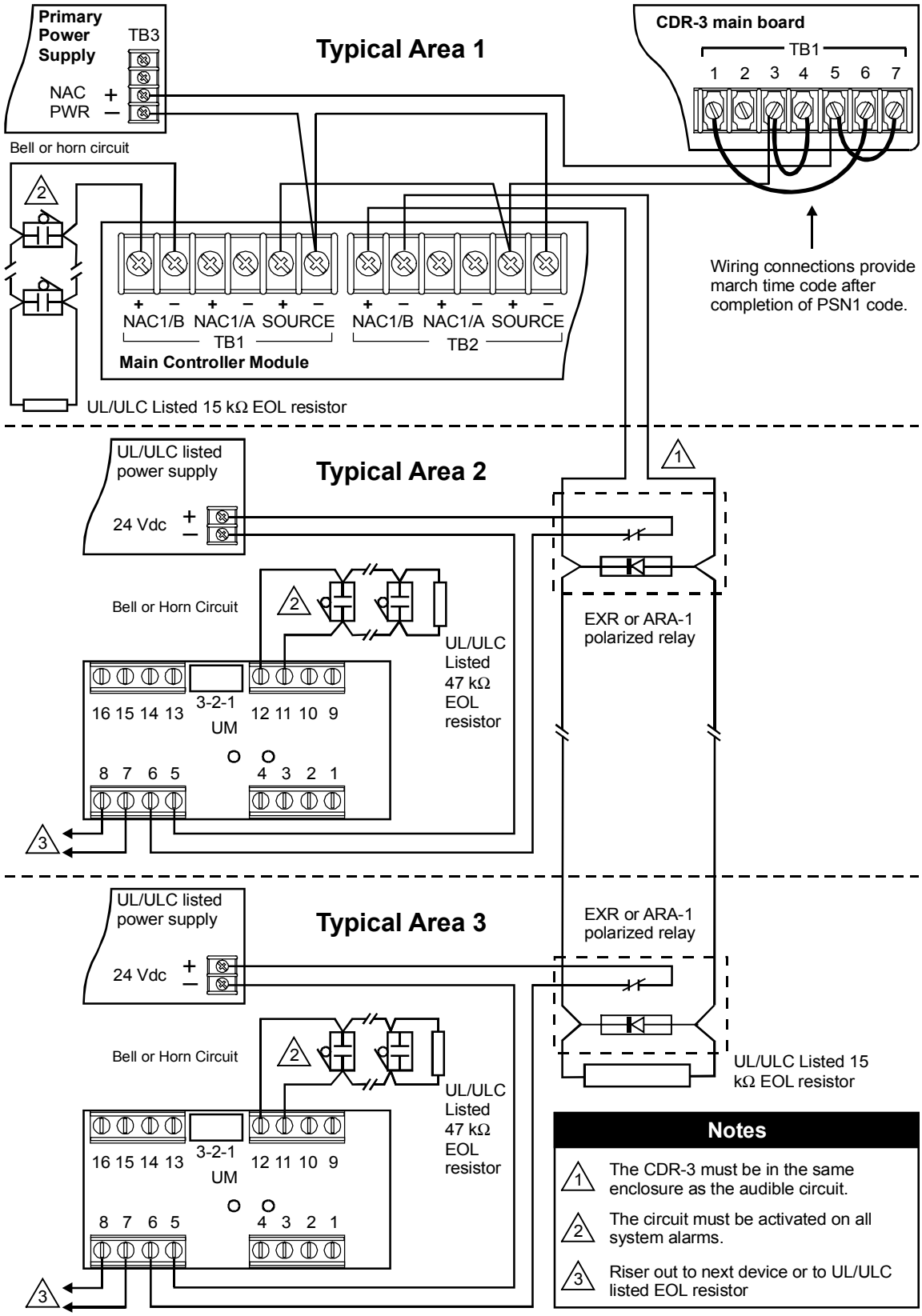


Figure C-5: Coded NAC risers

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