INSTALLED'S

WIRE
GUIDE

A CONCISE POCKET REFERENCE TO WIRE AND CABLE REQUIREMENTS FOR EST PRODUCTS AND SYSTEMS

FIRE ALARM • SECURITY • ACCESS CONTROL • CCTV

Published by Edwards Systems Technology

In conjunction with Paige Electric Co., L.P
## EST CONTACTS

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<thead>
<tr>
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<th>Phone</th>
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In conjunction with Paige Electric Co., L.P.
Wiring diagrams provided herein are for information and reference only and are not to be used for installation purposes. Consult the appropriate installation documents for wiring and configuration details.

This guidebook is for information only and is not intended as a substitute for verbatim legislated requirements. For authoritative specifications regarding the application of life safety, security, and access control systems, consult current editions of applicable codes and standards. For authoritative interpretation of those codes and standards, consult your local authority having jurisdiction.

While every effort has been made to ensure the accuracy and completeness of this guidebook, the authors and publishers assume no responsibility for errors, inaccuracies, omissions, or any inconsistencies herein.

For more information or questions relating to fire alarm products shown in this guide, contact EST. For more information or questions relating to cable products shown in this guide, contact Paige Electric.

Synergy, FullLight Strobe Technology, Genesis, and Signature Series are trademarks of Edwards Systems Technology Inc.

Also from EST Press:

**Security and Access Control Handbook**

- A practical guide to application and system design

**Handbook of Visual Notification Appliances for Fire Alarm Applications**

- A practical guide to regulatory compliance

**Glossary of Fire Alarm and Security Terminology**

- A desk reference for life safety and security professionals
INTRODUCTION

This technical handbook has been designed to provide the users and installers of EST Systems with quick information in a condensed, user-friendly format.

EST/Paige part numbers contained in this handbook have highlighted cable characteristics to allow you to easily identify the cable you require for each installation.

Multiple charts and graphs detail technical data for wire and cable to assist you with calculations.

If we can provide additional technical support, answer any of your daily questions, or assist with your additional requirements, we invite you to contact our technical service hotline.

TOLL FREE HOTLINE:
1-800-655-4497

It is our intention to keep the product information current and accurate. We can not cover specific applications or anticipate all requirements. All specifications are subject to change without notice.

For more information or questions relating to fire alarm products shown in this guide, contact EST.

For more information or questions relating to cable products shown in this guide, contact Paige Electric.
This book is provided to assist system designers and installers in the selection of cables for use with EST products. Those unfamiliar with EST Products should start by selecting a control panel.

The information shown for each control panel includes wiring diagrams and circuit tables.

The circuit type is designated with a letter, (A-Z). In the tables, the letters are listed on the left, on the drawings, letters appear in red diamonds. Once the circuit type (A-Z) is identified, the user can proceed to the Paige Catalog included in this guide.

Users familiar with EST products and their circuit types can proceed directly to the circuit type to obtain the cross reference.

Keys to symbols used in the diagrams can be found on pages 12, 13 and 16. Triangle symbols on diagrams refer to notes on the relevant catalog sheets and technical manuals. Please consult these for further information.

This book contains a wealth of reference information about cable selection and other related topics. This information can be found in the Reference Section.

As always, your comments are welcome. Please let us know how we can improve this guide.

For additional copies, contact: EST Marketing:

By e-mail at: EST.marketing@edwards.spx.com

By telephone: 888-378-2329
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Over a century ago when Robert Edwards installed the world’s first electric fire alarm bell in a New York City church, he began a tradition of innovation that would chart the course of building safety and security for the next 130 years. From pioneering work in multisensor technology, to award-winning design breakthroughs, the company that bears his name has established itself as the leader in cutting-edge systems and technology. Today, that name is synonymous with innovation and quality, and Edwards Systems Technology is widely regarded as the company that has achieved some of the most significant and forward-looking advances in its field. Among EST’s innovations you’ll find:

**Signature Series:** the world’s first truly intelligent multisensor smoke detector combines the output from three sensing elements and compares the results over time against sophisticated algorithms that characterize different types of combustion.

**Synergy Enabled EST3:** the first multi-function network control platform to earn across-the-board listings for fire detection, security, and access control.

**EST peer-to-peer networking:** an innovation that rendered much of the industry’s master/slave networks obsolete virtually overnight.

**Genesis Series:** the world’s smallest and slimmest line of audible and visual notification appliances eliminates bulky specular reflectors used in other emergency strobes and adds design appeal.

In this guide you will find EST products organized into the following subsections:

- Control Panels, FireWorks and Booster Power Supplies
- Initiating Devices: Manual Stations, EC Detectors and other detectors
- Notification Appliances
- Signature Analog Addressable Devices
- Accessories
The FireShield family of conventional panels and accessories consists of three panels, a DACT/dialer, serial remote annunciators and relays, city tie modules and reverse polarity modules. FireShield’s ingenious initiating device circuits (IDCs) can be programmed for one of eight configurations. Several of these configurations allow the use of one zone to do the work of two. Verified detection circuits allow detectors and contact devices (such as pull stations) to be installed on the same zone. Combination circuits allow waterflow switches and their associated valve tamper switches to be connected on a common two-wire IDC.

FireShield panels are available in three sizes and can be ordered with or without the optional DACT:

- **FS302** — The three-zone FS302 is ideal for use as a sprinkler supervisory panel. It includes three Class B IDCs and two Class B NACs.
- **FS502** — Factory configured with five Class B IDCs and two Class B NACs.
- **FS1004** — Factory configured with 10 Class B IDCs and four Class B NACs.

On the FS502 and FS104, IDCs or NACs can be paired to form single Class A circuits.

All panels are available in a red or gray finish.

**Following Page:**
The optional DACT/Dialer is a multifunction module that provides communications, modem capability, and LCD display functions. Its primary function is as a Digital Alarm Communicator Transmitter (DACT).

The FSRSI is ideal for common system annunciation. It includes five LEDs and a local silence/lamp test switch.

The FSRZI-A is used to indicate zones in the alarm state. It contains five red LEDs. The panel can support two modules programmed for each selection.

The Remote Relay Module (FSRRM) can be configured to function in either a zone relay mode or a common system mode.
CONTROL PANELS

FIRESHIELD

DACT (Digital Alarm Communicator Transmitter)

FSRSI (Remote System Indicator)

FSRZI-A (Remote Zone Indicator)

FSRM (Remote Relay Module)

Diagrams are for reference only. Consult the appropriate installation sheet for wiring details.
### Circuit Reference Table - FireShield

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<thead>
<tr>
<th>Ref/Pg</th>
<th>Circuit Type</th>
<th>Circuit Description</th>
<th>Gauges</th>
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<th>Notes</th>
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<td>18 AWG to 12 AWG</td>
<td>Alarm, Waterflow, Supervisory &amp; Monitor circuits</td>
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<td>N</td>
<td>95</td>
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<td>Five dry contact relays. Form C configurable as zone or common</td>
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<td>Telephone Line - DACT connection to RJ31X jack</td>
<td>7 ft long cable supplied with FSDACT</td>
<td>Zinc, FPL, FPLR, FPLP</td>
<td>7 ft long cable supplied with FSDACT</td>
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<td>V</td>
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<td>18 AWG to 12 AWG</td>
<td>Wiring for the FSRSI, FSRZI-A or FSRZI-A</td>
<td>18 AWG to 12 AWG</td>
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For maximum wire lengths see the tables, formulas and matrix in the reference section. For more detail on wiring specifications refer to the product manuals and installation sheets for the specific product. For cable part numbers turn to the Paige / EST Cross Reference Table on the page indicated.
Diagrams are for reference only. Consult the appropriate installation sheet for wiring details.
EST’s QSC life safety control panel provides a cost-effective solution for larger conventional life safety applications. Supporting up to 48 conventional Class B or a combination of 40 Class A and Class B initiating circuits, this panel leaves plenty of room to grow. QSC is compatible with either two- or four-wire conventional detectors. QuickStart’s modular design brings flexibility to every installation. Option cards provide a dialer, auxiliary relays and additional system capacity. QSC also supports as many as eight remote annunciators and up to 60 programmable front panel switches with dual LEDs for system control and display.

Diagrams are for reference only. Consult the appropriate installation sheet for wiring details.
Consult the QuickStart Wiring Reference Table on page 18 for further details.

Initiating Device Circuit – Class A

Initiating Device Circuit – Class B

Class B Notification Appliance Circuit with Genesis Signals and Signal Master for independent horn and strobe control and synchronization.

Notification Appliance Circuit – Class B with Separate Strobe and Horn Circuits

QSC Panel

PT-1S Printer

Up to eight annunciators per panel – Class A or Class B wiring. Second through eighth annunciator must be powered from a Booster Power Supply.

Legend

- Genesis Horn-Strobe
- Enhanced Integrity Horn-Strobe
- Manual Pull Station
- Genesis Signal Master
- Smoke Detector

Diagrams are for reference only. Consult the appropriate installation sheet for wiring details.
EST’s QS1 life safety control panel brings big-system intelligent control to small applications. Supporting up to 250 intelligent detectors and modules, QS1 takes full advantage of EST’s exclusive Signature Series technology, which provides electronic addressing, automatic device mapping, environmental compensation, and true multisensor detection. QuickStart’s innovative design makes it easy to add a dialer or extra auxiliary relays. QS1 also supports as many as eight remote annunciators and up to 30 programmable front panel switches with dual LEDs for system control and display. The benefits brought by QS1 to retrofit applications underscore the true potential of this powerful system. As an intelligent panel, QS1 supports Signature Series devices, which can use existing wiring in most retrofit applications. This makes upgrading from a conventional system to analog control a simple operation with minimal disruption to normal operations at the site.

Legend for diagrams on pages 14 & 15

- Enhanced Integrity Horn-Strobe
- Smoke Detector with Relay Base
- Smoke Detector with Isolator Base
- 2-Wire Smoke Detector
- Manual Pull Station
- End-of-Line Resistor
- Programmable I/O Module
- Universal I/O Module
- Dual Circuit Input Module
- Control Relay Module
- Signal Module
- Riser Monitor Module
- Monitor Module
- Junction Box

Diagrams are for reference only.
Consult the appropriate installation sheet for wiring details.
CONTROL PANELS

QUICKSTART QS1 CLASS A SIGNATURE DATA CIRCUIT

Consult the QuickStart Wiring Reference Table on page 18 for further details.

Class A Notification Appliance Circuit with Genesis Signals and Signal Master for Independent Horn and Strobe Control and Synchronization over two conductors.

Class B Notification Appliance Circuit

Critical Process Monitoring with Control

Waterflow Switch

Sprinkler Supervisory Switch

Elevator Capture

Up to eight annunciators per panel – Class A or Class B wiring. Second through eighth annunciator must be powered from a Booster power supply

2 pr. Class B or 4 pr. Class A

QS1 Panel

PT-1S Printer

see legend on page 13
CONTROL PANELS
QUICKSTART QS1 CLASS B SIGNATURE DATA CIRCUIT

Consult the QuickStart Wiring Reference Table on page 18 for further details.

see legend on page 13

RM

2 Pr. Horn and Strobe Synchronization with Audible Silence

24 Vdc 1 Pr.

Horn and Strobe Synchronization with Audible Silence

CM

Signature Data Circuit (1 pr.)

2 Pr.

Fire Damper

Class B Notification Appliance Circuit with Genesis Signals and Signal Master for Independent Horn and Strobe Control and Synchronization over two conductors.

CC1

2nd Floor

1 Pr.

Horn and Strobe Control (2 pr)

24 Vdc 1 Pr.

Critical Process Monitoring

MM1

2 Pr.

Waterflow Switch

Sprinkler Supervisory Switch

CT2

F

1 Pr.

Notification Appliance Circuit: Horn and Strobe Synchronization with Audible Silence

PM

QS1 Panel

PT-1S Printer

Up to eight annunciators per panel – Class A or Class B wiring. Second through eighth annunciator must be powered from a Booster Power Supply.

2 pr. Class B or 4 pr. Class A
EST’s QS4 QuickStart life safety control panel provides conventional and intelligent addressable circuits in a single intelligent control panel. Supporting up to 1,000 intelligent detectors and modules, QS4 takes full advantage of EST’s exclusive Signature Series technology, which provides electronic addressing, automatic device mapping, environmental compensation, and true multisensor detection. As a hybrid system, QS4 combines support for four Signature addressable circuits (1000 addressable points) along with up to 48 conventional Class B or a combination of 40 Class A and Class B initiating circuits. Compatible with either two- or four-wire detectors, conventional detectors. QuickStart’s design leaves plenty of room for system expansion. Option cards include a dialer, auxiliary relays, and additional system capacity. The QS4 also supports as many as eight remote annunciators and up to 60 programmable front panel switches with dual LEDs for system control and display.

Legend for diagram on page 17

- Enhanced Integrity Horn-Strobe
- Smoke Detector
- Smoke Detector with Relay Base
- Smoke Detector with Isolator Base
- Dual Circuit Input Module
- 2-Wire Smoke Detector
- Manual Pull Station
- End-of-Line Resistor
- Programmable I/O Module
- Universal I/O Module
- Control Relay Module
- Signal Module
- Riser Monitor Module
- Monitor Module
- Junction Box

Diagrams are for reference only. Consult the appropriate installation sheet for wiring details.
CONTROL PANELS

QUICKSTART WIRING DIAGRAM

Diagrams are for reference only. Consult the appropriate installation sheet for wiring details.

Class A Notification Appliance Circuit with Genesis Signals & Signal Master for Independent Horn & Strobe Control and Synchronization over two conductors.

Class B Notification Appliance Circuit with Genesis Signals & Signal Master for Independent Horn & Strobe Control and Synchronization over 2 conductors.

Initiating Device Circuit – Class A

Initiating Device Circuit – Class B

Class B Notification Appliance Circuit with Genesis Signals & Signal Master for Independent Horn & Strobe Control and Synchronization over two conductors.

Notification Appliance Circuit – Class A with Combination Horn-Strobe Circuit

Up to eight annunciators per panel – Class A or Class B wiring. Second through eighth annunciator must be powered from a Booster Power Supply.
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<th>Circuit Type</th>
<th>Gauges</th>
<th>Description</th>
<th>Notes</th>
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<tr>
<td>A</td>
<td>Initiating Device Circuit (IDC)</td>
<td>18 AWG to 12 AWG</td>
<td>TFN, THHN, FPL, FPLR, FPLP</td>
<td>Input circuits on ZB16-4, ZA8-2 and modules (CT1, CT2, WTM, MM, UM &amp; MAB)</td>
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<td>B</td>
<td>Notification Appliance Circuit (NAC) 24 Vdc</td>
<td>18 AWG to 12 AWG</td>
<td>TFN, THHN, FPL, FPLR, FPLP</td>
<td>Output Circuits on SLIC, ZB16-4, ZA8-2, and modules (CC1, CC2, UM, &amp; MAB)</td>
</tr>
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<td>Signature Addressable Loop</td>
<td>18 AWG to 12 AWG</td>
<td>TFN, THHN, FPL, FPLR, FPLP</td>
<td>Loop Controller (SLIC) card to addressable devices</td>
</tr>
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<td>I</td>
<td>24 Vdc Power distribution (Smoke Acc. &amp; AUX Power)</td>
<td>18 AWG to 12 AWG</td>
<td>TFN, THHN, FPL, FPLR, FPLP</td>
<td>4 Wire Detector/Relay/Annnc. AWG depends on voltage drop</td>
</tr>
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<td>N</td>
<td>Relay Module (ZR8)</td>
<td>18 AWG to 12 AWG</td>
<td>TFN, THHN, FPL, FPLR, FPLP</td>
<td>Eight dry contact relays (ZR8) Form A or B configurable.</td>
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<td>Telephone Line - DACT connection to RJ31X jack</td>
<td>7 ft cable supplied with FSDACT supplied with DACT</td>
<td>Terminal to Plug cable</td>
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<td>18 AWG 4 cond. min.</td>
<td>FPL, FPLR, FPLP</td>
<td>50 Ft Max. Panel to Printer</td>
</tr>
<tr>
<td>U</td>
<td>Communications Network RS-485</td>
<td>18 AWG to 12 AWG</td>
<td>FPL, FPLR, FPLP</td>
<td>Annunciator to Panel and Network Annunciator</td>
</tr>
</tbody>
</table>

For maximum wire lengths see the tables, formulas and matrix in the reference section.
For more detail on wiring specifications refer to the product manuals and installation sheets for the specific product.
CONTROL PANELS

QUICKSTART OPTION CARDS

NT-A Class A RS-485 Card/UART Port

ZR8 Relay Card

ZB16-4 Class B Zone Card

SLIC Signature Loop
Intelligent Controller

ZA8-2 Class A Zone Card

Diagrams are for reference only. Consult the appropriate installation sheet for wiring details.

EST
CONTROL PANELS

QUICKSTART OPTION CARDS AND ACCESSORIES

DLD Dual Line Dialer

RJ31X 8 PIN MODULAR CONNECTOR FOR PHONE LINE #1

RJ31X 8 PIN MODULAR CONNECTOR FOR PHONE LINE #2 (WIRED SAME AS PHONE LINE #1)

SURGE PROTECTOR
RING (RED)
TIP (GREEN)
PRIMISES PHONES

NO T-TAPS PERMITTED

TO PHONE LINE #2

RING (RED)
TIP (GREEN)

8 PIN MODULAR CONNECTOR FOR PHONE LINE #1

PHONE LINE #2 (WIRED SAME AS PHONE LINE #1)

1 8
7
6
5
4
3
2
1

RING RNG RNG RNG RNG

TB1

IN OUT IN OUT

LINE 1 LINE 2

2-CTM
City Tie Module

24 Vdc Power riser out

24 Vdc Power riser out

Alarm/Supervisory Wiring

Master Box

Municipal Circuit

PT-1S Serial Printer

24V+
24V-
COM
RX
TX

DB-25P REAR VIEW

PB6 TB1–18
PB6 TB1–17
PB6 TB1–16

DB-25P REAR VIEW

COM–COM
TX–RX
RX–TX
RxD–TxD
TxD–RxD

SIGA-CC1
/MCC1

(see page 24 for 9-pin wiring)

Other Accessories:
CDR-3 Coder (for wiring diagram see page 33)
RPM Reverse Polarity Card (no wiring diagram available)
EST3 is a modular system uniquely designed to easily meet the needs of standalone single node systems or multimode networks. Fire alarm, security, access control and audio functions use the same fundamental components, simplifying system layouts.

EST3 is a superbly adaptable life safety system, lending itself to medium and large building applications. Cabinets are available with room for system batteries up to 65 Amp hours. With EST3, one 24-volt battery supports up to four power supplies. Each supply will support up to 7 Amp load. With four supplies, 28 Amps of current is available — all backed up by a common battery.

EST3 operates on a multi priority peer-to-peer token ring network. The multi-priority token ring gives EST3 exceptional response. EST3 token ring network configuration also permits vast distances between nodes. The allowable distance between nodes on #18 AWG (0.75mm²) is 5,000 ft (1,523 m). With 64 nodes supported on a network, the total network length is in excess of 300,000 ft (91,400 m), or nearly 60 miles! A single node supports up to 10 Signature loop controllers with 250 devices per loop, (2,500 points total per node, 160,000 points per network).

Taking full advantage of digital technology, up to eight channels of audio sources can be sent over a single twisted pair of wires between nodes. Coupling the inherent reliability and performance of zoned amplifiers with EST3 simplified user interfaces makes audio system design and operation both easy and dependable.

EST3 is the right choice for any medium to large application. Its multiplex functions are second to none in the industry today.
## Control Panels

### Circuit Reference Table - EST

For cable part numbers turn to the Page/EST Cross Reference Tables on the pages indicated below.

<table>
<thead>
<tr>
<th>Ref/Pg</th>
<th>Circuit Type</th>
<th>Notes</th>
<th>Description</th>
<th>Gauges</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Initiating Device Circuit (IDC)</td>
<td>18 AWG to 12 AWG</td>
<td>TFN/THHN, FPL, FPLP</td>
<td>95</td>
</tr>
<tr>
<td>B</td>
<td>Notification Appliance Circuit (NAC)</td>
<td>18 AWG to 12 AWG</td>
<td>Twisted Pair - FPLR, FPL, FPLP</td>
<td>95</td>
</tr>
<tr>
<td>C</td>
<td>Signature Addressable Loop</td>
<td>18 AWG to 12 AWG</td>
<td>TFN/THHN, FPL, FPLP</td>
<td>95</td>
</tr>
<tr>
<td>D</td>
<td>Analog Addressable Loop</td>
<td>18 AWG to 12 AWG</td>
<td>TFN/THHN, FPL, FPLP</td>
<td>95</td>
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<tr>
<td>E</td>
<td>Security Device Circuit</td>
<td>18 AWG to 12 AWG</td>
<td>TFN/THHN, FPL, FPLP</td>
<td>95</td>
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<tr>
<td>F</td>
<td>Security (3-SAC) Bus</td>
<td>18 AWG to 14 AWG</td>
<td>FPL, FPLP</td>
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</tr>
<tr>
<td>G</td>
<td>Card/PIN Reader</td>
<td>22 AWG to 16 AWG</td>
<td>FPLR, FPLP or CM, CMR, CMP</td>
<td>96</td>
</tr>
<tr>
<td>H</td>
<td>Firemen’s Telephone</td>
<td>18 AWG to 12 AWG</td>
<td>TFN/THHN, FPL, FPLP</td>
<td>96</td>
</tr>
<tr>
<td>I</td>
<td>24 Vdc Power Distribution</td>
<td>18 AWG to 12 AWG</td>
<td>TFN/THHN, FPL, FPLP</td>
<td>95</td>
</tr>
<tr>
<td>J</td>
<td>Relay Module (FSRRM)</td>
<td>18 AWG to 12 AWG</td>
<td>TFN/THHN, FPL, FPLP</td>
<td>95</td>
</tr>
<tr>
<td>K</td>
<td>CO Telephone Line</td>
<td>18 AWG to 12 AWG</td>
<td>TFN/THHN, FPL, FPLP</td>
<td>95</td>
</tr>
<tr>
<td>L</td>
<td>RS-232 Communications</td>
<td>18 AWG to 12 AWG</td>
<td>TFN/THHN, FPL, FPLP</td>
<td>95</td>
</tr>
<tr>
<td>M</td>
<td>Network Fiber Optics</td>
<td>18 AWG to 12 AWG</td>
<td>TFN/THHN, FPL, FPLP</td>
<td>95</td>
</tr>
<tr>
<td>N</td>
<td>Network-16D Router Cable (Ethernet)</td>
<td>18 AWG to 12 AWG</td>
<td>TFN/THHN, FPL, FPLP</td>
<td>95</td>
</tr>
<tr>
<td>O</td>
<td>Network-16D Router Cable (Ethernet)</td>
<td>CAT 5E/6</td>
<td>CMR, CMG</td>
<td>100</td>
</tr>
<tr>
<td>P</td>
<td>Network Short-Haul Modems</td>
<td>26 AWG Min.</td>
<td>CM</td>
<td>100</td>
</tr>
<tr>
<td>Q</td>
<td>Network-16D Router Cable (Ethernet)</td>
<td>CAT 5E/6</td>
<td>CM</td>
<td>100</td>
</tr>
<tr>
<td>R</td>
<td>Fiber Optic (FIB)</td>
<td>Fiber Optic</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

For maximum wire lengths consult the reference section. For more detail on wiring specifications refer to the product manuals and installation sheets for the specific product.
3-CPU1 Central Processor Unit Module
As a single node standalone system, the 3-CPU1 can control up to 19 local rail modules. For larger systems, up to 64 nodes interconnect on a peer-to-peer multi-priority token ring protocol network.

Communications Cards (mount to back of module)
3-RS232: Two optically-isolated RS-232 ports support connection of a printer and/or an external command center.
3-RS485A/B: The 3-RS485A card provides a Class A or Class B circuit for network communications signal and two additional circuits for Class A digitized audio signals. The 3-RS485B card provides one Class B circuit for network communications and one for the digitized audio signals.
The Audio Source Unit (3-ASU/3-ASUFT) converts analog signals to digital signals. These units support connection of a local microphone, remote microphone, telephone voice line, and auxiliary audio input.
The 3-SSDC and 3-SDDC Signature Driver Controller modules provide an intelligent interface between the 3-CPU(1) module and Signature Series fire alarm and security devices.

3-SSDC Single Signature Driver Controller Module (supports one Signature Data circuit)

3-SDDC Signature Dual Driver Controller Module (supports two Signature circuits)

3-SDC Signature Device Card (upgrades a 3-SSDC to a 3-SDDC)
CONTROL PANELS

3-IDC8/4 Initiating Device Circuit (Hardwired) Module

**INITIATING DEVICE CIRCUIT (IDC)**
Connect to IDC 3, 4, 5, or 6
IDC/NAC 1, 2, 7, or 8

**NOTIFICATION APPLIANCE CIRCUIT (NAC)**
Connect to IDC/NAC 1, 2, 7, or 8

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3-MODCOM Modem Communicator

**SURGE PROTECTOR**
RING (RED)
TIP (GREEN)

**PREMISES PHONES**

**RJ31X 8 PIN MODULAR CONNECTOR FOR PHONE LINE #1**

**RJ31X 8 PIN MODULAR CONNECTOR FOR PHONE LINE #2**

7 Ft. (2.13 m)

**MODCOM (front view)**

Diagrams are for reference only. Consult the appropriate installation sheet for wiring details.
CONTROL PANELS

EST3 MODULES

3-OPS Off Premise Signaling Module

Fiber Optics Interface

Diagrams are for reference only. Consult the appropriate installation sheet for wiring details.
CONTROL PANELS

SECURITY & ACCESS CONTROL

3-SAC
Security/Access Control Module

Class A wiring

From 24 Vdc circuit or local 120 Vac

CRC

KPDISP

Keypad Display

24 Vdc supply

From last device

RS-485 line

To next device

CRC

120 Ω Terminating Resistor

KPDISP

Card Reader Controller

CRC

Card Reader Controller

To next CRC or other device

Reader wire connections

From Strike/maglock

Dry Contact connections

To next CRC or other device

From power supply

From plug-in transformer

Red (+)

Black (-)

To battery

16.5 Vac IN

16.5 Vac IN

+24 V IN

-24 V OUT

Strike PWR

Strike GND

NO NC

Reader PWR

Reader GND

Data 0

Data 1

LED A

LED B

Sounder

+ RS-485 IN

- RS-485 IN

- RS-485 OUT

From 3-SAC module or previous CRC

To next CRC or 120 EOL if this is the last device on Class B or back to 3-SAC module if Class A.

From 24 Vdc circuit or local 120 Vac

120 Ω Terminating Resistor

From 24 Vdc circuit or local 120 Vac

Terminating Resistor

Terminating Resistor

Diagrams are for reference only. Consult the appropriate installation sheet for wiring details.
CONTROL PANELS

EST3 NETWORK ACCESSORIES

IOP3A Isolated RS-232 Card

NOTE: The IOP3A must be configured in supervision mode.

IOP3A to 3-CPU1 wiring

Switch shown in UP position.

Diagrams are for reference only.
Consult the appropriate installation sheet for wiring details.
Network Short Haul Modem Communications Interface
3-NSHM1 single modem connection
3-NSHM2 two modem connection

Network B to A wiring using the NSHM1

Network A to B wiring using the NSHM1

Network wiring using the NSHM2

Diagrams are for reference only. Consult the appropriate installation sheet for wiring details.
IOP3A RS-232 Optical Isolator Card

Wiring diagram continues on page 33
CONTROL PANELS

EST3 NETWORK ACCESSORIES

CDR-3 Coder

Diagrams are for reference only. Consult the appropriate installation sheet for wiring details.
CONTROL PANELS

EST3 NETWORK ACCESSORIES

MTM-1 March Time Module

Diagrams are for reference only. Consult the appropriate installation sheet for wiring details.
**GFD Fround Fault Detection Module**

- Pair one in
- Pair two in
- To 24 V AC/DC
- To Telephone Line
- To Telephone
- To Optional 12 VDC Standby Battery
- To Optional NO Trouble Silence Switch
- To supervisory module (i.e. Signature Series CT1 or CT2 module) or 3-IDC traditional zone card.

**API-8/232ME Alphanumeric Pager Interface**

- Interface Trouble Contacts
- To Optional 12 VDC Standby Battery
- To 24 V AC/DC
- To Telephone
- To Telephone Line
- To Printer Port of Initiating System
- Optional NO Reset Switch

**Other Accessories:**

PT-1S Serial Printer (see page 20 for wiring)

Diagrams are for reference only. Consult the appropriate installation sheet for wiring details.
Remote Annunciator

Use EST3 remote annunciators wherever a compact system status display is needed. Annunciator configurations include: LCD only display, LED only display, or combination LED and LCD display in a single enclosure. Display and control is provided by the 3-LCD and Control Display Modules.

Control/Display modules install over any annunciator support module, maximizing annunciator design flexibility. A lamp test feature can program to any spare control switch. If a 3-LCD display is installed in the annunciator, simply operate the Alarm Silence and Trouble Silence switches simultaneously to lamp test all LEDs. 3-REMICA remote microphones can also be installed in annunciator cabinets.
CONTROL PANELS

EST3 NETWORK ANNUNCIATORS

Envory Graphic Annunciator

Envoy graphic annunciators and smoke control panels are designed to present complex status and control information in an easy to understand package. The design of Envoy products permits users to rapidly determine system status and easily operate associated system controls. The addition of system LCD annunciators and remote microphones can turn Envoy into a complete fire command station.

For wiring information see the EST3 wiring diagram on page 24.
FireWorks is a family of software and hardware options designed to work in concert with EST life safety and property protection systems. FireWorks provides a simple user interface, taking what could be an overwhelmingly large amount of information and presenting it in an easy-to-understand format. FireWorks does this by dividing major system functions into easy-to-manage quadrants. These quadrants make the system very intuitive to use because information is presented logically. To further enhance usability, FireWorks is event driven. This greatly increases the user’s ability to deal with system events by eliminating the confusion sometimes experienced when systems present all information at once. FireWorks automatically prioritizes the events for the user in an Event Quadrant. Here the highest priority event is displayed first, and the lowest priority event is displayed last. This allows the user to quickly determine which events warrant the most immediate attention.
**CONTROL PANELS**

**FIREWORKS WIRING DIAGRAM**

---

**Notes:**
- RS-232 Line Supervised and power limited maximum length 50ft.
- FireWorks meets UL864 category UJOZ when rack mounted and UPS backed up. Contact the AHJ for other application configurations.

**Diagram 1:**
- EST3, EST2 IRC-3 or FCC Fire Panel
- CCTV Controller
- FireWorks Workstation (FW5)
- 120 Vac
- MFC-A Mini-Mux with FCOM-FIB Module
- 24Vdc

**Diagram 2:**
- EST3 or EST2 Fire Panel
- EST3, EST2 IRC-3 or FCC Fire Panel
- CCTV Controller
- FireWorks Workstation (FW3)
- 120 Vac

---

Diagrams are for reference only. Consult the appropriate installation sheet for wiring details.
The Remote Booster Power Supply is a self-contained 24 Vdc power supply designed to augment fire alarm audible and visual power requirements. The booster contains all of the necessary circuits to monitor and charge batteries, control and supervise four Class B or two Class A NAC circuits and monitor two controlling inputs from external sources. Simple switch selection provides a wide variety of operational configurations. Each remote booster power supply is supplied with its own enclosure providing ample space for additional interface modules and battery compartment. The BPS is available in either a 6.5 or 10 amp version @ 24 Vdc. The Remote Booster Power Supply provides additional power for audible and visual devices when constrained by system capacity or site application. Fault conditions detected by the BPS will open the main panel’s NAC. This initiates a trouble condition and eliminates the need to wire a separate trouble contact back to the control panel. During alarm condition, detected faults are overridden and the main panel’s default configuration is restored. The BPS’s default output configuration is continuous 24 Vdc on all NACs. This output is typically used to drive visual BPS notification appliance circuits.

see EST3 reference table on page 22
Manual Pull Stations

**Metal Manual Pull Stations**

**270 Series**: Single action, break glass. Available with normally open, normally closed or combination NO/NC contacts. 270 Series with screw terminals for field connection. 270A Series with 6-inch wire leads.

**270P Series**: Break glass, normally open pre-signal station. Screw terminals.

**Lexan Manual Pull Stations**

The EST 276B/277B series includes single and double action stations, both available with either terminals or 6” wire leads for field wiring connections. All types can be either pre-signal or general alarm and are available with single or double pole alarm contacts that can be normally open, normally closed or a combination of both.

**276B Series**: Single action w/ terminals

**277B Series**: Single action w/ wire leads

**278B Series**: Double action w/ terminals

**279B Series**: Double action w/ wire leads

**Institutional Manual Stations**

**1534-1**: Key-operated Station (deters tampering)

**Hazardous Location Manual Station**

**XAL-53**: rugged double-action fire alarm

Diagrams are for reference only. Consult the appropriate installation sheet for wiring details.
INITIATING DEVICES

EC SERIES DETECTORS

Smoke and Heat Detectors

EC30U-3: Low-profile Plug-in Photoelectric Detector for all fire types.
EC20FTU-3: Low-profile Plug-in Fixed Temperature Heat Detector for locations that experience fluctuations in ambient temperature (laundries, industries).
EC20RRU-3: Low-profile Plug-in Rate-of-Rise Heat Detector for locations where ambient temperature is relatively constant but where steam and smoke are present (kitchens, shower rooms).

Duct Detector
EC30DU-3: Photoelectric Duct Smoke

Detector Accessories
CSBU-1: Standard Detector Base
6260A-CU: Duct Smoke Detector Housing
EC-LED: Remote Alarm LED
EC-DTS: Remote LED/Test Station

CSBU-1 wiring to EC-LED or C-DTS

Diagrams are for reference only. Consult the appropriate installation sheet for wiring details.
The SuperDuct four-wire duct is designed specifically for rooftop HVAC systems. The detector assembly provides easy access to the smoke sensor, its wiring connections, sample and exhaust tube fittings, and the smoke chamber itself. Air enters the assembly by means of an air sampling tube (ordered separately), and exits by means of a six-inch exhaust tube (included).
INITIATING DEVICES

BEAM DETECTORS

Fireray 200 Beam Detector

The Fireray 2000 is a projected beam smoke detector designed to detect smoke in a large volume. The system is comprised of three pieces, a transmitter head, a receiver head, and a control box.

Fireray Wiring

Reflective Beam Smoke Detector (EC-50R/-100R)

Single Zone Wiring

The EC-50R/-100R comprises a transmitter and receiver in a single enclosure and is usually installed between 19 and 24 inches below the ceiling.

Low-level Tester Wiring
Genesis (wall mount) Chimes, Chime-strobes: GC-HVDM

The Genesis line of signals are the smallest, most compact audible-visible emergency signaling devices in the world. Speaker-strobes feature 15, 30, 75 or 110 candela output, selectable with a conveniently-located switch on the bottom of the device. All Genesis strobes self-synchronize when installed with the Genesis Signal Master or SIGA-CC1S module.

Genesis chimes automatically pulse at 60 strokes per minute, when steady (non-stroked) voltage is applied, or may be field-configured for temporal output. When installed with a G1M Signal Master Module, the chime may also be field-configured for coded operation, which enables the chime output to match the rate that voltage is applied to the circuit. Peak output level is 79 dBA (peak). The chime may be set for low dB output with a jumper cut that reduces sound output by about 5 dB.

Models:
- G1-CVM Genesis Chime-Strobe (selectable 15, 30, 75, or 110 cd output, selectable high/low dB output)
- G1-C Genesis Chime (selectable high/low dB output)
- G1F-CVM Genesis Chime-Strobe (selectable 15, 30, 75, or 110 cd output, selectable high/low dB output) — with "FIRE" marking
- G1F-C Genesis Chime (selectable high/low dB output) — with "FIRE" marking
- SIGA-CC1S Intelligent Synchronization Output Module (2-gang)
- SIGA-MCC1S Intelligent Synchronization Output Module (Plug-in UIO)

Chime Wiring

Note: Strobes must have continuous voltage.

Diagrams are for reference only. Consult the appropriate installation sheet for wiring details.
NOTIFICATION APPLIANCES

Genesis (ceiling mount) Field Configurable Horns, Strobes, Synchronization module

Models:
- GC-HDVM: Genesis Ceiling/Wall Horn-Strobe (selectable 15, 30, 75, or 95 cd output)
- G1M-RM: Genesis Signal Master — Remote Mount (1-gang)
- GC-VM: Genesis Ceiling Strobe (selectable 15, 30, 75, or 95 cd output)
- GCF-VM: Genesis Ceiling Strobe (selectable 15, 30, 75, or 95 cd output) with FIRE marking.
- SIGA- CC1S: Intelligent Synchronization Output Module (2-gang)
- SIGA- MCC1S: Intelligent Synchronization Output Module (Plug-in UIO)

Diagram:
- **Horn Wiring**
  - Polarity shown in alarm condition
  - Note: Strobes must have continuous voltage.

- **Strobe Wiring**
  - To listed fire alarm control panel
  - To next device or end of line device

Diagrams are for reference only. Consult the appropriate installation sheet for wiring details.
Genesis (wall mount) Speakers

All Genesis speakers include a DC blocking capacitor to allow electrical supervision of the audio distribution circuit. Models for 25 V_{RMS} and 70 V_{RMS} circuits are available. \( \frac{1}{4} \) W to 2 W operation is selectable with a conveniently-located switch on the bottom of the device.

Models:
- **G4-S2VM**: 25 Volt Speaker-strobe with selectable 15, 30, 75, or 110 cd output
- **G4-S7VM**: 70 Volt Speaker with selectable 15, 30, 75, or 110 cd output
- **G4-S2**: 25 Volt Speaker
- **G4-S7**: 70 Volt Speaker
- **G1M-RM**: Synchronization Output Module (1-gang)

---

Diagrams are for reference only. Consult the appropriate installation sheet for wiring details.
Genesis (ceiling mount) Field Configurable Speakers and Speaker/Strobes

Genius (ceiling mount) Field Configurable Speakers and Speaker/Strobes

Speaker Wiring

- Input voltage matching the voltage rating of the speaker (25 or 70 Vrms)
- To listed fire alarm control panel
  - +
  - To next device or end of line device

Speaker/Strobe Wiring

- Input voltage matching the voltage rating of the speaker (25 or 70 Vrms)
- To listed fire alarm control panel
  - +
  - Input voltage matching the voltage rating of the strobe
  - To next device or end of line device

Models:

- GC-S2VM 25 Volt Speaker-strobe, c/w selectable 15, 30, 75, or 95 cd output
- GC-S7VM 70 Volt Speaker-strobe, c/w selectable 15, 30, 75, or 95 cd output
- GC-S2 25 Volt Speaker with selectable ¼, ½, 1, or 2 watt taps.
- GC-S7 70 Volt Speaker with selectable ¼, ½, 1, or 2 watt taps.

Diagrams are for reference only. Consult the appropriate installation sheet for wiring details.
964 and 965 Series Speaker and Speaker/Strobe

These Speakers and Speaker/Strobes are available in either 4 inch or 8 inch size. 964 Series speakers connect to 25 Vrms audio circuits. 965 Series speakers connect to 70 Vrms audio circuits. The strobe must be connected to signal circuits which output a constant (not pulsed) 24 Vdc voltage.

Models (R = round):

25 volt
- 964-1A-4R Speaker
- 964-5A-4R Speaker-Strobe, 15cd
- 964-7A-4R Speaker-Strobe, 15/75cd
- 964-3A-4R Speaker-Strobe, 30cd
- 964-8A-4R Speaker-Strobe, 110cd

70 volt
- 965-1A-4R Speaker
- 965-5A-4R Speaker-Strobe, 15cd
- 965-7A-4R Speaker-Strobe, 15/75cd
- 965-3A-4R Speaker-Strobe, 30cd
- 965-8A-4R Speaker-Strobe, 110cd
964 and 965 Series Speaker and Speaker/Strobe

These Speakers and Speaker/Strobes are available in either 4 inch or 8 inch size. 964 Series speakers connect to 25 Vrms audio circuits. 965 Series speakers connect to 70 Vrms audio circuits. The strobe must be connected to signal circuits which output a constant (not pulsed) 24 Vdc voltage.

KEY:  Key:  – Speaker Symbol

A signal matching the input voltage rating of the speaker (25 or 70 Vrms)

CAUTION: Electrical supervision requires wire run to be broken at each device.

Models (S=square):
964-1A-4S same as those listed on page 49
Synchronized Strobes - 405 Series

405 Series strobes are available with 15 cd, 15/75 cd, 30 cd, 60 cd, and 110 cd effective flash intensity and are fully compatible with Genesis signals.

- 405-5A-T Strobe, 15 cd
- 405-7A-T Strobe, 15/75 cd
- 405-3A-T Strobe, 30 cd
- 405-6A-T Strobe, 60 cd
- 405-8A-T Strobe, 110 cd

Outdoor Listed Strobes

- CS405-7A-T Strobe, 15/75, Outdoor
- CS405-8A-T Strobe, 110 cd, Outdoor

Wiring for 405 and 202 Series Strobes

202 Series Mini-strobes

202 Series strobes are available with 15/75 cd, and 110 cd effective flash intensity. They are fully compatible with Genesis signals.

- 202-7A-T Strobe - 15/75 cd
- 202-8A-T Strobe - 110 cd
- 203-8A-T Strobe - 110 cd, 120 Vac
NOTIFICATION APPLIANCES

INTEGRITY

757 Series Speaker Strobes

Integrity strobes synchronize to the latest UL 1971 requirements when used with an external control module (G1M or SIGA-CC1S). High efficiency speaker produces a loud 90 dBA at 2 watts. Easy to select for ¼, ½, 1, or 2 watt operation. Integrity speakers are supplied with a DC Blocking Capacitor for audio circuit supervision.

Diagrams are for reference only. Consult the appropriate installation sheet for wiring details.
NOTIFICATION APPLIANCES

INTEGRITY

757 Series Re-entrant Speaker and Speaker/Strobes (outdoor use)

25 Volt Re-Entrant Speakers
757-1A-R25 Speaker
757-7A-RS25 Speaker-Strobe, 15/75cd
757-3A-RS25 Speaker-Strobe, 30cd
757-8A-RS25 Speaker-Strobe, 110cd

70 Volt Re-Entrant Speakers
757-1A-R70 Speaker
757-7A-RS70 Speaker-Strobe, 15/75cd
757-3A-RS70 Speaker-Strobe, 30cd
757-8A-RS70 Speaker-Strobe, 110cd

Diagrams are for reference only. Consult the appropriate installation sheet for wiring details.
757 Series Temporal Horn and Horn-strobe

Integrity strobes synchronize to the latest UL 1971 requirements when used with an external control module (G1M or SIGA-CC1S). Audible output is adjustable - select temporal or continuous tones, and High setting for 98 dBA output or Low setting for 94 dBA sound output.

Models

- 757-1A-T Temporal Horn
- 757-7A-T Temporal Horn-Strobe, 15/75cd
- 757-8A-T Temporal Horn-Strobe, 110cd
Weather/Explosion proof heat detectors
Series 500 heat sensors are designed for use in applications requiring protection against weather, moisture (internal condensation), and explosive atmospheres. Heat sensors are normally-open devices designed to close an electrical circuit upon activation. Sensors use dual action, electric fire detection thermostats that employ two independent methods of detection: rate-of-rise and fixed temperature.

Hazardous Location, Weatherproof Strobes
106DEX hazardous location strobes are diode polarized life safety signaling appliances designed for installation in hazardous environments.

Hazardous Location Multiple Tone Signals
EST 5533BD signals are heavy-duty industrial, tone-selectable, signaling devices capable of producing volume-controlled, high-decibel tones. The signals accept up to two contact closures and deliver two audible output signals selected from the 19 available tones.

Hazardous Location Horns and Sirens
The 5522D-AW (Horn) and the 5523D-AW (Siren) are extremely high decibel, high-performance diode-polarized signaling appliances intended for fire alarm and life safety applications. The signals operate with very low current consumption and do not require extra current on start-up.

Hazardous Location Bells
430D series: diode-polarized, heavy duty fire bells for use in life safety applications where a diode supervised signal is required.

Hazardous Location Horns
888D and 889D: diode-polarized, heavy duty, high decibel vibrating horns intended for use in life safety systems in hazardous (classified) locations.

Diagrams are for reference only. Consult the appropriate installation sheet for wiring details.
SIGNATURE MODULES

MANUAL PULL STATION WITH MODULE

270 Series Series One- and Two-stage Pull Stations

SIGA-270 One Stage Fire Alarm Station
SIGA-270P Two Stage (Presignal) Fire Alarm Station
SIGA-278 Double Action (One Stage) Fire Alarm Station

Note: Wiring is the same for both the SIGA-270 and the SIGA-278

Diagrams are for reference only. Consult the appropriate installation sheet for wiring details.
SIGNATURE MODULES

FIRE INPUT MODULES (GANG MOUNT)

SIGA-CT1, SIGA-CT2, SIGA-WTM, SIGA-MM1, SIGA-UM

Modules are intelligent analog addressable devices used to connect one or two Class B normally-open Alarm, Supervisory, or Monitor type dry contact Initiating Device Circuits (IDC). Models:

SIGA-CT1 Single Input Module
SIGA-CT2 Dual Input Module
SIGA-MM1 Monitor Module
SIGA-WTM Waterflow/Tamper Module
SIGA-UM Universal Class A/B Module

![Diagram of a Single Input Module (SIGA-CT1 shown above)]

![Diagram of a SIGA-UM Class B Dual Input Module (CT-2 wiring shown above)]

Diagrams are for reference only. Consult the appropriate installation sheet for wiring details.
SIGNATURE MODULES

FIRE INPUT MODULES (UIO MOUNT)

Input Modules SIGA-UIO (2R/6/6R), MCT1, MCT2, MAB

SIGA-UIO2R Universal Input-Output Module Board
w/Riser Inputs — Two Module Positions

SIGA-UIO6R Universal Input-Output Module Board
w/Riser Inputs — Six Module Positions

SIGA-UIO6 Universal Input-Output Module Board
— Six Module Positions

SIGA-MCT2 Dual Input Plug-in (UIO) Module

SIGA-MAB Universal Class A/B Module (Plug-in)

Personality Codes: 1, 2, 3, or 4

Personality Codes: 9, 10, 11, or 12

Green LED (Normal)
Red LED (Active)

Remove Module Jumpers

Data In
Signature
Data
Circuit

Data Out

Remove motherboard jumpers.

No connections required for SIGA-MAB using personality codes 1, 2, 3, 4, 9, 10, 11, or 12.

Diagrams are for reference only. Consult the appropriate installation sheet for wiring details.
Input Modules SIGA-SEC-2, SIGA-MD

The SIGA-SEC2 Dual Input Security Module is an intelligent analog addressable device used to connect one or two normally-open or normally-closed dry contact security circuits.

The SIGA-MD is a Passive Infrared (PIR) motion detection module that connects directly to the Signature loop.
The SIGA-UM Universal Class A/B Module is installed to a standard North American 2-gang electrical box. Separate I/O and data loop connections are made to each module. The SIGA-UM may be used to connect any one of the following: two Class B or one Class A Initiating Device Circuits; one Class A or B Notification Appliance Circuit; one Class A or B Circuit for 2-wire Smoke Detectors; one Form “C” (NO/NC) Dry Output Contact Relay.

SIGA-CC1 Single Input Signal Modules and SIGA-CC2 Dual Input Signal Modules are used for connecting, upon command from the loop controller, supervised Class B signal or telephone circuits to their respective power inputs. The power inputs may be polarized 24 Vdc to operate audible and visible signal appliances or 25 and 70 VRMS to operate audio evacuation speakers and firefighter’s telephones. The actual operation of the SIGA-CC1 and SIGA-CC2 is determined by the “personality code” selected by the installer.

**SIGA-CC2 Wiring**

![Diagram of SIGA-CC2 Wiring](image)
SIGNATURE MODULES

OUTPUT MODULES (GANG MOUNT)

SIGA-CC1 Wiring

Personality Code 5
Typical Speaker Circuit
UL/ULC Listed
47KΩ EOL

Personality Code 6
Typical Telephone Circuit
UL/ULC Listed
47KΩ EOL

Personality Code 5
Typical Notification Appliance Circuit
UL/ULC Listed
47KΩ EOL

Install the Bi-Polar Transient Protector (P/N 235196P) here.

SIGA-UM Single Output Module (Personality Code 15 or 16)

Typical Speaker Circuit (Personality Code 15)

Wired to Terminals 13 and 14
For Style Z (Class A)

Wired to Terminals 11 and 12
Style Y (Class B)

UL/ULC Listed
47KΩ EOL
SIGNATURE MODULES

OUTPUT MODULES (GANG MOUNT)

SIGA-CR Control Relay, SIGA-CRR Polarity Reversal Relay Modules

The SIGA-CR Control Relay Module provides a Form “C” dry relay contact to control external appliances such as door closers, fans, dampers etc. This device does not provide supervision of the state of the relay contact. Instead, the on-board microprocessor ensures that the relay is in the proper ON/OFF state. Upon command from the loop controller, the relay activates the normally open or normally-closed contact.

The SIGA-CRR Polarity Reversal Relay Module provides a Form “C” dry relay contact to power and activate a series of SIGA-AB4 Audible Sounder Bases. Upon command from the Signature loop controller, the SIGA-CRR reverses the polarity of its 24 Vdc output, thus activating all Sounder Bases on the data loop.
SIGNATURE MODULES

OUTPUT MODULES (UIO MOUNT)

Universal Input/Output Module Motherboards

Signature Series Universal Input-Output Module Motherboards provide mounting and wiring terminations for up to six Signature Series plug-in UIO (SIGA-“M” series) modules.

SIGA-UIO2R Universal Input-Output Module Board w/Riser Inputs - Two Module Positions

Module Input/Output Wiring

Refer to individual module installation sheet for wiring details.

SIGA-UIO6R Universal Input-Output Module Board w/Riser Inputs - Six Module Positions

Module Input/Output Wiring (maximum current is 8 Amps)

Refer to individual module installation sheet for wiring details.

SIGA-UIO6 Universal Input-Output Module Board - Six Module Positions

Diagrams are for reference only. Consult the appropriate installation sheet for wiring details.
SIGNATURE MODULES

OUTPUT MODULES (UIO MOUNT)

SIGA-MAB

The SIGA-MAB is a Universal Class A/B Module that takes advantage of the modular flexibility and easy installation that characterizes all UIO modules. Two- and six-module UIO motherboards are available. These can accommodate individual risers for each on-board module, or shared risers in any combination with their UIO modules. All wiring connections are made to terminal blocks on the motherboard. UIO assemblies may be mounted in EST enclosures. The SIGA-MAB may be used to connect any one of the following:
- one Class B or one Class A Initiating Device Circuit
- one Class A or B Notification Appliance Circuit

![Diagram of SIGA-MAB connections and components]

Diagrams are for reference only. Consult the appropriate installation sheet for wiring details.
SIGNATURE MODULES

OUTPUT MODULES (UIO MOUNT)

SIGA-MCC1/MCC2

SIGA-MCC1 Single Input Signal Modules and SIGA-MCC2 Dual Input Signal Modules are intelligent analog addressable devices used for connecting, upon command from the loop controller, supervised Class B signal or telephone circuits to their respective power inputs. The power inputs may be polarized 24 Vdc to operate audible and visible signal appliances or 25 and 70 VRMS to operate audio evacuation speakers and firefighter’s telephones.
SIGNATURE MODULES

OUTPUT MODULES (UIO MOUNT)

SIGA-MCC2 Wiring

Diagrams are for reference only. Consult the appropriate installation sheet for wiring details.
SIGNATURE MODULES

OUTPUT MODULES (UIO MOUNT)

SIGA-MCR/MCRR

The SIGA-MCR Control Relay Module provides a Form “C” dry relay contact to control external appliances such as door closers, fans, dampers etc.

The SIGA-MCRR Polarity Reversal Relay Module provides a Form “C” dry relay contact to power and activate a series of SIGA-AB4 Audible Sounder Bases.
SIGNATURE MODULES

FIREMEN’S TELEPHONE/WARDEN STATION

Firemen's Telephones

6833-1 Portable Handset Receptacle

6830-1 Telephone Handset

6830-5A Telephone Handset

Note: Use of “Off Hook” Terminals 3, 4, and 6 are for NFPA 72, 3-state operation (IRC-3 and FCC only).

When using multiple handsets on a common telephone circuit, the Off Hook zone is to be wired in series using terminals 3 and 4 with the last handset wired using terminal 3 and 6 as illustrated.

6830-NY Warden Station

Diagrams are for reference only. Consult the appropriate installation sheet for wiring details.
The SIGA-REL is an analog addressable module that communicates directly with the fire alarm panel Signature loop controller. The SIGA-REL controls sprinkler, pre-action and deluge systems, and may also be used to release extinguishing agents such as CO₂, Halon, or foam.

**SIGA-REL**

### Notes

1. Four RELA-EOLs per circuit, max.
2. Class B, 24 Vdc output
3. Class B, normally-open manual release station
4. Class B, normally-open abort station
5. Listed 47 kΩ EOL resistor
6. Nonpolarized valve. The releasing solenoid valve wiring is not supervised for wire-to-wire shorts. Run the connection to the valve in conduit within 20 feet of the RELA-EOL Solenoid Polarizing Relay.
7. Polarity of circuit shown in supervisory state. On alarm, polarity reverses.
8. Supervised and power-limited.
9. Power-limited when connected to a power-limited source. If nonpower-limited, maintain 1/4 inch (6.4 mm) separation. Otherwise, use FPL, FPLR, or FPLP in accordance with the National Electric Code (NEC). Destroy power-limited markings.
10. Installations, which include other wiring, require FPL, FPLR, FPLP, or equivalent NEC-approved wiring for all power-limited wiring.
SIGMA-IM Fault Isolator Module

The SIGMA-IM Isolator Module enables part of the Signature data loop to continue operating should a short circuit occur. The module can be wired into a Class A data loop at any point.

For maximum wire resistance, refer to the appropriate manufacturer's documentation.

Max. #12 AWG (2.5mm²) wire.

Refer to Signature Loop Controller Installation Sheet for wiring specifications.

This module should be used only with Class A wiring.

Maximum circuit resistance between isolators is 6 ohms.

All wiring is power-limited and supervised.

Diagrams are for reference only. Consult the appropriate installation sheet for wiring details.
SIGNATURE MODULES

AUDIO AMPLIFIERS AND POWER SUPPLY

SIGA-AA (30, 50) Intelligent Audio Amplifiers

SIGA amplifiers are high efficiency switch mode audio amplifiers available in 30 and 50 watt sizes:

SIGA-AA30  30 Watt Amplifier
SIGA-AA50  50 Watt Amplifier

Intelligent Auxiliary Power Supply

The SIGA-APS power supply is a switch mode supply that provides additional power for any Fire Alarm Control Panel that contains a Signature Data Circuit.

Diagrams are for reference only. Consult the appropriate installation sheet for wiring details.
Intelligent Multisensor Detectors

Signature Series Intelligent Multisensor Detectors gather analog information from their smoke sensing elements and convert it into digital signals. Each detector’s on-board microprocessor measures and analyzes these signals and compares the information to historical readings and time patterns to make an alarm decision. Digital filters remove signal patterns that are not typical of fires.

SIGA-IS Intelligent Ionization Smoke Detector: single smoke sensing element.

SIGA-PS Intelligent Photoelectric Smoke Detector: single smoke sensing element.

SIGA-PHS Intelligent 3D Multisensor Detector: two fire sensing elements (photoelectric and heat).

SIGA-IPHS Intelligent 4D Multisensor Detector: three fire sensing elements (ionization, photoelectric, and heat).

SIGA-HFS and SIGA-HRS Intelligent Heat Detectors gather analog information from their fixed temperature and/or rate-of-rise heat sensing elements and converts it into digital signals.

Available bases:

SIGA-SB(4) Standard Base

SIGA-AB4G Audible Sounder Base (wiring shown on this page)

SIGA-RB(4) Relay Base

SIGA-IB(4) Isolator Base (wiring shown on page 69)
SIGA-DMP Duct Detector Mounting Plate
SIGA-DH Duct Detector Housing

Provides convenient mounting of Signature Series intelligent smoke detectors in ducts, raised floor or plenum applications. The 7-inch plate may also be installed in low velocity ducts with a maximum width of 36 inches and a maximum height of 36 inches. Includes a 4-inch square junction box for wiring connections. Compatible with the following: SIGA-PS, SIGA-PHS, SIGA-IPHS, SIGA-SB Standard Base, SIGA-RB Relay Base, SIGA-IB Isolator Base.

Diagrams are for reference only. Consult the appropriate installation sheet for wiring details.
Wiring: Standard Detector Base to SIGA-LED

Remote LED (SIGA-LED)
Max. Resistance per Wire
Must NOT Exceed 10Ω

DATA IN (-)
From Signature Controller or Previous Device

DATA OUT (-)
To Next Device

DATA IN (+)
DATA OUT (+)

Wiring: Duct Detector Test Station SIGA-DTS

Red LED (Alarm/Active)
Factory Connections Do NOT Alter

Green LED (Normal)

DATA IN (+)
DATA OUT (+)

DATA IN (-)
DATA OUT (-)

From Signature Controller or Previous Device
To Next Device
General Information
The 24 Vdc notification appliance circuits must be a minimum of 18 AWG (0.75 mm²) pair. Terminals on FireShield, QuickStart and EST3 will support 18-12 AWG wire. Circuit length limits are determined using the maximum allowable circuit resistance and cable manufacturer’s specifications.

Circuit capacity
FireShield notification appliance circuits are rated at 1.5 amps each at 24 Vdc FWR. QuickStart notification appliance circuits are rated at 1 or 2 amps each at 24 Vdc FWR. EST3 notification appliance circuits are rated at 3.5 amps each at 24 Vdc regulated.

Table A-1: Wire resistance ratings to use for wire length calculations

<table>
<thead>
<tr>
<th>Wire Size</th>
<th>Resistance per 1000 ft pair (ohms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 AWG / (0.75 mm²)</td>
<td>13.0</td>
</tr>
<tr>
<td>16 AWG / (1.0 mm²)</td>
<td>8.0</td>
</tr>
<tr>
<td>14 AWG / (1.50 mm²)</td>
<td>5.2</td>
</tr>
<tr>
<td>12 AWG / (2.5 mm²)</td>
<td>3.5</td>
</tr>
</tbody>
</table>
NAC Voltage Drop Calculations

Notification appliance circuit voltage drop calculation

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>feet</td>
<td>x</td>
<td>x Ohms</td>
<td>÷ 1000 =</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panel voltage</th>
<th>Voltage drop</th>
<th>End of line voltage [3]</th>
</tr>
</thead>
<tbody>
<tr>
<td>[4]</td>
<td>-</td>
<td>=</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Voltage drop</th>
<th>Panel voltage</th>
<th>Voltage drop %</th>
</tr>
</thead>
<tbody>
<tr>
<td>÷ [4]</td>
<td>=</td>
<td></td>
</tr>
</tbody>
</table>

FireShield voltage drop calculation notes

[1] Use wire resistance from Table 1.
[2] Use the 20 Vdc VFWR Average/Mean Operating Current ratings found on the installation or catalog sheet of each device.
[4] 18.6 V for 230 V at 50 Hz, 18.8 V for 230 V at 60 Hz, 18.9 V for 120 V at 60 Hz

QuickStart voltage drop calculation notes

[1] Use wire resistance from Table 1.
[2] Use the 20 Vdc VFWR Average/Mean Operating Current ratings found on the installation or catalog sheet of each device.
[4] 17.5 Vdc

EST3 voltage drop calculation notes

[1] Use wire resistance from Table 1.
[2] Use the 20 Vdc Average/Mean Operating Current ratings found on the installation or catalog sheet of each device.

Note: Due to expected changes by UL the calculations on these two pages and the load currents for all audio and visual devices are expected to be revised by the end of 2005.
Notification appliance circuit maximum wire length calculation

Use this worksheet to determine the maximum wire length of a notification appliance circuit. Fill in one worksheet for each NAC connected to the panel.

Maximum signal loss allowed [1]  \( \times \) \( \frac{1000}{\text{V}} \)

Wire resistance per 1000 ft/pair [2]  \( \div \) \( \text{ohms} \)

Total operating current required [3]  \( \div \) \( \text{A} \)

Maximum circuit length  \( \div \) \( \text{ft} \)

**FireShield maximum wire length calculation notes**

[1] 1.6 V for 230 V at 50 Hz, 1.8 V for 230 V at 60 Hz, 1.9 V for 120 V at 60 Hz
[2] Use wire resistance from Table 1.
[3] Use the 20 Vdc VFWR Average/Mean Operating Current ratings found on the installation or catalog sheet of each device.

**QuickStart maximum wire length calculation notes**

[1] For worst case estimates, assume a 1.5 V line loss and all appliances are clustered at the end of the circuit.
[2] Use wire resistance from Table 1.
[3] Use the 20 Vdc VFWR Average/Mean Operating Current ratings found on the installation or catalog sheet of each device.

**EST3 maximum wire length calculation notes**

[1] For worst case estimates, assume a 3.4 V line loss and all appliances are clustered at the end of the circuit.
[2] Use wire resistance from Table 1.
[3] Use the 20 Vdc Average/Mean Operating Current ratings found on the installation or catalog sheet of each device.
25 Vrms or 70 Vrms NAC wire length

The maximum allowable wire length is the farthest distance that a pair of wires can extend from the amplifier to the last speaker on the notification appliance circuit without losing more than 0.5 dB of signal. 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.

For example, the maximum allowable wire length for an audio circuit consisting of a 40 W, 25 Vrms amplifier driving thirty 1-watt speakers, using 18-gauge wire would be 95 ft.

$$94.95 = \frac{59.25 \times 25}{13 \times 13}$$

B-1 and B-2 gives the maximum allowable wire lengths for various wire sizes and loads. Use B-1 when designing circuits for amplifiers set for 25 Vrms output. Use B-2 when designing circuits for amplifiers set for a 70 Vrms output.
**REFERENCE SECTION**

**25 OR 70 VRMS NAC WIRE LENGTH**

**B-1: Maximum allowable length at 25 Vrms, 0.5 dB loss**

<table>
<thead>
<tr>
<th>Wire Size (mm²)</th>
<th>15 W ft</th>
<th>15 W m</th>
<th>20 W ft</th>
<th>20 W m</th>
<th>30 W ft</th>
<th>30 W m</th>
<th>40 W ft</th>
<th>40 W m</th>
<th>90 W ft</th>
<th>90 W m</th>
<th>120 W ft</th>
<th>120 W m</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 AWG (0.75 mm²)</td>
<td>1489</td>
<td>454</td>
<td>1117</td>
<td>340</td>
<td>744</td>
<td>227</td>
<td>558</td>
<td>170</td>
<td>248</td>
<td>76</td>
<td>186</td>
<td>57</td>
</tr>
<tr>
<td>16 AWG (1.0 mm²)</td>
<td>2420</td>
<td>738</td>
<td>1815</td>
<td>553</td>
<td>1210</td>
<td>369</td>
<td>907</td>
<td>276</td>
<td>403</td>
<td>123</td>
<td>302</td>
<td>92</td>
</tr>
<tr>
<td>14 AWG (1.5 mm²)</td>
<td>3722</td>
<td>1134</td>
<td>2792</td>
<td>851</td>
<td>1861</td>
<td>567</td>
<td>1396</td>
<td>426</td>
<td>620</td>
<td>189</td>
<td>465</td>
<td>142</td>
</tr>
<tr>
<td>12 AWG (2.5 mm²)</td>
<td>6049</td>
<td>1844</td>
<td>4537</td>
<td>1383</td>
<td>3024</td>
<td>922</td>
<td>2268</td>
<td>691</td>
<td>1008</td>
<td>307</td>
<td>756</td>
<td>230</td>
</tr>
</tbody>
</table>

**B-2: Maximum allowable length at 70 Vrms, 0.5 dB loss**

<table>
<thead>
<tr>
<th>Wire Size (mm²)</th>
<th>15 W ft</th>
<th>15 W m</th>
<th>20 W ft</th>
<th>20 W m</th>
<th>30 W ft</th>
<th>30 W m</th>
<th>40 W ft</th>
<th>40 W m</th>
<th>90 W ft</th>
<th>90 W m</th>
<th>120 W ft</th>
<th>120 W m</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 AWG (0.75 mm²)</td>
<td>1489</td>
<td>454</td>
<td>1117</td>
<td>340</td>
<td>744</td>
<td>227</td>
<td>558</td>
<td>170</td>
<td>248</td>
<td>76</td>
<td>186</td>
<td>57</td>
</tr>
<tr>
<td>16 AWG (1.0 mm²)</td>
<td>2420</td>
<td>738</td>
<td>1815</td>
<td>553</td>
<td>1210</td>
<td>369</td>
<td>907</td>
<td>276</td>
<td>403</td>
<td>123</td>
<td>302</td>
<td>92</td>
</tr>
<tr>
<td>14 AWG (1.5 mm²)</td>
<td>3722</td>
<td>1134</td>
<td>2792</td>
<td>851</td>
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<td>2268</td>
<td>691</td>
<td>1008</td>
<td>307</td>
<td>756</td>
<td>230</td>
</tr>
</tbody>
</table>
REFERENCE SECTION

SIGNATURE DATA CIRCUIT MAXIMUM WIRE LENGTH CALCULATIONS

QS1, QS4 and EST3

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. Note: 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.

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

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 on the next page.

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 C-2
   - If 1–5 SIGA-UMs are installed, use Table C-3
   - If 6–10 SIGA-UMs are installed, use Table C-4
   - If 11–15 SIGA-UMs are installed, use Table C-5
REFERENCE SECTION

SIGNATURE DATA CIRCUIT MAXIMUM WIRE LENGTH CALCULATIONS

Use this worksheet to determine the maximum amount of wire you can use to construct a Signature loop.

**Step 1:** Calculate the total amount of wire you can used based on the cable manufacturer’s capacitance per foot rating. Total amount of wire shall not exceed the values listed in Table.

Determining the total loop length

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

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

Table C-1: Maximum amount of wire you can use to construct a Signature loop

<table>
<thead>
<tr>
<th>Wire type</th>
<th>14 AWG</th>
<th>16 AWG</th>
<th>18 AWG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Twisted pair</td>
<td>13,157 ft (4,010 m)</td>
<td>13,888 ft (4,233 m)</td>
<td>20,000 ft (6,096 m)</td>
</tr>
<tr>
<td>Twisted-shielded pair</td>
<td>5,952 ft (1,814 m)</td>
<td>6,098 ft (1,859 m)</td>
<td>8,621 ft (2,628 m)</td>
</tr>
<tr>
<td>Non-twisted, non-shielded pair</td>
<td>20,000 ft (6,096 m)</td>
<td>20,000 ft (6,096 m)</td>
<td>20,000 ft (6,096 m)</td>
</tr>
</tbody>
</table>

If the cable manufacturer’s data indicates the capacitance per foot of the cable, the following method may be used 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 (6,098 meters).
**REFERENCE SECTION**

**SIGNATURE DATA CIRCUIT MAXIMUM WIRE LENGTH CALCULATIONS**

\[ L_{\text{Max}} = \frac{500,000}{C_{\text{pf/Ft}}} \]

where: \( L_{\text{Max}} \) = maximum total cable length in feet

\( C_{\text{pf/Ft}} \) = Cable capacitance in picofarads per foot

Note: A short circuit on a Signature data circuit can disable the entire circuit. In order to limit the effect of a single short circuit on the SDC, SIGA-IB Isolator Bases or SIGA-IM Isolator modules can be installed at strategic points in the circuit.

**Step 2:** Use Tables C-2, C-3, C-4, and C-5 to determine the longest allowable circuit path based on wire size and type, and the number of detector, module, SIGA–UMs or –MABs installed on the loop.

In the illustration below, the longest circuit path (shown in bold lines) is 1240 ft (377.95 m). The total amount of wire comprising the loop is 1740 ft (530.35 m).

Table C-2 through Table C-5 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.
## SIGNATURE DATA CIRCUIT MAXIMUM WIRE LENGTH CALCULATIONS

### REFERENCE SECTION

Table C-2: Longest allowable circuit path with 0 SIGA-UMs or SIGA-MABs configured for 2-wire smokes

<table>
<thead>
<tr>
<th>Signature detector addresses</th>
<th>Signature module addresses</th>
<th>Maximum wire distance using nontwisted, nonshielded wire pairs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>18 AWG</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ft</td>
</tr>
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# SIGNATURE DATA CIRCUIT MAXIMUM WIRE LENGTH CALCULATIONS

Table C-3: Longest allowable circuit path with 1 to 5 SIGA-UMs or SIGA-MABs configured for 2-wire smokes

<table>
<thead>
<tr>
<th>Signature detector module addresses</th>
<th>Signature module addresses</th>
<th>Maximum wire distance using nontwisted, nonshielded wire pairs</th>
</tr>
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<tbody>
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<td></td>
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</tr>
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</tr>
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Table C-4: Longest allowable circuit path with 6 to 10 SIGA-UMs or SIGA-MABs configured for 2-wire smokes

<table>
<thead>
<tr>
<th>Signature detector addresses</th>
<th>Signature module addresses</th>
<th>Maximum wire distance using nontwisted, nonshielded wire pairs</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>18 AWG</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ft</td>
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### Table C-5: Longest allowable circuit path with 11 to 15 SIGA-UMs or SIGA-MABs configured for 2-wire smokes

<table>
<thead>
<tr>
<th>Signature detector addresses</th>
<th>Signature module addresses</th>
<th>Maximum wire distance using nontwisted, nonshielded wire pairs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>18 AWG</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ft</td>
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</table>

**Diagrams are for reference only. Consult the appropriate installation sheet for wiring details.**
Overview
Cumulative data network capacitance refers to the total capacitance of all copper wire used for the data riser. The cumulative capacitance of data networks must be within certain limits to permit stable network communications. Audio networks are not affected by cumulative capacitance, due to the method of retransmitting data. The audio network retransmits data byte-by-byte, so the individual bit times of a byte are restored at each node in the network. The data network retransmits data bit-by-bit. This method of retransmitting data restores the amplitude of a bit at each node, but any distortions in bit timing are passed through to the next node. Data network communication faults begin to occur at about 23% distortion of bit timing. Cumulative data network capacitance induces bit timing distortion.

A fiber link in a data network electrically isolates two nodes, but distortions in bit timing are *not* restored by the fiber segment. Distortions in bit timing are passed through the fiber to the next node. The bit transition time of model 3-FIB fiber cards is fast enough to be neglected in determining the maximum wire length that can be used in the data network.

Data network specifications
Here are the maximum allowed values between any three nodes of a network.

- **Resistance:** 90 ohms
- **Distance:** 5,000 feet
- **Capacitance:** 0.3 microfarads

The following table lists the maximum cumulative capacitance for the entire data network given various wire sizes and transmission rates. *Maximum cumulative capacitance* is the total capacitance of all installed copper wire used in the data network.

<table>
<thead>
<tr>
<th>Wire size (AWG)</th>
<th>At 38.4 Kbaud</th>
<th>At 19.2 Kbaud</th>
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</thead>
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<tr>
<td>14</td>
<td>2.1</td>
<td>4.2</td>
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Cable properties
Data and audio networks in an EST3 system do *not* require the use of shielded cable, and networks designed with twisted-pair can be about twice as long as those designed with shielded cable. The maximum length of a data network varies with the properties of the wire used. Wire manufacturers typically provide specifications for wire resistance and capacitance.
Resistance is generally specified in ohms per 1,000 feet, and must be doubled for 1,000 feet of a twisted-pair cable. Capacitance is specified in picofarads per foot (pF/ft). The capacitance between conductors of a twisted-pair is commonly referred to as conductor-conductor or mutual capacitance. Shielded cable has an additional capacitance between each conductor and the shield. The capacitance of either conductor to shield is typically twice the value of mutual capacitance, and the highest value of capacitance must be used when calculating the maximum length of a data network. The overall length of data networks designed with twisted-pair cable is about twice as long as data networks designed with shielded cable due to the additional capacitance resulting from the shield.

Calculating a maximum length
The maximum length of a data network can be calculated by dividing the maximum cumulative capacitance allowed by the highest capacitance rating of the selected cable. For example, say you wanted to determine maximum length of a data network using 18 AWG cable that is rated at 25 pF per foot. The network will communicate at 38.4 Kbaud. The maximum length equals the maximum cumulative capacitance divided by the capacitance per foot. In equation form:

$$ML = \frac{MCC}{CPF}$$

In our example:  
$$ML = \frac{1.4 \text{ mF}}{25 \text{ pF/ft}}; \quad ML = 56,000 \text{ ft}$$

Calculating maximum wire capacitance per foot
The capacitive property of twisted-pair cable varies and the cost of cable generally increases as the capacitance per foot decreases. Following is a sample calculation for determining the maximum capacitance per foot that a cable can have for a given network length. The maximum capacitance per foot equals the maximum cumulative capacitance divided by the total network length. In equation form:

$$MCPF = \frac{MCC}{TNL}$$

Where:
- MCC can be obtained from the table given in this topic
- Total network length is the sum of the lengths of individual copper runs in the network

Example: The total copper distance of a network is 26,000 ft. Calculate the maximum capacitance per foot that can be used for 18 AWG twisted-pair cable at 38.4K baud.

$$MCPF = \frac{MCC}{TNL}$$
$$MCPF = \frac{1.4 \text{ mF}}{26,000 \text{ ft}}$$
$$MCPF = 53.8 \text{ pF/ft}$$
3-SAC Data Bus

SAC bus wiring requirements
Type: unshielded, twisted pair, > 6 twists per foot
Maximum bus length: 4,000 ft (1,220 m) @ 25 pF/ft
Maximum total circuit capacitance: 0.1 µF
Maximum total circuit resistance: 52 Ohms

3-SAC Power

This topic provides information to help you determine whether:
• A power supply must be added to the SAC bus
• Adequate voltage will be available to CRCs and KPDISPs on the SAC bus
• The standby battery in each CRC is properly sized

Determining the need for a remote power supply
The need for additional power is dictated by the current drawn by the devices on the SAC bus. Each 3-PPS/M can supply a total of 7 A through two 3.5 A outputs. Each SAC line can therefore draw a maximum of 3.5 A. This consists of the current drawn by the CRCs and KPDISPs plus any readers, strikes, or maglocks.
If the load on the 3-PPS/M supply is greater than 3.5 A, you’ll need to split the devices over two SAC buses, or add a remote power supply.

To determine the total load on the 3-PPS/M:
1. Complete Form A (below) to calculate the system alarm and standby load current.
2. Total the columns to determine the Total Alarm Load and Total Amp Hours. These two totals will be used in later calculations.
3. If the Total Alarm Load is greater than 3.5 A, the devices must be divided between two SAC buses, each with a separate supply — OR — a remote power supply must be installed.
4. If a remote power supply is used a ground wire must be between the 3-SAC and the remote power supply.
Form A: 3-SAC alarm and standby load

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<th>Device</th>
<th>Qty</th>
<th>Alarm current (mA)</th>
<th>Total alarm current (mA)</th>
<th>Standby current (mA)</th>
<th>Total Standby current (mA)</th>
<th>Standby time (Hours)</th>
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Strike rating

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<th>Qty</th>
<th>Total</th>
<th>Standby</th>
<th>Amp hours</th>
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Maglock rating

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<th>Total</th>
<th>Standby</th>
<th>Amp hours</th>
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<td>200 mA @ 12 V</td>
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<td>250 mA @ 12 V</td>
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<td>350 mA @ 12 V</td>
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<td>400 mA @ 12 V</td>
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<td>450 mA @ 12 V</td>
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<td>500 mA @ 12 V</td>
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<td>470</td>
<td></td>
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</tbody>
</table>

Total alarm load (must be < 3.5 A)

Total amp hours (Battery)

Note: Standby time = length of time that the device will draw standby current from battery. There is no minimum standby time for access control.
Providing adequate voltage for devices

To determine whether each CRC and KPDISP will have adequate input voltage, calculate the voltage drops along the SAC bus. Voltage drops can be estimated or actual.

**Estimated voltage drop**

To estimate the voltage drop use Table D-1 and Table D-2, which show the maximum wire length for a given number of doors at a given current load. The tables assume even spacing between the doors and an equal load at each door.

1. First, determine the load per door by adding the alarm currents of the CRC, door lock, card reader, and sounder.
2. Determine the number of doors you need to secure. Find the number of doors
   Table D-1 then search across that row for the column with the current you calculated in step 1.
3. The intersection gives the maximum distance from the 3-PPS/M or remote power supply to the last door.
4. If the distance to the last door in your installation is less than this distance no further calculations are needed.
5. If the distance to the last door in your installation is greater than this distance check Table D-2 using steps 1 through 4.
6. If changing the gauge of the wire does not work, you must run a second power line, or divide the SAC bus and add a remote power supply. In either case, recheck your estimates.

For example: You are putting a CRC, a strike rated at 250 mA @ 12 Vdc, a CR-5395 and a CRCSND at 8 doors. The furthest door is 500 feet from the control.
Using step 1 above, you determine that the total alarm current for this door is 149 mA. In Table D-1 (for 16 AWG), find 8 in the Doors column, go across this row to the 150 mA column. The intersection shows a maximum length of 584 feet. Since the distance from the control panel to the last door is less than 584 feet, no further calculations are needed.

**Actual voltage drop**

To calculate the actual voltage drop based on the actual load for each device and the actual distance between each device, follow the steps on the next page.
1. Start the EST 3 System Builder program and select the 16 AWG check box.
2. Enter the actual alarm load for the first device and the distance from the control panel to that device. The system will calculate the voltage drop and indicate whether it is OK to continue.
3. Continue by adding the actual alarm load and the distance from the previous device on the SAC bus.
4. If you successfully enter all devices with no error messages, no further calculations are required. The panel supply will be adequate and each device will receive sufficient voltage.
5. If an error message occurs, you have the following options:
   - Repeat the process using 14 AWG in step 1
   - Run a second power supply line
   - Divide the SAC bus and add a remote power supply

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<thead>
<tr>
<th>Doors</th>
<th>Load (mA)</th>
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<tr>
<td>2</td>
<td>3800</td>
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<tr>
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<td>19</td>
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Note: All distance measurements given in feet. X means that the 3-PPS/M will not support these devices at any distance.
### Reference Section

**Sac Bus Wire Length Tables**

Table D-2: SAC bus wire lengths versus number of doors and current loads using 14 AWG wire

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<th>300</th>
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Note: All distance measurements given in feet. X means that the 3-PPS/M will not support these devices at any distance.
Circuit Wiring Specifications

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<th>Circuit Type</th>
<th>No. of Conductors</th>
<th>Voltage Drop</th>
<th>Max. Ckt. Res.</th>
<th>Max. Ckt. Capacitance</th>
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<td>Network Com (RS-485)</td>
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- Max. Ckt. Res. = 70Ω, NO T-Taps
- Max. Ckt. Capacitance = 0.07 μF
- Max. Ckt. Res. = 90Ω, NO T-Taps
- Max. Ckt. Capacitance = 0.3 μF
- Max. Ckt. Res. = 36 w/RZB; 50Ω w/o RZB
- Max. Ckt. Capacitance = 0.2 μF
- Max. Ckt. Res. = 50Ω
- Max. Length 50 Ft. (15.2 M) without modem.
- #18 AWG Twisted/Shielded, 4,000 Ft. (1,220 M) Max
- 230V, 20A Max.

Jacket material must be rated for application.
# REFERENCES

## PAIGE EST CABLE TABLES

### REFERENCE TYPE
- **Initiating Device Circuit (IDC)**
- **Notification Appliance (NAC) 24Vdc**
- **24 Vdc Power Distribution (Aux. Pwr)**
- **Relay Module (ZR8 or FSRRM)**

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<th>NON-PLENUM</th>
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<th>Outdoor or Direct Burial</th>
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<td><strong>DESCRIPTION</strong></td>
<td><strong>TFN or THHN</strong></td>
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<td>--- &gt;</td>
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<tr>
<td>14</td>
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Refer to Paige section page #: 25 37 26 29, 37 67

### REFERENCE TYPE
- **Notification Appliance Circuit (Audio)**
- **Signature Addressable Loop**
- **Analog Addressable Loop**

<table>
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<tr>
<th>PAIGE PART NUMBERS</th>
<th>NON-PLENUM</th>
<th>PLENUM</th>
<th>Outdoor or Direct Burial</th>
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<td><strong>COND</strong></td>
<td><strong>DESCRIPTION</strong></td>
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</table>

Refer to Paige Section page #: 25 26 29 67

Paige DISTINGUISHER versions are available with color-coded jacket stripes for easy identification. See Paige section pp. 32-34. Metal Clad (MC) versions of TFN or THHN are available. See Paige section page 38-40.

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Diagrams are for reference only. Consult the appropriate installation sheet for wiring details.
## REFERENCES

### PAIGE EST CABLE TABLES

#### REFERENCE TYPE

- **Fireman’s Telephone**

<table>
<thead>
<tr>
<th>PAIGE PART NUMBERS</th>
<th>NON-PLENUM</th>
<th>PLENUM</th>
<th>Outdoor or Direct Burial</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWG</td>
<td>PAIRS</td>
<td>Description</td>
<td>FPLR</td>
</tr>
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<tr>
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<tr>
<td>14</td>
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<td>12</td>
<td>1</td>
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</table>

Refer to Paige section page #: 27 30 68

Paige DISTINGUISHER versions are available with color-coded jacket stripes for easy identification. See Paige section pp. 32-34.

#### Card / PIN Reader

#### Security Device Circuit

<table>
<thead>
<tr>
<th>PAIGE PART NUMBERS</th>
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<th>PLENUM</th>
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<td>DESCRIPTION</td>
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<td>16</td>
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<td>Twisted</td>
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</table>

Refer to Paige section page #: 7 - 8 26 15 - 16 29 67

Stranded security and sound cables rated CM, CMR, and CMP may also be used. See Paige section pages 5-22.

Paige DISTINGUISHER versions are available with color-coded jacket stripes for easy identification. See Paige section pages 32-34.
REFERENCES

PAIGE EST CABLE TABLES

REFERENCE TYPE

◊ Security (3-SAC) Data Bus
Per circuit maximums for type K circuits:
Capacitance = 0.1 microfarads, Resistance = 52 ohms, Distance = 4000 ft
Cables shown below are twisted, non-shielded

<table>
<thead>
<tr>
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<tbody>
<tr>
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<td>Part #</td>
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<th>Outdoor or Direct Burial</th>
<th>Notes</th>
<th>Mutual Capacitance is Nominal pico-Farads per foot. DC Resistance is Nominal Ohms per 1,000'.</th>
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<td>Part #</td>
<td>DC Res Ohms / 1,000'</td>
<td>Mutual Capacitance pF / ft</td>
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<td>1602WDB</td>
<td>4.1</td>
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<td>2</td>
<td>1402WDB</td>
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<td>1202WDB</td>
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<td>Part #</td>
<td>DC Res Ohms / 1,000'</td>
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</table>

For low capacitance, extended distance, plenum options, call Paige

Paige DISTINGUISHER versions are available with color-coded jacket stripes for easy identification. See Paige section pp. 32-34.
# REFERENCES

## PAIGE EST CABLE TABLES

### REFERENCE TYPE
- Audio Network
- RS-485 Communications Network

Per circuit maximums for type T & U circuits:

- Capacitance: 0.3 microfarads
- Resistance: 90 ohms, Distance = 5000 ft

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<td>COND.</td>
<td>Part #</td>
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<tr>
<td>16</td>
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<td>4718A</td>
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<td>Part #</td>
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</table>
| 18 | 2 | 1802WDB | 6.4 | 31 | Mutual Capacitance is Nominal pico-Farads per foot. DC Resistance is Nominal Ohms per 1,000’.
| 16 | 2 | 1602WDB | 4.1 | 34 |
| 14 | 2 | 1402WDB | 2.6 | 36 |
| 12 | 2 | 1202WDB | 1.7 | 40 |

### EXTENDED DISTANCE

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RS-232 Communications (Printer / Fireworks)

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Refer to Paige section page #: 7, 26, 15, 29

50’ Max. Panel to Printer or Panel to Fireworks. Stranded security and sound cables rated CM, CMR, and CMP may also be used. See Paige section pages 5-22.

Fireshield Serial Communication Bus

Per circuit maximums for type V circuits:
Capacitance: 0.03 microfarads; Resistance: 13 ohms; Distance: 1000 ft @ 18 AWG

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<table>
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<th>Paige Part #s</th>
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<tr>
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Other: Mutual Capacitance is Nominal pico-Farads per foot.
DC Resistance is Nominal Ohms per 1,000'.
Paige DISTINGUISHER versions are available with color-coded jacket stripes for easy identification. See Paige section pp. 32-34.
### Reference Type

#### Network Fiber Optics

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Refer to Paige section page # 81 80 82

All items are multi-mode 62.5/125

#### Netcom 16D Router

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Refer to Paige section page #: 53, 58 54, 58

#### Fireworks Short-haul Modems

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Refer to Paige section page #: 51 52
The EST Installer’s Wire Guide is a concise reference to wire and cable requirements for EST products and systems. This valuable resource provides installers, as well as service and maintenance personnel, with at-a-glance information and more than one hundred wiring diagrams – all cross-referenced to easy-to-read wire charts. Well-organized and easy-to-use, the EST Installer’s Wire Guide is designed to be part of every technician’s basic toolkit.

EST Press is an imprint of Edwards Systems Technology, Inc. 8985 Town Center Parkway, Bradenton, FL 34202

Also from EST Press:

**Security and Access Control Handbook**
– A practical guide to application and system design

**Handbook of Visual Notification Appliances for Fire Alarm Applications**
– A practical guide to regulatory compliance

**Glossary of Fire Alarm and Security Terminology**
– A desk reference for life safety and security professionals