Andover Infinet™

i2 Controller Technical Reference

Schneider Electric

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Related Documents:

> *Continuum Power Supply Reference*, 30-3001-702
> *Continuum I/O System Reference*, 30-3001-499
> *Continuum Display Module Reference*, 30-3001-711
> *Continuum Command Terminal Configuration Guide*, 30-3001-743
> *Andover Plain English Language Reference,* 30-3001-872
> *i2/b3 8xx-V Controller Retrofit Guide,* 30-3001-988
> *bCX1 Series Controller Technical Reference,* 30-3001-890
> *UL-864 Continuum Smoke Control System Design Guide,* 30-3001-734
> *Infinet Service Tool User's Guide, 30-3001-989*
> Continuum Online Help

Regulatory Notices

Federal Communications Commission

FCC Rules and Regulations CFR 47, Part 15, Class A. This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Caution: The user that changes or makes modifications not expressly approved by Tour Andover Controls, Inc. for compliance could void the user's authority to operate the equipment.

Industry Canada (ICES — 003)

This Class A digital apparatus meets all requirements of the Canadian Interference Causing Equipment Regulations.

Cet appareil numérique de la Classe A respecte toutes les exigences du Réglement sur le matériel brouilleur du Canada.

CE – Compliance to European Union (EU)

This equipment complies with the European Union (EU) standards specified in the EU EMC directive 89/336/EEC and/or the product-safety low voltage directive 73/23/EEC, governing the European community.

C-Tick – Australian Communications Authority (ACA)

N1831

This equipment carries the C-Tick label and complies with EMC and radio communications regulations of the Australian Communications Authority (ACA), governing the Australian and New Zealand communities.

WEEE – Directive of the European Union (EU)

This equipment and its packaging carry the waste electrical and electronic equipment (WEEE) label, in compliance with European Union (EU) Directive 2002/96/EC, governing the disposal and recycling of electrical and electronic equipment in the European community.

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Introduction

This manual describes the installation, and use of all Andover Infinet™ II (i2) controllers.

The i2 family of intelligent, programmable, stand-alone controllers provides cost-effective Direct Digital Control of individual terminal units: VAV boxes, fan powered induction units, unit ventilators, heat pumps, etc. The Infinet's true peer-to-peer communications protocol provides the series with the ability to instantly communicate with an Infinity CX controller, Andover Continuum NetController, Andover Continuum bCX1 9640 controller, as well as its entire network of Andover Continuum Infinet field bus controllers. Up to 254 i2 controllers (127 per Infinet port) can be networked with the Infinity family of controllers.

Note: For complete information on bCX1 controllers, see the bCX1 Series Controller Technical Reference, 30-3001-890, and the Continuum online help.

i2 Controller Overview

The following lists the basic features included in the i2 series controllers. Specific information on each controller may be found in other parts of this reference:

Model	Inputs	Outputs	Other Features
i2608	8 Universal	None	
i2624	24 Universal	None	
i2800	8 Universal 1 Smart Sensor	8 Form C	
i2804	8 Universal 1 Smart Sensor	4 Form C 4 Analog	
i2810	8 Universal 1 Smart Sensor	8 Form C	Output Override control Expansion Interface
i2814	8 Universal 1 Smart Sensor	4 Form C 4 Analog	Output Override control Expansion Interface
i2850	4 Universal 1 Smart Sensor	3 Form A 1 Form K Tri-state	1 Airflow Sensor Expansion Interface
i2851	4 Universal 1 Smart Sensor	3 Form A 1 Form K Tri-state	Expansion Interface
i2853	4 Universal 1 Smart Sensor	3 Form A 1 Form K Tri-state	2 Airflow Sensors Expansion Interface
i2865	4 Universal 1 Smart Sensor	3 Form A Triac 1 Tri-state Actuator control	1 Airflow Sensor Built-in Actuator
i2865-V	4 Universal 1 Smart Sensor	3 Form A Triac 1 Tri-state Actuator control	1 Airflow Sensor Built-in Actuator
iI2866	4 Universal 1 Smart Sensor	3 Form A Triac 1 Tri-state Actuator control 2 Analog	1 Airflow Sensor Built-in Actuator
i2866-V	4 Universal 1 Smart Sensor	3 Form A Triac 1 Tri-state Actuator control 2 Analog	1 Airflow Sensor Built-in Actuator
i2867	4 Universal 1 Smart Sensor	5 Form A Triac 2 Analog	
i2885	2 Universal	2 Form A Triac 1 Tri-state Actuator control	1 Airflow Sensor Built-in Actuator
i2885-V	2 Universal	2 Form A Triac 1 Tri-state Actuator control	1 Airflow Sensor Built-in Actuator

i2887	3 Universal	4 Form A Triac	
	1 Smart Sensor	1 Form A Relay	
i2887-L	3 Universal	4 Form A Triac	Aux power output
	1 Smart Sensor	1 Form A Relay	
i2920	16 Universal	8 Form C	Output Override control
	1 Smart Sensor	8 Analog	Expansion Interface

The following pages illustrate the major connection areas for each controller. Subsequent sections detail power, network, input and output specifications and connections.

Wireless Support

The i2 field bus controllers can also be configured in an Infinet wireless field bus mesh network with its Ethernet-level wireless parent bCX1 9640 controller. A *Wireless Adapter* is connected to each controller's COMM2 port via the controller's service port interface. Network signals are strengthened, where necessary, via *Wireless Repeaters* to carry the data between nodes in a wireless network. The i2 controllers are configured as wireless controllers through CyberStation. For more information, please see the *Andover Continuum CyberStation Configurator's Guide*, 30-3001-781, and the CyberStation online help.

For more information on Andover Continuum wireless products and technology, please see:

- *Wireless Adapter/Repeater Installation Instructions*, 30-3001-887

- *Wireless Mesh Network Concepts and Best Practices Guide*, 30-3001-912

- *Wireless Maintenance Tool User's Guide*, 30-3001-913

i2 vs Andover Infinet ^{TM} I Controller Compatibility Issues

If you are replacing older Andover Infinet^{TM} controllers with i2 equivalents, there may be some slight compatibility issues. The following lists all known differences between the two:

All Models: Controller Memory

i2 controllers include flash memory that may be accessed via program control. This addition does not affect existing programs ported from Infinet I devices.

All Models: System Variables

i2 controllers include several new system variables (described later in the programming section). This addition does not affect existing operation or programs ported from Infinet I devices.

All Models: Output Connections

i2 controllers may switch outputs differently than the controllers you are replacing. Refer to the wiring diagrams included in this document.

xP Modules: Different from EMX

Some i2 controller models include expansion capability that looks similar to the old EMX system but it operates on a very different addressing principle. Complete information on the new expansion modules may be found later in this document.

i2920: Different from SCX920

The i2920 includes eight **Digital/Tri-state** pair outputs on channels #1-8 and eight voltage/current outputs on channels 9-16

The SCX920 has eight **universal** outputs on channels #1-8

Special System Characteristics

Smoke Control Operation (UL 864)

i2 controllers available through Schneider Electric that are listed with UL for Smoke Control applications are the following:

i2608-S
i2624-S
i2800-S
i2804-S
i2850-S
i2851-S
i2853-S
i2865-S
i2866-S
i2867-S
i2920-S

The Smart Sensor connection and the Expansion Options available for many controllers are not listed for UL 864 applications.

i2 Repeaters available through Schneider Electric that are listed with UL for Smoke Control applications are the following:

i2210 AC-S
i2210 DC-S
i2200 AC-S
i2200 DC-S

SX8000 Smoke Control
Although it is possible to operate the i2 family of controllers with the SX8000 workstation, this type of system is not approved for smoke control applications.

Pulsed Outputs
Although i2 series controllers are capable of pulsed output, using pulsed output is not allowed for UL864 applications.

i2600 Series

The following diagram indicates the locations of each of the main connection points.
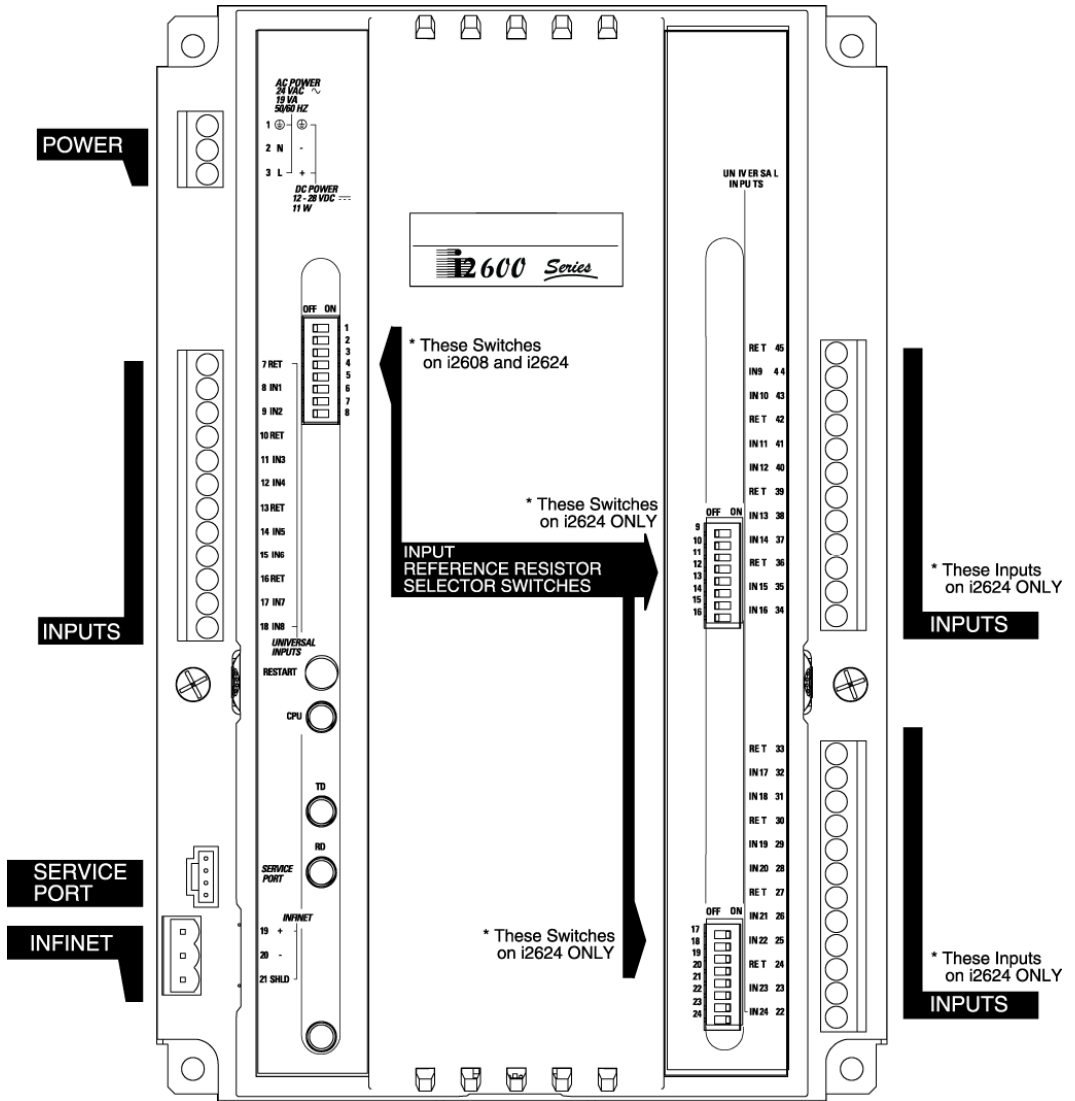
i2800 Series

The following diagram indicates the locations of each of the main connection points.
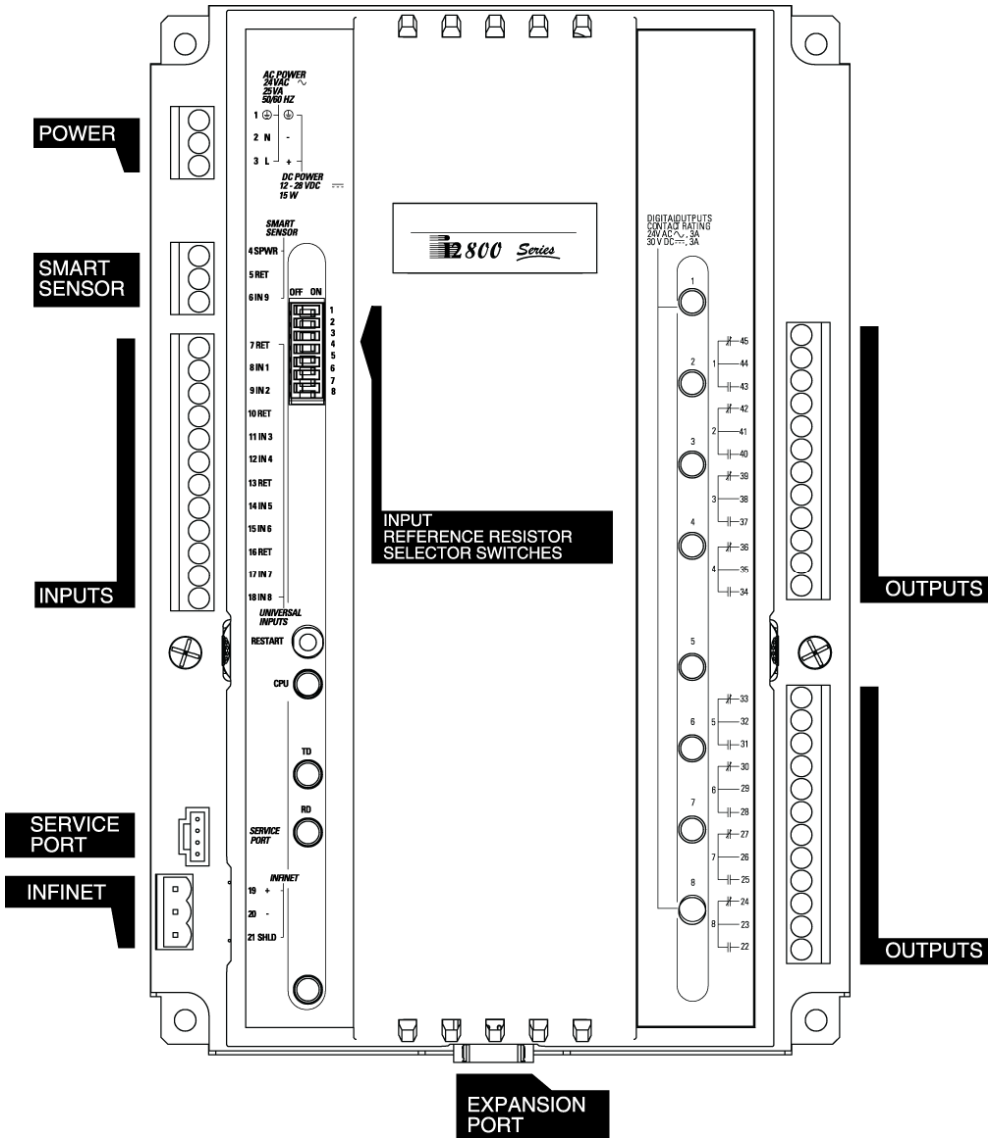
i2810 Series

The following diagram indicates the locations of each of the main connection points.
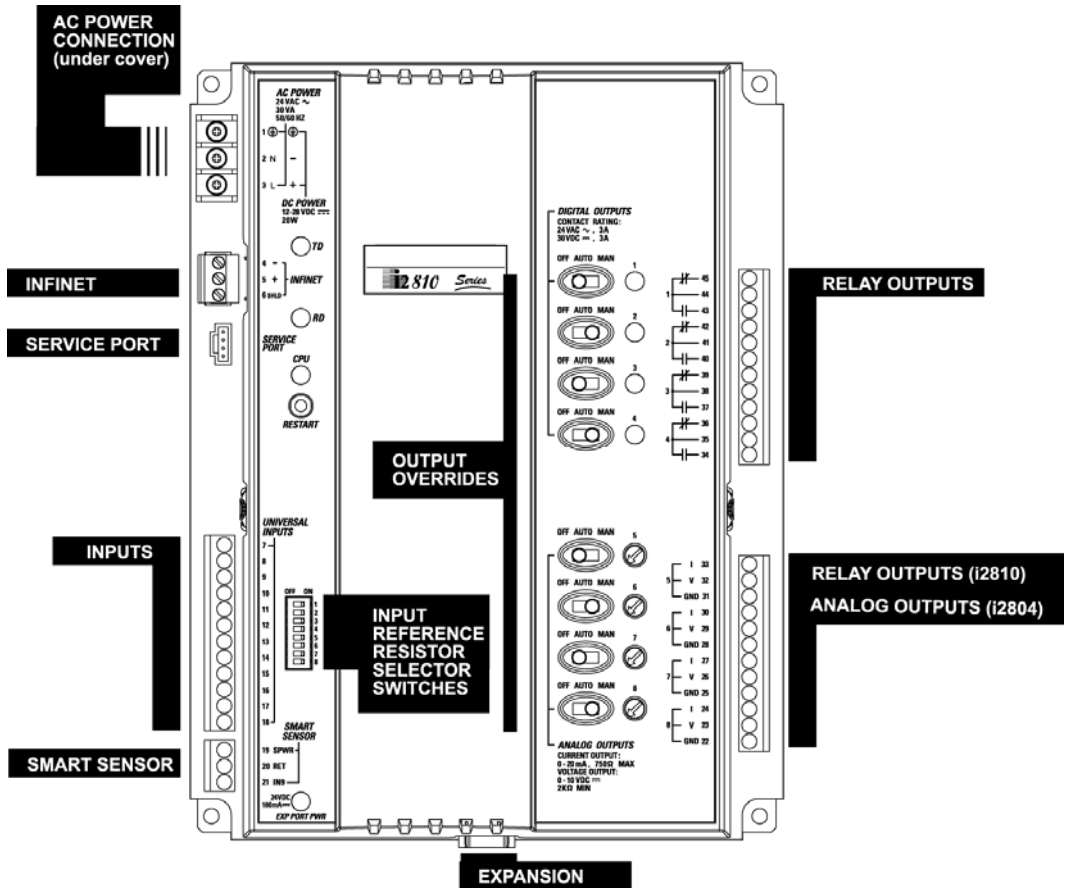
i2850 Series

The following diagram indicates the locations of each of the main connection points.
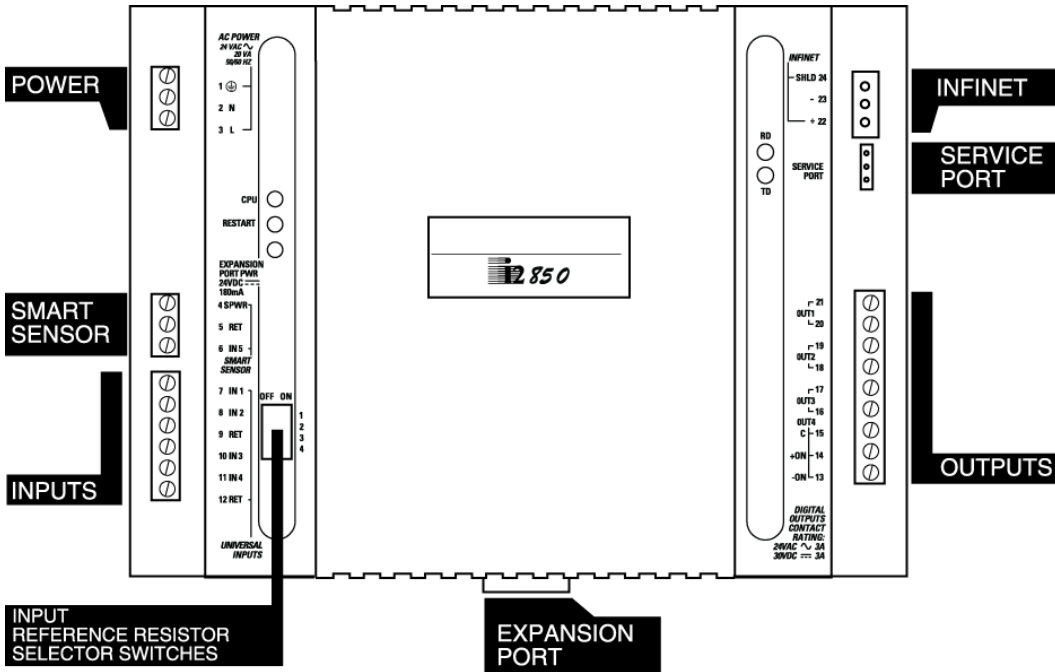
i2865 / i2866

The following diagram indicates the locations of each of the main components and connection points:
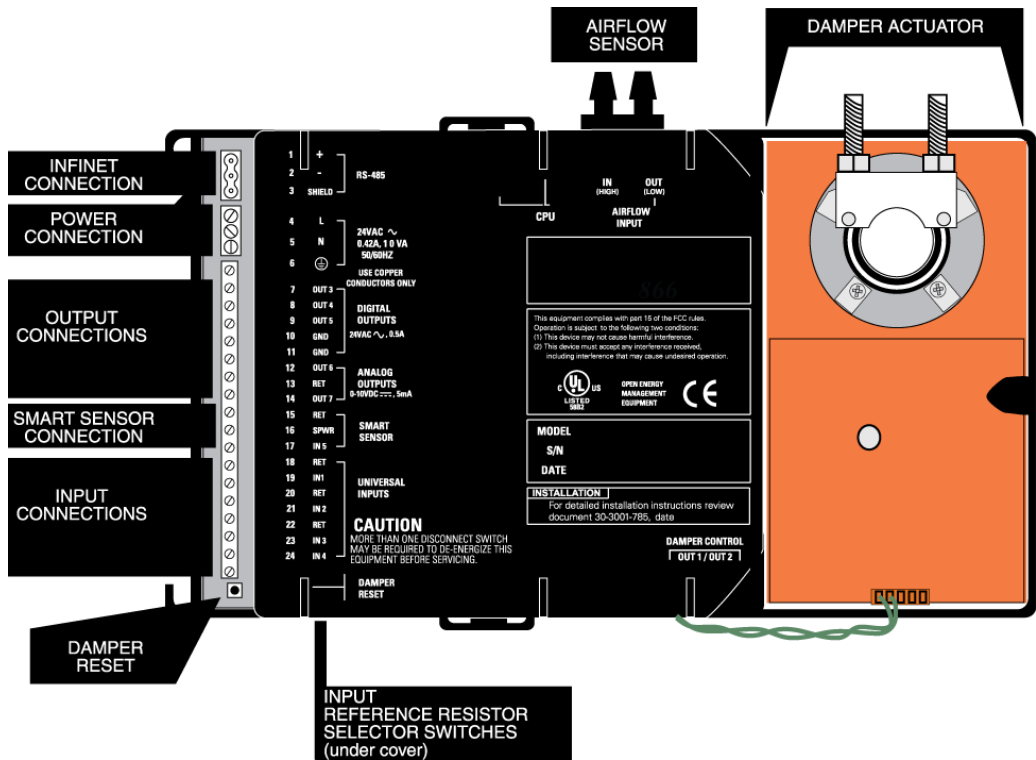
i2865-V/ i2866-V/i2885-V

The following diagram indicates the locations of each of the main components and connection points:
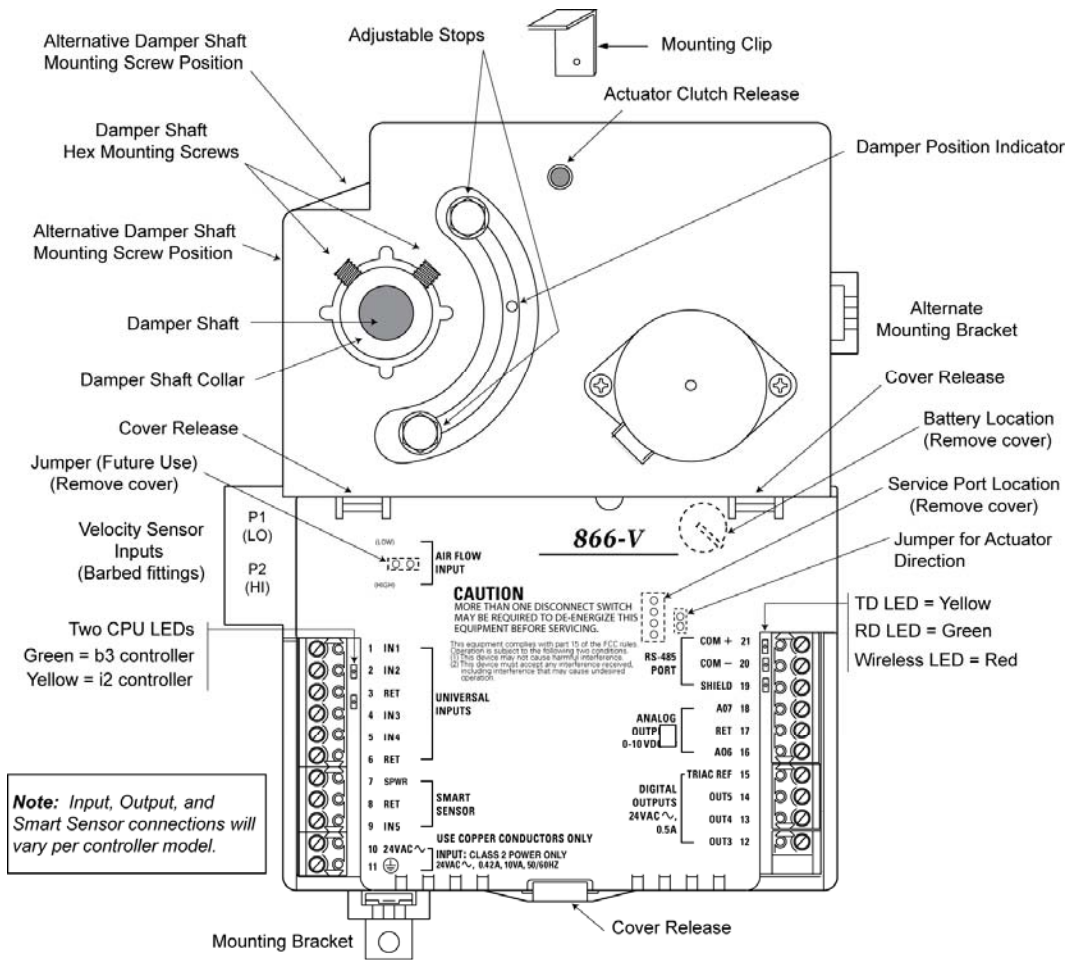
i2867

The following diagram indicates the locations of each of the main components and connection points:
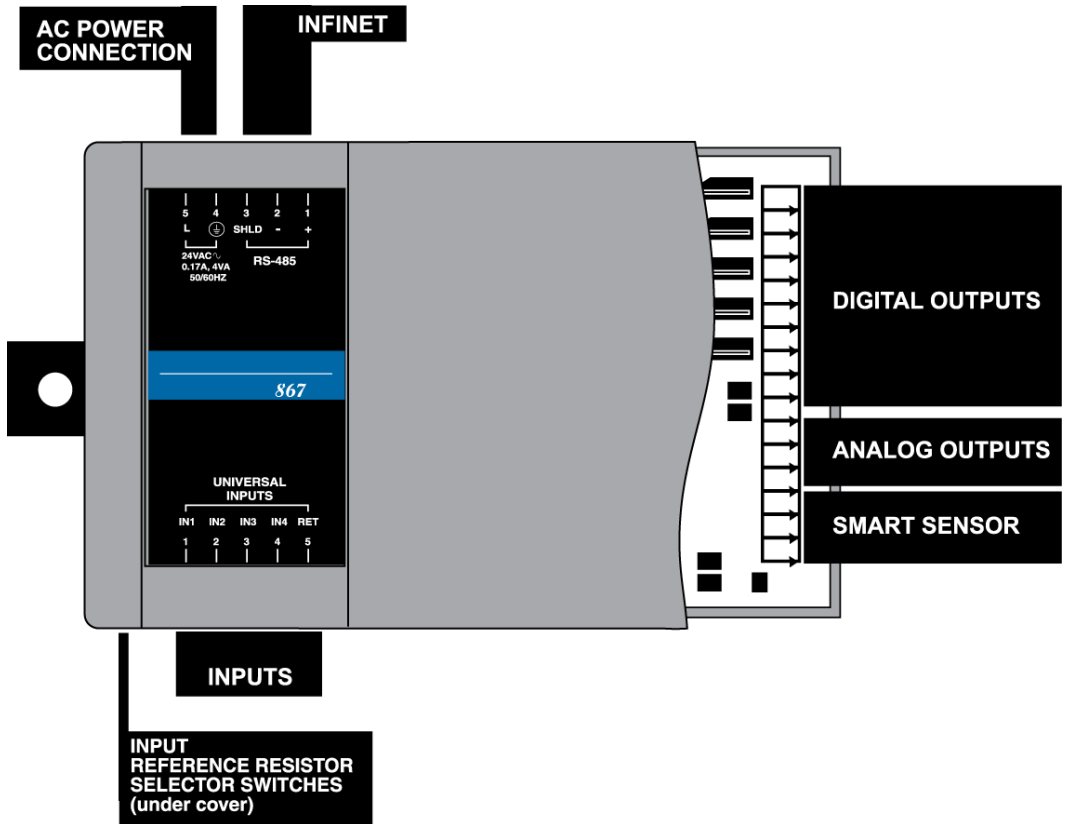
i2885

The following diagram indicates the locations of each of the main components and connection points:
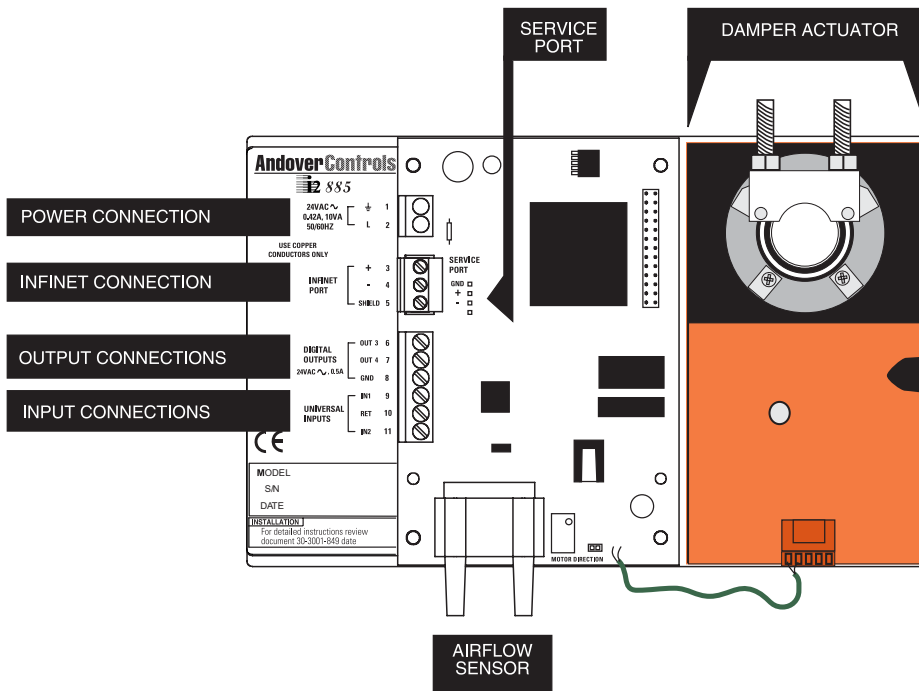
i2887

The following diagram indicates the locations of each of the main components and connection points:
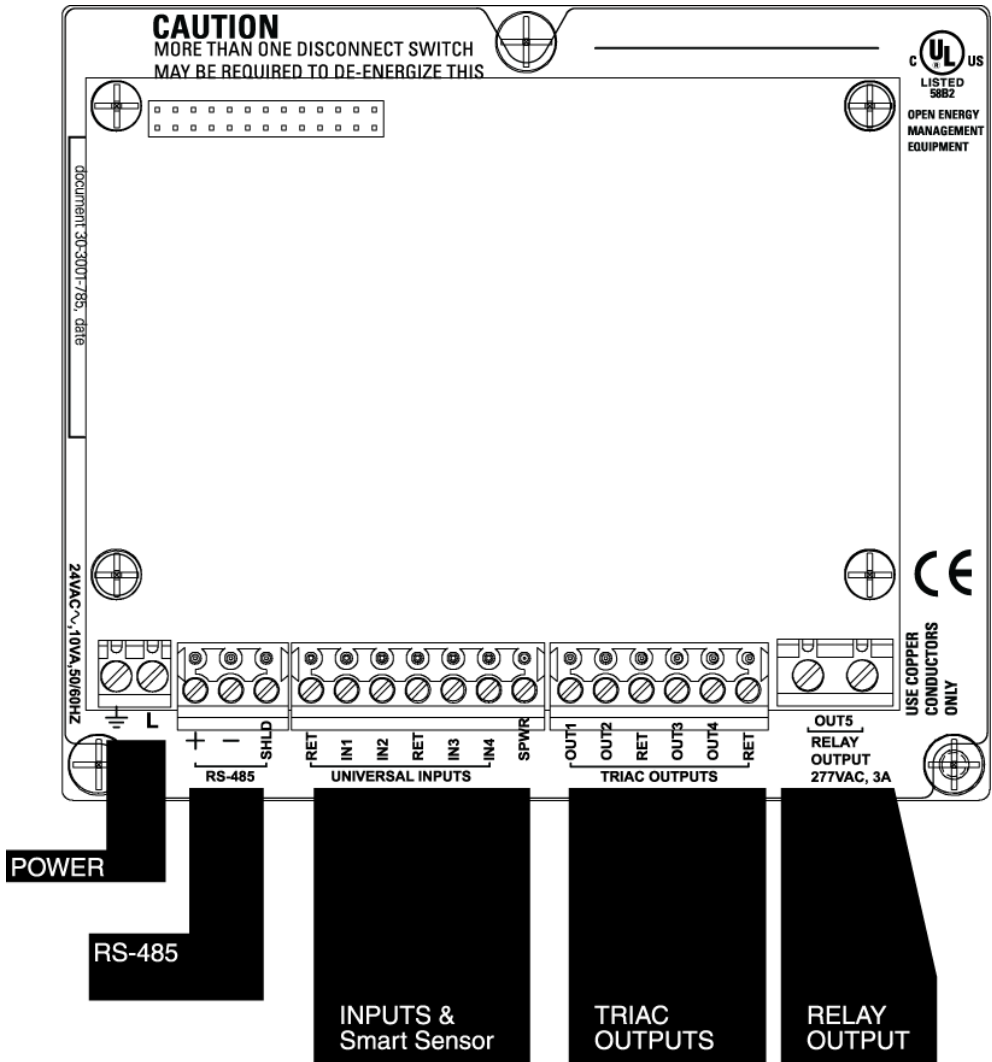
i2887-L

The following diagram indicates the locations of each of the main components and connection points:

i2920

The following diagram indicates the locations of each of the main connection points.

AC POWER CONNECTION (under cover)

MANUAL OUTPUT OVERRIDE SWITCHES

RELAY OUTPUTS

SERVICE PORT

INFINET

INPUTS

INPUT REFERENCE RESISTOR SELECTION SWITCHES

SMART SENSOR

ANALOG OUTPUTS

EXPANSION PORT

MANUAL SETPOINT ADJUST
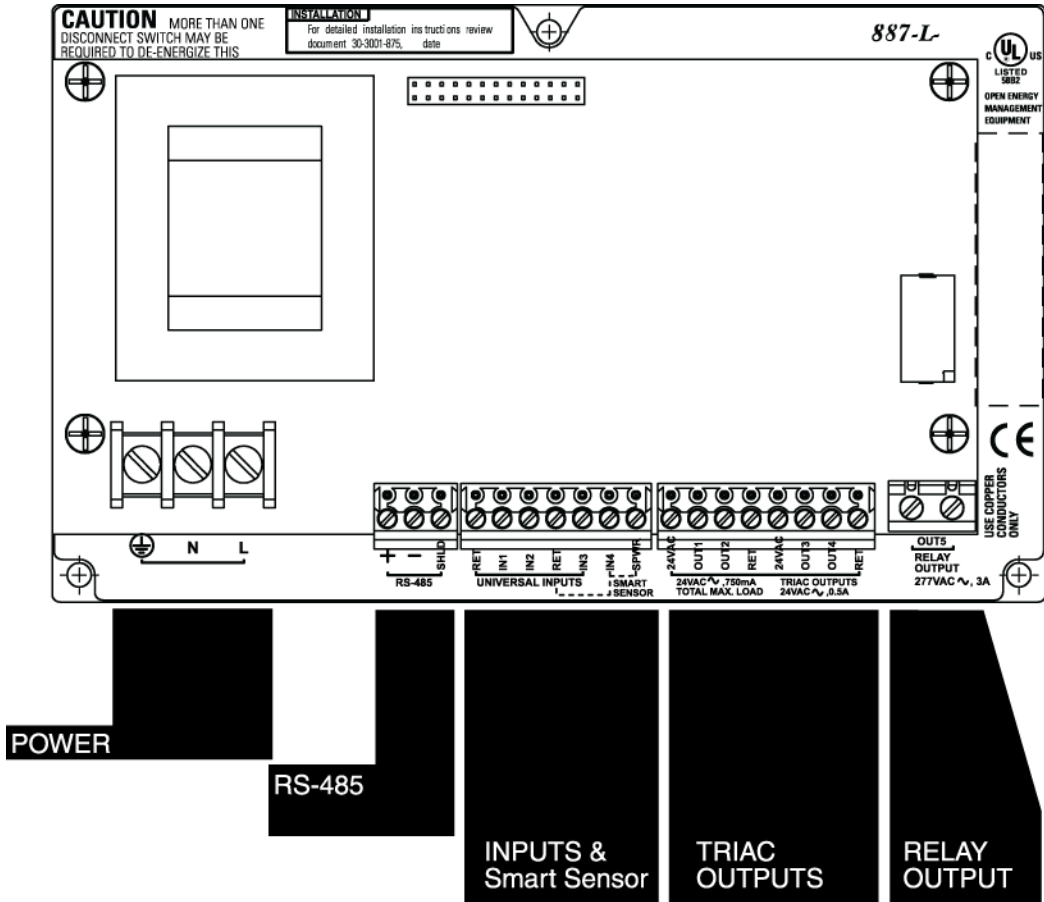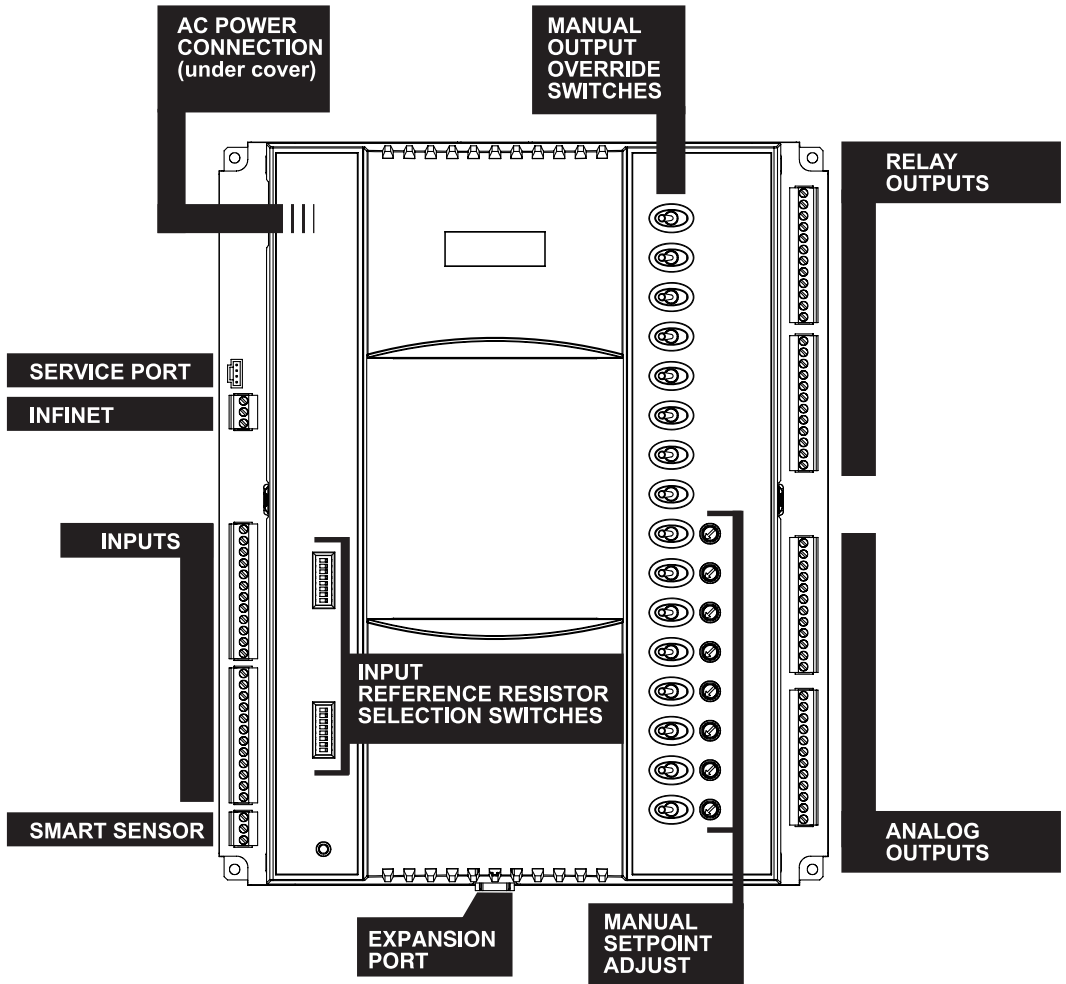
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Mechanical Installation

Mechanical Installation

Attach most of the i2 series controller chassis using standard No. 6 screws through the pre-drilled holes in the four corners of the base plate as shown in the following illustrations. Controllers that have different mounting schemes are outlined as necessary.

Dimension Drawings

The diagrams on the following pages illustrate the overall dimensions of the controller package and the location of each of the four corner screw holes.

The dimensions on each diagram are in inches with millimeters included within parentheses ( ).

Note: All of these controllers are intended for field installation within the enclosure of another product.

i2600 Series
i2800 Series
i2810 Series
i2920 Mechanical Dimensions
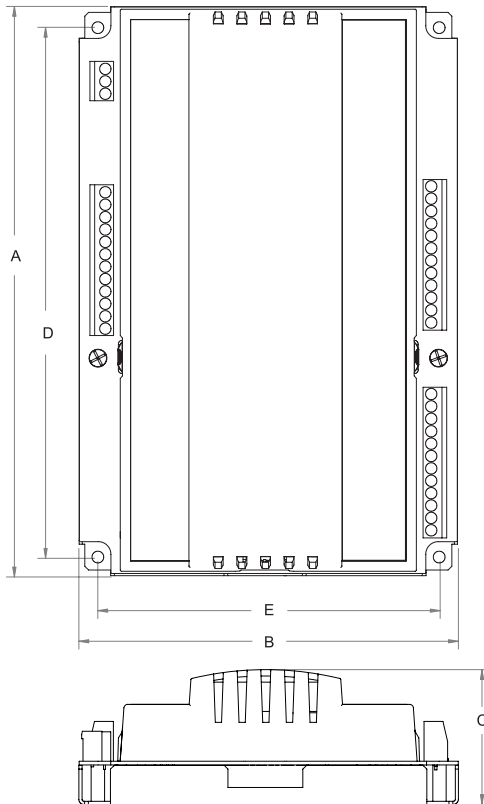
Controller	A	B	C	D	E
i2600 Series	9.03 (229)	6.01 (153)	2.14 (54)	8.41 (214)	5.42 (138)
i2800 Series	9.03 (229)	6.01 (153)	2.14 (54)	8.41 (214)	5.42 (138)
i2810 Series	9.51 (241)	7.26 (184)	2.14 (54)	8.96 (228)	6.71 (170)
i2920	13.00 (330)	10.66 (271)	2.72 (69)	12.45 (316)	10.11 (257)

i2850 Series Mechanical Dimensions

8.16 (207)

2.44 (62)

$\emptyset$.187 (5) THRU

5.47 (139)

4.920 (125)

.27 (7)

.27 (7)

7.610 (193)
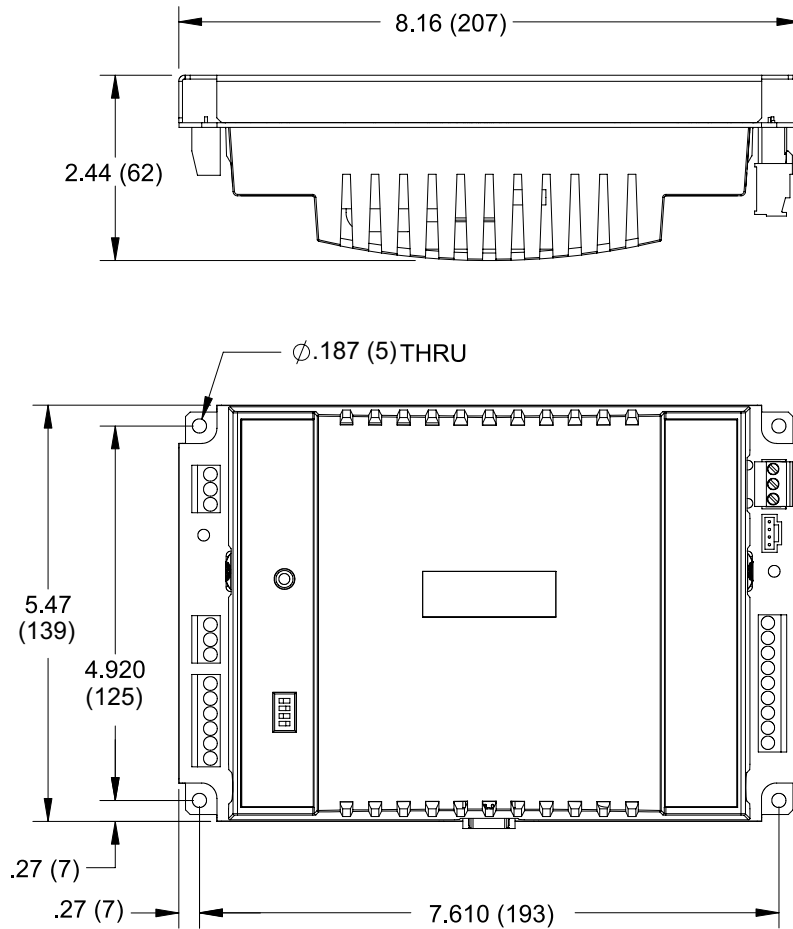
i2865/866 Mechanical Dimensions

The i2865 /866 controllers are designed to fit over an existing VAV shaft and be mounted to the housing. It is secured via one sheet metal screw.

Note:
There are specific procedures to follow when mounting this unit. Refer to the mounting procedures outlined on page 32.

The overall dimensions of the unit are:

.88
(22)

.50
(13)

2.12
(54)

2.46
(62)

7.06
(179)

.75
(19)

4.44
(113)

1.44
(37)

1.41
(36)

4.84
(123)

.75
(19)

.86
(22)

8.09
(205)
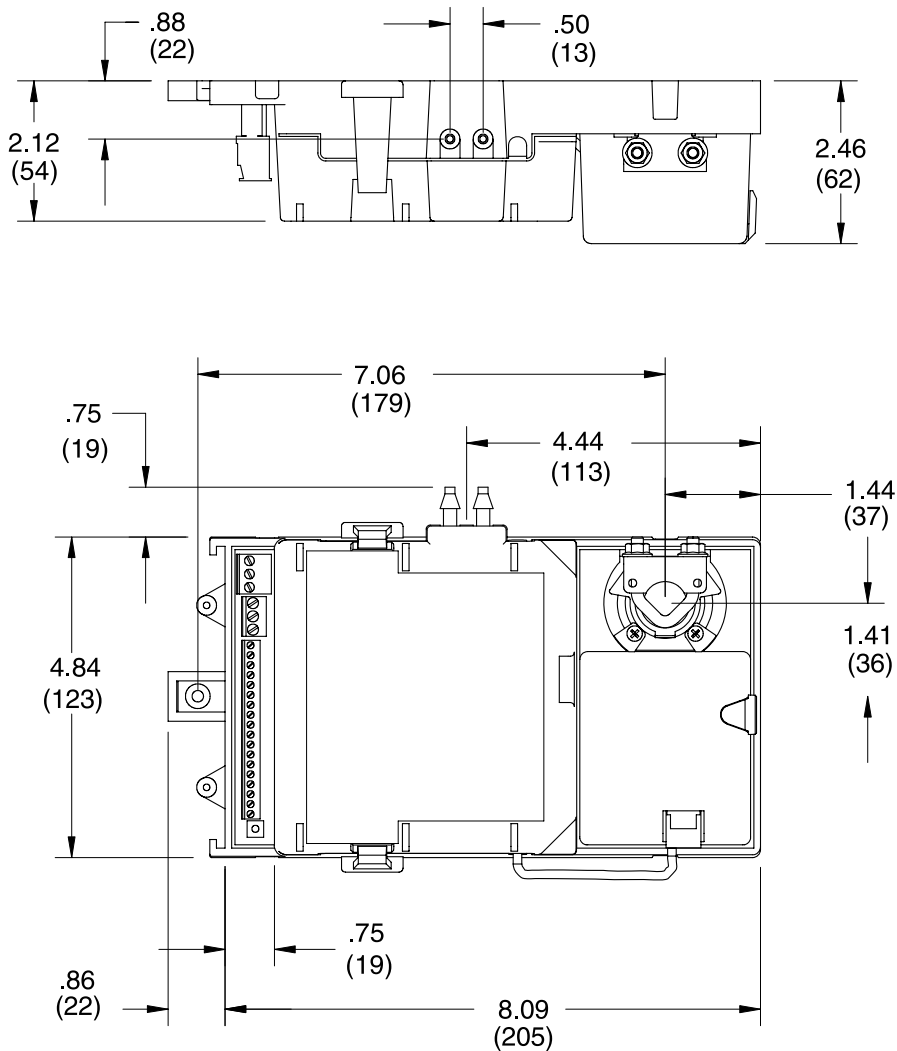
i2865-V/866-V and i2885-V Mechanical Dimensions

The i2865-V/866-V and i2885-V controllers are designed to fit over an existing VAV shaft and be mounted to the housing. It is secured via one sheet metal screw.

Note:
There are specific procedures to follow when mounting this unit. Refer to the mounting procedures outlined on page 34.

The overall dimensions of the unit are:

7.75"
(197 mm)

6.25"
(159 mm)

2.5"
(63 mm)

i2867 Mechanical Dimensions

The overall dimensions of the unit are:

6.20"
(157 mm)

6.50"
(165 mm)

2.50 "
(64 mm)

3.50 "
(89 mm)
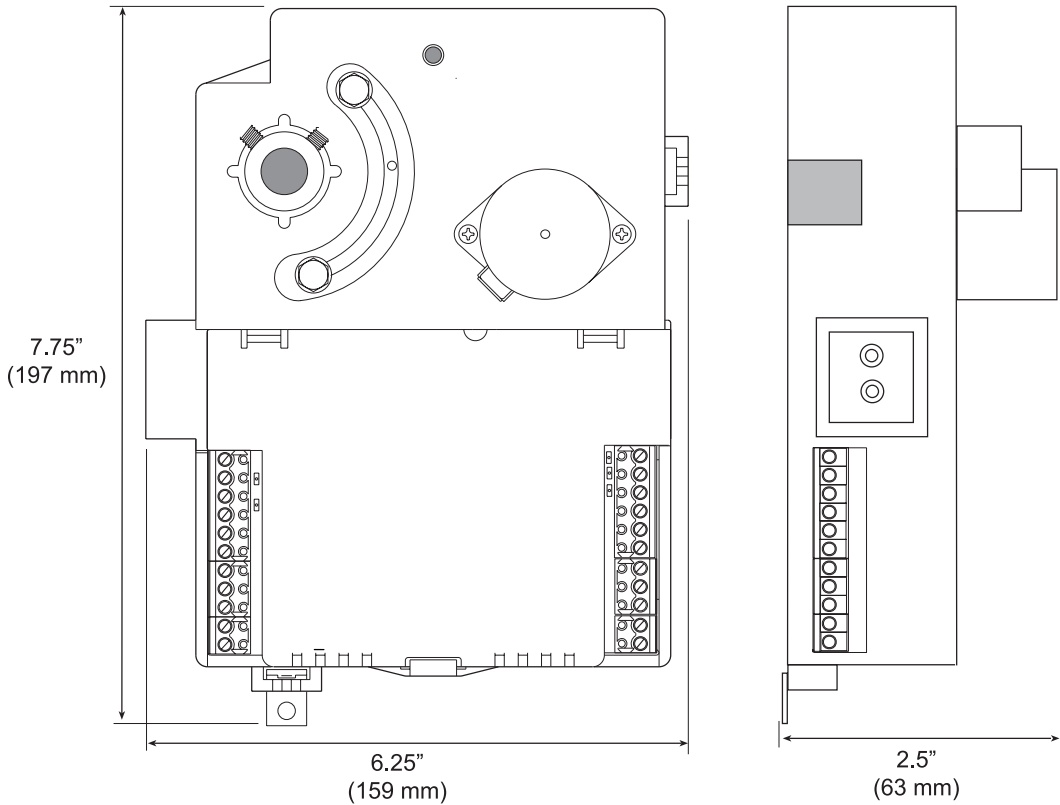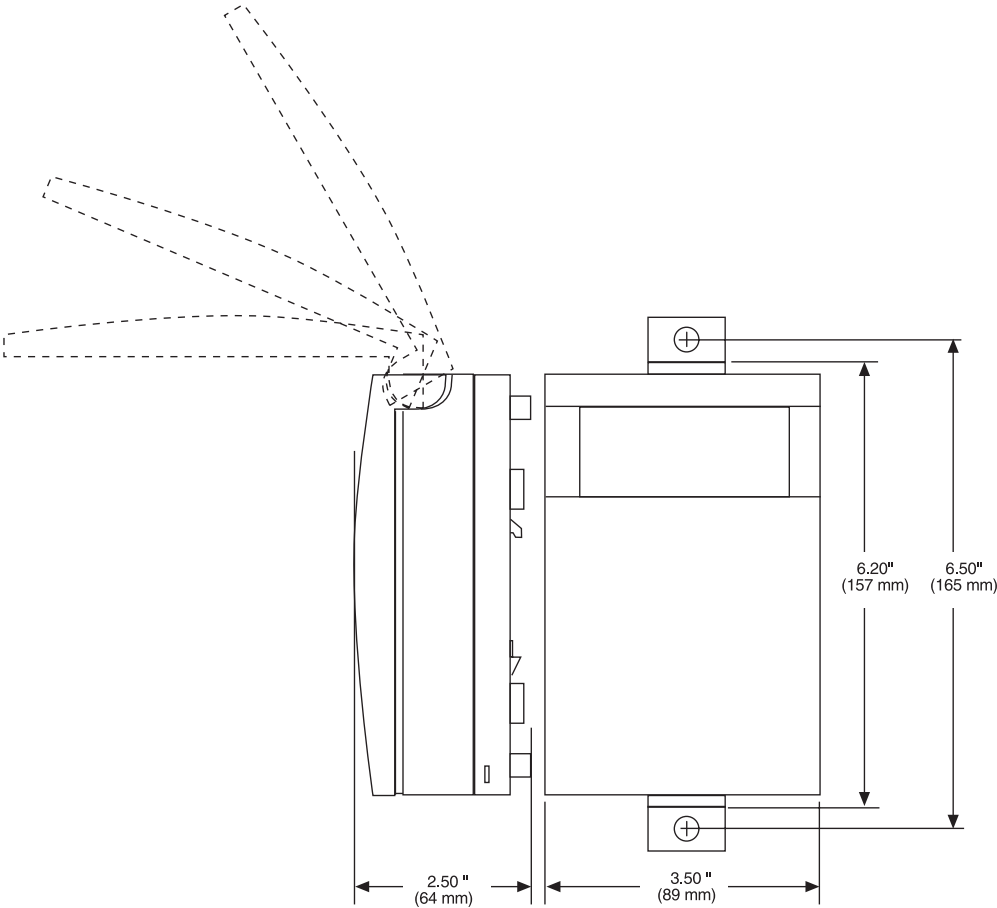
i2885 Mechanical Dimensions

The i2885 controller is designed to fit over an existing VAV shaft and be mounted to the housing. It is secured via one sheet metal screw.

Note:
There are specific procedures to follow when mounting this unit. Refer to the mounting procedures outlined on page 30.

The overall dimensions of the unit are:
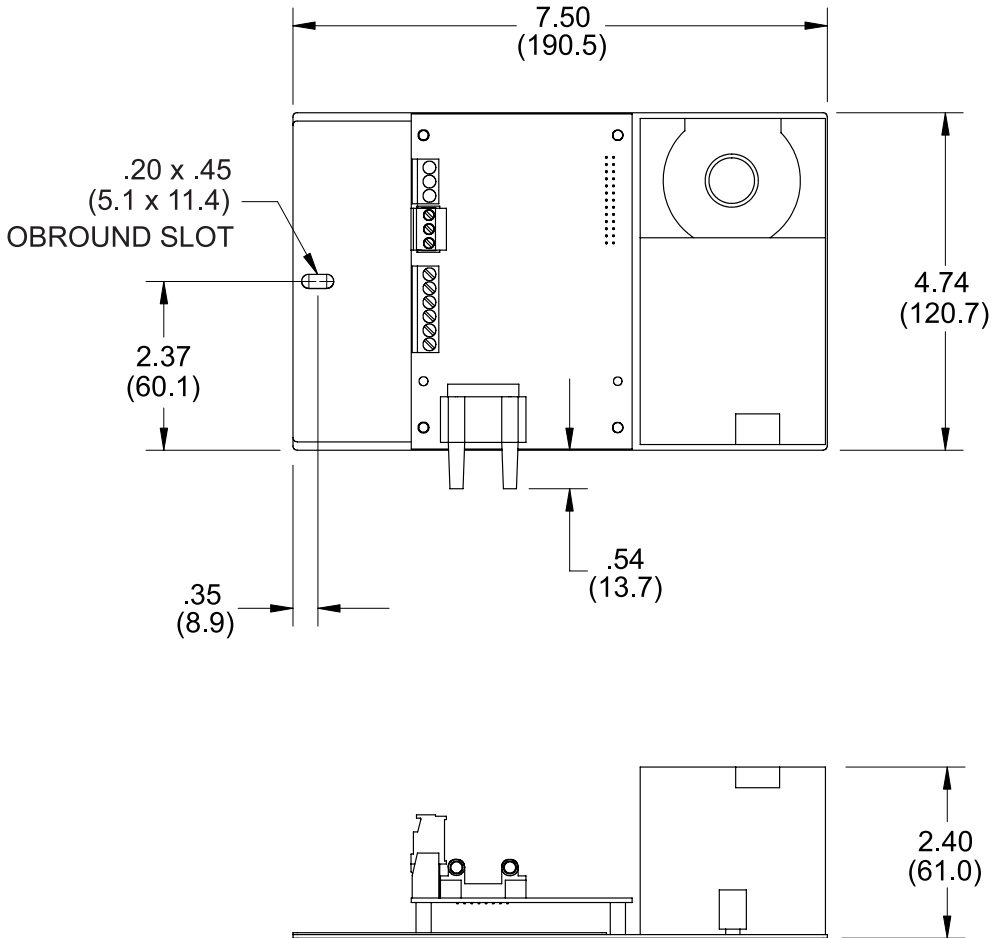
i2887 Mechanical Dimensions

The overall dimensions of the unit are:
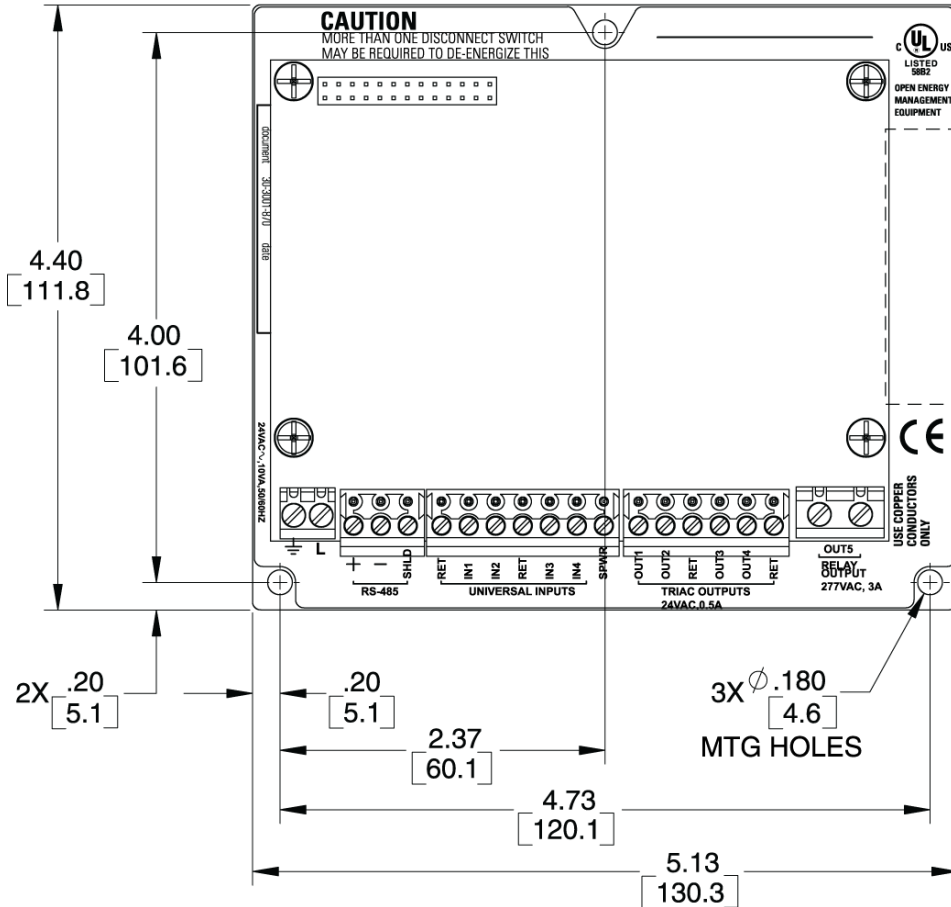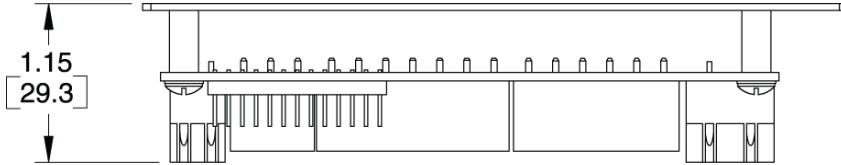
i2887-L (open class) Mechanical Dimensions

The overall dimensions of the unit are:
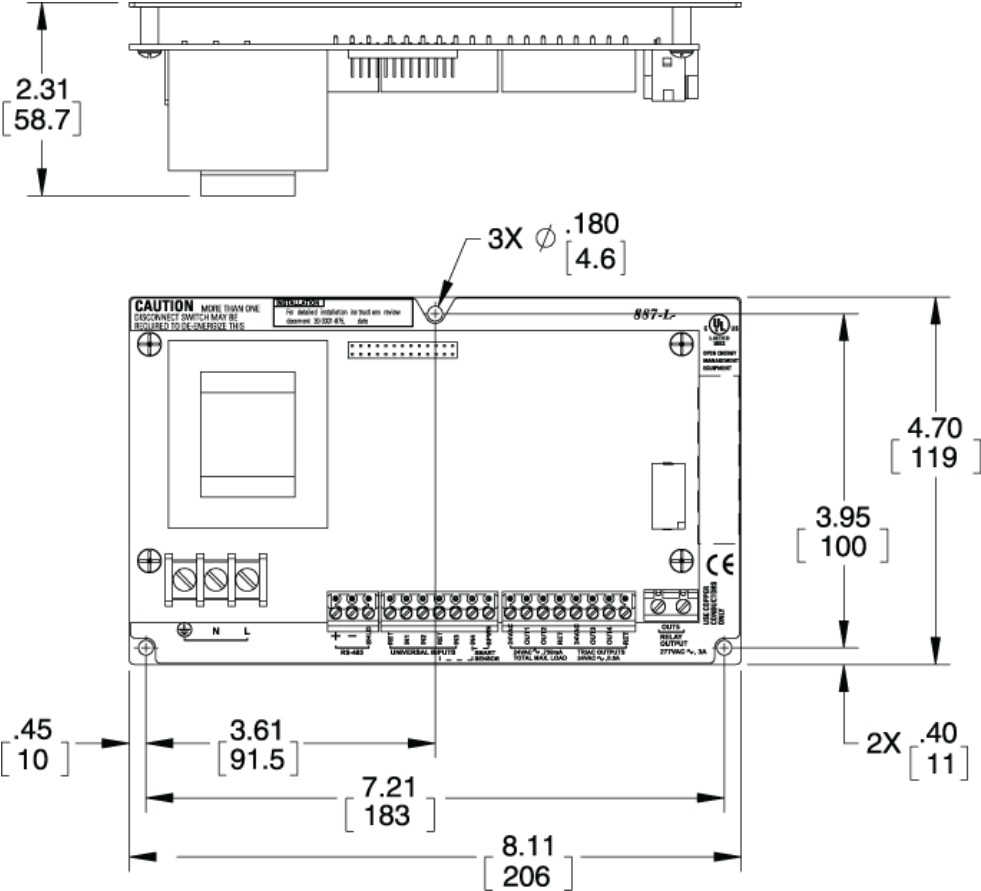
i2200, i2210 Repeater Mechanical Dimensions

i2200   **i2210**
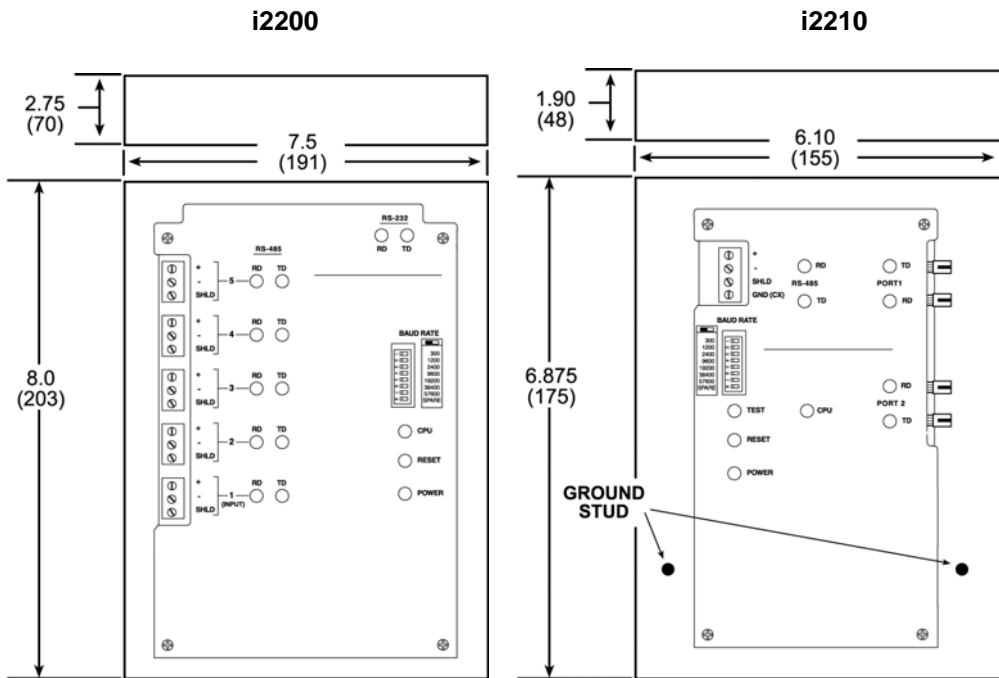
UL-864 Note: i2200 must be surface mounted when used in UL-864 Smoke Control applications.

XP Module Mechanical Dimensions

All I/O Modules

7.10 (180)

0.16 (4) 6.78 (172)

3.21 (82)

2.55 (65)

0.33 (8)

4X ∅.187 (5) THRU
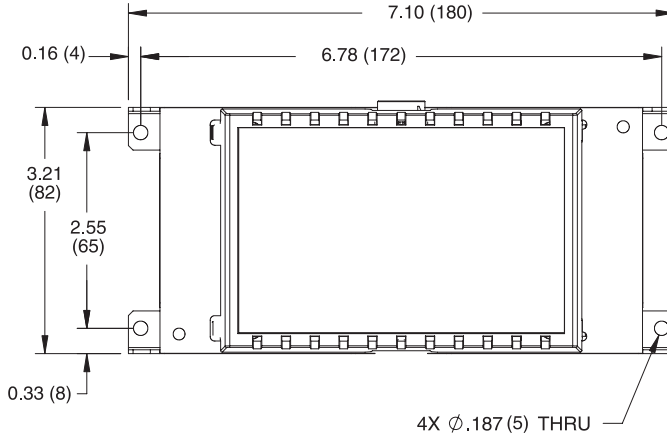
External Display Module

127.1
5.00

120.1
4.73

29.9
1.18

60.4
2.38

41.9
1.65

178.1
7.01

154.2
6.07

184.2
7.25

12.6
.50

4.6
∅.180 (4) MTG HOLES
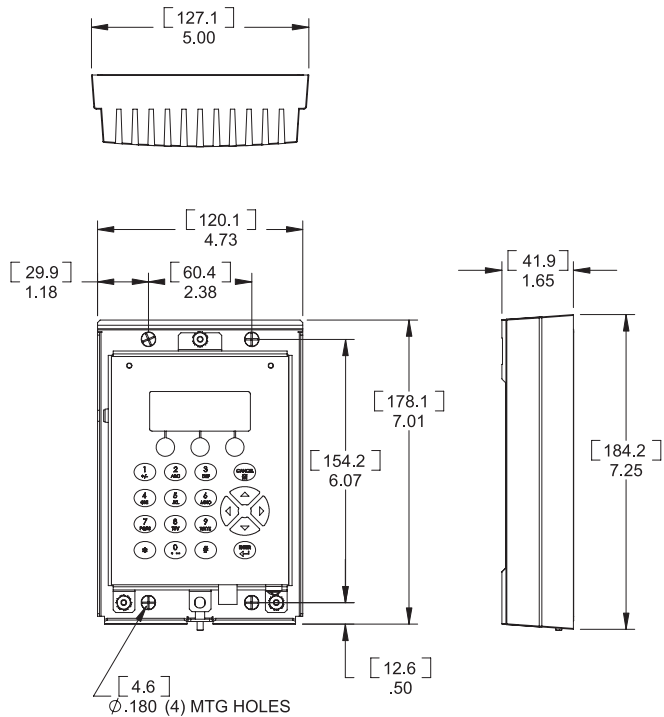
Actuator Installation

i2865/866/885 Installation

Attach the controller to the VAV box using the following procedure:

1. Loosen the nuts that attach the mounting U-bolt to the actuator motor.

U-bolt clamp with nuts

Manual override button
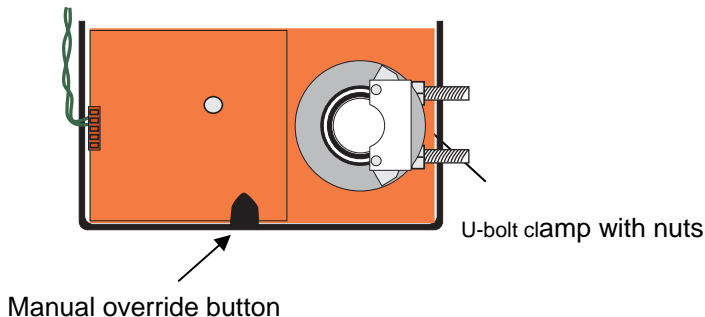
2. Manually, position the damper blade at its fully closed position.

3. With the manual override button depressed, rotate the actuator clamp of the controller motor to approximately 1/16 - 1/8" between the actuator stop and clamp, depending on seal design. The rotation direction to turn depends on the setting of the rotation direction switch on the controller. The default direction to position the clamp would be counter-clockwise (full '-' position). See the other side of this sheet for details on the rotation direction switch.

Stop
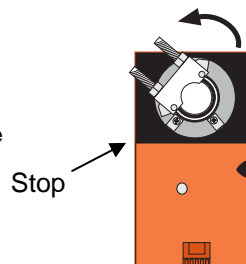
4. Position the unit at the proper perspective on the VAV box. Carefully insert the shaft of the VAV unit into the opening of the actuator motor through the U-bolt. Make sure the controller is flush with the VAV housing. Finger-tighten the nuts to secure the shaft to the actuator.

5. Insert a #8 self-tapping screw through the mounting slot to secure the controller to the housing. Position the screw in the center of the slot. Do not over-tighten. The controller should move freely on this screw.

865/866   885

#8 Self-tapping screw
secures the unit to the housing
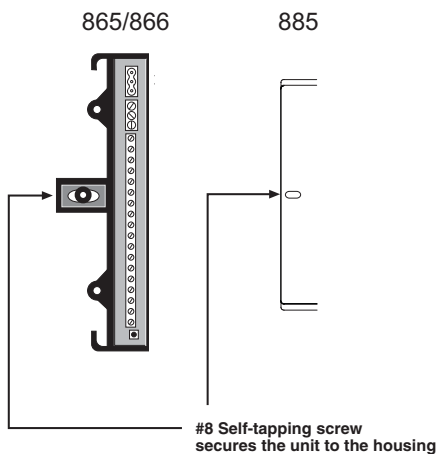
6. Tighten the U-Bolt to the shaft using an 8 mm wrench.

Note: For information about Programming the Actuator, see "Actuator Programming and Use" in Section 8.

Actuator Installation

i2865-V/866-V/885-V Installation

Attach the controller to the VAV box using the following procedure:

Refer to the following illustration to install the actuator.

Alternative Damper Shaft
Mounting Screw Position

Adjustable Stops

Mounting Clip

Actuator Clutch Release

Damper Shaft
Hex Mounting Screws

Damper Position Indicator

Alternative Damper Shaft
Mounting Screw Position

Alternate
Mounting Bracket

Damper Shaft

Cover Release

Damper Shaft Collar

Battery Location
(Remove cover)

Cover Release

Service Port Location
(Remove cover)

Jumper (Future Use)
(Remove cover)

P1 (LO)

(LOW)

866-V

Jumper for Actuator
Direction

Velocity Sensor
Inputs
(Barbed fittings)

P2 (HI)

(HIGH)

AIR FLOW
INPUT

TD LED = Yellow
RD LED = Green
Wireless LED = Red

CAUTION
MORE THAN ONE DISCONNECT SWITCH
MAY BE REQUIRED TO DE-ENERGIZE THIS
EQUIPMENT BEFORE SERVICING.

Two CPU LEDs

Green = b3 controller
Yellow = i2 controller

This equipment complies with part 15 of the FCC rules.
Operation is subject to the following two conditions.
(1) This device may not cause harmful interference.
(2) This device must accept any interference received,
including interference that may cause undesired
operation.

COM + 21
COM − 20
SHIELD 19

RS-485
PORT

1 IN1
2 IN2
3 RET
4 IN3
5 IN4
6 RET

UNIVERSAL
INPUTS

ANALOG
OUTPUT
0-10 VDC

A07 18
RET 17
A06 16

TRIAC REF 15

Note: Input, Output, and
Smart Sensor connections will
vary per controller model.

7 SPWR
8 RET
9 IN5
10 24VAC~
11 ⏚

SMART
SENSOR

DIGITAL
OUTPUTS
24VAC~,
0.5A

OUT5 14
OUT4 13
OUT3 12

USE COPPER CONDUCTORS ONLY

INPUT: CLASS 2 POWER ONLY
24VAC~, 0.42A, 10VA, 50/60HZ

Mounting Bracket

Cover Release

Procedure

Attach the controller to the VAV box using the following procedure:

1. Check the mounting location for the Andover Continuum i2 865-V/866-V/885-V controller. The unit is typically mounted with the controller extending down or to the right from the damper shaft. However, the controller can be operated in any position within the vertical plane.

Note: Installing the controller to the right (with the barbed fittings pointing down) will help to prevent condensate from migrating into the on-board velocity sensor.

   With a downward extension, the available area around the damper shaft must measure 6" (160mm) down from the lower edge of the shaft, 4.5" (120mm) to the right, 1.5" (40mm) to the left and 1.75" (45mm)above the shaft. Ensure the location allows enough clearance for servicing.

   The actuator is designed to mount over a ½" (12.7 mm) diameter shaft with a minimum of 2.5" (63.5mm) of exposed shaft. If the damper shaft is less than ½" (12.7mm) an adapter, which can be purchased from Schneider Electric, may be required. The 865/866/885-V controller will **not** work with larger damper shaft*s.*

2. If the exposed damper shaft is less than 2" (51mm) but at least 1" (25.4mm) long, move the two damper shaft mounting screws to the alternate lower damper shaft positions (see illustration on previous page).

3. Select the mounting bracket location that will provide the most stability for the operation of the actuator. Position the mounting clip in the desired mounting bracket. Do **not** insert the clip more than half-way into the bracket. This will allow the clip and back of the actuator to properly align with the VAV box.

4. Rotate the VAV damper shaft by hand to the fully closed position. Note whether the damper is rotated clockwise (CW) or counter-clockwise (CCW) to close.

5. Slip the controller over the damper shaft. Position the actuator and, using a self-tapping sheet metal screw, secure the mounting clip to the VAV box.

6. Press the actuator toward the box until the actuator comes in contact with the VAV box, or the mounting clip snaps into the bracket, or the back of the actuator comes into contact with the VAV box.

7. Press and hold the red actuator clutch release and rotate the actuator to a nearly closed position, the 5° index mark if the damper shaft was rotated CCW to close (step 5). Rotate the actuator collar to the 85° index mark if the damper shaft was rotated CW to close (step 5).

8. Tighten the two damper Allen screws using the supplied hex wrench. The minimum torque required to secure the controller to the damper shaft depends on the shaft material. The maximum torque for the socket screws at 30 inch-pounds (3.4 Nm).

Note: The damper shaft should rotate freely when the clutch is released. If it does not, the actuator may not be properly aligned with the damper shaft – it may be necessary to repeat steps 4 though 9 using a new orientation.

9. If the damper does not provide a mechanical stop in the open direction, or it is not desirable to use the damper's open stop, set the adjustable stops on the i2865-V /866-V/885-V controller to the desired position. Use a ¼" hex driver to adjust the screw stop on the controller.

Note: For the 866-V model only, the damper position feedback reporting option can be enabled by setting the Andover Continuum attribute, *LCDState*, to ENABLED. The attribute, *Override Value*, indicates the damper position as a fractional value from 0 (at the closed stop) to 1 (at the open stop).

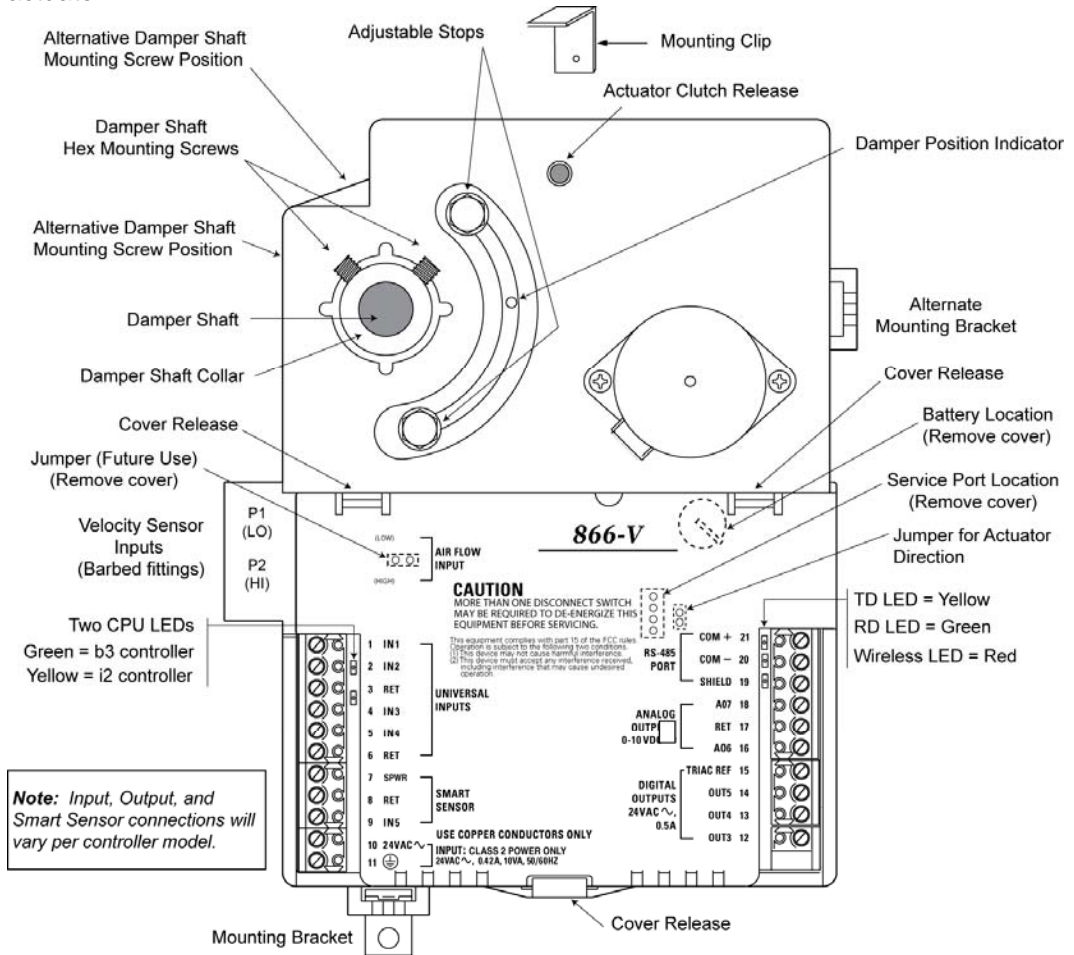**Note: For information about programming the actuator, see "Actuator Programming and Use" in Section 8.**

Refer to the *i2/b3 865/866/885-V Controller Installation Instructions*, 30-3001-985, for additional information regarding the installation of your new "-V" controller.

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Power Connections

Power Connections

The i2 series controllers are operated via an external power source. An internal power converter creates the necessary DC voltages to supply the microprocessor circuitry.

The following lists indicate the primary power sources for each controller. As indicated, some of the controllers listed include multiple power source choices.

Controller Power Options

Controller	24VAC	12-28VDC	115-230AC
i2600 Series	X	X	
i2800 Series	X	X	
i2810 Series	X	X	
i2850 Series	X		
i2865/866	X		
i2865/866-V	X		
i2867	X		
i2885	X		
i2885-V	X		
i2887	X		
i2887-L			X (separate models for each)
i2920			X

Detailed connection diagrams may be found on the next few pages.

24VAC Connections

When using a 24V AC source, this power supply is connected via three terminals located on the power connector. The unit should receive power from its own independent, un-switched circuit.

The power connector is always located on the left side of the module case (as viewed from the front) and consists of three screw terminals.

The 24 VAC connection consists of both terminals from the secondary of a power-line to 24 VAC transformer. Connection to the controller is via a screw type connector. The ground wire to the controller should not exceed 12" in length and it must be connected to a good earth ground.

Powering Multiple i2 Series Controllers

Unless all the i2 Series controllers you intend to power are resident in the same cabinet, **it is imperative that you use a separate transformer for each controller**. When you attempt to power multiple remotely located controllers from a single power source the voltage drop caused by the current draw per controller (realize that the actuator may be using power from the controller as well) results in marginal operation and in most cases prevents proper communications between controllers.

UL-864 Notes: All controllers used for UL864 Smoke Control applications must be powered by separate transformers. The optional varistors shown on the primary side of each 24VAC connection drawing are <u>not to be used</u> for Smoke Control applications.

   ⚠   *CAUTION: Make sure that 24 VAC is not connected to the power cable while you are wiring the controller, or you could receive an electrical shock that is life-threatening.*

The 24VAC connections are as follows:

i2600 Series
i2800 Series
i2810 Series
i2850 Series
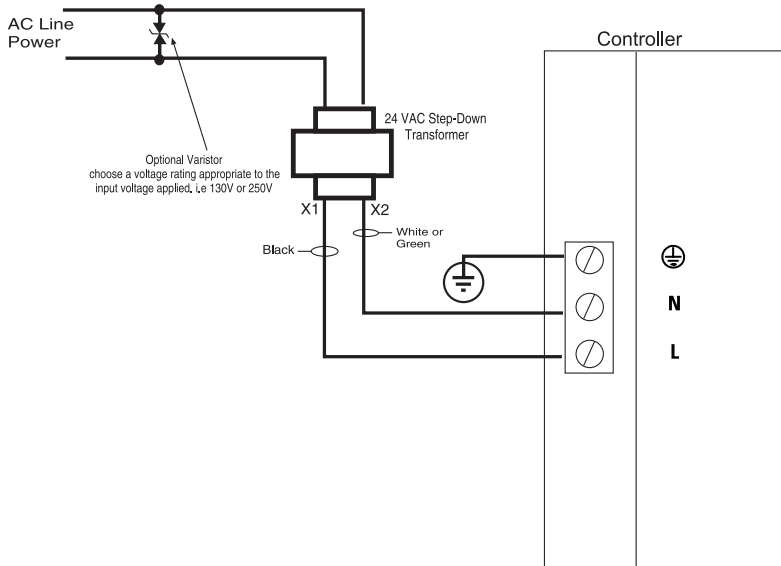
i2865/866 24VAC Connection
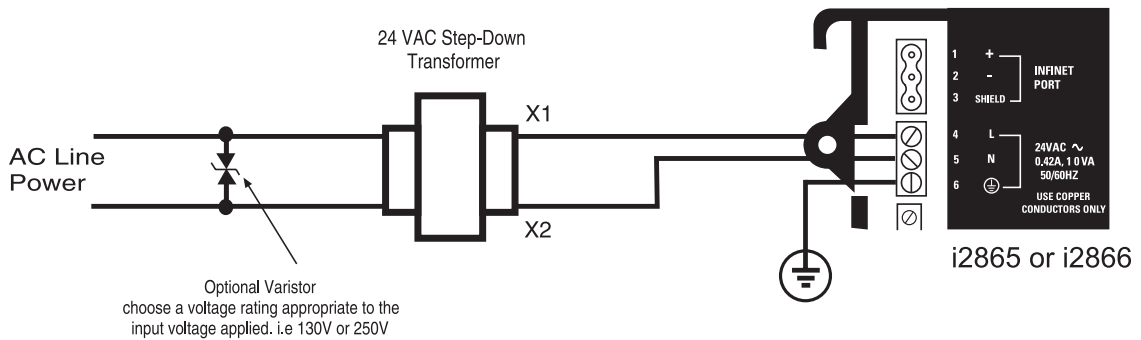
i2865-V/866-V 24VAC Connection

24 VAC Step-Down
Transformer

X1

AC Line
Power

10 24VAC ∿
11

Optional Varistor
(Choose a voltage rating appropriate to the
input voltage applied. For example, 130V
or 250V)

X2

⚠
Warning
Class 2 power only!

i2867 24VAC Connection

24 VAC Step-Down
Transformer

X1

AC Line
Power

X2

Optional Varistor
choose a voltage rating appropriate to the
input voltage applied. i.e 130V or 250V
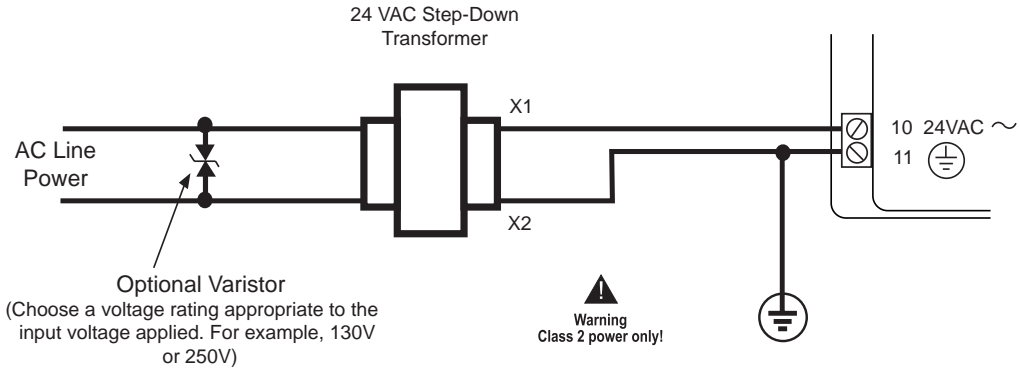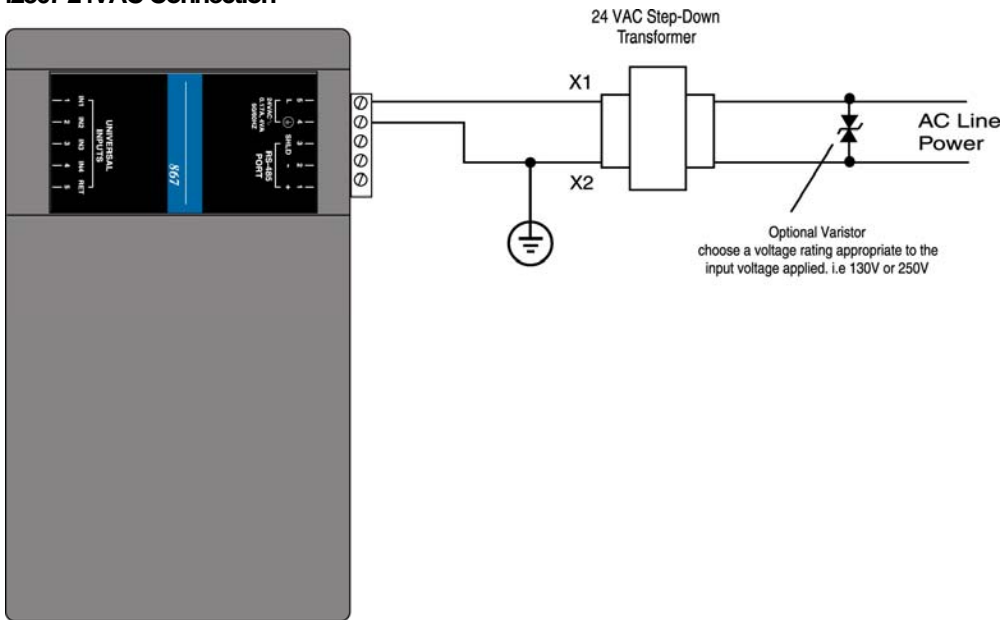
i2885 24VAC Connection
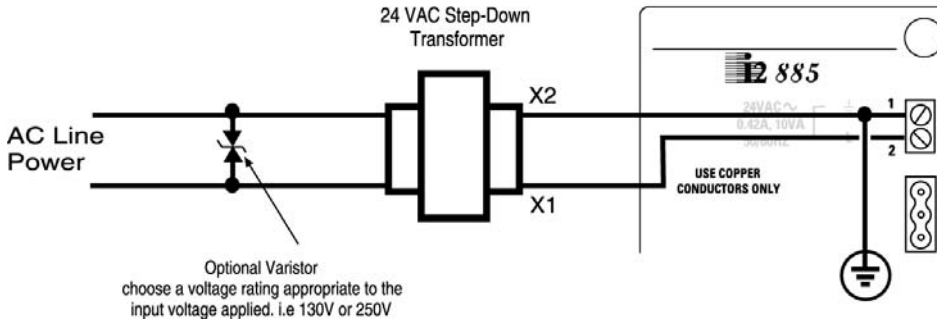
i2885-V 24VAC Connection
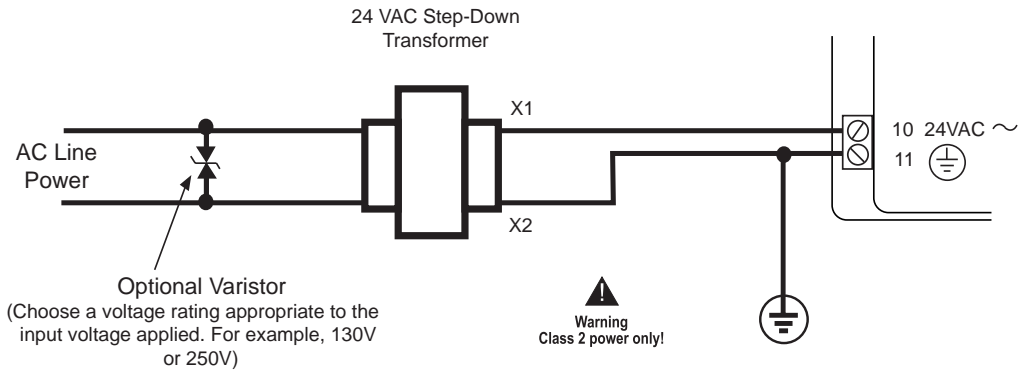
i2887 24VAC Connection
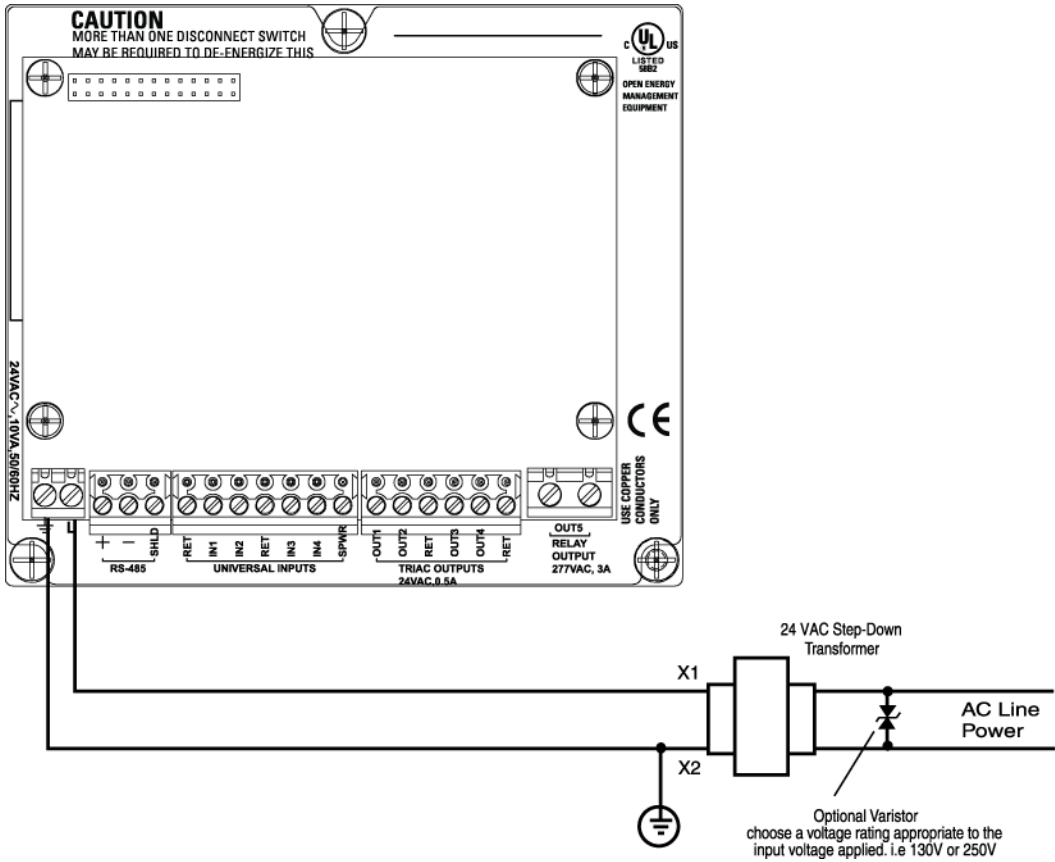
12 - 28 VDC Connection

Some i2 series controllers can be powered by an external 12-28 VDC $\overline{}$ source. This power supply is connected via terminals located on the Power connector.

The DC connections are as follows:

i2600 Series
i2800 Series
i2810 Series
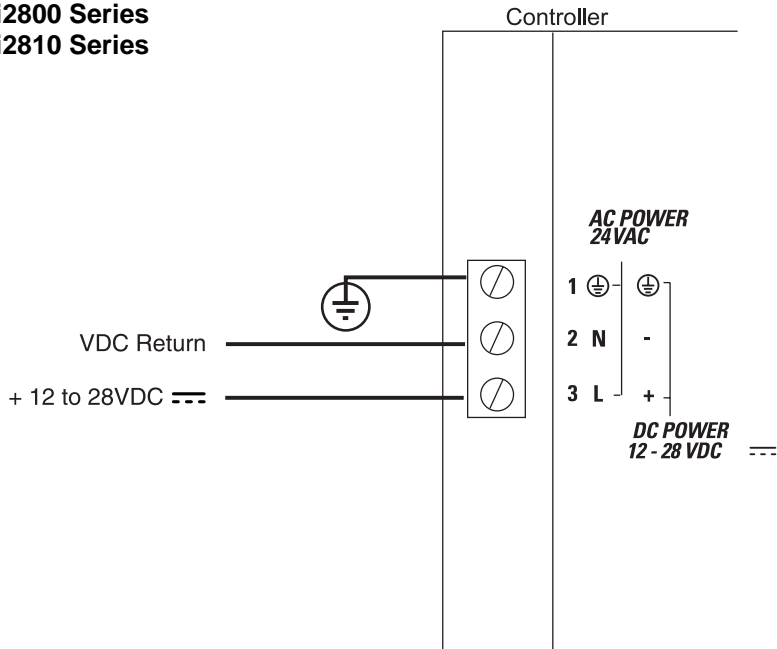
115 - 230 VAC Connection

The i2887-L and the i2920 controller are the only controllers powered by an external AC mains source.

MODEL	POWER
i2887-L-115	115 VAC $\sim$, 50 or 60 Hz
i2887-L-230	230 VAC $\sim$, 50 or 60 Hz
i2920	115-230 VAC $\sim$, 50 or 60 Hz

i2920 AC Connection
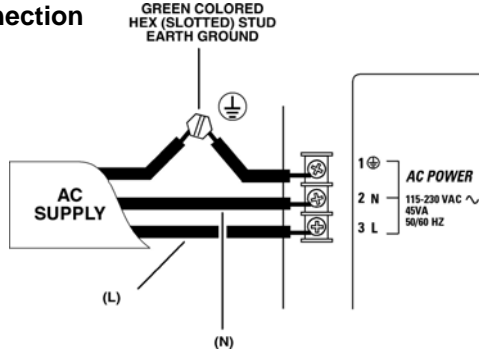
i2887-L AC Connection
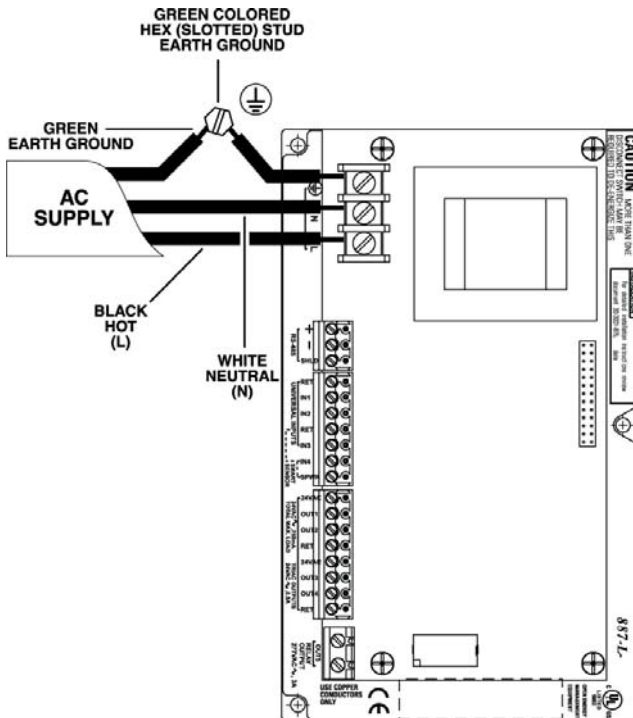
CAUTION: The AC power wiring should be connected by a qualified technician per applicable electrical codes. In the United States, wiring must conform to the National Electrical Code NFPA 70. Do not connect the power wiring with power applied.

Battery Backup Connection & Replacement

If the power source is interrupted during operation, backup power for the internal controller state memory is provided by a coin-style 3 Volt Lithium battery. This battery can maintain backup status for typically 5-years.

To access the battery holder, the module cover must be removed. The cover is secured via two force fitting plastic tabs. To remove the cover, gently depress the two cover latches simultaneously while lifting the cover. A typical controller cover is shown below:

COVER LATCHES
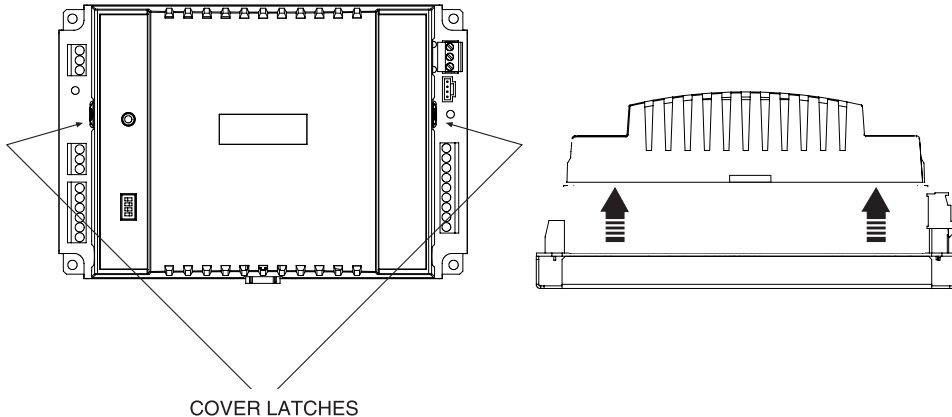
Once the access cover is removed, the printed circuit board is accessible. The following illustrates the location of the battery holder on the i2850 in relation to the board. Each controller uses a similar holder:
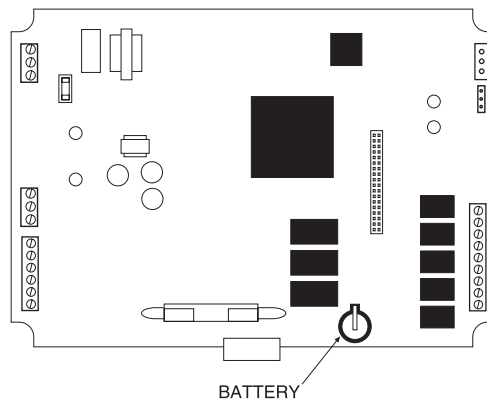
BATTERY

During shipment, an insulating plastic tab is inserted under the clip on the battery to prevent it from draining prior to installation. To activate the battery, this tab must be removed. Should it become necessary to replace the battery, the battery is placed in a coin-style holder. The battery used in the i2 series varies per controller. The following table indicates the replacement battery type:

Controller Battery Types

Controller	Battery	Controller	Battery	Controller	Battery
i2600 Series	CR 1225	i2865/866	CR 1225	i2885-V	none
i2800 Series	CR 1225	i2865-V/866-V	CR 1225	i2920	BR 2325
i2810 Series	CR1225	i2867	CR 1225		
i2850 Series	CR1225	i2885	none		

> ⚠️ **CAUTION: There is danger of explosion if the battery is incorrectly replaced.**
> **Replace only with the same or equivalent type recommended above.**
> **Replacement of batteries is to be performed by a trained technician.**
> **Dispose of used batteries according to manufacturer's instructions.**

Building Ground Requirements

Be sure that all equipment from Schneider Electric is grounded to true Earth ground. True Earth ground protects the equipment from transients and other power surges in the area. We cannot guarantee that the controller system will operate as documented without a properly grounded installation.

An example of a sub-standard ground is a galvanized steel cold water pipe. As the pipe corrodes, it does not act as a true ground. The corrosion acts as an insulator, raising the potential of the pipe with respect to the ground.

When lightning strikes in the area of the installation, it drastically changes the potential of the Earth. Since properly grounded Andover Continuum units respond to changes in potential more rapidly than poorly grounded electrical systems, a poorly grounded building tries to reach ground through the Andover Control system. The surge of current can destroy electronic components on the controller board. Surges of much lower potential than lightning also impact the reliability of the equipment.

Inspecting the Ground

Be sure to have your grounds inspected before you begin the installation process to be sure your municipality follows the National Electrical Code. Many municipalities do not follow the code and often have substandard electrical grounds.

Check your ground as follows:

Inspect the building power distribution panel for Earth-ground termination. If the ground termination is any of the following, it is not adequate and must be corrected:

> Does not exist.
> Is connected to a corroded or galvanized pipe.
> Is connected using a small gauge wire (less than 14 AWG).

Be sure your Andover Continuum cabinet is connected to the ground with a copper conductor that terminates at the distribution panel.

Lightning Protection

Although metal oxide varistors are built into the board to protect against power line transients, this protection is not sufficient to protect against lightning. Lightning arresters are required at each point where Infinet cables enter or exit a building. The following lightning arrester is recommended:
Schneider Electric # 01-2100-299, Two pair gas tube lightning arrester

UL-864 Note: For Smoke Control applications, connections between buildings are to be handled using the i2210 Fiber Optic repeater. The use of lightning arrestors are not allowed.

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RS-485
Infinet

Introducing Infinet

Infinet is a high-performance, token-passing local area network (LAN) field bus that is built into all i2 controllers. The protocol supports a combination of shared resource and peer-to-peer communications, where more than one controller can be the network master at any given time.

Electrically similar to standard RS-485, Infinet is physically wired using two-conductor shielded twisted pair cable that transmits data at a rate of up to 19.2 Kb/sec. Although Infinet utilizes a token-passing data access system, it allows for a combination of daisy-chained bus and star topologies to be implemented.

Infinet II networks support a mix of i2 and older Infinet I devices. Infinet networks only support Andover Continuum Infinet controllers. You cannot mix Infinet and other RS-485 type controllers (i.e., BACnet or LONMark) on the Infinet network wiring.

UL-864 Note: The Infinet meets NFPA Style 3.5 supervision requirements.

Infinet Cable Specifications

Cables used to form the Infinet should conform to the following specifications:

Wire Size:	24 AWG
Cable Type:	Twisted-pair, copper wire, tinned
Shield:	Braid
Nominal Impedance:	120 Ω
Velocity of propagation:	78%
Capacitance:	<12.5 pF/ft between conductors and < 22 pF/ft between the conductor connected to ground and the next conductor.

Maximum Cable Length

Cable lengths of up to 4,000-ft (1,220 m) daisy chained from Infinet controller to Infinet controller on one arm of a star are supported. After 4,000 ft (1,220 m), a signal repeater (i2200) is required to add more nodes to the network or further extend the cabling. Using an i2210 repeater allows you to extend the length of Infinet with fiber optic cable, recommended for running cable between buildings and through noisy environments.

Maximum Number of Devices

The Infinet supports a maximum of 127 nodes overall. Each controller represents a single node on the network. Display devices such as Infinet I DCX250 devices represent a node as well.

Infinet Network Configurations

Infinet allows for both daisy-chained and star network topologies to co-exist. In all Infinet configurations, a network controller or gateway can be used to initiate the Infinet.

Note: In this section's network illustrations, the parent network controller can be a suitably equipped CX controller, a Continuum NetController, or a bCX1 9640.

Daisy Chain Configuration

Daisy chained configurations consist of a single cable that is routed to the first controller then to the next, and so on. A simple daisy chain Infinet is illustrated below:
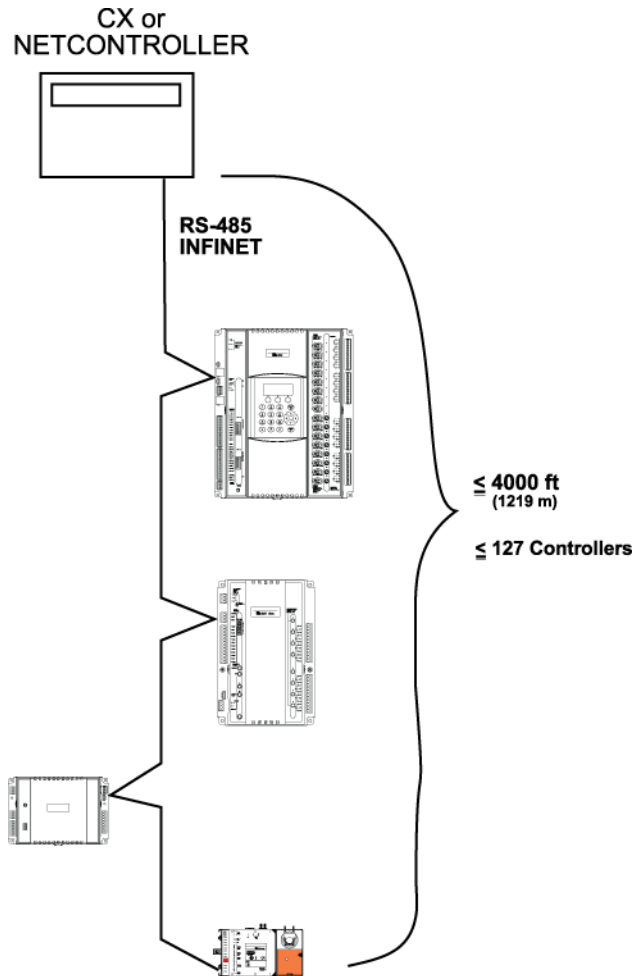
In this configuration you can have as many as 127 controllers or "nodes" on the network. There is a limitation, however, of 4000 feet (1200 m) before some sort of repeater is needed. Unlike other RS-485 networks, no terminators are required for the standard Infinet.

Daisy Chain Configuration with i2200 Repeater

Daisy chained configurations that extend beyond the maximum cable length must include an Infinet Repeater.

CX or
NETCONTROLLER

RS-485
INFINET

> 4000 ft
(1219 m)

≤ 127 Controllers
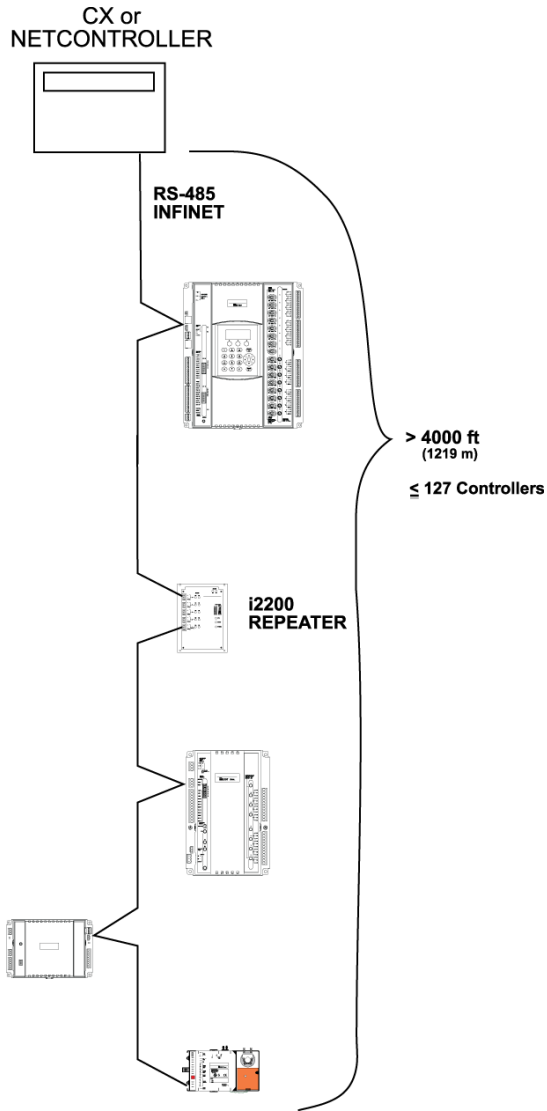
i2200
REPEATER

In this configuration, only one port of the four-port repeater is connected. The i2200 acts as a simple signal booster-repeater to allow distances of greater than the maximum cable length.

Star Configuration with i2200 Repeater

The i2200 repeater allows you to connect up to four additional Infinet network spurs to a single Infinet source. In this way, a star network configuration is supported. A simple two-spur star configuration is illustrated below:
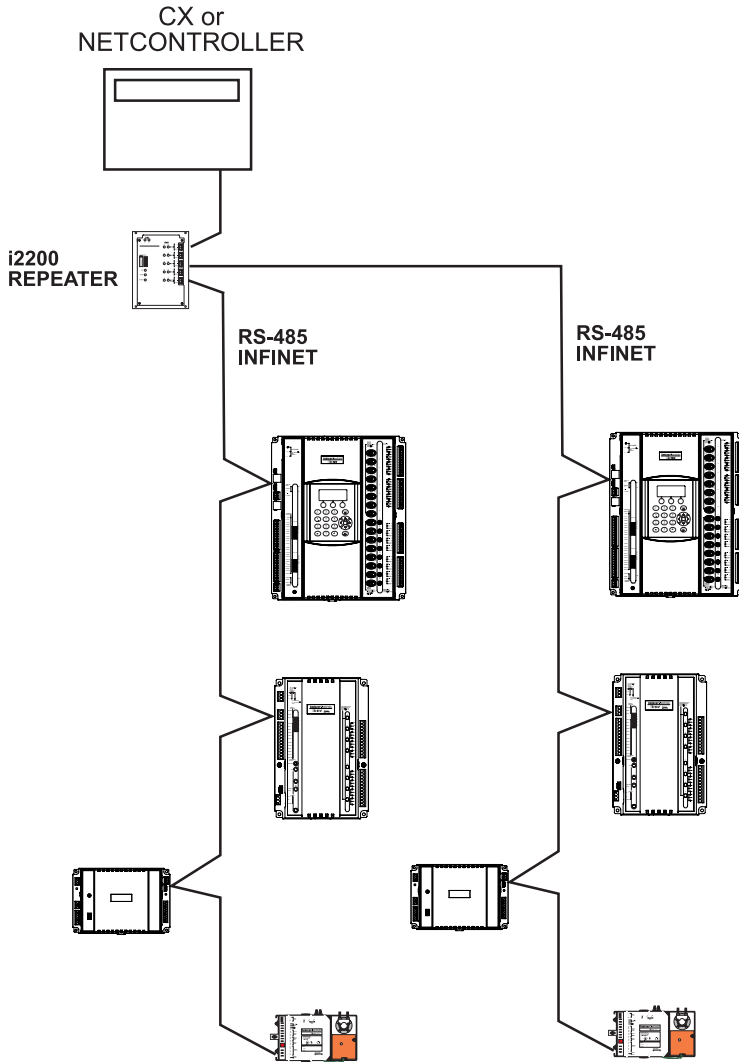
Although this configuration provides a multiple-leg star with greater distances, you can still have only as many as 127 controllers or "nodes" on the network.

Infinet Between Buildings Using the i2210

The i2210 repeater allows you to convert the Infinet RS-485 signal into light waves using fiber optics. Two i2210 repeaters used together provide a noise-immune, lightning-protected method of extending the Infinet between buildings. A simple fiber optic building-to-building Infinet configuration is illustrated below:
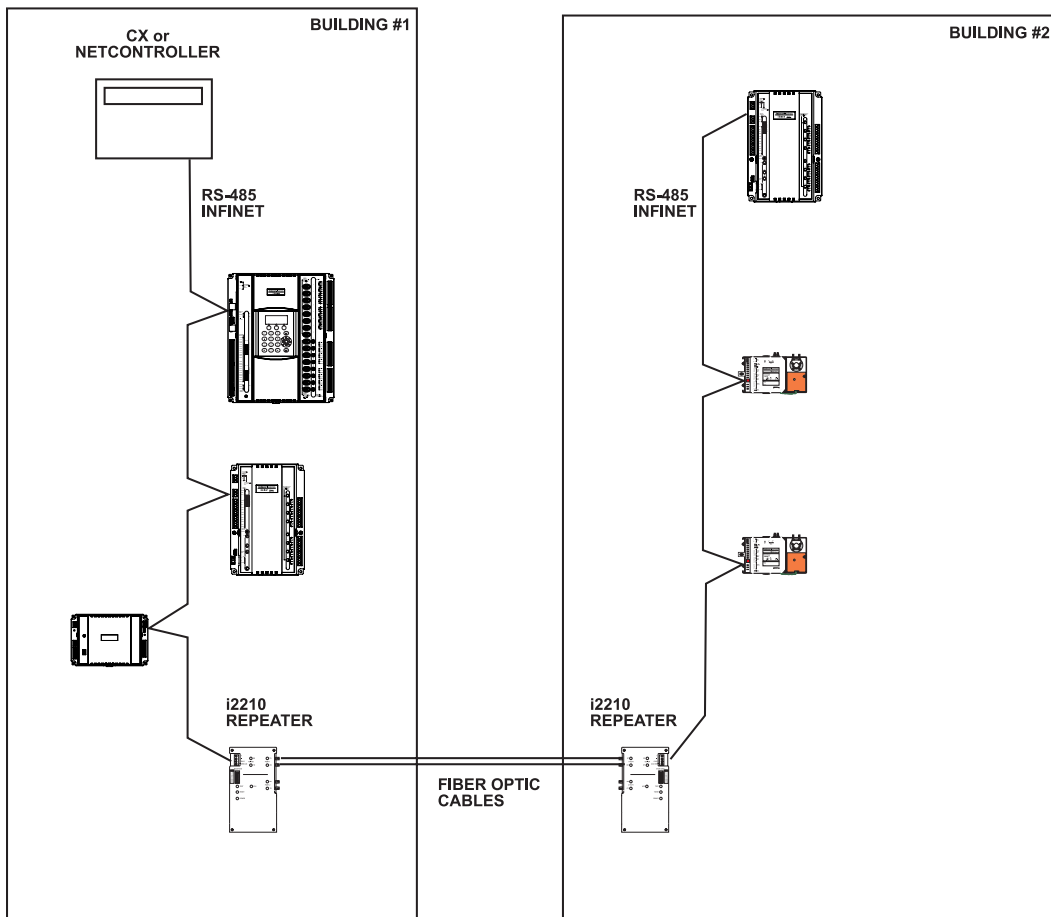
Although this configuration provides noise immunity with greater distances, you can still have only as many as 127 controllers or "nodes" on the network.

Infinet Network Shielding

The shield within the Infinet cable is essential to protect the network from electromagnetic interference and harmful transient voltage spikes. A properly applied shielding strategy is required for reliable communications.

Each device on the Infinet network must be connected to the shield. To facilitate this, each controller is provided with a three position connector that includes a single connection for the shield.
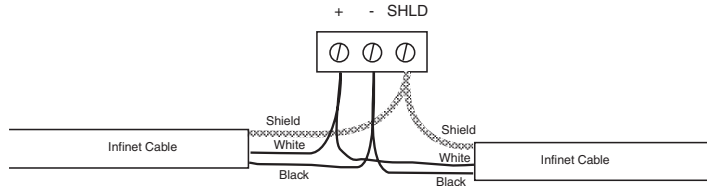
To work properly, the shield must be connected to Earth ground. This connection must occur at only one point along the entire Infinet network. The shield connection within an i2 Series controller is not tied directly to ground. It is capacitively coupled to ground.

The shield connection from the Infinet source controller (CX, NetController, or bCX1 9640) is internally directly connected to ground. The CX, NetController, or bCX1 9640 must then be properly connected to Earth ground to provide this reference point. Refer to the discussion of what a good Earth ground is on page 40 of this manual.

Shield Issues with Repeaters

Infinet shielding is connected to both types of repeaters. The i2200 repeater shield (Input port #1) is connected the same as any other i2 controller node on the network. Its shield connection is not directly connected to ground. All shield connections for the four additional ports (port #2-5) the repeater provides are electrically connected together and to the Earth ground connection of the unit.

A different issue occurs with the i2210. The i2210 fiber repeater allows a noise-free (electrically isolated) optical connection between two points. It therefore breaks the shield connection by providing no electrical signal to a companion i2210. The i2210 that is electrically wired to the Infinet is connected to the shield like any i2 controller. To provide a ground point for remote Infinet through the use of a fourth terminal labeled GND. Connecting the shield wire of the remote Infinet spur to this GND pin provides the Earth ground point.

The diagrams on the following page illustrate the proper way to connect the shield for both sides of a two-building fiber isolated Infinet.

The shield of the source Infinet (the one electrically connected to the CX, NetController, or bCX1 9640) is tied to Earth ground at the CX, NetController, or bCX1 9640. Connect the shield to the shield pin of the i2210:

Infinet Network Cable
From CX or NetController

White (+)
Black (-)
Shield

+
-
SHLD
GND (CX)

BAUD RATE

300
1200
2400
9600
19200
38400
57600
SPARE
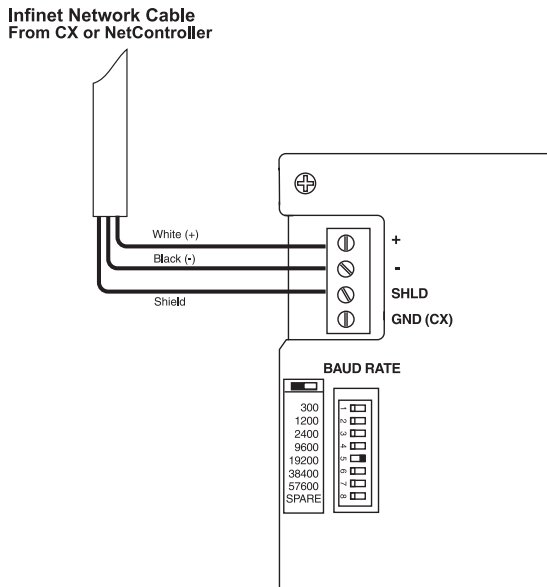
The shield of the extension Infinet (the one in the remote building that is isolated via fiber connection) is tied to Earth ground at the i2210 via the GND connection:

Infinet Network Cable Extension

White (+)
Black (-)
Shield

+
-
SHLD
GND (CX)

BAUD RATE

300
1200
2400
9600
19200
38400
57600
SPARE
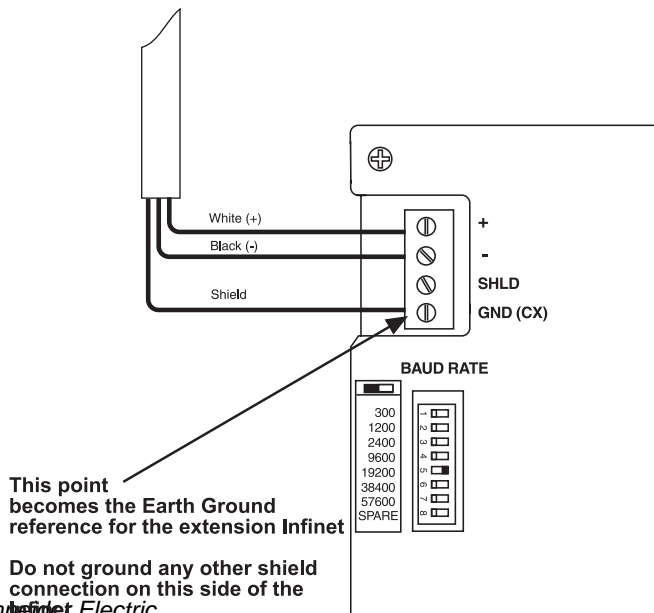
**This point
becomes the Earth Ground
reference for the extension Infinet**

**Do not ground any other shield
connection on this side of the**

Controller Infinet Connections

The Infinet port is typically found on the left hand side of the controller. On the i2865/866, i2865-V/866-V, i2867 and the i2887 it is found elsewhere. It may be labeled "Infinet" or simply "RS-485". Refer to the overview diagrams found in the Introduction section of this manual for the exact location of the connector.

The pin connections are shown below:

Infinet Network Cable

White (+)   +

Black (-)   -

SHLD

Shield
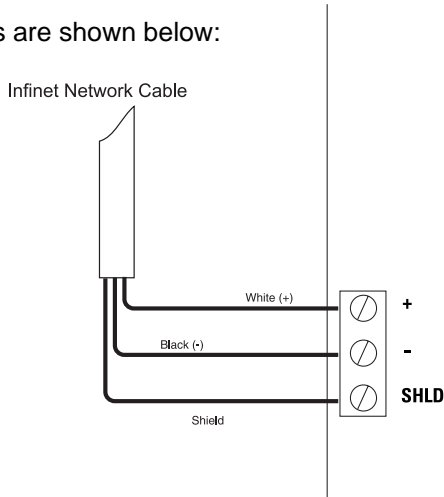
Connection to the cable is done by inserting a stripped conductor into the opening on a screw terminal position and tightening the associated screw to secure it in place.
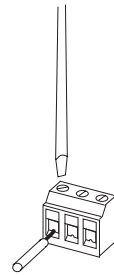
When the network is connected to more than one device, it is done so in a daisy chain manner as shown below:

+   -   SHLD

Shield   Shield
Infinet Cable   White   White   Infinet Cable
                 Black   Black
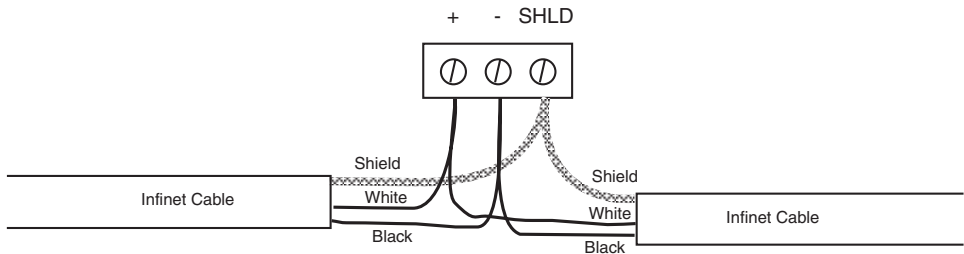
* Wire colors are included for clarity. The colors of your cable may vary. However, make sure that all Infinet connections are consistent on their connections.

Infinet Repeater Connections

The physical length of the Infinet wiring may be extended by utilizing either the i2200 or i2210 repeaters.

i2200 Connections

The *i2200* is a five-port RS-485 repeater/hub that includes a fifth port that is an RS-485-to-RS-232 converter for use with short haul modems or other RS-232 communications devices. The multiple ports allow you to construct a star network configuration.

Baud Rate

The communications Baud Rate is determined by the small 8-position switch on the front panel. Typically, for Infinet use, this is set to 19200. All ports (input RS-485, four output RS-485, and the RS-232 ports) communicate at the switch setting.

RS-232

The RS-485 to RS-232 conversion port is provided in order to facilitate extending the Infinet using an RS-232 device such as a short-haul modem. A typical modem configuration is illustrated below:

UL-864 Note: RS-232 connection is not intended for use in UL-864 Smoke Control applications.
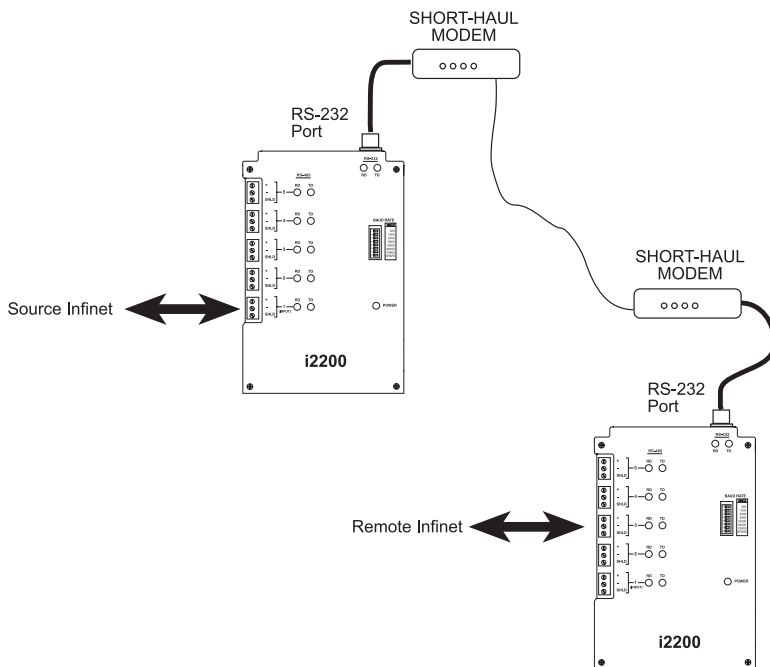
i2210 Connections

The *i2210* is a three-port hub that can connect up to 127 *Infinet* controllers. You can set up *i2210*s in two possible configurations:

> Point-to-point configuration
> Daisy chain configuration

Fiber Cable Recommendations:

62.5/125 Duplex Glass Fiber with ST-style connector

max. attenuation allowable: 13.5dB

Note:
When using repeaters. Make sure that the communication Baud Rate is set to the same speed as the network. For standard Infinet this will typically be 19200.

POINT TO POINT CONFIGURATION
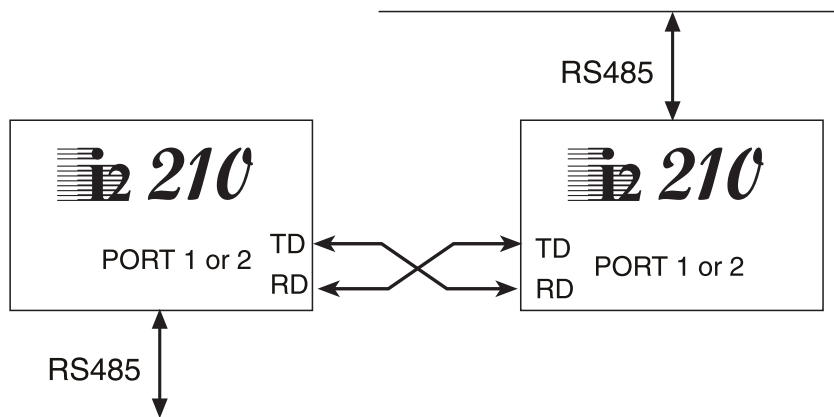
When you use the daisy chain configuration, you can have an *Infinet* on the Infinet port of each i2210 which allows you to expand the *Infinet*.

DAISY CHAIN CONFIGURATION

Note: You can daisy chain up to 10 i2210s together.
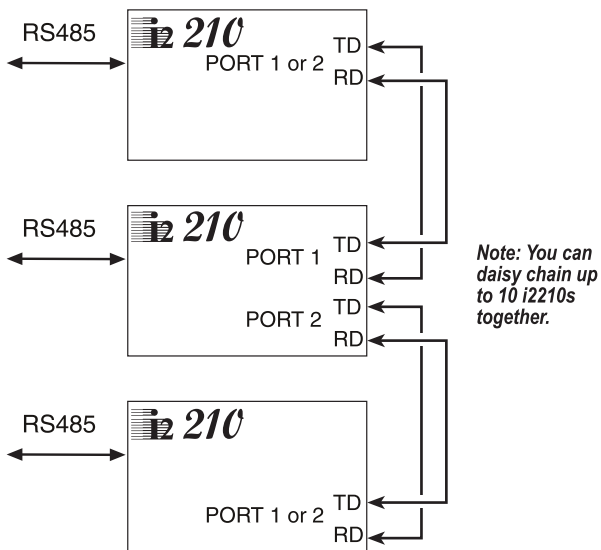
5

Controller Inputs

Input Connections

Universal Inputs

The i2 series controllers include Universal inputs that are unique in that they are software configurable to handle any one of the following five input types:

Thermistor	Counter	Digital
Voltage	Supervised*	

* Supervised inputs are not available on the i2885, i2885-V, and i2887(L). Supervised inputs are not to be used in UL864 Smoke Control Applications.

Number of Inputs
The following table lists the input complement of each controller.

Controller	Inputs	Controller	Inputs
i2608	8	i2865	4 + Smart Sensor
i2624	24	i2865-V	4 + Smart Sensor
i2800	8 + Smart Sensor	i2866	4 + Smart Sensor
i2804	8 + Smart Sensor	i2866-V	4 + Smart Sensor
i2810	8 + Smart Sensor	i2867	4 + Smart Sensor
i2814	8 + Smart Sensor	i2885	2
i2850	4 + Smart Sensor	i2885-V	2
i2851	4 + Smart Sensor	i2887(L)	3 + Smart Sensor
i2853	4 + Smart Sensor	i2920	16 + Smart Sensor

Universal Input Specifications
The Universal inputs for most i2 controllers accept 0-5VDC. The inputs for the 810 Series accept 0-10VDC. The maximum line resistance is 4700 ohms. The maximum short circuit current is 0.33mA for i2920 inputs and 0.512mA for all other inputs.

Input Wiring

The input terminations are typically located on the left of the module, however, the i2624 includes inputs on both the left and right sides of the module. Connection is via screw terminal. The inputs are labeled IN1 through INx and are typically followed by a connection labeled RET for the input signal return. It is recommended that a separate return wire be used for each input.

The following pages include diagrams detailing each module's input connections:

608/624   800/804   810/814   850/851/853

608/624

⌀	7 RET
⌀	8 IN1
⌀	9 IN2
⌀	10 RET
⌀	11 IN3
⌀	12 IN4
⌀	13 RET
⌀	14 IN5
⌀	15 IN6
⌀	16 RET
⌀	17 IN7
⌀	

624 ONLY

RET 45	⌀
IN9 44	⌀
IN 10 43	⌀
RET 42	⌀
IN 11 41	⌀
IN 12 40	⌀
RET 39	⌀
IN 13 38	⌀
IN 14 37	⌀
RET 36	⌀
IN 15 35	⌀
IN 16 34	⌀

RE T 33	⌀
IN 17 32	⌀
IN 18 31	⌀
RET 30	⌀
IN 19 29	⌀
IN 20 28	⌀
RET 27	⌀
IN 21 26	⌀
IN 22 25	⌀
RET 24	⌀
IN 23 23	⌀
IN 24 22	⌀

800/804

⌀	7 RET
⌀	8 IN 1
⌀	9 IN 2
⌀	10 RET
⌀	11 IN 3
⌀	12 IN 4
⌀	13 RET
⌀	14 IN 5
⌀	15 IN 6
⌀	16 RET
⌀	17 IN 7
⌀	18 IN 8

810/814

⌀	7 RET
⌀	8 IN 1
⌀	9 IN 2
⌀	10 RET
⌀	11 IN 3
⌀	12 IN 4
⌀	13 RET
⌀	14 IN 5
⌀	15 IN 6
⌀	16 RET
⌀	17 IN 7
⌀	18 IN 8

850/851/853

⌀	7 IN 1
⌀	8 IN 2
⌀	9 RET
⌀	10 IN 3
⌀	11 IN 4
⌀	12 RET

865/866

⊘	18	RET
⊘	19	IN 1
⊘	20	RET
⊘	21	IN 2
⊘	22	RET
⊘	23	IN3
⊘	24	IN4

867

IN1 IN2 IN3 IN4 RET

1	2	3	4	5
⊖	⊖	⊖	⊖	⊖

885

IN1	9	⊘
RET	10	⊘
IN2	11	⊘

887(L)

⊖	⊖	⊖	⊖	⊖	⊖
RET	IN1	IN2	RET	IN3	IN4	SPWR

UNIVERSAL INPUTS

920

⊘	7	RET
⊘	8	IN 1
⊘	9	IN 2
⊘	10	RET
⊘	11	IN 3
⊘	12	IN 4
⊘	13	RET
⊘	14	IN 5
⊘	15	IN 6
⊘	16	RET
⊘	17	IN 7
⊘	18	IN 8

⊘	19	RET
⊘	20	IN 9
⊘	21	IN 10
⊘	22	RET
⊘	23	IN 11
⊘	24	IN 12
⊘	25	RET
⊘	26	IN 13
⊘	27	IN 14
⊘	28	RET
⊘	29	IN 15
⊘	30	IN 16

865/866-V

⊘	1	IN 1
⊘	2	IN 2
⊘	3	RET
⊘	4	IN3
⊘	5	IN4
⊘	6	RET

885-V

| IN1 | 4 | ⊘ |
| RET | 5 | ⊘ |

Wiring Concerns

Do not remotely ground any part of the sensor wiring. Remote grounds connected to the return terminals could make the controller operate incorrectly or damage the equipment. The signal return is not true earth ground. It is an electronic reference point necessary to interpret the sensor properly.

For reliable input operation, follow these input wiring guidelines:

- Never lay wires across the surface of the printed circuit board.
- Wires should never be within 1 in. or 25 mm of any component on the printed circuit board.
- Use shielded input wire. Do not use the shield as the signal return wire.
- Terminate the shield of the input wires at one end of the run only, preferably at the end where your controller is located.
- Be careful when stripping wire not to drop small pieces of wire inside the cabinet.
- Don't run your input wiring in the same conduit with AC power.
- Don't run your input wiring in the same conduit with your output wiring.

CAUTION: Do not externally ground any input connected to the controller. This may damage the unit.
Do not connect inputs while the controller is running.

Input Pull-up Resistor Selection

The i2 series (except the i2885, i2885-V and i2887(L)) inputs can be configured to include internal pull-up resistors. In some measuring instances it is desirable that there be no pull-up resistor. Instead of physically removing or cutting the resistor off the printed circuit board, the input module includes a pull-up resistor selection switch. When the switch is placed in the enabled ON position, the pull-up resistor is connected to the input line. When the switch is moved to the disabled OFF position, the pull-up resistor is removed from the circuit. The i2885 and i2885-V have no selection switch. Their pull-up resistors are permanently enabled. The following is a schematic representation of the switch and its associated pull-up:

VREF

Each input includes a reference resistor that may be disabled.

10K

Switch shown in 'disabled' OFF position
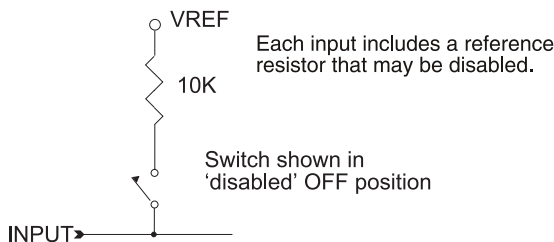
INPUT

Input Pull-up Resistor Switch Location

The i2 Series (except the i2885, i2885-V and i2887(L)) pull-up selection switches allow you to select whether or not you want a pull-up resistor in the circuit. The small multi-position resistor selection switch modules are located in different places depending on the particular model. Some are accessible through an access window on the module case beside the input screw terminals. Others are located on the PC board behind the cover (i2867) or close to the input terminals (i2885/886 and i2865-V/866-V).

These switch modules are commonly called "DIP Switches" and require a small object such as the tip of a pen or a small screwdriver to operate them. Each switch position acts as a "slide switch". Pressing the raised slide marker to the right side marked "on" closes or enables the switch. To open or disable the switch position, press the slide marker over to the left or "off" side.

Measuring Temperature

All of the i2 series inputs may be configured to sense temperature by configuring one of the controller's inputs appropriately. This is done by setting the Electrical Type to either **ACC Temp (DEG F)** or **ACC Temp (DEG C)**. Connect a resistive thermistor sensor to that input terminal. The following is a schematic representation of the connection:
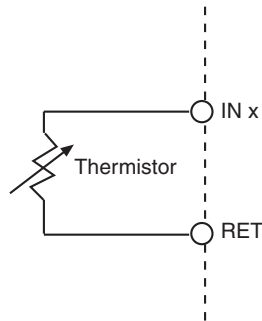
One lead connects to a numbered input terminal, the other to a return terminal.

To measure temperature, the pull-up resistor switch associated with this input must be enabled (ON). When the input point is configured as a temperature input, the controller utilizes a look-up table to convert from a voltage reading to a temperature reading in degrees Fahrenheit or Celsius.

> ⚠ *CAUTION: Never apply a voltage to a thermistor—doing so alters the thermistor's accuracy and reliability. We recommend replacing any thermistor that has had any sort of voltage applied to it.*

Maximum Wire Runs for Thermistors

To keep thermistor errors minimal, limit the length of wire runs to the maximum for the gauge wire you select.

The following two pages include three tables that indicate the maximum length runs for wires of various gauges to keep errors within certain temperature limits when using thermistor elements.

**Wire Gauges and Corresponding Maximum Runs for
Sensing Temperatures Up to 70 °F (21 °C)**

Gauge	1/2 °F (.28 °C) Error	1/4 °F (.14 °C) Error	1/10 °F (.06 °C) Error
#14 2.5 mm^2	26,700 ft. 8150 m	13,300 ft. 4000 m	5,300 ft. 1600 m
#16 1.5 mm^2	16,700 ft. 5120 m	8,300 ft. 2500 m	3,300 ft. 1000 m
#18 1.0 mm^2	10,500 ft. 3200 m	5,200 ft. 1600 m	2,100 ft. 640 m
#20 0.5 mm^2	6600 ft. 2000 m	3,300 ft. 1000 m	1,300 ft. 400 m
#22 0.35 mm^2	4,100 ft. 1250 m	2,000 ft. 600 m	800 ft. 250 m

**Wire Gauges and Corresponding Maximum Runs for
Sensing Temperatures Up to 100 °F (38 °C)**

Gauge	1/2 °F (.28 °C) Error	1/4 °F (.14 °C) Error	1/10 °F (.06 °C) Error
#14 2.5 mm^2	12,600 ft. 3800 m	6,300 ft. 1900 m	2,500 ft. 760 m
#16 1.5 mm^2	7,900 ft. 2400 m	3,900 ft. 1200 m	1,500 ft. 450 m
#18 1.0 mm^2	5,000 ft. 1500 m	2,500 ft. 760 m	1,000 ft. 300 m
#20 0.5 mm^2	3,100 ft. 950 m	1,500 ft. 450 m	600 ft. 180 m
#22 0.35 mm^2	1,900 ft. 580 m	900 ft. 275 m	300 ft. 90 m

**Wire Gauges and Corresponding Maximum Runs for
Sensing Temperatures Up to 150 °F (65 °C)**

Gauge	1/2 °F (.28 °C) Error	1/4 °F (.14 °C) Error	1/10 °F (.06 °C) Error
#14 2.5 mm^2	4,100 ft. 1250 m	2,000 ft. 600 m	800 ft. 240 m
#16 1.5 mm^2	2,600 ft. 800 m	1,300 ft. 400 m	500 ft. 150 m
#18 1.0 mm^2	1,600 ft. 500 m	800 ft. 240 m	300 ft. 90 m
#20 0.5 mm^2	1,000 ft. 300 m	500 ft. 150 m	200 ft. 60 m
#22 0.35 mm^2	600 ft. 180 m	300 ft. 90 m	100 ft. 30 m

Measuring DC Voltages

All Universal inputs can be configured to sense DC voltage by setting the Electrical Type to *Voltage* and connecting the input terminals to a DC voltage source within the range of the module's input specifications. The following is a schematic representation of the connection:
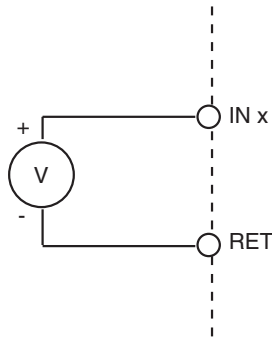
The plus lead connects to the numbered input terminal, the other to a return terminal. **To measure voltage, the pull-up resistor switch associated with this input is usually <u>disabled (OFF)</u>.**

i2885, i2885-V, and i2887(L) Pull-up Resistor Interference

When interfacing the i2885, i2885-V and i2887 to a voltage output device, specific information on the transducer may be required. The pull-up resistor of the input circuit will affect the output of the transducer. It is necessary to know the source resistance (Rs) of the transducer and to use the following conversion equation:

(ElecValue - (Vref * Rs / (Rs + Rref)) / (Rref / (Rs + Rref)))

Example

To solve for a voltage input with a transducer having a source resistance of 100 ohms:

> Vref = 5.12 V
> Rref = 10K ohms (pull-up built into the i2885, i2885-V)
> Rs = 100 ohms

(ElecValue - (5.12*100 / (100+10000))/(10000/(100+10000)))

Thus:

(ElecValue - 0.051)/0.990

This conversion adjusts for the correct reading from the transducer. It does not convert to your engineering type.

2-Wire Voltage Interface

The following figure illustrates a 2-wire, current measuring transducer with 0 to 5 volts DC output:
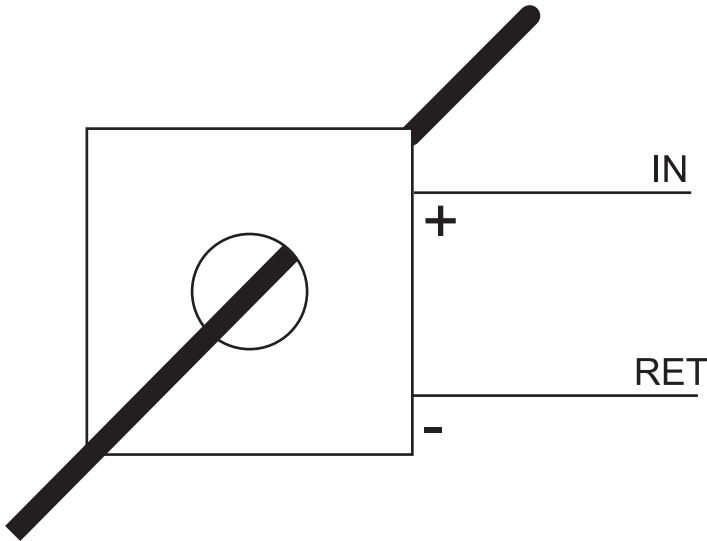
Many voltage output transducers do not operate correctly with a pull-up resistor in the circuit due to their high source resistance. When connected to the input of the controller, there will be a "dead band" at the low end. *The input at the controller will always read at least 0.7 Volts.* **Therefore, the pull-up resistor switch associated with this input is set to <u>disabled (OFF)</u>.**

Sensing Contact Closures (Digital)

Digital input points are designed to allow the monitoring of contact closures across an input (contact wired between the input and return). All i2 series inputs and the Smart Sensor input (if applicable) can be configured as Digital Inputs.
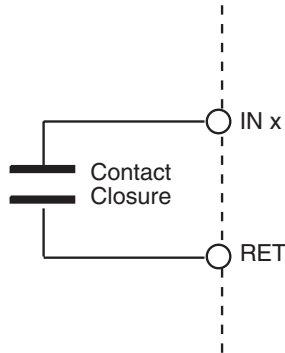
To sense a digital input or contact closure, configure an input point with an Electrical Type of *Digital*. **To sense contact closures, the pull-up resistor switch associated with this input must be enabled.**

Note: When configuring a Digital point, there is a "Polarity" attribute. If this attribute is enabled, readings are reversed: "On" will occur when the contact is open, and "Off" occurs when the contact is closed.

Counting Pulsing Signals or Contact Closures

Counter inputs are designed to allow the monitoring of digital pulse trains or contact closures across an input just like digital inputs, but they accumulate a total of those closures and act like a counter. All i2 series inputs, except Smart Sensor inputs, can be configured as Counter Inputs.

Interfacing is similar to a digital input, however, you set the Electrical Type attribute to *Counter* instead. **To count signals or contact closures, the pull-up resistor switch associated with this input must be enabled.**

When using an input as a counter, you must take into account the frequency of the input signal being counted. Universal inputs do not allow for very high speed contact counting. These inputs allow counting up to a maximum of 4 Hz or 4 contact closures per second.

Minimum Pulse Width

The high period of the signal must be at least 125 milliseconds.
The low period of the signal must be at least 125 milliseconds.

Supervised Inputs

All i2 series inputs, except i2885, i2885-V, and i2887(L) and Smart Sensor inputs, can be Supervised inputs. The following drawings depict the three types of supervised inputs that we recommend:

Normally Closed Supervised Inputs (Series)

NC Series
With this type of input wiring, a resistor is placed in series with the input. When the input contact switch is closed (normal position) the input contact is assumed to be closed. The circuit presents a reading of 10 K ohms at the input.
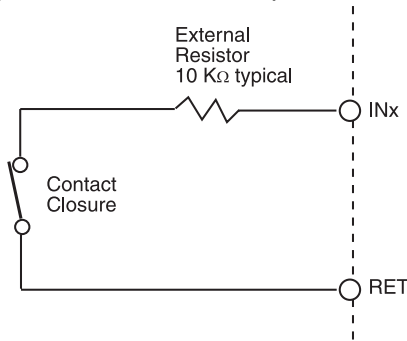
Circuit Action	Input Senses	Condition
Switch Closed	External Resistance	Input contact Closed
Switch Opened	Infinite Resistance	Input contact Open
Wire Cut	Infinite Resistance	Input contact Open 'Violation'
Input Shorted	Zero Ohms	Violation or error

When the input contact is opened the switch opens and an infinite resistance is measured. If the wires to the input contact are cut it also appears as an "input contact open" condition. In this case there would be a input contact open without a valid card swipe or valid keypad entry resulting in an "input contact violation". Shorting the input causes a zero ohm resistance, which also results in an input contact violation.

When configuring for this type of contact select:

ElecType: **Supervised**
Resistor Type: **NCSeries**

Normally Closed Supervised Inputs (Series Parallel)

NC Series Parallel
With this type of input wiring, two external resistors are added to the input, one in series and the other in parallel. When the input contact switch is closed (normal position) the input contact is assumed to be closed. The circuit presents a reading composed of both resistances in parallel that works out to be half the value of one of them (5 KΩ).
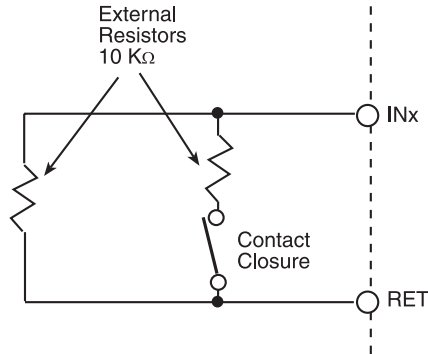
Circuit Action	Input Senses	Condition
Switch Closed	External Resistance $\div$ 2	Input contact Closed
Switch Opened	External Resistance	Input contact Open
Wire Cut	Infinite Resistance	Violation or error
Input Shorted	Zero Ohms	Violation or error

When the input contact is opened the switch opens and the value of the parallel resistor is measured. If the wires to the input contact are cut it appears as an infinite resistance. Shorting the input causes a zero ohm resistance. Both a short and an infinite resistance (open) should result in an error condition.

When configuring for this type of contact select:

ElecType: **Supervised**
Resistor Type: **NCSerPar**

Normally Open Supervised Inputs

NO Series Parallel

With this type of input wiring, two external resistors are added to the input, one in series and the other in parallel. When the input contact switch is open (normal position) the input contact is assumed to be closed. The circuit reads the value of the parallel resistor.
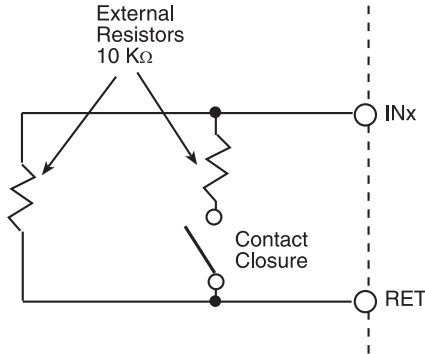
Circuit Action	Input Senses	Condition
Switch Closed	External Resistance ÷ 2	Input contact Open
Switch Opened	External Resistance	Input contact Closed
Wire Cut	Infinite Resistance	Violation or error
Input Shorted	Zero Ohms	Violation or error

When the input contact is opened the switch closes and a reading results that is composed of both resistances in parallel that works out to be half the value of one of them (5 KΩ). If the wires to the input contact are cut it appears as an infinite resistance. Shorting the input causes a zero Ω resistance. Both a short and an infinite resistance (open) should result in an error condition.

When configuring for this type of contact select:

ElecType: **Supervised**
Resistor Type: **NOSeriPar**

Wiring Door Switches

The maximum length wire you should use is 500 ft of #18 gauge wire (152 m of 1.0 mm^2 wire) or 200 ft of #22 gauge wire (60 m of 0.35 mm^2 wire).

Some switches have built-in resistors that facilitate Series Parallel connections as shown below:
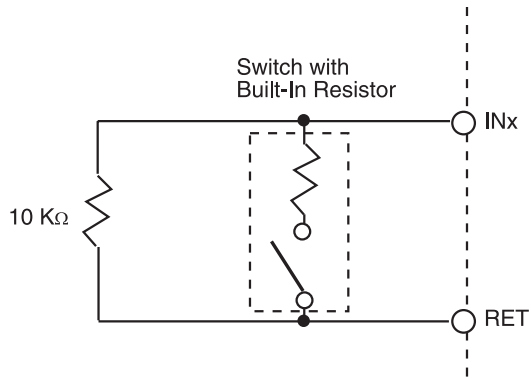
Wiring Motion Detectors
Motion detectors are devices that close a switch contact when motion is detected.

Wiring is similar to a normal input contact switch input, however, the motion sensor requires an external power supply of 12 VDC or 24 VDC (UL listed under Category Control #APHV). The maximum length wire you should use is 500 ft of #18 gauge wire (152 m of 1.0 mm^2 wire) or 200 ft of #22 gauge wire (60 m of 0.35 mm^2 wire).

The following shown a typical motion detector circuit:

```
No
Motion
Detected
```

Normally Open
PIR Motion
Detector

10 KΩ

INx

RET
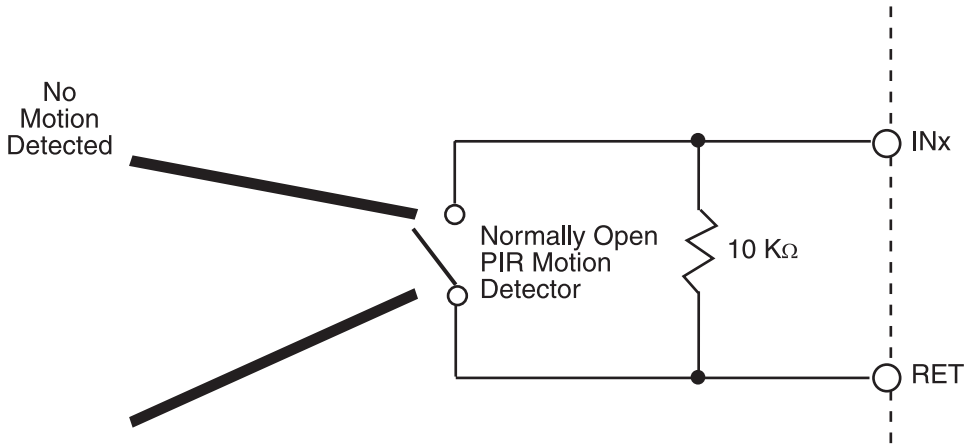
Measuring Airflow

The following i2 controllers include an airflow sensor:

Controller	Sensors	Range	Resolution
i2850	1	0-2" W.C. (0-500Pa)	0.005" W.C. (1.25Pa) @23°C (73°F)
i2853	2	0-2" W.C. (0-500Pa)	0.005" W.C. (1.25Pa) @23°C (73°F)
i2865/866	1	0-2" W.C. (0-500Pa)	0.005" W.C. (1.25Pa) @23°C (73°F)
i2865/866-V	1	0-1" W.C. (0-250Pa)	0.0013" W.C. (1.25Pa) @23°C (73°F)
i2885	1	0-1" W.C. (0-250Pa)	0.0013" W.C. (1.25Pa) @23°C (73°F)
i2885-V	1	0-1" W.C. (0-250Pa)	0.0013" W.C. (1.25Pa) @23°C (73°F)

The airflow sensors on the various controllers are located as shown:
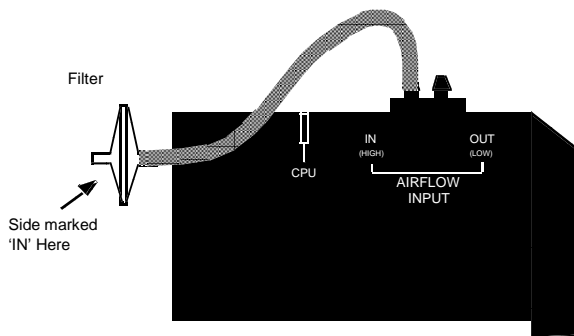
i2850 Series Airflow Sensor
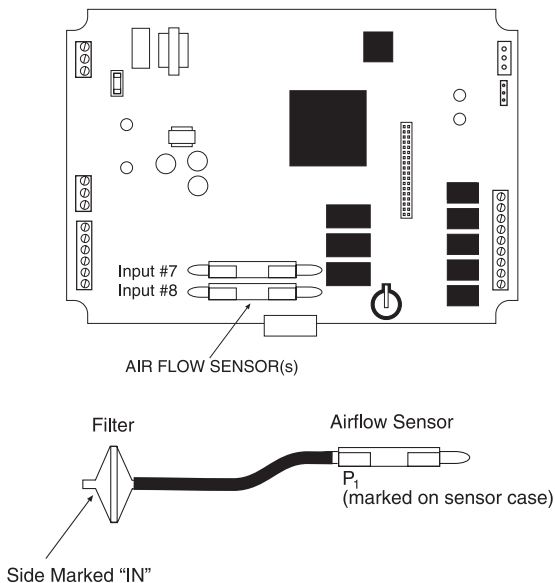
i2885 Airflow Sensor
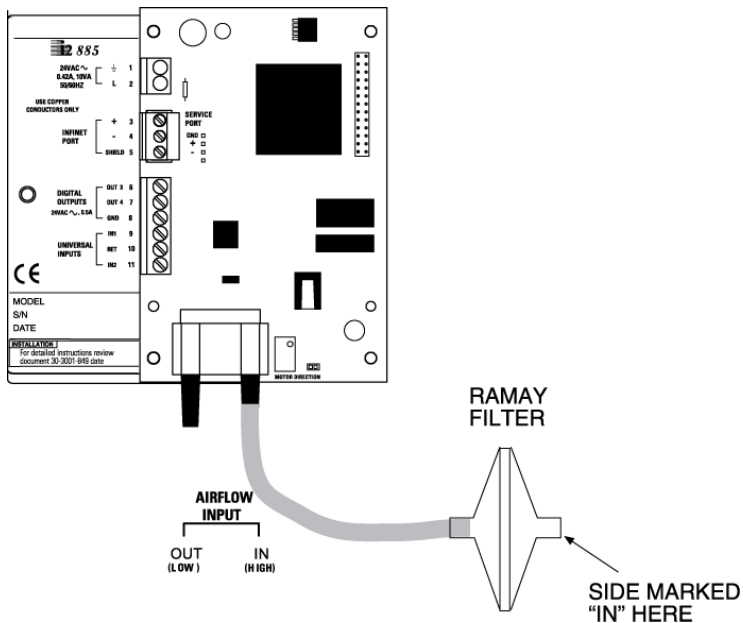
The following steps explain the connection of the airflow sensor:

1. Using a small piece of 1/4" (6.35 mm) I.D. pneumatic tubing, attach the 'OUT' side of a 5 micron filter to the input connection (the side marked 'P1') of the sensor as shown above.
2. Connect a 1/4" I.D. pneumatic tube from the other end of the filter (the side marked 'IN') to the 'HI' opening on a VAV box.
3. Connect a 1/4" I.D. pneumatic tube from the output connector (the side marked 'OUT') of the airflow sensor to the 'LO' opening on a VAV box.

Note: Keep tubing to a maximum of 15 inches (380.99 mm) in length.

To measure Air Flow, configure an input point with an Electrical Type of *Voltage*.

I2865-V/866-V and i2885-V Airflow Sensor
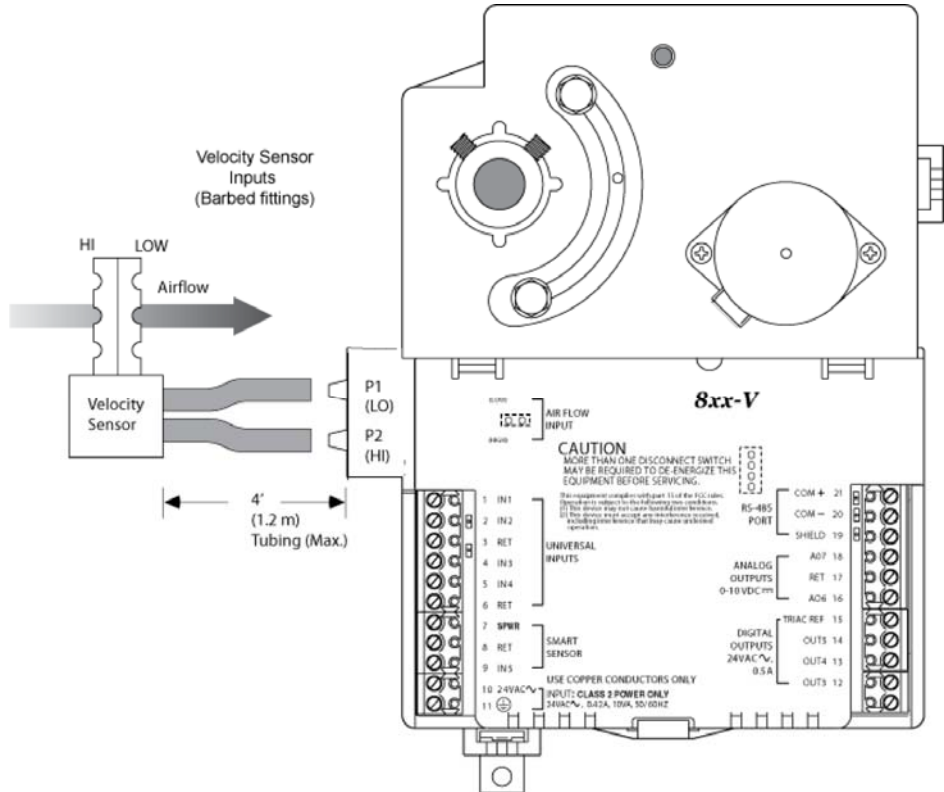
The following steps explain the connection of the airflow sensor:

1. Connect the low pressure side of the velocity sensor to the barbed fitting labeled P1 (LO) on the controller.
2. Connect the high pressure side of the velocity sensor to the barbed fitting labeled P2 (HI) on the controller.

Note: Use a maximum length of 4' (1.2m) FRPE polyethylene tubing or 0.25" (6.34 mm) O.D. and 0.125" (3.175 mm) I.D. Tygon tubing.

Do not expose the velocity sensor to moisture. If moisture condensation is a potential problem, orient the tubing and controller so that the barbed fittings are above the lowest part of the tubing to create a moisture trap.

To measure air flow, configure an input point with an Electrical Type of **Voltage**.

Smart Sensor Bus Interface

The Smart Sensor is a room temperature sensor that includes an LCD or LED display and a 6-button programmable keypad. Several i2 Series Controllers include a special interface port designed for this device.

Note: The Smart Sensor Interface is not listed for UL-864 Smoke Control Operation.

The following controllers include a Smart Sensor interface:

i2800	i2850	I2866	i2887 (L)
i2804	i2851	i2865-V	i2920
i2810	i2853	i2866-V	
i2814	i2865	i2867	

The interface between the controller and the Smart Sensor Bus consists of three wires connected to positions on the screw-terminal connector typically located on the left side of the Controller module:

The controller communicates with the keypad and the display of the Smart Sensor device over a single wire (the PWR connection).

The RET line is the return for both the communications line and the internal thermistor.

The input signal is the active lead from the Smart Sensor thermistor. Its connection is labeled according to a controller-specific input assignment. This input must be configured as a general Temperature input.

The following page illustrates the connections between the Smart Sensor and the controller:

Smart Sensor Wiring
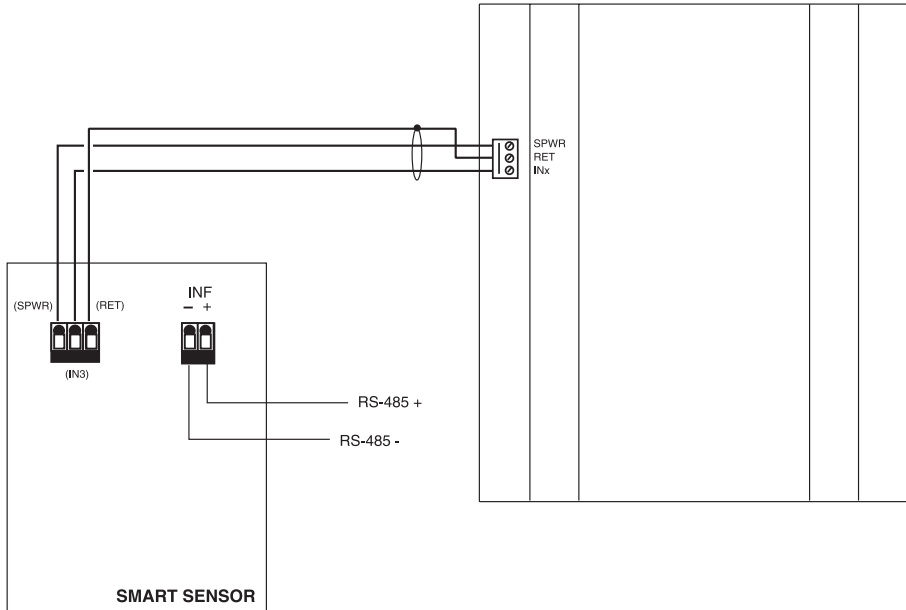
The controller includes a single Smart Sensor three-pin connector. Each controller numbers the thermistor input differently. However, the input connection always connects to the Smart Sensor IN3 terminal (shown above on the left).

Controller	Smart Sensor Thermistor
800 Series	IN9
810Series	IN9
850 Series	IN5
865/866	IN5
865/866-V	IN5
867	IN5
887(L)	IN4
920	IN17

6

-

-

-

-

-

-

Controller Outputs

Output Connections

All i2 series controllers, except the i2600 Series, include some form of output complement. Outputs come in relay and Triac versions in many contact configurations.

Output Specifications

For specific output specifications, consult the datasheet or the installation sheet for the particular controller. Generally, the following specifications apply:

Digital Relay Outputs:	3A @ 24VAC/30VDC
Triac Outputs:	0.5A @ 24VAC (30mA minimum load)
	0.3A @ 24VAC (i2887, i2887-L)

All digital output loads are resistive.

i2887-L Output Power Supply

The i2887-L includes the ability to supply power to its output loads eliminating the necessity for an external transformer. The following limitations apply:

The total allowable current sourced by the internal power source for all external loads is 750mA.

Number of Outputs

The following table lists the output complement of each controller.

Controller	Outputs	Controller	Outputs
i2608	0	i2865	3 Form A Triac, Actuator
i2624	0	i2865-V	3 Form A Triac, Actuator
i2800	8 Form C	i2866	3 Form A Triac, 2 Analog, Actuator
i2804	4 Form C, 4 Analog	i2866-V	3 Form A Triac, 2 Analog, Actuator
i2810	8 Form C	i2867	5 Form A Triac, 2 Analog
i2814	4 Form C, 4 Analog	i2885	2 Form A Triac, Actuator
i2850	3 Form A, 1 Tri-state	i2885-V	2 Form A Triac, Actuator
i2851	3 Form A, 1 Tri-state	i2887(L)	4 Form A Triac, 1 Form A Relay
i2853	3 Form A, 1 Tri-state	i2920	8 Form C, 8 Analog

Output Wiring

Output terminations are typically located along the right side of the module. Connection is via screw terminal.

⚠ **CAUTION: Do not connect outputs while the controller is running.**

The following pages include diagrams detailing each module's output connections:

608/624   800/804   810/814   850/851/853

800	804	810	814	

NONE

800
```
   45 ⊘
1  44 ⊘
   43 ⊘
   42 ⊘
2  41 ⊘
   40 ⊘
   39 ⊘
3  38 ⊘
   37 ⊘
   36 ⊘
4  35 ⊘
   34 ⊘

   33 ⊘
5  32 ⊘
   31 ⊘
   30 ⊘
6  29 ⊘
   28 ⊘
   27 ⊘
7  26 ⊘
   25 ⊘
   24 ⊘
8  23 ⊘
   22 ⊘
```

804
```
      41 ⊘
1     40 ⊘
      39 ⊘
      38 ⊘
2     37 ⊘
      36 ⊘
      35 ⊘
3     34 ⊘
      33 ⊘
      32 ⊘
4     31 ⊘
      30 ⊘

RET 29 ⊘
 V  28 ⊘
RET 27 ⊘
 V  26 ⊘
RET 25 ⊘
 V  24 ⊘
RET 23 ⊘
 V  22 ⊘
```

810
```
   45 ⊘
1  44 ⊘
   43 ⊘
   42 ⊘
2  41 ⊘
   40 ⊘
   39 ⊘
3  38 ⊘
   37 ⊘
   36 ⊘
4  35 ⊘
   34 ⊘

   33 ⊘
5  32 ⊘
   31 ⊘
   30 ⊘
6  29 ⊘
   28 ⊘
   27 ⊘
7  26 ⊘
   25 ⊘
   24 ⊘
8  23 ⊘
   22 ⊘
```

814
```
    45 ⊘
1   44 ⊘
    43 ⊘
    42 ⊘
2   41 ⊘
    40 ⊘
    39 ⊘
3   38 ⊘
    37 ⊘
    36 ⊘
4   35 ⊘
    34 ⊘

  I   33 ⊘
5 V   32 ⊘
  GND 31 ⊘
  I   30 ⊘
6 V   29 ⊘
  GND 28 ⊘
  I   27 ⊘
7 V   26 ⊘
  GND 25 ⊘
  I   24 ⊘
8 V   23 ⊘
  GND 22 ⊘
```

850/851/853
```
OUT 1  21 ⊘
       20 ⊘
OUT 2  19 ⊘
       18 ⊘
OUT 3  17 ⊘
OUT 4  16 ⊘
   C   15 ⊘
 + ON  14 ⊘
 - ON  15 ⊘
```

865/866

865

⊘	OUT 3
⊘	OUT 4
⊘	OUT 5
⊘	GND
⊘	GND
⊘	
⊘	
⊘	

866

⊘	OUT 3
⊘	OUT 4
⊘	OUT 5
⊘	GND
⊘	GND
⊘	OUT 6
⊘	RET
⊘	OUT 7

867

GND	1	⊘
OUT1	2	⊘
GND	3	⊘
OUT2	4	⊘
GND	5	⊘
OUT3	6	⊘
GND	7	⊘
OUT4	8	⊘
GND	9	⊘
OUT5	10	⊘
RET	11	⊘
OUT6	12	⊘
OUT7	13	⊘

885

OUT3	6	⊘
OUT4	7	⊘
GND	8	⊘

887

OUT1 OUT2 RET OUT3 OUT4 RET

OUT5
RELAY
OUTPUT
277VAC, 3A

920

	81	⊘		57	⊘
1	80		9 — V	56	
	79			GND 55	
	78	⊘		54	⊘
2	77		10 — V	53	
	76			GND 52	
	75	⊘		51	⊘
3	74		11 — V	50	
	73			GND 49	
	72	⊘		48	⊘
4	71		12 — V	47	
	70			GND 46	
	69	⊘		45	⊘
5	68		13 — V	44	
	67			GND 43	
	66	⊘		42	⊘
6	65		14 — V	41	
	64			GND 40	
	63	⊘		39	⊘
7	62		15 — V	38	
	61			GND 37	
	60	⊘		36	⊘
8	59		16 — V	35	
	58			GND 34	

865/866-V

865-V

⊘	15	TRIAC REF
⊘	14	OUT 5
⊘	13	OUT 4
⊘	12	OUT 3

866-V

⊘	18	A07
⊘	17	RET
⊘	16	A06
⊘	15	TRIAC REF
⊘	14	OUT 5
⊘	13	OUT 4
⊘	12	OUT 3

885-V

OUT3	6	⊘
OUT4	7	⊘
NOT USED	8	⊘
TRIAC REF	9	⊘

887-L

24VAC OUT1 OUT2 RET 24VAC OUT3 OUT4 RET

OUT5
RELAY
OUTPUT
277VAC, 3A

Digital Outputs

Form A Relays i2850 Series and i2887(L)

The i2887(L) and the i2850 series include Form A relay outputs. The following is a functional schematic representation of the connection:

OUT x
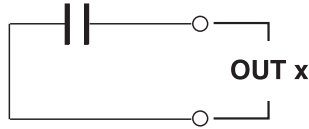
These output contacts operate as a single pole switch. When the output is set to an 'ON' state, the contacts close allowing current to flow between the output terminals.

To use the Form A output in your system, configure an output point with an Electrical Type of *Digital*.

Form C Relays i2800 Series, i2810 Series, i2920

These outputs operate as either two-position (on/off) or pulse-width modulation (PWM) control. The PWM feature permits the modulation of valves and dampers to 0.1 second resolution. Two adjacent Form C relay outputs can be combined in software to provide a Tri-state output, for bi-directional control of valves and dampers and other end devices.

The following is a functional schematic representation of the connection:

OUT x NC

OUT x COM

OUT x NO
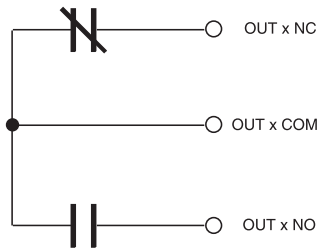
To use the Form C output in your system, configure an output point with an Electrical Type of *Digital*.

Tri-State Outputs

The following sections describe various types of tri-state outputs.

Form-K Tri-State Relay Output

i2850 series controllers include a Tri-state Form K relay output designated as OUT4. The following is a schematic representation of a Tri-state output:
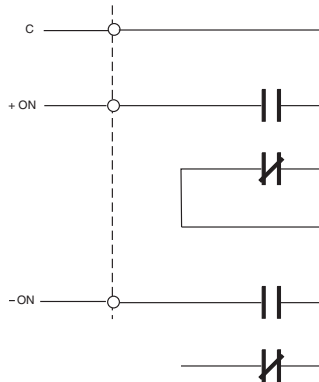
Configure Output 4 with an Electrical Type of *Tri-state*.

Note that Tri-state outputs fail in the OFF state if there is no power.

Combining Form A Relay Outputs as a Tri-State Output

Adjacent output pairs such as:

OUT1 and OUT2
OUT2 and OUT3

can be combined to form a standard Tri-state output. The outputs are electrically connected as shown in the schematic for the built-in Tri-state output.

Configure the output point of the first point of a pair (i.e., OUT1 of the pair OUT1 and OUT2) with an Electrical Type of *Tri-state***.**
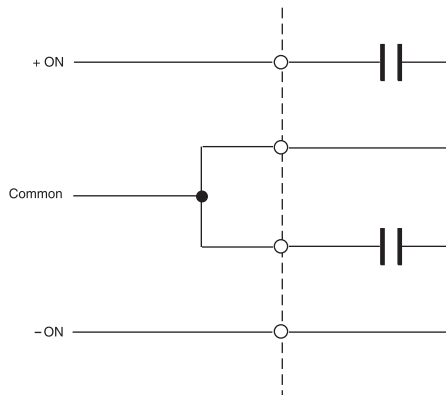
Combining Form C Relay Outputs as a Tri-State Output

Adjacent output pairs such as:

OUT1 and OUT2
OUT2 and OUT3

can be combined to form a standard Tri-state output. The outputs are electrically connected as shown in the schematic for the built-in Tri-state output.

Configure the output point of the first point of a pair (i.e., OUT1 of the pair OUT1 and OUT2) with an Electrical Type of *Tri-state***.**
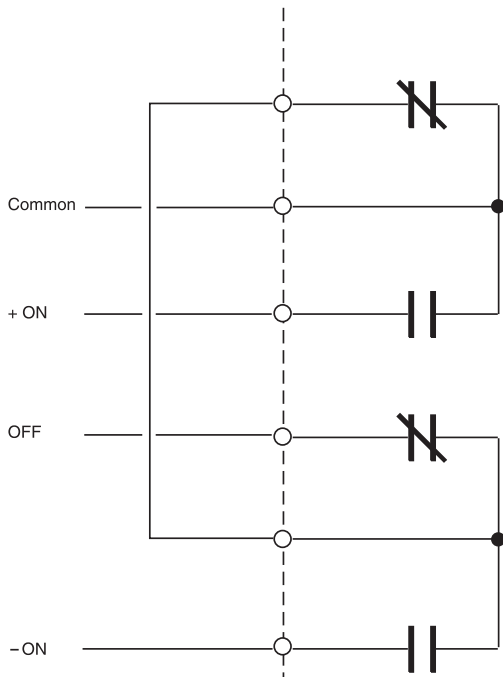
Relay Output Override Controls

UL-864 Note: The use of output overrides is prohibited in UL-864 Smoke Control Applications.

The i2810 series and the i2920 include output override switches for each relay output.


```
OFF  AUTO  ON
```
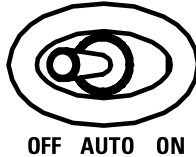
The output of the module can be directed from program control to manual control. The output can be disabled completely as well.

The following describes the actions associated with each position of the override controls:

OFF	The output relay is de-energized to an 'OFF' state manually by setting the switch to OFF. Programs have no effect on the output when the switch is in this position.
AUTO	The action of the output relay is determined as a direct result of program control.
ON	The output relay is energized to an 'ON' state manually by setting the switch to ON. Programs have no effect on the output when the switch is in this position.

Form A Triac Outputs i2865/866, i2867, i2885 & i2887(L)

The following is a functional schematic representation of the proper way to use the Form A Triac output:

24 VAC Step-Down
Transformer

X1

Black

LOAD

OUT x

FORM A

AC Line
Power

GND

X2

White or
Green

Grounded
Internally
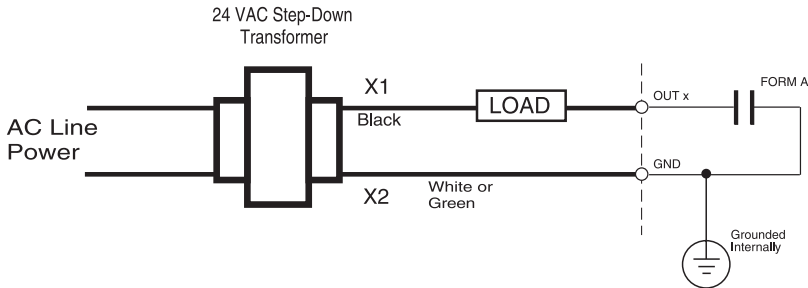
When the output is activated, the connection between the "OUTx" and "GND" terminals becomes a virtual short circuit. Using the Form A connection you can control anything that would normally be controlled (within specifications) via a switch or relay contact closure.

Switching Loads with Triacs
Although the Triac-based outputs provided with this unit appear as relay contacts in the schematics provided, they are actually solid-state switches that have limitations on the loads they can switch.

AC vs. DC
The first limitation is that they cannot be used with DC loads. A Triac switches AC only.

Minimum Load Current
The second limitation involves the minimum load current. In order for the Triac to switch it must have at least 30 ma of holding current from the load. If your load is less than 30 ma you can increase it by connecting a resistor across the load (not directly at the Triac!). Check the current draw specification on your field device, and if it does not meet this minimum, add a resistor in parallel with the device being driven sized to achieve the minimum loading. Use the following formulas to determine resistance and wattage:

$$\text{Resistance (ohms)} = \frac{\text{Voltage}}{\text{Current}} \qquad \text{Power (watts)} = \frac{(\text{Voltage})^2}{\text{Resistance}}$$

Maximum Current and Voltage
0.5A @ 24 VAC   i2867
0.3A @ 24 VAC   i2887, i2887-L

Form A Triac Outputs i2865-V/2866-V & i2885-V

The i2 865/866-V controllers use three Form A triac output terminals with a single triac reference. This configuration gives you the flexibility to wire the single triac reference as either a hot or ground connection. On these new controllers, all three outputs must be wired the same, as either hot or ground switch applications.

To make a **hot** switch connection, connect one of the output terminals (OUTX, where X= 3, 4, or 5) to a load, and connect the Triac Reference to the incoming 24 VAC power.

Switching Option - Triac Form A Hot Connection

Note: i2/b3 885-V Controller only has two digital outputs
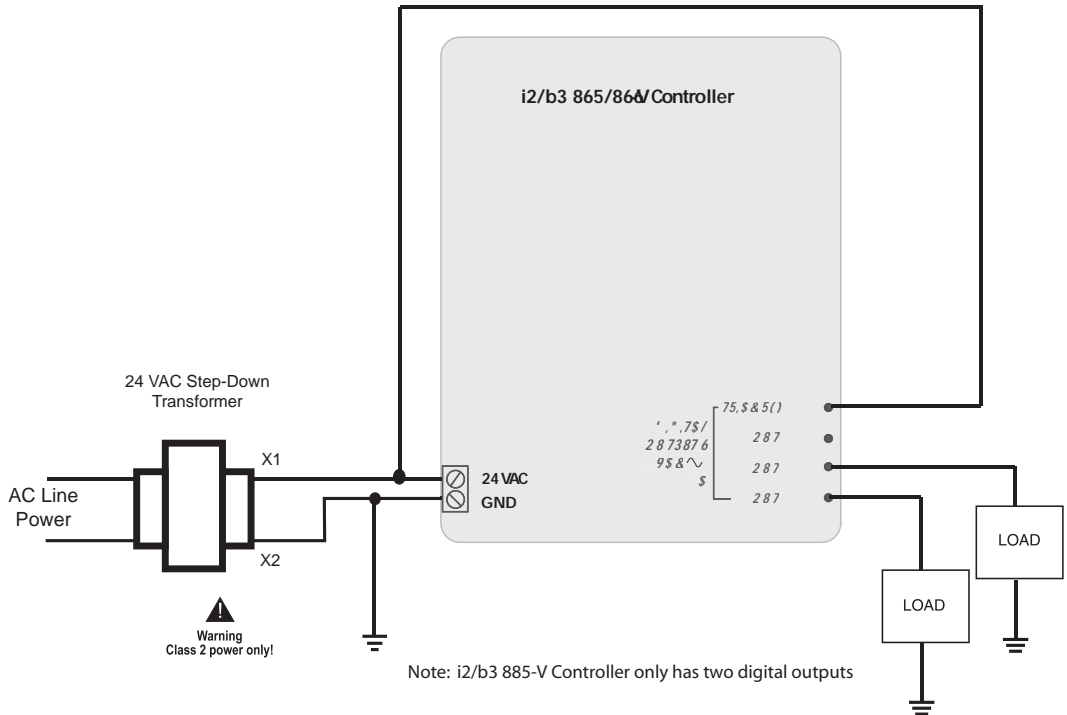
To make a **ground** switch connection, connect one of the output terminals (OUTX, where X= 3, 4, or 5) to a load in series with the 24 VAC incoming power, and connect the Triac Reference to ground.

Switching Option - Triac Form A Ground Connection
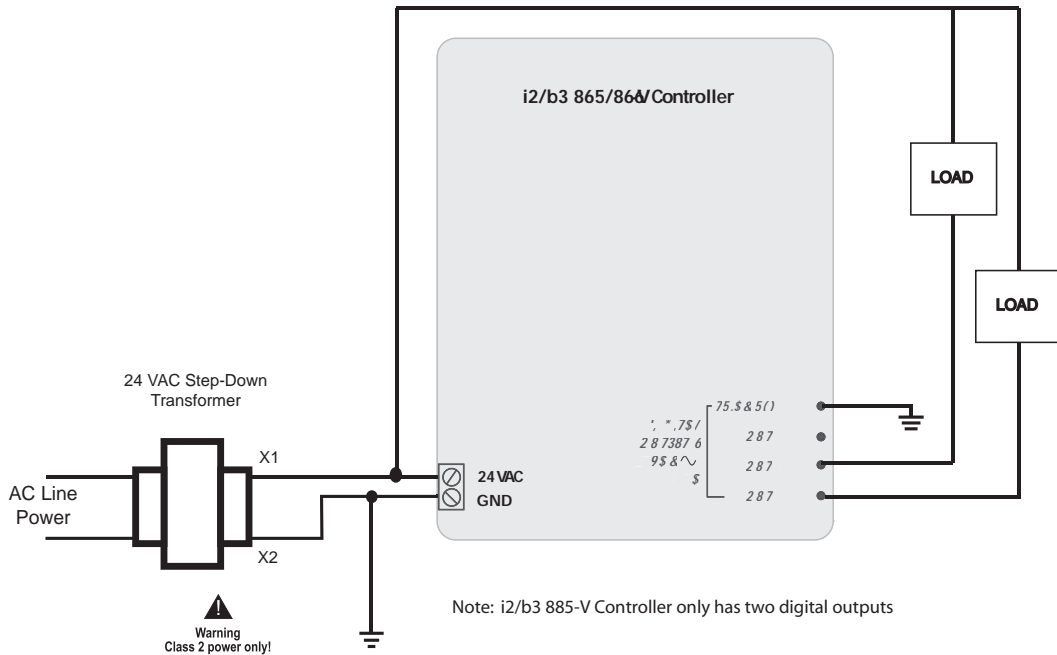
The new b3 885-V controller, which has only two output terminal connections, works the same, allowing for either two hot or ground switch applications.

Form K Triac Outputs i2865-V/866-V & i2885-V

To create a Form K triac connection on the new i2865 /866-V controllers, make the individual connections from the terminals 12 and 13 (OUT3 and OUT4), or use terminals 13 and 14 (OUT4 and OUT5), with a common ground reference to terminal 15 (TRIAC REF).

Switching Option - Triac Form K Ground Connection

Note: i2/b3 885-V Controller only has two digital outputs
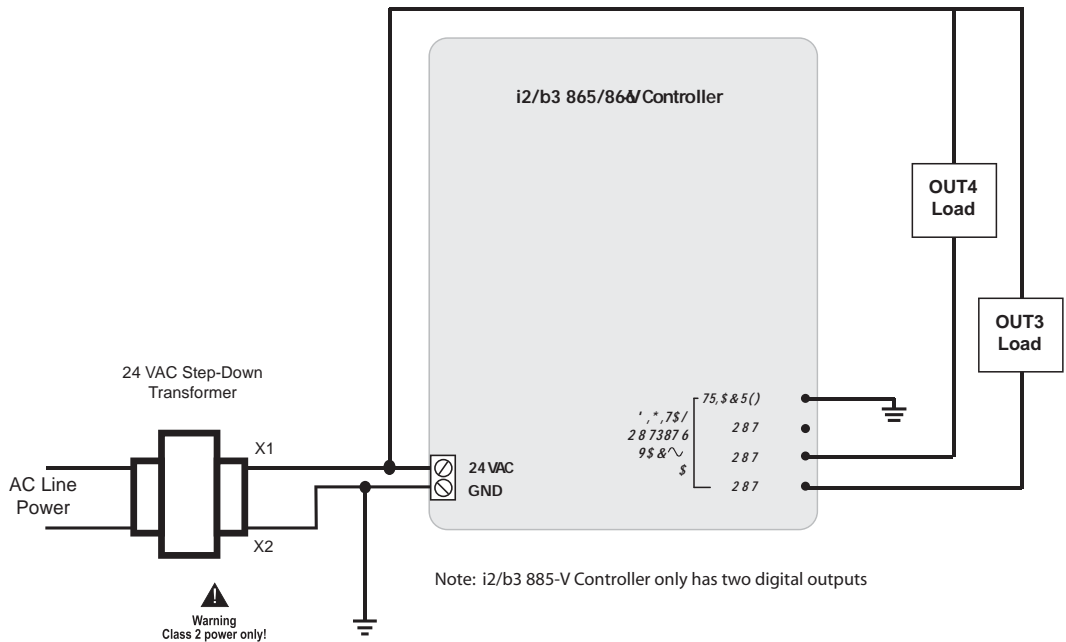
To maintain Form K triac connections on the new i2885-V controller, make the individual connections from terminal 6 and 7 (OUT3 and OUT4) with a common ground reference to terminal 9 (TRIAC REF). Terminal 8 is not used on the i2885-V controller.

Internally Powered Triac Outputs i2887-L

The i2887-L includes an internal 24VAC power source that can be used to power external loads thus eliminating the need for an external transformer. The following is a functional schematic representation of the proper way to use the Internal- powered Triac output:
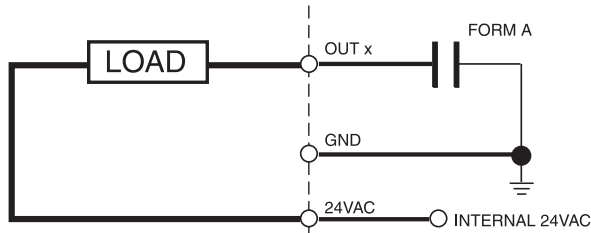
All other limitations that normally apply to Triac outputs exist in this configuration as well.

Note: The total allowable current sourced by the internal 24VAC power source for all external loads is 750mA .

Analog Outputs (i2804, i2814, i2920)

The i2804, i2814 and i2920 include Analog outputs that may be configured to provide either voltage or current.

Each output presents two ways of connecting, resulting in a current output between the terminal labeled 'I' and 'GND', and a voltage output between the terminal labeled 'V' and the terminal labeled 'GND'.

The diagram screen printed on the module indicates where each input number is located on the terminal block.

The following is a schematic representation of the connection:
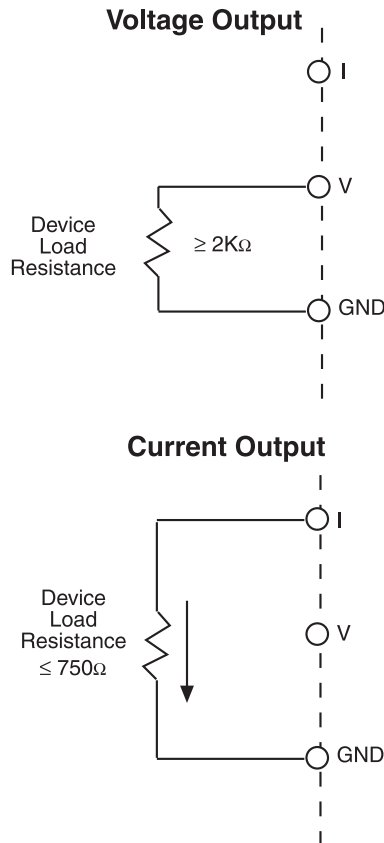
Voltage Output

Device
Load
Resistance

$\geq 2K\Omega$

○ I

○ V

○ GND

Current Output

Device
Load
Resistance
$\leq 750\Omega$

○ I

○ V

○ GND

Analog Output Override Controls

The i2804, i2814 and the i2920 controller include an output override switch and manual variable control for each output.
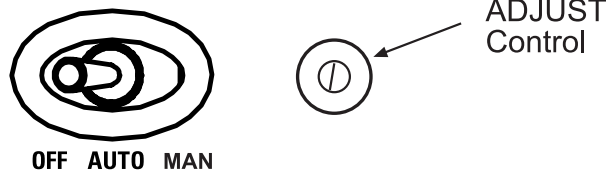
OFF AUTO MAN

The following describes the actions associated with each position of the override controls:

OFF   The output is set to zero volts, zero mA. Programs and the setting on the ADJUST potentiometer have no effect on the output Device when the switch is in this position.

AUTO   The analog signal is generated as a direct result of program control. The setting on the ADJUST potentiometer has no effect on the output Device when the switch is in this position.

MANUAL   The analog signal generated by the module is controlled manually by adjusting the ADJUST potentiometer. Programs have no effect on the output when the switch is in this position.

ADJUST   This is a variable control that allows you to manually adjust the output of the analog signal when the override switch is in the MANUAL position. Insert the tip of a small screwdriver to use this control. Turning to the right (clockwise) increases the output. Turning left (counterclockwise) decreases the output.

Voltage Output (i2804, i2866, i2866-V, & i2867)

The i2804, i2866, i2866-V and i2867 controllers provide a voltage output that is a ground-referenced signal with a range of 0–10 VDC. The maximum output current is 5 mA (2,000 ohms minimum resistance). Ensure that the device being connected is either floating or at the same ground potential as the controller.

Configure the output point with an Electrical Type of **Voltage**.
Connect the device across the following terminals:

i2804
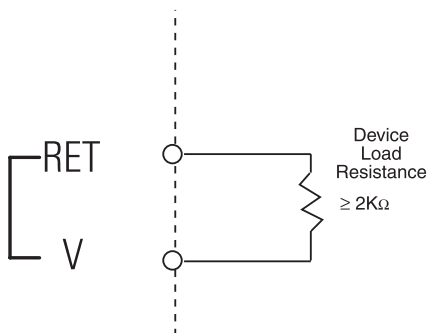
i2866, i2867
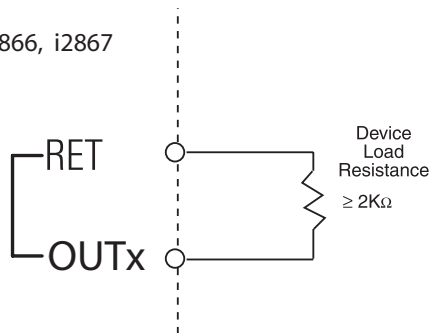
i2866-V
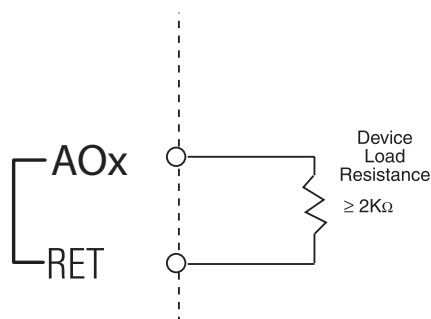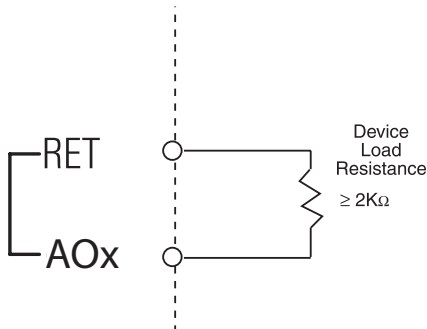
Note: The load resistance (of the external device) must be greater than or equal to 2KΩ.

7

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Expansion
Interface

Controller Expansion Interface

UL-864 Note: The use of the Expansion Interface is not listed for UL-864 Smoke Control Applications.

The following controllers include an expansion connector that allows you to add to the number of inputs or outputs via an external expansion module:

   i2810 Series
   i2850 Series
   i2920 (not expandable when used in an SX8000-based Infinity System)

Modules include various input, output and display/keypad models:

The **INPUT** modules are:

- xPDI8; 8-Channel Digital Input Module
- xPUI4; 4-Channel Universal Input Module

The **OUTPUT** modules are:

- xPAO2; 2-Channel Analog Output Module
- xPAO4; 4-Channel Analog Output Module
- DO2; 2-Channel Relay Output Module
- DO4; 4-Channel Relay Output Module

The **BI-DIRECTIONAL** (contain both inputs and outputs) modules are:

- xPBA4; 4 Universal Inputs, 4 Analog Outputs Module
- xPBD4; 4 Universal Inputs, 4 Digital Outputs Module

The **DISPLAY** modules are:

- xPDisplay; Internal Mounted Keypad/Display Module (i2920 only)
- xPRemote Display; Externally Mounted Keypad/Display Module

Expansion modules are connected to the controller via the expansion connector located on the bottom of the unit. Modules can be directly connected to the controller or be interfaced using a cable.

The Expansion Connector is located on the bottom of the controller
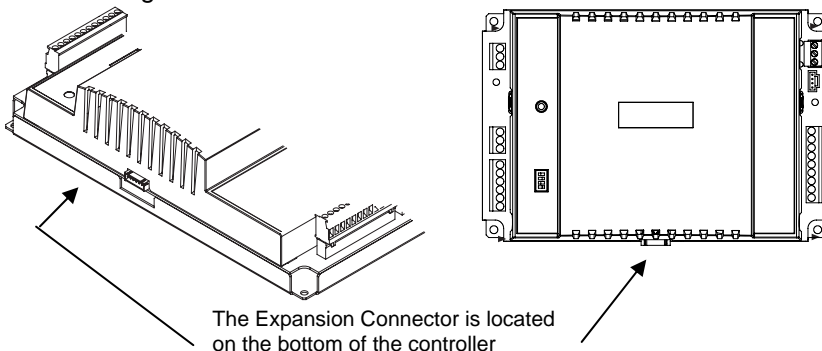
Possible Expansion I/O Module Combinations
These combinations are based on current draw and programming limitations. The following tables describe the Andover Continuum Point Count and the modules necessary to make the combination.

Analog Output Only Expansion:

Point Count	Modules Necessary
2 Analog Outputs	xPAO2
2 Analog Outputs	xPAO2 + xPAO2
4 Analog Outputs	xPAO4

Digital Output Only Expansion:

Point Count	Modules Necessary
2 Digital Outputs	xPDO2
4 Digital Outputs	xPDO2 + xPDO2
4 Digital Outputs	xPDO4
6 Digital Outputs	xPDO4 + xPDO2

Digital Input Only Expansion:

Point Count	Modules Necessary
8 Digital Inputs	xPDI8
16 Digital Inputs	xPDI8 + xPDI8

Universal Input Only Expansion:

Point Count	Modules Necessary
4 Universal Inputs	xPUI4
8 Universal Inputs	xPUI4 + xPUI4

Keypad/Display Only Expansion *

Point Count	Modules Necessary
16 button, 2 x 16 char display	xPDISPLAY

I/O Combination Expansion:

Point Count	Modules Necessary
2 Analog, 2 Digital Outputs	xPAO2 + xPD02
2 Analog, 4 Digital Outputs	xPAO2 + xPDO4
2 Analog Outputs, 8 Digital Inputs	xPAO2 + xPDI8
2 Digital Outputs, 8 Digital Inputs	xPDO2 + xPDI8
4 Universal Inputs, 4 Digital Outputs	xPUI4 + xPDO4
4 Universal Inputs, 8 Digital Inputs	xPUI4 + xPDI8

Combination Display Expansion*:

Point Count	Modules Necessary
2 Analog Outputs, Display	xPAO2 + xPDISPLAY
2 Digital Outputs, Display	xPDO2 + xPDISPLAY
4 Digital Outputs, Display	xPDO4 + xPDISPLAY
4 Universal Inputs, Display	xPUI4 + xDISPLAY

8 Digital Inputs, Display	xPDI8 + xPDISPLAY
16 Digital Inputs, Display	xPDI8 + xPDI8 + xPDISPLAY
2 Digital Outputs, 8 Digital Inputs, Display	xPDO2 + xPDI8 + xPDISPLAY
2 Analog Outputs, 8 Digital Inputs, Display	xPDAO2 + xPDI8, + xPDISPLAY
4 Universal Inputs, 2 Digital Outputs, Display	xPUI4 + xPDO2 + xPDISPLAY
4 Universal Inputs, 8 Digital Inputs, Display	xPUI4 + xPDI8 + xPDISPLAY

*Expansion Power Limitation

The Expansion Interface allows for two modules plus the xPDisplay as long as the combination does not draw more current than the Controller can supply. Controllers can supply a maximum of 180mA @ 24 VDC. Refer to the individual power requirements for each module listed below.

Power Consumption of Expansion Modules

The number of Expansion Modules is limited by the capacity of the power supply current available from the controller. The maximum current available is 180 mA.

The table below lists the current draw for each Expansion Module.

Module	# Channels	Current draw @ 24VDC
xPAO2; Analog Output Module	2	80mA
xPAO4; Analog Output Module	4	120mA
xPDO2; Digital Output Module	2	60mA
xPDO4; Digital Output Module	4	100mA
xPDI8; Digital Input Module	8	25mA
xPUI4; Universal Input Module	4	50mA
xPBA4; Bi-directional Module	8 (4 UI, 4 AO)	60mA
xPBD4; Bi-directional Module	8 (4 UI, 4 DO)	125mA
xPDisplay; Keypad/Display Module	N/A	70mA

Expansion Cable Connections

Expansion modules are connected to the controller and each other via the expansion connector or by using a cable. There are two types of cables available and two lengths of each type. The following table outlines the types, their use and the Schneider Electric part numbers for each.

Type	Usage	Length	Part #
Female-Male	Controller-Module Module-Module	3 Feet (914 mm)	XP-MOD-CABLE-3
Female-Male	Controller-Module Module-Module	10 Feet (3 M)	XP-MOD-CABLE-10
Female-Female	Controller-Display Module-Display	3 Feet (914 mm)	01-0100-484
Female-Female	Controller-Display Module-Display	10 Feet (3 M)	XP-DISP-CABLE-10

The following pages detail possible expansion module connections and illustrate the use of the expansion cables.

Note: The total length of all cables cannot exceed 10 Feet (3M)

Basic Expansion (no Display)

Adding expansion modules to a supported controller is a simple task of plugging the two together. The supported configurations for simple local expansion are illustrated below. The modules used must conform to the supported combinations list shown on the first page of this section.
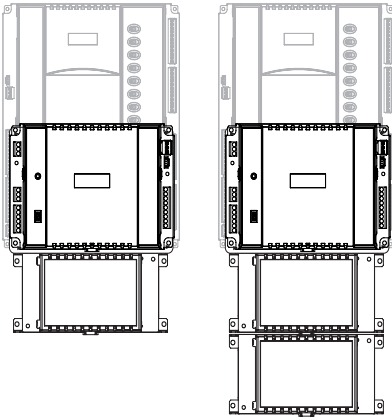
Remote Expansion (no Display)

The system allows modules to be located up to 10' (3M) from the main controller. Expansion cables are available in 3' (914mm) and 10' (3M) lengths. The supported basic remote expansion configurations are illustrated below:
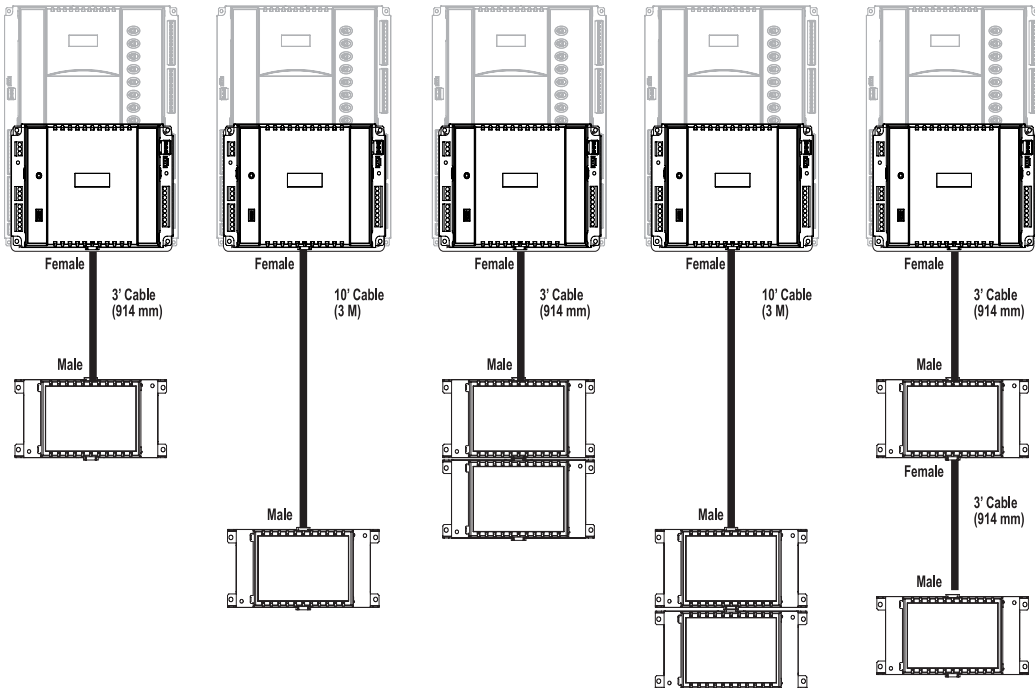
Basic Expansion (with External Display)

The remote xP Display may be added to any supported controller as well as in addition to up to two expansion modules. The supported configurations for simple local expansion are illustrated below. As before, the modules used must conform to the supported combinations list shown on the first page of this section.

Female

Female

Female

Female

Female

Female

3' Cable
(914 mm)

10' Cable
(3 M)

3' Cable
(914 mm)

10' Cable
(3 M)

3' Cable
(914 mm)

10' Cable
(3 M)
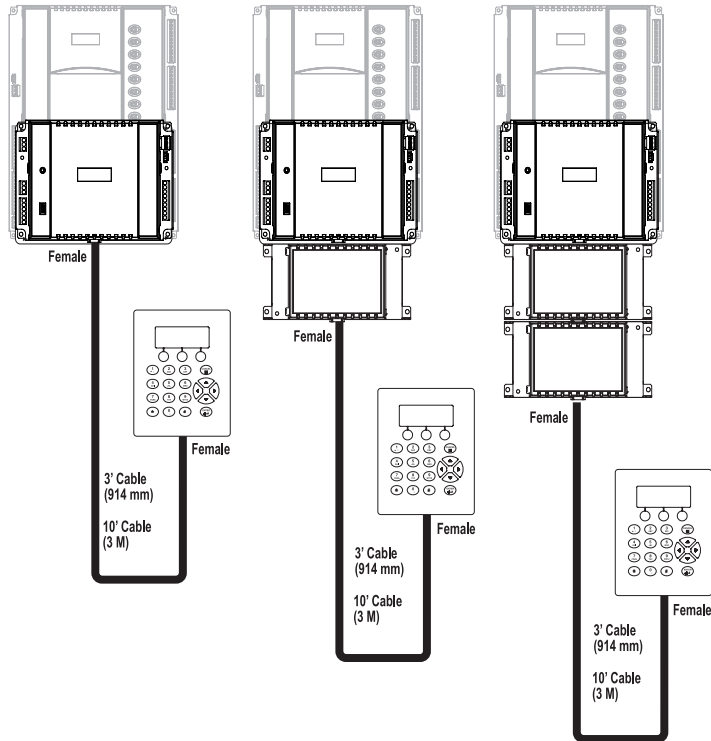
Remote Expansion (with External Display)

The system allows modules display modules to be added to remote expansion modules as well. The supported basic remote expansion configurations are illustrated below:
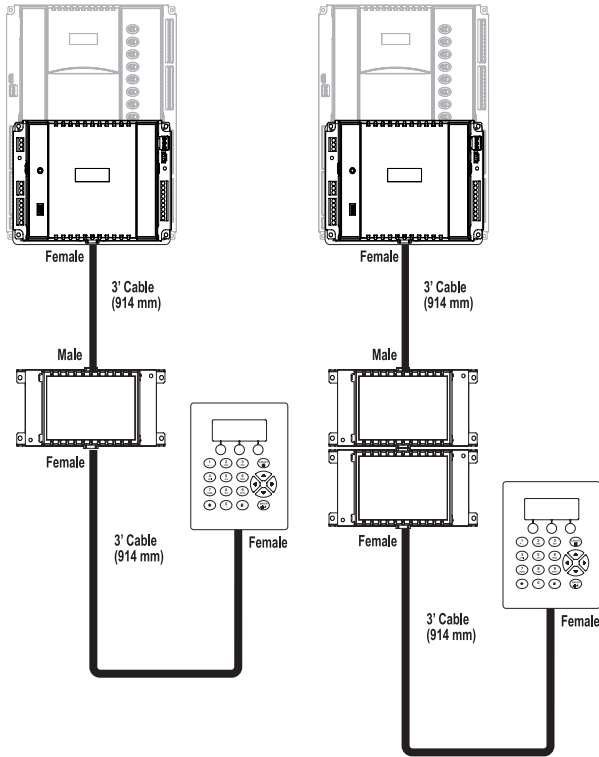
Basic Expansion (i2920 with Internal Display)

The xP Display may be added internally to any i2920 controller as well as in addition to up to two expansion modules. The supported configurations for simple local expansion are illustrated below. As before, the modules used must conform to the supported combinations list shown on the first page of this section.
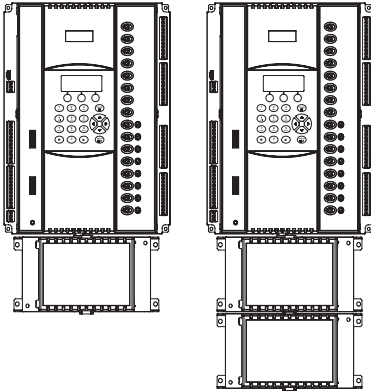
Remote Expansion (i2920 with Internal Display)
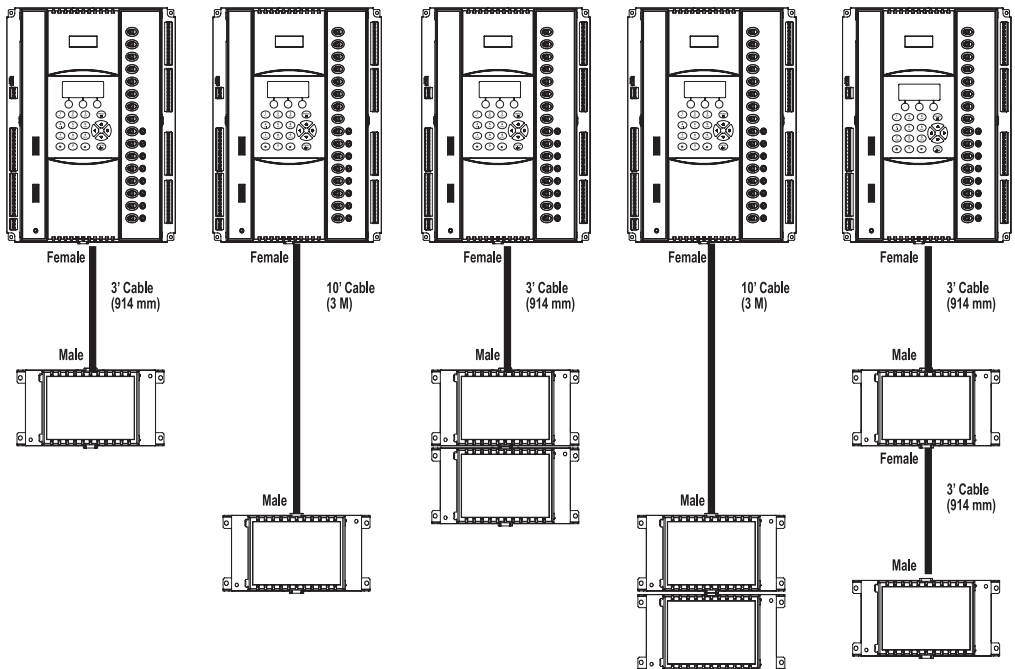
Expansion Input/Output Wiring

Terminations are typically located along the right and left side of the expansion module. Connection is via screw terminal.

The following diagram details each module's connections:

xP Expansion Module Input Connectors

xPDI8

RTN
IN1
IN2
RTN
IN3
IN4
RTN
IN5
IN6
RTN   DIGITAL INPUTS
IN7   0-5VDC
IN8

xPUI4

RTN
IN1
IN2
RTN
IN3
IN4
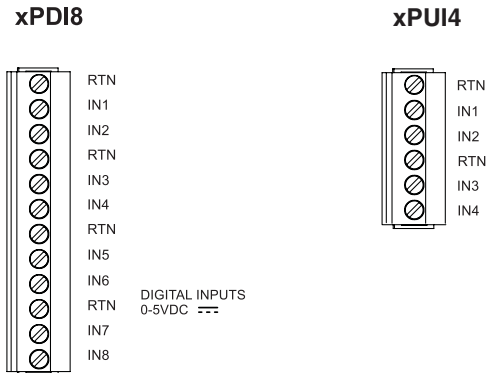
xP Expansion Module Output Connectors

xPAO2

1 — I
  — V
  — GND

2 — I
  — V
  — GND

xPAO4

1 — I
  — V
  — GND

2 — I
  — V
  — GND

3 — I
  — V
  — GND

4 — I
  — V
  — GND

xPDO2

1 — NC
  — C
  — NO

2 — NC
  — C
  — NO

xPDO4

1 — NC
  — C
  — NO

2 — NC
  — C
  — NO

3 — NC
  — C
  — NO

4 — NC
  — C
  — NO
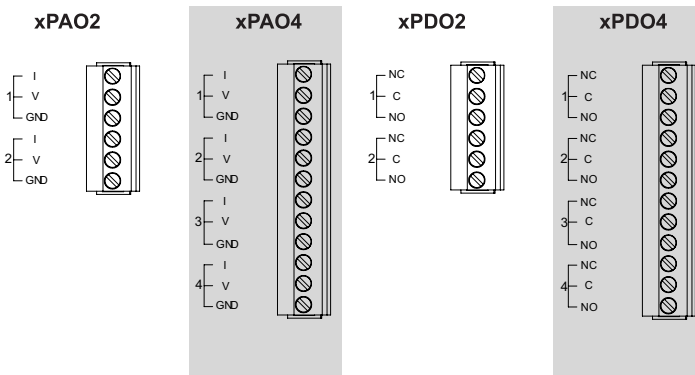
8

Operation
/Programming

Operation/Programming
All controllers except i2885, i2885-V, & 887(L)

The i2 series controllers are microcomputers that, along with the input and output circuitry, includes program memory and data memory. The hardware of the i2 Series cannot be used for control or monitoring without being configured and programmed.

Key Concepts

There are many concepts to learn; however, there are a few key ones that you need to understand before attempting to grasp the others. These key concepts are outlined below.

Workstation
The user interacts with the system (either Continuum or *Infinity*) through a personal computer called the workstation. Workstation software, called CyberStation, or SX8000 is used to configure (set-up), program, monitor and operate the system.

Programming
Programs in a BASIC-like language called Plain English are created on the workstation and downloaded to the controller where they run.

Configuration
The configuration process is where the various settings for the controller are applied. Configuration information includes such things as the setting of each input type.

Points
The control of equipment requires monitoring individual inputs and actuating individual outputs. In *Infinity* and Continuum systems, these discrete entities are referred to as 'points'. You'll see 'output point' or 'input point' referred to quite often.

In keeping with this tradition, internal places within a controller or workstation's memory are also referred to as points. These software-based points may be temporary storage locations for set points or the memory location where the current date and time are stored.

Flash Memory
Memory holds configuration data and the programs the controller uses during operation. Flash Memory is a kind of memory that has the ability to retain its contents even during a power failure (also known as non-volatile). Flash does not require batteries to retain this information.

Database
The information that describes the structure and operation of your building is stored in a software database. The values of each point in the system, the settings for limits, the configuration of the hardware and more are contained within this software structure. The database is the key to the entire system.

Configuration Process

The controller is shipped from the factory with the operating system firmware pre-programmed into its program memory. This firmware allows the controller to communicate with a CyberStation so that it can be further configured and programmed to meet the requirements of its intended task.

Once the controller is physically installed at your site it must be configured and programmed. The following information is presented as an overview of the process. Detailed descriptions of configuration can be found in the *Andover Continuum CyberStation Configurator's Guide*, 30-3001-781, or the *Infinity SX8000 Programmer's Guide*.

After configuration, the new controller will be visible in the database tree shown in the Continuum Explorer window. The following screen shot illustrates the new controller after creation. This particular screen comes from CyberStation:
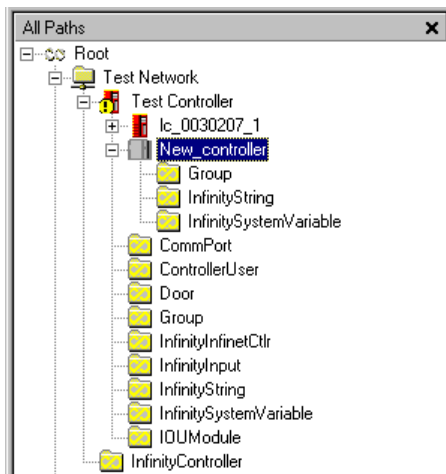
The i2850 Series device is the controller named "New_controller". As an Infinet II controller, its icon is different from an Infinet I controller.

The folders shown beneath the icon are made visible by clicking the small plus symbol next to the icon. These folders hold other programmable entities within the controller.

Compatibility
The i2885 and i2885-V are designed to work with Continuum (version1.5 or higher) but not with Infinity systems or earlier Continuum versions. All other i2 series controllers support both Infinity systems and Continuum.

Magic Variables (not applicable to i2885 and i2885-V)
There are several "magic" variables that are used to set up the operation of the flash memory. On Continuum systems (v 1.5 or higher), these variables are automatically created as System Variables. On Infinity systems or pre-version 1.5 Continuum systems, these variables are manually created numerics.

Controller Memory

Infinet II controllers except the i2885, i2885-V, and i2887(L) have two distinct program memories. One is dedicated to the lower-level operation of the controller and the other holds user-defined items such as point data and Plain English programs.

Flash Files

Periodically, newer versions of the operating system are released. You can find and download the latest version of the operating system from the Schneider Electric Technical Support web site. These new versions consist of one or more "flash files". Workstation software includes provisions for you to upload these flash files directly to the controller.

Application Memory

Plain English programs and point data are stored in Application Memory. This memory is backed up with a battery to guard against power failure. The controller includes an extra Flash Memory for storing some of the Application data as well. This Flash Memory can be commanded to store the configuration data contained in the battery-backed memory as an extra insurance against loss.

Advantages of Flash Memory

Initially it may seem redundant to include a flash memory along with battery-backed memory to hold application data. However, it is this redundancy that makes its addition attractive.

Although it is unlikely that the battery will fail or that the data in that memory will become corrupted, it is an extra layer of protection for your configuration data to be able periodically to lock it into flash.

Limitations of Flash Memory

Flash memory circuits are rated for a limited number of write operations (minimum of 10,000 to an average expected lifetime of 100,000). In the controller, flash memory is used for storing completed configurations and a snapshot of data at a particular time. When used in this manner, the memory should last the lifetime of the product. To give you an idea of how many operations are available, see the following table.

Average Expected Lifetime Of Flash Memory Circuits

Write to Flash	Number of Operations Available	
1 time per day	27 years at minimum rating	274 years at average expected lifetime
10 times per day	2.7 years at minimum rating	27 years at average expected lifetime

If you're really worried about exceeding the maximum number of writes, the controller includes an automatic software-based "circuit breaker" that warns you at certain intervals.

An Infinity controller sets the circuit breaker at 2000 writes to flash for database, configuration and operational program saves. For database saves, the system variable ACCStatusBackup is set to ACCBackupDisabled and requires you to set the ACCStatusBackup variable to ACCBackupEnabled.

For configuration and operation write operations to flash, a counter is incremented for each save and you need to create the numeric INFFlashDisabled to monitor the number of write operations. When the 2000 limit is reached, INFFlashDisabled is set to a non-zero value and logs an error. Using CyberStation, reset this value to 0 and reboot the controller to enable write operations.

The circuit breaker helps to protect against a rogue Plain English program constantly changing a configuration setting.

Start-up From Power Failure

With so many memory options available to the controller for storing critical data, we thought it would be equally helpful to provide various options for retrieving that data upon start-up from a power down condition.

Although the controller has a default start-up mode, there are two other start-up sequences that you can choose.

Possible Restart Conditions
The following describes the three types of conditions a controller may encounter during a restart from a power failure:

Cold Start: The controller powers up from reset with no user objects or configuration in place.

Cool Start: The controller powers up from reset and restores the user configuration from Flash memory. It is assumed that a configuration was explicitly saved by the user at some point prior to power down. Point log data is not restored (with the exception of manual arrays on setpoints), Plain English programs are started at their beginning, and user points, whose SetPoint attribute has been set, have their values restored. Cool start can be thought of as a "self reload".

Warm Start: The controller powers up from reset with a user configuration in place. The user configuration is that which was present in the controller and preserved due to the battery-backed memory when it was reset and/or power was lost. Point log data is preserved, Plain English programs are restarted at the same logical line that was being interpreted when the controller shut down, and all user points have their values restored. Warm start is functionally similar to an Infinet 1 warm start.

Overview of Available Restart Modes

One of the settings during the controller definition phase of the configuration process is to determine the power restart mode. The following modes are available:

ACCWarmStartOnly The controller, upon recovery from reset, attempts a warm start; if that fails, proceeds with cold start.

ACCCoolStartOnly The controller, upon recovery from reset, attempts a cool start; if that fails, proceeds with cold start.

ACCWarmToCool The controller, upon recovery from reset, attempts warm start; if that fails, attempts a cool start; if that fails, proceeds with cold start. This is the default mode for the controller.

Detailed Description of Restart Modes

Warm Start Only

Selected by:

Continuum System Variable: ACCRestartMode = ACCWarmStartOnly

Infinity Numeric*:   INFRestartMode = 0

In this mode, after a reset the controller examines the database in its internal RAM, attempts to correct any data corruption that may have been caused by an untimely reset/power loss, validates the database and attempts to use it if it is found to be valid.

- Point values (with the exception of input points) are restored.
- Input point values are purged and a fresh sample is obtained from the hardware before the Scanner runs.
- Output points are marked for hardware update such that their values will be refreshed to the hardware upon completion of the Scan (pulsed output values are assumed to have expired).
- All log data are retained.
- Plain English programs, that were running when the system went down, are re-started at the same logical line that was "CurrentLine" when the controller shut down. The Status, and State attributes are left unchanged. Line start times are left at whatever value they had when the controller went down and ts, tm, th, td will be incremented (from whatever value they had before power down) by the time delta imposed by the first time sync message after warm start. The elapsed time variables are actually computed values, hence their behavior is a side effect of the fact that the line start times are left unchanged.

*Infinity numeric or pre-version 1.5 Continuum numeric

Cool Start Only

Continuum System Variable: ACCRestartMode = ACCCoolStartOnly

Infinity Numeric*:   INFRestartMode = 1

In this mode, the user database is backed-up to the User Backup Area of Flash memory upon user command only (manually). When the controller powers up after a reset, it examines the backup area in Flash memory, and if a valid backup is found, the data is restored to RAM. Certain portions of the data are re-initialized:

- Point values whose SetPoint attribute are TRUE have their values restored
- Input point values are purged and a fresh sample obtained from the hardware before the Scanner runs.
- Output points are purged.
- All automatic log data are purged
- Manual array data are retained for setpoint variables only.
- The CurrentLine attribute of Plain English programs is set to its first line. The program is run ONLY if the AutoStart attribute is TRUE. The State attribute is restored and its value observed.

Warm to Cool

Continuum System Variable: ACCRestartMode = ACCWarmToCool

Infinity Numeric*:   INFRestartMode = 2

In this mode, the user database is backed-up to the User Backup Area of Flash memory only when the user specifically requests a backup. When the controller powers-up after a reset, it examines the database in RAM, attempts to correct any data corruption that may have been caused by an untimely reset/power loss, validates the database (against things like bad pointers etc.) and attempts to use it if it is found to be valid. If this fails, it examines the User Backup Area of Flash memory, and if a valid backup is found then data is restored to RAM (cool start).

*Infinity numeric or pre-version 1.5 Continuum numeric

Setting the Restart Mode

On Continuum Systems:
When you define the controller using the Continuum CyberStation, a system variable called ACCRestartMode is automatically created in the controller. Through the Continuum Explorer, open the System Variables folder and open the ACCRestartMode variable.
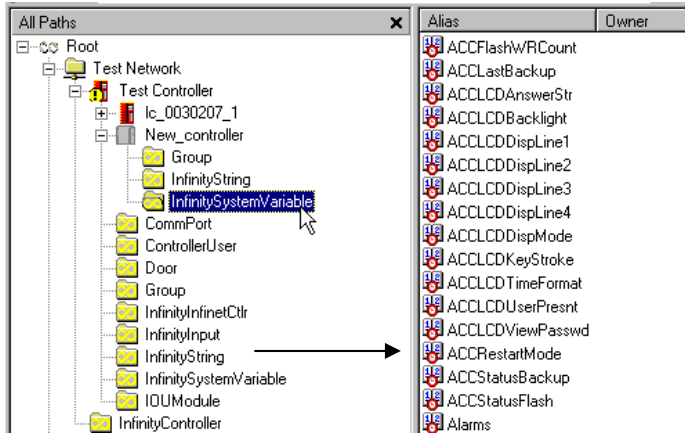
In the editor window you select the desired mode from the three modes previously mentioned.

On Infinity Systems*:
Defining the controller on an Infinity system or a pre-version 1.5 Continuum system requires you to manually create a numeric variable: INFRestartMode. After creation you need to set this variable as follows:

Mode	Set INFRestartMode to:
Warm Start Only	0
Cool Start Only	1
Warm To Cool	2

*Infinity numeric or pre-version 1.5 Continuum numeric

Flash Memory Backup Variables and Tools

With the restart mode set to ACCCoolStartOnly or ACCWarmTo Cool, you have the option of backing up your database to the internal Application Flash Memory. There are several status variables that can be monitored to determine the current state of the information in the flash area.

ACCStatusFlash   Indicates the state (empty, valid or failure) of the Flash memory device. In this case "valid" indicates that a valid database is present.

ACCStatusBackup   Indicates the operational state (backup needed, backup done, backup in progress, etc.) of the memory. It also includes provisions to initiate a backup operation.

ACCFlashWRCount   Stores a running tally of the number of write operations performed on the flash memory.

There are two features that prevent loss of operations:

Flash Circuit Breaker   Prevents you from unintentionally performing more write operations than the flash memory allows (2000 total).

Automatic Notification of
Backup Needed   Visual indication in the Continuum Explorer of the need to backup a controller.

Using the ACCStatusFlash Variable

The ACCStatusFlash variable indicates the current state (empty, full or failure) of the Flash memory device. The controller stores status information into this variable.

On Continuum Systems:

A system variable called ACCStatusFlash is automatically created when the controller is defined.

ACCStatusFlash can have the following values:

ACCFlashEmpty	There is no valid database in Flash memory
ACCFlashValid	There is a valid database in Flash memory
ACCFlashFailure	An error was encountered while trying to perform a backup to Flash. In this state, the data in flash is unusable

On Infinity Systems*:

A numeric called INFStatusFlash must be manually created prior to its use.

INFStatusFlash can have the following values:

0 (zero)	There is no valid database in Flash memory
1	There is a valid database in Flash memory
2	An error was encountered while trying to perform a backup to Flash. In this state, the data in flash is unusable

*Infinity numeric or pre-version 1.5 Continuum numeric

Using the ACCStatusBackup Variable

The ACCStatusBackup variable indicates the operational state (backup needed, backup done, backup in progress, etc.) of the memory. **It is also used to initiate a backup operation.** The controller stores status information into this variable and the user initiates a manual backup operation through this variable.

Note: The CyberStation user interface includes the ability to command a flash backup as well as the method presented below.

On Continuum Systems:

A system variable called ACCStatusBackup is automatically created when the controller is defined.

ACCStatusBackup, when used as an indicator, can have the following values:

ACCBackupDone	A backup to Flash memory has been successfully completed, or the controller has not been configured.
ACCBackupNeeded	A configuration item has changed value since the last successful backup to Flash memory.
ACCBackupInProgress	A backup to Flash memory operation is underway. Note: The database is available on a read-only basis during the backup operation.
ACCBackupDisabled	The database has been saved to Flash memory 2,000 times and the user has attempted further backup operations without re-setting the Flash Circuit Breaker (see ACCBackupEnable). For as long as this condition persists, further backup operations are disabled.
ACCBackupInactive	The system has been placed in WarmStartOnly mode and therefore, Flash user backup area is not available for use.

ACCStatusBackup*, when used to initiate a backup can have the following values:

ACCBackupEnable	A command from the user. This allows you to override the Flash Circuit Breaker and perform further backup operations. Further backup operations will be uninhibited until an additional 2,000 Flash write cycles have been incurred.
ACCBackupNow	A command from the user. This causes the system to initiate a backup of the current database to Flash memory.

* Be careful if setting this using Plain English. Remember there is a maximum number of Flash writes!

Using the ACCStatusBackup Variable (continued)

On Infinity Systems*:

A numeric called INFStatusBackup must be manually created prior to its use.

INFStatusBackup, when used as an indicator can have the following values:

0 (zero)	A backup to Flash memory has been successfully completed.
1	A configuration item has changed value since the last successful backup to Flash memory.
3	A backup to Flash memory operation is underway. Note: The database is available on a read-only basis during the backup operation.
4	The database has been saved to Flash memory 2,000 times and the user has attempted further backup operations without re-setting the Flash Circuit Breaker (see BackupEnable). For as long as this condition persists, further backup operations are disabled.
6	The system has been placed in WarmStartOnly mode and therefore, Flash user backup area is not available for use.

IMPORTANT NOTE: You must use the command line to write to the INFStatusBackup variable. Do not use the editor window in the SX8000, CyberStation or the terminal interface within a CX to initiate a backup operation. It is not recommended that you set this variable using Plain English.

INFStatusBackup, when used to initiate a backup can have the following values:

5	A command from the user. This allows you to override the Flash Circuit Breaker and perform further backup operations. Further backup operations will be uninhibited until an additional 2,000 Flash write cycles have been incurred.
2	A command from the user. This causes the system to initiate a backup of the current database to Flash memory.

*Infinity numeric or pre-version 1.5 Continuum numeric

Using the ACCFlashWRCount Variable

The ACCFlashWRCount variable Stores a running tally of the number of write operations performed on the flash memory. The controller stores the count information into this variable.

On Continuum Systems:

A system variable called ACCFlashWRCount is automatically created when the controller is defined.

On Infinity Systems*:

A numeric called INFFlashWRCount must be manually created prior to its use.

*Infinity numeric or pre-version 1.5 Continuum numeric

Operation/Programming (i2885, i2885-V, and i2887(L) Only)

The i2885, i2885-V and i2887(L) controllers are microcomputers that, along with the input and output circuitry, includes program memory and data memory. The hardware cannot be used for control or monitoring without being configured and programmed.

Key Concepts

There are many concepts to learn; however, there are a few key ones that you need to understand before attempting to grasp the others. These key concepts are outlined below.

Workstation
The user interacts with the system through a personal computer called the workstation. Workstation software called CyberStation is used to configure (set-up), program, monitor and operate the system.

Programming
Programs in a BASIC-like language called Plain English are created on the workstation and downloaded to the controller where they run.

Configuration
The configuration process is where the various settings for the controller are applied. Configuration information includes such things as the setting of each input type.

Points
The control of equipment requires monitoring individual inputs and actuating individual outputs. In Continuum systems, these discrete entities are referred to as 'points'. You'll see 'output point' or 'input point' referred to quite often.

In keeping with this tradition, internal places within a controller or workstation's memory are also referred to as points. These software-based points may be temporary storage locations for set points or the memory location where the current date and time are stored.

Flash Memory
Memory holds configuration data and the programs the controller uses during operation. Flash Memory is a kind of memory that has the ability to retain its contents even during a power failure (also known as non-volatile). Flash does not require batteries to retain this information.

Database
The information that describes the structure and operation of your building is stored in a software database. The values of each point in the system, the settings for limits, the configuration of the hardware and more are contained within this software structure.

The database is the key to the entire system.

Configuration Process

The controller is shipped from the factory with the operating system firmware pre-programmed into its program memory. This firmware allows the controller to communicate with a workstation so that it can be further configured and programmed to meet the requirements of its intended task.

Once the controller is physically installed at your site it must be configured and programmed. The following information is presented as an overview of the process. Detailed descriptions of configuration can be found in the *Andover Continuum CyberStation Configurator's Guide*, 30-3001-781.

After configuration, the new controller will be visible in the database tree shown in the workstation Continuum Explorer window. The following screen shot illustrates the new controller after creation. This particular screen comes from a Continuum workstation:
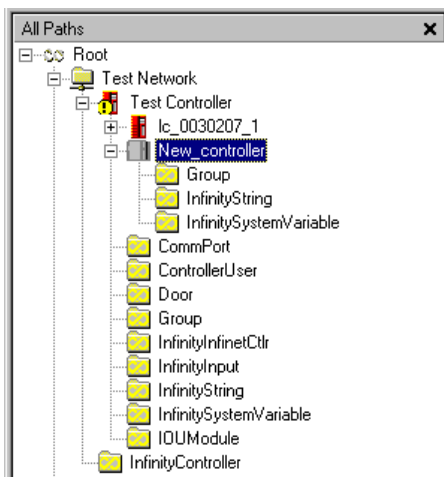
The i2800 series device is the controller named "New_controller". As an Infinet II controller, its icon is different from an Infinet I controller.

The folders shown beneath the icon are made visible by clicking the small plus symbol next to the icon. These folders hold other programmable entities within the controller.

Compatibility

The i2885 and i2885-V are designed to work with Continuum (version1.5 or higher) but not with Infinity systems or earlier Continuum versions. All other i2 series controllers support both Infinity systems and Continuum.

Controller Memory

Infinet II controllers such as the i2885, i2885-V and i2887(L) have two distinct program memories. One, RAM memory, is volatile and will be erased in the event of a power failure. The other is Flash memory which is non-volatile. To preserve programs and point readings it is necessary to transfer the contents of RAM memory to the Flash.

Flash Files

Periodically, newer versions of the operating system are released. You can find and download the latest version of the operating system from the Schneider Electric Technical Support web site. These new versions consist of one or more "flash files". Workstation software includes provisions for you to upload these flash files directly to the controller.

RAM Memory

Plain English programs and point data are stored in RAM memory. **The contents of this memory is lost in the event of a power failure.**

⚠ *CAUTION: The user must perform a backup to flash in order to guard against data loss.*

Limitations of Flash Memory

Flash memory circuits are rated for a limited number of write operations (minimum of 10,000 to an average expected lifetime of 100,000). In the controller, flash memory is used for storing completed configurations and a snapshot of data at a particular time. When used in this manner, the memory should last the lifetime of the product. To give you an idea of how many operations are available, see the following table.

Average Expected Lifetime Of Flash Memory Circuits

Write to Flash	Number of Operations Available	
1 time per day	27 years at minimum rating	274 years at average expected lifetime
10 times per day	2.7 years at minimum rating	27 years at average expected lifetime

If you're really worried about exceeding the maximum number of writes, the controller includes an automatic software-based "circuit breaker" that warns you at certain intervals.

An Infinity controller sets the circuit breaker at 2000 writes to flash for database, configuration and operational program saves. For database saves, the system variable ACCStatusBackup is set to ACCBackupDisabled and requires you to set the ACCStatusBackup variable to ACCBackupEnabled.

For configuration and operation write operations to flash, a counter is incremented for each save and you need to create the numeric INFFlashDisabled to monitor the number of write operations. When the 2000 limit is reached, INFFlashDisabled is set to a non-zero value and logs an error. Using CyberStation, reset this value to 0 and reboot the controller to enable write operations.

The circuit breaker helps to protect against a rogue Plain English program constantly changing a configuration setting.

Start-up From Power Failure

Restart Conditions
The following describes the two types of conditions a controller may encounter during a restart from a power failure:

Cold Start: The controller powers up from reset with no user objects or configuration in place.

Cool Start: The controller powers up from reset and restores the user configuration from Flash memory. It is assumed that a configuration was explicitly saved by the user at some point prior to power down. Point log data is not restored (with the exception of manual arrays on setpoints), Plain English programs are started at their beginning, and user points, whose SetPoint attribute has been set, have their values restored. Cool start can be thought of as a "self reload".

Overview of Available Restart Mode
The controller is pre- configured for the following restart mode:

ACCCoolStartOnly   The controller, upon recovery from reset, attempts a cool start; if that fails, proceeds with cold start.

Detailed Description of the Restart Mode

Cool Start Only

Continuum System Variable: ACCRestartMode = ACCCoolStartOnly

In this mode, the user database is backed-up to the User Backup Area of Flash memory upon user command only (manually). When the controller powers up after a reset, it examines the backup area in Flash memory, and if a valid backup is found, the data is restored to RAM. Certain portions of the data are re-initialized:

- Point values whose SetPoint attribute are TRUE have their values restored
- Input point values are purged and a fresh sample obtained from the hardware before the Scanner runs.
- Output points are purged.
- All automatic log data are purged
- Manual array data are retained for setpoint variables only.
- The CurrentLine attribute of Plain English programs is set to its first line. The program is run ONLY if the AutoStart attribute is TRUE. The State attribute is restored and its value observed.

Flash Memory Backup Variables and Tools

To avoid losing data, you must back up your database to the internal Flash Memory. There are several status variables that can be monitored to determine the current state of the information in the flash area.

ACCStatusFlash	Indicates the state (empty, valid or failure) of the Flash memory device. In this case "valid" indicates that a valid database is present.
ACCStatusBackup	Indicates the operational state (backup needed, backup done, backup in progress, etc.) of the memory. It also includes provisions to initiate a backup operation.
ACCFlashWRCount	Stores a running tally of the number of write operations performed on the flash memory.
ACCLastBackup	Indicates the date and time of the last backup of the object system to flash. The i2 controller updates this variable to the current time after successfully performing a backup operation.

There are two features that prevent loss of operations:

Flash Circuit Breaker	Prevents you from unintentionally performing more write operations than the flash memory allows (2000 total).
Automatic Notification of Backup Needed	Visual indication in the Continuum Explorer of the need to backup a controller.

Using the ACCStatusFlash Variable

The ACCStatusFlash variable indicates the current state (empty, valid or failure) of the Flash memory device. The controller stores status information into this variable.

A system variable called ACCStatusFlash is automatically created when the controller is defined.

ACCStatusFlash can have the following values:

ACCFlashEmpty	There is no valid database in Flash memory
ACCFlashValid	There is a valid database in Flash memory
ACCFlashFailure	An error was encountered while trying to perform a backup to Flash. In this state, the data in flash is unusable

Using the ACCStatusBackup Variable

The ACCStatusBackup variable indicates the operational state (backup needed, backup done, backup in progress, etc.) of the memory. **It is also used to initiate a backup operation.** The controller stores status information into this variable and the user initiates a manual backup operation through this variable.

Note: The CyberStation user interface includes the ability to initiate a flash backup as well as the method presented below.

A system variable called ACCStatusBackup is automatically created when the controller is defined.

ACCStatusBackup, when used as an indicator, can have the following values:

ACCBackupDone	A backup to Flash memory has been successfully completed, or the controller has not been configured.
ACCBackupNeeded	A configuration item has changed value since the last successful backup to Flash memory.
ACCBackupInProgress	A backup to Flash memory operation is underway. Note: The database is available on a read-only basis during the backup operation.
ACCBackupDisabled	The database has been saved to Flash memory 2,000 times and the user has attempted further backup operations without re-setting the Flash Circuit Breaker (see BackupEnable). For as long as this condition persists, further backup operations are disabled.

ACCStatusBackup, when used to initiate a backup can have the following values:

ACCBackupEnable   A command from the user. This allows you to override the Flash Circuit Breaker and perform further backup operations. Further backup operations will be uninhibited until an additional 2,000 Flash write cycles have been incurred.

ACCBackupNow   A command from the user. This causes the system to initiate a backup of the current database to Flash memory.

Using the ACCFlashWRCount Variable

The ACCFlashWRCount variable stores a running tally of the number of write operations performed on the flash memory. The controller stores the count information into this variable.

A system variable called ACCFlashWRCount is automatically created when the controller is defined.

I/O Point Assignments

The following pages list the input and output point assignments for each controller:

i2600 Series I/O Point Assignments

Function	Input Point Assignment	Electrical Type	
Input 1	1	* see note 1	
Input 2	2	* see note 1	
Input 3	3	* see note 1	
Input 4	4	* see note 1	i2608
Input 5	5	* see note 1	
Input 6	6	* see note 1	
Input 7	7	* see note 1	
Input 8	8	* see note 1	
Input 9	9	* see note 1	
Input 10	10	* see note 1	
Input 11	11	* see note 1	
Input 12	12	* see note 1	
Input 13	13	* see note 1	
Input 14	14	* see note 1	i2624
Input 15	15	* see note 1	
Input 16	16	* see note 1	
Input 17	17	* see note 1	
Input 18	18	* see note 1	
Input 19	19	* see note 1	
Input 20	20	* see note 1	
Input 21	21	* see note 1	
Input 22	22	* see note 1	
Input 23	23	* see note 1	
Input 24	24	* see note 1	

* Note 1: valid ElecTypes are:
    Voltage
    ACCTemp(DegF)
    ACCTemp(DegC)
    Digital
    Counter
    Supervised

i2800 Series I/O Point Assignments

Function	Input Point Assignment	Electrical Type
Input 1	1	* see note 1
Input 2	2	* see note 1
Input 3	3	* see note 1
Input 4	4	* see note 1
Input 5	5	* see note 1
Input 6	6	* see note 1
Input 7	7	* see note 1
Input 8	8	* see note 1
Input 9 (Smart Sensor)	9	* see note 2

Function	Output Point Assignment	Electrical Type
Output 1	1	Digital, Tri-State
Output 2	2	Digital, Tri-State
Output 3	3	Digital, Tri-State
Output 4	4	Digital, Tri-State
Output 5 (i2800 only)	5	Digital, Tri-State
Output 6 (i2800 only)	6	Digital, Tri-State
Output 7 (i2800 only)	7	Digital, Tri-State
Output 8 (i2800 only)	8	Digital
Output 5 (i2804 only)	5	Voltage
Output 6 (i2804 only)	6	Voltage
Output 7 (i2804 only)	7	Voltage
Output 8 (i2804 only)	8	Voltage

* Note 1: valid ElecTypes are:
    Voltage
    ACCTemp(DegF)
    ACCTemp(DegC)
    Digital
    Counter
    Supervised

* Note 2: valid ElecTypes are:
    ACCTemp(DegF)
    ACCTemp(DegC)
    Digital

i2810 Series I/O Point Assignments

Function	Input Point Assignment	Electrical Type
Input 1	1	* see note 1
Input 2	2	* see note 1
Input 3	3	* see note 1
Input 4	4	* see note 1
Input 5	5	* see note 1
Input 6	6	* see note 1
Input 7	7	* see note 1
Input 8	8	* see note 1
Input 9 (Smart Sensor)	9	* see note 2

Function	Output Point Assignment	Electrical Type
Output 1	1	Digital, Tri-State
Output 2	2	Digital, Tri-State
Output 3	3	Digital, Tri-State
Output 4	4	Digital, Tri-State
Output 5 (i2810 only)	5	Digital, Tri-State
Output 6 (i2810 only)	6	Digital, Tri-State
Output 7 (i2810 only)	7	Digital, Tri-State
Output 8 (i2810 only)	8	Digital
Output 5 (i2814 only)	5	Voltage
Output 6 (i2814 only)	6	Voltage
Output 7 (i2814 only)	7	Voltage
Output 8 (i2814 only)	8	Voltage

* Note 1: valid ElecTypes are:
    Voltage
    ACCTemp(DegF)
    ACCTemp(DegC)
    Digital
    Counter
    Supervised

* Note 2: valid ElecTypes are:
    ACCTemp(DegF)
    ACCTemp(DegC)
    Digital

i2850 Series I/O Point Assignments

Function	Input Point Assignment	Electrical Type
Input 1	1	* see note 1
Input 2	2	* see note 1
Input 3	3	* see note 1
Input 4	4	* see note 1
Input 5	5	* see note 2
Airflow 1 (i2850 & i2853)	8	Voltage
Airflow 2 (i2853 only)	7	Voltage

Function	Output Point Assignment	Electrical Type
Output 1	1	Digital, Tri-State
Output 2	2	Digital, Tri-State
Output 3	3	Digital
Output 4	4	Tri-State

* Note 1: valid ElecTypes are:
> Voltage
> ACCTemp(DegF)
> ACCTemp(DegC)
> Digital
> Counter
> Supervised

* Note 2: valid ElecTypes are:
> ACCTemp(DegF)
> ACCTemp(DegC)
> Digital

i2865/866, i2865-V/866-V Series I/O Point Assignments

Function	Input Point Assignment		Electrical Type
	i2865/-V	i2866/-V	
Universal Input 1	1	1	* See Note 1
Universal Input 2	2	2	* See Note 1
Universal Input 3	3	3	* See Note 1
Universal Input 4	4	4	* See Note 1
Smart Sensor Input	5	5	* See Note 2
Airflow Sensor Input	7	7	Voltage

	Output Point Assignment		
	i2865/-V	i2866/-V	
Actuator	1	1	Tri-State
Output 3	3	3	Digital, Tri-State
Output 4	4	4	Digital, Tri-State
Output 5	5	5	Digital
Output 6	–	6	Voltage
Output 7	–	7	Voltage

* Note 1: Valid ElecTypes are: Voltage
ACCTemp(DegF)
ACCTemp(DegC)
Digital
Counter

* Note 2: Valid ElecTypes are: ACCTemp(DegF)
ACCTemp(DegC)
Digital

Actuator LCDState Attribute Note:

Toggling the value of the LCDState attribute of Output 1 (the Actuator) performs the same action as pressing the Actuator Clutch button.

i2867 Series I/O Point Assignments

Function	Input Point Assignment	Electrical Type
Input 1	1	* see note 1
Input 2	2	* see note 1
Input 3	3	* see note 1
Input 4	4	* see note 1
Input 5	5	* see note 2

Function	Output Point Assignment	Electrical Type
Output 1	1	* see note 3
Output 2	2	* see note 3
Output 3	3	Digital, Tri-State
Output 4	4	Digital, Tri-State
Output 5	5	Digital
Output 6	6	Voltage
Output 7	7	Voltage

* Note 1: valid ElecTypes are:
> Voltage
> ACC(Temp(DegF)
> ACCTemp(DegC)
> Digital
> Counter

* Note 2: valid ElecTypes are:
> Digital
> ACCTemp(DegF)
> ACCTemp(DegC)

* Note 3: valid ElecTypes are:
  When using CyberStation: Digital, Tri-State
  When using SX8000: Tri-State only

i2885 and i2885-V Series I/O Point Assignments

Function	Input Point Assignment	Electrical Type
Universal Input 1	1	Voltage ACCTemp(DegF) ACCTemp(DegC) Digital Counter
Universal Input 2	2	Voltage ACCTemp(DegF) ACCTemp(DegC) Digital Counter
Airflow Sensor Input	7	Voltage

	Output Point Assignment	
Actuator	1	Tri-State
Output 3	3	Digital, Tri-State
Output 4	4	Digital

i2887(L) Series I/O Point Assignments

Function	Input Point Assignment	Electrical Type
Universal Input 1	1	Voltage ACCTemp(DegF) ACCTemp(DegC) Digital Counter
Universal Input 2	2	Voltage ACCTemp(DegF) ACCTemp(DegC) Digital Counter
Universal Input 3	3	Voltage ACCTemp(DegF) ACCTemp(DegC) Digital Counter
Smart Sensor Input	4	ACCTemp(DegF) ACCTemp(DegC) Digital

	Output Point Assignment	
Triac Output 1	1	* see note 1
Triac Output 2	2	* see note 1
Triac Output 3	3	* see note 1
Triac Output 4	4	* see note 1
Relay Output 5	5	Digital

* Note 1: valid ElecTypes are:
  When using CyberStation: Digital, Tri-State
  When using SX8000: Tri-State only

i2920 Series I/O Point Assignments

Function	Input Point Assignment	Electrical Type
Input 1 - 16	1 - 16	Voltage ACCTemp(DegF) ACCTemp(DegC) Digital Counter Supervised
Input 17	17	ACCTemp(DegF) ACCTemp(DegC) Digital

Function	Output Point Assignment	Electrical Type
Output 1-8	1 - 8	Digital, Tri-State
Output 9-16	9-16	Voltage and Current

Expansion Point Assignments

xP Expansion Module points add to the existing points within a controller.
The point assignment in the first xP module connected to a controller will be one more than the highest point number that exists in the controller.

Example:
When adding 8 Digital inputs (xPDI8) to an i2853 controller, the first point in the DI8 will be assigned point # 9 (one higher than the highest input (Airflow 1)).

Subsequent Expansion modules plugged into other expansion modules assume point assignments that are one higher than the previous module. The following table lists the first expansion input and output point assignments for each controller:

FIRST EXPANSION POINT ASSIGNMENTS

Controller	First Expansion Point	
	INPUT	OUTPUT
i2810	10	9
i2814	10	9
i2850	9	6
i2851	6	6
i2853	9	6
i2920*	18	17

* On Infinity systems using the SX8000 workstation, the i2920 does not support expansion modules. The SX8000 had a limitation to the number of inputs/outputs it supported on a single controller.

Actuator Programming & Use [i2865, 866, 885]

The actuator motor provided in the i2 controllers that include a built-in actuator is controlled by sending a pulse to the actuator output (positive or negative) that corresponds to the desired position of the damper blade. Your program should limit the minimum pulse width to 1 second.

Note: If the damper has reached its limit of motion, the manual override button is pressed and the actuator is moved manually it is necessary that you toggle the value of the LCDState attribute of output 1 (the actuator) to provide a damper reset.

⚠ *CAUTION: Be sure that the actuator has come to a full stop before changing directions.*

Changing Actuator Rotation Direction [i2865/i2866]

The i2865/866 controller actuator may be mounted in any of several orientations with respect to the damper. A small switch is provided inside the plastic cover of the controller that allows you to change the direction that the actuator moves when positive pulses are applied.

CW CCW

Switch Determines
Rotation of Actuator
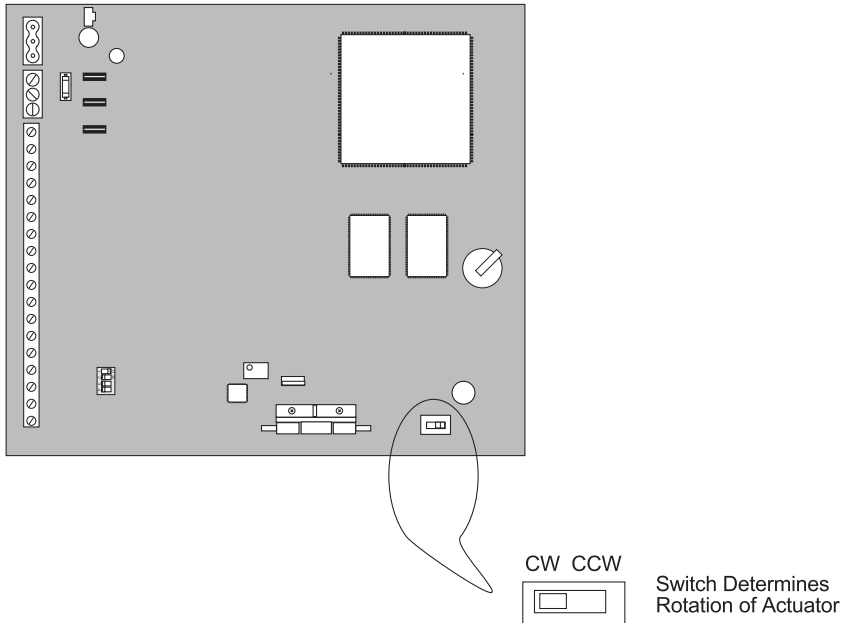
Changing Actuator Rotation Direction [i2885]

The i2885 controller actuator may be mounted in any of several orientations with respect to the damper. A small jumper is provided on the controller that allows you to change the direction that the actuator moves when positive pulses are applied.
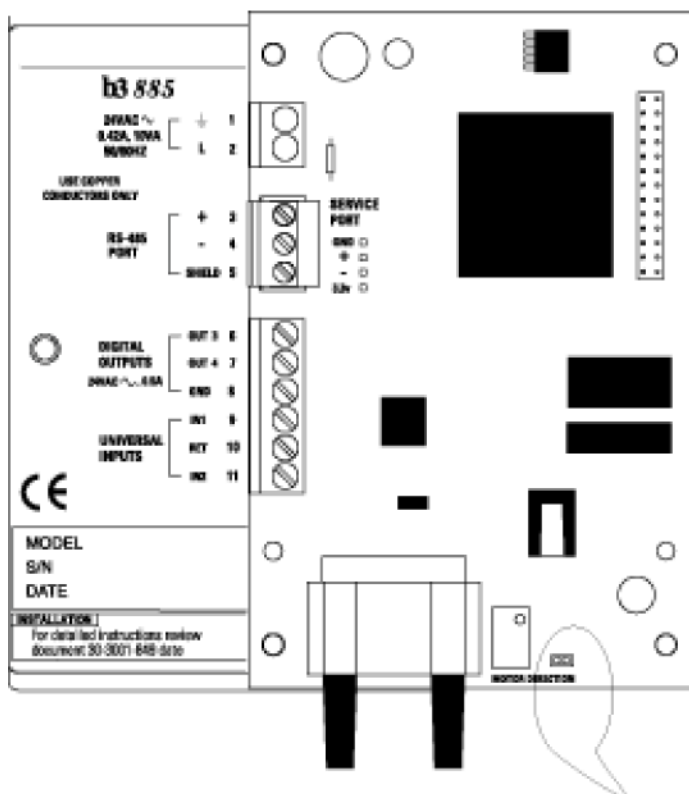
Jumper Determines
Rotation of Actuator

Jumper Connected
+ = CW
- = CCW

Jumper Disconnected
+ = CCW
- = CW

Actuator Programming & Use [i2865-V/866-V, 885-V]

The actuator motor provided in the i2 controllers that include a built-in actuator is controlled by sending a pulse to the actuator output (positive or negative) that corresponds to the desired position of the damper blade. Your program should limit the minimum pulse width to 1 second.

Note: If the damper has reached its limit of motion, the manual override button is pressed and the actuator is moved manually. It is necessary that you toggle the value of the LCDState attribute of output 1 (the actuator) to provide a actuator clutch release.

 CAUTION: Be sure that the actuator has come to a full stop before changing directions.

Changing Actuator Rotation Direction i2865-V/866-V & i2885-V

The i2865-V/866-V, and 885-V controller actuator may be mounted in any of several orientations with respect to the damper. A small jumper is provided on the controller that allows you to change the direction that the actuator moves when positive pulses are applied.
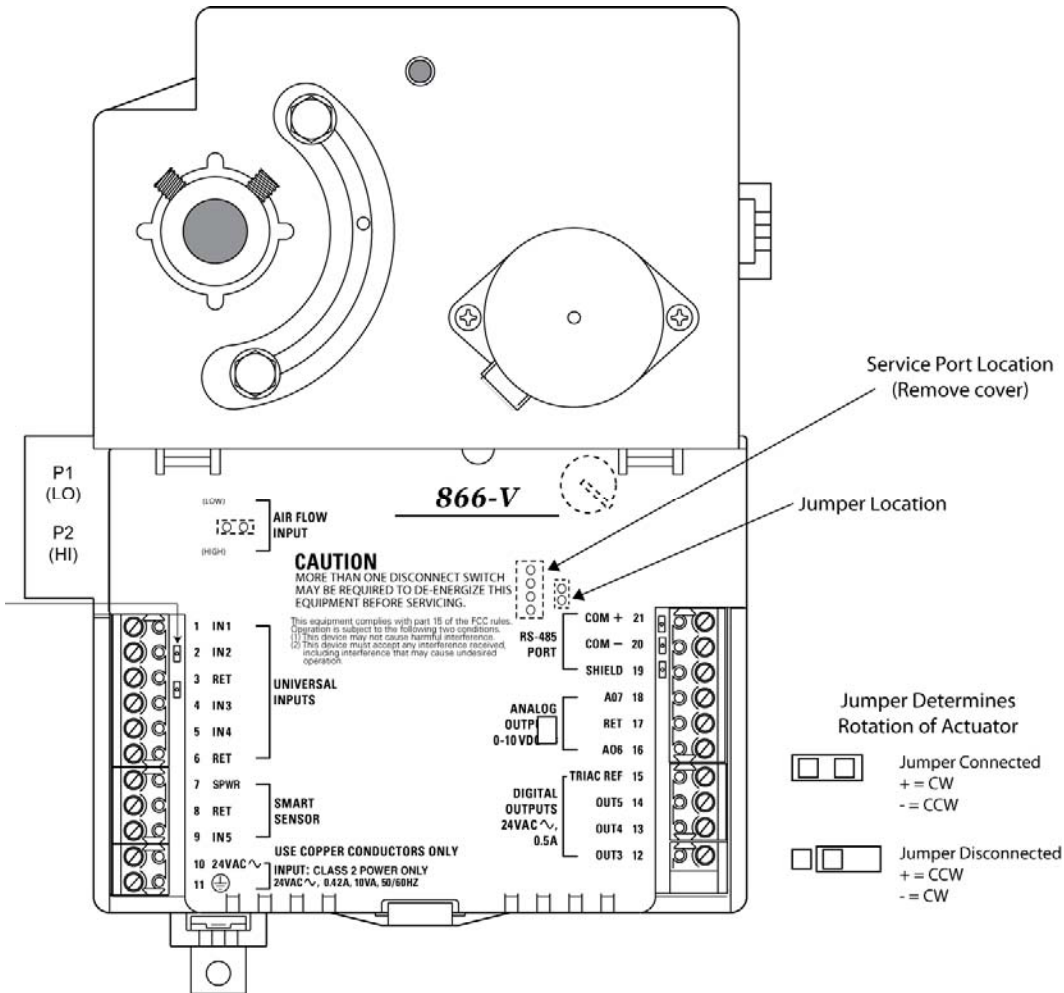
Plain English Function Changes [i2885, i2885-V, and i2887(L) ONLY]

The following Plain English system functions are not supported in the i2885, i2885-V and i2887(L) controllers:

UNSUPPORTED	
ACOS	SINE
ARCCOSINE	STANDARD_DEVIATION
ARCSINE	STR_TO_DATE
ARCTANGENT	STR_TO_NUM
ARCTANGENT2	STR_TO_TIME
ASC	STRINGFILL
ASIN	TAB
ATAN	TAN
ATAN2	TANGENT
CEILING	VAL
CHR	
CLOSELIST	
COS	
COSINE	
EXP	
EXPONENTIAL	
FACT	
FACTORIAL	
FIRST	
FLOOR	
GETOBJECT	
LAST	
LEFT	
LEN	
LENGTH	
LN	
LOG	
MID	
NUM_TO_STR	
OPENLIST	
RANDOM	
RIGHT	
RND	
ROUND	
SD	
SEARCH	
SIN	

Pre-Operation Checks

1. Make sure the internal battery is present and the protective tab is removed.
2. Make sure the power is wired properly (both wires have been connected).
3. Make sure the controller is connected to a true earth ground.
4. Make sure you have used the proper cables and wires at correct lengths.
5. Make sure Infinet cables and shields have been properly wired.

Initial Power-Up

Enable the external power source (or close the power connection). The controller starts automatically. If the controller has been off, outputs remain off. If you have pressed the internal RESET button, outputs turn off.

CPU Indicators

Each device (controller or expansion module) includes a CPU indicator that can be used to determine the relative health of the unit. The following table indicates the nominal blink pattern of the CPU indicator LED for each device. Any blink rate other than that listed below might be considered abnormal, however, many factors affect the blink pattern. Refer to the Troubleshooting section for a complete discussion on "abnormal" blink rates.

Device	Normal Blink Pattern
i2 controllers	5 times/second
xP I/O modules	blinks the board number based upon position every 2 seconds
xP Display	2 times per second

9

Troubleshooting

General Troubleshooting

CPU Indicator Is Not Blinking

If the CPU indicator is not blinking then the unit is not operating. This could be due to the loss of primary AC power or other internal dysfunction.

Check that power is available and connected properly to the power terminals. This can be done using a multimeter reading the voltage across the L and N terminals.

If power appears to be OK, remove power and all other connections from the unit. The fuse within the unit may have failed. To access the fuse, the controller housing itself must be disassembled. The housing consists of two pieces that are snapped together.

Follow the illustrations below to open the housing of any controller and gain access to the fuse area of the printed circuit board. The cover of all i2 series controllers (except the i2865-V/866-V, i2885-V and the i2867) is designed the same. The illustration below depicts the i2850 controller:

COVER LATCHES

FUSE
2A @ 250V

i2850 Series example
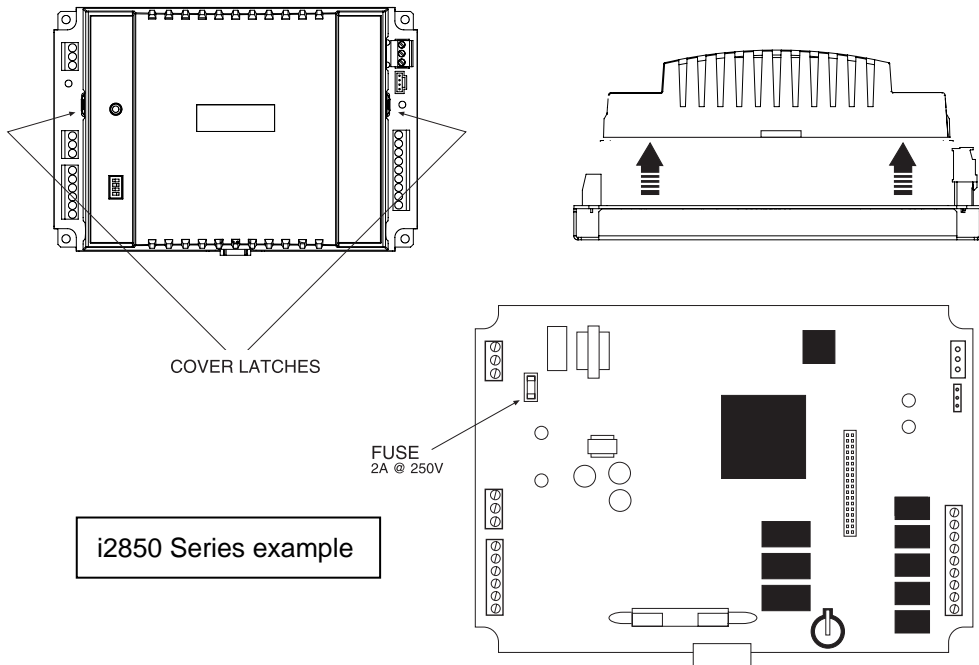
The power fuse of all i2 series controllers is located adjacent to the input power terminals. Remove the plug-in power fuse component and check it for continuity with an Ohm meter. If the fuse is blown, replace it with a similar size fuse (it resides in a socket). A table listing the fuse types per controller model is listed on the following page. After replacement, take care re-mounting the cover.
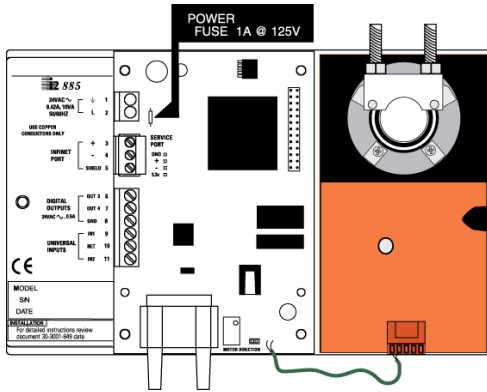
Gaining Internal Access to the i2867

Follow the illustrations below to open the housing and gain access to the fuse area of the printed circuit board:
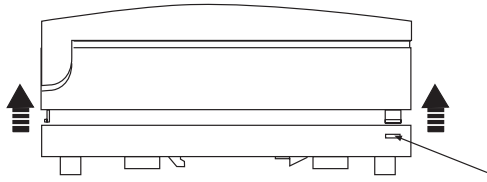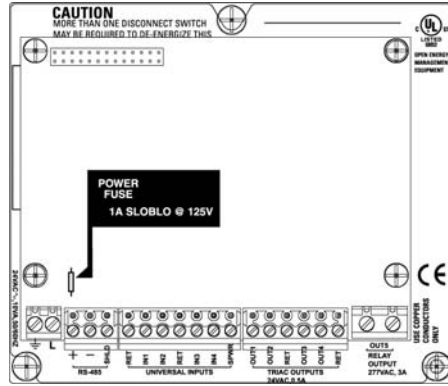

FUSE

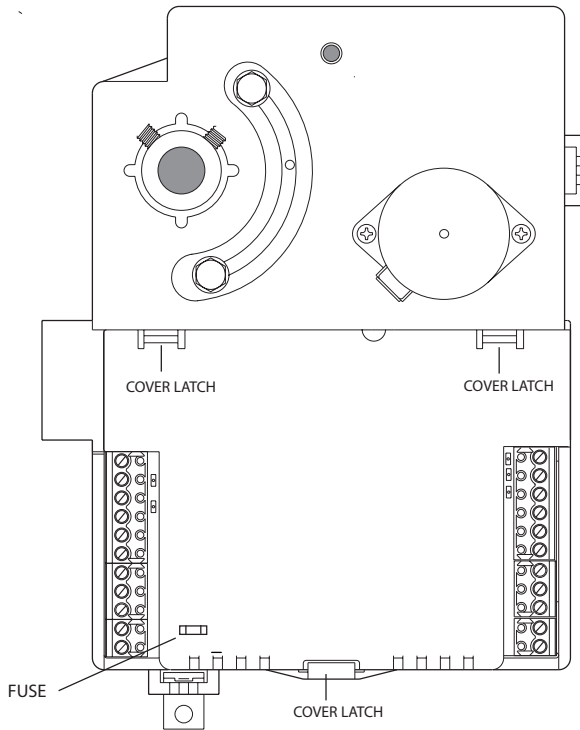Depress tabs found on both sides of the case
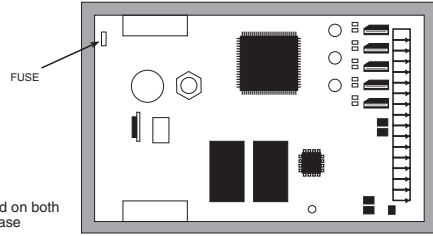
Fuse Location on the i2885

Fuse Location on the i2887

POWER FUSE 1A @ 125V

Fuse Location on the i2865-V/866-V/885-V

Controller Main Power Fuse Types

Controller	Fuse Type	Part #
i2850 Series i2865/866 i2865-V/866-V i2885 i2885-V i2867	2A @ 125VAC, NANO	01-2180-006
i2600 Series i2800 Series i2810 Series	3A @ 125VAC, SLOBLO, NANO	01-2180-010
i2887 i2887	1A @ 125VAC, SLOBLO, PICO 3A @ 250VAC, 3AG	01-2100-491 01-2100-207
i2920	3A @ 250VAC, 3AG	01-2100-207

Unit Appears Functional But Is Not Responding To CX Controller

If the CPU indicator is blinking normally chances are that the unit is operational. However, in that the controller is a programmable unit, it is possible that there is a programming problem.

Monitoring Infinet Activity

Infinet communications can be monitored simply by observing the status of the TXD (transmit) and RXD (receive) LED indicators. During Infinet communications, both of these LEDs should show activity.

One Input or Output Appears to Be Not Working

If the CPU indicator is operating and other inputs/outputs are operating properly there could be two reasons for the failure:

- The Input or Output has been damaged. In this case contact a Schneider Electric representative for assistance.

- If this is the first time using the controller, perhaps the program controlling the input/output is not correct. Re-check your program.

CPU Indicator Is Not Blinking its "Normal Rate"

The CPU indicator is affected by many internal conditions. Errant Plain English programs can change the blink pattern. It is important to realize that an "abnormal" blink pattern does not always indicate a hardware failure. The following are some suggestions of where to look when the blink pattern changes.

Blink Pattern	Symptom
2.5 times/second, equal time on and off	BOOT MODE (application is being up-revved, is not present or is corrupt.
2.5 times/second, short on, long off blink	NORMAL OPERATION ,however, the Error system variable*<>0 and there are entries in the error log.

The Error System variable is incremented as errors are encountered. When its value is not zero it affects the blink rate. The variable can be cleared (set to zero) using the CyberStation workstation. This should clear the unusual blink condition. However, whenever there are errors in the system log, it is a good idea to determine the source of the error to prevent them from re-occurring. Most errors are not hardware-related. Your Plain English programs may be the source of the problem.

Check to see if you have any disabled Plain English programs and then check the ErrorCode attribute for the particular program to view the reason for being disabled.

Internal Restart Button

Should the controller appear to be non-responsive and all other attempts to revive it fail, try pressing the Restart button. The button is recessed behind the cover and is accessed using a non-metallic probe.

Note: The i2865-V, i2866-V, i2885-V and i2887(L) have no Restart button. To restart these controllers, cycle the power.

Infinet Troubleshooting

Troubleshooting Methodology

The troubleshooting methodology described below shows you how to efficiently identify problems and their causes throughout the network.

The first two steps in troubleshooting require the most time, but are the most crucial. The more thoroughly and accurately you complete those steps, the sooner you can isolate and correct the problem, and minimize the amount of time that the impaired network leg is disabled.

Define the Problem

The first step in troubleshooting a communications problem is to define the problem. To do this, you *must* know how your network is configured. This is a good time to review the network documentation. If it does not exist or is incomplete, then take the time to complete it. The documentation should include:

- The exact wiring configuration, with approximate distances for all lengths of cable.
- Notes detailing any deviations from specified cable types.
- A list of all symptoms. Run tests to make the symptoms list is as complete as possible. This list and the network documentation combined enable you to define the problem and focus your troubleshooting.

Identify the Cause

Now the troubleshooting begins. You need to isolate each problem and associate it with an individual device or wire segment. You can accomplish this *only* by:

- Segmenting the network to eliminate the symptom

or

- Using test equipment to identify the problem.

Fix the Problem

Once you know the wire segment or device (controller or repeater, for example) that is causing the problem, you can fix the problem by repairing or replacing the malfunctioning device or defective cable.

Verify the Solution

Now is the time to verify that your solution has really fixed the problem. To verify the solution, you need to:

- Rerun tests for communications problems

and

- Compile a new symptoms list.

If your tests and symptoms list identify no symptoms, then the problem has been fixed. If symptoms persist, repeat the troubleshooting process from the beginning.

Defining the Problem on Infinet

Defining any communications problem within *Infinet* requires preparing a network "asbuilt" map, compiling a list of symptoms, and comparing the two documents.

Preparing an Asbuilt Map

An *asbuilt map* documents every network component and presents the network as it is actually constructed, identifying:

- Every network connection in the order of its installation.
- Approximate distances of all twisted pair and fiber optic cable runs throughout the network.
- The part or model number of every cable.

An asbuilt map differs from the network map that usually reflects the network's configuration guide. Preparing and thoroughly documenting an asbuilt map can save you time when troubleshooting, and becomes particularly useful when you need to:

- Segment the network to isolate problems.
- Verify that no wiring rule violations exist.

Recognizing Symptoms Common to **Infinet** *Problems*

The most common symptoms pointing to a problem with *Infinet* communications are:

- Random or constant Infinet reconfigures
- Infinet controller randomly or constantly off-line
- Group of Infinet controllers randomly or constantly off-line
- Replaced Infinet controller off-line
- The CX or NetController's inability to locate newly added Infinet controllers during LEARN
- Data corruption errors, also known as invalid Cyclic Redundancy Check (CRC) errors
- Programs that use point-to-point communications disabling
- Some Infinet controllers are missing Export information
- The Infinet controller fails to come back online after a PowerFail

Recognizing **Infinet** *Error Messages*

The CX or NetController logs two types of *Infinet* error messages:

- Failed to respond to token pass
- Received invalid CRC

Compiling a Symptoms List

A symptoms list helps you:

- Focus troubleshooting efforts in the area of the network where the problem actually occurs.
- Determine the actions you need to take or tools you need to apply to isolate the problem.

You can generate a complete symptoms list in the following ways:

- Using system information.
- Running a Plain English program that monitors the following object attributes:
- Comm port Reconfigures
- Infinet Controller Attributes:
- Infinet Error
- InfinetErrCount
- InfinetErrTime
- Running a program that disables itself.

Programs that utilize point-to-point communications may disable in response to unsuccessful attempts at retrieving information. Unsuccessful attempts at retrieving information can include, for example, trying to retrieve information that the controller cannot have, or attempting to perform an illegal function, such as dividing by zero. When unsuccessful, the program sets its own state to Disable.

Notes on Point-to-Point Communication

- Point-to-point communication occurs whenever a program on one controller explicitly requests a point's attribute (the point's actual value or state, for example) from the controller where the point resides.
- When the program refers to a point's attribute, the program directly contacts the controller where that point resides and requests the current information for the point.
- Programs that use point-to-point communication automatically disable if the controller you are retrieving the point's attribute information from does not respond.

Identifying the Cause of an *Infinet* Problem

Once you have your symptoms list, you can try to identify the cause of the problem.

Identifying the Problem Type

Use the data from the symptoms list and the asbuilt map to determine if the problem belongs to one of the following:

- Single node
- Network segment
- Global network

Understanding Common Causes of Infinet *Problems*

Common causes of *Infinet* problems include the following:

- Wiring open (physical break in the network wiring)
- Wiring short (wiring physically connects to other wiring or shield, or shorts to ground)
- Cabling rule violation
- Controller at different ground potential
- Repeater set to incorrect baud rate
- Controller in hardfail (software making the controller shut itself down)
- Duplicate ID due to incorrect replacement procedure
- Controller constantly resetting
- Controller hardware failure

Infinet **Troubleshooting Tools and Techniques**

Use the following tools and techniques to help identify the causes of *Infinet* communications problems:

- Segment the Infinet.
- Observe LEDs on i2200, i2210 repeaters and on Infinet controllers.
- Verify the integrity of the wire run (also called ringing out cable runs) with a meter.
- Measure ground potential with a meter.
- Observe Infinet waveforms with an oscilloscope.
- Test Infinet controller transceivers with a meter.
- Test other communication devices.

The order in which you apply troubleshooting tools and techniques depends on the symptoms that you identify. For example, if a controller does not come on line, you might first look at LEDs on that controller. However, if you know that the wiring preceding the controller is not defective, then you might choose to segment the network beyond the controller as a first step.

Segmenting Infinet

Segmenting the network is a technique that helps you identify the location and cause of the problem. The easiest method to follow when segmenting is to disconnect one leg of a repeater at a time. With each disconnect, determine if the symptoms disappear. Continue segmenting until you can isolate the problem.
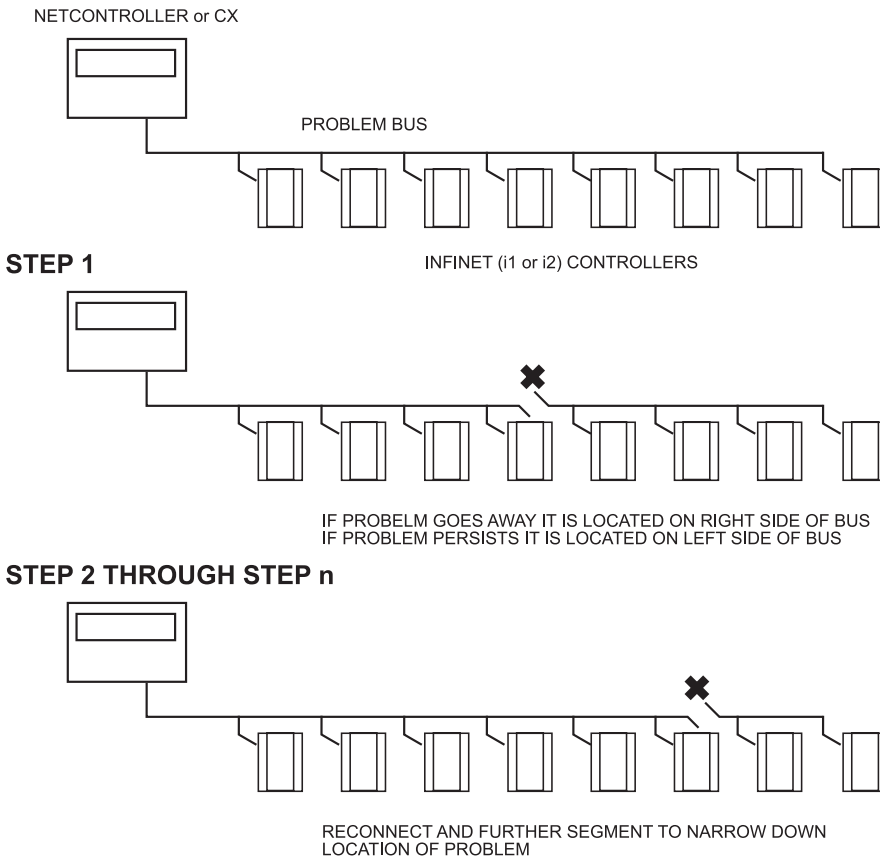
The figure below illustrates this methodology.

Segmenting a Bus Topology
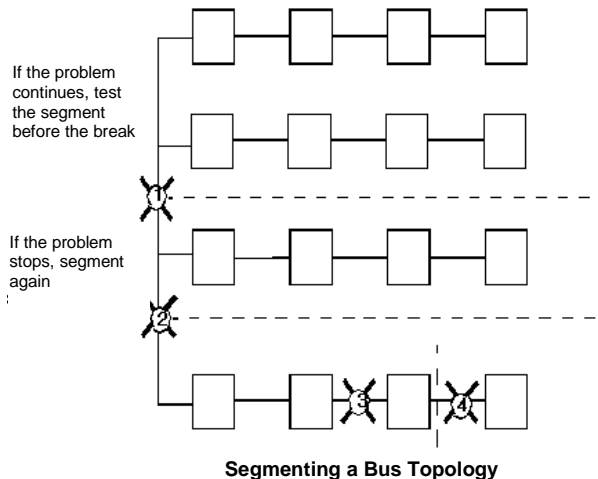
Physically Segmenting Infinet

To segment a network, disconnect one leg of the network at a time. As the example on the previous page shows, you usually break the network at equal intervals, as follows:

Check your network documentation to determine the best location to segment the network. If your network is wired as a:

- Star or distributed star—disconnect a single star.

- Bus topology
  Problems can usually be found in Bus-based networks using a method called the "binary chop". This technique involves identifying the offending leg of the network, disconnecting the physical connection approximately half way down the line and observing if the problem remains. Moving down the network in this manner usually isolates the problem equipment of wire. The diagram below indicates this technique graphically.

NETCONTROLLER or CX

PROBLEM BUS

STEP 1

INFINET (i1 or i2) CONTROLLERS

IF PROBELM GOES AWAY IT IS LOCATED ON RIGHT SIDE OF BUS
IF PROBLEM PERSISTS IT IS LOCATED ON LEFT SIDE OF BUS

STEP 2 THROUGH STEP n

RECONNECT AND FURTHER SEGMENT TO NARROW DOWN
LOCATION OF PROBLEM

Testing an Infinet Cable with a Digital Multimeter

A common practice for verifying that a length of cable is working is to twist the two conductors together at one end, go to the other end of the cable, and expect to measure a short. (0 Ω)

A far better method is to use two resistors and:

1. Place one resistor value between plus (+) and minus (–) at one end of the cable. (250Ω)

2. Place the second resistor value between plus (+) and shield at the other end of the cable. (500Ω)

3. Go to the other end and measure from plus to minus (+ to –) and plus (+) to shield.

Use this process to test for the following conditions:

- Open— Plus (+), minus (–), or shield
- Short— Plus (+) to minus (–)
- Short— Plus (+) to shield
- Short— Minus (–) to shield

Measuring Ground Potential with a Digital Multimeter

Signal potential refers to the horizontal plane along which signals are sent and received with respect to ground. *RS-485* requires that all devices communicating with each other be at a reasonable ground potential.

To measure the ground potential of any *Infinet* controller:

- Use a voltmeter to measure between the Earth ground connection (for power) and the Infinet shield connection.
- This process lets you measure the ground difference between the Infinet controller and the ground at the repeater or CX or NetController where the shield connects to ground.
- Measure each voltage—AC as well as DC. A reading higher than 2 to 3V on either voltage indicates a grounding problem.
- Measure combined voltages using the formula below. If the result is greater than 7V, a grounding problem exists.

$$\text{Combined Voltage} = \text{DC} + (1.4 \times \text{AC})$$

Evaluating Infinet Signal Levels with an Oscilloscope

Note: When using the oscilloscope, be sure you begin testing at the CX, NetController or at a repeater port.

An oscilloscope is a valuable tool for troubleshooting *Infinet*, and can also improve your efficiency in solving intermittent wiring problems. *Infinet* is an RS-485 local area network operating at 19.2 Kbps. RS-485 is a differential signal, driven 0 to 5 V by older Infinet devices and 0 to 3.3 V by i2 devices.
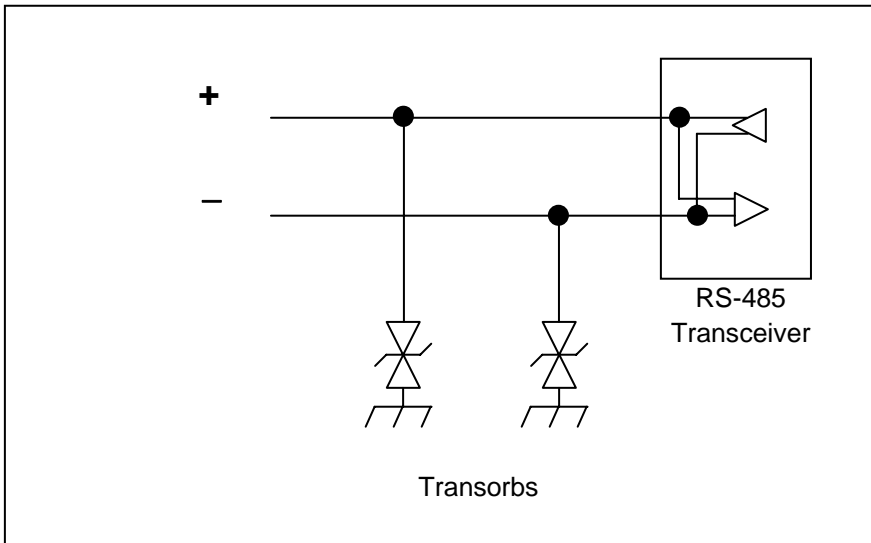
The Ideal Signal

On long cable runs with many *Infinet* devices attached, signal levels often attenuate (weaken). This situation does *not* present any problems as long as the positive (low) signal maintains a lower amplitude than the negative (high) signal.

- It is not important to try to read or analyze the data using the scope. (You can use a protocol analyzer for that.) Rather, you are concerned with overall signal amplitude levels at this time.
- Ideally, i2 RS-485 signal levels are approximately .5 to 3.3V (.5 to 4.5 V for older Infinet devices and InfiLink repeaters), with the positive connection appearing as a true representation of data (data 0 = low; data 1 = high) and the negative connection being the opposite (inverted) of the positive connection, as shown in the example below:
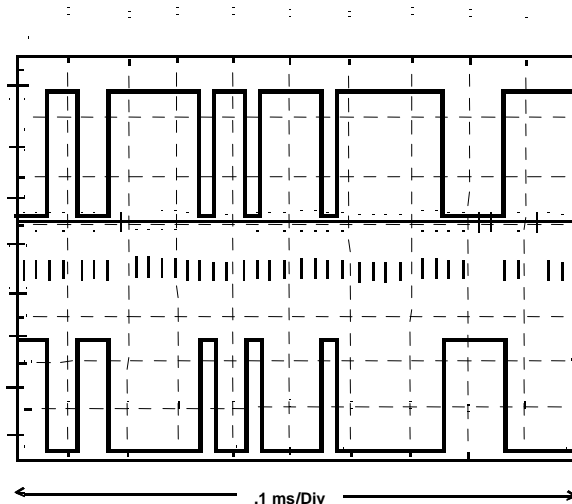
.1 ms/Div

> *Note: i2 RS-485 signal levels are approximately .5 to 3.3V (.5 to 4.5 V for older Infinet devices and InfiLink repeaters)*
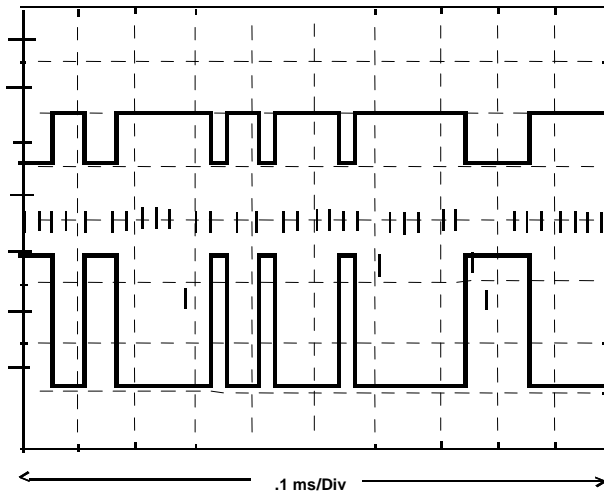
Signal Trace—Short of the Minus (–) Connection to Ground

The signal trace shown below indicates that a short from ground or a short to ground exists on the leg of the *Infinet.*

.1 ms/Div
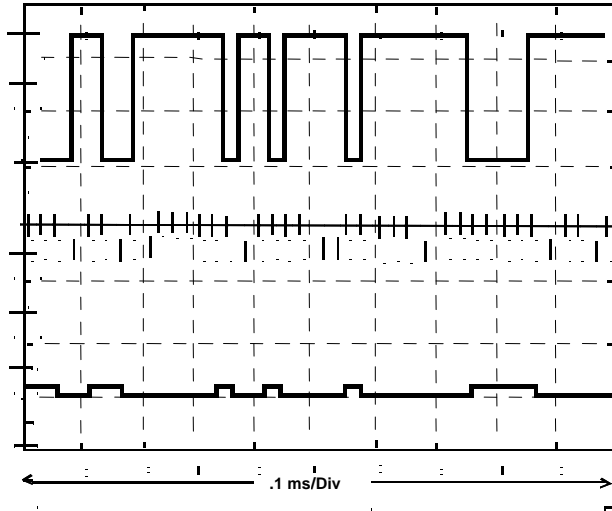
## *Signal Trace—Shorted Transceiver on an* **Infinet** *Device*

The signal trace shown below indicates that at least one *Infinet* controller has a shorted transceiver (+).

.1 ms/Div

Note: i2 RS-485 signal levels are approximately .5 to 3.3V (.5 to 4.5 V for older Infinet devices and InfiLink repeaters)

Signal Trace—**Infinet** *Device at a Different Ground*

Signal potential refers to the horizontal plane along which signals are sent and received with respect to ground. Signal transmission and receipt must occur within the same range of potential.
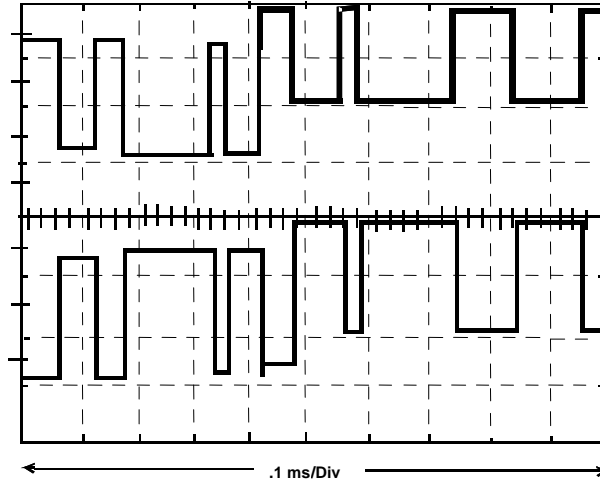

.1 ms/Div

Note: i2 RS-485 signal levels are approximately .5 to 3.3V (.5 to 4.5 V for older Infinet devices and InfiLink repeaters)

Signal Trace—Open on the Plus (+) Connection

A signal with an open on the positive (+) connection displays a disintegrating signal trace, as shown.

- A predominantly disintegrating trace pattern displaying on the oscilloscope indicates that you have segmented beyond the problem. Segment closer to the controller.
- A predominantly non-disintegrating trace pattern displaying on the oscilloscope indicates that you have segmented between the controller and the problem.
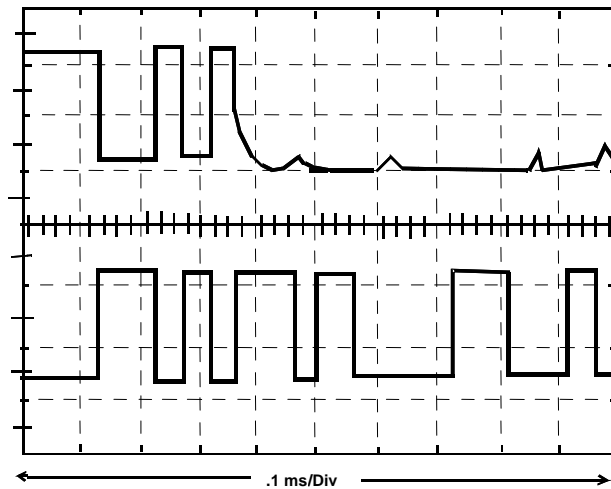
.1 ms/Div

Note: i2 RS-485 signal levels are approximately .5 to 3.3V (.5 to 4.5 V for older Infinet devices and InfiLink repeaters)

Troubleshooting the i2200 Repeater

Errors are easily diagnosed using the status indicators built-into the i2200 repeater. The illustration below points out the locations of the indicators
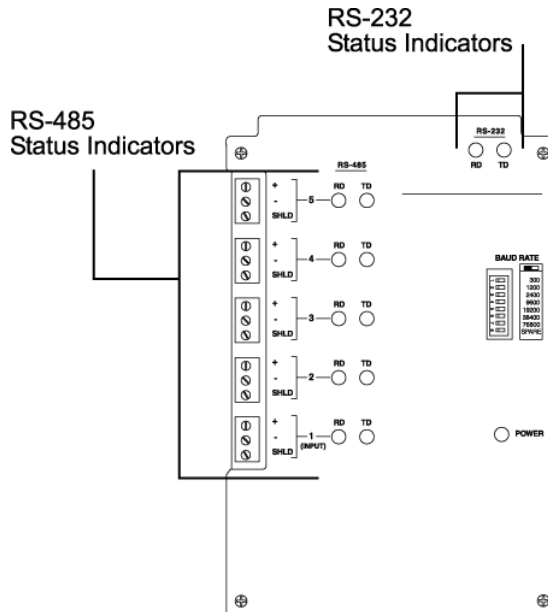
RS-232 Status Indicators

The RD and TD indicators located at the top of the unit represent activity to and from a device connected to the RS-232 port.

RS-485 Status Indicators for Ports 2 through 5

The RD and TD indicators for ports 2 through 5 flash on and off to indicate their corresponding ports are receiving and transmitting *Infinet* signals.

RS-485 Status Indicators for Port 1

The RD and TD indicators for port 1 flash on and off to indicate the *CX or NetController* is receiving and transmitting *Infinet* signals.

Note: You must use Port 1 for the connection to the CX or NetController.
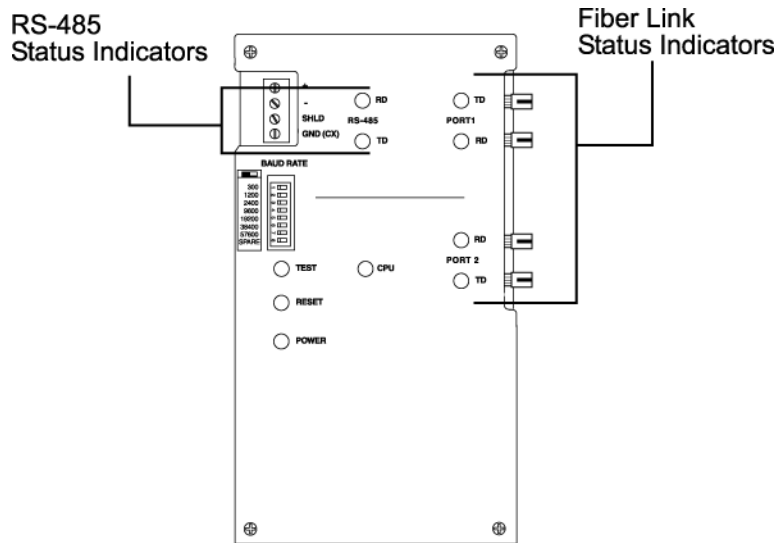
Baud Rate Setting

- The baud rate set via the switch on the right of the i2200 should match the rate set for Infinet in the software.
- Check the CommPort Baud attribute setting using PRINT on the Command line.
- Open the CommPort editor from the Continuum Explorer.
- Check the baud rate setting on the front of i2200.

Power Fuses

If AC power to the i2200 fails but power is actually available, check the 2A, 250V, PICO, fuse Schneider Electric P/N 01-2100-440. You can use the same fuse on 115 V links as well as on 230 V links.

Troubleshooting the i2210 Repeater

Errors are easily diagnosed using the status indicators built-into the i2210 repeater. The illustration below points out the locations of the indicators

RS-485 Status Indicators

The RD and TD indicators flash on and off to indicate the *CX or NetController* is receiving and transmitting *Infinet* signals.

RS-485 Fiber Link Indicators

The RD and TD indicators flash on and off to indicate their corresponding ports are receiving and transmitting *Infinet* signals.

Baud Rate Setting

- The baud rate set via the switch on the right of the i2210 should match the rate set for Infinet in the software.
- Check the CommPort Baud attribute setting using PRINT on the Command line.
- Open the CommPort editor from the Continuum Explorer.
- Check the baud rate setting on the front of i2210.

Power Fuses

If AC power to the i2210 fails but power is actually available, check the 2A, 250V, PICO, fuse Schneider Electric P/N 01-2100-440.

Attaching the Infinet (RoamIO$_2$) Service Tool

RoamIO$_2$ Hardware Adapter

The RoamIO$_2$ hardware adapter serves as an interface between the Infinet bus and a PC laptop or a hand-held Pocket PC. It allows you to view the configuration of the system and allows you to make local changes to points to facilitate troubleshooting.
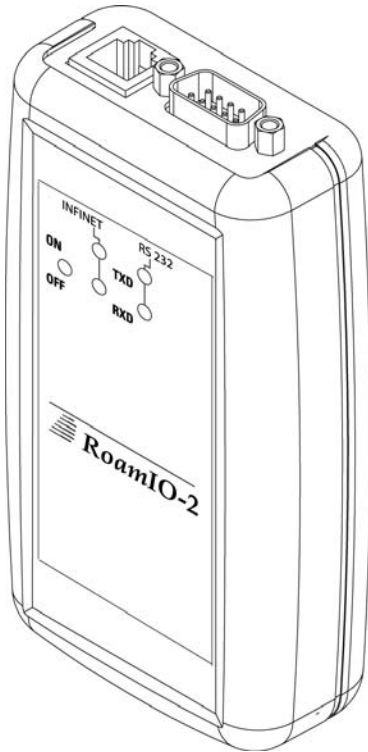
The Service Port

Each Andover Continuum controller and sensor includes a built-in Service Port for use during troubleshooting and for connecting to the wireless adapter. The Service Port is basically a special connection to the RS-485 Infinet network. There are several types of Service Port connectors.

Controllers typically have a four-pin connector that is located next to or behind the RS-485 Infinet connection. Some of the older models have an RJ11 telephone-type connector for the Service Port.

Sensors have a mixture of types but the most common type is a round phono-style connector.

The RoamIO$_2$ includes cables and adapters for every type of Service Port connection.

CAUTION: Service Ports are used for troubleshooting and connecting to the wireless adapter. Connect only Schneider Electric approved troubleshooting tools to these ports.

Connecting the RoamIO$_2$ to the Controller

Connect the serial port of the PocketPC using an RS-232 adapter or directly from your laptop to the RoamIO$_2$ hardware adapter. The connector on the RoamIO$_2$ is a standard DB-9 male connection. Using an appropriate combination of cables and adapters connect the RoamIO$_2$ to any Infinet controller's service port.

For complete instructions and information, see *the Infinet Service Tool User's Guide*, 30-3001-989.

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