

Operation and Maintenance Hardware Manual

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Project: Browning Hall

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460	BAPI	ZPT-20-SR73-BB-ST-D	Standard Range Pressure Sensor, 0-2"w.c., Bapi Box, Remote Static Probe w/ Display
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497	Belimo	F680HD+NC+GRX24-3	Butterfly Valve,3",2 Way,302 Cv,w/ Non-Spring,24V,Floating
501	Belimo	G220+LF24-SR US	Globe Valve,0.75",2 Way,7.5 Cv,w/ Spring Return,24V,Modulating
505	Belimo	G232+NC+SVB24-SR	Globe Valve,1.25",2 Way,20 Cv,w/ Non-Spring,24V,Modulating
509	Belimo	G250+NO/FO+AFB24-SR-X1	Globe Valve,2",2 Way,40 Cv,w/ Spring Return,24 - 240V,Modulating
513	Belimo	G340+NC+SVB24-SR	Globe Valve,1.5",3 Way,28 Cv,w/ Non-Spring,24V,Modulating
517	Belimo	G6100C+NC+EVB24-SR	Globe Valve,4",2 Way,170 Cv,w/ Non-Spring,24V,Modulating
522	Belimo	G765+AFX24-MFT-X1 P-10001	Globe Valve,2.5",3 Way,68 Cv,w/ Spring Return,24V,MFT
528	Cleveland	AFS-460-112	Differential Pressure Switch, 0-12 in. WC, SPST, Man. Reset (NC), 1/4" Barbed Fittings
530	Core Lectro	LE11300	24V Transformer, 40VA
531	Core Lectro	LE12100	24V Transformer, 96VA
532	Ebtron	GTC116P+69x60-1-2-15	Air Flow Station
532	Ebtron	GTC116P+56 x 26-1-2-10	Air Flow Station
532	Ebtron	GTC116P+36 x 20-1-2-10	Air Flow Station
532	Ebtron	GTC116P+70 x 20-1-2-10	Air Flow Station
532	Ebtron	GTC116P+48 x 20-1-2-10	Air Flow Station
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560	Functional Devices	RIB2401B	Enclosed Relay 20 Amp SPDT with 24 Vac/DC/208-277 Vac Coil
561	Functional Devices	RIBMNLB-6NO	Relay Logic Board - 6 Alarm Points
561	Functional Devices	RIBMNLB-4NO	Relay Logic Board - 4 Alarm Points
562	Functional Devices	RIBXGTA	Current Switch, Split Core, Adj. Setpoint to 0.5A
563	Functional Devices	RIBXLSA	Enclosed Relay/AC Sensor Combination, SPST + Override Switch w/ 10-30 VAC/DC Coil
564	Idec	RH2B- ULDC24V+SH2B-05	Control Relay,DPDT,24VDC,LED,w/ Socket
564	Idec	RH2B- ULAC24V+SH2B-05	Control Relay,DPDT,24VAC,LED,w/ Socket
564	Idec	RH2B- ULAC120V+SH2B-05	Control Relay,DPDT,120VAC,LED,w/ Socket
566	Kele	UCS-221E	Sequencer Control Module, Two Stage
568	Onicon	F-1210	Insertion Flow Meter, Analog Output
570	Saginaw	SCE-18N1606NKT	16" x 18" (Small) Control Panel
570	Saginaw	SCE-24N2006NKT	20" x 24" (Medium) Control Panel
570	Saginaw	SCE-36N2406NKT	24" x 36" (Large) Control Panel
572	Siemens	134-1511	Low-Limit Temp Sw,SPDT,Man Rst,35-45F,20'
578	Veris	PW2XX04S	Differential Pressure Sensor (wet), 0-100 PSIG, 0-100 PSID
580	Veris	H300	Current Switch, Split Core, Fixed Setpoint 0.15A, Micro
582	Veris	PG07AM	Gauge Press Sensor, 0-100psig, 4-20mA

LWM

LWM Lightweight Metal Enclosure

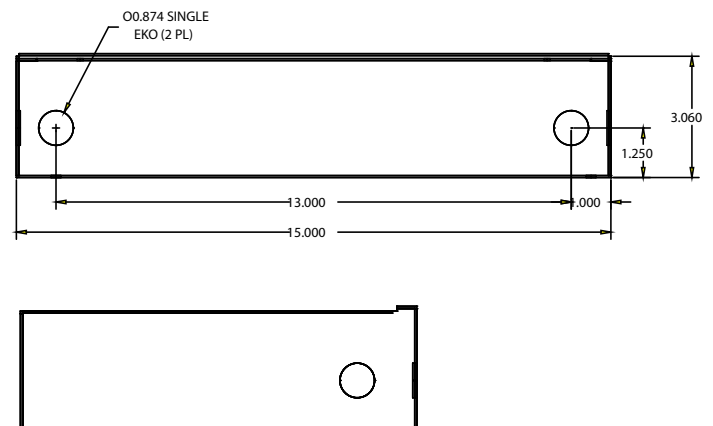
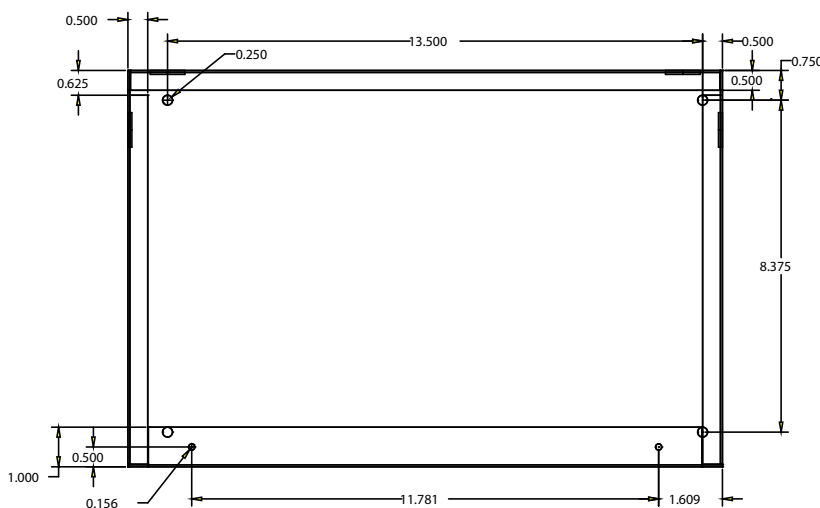
The LWM Lightweight Metal Enclosure is a durable, metal enclosure built with 18 CRS. Each enclosure features 4 0.874" knockouts located on the left, right and bottom sides of the enclosure. There are two different cover options - a beige powdercoated CRS cover, or a 9034-1112 clear Lexan polycarbonate cover. The cover is easily removed with two durable sheet metal screws. Each enclosure is coated with a durable, beige powder coat finish. Dimensions of the cabinet measure 15x10x3.



YM9050



YM9051



Ordering Information:

Part #	Description
YM9050	LWM Metal Enclosure (Lexan door)
YM9051	LWM Metal Enclosure (Painted steel door)

AAR Controller

Technical Instructions

1150 Roberts Boulevard, Kennesaw, Georgia 30144
770-429-3000 Fax 770-429-3001 | www.automatedlogic.com





Verify that you have the most current version of this document. Go to <https://accounts.automatedlogic.com>, then select **Support** > **Download** > **Documents** > **Hardware**. Important changes are listed in **Document revision history** at the end of this document.

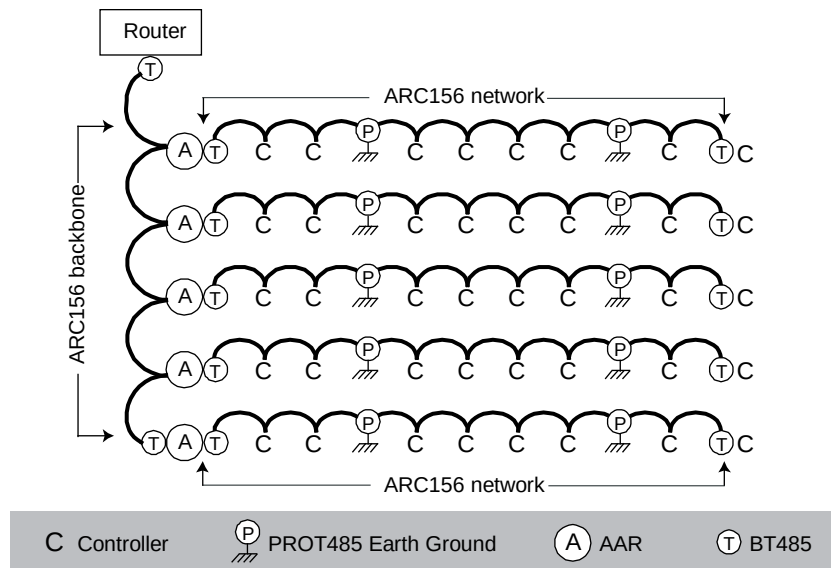
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What is the AAR controller?

The AAR is a BACnet router that provides communication between two ARC156 networks. You can use AAR's to add one or more ARC156 networks to the ARC156 backbone network that leads to the server. See the *ARC156 Wiring Technical Instructions* for network requirements such as configuration, length, and network accessories.



NOTES

- The AAR can be located anywhere on its ARC156 network; it does not have to be at one end of the network.
- Do not place another AAR on an AAR's ARC156 network. Cascading AAR's greatly reduce performance of the network.
- The AAR can act as a color caching/time-sync master and dead module detector.
- The AAR does not support Alarm Store and Forward.
- The AAR does not run a control program.



TIPS

- Put controllers on the AARs' networks where possible instead of on the ARC156 backbone to improve network performance.
- If possible, put all controllers for related terminal units and their air source below one AAR to localize network traffic between them. If this is not possible, try to put the air source controller on the backbone.
- Although an ARC156 network can contain up to 99 controllers, use ± 50 controllers as a starting number for the network. Numerous factors such as network configuration and performance affect the number of controllers that an AAR's network can have.

Specifications

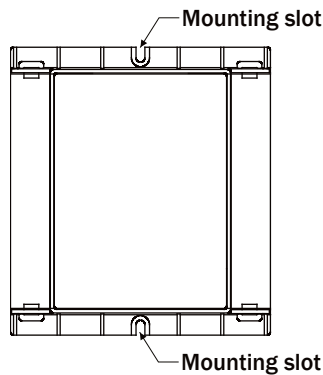
Power	24 Vac $\pm 10\%$, 50–60 Hz, 20 VA 26 Vdc (25 V min, 30 V max)
Comm ports	Comm 1 communicates with the ARC156 backbone network. Comm 2 communicates with the AAR's ARC156 network.
Local Access port	For system start-up and troubleshooting
Microprocessor	High speed 16-bit microprocessor with ARCNET communication co-processor
Memory	1 MB non-volatile battery-backed RAM, 1 MB Flash memory, 16-bit memory bus
Real-time clock	Battery-backed real-time clock keeps track of time in event of power failure
Battery	10-year Lithium CR2032 battery retains the following data for a maximum of 10,000 hours during power outages: time and editable properties.
Protection	Incoming power and network connections are protected by non-replaceable internal solid-state polyswitches that reset themselves when the condition that causes a fault returns to normal. The power and network connections are also protected against transient excess voltage/surge events lasting no more than 10 msec.
BT485 connector	You attach a BT485 (not included) to a controller at the beginning and end of a network segment to add bias and to terminate a network segment.
Status indicators	LED's indicate status of communications, running, errors, and power
Environmental operating range	0 to 130 °F (-17.8 to 54.4 °C), 10–90% relative humidity, non-condensing NOTE The controller must be installed within the building.
Physical	Rugged GE C2950 Cyclopy plastic
Overall dimensions	Width: 5 1/16 in. (12.9 cm) Height: 5 11/16 in. (14.4 cm)
Mounting dimensions	5 9/16 in. (14.1 cm) between mounting slot centerlines
Recommended panel depth	1 1/2 in. (3.8 cm)
Weight	0.4 lbs (0.2 kg)
Listed by	UL-916 (PAZX), cUL-916 (PAZX7), FCC Part 15-Subpart B-Class A, CE

NOTE The AAR's DIP switches are for future use and currently have no functionality.

To mount the AAR

NOTE You must mount the AAR inside the building. The AAR's warranty will be void if you mount it outside.

Screw the AAR into an enclosed panel using the mounting slots shown below. Leave about 2 in. (5 cm) on each side of the controller for wiring.



Wiring for power



WARNING Do not apply line voltage (mains voltage) to the controller's ports and terminals.



CAUTIONS

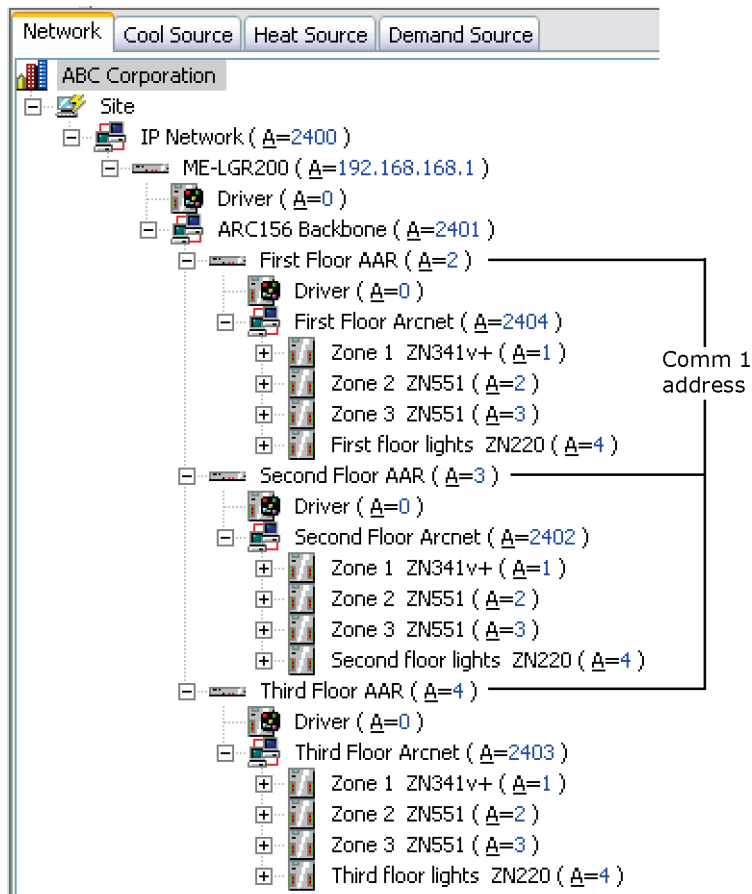
- The AAR is powered by a Class 2 power source. Take appropriate isolation measures when mounting it in a control panel where non-Class 2 circuits are present.
- Automated Logic® controllers can share a power supply as long as you:
 - Maintain the same polarity.
 - Use the power supply only for Automated Logic® controllers.

To wire for power

- 1 Remove power from the power supply.
- 2 Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**.
- 3 Connect the transformer wires to the screw terminal connector.
- 4 Apply power to the power supply.
- 5 Measure the voltage at the AAR's power input terminals to verify that the voltage is within the operating range of 21.6–26.4 Vac.
- 6 Connect a 4-inch (10.2 cm) wire from **Gnd** to the control panel.
- 7 Insert the screw terminal connector into the AAR's power terminals.
- 8 Verify that the **Power** LED is on and the **Run** LED is blinking.

Addressing the AAR

The address of the **Comm 2** port (the AAR's address on its ARC156 controller network) is 101. You must set the address of the **Comm 1** port (the AAR's address on the ARC156 backbone network). The figure below shows addressing in a typical system using AAR's.

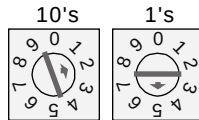


You must give the AAR an address that is unique on the network. You can address the AAR before or after you wire it for power.

To address the AAR

- 1 If the AAR has been wired for power, pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**. The controller reads the address each time you apply power to it.
- 2 Using the rotary switches, set the controller's address to match the **Address** in the controller's properties dialog box in SiteBuilder. Set the **Tens (10's)** switch to the tens digit of the address, and set the **Ones (1's)** switch to the ones digit.

EXAMPLE If the controller's address is 25, point the arrow on the **Tens (10's)** switch to 2 and the arrow on the **Ones (1's)** switch to 5.



Wiring for communications

The AAR communicates using BACnet on an ARC156 network communicating at 156 kbps. ARC156 is a unique implementation of the industry standard ARCNET. For a summary of differences between ARCNET and ARC156, see the *ARC156 Wiring Technical Instructions*.

Wiring specifications

Use 22 AWG, low-capacitance, twisted, stranded, shielded copper wire. See the *ARC156 Wiring Technical Instructions*.



WARNING Do not apply line voltage (mains voltage) to the controller's ports and terminals.

To wire the AAR for communications

- 1 Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**.
- 2 Check the communications wiring for shorts and grounds.
- 3 Connect the ARC156 backbone wiring to the **Comm 1** screw terminals labeled **Net +**, **Net -**, and **Shield**.
- 4 Connect the wiring for the AAR's ARC156 network to the **Comm 2** screw terminals labeled **Net +**, **Net -**, and **Shield**.
NOTE Use the same polarity throughout the network segment.
- 5 If the AAR is at either end of a network segment, connect a BT485 to the AAR.
- 6 Insert the power screw terminal connector into the AAR's power terminals.
- 7 Verify communication with the network by viewing a Module Status report in the WebCTRL® interface.

Downloading the AAR

Download the following items to the AAR's battery-backed memory:

Item	Notes
DRV_AAR driver	Must be in WebCTRLx.x\webroot\<system_name>\drivers . NOTE To verify that you have the driver's latest version, go to http://accounts.automatedlogic.com/download , then select Drivers > ExecB . Compare the latest version to the AAR's driver in SiteBuilder.
Editable properties	

If you change any of the above items or the AAR's address after the initial download, you must download again. The first download takes longer than subsequent downloads.



CAUTIONS

- The AAR will lose stored data when you download.
- The AAR will shut down and restart when you download, causing loss of communication with controllers on the **Comm 2** port.

To download from the WebCTRL® interface

If your network is complete, you can download from any network browser. If not complete, connect a laptop with a local copy of the system database to the AAR's local access port. See *To communicate through the local access port* (page 10).

- 1 On the WebCTRL® **Network**  tree, select the controller.
- 2 Click **Downloads**.
- 3 Do one of the following:
 - If the controller is in the Downloads list, go to step 4.
 - If the controller is not in the list:
 - a. Click **Add**.
 - b. In the pop-up, select the controller.
 - c. Select **All Content**.
 - d. Click **Add**.
 - e. Click **Close**.
- 4 Select the controller in the Downloads list.
- 5 Click **Start**.

NOTES

- If the download fails, locate and resolve the problem, then retry the download.
- You can also download a controller from the **Devices** page.

To set up the driver

After you download the driver to the AAR, you may want to change its properties in the WebCTRL® interface to suit your application.

- 1 On the WebCTRL® **Network**  tree, click ► to the left of the controller.
- 2 Click ► to the left of **Driver** to see its children.
- 3 Make changes as needed on the **Properties** page for **Driver** and any of its children.

Driver

On the **Driver** page, you can change properties related to module clock synchronization and failure. See table below.

Module Clock	
Clock Fail Date and Time	Date and time the control program uses when controller's real-time clock is invalid.  TIP Use an occupied date and time (such as a Tuesday at 10 a.m.) so the equipment does not operate in unoccupied mode if the controller loses power during occupancy.
Time Sync Sensitivity (seconds)	When the controller receives a time sync request, if the difference between the controller's time and the time sync's time is greater than this field's value, the controller's time is immediately changed. If the difference is less than this field's value, the controller's time is slowly adjusted until the time is correct.

NOTE BACnet COV Throttling does not apply to the AAR.

Device

On the **Device** page, you can change the following properties:

- BACnet device object properties for the AAR
- AAR network communication

Configuration	NOTE The three APDU fields refer to all networks over which the AAR communicates.
Max Masters and Max Info Frames	Do not apply to the AAR.

Notification Classes

Alarms in the WebCTRL® application use Notification Class #1. A BACnet alarm's Notification Class defines:

- Alarm priority for Alarm, Fault, and Return to Normal states
- Options for BACnet alarm acknowledgment
- Where alarms should be sent (recipients)

Priorities	NOTE BACnet defines the following Network message priorities for Alarms and Events.										
	<table> <tr> <th>Priority range</th><th>Network message priority</th></tr> <tr> <td>00–63</td><td>Life Safety</td></tr> <tr> <td>64–127</td><td>Critical Equipment</td></tr> <tr> <td>128–191</td><td>Urgent</td></tr> <tr> <td>192–255</td><td>Normal</td></tr> </table>	Priority range	Network message priority	00–63	Life Safety	64–127	Critical Equipment	128–191	Urgent	192–255	Normal
Priority range	Network message priority										
00–63	Life Safety										
64–127	Critical Equipment										
128–191	Urgent										
192–255	Normal										
Priority of Off-Normal	BACnet priority for Alarms.										
Priority of Fault	BACnet priority for Fault messages.										
Priority of Normal	BACnet priority for Return-to-normal messages.										
Ack Required for Off-Normal, Fault, and Normal	Specifies whether alarms associated with this Notification Class require a BACnet Acknowledgment for Off-Normal, Fault, or Normal alarms.  TIP You can require operator acknowledgment for an Alarm or Return-to-normal message (stored in the WebCTRL® database). In the WebCTRL® interface on the Alarm > Enable/Disable tab, change the acknowledgment settings for an alarm source or an alarm category.										
Recipient List											
Recipients	The first row in this list is the WebCTRL® application. Do not delete this row. Click Add if you want other BACnet devices to receive alarms associated with this Notification Class.										
Recipient Description	Name that appears in the Recipients table.										
Recipient Type	Use Address (static binding) for either of the following: • Third-party BACnet device recipients that do not support dynamic binding • When you want alarms to be broadcast (you must uncheck Issue Confirmed Notifications). This use is rare.										
Days and times	The days and times during which the recipient will receive alarms.										
Recipient Device Object Identifier	Type the Device Instance from SiteBuilder (or from the network administrator for third-party devices) in the # field.										
Process Identifier	Change for third-party devices that use a BACnet Process Identifier other than 1. The WebCTRL® application processes alarms for any 32-bit Process Identifier.										
Issue Confirmed Notifications	Select to have a device continue sending an alarm message until it receives delivery confirmation from the recipient.										
Transitions to Send	Uncheck the types of alarms you do not want the recipient to get.										

Calendars

Calendars are provided in the driver for BACnet compatibility only. Instead, use the **Schedules** feature in the WebCTRL® interface.

Common and Specific Alarms

On these pages, you can enable/disable, change BACnet alarm properties, or set delays for the following BACnet alarms.

Common alarms:

- Module Halted
- All Programs Stopped
- Duplicate Address
- Locked I/O
- Control Program
- Program Stopped
- Excessive COV

Specific alarm:

- Dead Module Timeout

NOTE To set up alarm actions for controller generated alarms, see *Setting up alarm actions* in WebCTRL® Help.

Module Generated Alarm	
Description	Short message shown on the Alarms page or in an alarm action when this type of alarm is generated.
Events	
Alarm Category and Alarm Template	See <i>Customizing alarms</i> in WebCTRL® Help.
Enable	Clear these checkboxes to disable Alarm or Return to normal messages of this type from this controller.
Notification Class	Do not change this field.

BACnet router properties

On the **BACnet router properties** page, you can change the following properties:

- BACnet routing settings
- Color and prime variable caching settings

BACnet Router Options	
Ignore all Reject-Message-to-Network, Reason=1 messages	Clear to delete and rediscover a route if a network's router indicates that the network is no longer present (reason=1). Select to continue routing messages to a network even if its router indicates that the network is no longer present.

Color/Prime Variable Caching	
Disable Color Cache	Clear (enable) to improve responsiveness in retrieving colors. Select (disable) to reduce network traffic to third-party (non-color-supporting) devices. NOTE Selecting this checkbox also disables dead module alarms.
Dead Module Timeout	After this period (minutes:seconds) of non-response from an ExecB controller, the router sends an alarm to the server.

To communicate through the local access port

Using a computer and a USB Link Kit, you can communicate locally with the AAR to download or to troubleshoot.

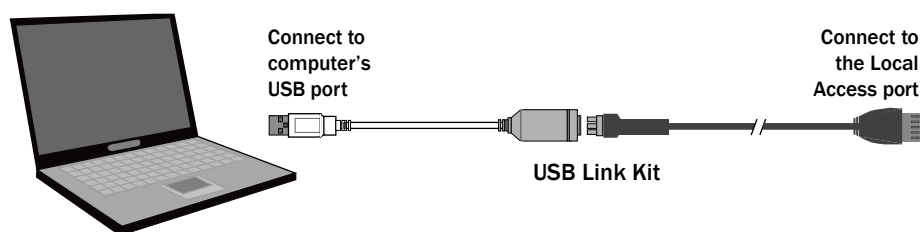
PREREQUISITES

- A computer with a USB port
- A USB Link Kit. See the *USB Link Kit Technical Instructions*.
NOTE The USB Link Kit driver is installed with a WebCTRL® v5 or later system. But if needed, you can get the latest driver from <http://www.silabs.com/products/mcu/Pages/USBtoUARTBridgeVCPDrivers.aspx>. Install the driver before you connect the USB Link Kit to your computer.
- v1.73c.005 or later controller driver



CAUTION If multiple controllers share power but polarity was not maintained when they were wired, the difference between the controller's ground and the computer's AC power ground could damage the USB Link Kit and the controller. If you are not sure of the wiring polarity, use a USB isolator between the computer and the USB Link Kit. Purchase a USB isolator online from a third-party manufacturer.

Connect the USB Link Kit to the computer and to the controller's Local Access port.



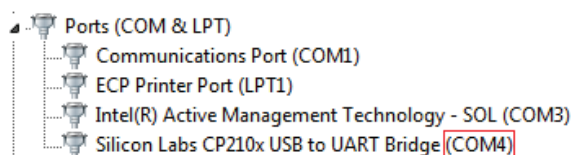
NOTE If using a USB isolator, plug the isolator into your computer's USB port, and then plug the USB Link Kit cable into the isolator.

To set up a Local Access connection in the WebCTRL® interface

For the WebCTRL® application to communicate with the Local Access port, you must do the following:

- 1 On the **System Configuration**  tree, select **Connections**.
- 2 On the **Configure** tab, click **Add**.
- 3 From the **Type** drop-down list, select **BACnet Local Access**.
- 4 Optional: Edit the **Description**.
- 5 Type the computer's **Port** number that the USB cable is connected to.

NOTE To find the port number, plug the USB cable into the computer's USB port, then select **Start > Control Panel > System > Device Manager > Ports (Com & LPT)**. The COM port number is beside **Silicon Labs CP210x USB to UART Bridge**.



- 6 Set the **Baud** rate to 115200.
- 7 Click **Accept**.
- 8 On the **View** tab, click the button next to the BACnet/IP network, then select **BACnet Local Access**.
- 9 Click **Accept**.
- 10 On the **Configure** tab, select **BACnet Local Access**, then click **Start**.
NOTE If an error message appears, make sure the COM port you selected is not in use. For example, PuTTY may be open and is holding the port open.
- 11 On the **Network**  tree, select the controller that you are connected to.
- 12 Click , then select **Manual Command**.
- 13 Type `rnet` here in the dialog box, then click **OK**.
- 14 On the **Properties** page, click **Module Status**. If a Modstat report appears, the WebCTRL® application is communicating with the controller.

Troubleshooting

If you have problems mounting, wiring, or addressing the AAR, contact ALC Technical Support.

LED's

The LED's on the AAR show the status of certain functions.

If this LED is on...	Status is...
Power	The AAR has power
Comm 1 Rx	The AAR is receiving data from the Comm 1 port

Comm 1 Tx	The AAR is transmitting data over the Comm 1 port
Comm 2 Rx	The AAR is receiving data from the Comm 2 port
Comm 2 Tx	The AAR is transmitting data over the Comm 2 port

The **Run** and **Error** LED's indicate controller and network status.

If Run LED shows...	And Error LED shows...	Status is...
2 flashes per second	Off	Normal
2 flashes per second	2 flashes, alternating with Run LED	Five minute auto-restart delay after system error
2 flashes per second	3 flashes, then off	The controller has just been formatted
2 flashes per second	4 flashes, then pause	Two or more devices on this network have the same network address
2 flashes per second	1 flash per second	The controller is alone on the network
2 flashes per second	On	Obtain a Module Status Report (Modstat) to determine which of the following occurred: • Exec halted after frequent system errors • Control programs halted
5 flashes per second	On	Exec start-up aborted, Boot is running
5 flashes per second	Off	Firmware transfer in progress, Boot is running
7 flashes per second	7 flashes per second, alternating with Run LED	Ten second recovery period after brownout
14 flashes per second	14 flashes per second, alternating with Run LED	Brownout
On	On	Failure. Try the following solutions: • Turn the AAR off, then on. • Format the AAR. • Download the AAR. • Replace the AAR.

NOTE If you resolve the issue but the **Error** LED does not turn off, cycle power to the controller.

To format the controller

If you cannot communicate with a controller after downloading it, as a last resort, you can manually format the controller to erase its memory.

- 1 Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**.
- 2  Make sure the address switches are not set to 0, 0.
- 3 Short the **Format** jumper's pins and maintain the short for steps 3 and 4.
- 4 Insert the power screw terminal connector into the AAR's power terminals.

- 5 Continue to short the jumper until the **Error** LED flashes three times in sync with the **Run** LED.
- 6 Remove the short.
- 7 Download the AAR.

To get the AAR's serial number

If you need the AAR's serial number when troubleshooting, the number is on:

- a sticker on the back of the main controller board
- a Module Status report (Modstat) under **Core** (or **Main**) **board hardware**



To obtain a modstat in the WebCTRL® interface:

- 1 Select the AAR in the **Network**  tree.
- 2 On the **Properties** page, click **Module Status**.

Recovering from a power outage

The AAR has a 10-year Lithium CR2032 battery that retains the following data for a maximum of 10,000 hours during power outages.

- Time
- Editable properties

If the above data is lost after power returns, replace the battery and then download the AAR. See instructions below.

To replace the AAR's battery

If the AAR experiences a power outage and loses parameters such as network numbers, obtain a modstat. If one of the entries under **Information message history** is **Possible battery failure**, replace the battery.

- 1 Verify that the AAR's power is on.
- 2 Remove the battery from the controller, making note of the battery's polarity.
- 3 Insert the new battery into the controller, matching the polarity of the battery you removed.
- 4 Download the AAR.

To take the AAR out of service

If needed for troubleshooting or start-up, you can prevent the WebCTRL® application from communicating with the AAR.

- 1 On the WebCTRL® **Network**  tree, select the AAR.
- 2 On the **Properties** page, check **Out of Service**.
- 3 Click **Accept**.

Compliance

FCC Compliance

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.



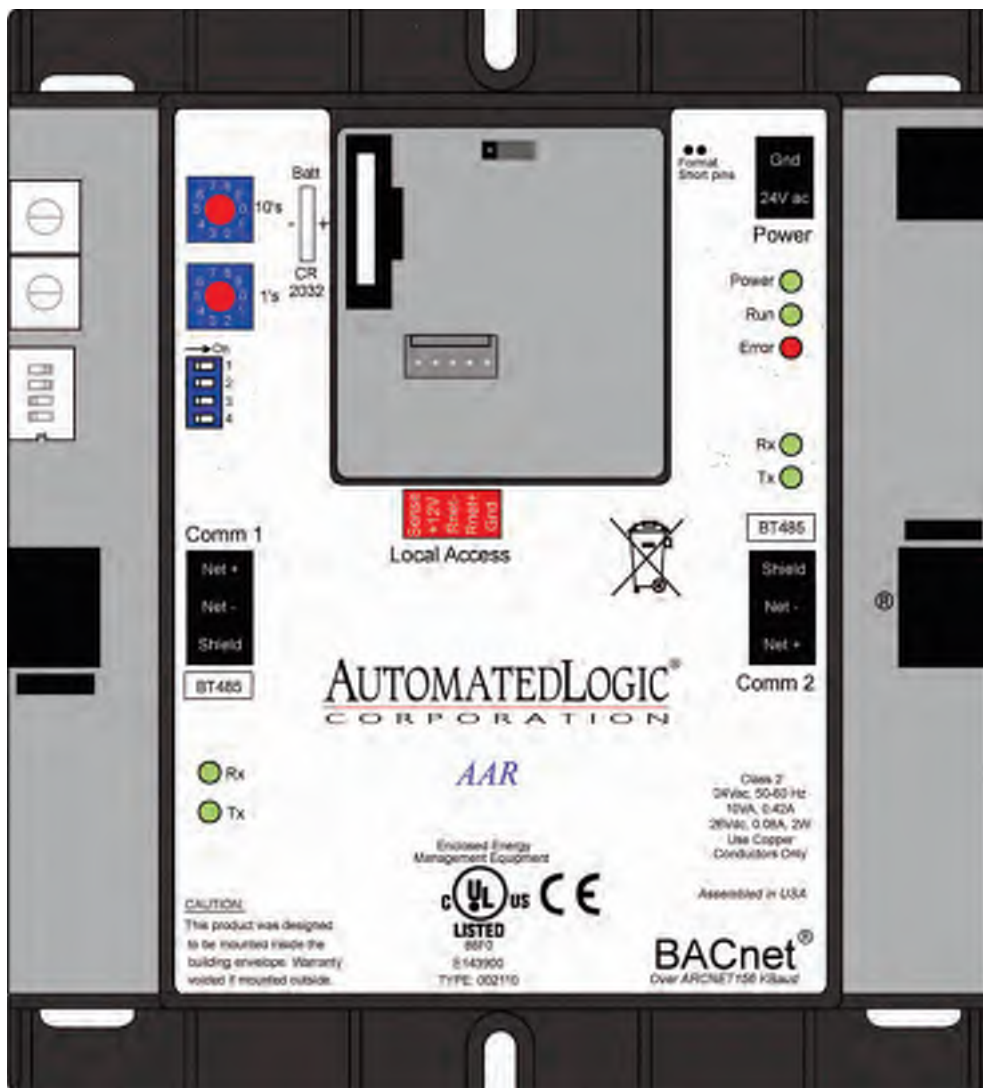
CAUTION Changes or modifications not expressly approved by the responsible party for compliance could void the user's authority to operate the equipment.

CE Compliance



WARNING This is a Class A product. In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate measures.

Appendix - AAR coverplate



Document revision history

Important changes to this document are listed below. Minor changes such as typographical or formatting errors are not listed.

Date	Topic	Change description	Code*
9/26/16	To set up a Local Access connection in the WebCTRL interface	Updated WebCTRL menu button in step 12.	A-D
	Appendix - AAR coverplate	Updated coverplate	A-D
4/16/15	Entire document	New look, no content changes	A-D
9/4/14	LED's	Changed the Status description for when the Run LED shows 2 flashes per second and the Error LED is On. Also added a note below the table regarding cycling power to turn off Error LED.	A-TS-JM-F-BK

* For internal use only

Equipment Portal Controller

Technical Instructions

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770-429-3000 Fax 770-429-3001 | www.automatedlogic.com



Rev. 2/15/2017
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Verify that you have the most current version of this document. Go to <https://accounts.automatedlogic.com>, then select **Support > Download > Documents > Hardware**. Important changes are listed in **Document revision history** at the end of this document.

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What is the Equipment Portal?

The Equipment Portal controller lets you integrate a single third-party device into your WebCTRL® system. The Equipment Portal can convert proprietary or open protocols such as Modbus or LonWorks to BACnet/ARC156 or BACnet MS/TP communications.

NOTE This document contains the instructions to install the Equipment Portal in a WebCTRL® system. For instructions to integrate the third-party device into the WebCTRL® system, see the *Integration Guide* for the appropriate third-party protocol. Go to <http://accounts.automatedlogic.com/download>, then select **Third-party Interfaces > Documents > Third-party Integration Guides (Equipment Portal)**.

Driver and control program

Driver	Specific to the third-party protocol. See the appropriate Integration Guide.
Maximum number of control programs	1
Maximum number of BACnet objects*	12000

* Depends on available memory.

Specifications

Power	24 Vac $\pm 10\%$, 50–60 Hz, 10 VA, single Class 2 source only 20 VA or less. 26 Vdc $\pm 10\%$, 5W
Third-party integration points	100
BACnet port	For communication with the controller network using ARC156 or MS/TP (9600 bps–76.8 kbps).
Equipment Port	For communication on EIA-232 or EIA-485. Communicates with a third-party device and protocol at various baud rates.
Optional Plug-in Comm Port	14-pin port that supports a LonWorks® plug-in card.
Rnet port	Supports: • Up to 5 ZS sensors • One Wireless Adapter that communicates with up to 5 wireless sensors • One Equipment Touch • Up to 4 RS Standard sensors and one RS Plus, RS Pro, or RS Pro-F sensor. NOTE ZS sensors, a Wireless Adapter, and an Equipment Touch can share the Rnet, but not RS sensors.

Local Access port	For system start-up and troubleshooting
Microprocessor	High speed 16-bit microprocessor with ARCNET communication co-processor
Memory	1 MB non-volatile battery-backed RAM, 1 MB Flash memory, 16-bit memory bus
Real-time clock	Battery-backed real-time clock keeps track of time in event of power failure
Battery	10-year Lithium CR2032 battery retains the following data for a maximum of 10,000 hours during power outages: time, control programs, editable properties, schedules, and trends. A low battery is indicated by a low battery alarm in the WebCTRL® application.
Protection	Incoming power and network connections are protected by non-replaceable internal solid-state polyswitches that reset themselves when the condition that causes a fault returns to normal. The power and network connections are also protected against transient excess voltage/surge events lasting no more than 10 msec.
BT485 connector	You attach a BT485 (not included) to a controller at the beginning and end of a network segment to add bias and to terminate a network segment.
Status indicators	LED's indicate status of communications, running, errors, and power
Environmental operating range	0 to 130°F (-17.8 to 54.4°C), 10–90% relative humidity, non-condensing NOTE The controller must be installed within the building.
Physical	Rugged GE C2950 Cyclopy plastic
Overall dimensions	Width: 4 in. (10.16 cm) Height: 5 in. (12.7 cm)
Recommended panel depth	1.75 in. (4.45 cm) NOTE Add .75 in. (1.91 cm) for the option card.
Weight	.56 lbs (.25 kg)
Listed by	UL-916 (PAZX), cUL-916 (PAZX7), FCC Part 15-Subpart B-Class A, CE

Zone sensors

Automated Logic® wireless sensors

You can connect a Wireless Adapter to Equipment Portal's **Rnet** port. The Wireless Adapter communicates with up to 5 wireless sensors. When using wireless sensors, the Rnet can have:

- Up to 5 wireless and ZS sensors (any combination)
- One Wireless Adapter
- One Equipment Touch

ZS Sensors

You can wire up to 5 ZS sensors to the Equipment Portal's Rnet port.

RS sensors

You can wire RS sensors to the Equipment Portal's **Rnet** port. An Rnet can consist of any of the following combinations of devices wired in a daisy-chain or star configuration:

- 1 RS Plus, RS Pro, or RS Pro-F
- 1–4 RS Standards
- 1–4 RS Standards, and 1 RS Plus, RS Pro, or RS Pro-F

Equipment Touch devices

You can wire an Equipment Touch to the Equipment Portal's Rnet port to view or change the controller's property values, schedule equipment, view trends and alarms, and more, without having to access the system's server. The Rnet can have one Equipment Touch, one Wireless Adapter, and up to 5 ZS sensors. RS sensors cannot share the Rnet with an Equipment Touch.

To mount the Equipment Portal

The Equipment Portal is to be mounted inside a building.

Screw the Equipment Portal into an enclosed panel using the mounting holes provided on the cover plate. Leave about 2 in. (5 cm) on each side of the controller for wiring.

Wiring for power

 **WARNING** Do not apply line voltage (mains voltage) to the controller's ports and terminals.

 CAUTIONS

- The Equipment Portal is powered by a Class 2 power source. Take appropriate isolation measures when mounting it in a control panel where non-Class 2 circuits are present.
- Automated Logic® controllers can share a power supply as long as you:
 - Maintain the same polarity.
 - Use the power supply only for Automated Logic® controllers.

To wire for power

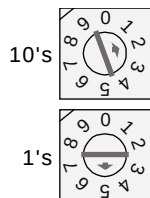
- 1 Remove power from the power supply.
- 2 Pull the screw terminal connector from the Equipment Portal's power terminals labeled **Hot** and **Gnd**.
- 3 Connect the transformer wires to the screw terminal connector.
- 4 Apply power to the power supply.
- 5 Measure the voltage at the Equipment Portal's power input terminals to verify that the voltage is within the operating range of 21.6–26.4 Vac.
- 6 Connect a 4-inch (10.2 cm) wire from **Gnd** to the control panel.
- 7 Insert the screw terminal connector into the Equipment Portal's power terminals.
- 8 Verify that the **Power** LED is on and the **Run** and **Error** LED's are blinking.

To address the Equipment Portal

You must give the Equipment Portal an address that is unique on the network. You can address the Equipment Portal before or after you wire it for power.

- 1 If the Equipment Portal has been wired for power, pull the screw terminal connector from its power terminals labeled **Gnd** and **Hot**. The controller reads the address each time you apply power to it.
- 2 Using the rotary switches, set the controller's address to match the **Address** in the controller's properties dialog box in SiteBuilder. Set the **Tens (10's)** switch to the tens digit of the address, and set the **Ones (1's)** switch to the ones digit.

EXAMPLE If the controller's address is 25, point the arrow on the **Tens (10's)** switch to 2 and the arrow on the **Ones (1's)** switch to 5.



Wiring for communications

The Equipment Portal communicates through the following ports:

Port	Communicates with...	Protocol	Port type(s)	Baud rate(s)
BACnet	The WebCTRL® system	BACnet/ARC156 ¹	ARC156	156 kbps
		BACnet MS/TP	EIA-485 (2-wire)	9600 bps 19.2 kbps 38.4 kbps 76.8 kbps (default)
Eq Port	A third-party device	Modbus	EIA-232 EIA-485 (2-wire or 4-wire)	9600 bps 19.2 kbps 38.4 kbps
Optional Plug-in Comm Port	A LonWorks device	LonWorks	Plug-in card	
Local Access ²	A computer and an APT	Enhanced Access	Rnet	115.2 kbps

¹ ARC156 is a unique implementation of the industry standard ARCNET. For a summary of differences between ARCNET and ARC156, see the *ARC156 Wiring Technical Instructions*.

² See *To communicate through the local access port* (page 14).

Wiring specifications

For wiring specifications to wire a third-party device, see the *Integration Guide* for the third-party protocol.

For...	Use...	Maximum Length
ARC156 ¹ or MS/TP ²	22 AWG, low-capacitance, twisted, stranded, shielded copper wire	2000 feet (610 meters)

¹ See the *ARC156 Wiring Technical Instructions*.

² See the *MS/TP Networking and Wiring Technical Instructions*.



WARNING Do not apply line voltage (mains voltage) to the controller's ports and terminals.

To wire to a BACnet/ARC156 network

- 1 Remove power from the Equipment Portal.
- 2 Check the communications wiring for shorts and grounds.
- 3 Connect the communications wiring to the **BACnet port** screw terminals labeled **Net +**, **Net -**, and **Shield**.
NOTE Use the same polarity throughout the network segment.
- 4 If the Equipment Portal is at either end of a network segment, connect a BT485 to the Equipment Portal.
- 5 Set DIP switch 4 to **Off**.
- 6 Apply power to the Equipment Portal.
- 7 Verify communication with the network by viewing a Module Status report in the WebCTRL® interface.

To wire to a BACnet MS/TP network

- 1 Remove power from the Equipment Portal.
- 2 Check the communications wiring for shorts and grounds.
- 3 Connect the communications wiring to the **BACnet port** screw terminals labeled **Net +**, **Net -**, and **Shield**.
NOTE Use the same polarity throughout the network segment.
- 4 If the Equipment Portal is at either end of a network segment, connect a BT485 to the Equipment Portal.
- 5 Set DIP switch 4 to **On**.
- 6 Apply power to the Equipment Portal.
- 7 Set DIP switches 1 and 2 to the appropriate baud rate. See the MS/TP baud diagram on the Equipment Portal.
NOTE Use the same baud rate for all controllers on the network segment.

To wire a third-party device

See the *Integration Guide* for the third-party device or protocol.

Wiring devices to the Equipment Portal's Rnet port

You can wire the following devices to the Equipment Portal's Rnet port in a daisy-chain or star configuration:

- *ZS or RS sensors* (page 7)
- *Wireless Adapter* (page 8) that communicates with wireless sensors
- *Equipment Touch* (page 9)

NOTE ZS sensors, a Wireless Adapter, and an Equipment Touch can share the same Rnet, but not RS sensors.

The Rnet communicates at a rate of 115 kbps.

Rnet wiring specifications

NOTE Use the specified type of wire and cable for maximum signal integrity.

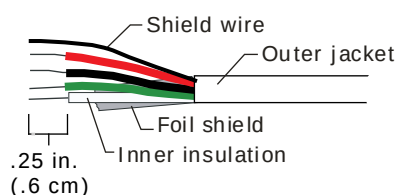
Description	4 conductor, shielded or unshielded, CMP, plenum rated cable
Conductor	22 AWG (7x0096) bare copper
Maximum length	500 feet (152 meters)
Insulation	Low-smoke PVC (or equivalent)
Color Code	Black, white, green, red
Shielding	If shielded, Aluminum/Mylar shield (100% coverage) with TC drain wire
UL temperature rating	32–167 °F (0–75 °C)
Voltage	300 Vac, power limited
Listing	UL: NEC CL2P, or better

To wire a ZS or an RS sensor to the Equipment Portal

For complete sensor installation instructions, including ZS sensor power requirements, see:

- *ZS Sensors Technical Instructions*
- *RS Sensors Technical Instructions*

- 1 Remove power from the Equipment Portal.
- 2 Partially cut, then bend and pull off the outer jacket of the Rnet cable(s). Do not nick the inner insulation.



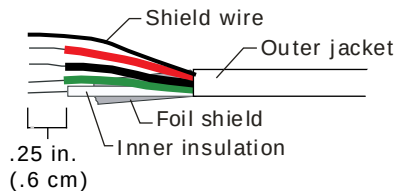
- 3 Strip about .25 inch (.6 cm) of the inner insulation from each wire.
 - 4 Wire each terminal on the Equipment Portal's **Rnet** port to the terminal of the same name on the sensor.
- NOTE** If using shielded wire, connect the shield wire and the ground wire to the **Gnd** terminal.
- 5 Apply power to the Equipment Portal.

To wire a Wireless Adapter to the Equipment Portal

NOTES

- The Wireless Adapter requires a 24 Vac power supply. It is not powered by the Rnet.
- If the Wireless Adapter will be:
 - Daisy-chained on the Rnet with ZS sensors or an Equipment Touch, use the standard 4-conductor Rnet cable.
 - The only device on the Rnet, you can use a 3-conductor cable instead of the standard 4-conductor Rnet cable.
- For complete Wireless Adapter installation instructions, see the *Wireless Sensors Technical Instructions*.

- 1 Remove power from the Equipment Portal.
- 2 Partially cut, then bend and pull off the outer jacket of the Rnet cable(s). Do not nick the inner insulation.



- 3 Strip about .25 inch (.6 cm) of the inner insulation from each wire.
- 4 Wire the Equipment Portal's **Rnet+**, **Rnet-**, and **Gnd** terminals to the terminals of the same name on the Wireless Adapter's Rnet connector.



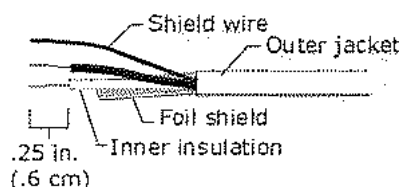
- NOTE** If using shielded wire, connect the shield wire and the ground wire to the **Gnd** terminal.
- 5 Apply power to the Equipment Portal.

To wire an Equipment Touch to the Equipment Portal

NOTES

- The Equipment Touch requires a 24 Vac power supply. It is not powered by the Rnet.
- If the Equipment Touch will be:
 - Daisy-chained on the Rnet with ZS sensor or a Wireless Adapter, use the standard 4-conductor Rnet wiring and follow the wiring instructions *To wire a ZS or an RS sensor to the Equipment Portal* (page 7).
 - The only device on the Rnet, you can use a 2-conductor cable instead of the standard 4-conductor Rnet cable and follow the instructions below.
- For complete Equipment Touch installation instructions including wiring diagrams, see the *Equipment Touch Installation and Setup Guide*.

- 1 Remove power from the Equipment Portal.
- 2 Partially cut, then bend and pull off the outer jacket of the cable. Do not nick the inner insulation.



- 3 Strip about .25 inch (.6 cm) of the inner insulation from each wire.
- 4 Wire the Equipment Portal's **Rnet+** and **Rnet-** terminals to the terminals of the same name on the Equipment Touch's connector.
NOTE If using shielded wire, connect the shield wire and the ground wire to the **Gnd** terminal.
- 5 Apply power to the Equipment Portal.

Downloading the Equipment Portal

Download the following items to the Equipment Portal's battery-backed memory:

Item	Notes
Control program	Must be in WebCTRLx.x\webroot\<system_name>\programs .
Driver	Must be in WebCTRLx.x\webroot\<system_name>\drivers . NOTE To verify that you have the driver's latest version, go to http://accounts.automatedlogic.com/download , then select Drivers > ExecB . Compare the latest version to the Equipment Portal's driver in SiteBuilder.
Editable properties	
Schedules	

If you change any of the above items or the Equipment Portal's address after the initial download, you must download again. The first download takes longer than subsequent downloads.



CAUTIONS

- The Equipment Portal will lose stored data when you download.
- Equipment controlled by the Equipment Portal will shut down and restart when you download.

To download from the WebCTRL® interface

If your network is complete, you can download from any network browser. If not complete, connect a laptop with a local copy of the system database to the Equipment Portal's local access port. See *To communicate through the local access port* (page 14).

- 1 On the WebCTRL® **Network**  tree, select the controller.
- 2 Click **Downloads**.
- 3 Do one of the following:
 - If the controller is in the Downloads list, go to step 4.
 - If the controller is not in the list:
 - a. Click **Add**.
 - b. In the pop-up, select the controller.
 - c. Select **All Content**.
 - d. Click **Add**.
 - e. Click **Close**.
- 4 Select the controller in the Downloads list.
- 5 Click **Start**.

NOTES

- If the download fails, locate and resolve the problem, then retry the download.
- You can also download a controller from the **Devices** page.

To set up the driver

After you download the driver and control program(s) to the Equipment Portal, you may want to change the driver's properties in the WebCTRL® interface to suit your application.

- 1 On the WebCTRL® **Network**  tree, click  to the left of your Equipment Portal.
- 2 Click  to the left of **Driver** to see its children.
- 3 Make changes as needed on the **Properties** page for **Driver** and any of its children.

Driver

On the **Driver** page, you can change the following properties:

- Module clock synchronization and failure. See table below.
- Network Input microblock communication properties.

BACview Control	
BACnet Write Priority	Select View Field Definition Help for a description of this field.
Keypad Inactivity timeout (minutes)	Log out the user (if a user-level password is required), turn off the backlight, and display the standby screen after this period of inactivity.
Keypad user-level password	Numeric password user must enter to access system through a BACview® device.
TouchScreen Control	
TouchScreen Schedule Edit Enable	Check this field to allow a user to edit this controller's schedules from an Equipment Touch's Schedules screen.
Module Clock	
Clock Fail Date and Time	Date and time the control program uses when controller's real-time clock is invalid.  TIP Use an occupied date and time (such as a Tuesday at 10 a.m.) so the equipment does not operate in unoccupied mode if the controller loses power during occupancy.
Time Synch Sensitivity (seconds)	When the controller receives a time sync request, if the difference between the controller's time and the time sync's time is greater than this field's value, the controller's time is immediately changed. If the difference is less than this field's value, the controller's time is slowly adjusted until the time is correct.
Network Microblocks	
Number of poll retries before Network Input Microblocks indicate failure	The maximum number of retries after the initial attempt that a Network microblock will attempt to communicate with its target device. If unsuccessful, the point will transition to an idle state for 30 seconds before attempting to communicate again. Change this field only if directed by Technical Support.
Periodic rebinding interval	If a microblock uses a wildcard in its address, this timer determines how often the microblock will attempt to find the nearest instance of its target. For example, if an outside air temperature address uses a wildcard, a VAV application will look for the outside air temperature on the same network segment or on the nearest device containing that object.
BACnet COV Throttling	
Enable COV Throttling	Under normal circumstances, COV Throttling should be enabled to prevent excessive network traffic if an object's COV Increment is set too low. See EXCEPTION below. When enabled, if an object generates excessive COV broadcasts (5 updates in 3 seconds), the driver automatically throttles the broadcasts to 1 per second. Also, if the object's value updates excessively for 30 seconds, an alarm is sent to the WebCTRL® application listing <u>all</u> objects that are updating excessively. A Return-to-normal alarm is sent only after <u>all</u> objects have stopped updating excessively. EXCEPTION: In rare circumstances, such as process control, a subscribing object may require COV updates more frequently than once per second. For these situations, clear this checkbox, but make sure that your network can support the increased traffic. You will also need to disable the Excessive COV alarms under the driver's Common Alarms.

Trend Sampling	
Collect a daily midnight sample for all points in this controller that are sampling on COV	For values that change infrequently, select to verify at midnight daily that the point is still able to communicate trend values.

Device

On the **Device** page, you can change the following properties:

- BACnet device object properties for the Equipment Portal
- Equipment Portal communication

Configuration	NOTE The three APDU fields refer to all networks over which the Equipment Portal communicates.
Max Masters and Max Info Frames	Apply only if the Equipment Portal's MS/TP network is enabled.

Notification Classes

Alarms in the WebCTRL® application use Notification Class #1. A BACnet alarm's Notification Class defines:

- Alarm priority for Alarm, Fault, and Return to Normal states
- Options for BACnet alarm acknowledgment
- Where alarms should be sent (recipients)

Priorities	NOTE BACnet defines the following Network message priorities for Alarms and Events.	
	Priority range	Network message priority
	00–63	Life Safety
	64–127	Critical Equipment
	128–191	Urgent
	192–255	Normal
Priority of Off-Normal	BACnet priority for Alarms.	
Priority of Fault	BACnet priority for Fault messages.	
Priority of Normal	BACnet priority for Return-to-normal messages.	

Ack Required for Off-Normal, Fault, and Normal	Specifies whether alarms associated with this Notification Class require a BACnet Acknowledgment for Off-Normal, Fault, or Normal alarms.  TIP You can require operator acknowledgment for an Alarm or Return-to-normal message (stored in the WebCTRL® database). In the WebCTRL® interface on the Alarm > Enable/Disable tab, change the acknowledgment settings for an alarm source or an alarm category.
Recipient List	
Recipients	The first row in this list is the WebCTRL® application. Do not delete this row. Click Add if you want other BACnet devices to receive alarms associated with this Notification Class.
Recipient Description	Name that appears in the Recipients table.
Recipient Type	Use Address (static binding) for either of the following: • Third-party BACnet device recipients that do not support dynamic binding • When you want alarms to be broadcast (you must uncheck Issue Confirmed Notifications). This use is rare.
Days and times	The days and times during which the recipient will receive alarms.
Recipient Device Object Identifier	Type the Device Instance from SiteBuilder (or from the network administrator for third-party devices) in the # field.
Process Identifier	Change for third-party devices that use a BACnet Process Identifier other than 1. The WebCTRL® application processes alarms for any 32-bit Process Identifier.
Issue Confirmed Notifications	Select to have a device continue sending an alarm message until it receives delivery confirmation from the recipient.
Transitions to Send	Uncheck the types of alarms you do not want the recipient to get.

Calendars

Calendars are provided in the driver for BACnet compatibility only. Instead, use the **Schedules** feature in the WebCTRL® interface.

Common and Specific Alarms

On these pages, you can enable/disable, change BACnet alarm properties, or set delays for the following BACnet alarms:

Common alarms:

- Module Halted
- All Programs Stopped
- Duplicate Address
- Locked I/O
- Control Program
- Program Stopped
- Excessive COV

Specific alarm:

- Low Battery Alarm

NOTE To set up alarm actions for controller generated alarms, see *Setting up alarm actions* in WebCTRL® Help.

Module Generated Alarm	
Description	Short message shown on the Alarms page or in an alarm action when this type of alarm is generated.
Events	
Alarm Category and Alarm Template	See <i>Customizing alarms</i> in WebCTRL® Help.
Enable	Clear these checkboxes to disable Alarm or Return to normal messages of this type from this controller.
Notification Class	Do not change this field.

Protocols

The **Protocols** page shows the status of the protocols currently running on the Equipment Portal.

To communicate through the local access port

Using a computer and a USB Link Kit, you can communicate locally with the Equipment Portal to download or to troubleshoot.

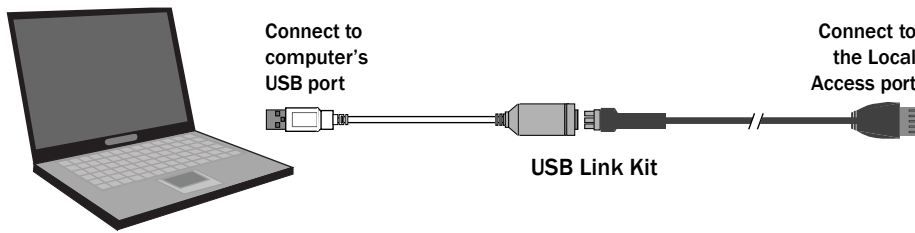
PREREQUISITES

- A computer with a USB port
- A USB Link Kit. See the *USB Link Kit Technical Instructions*.
NOTE The USB Link Kit driver is installed with a WebCTRL® v5 or later system. But if needed, you can get the latest driver from <http://www.silabs.com/products/mcu/Pages/USBtoUARTBridgeVCPDrivers.aspx>. Install the driver before you connect the USB Link Kit to your computer.
- v1.73c.005 or later controller driver



CAUTION If multiple controllers share power but polarity was not maintained when they were wired, the difference between the controller's ground and the computer's AC power ground could damage the USB Link Kit and the controller. If you are not sure of the wiring polarity, use a USB isolator between the computer and the USB Link Kit. Purchase a USB isolator online from a third-party manufacturer.

Connect the USB Link Kit to the computer and to the controller's Local Access port.



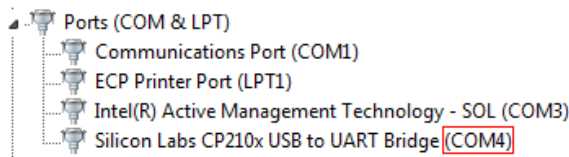
NOTE If using a USB isolator, plug the isolator into your computer's USB port, and then plug the USB Link Kit cable into the isolator.

To set up a Local Access connection in the WebCTRL® interface

For the WebCTRL® application to communicate with the Local Access port, you must do the following:

- 1 On the **System Configuration**  tree, select **Connections**.
- 2 On the **Configure** tab, click **Add**.
- 3 From the **Type** drop-down list, select **BACnet Local Access**.
- 4 Optional: Edit the **Description**.
- 5 Type the computer's **Port** number that the USB cable is connected to.

NOTE To find the port number, plug the USB cable into the computer's USB port, then select **Start > Control Panel > System > Device Manager > Ports (Com & LPT)**. The COM port number is beside **Silicon Labs CP210x USB to UART Bridge**.



- 6 Set the **Baud** rate to 115200.
- 7 Click **Accept**.
- 8 On the **View** tab, click the button next to the BACnet/IP network, then select **BACnet Local Access**.
- 9 Click **Accept**.
- 10 On the **Configure** tab, select **BACnet Local Access**, then click **Start**.
NOTE If an error message appears, make sure the COM port you selected is not in use. For example, PuTTY may be open and is holding the port open.
- 11 On the **Network**  tree, select the controller that you are connected to.
- 12 Click , then select **Manual Command**.
- 13 Type `rnet here` in the dialog box, then click **OK**.
- 14 On the **Properties** page, click **Module Status**. If a Modstat report appears, the WebCTRL® application is communicating with the controller.

Troubleshooting

If you have problems mounting, wiring, or addressing the Equipment Portal, contact ALC Technical Support.

LED's

The LED's on the Equipment Portal show the status of certain functions.

If this LED is on...	Status is...
Power	The Equipment Portal has power
Rx1	The Equipment Portal is receiving data on the BACnet port.
Tx1	The Equipment Portal is transmitting data on the BACnet port.
Rx2	The Equipment Portal is receiving data on the Eq Port.
Tx2	The Equipment Portal is transmitting data on the Eq Port.

The **Run** and **Error** LED's indicate controller and network status.

If Run LED shows...	And Error LED shows...	Status is..
2 flashes per second	Off	Normal
2 flashes per second	2 flashes, alternating with Run LED	Five minute auto-restart delay after system error
2 flashes per second	2 flashes in sync with Run LED, then pause	The controller is configured for a different baud rate than the rest of the network segment
2 flashes per second	3 flashes, then off	The controller has just been formatted
2 flashes per second	4 flashes, then pause	Two or more devices on this network have the same ARC156 network address
2 flashes per second	On	Exec halted after frequent system errors or control programs halted
5 flashes per second	On	Exec start-up aborted, Boot is running
5 flashes per second	Off	Firmware transfer in progress, Boot is running
7 flashes per second	7 flashes per second, alternating with Run LED	Ten second recovery period after brownout
14 flashes per second	14 flashes per second, alternating with Run LED	Brownout

NOTE If you resolve the issue but the **Error** LED does not turn off, cycle power to the controller.

To format the controller

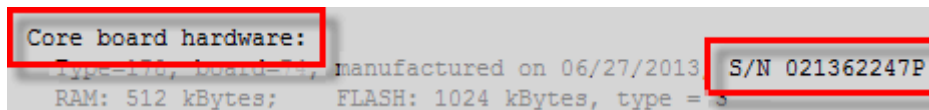
If you cannot communicate with a controller after downloading it, as a last resort, you can manually format the controller to erase its memory.

- 1 Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **Hot**.
- 2  Make sure the address switches are not set to 0, 0.
- 3 Short the **Format** jumper's pins and maintain the short for steps 3 and 4.
- 4 Insert the power screw terminal connector into the Equipment Portal's power terminals.
- 5 Continue to short the jumper until the **Error** LED flashes three times in sync with the **Run** LED.
- 6 Remove the short.
- 7 Download the Equipment Portal.

To get the Equipment Portal's serial number

If you need the Equipment Portal's serial number when troubleshooting, the number is on:

- a sticker on the back of the main controller board
- a Module Status report (Modstat) under **Core** (or **Main**) **board hardware**



To obtain a modstat in the WebCTRL® interface:

- 1 Select the Equipment Portal in the **Network**  tree.
- 2 On the **Properties** page, click **Module Status**.

Recovering from a power outage

The Equipment Portal has a 10-year Lithium CR2032 battery that retains the following data for a maximum of 10,000 hours during power outages.

- Time
- Control programs
- Editable properties
- Trends
- Schedules

If the above data is lost after power returns, replace the battery and then download the Equipment Portal. See instructions below.

To replace the Equipment Portal's battery

If the Equipment Portal sends a **Low Battery** alarm to the WebCTRL® application, replace the battery.

- 1 Verify that the Equipment Portal's power is on.
- 2 Remove the battery from the controller, making note of the battery's polarity.
- 3 Insert the new battery into the controller, matching the polarity of the battery you removed.
- 4 Download the Equipment Portal.

To take the Equipment Portal out of service

If needed for troubleshooting or start-up, you can prevent the WebCTRL® application from communicating with the Equipment Portal.

- 1 On the WebCTRL® **Network**  tree, select the Equipment Portal.
- 2 On the **Properties** page, check **Out of Service**.
- 3 Click **Accept**.

Compliance

FCC Compliance

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.



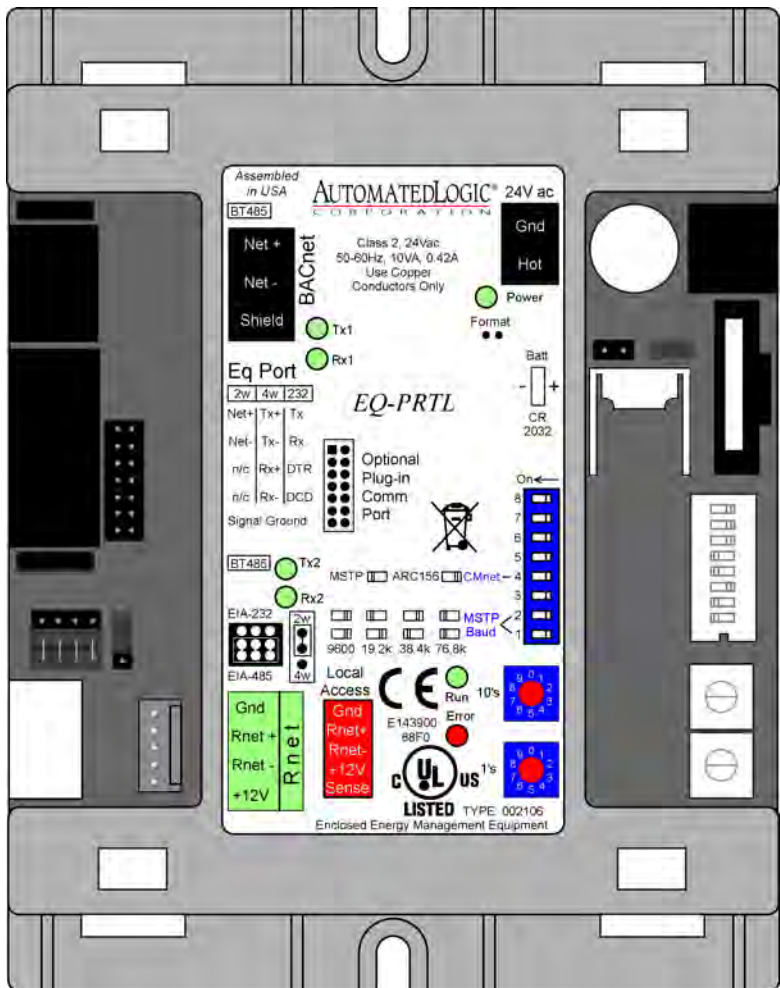
CAUTION Changes or modifications not expressly approved by the responsible party for compliance could void the user's authority to operate the equipment.

CE Compliance



WARNING This is a Class A product. In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate measures.

Appendix - Equipment Portal coverplate



Document revision history

Important changes to this document are listed below. Minor changes such as typographical or formatting errors are not listed.

Date	Topic	Change description	Code*
2/6/17	Specifications	Added wireless sensors to the Rnet port specification.	X-D
	Zone sensors	Added wireless sensors to this topic.	
	Equipment Touch	Added Wireless Adapter to this topic.	
	Wiring devices to the Rnet port	Added Wireless Adapter to this topic.	
	To wire a Wireless Adapter to the Equipment Portal	New topic.	
9/26/16	To set up a Local Access connection in the WebCTRL interface	Updated WebCTRL menu button in step 12.	A-D
	Appendix - Equipment Portal coverplate	Updated coverplate.	A-D
4/16/15	Entire document	New look, no content changes.	A-D
10/7/14	Driver	Added the Network Microblock fields.	A-TS-RB-F
5/13/14	Specifications	Rnet Port: Added Equipment Touch and removed BACview® devices.	A-D-CP-O-TC
	Zone sensors	Removed references to BACview.	
	Equipment Touch devices	New topic.	
	BACview devices	Removed topic.	
	Wiring zone sensors to the Equipment Portal	Changed to "Wiring devices to the Equipment Portal's Rnet port".	
	To wire an Equipment Touch to the Equipment Portal	New topic.	
	To set up the driver > Driver	Added new driver property: TouchScreen Schedule Edit Enable.	

* For internal use only

LGR25 Controller

Technical Instructions

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Verify that you have the most current version of this document. Go to <https://accounts.automatedlogic.com>, then select **Support > Download > Documents > Hardware**. Important changes are listed in **Document revision history** at the end of this document.

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What is the LGR25?

The LGR25 is a BACnet router and a protocol translator for integrating third-party points into your WebCTRL® system.

Driver and control program

Driver ¹	DRV_MELGR_VANILLA
Maximum number of control programs ²	999
Maximum number of BACnet objects ²	12000

¹ To integrate a third-party device into your WebCTRL® system, you must use the driver for the specific protocol or device. Go to <http://accounts.automatedlogic.com/download>, then select **Third-party Integration > Third-party Interface (ME-LGR & LGR)**.

² Depends on available memory.

Specifications

Power	24 Vac $\pm 10\%$, 50–60 Hz, 24 VA 26 Vdc $\pm 10\%$, 10 W
Third-party integration points	25
10/100 BaseT Ethernet Port	For communication on the Ethernet at 10 or 100 Mbps, half duplex
BACnet port	For communication with the controller network using ARC156
Port S1	For communication on EIA-232 or EIA-485. Communicates with the controller network using MS/TP (9600 bps–76.8 kbps) or a third-party device and protocol at various baud rates.
Port S2	For communication on EIA-232 or EIA-485. Communicates with the controller network using PTP (9600 bps–115.2 kbps) or a third-party device and protocol at various baud rates.
Rnet port	Supports: • Up to 15 ZS sensors • One Wireless Adapter that communicates with up to 15 wireless sensors • One Equipment Touch • Up to 4 RS Standard sensors and one RS Plus, RS Pro, or RS Pro-F sensor NOTE ZS sensors, a Wireless Adapter, and an Equipment Touch can share the Rnet, but not RS sensors.
Rnet Local Access port	For system start-up and troubleshooting

Microprocessor	32-bit Motorola Power PC microprocessor with cache memory, Fast Ethernet controller, high performance 32-bit communication co-processor, ARCNET communication co-processor, and I/O expansion CAN co-processor
Memory	16 MB non-volatile battery-backed RAM (with 12 MB available for use), 8 MB Flash memory, 32-bit memory bus
Real-time clock	Battery-backed real-time clock keeps track of time in event of power failure
Battery	10-year Lithium CR123A battery retains the following data for a maximum of 720 hours during power outages: time, control programs, editable properties, schedules, and trends. To conserve battery life, you can set the driver to turn off battery backup after a specified number of days and depend on the archive function to restore data when the power returns. A low battery is indicated by the Battery low LED or a low battery alarm in the WebCTRL® application.
Data archive	Control programs, editable properties, and schedules are archived to non-volatile Flash memory daily and after every power up or download. If a power outage occurs and the battery backup fails or is turned off, the data is automatically restored from this archive.
Protection	Incoming power and network connections are protected by non-replaceable internal solid-state polyswitches that reset themselves when the condition that causes a fault returns to normal. The power and network connections are also protected against transient excess voltage/surge events lasting no more than 10 msec.
BT485 connector	You attach a BT485 (not included) to a controller at the beginning and end of a network segment to add bias and to terminate a network segment.
Status indicators	LED's indicate status of communications and low battery status. Seven segment display indicates running, error, and power status.
Environmental operating range	-20 to 140 °F (-29 to 60 °C), 10–90% relative humidity, non-condensing
Physical	Rugged aluminum cover, removable screw-type terminal blocks
Overall dimensions	Width: 11 5/16 in. (28.7 cm) Height: 7 1/2 in. (19 cm)
Mounting dimensions	Width: 10 13/16 in. (27.5 cm) Height: 5 in. (12.7 cm)
Recommended panel depth	2 3/4 in. (7cm)
Weight	1.4 lbs (0.64 kg)
BACnet support	Conforms to the BACnet Building Controller (B-BC) Standard Device Profile as defined in ANSI/ASHRAE Standard 135-2012 (BACnet) Annex L, Protocol Revision 9
Listed by	UL-916 (PAZX), cUL-916 (PAZX7), FCC Part 15-Subpart B-Class A, CE

Zone sensors

Automated Logic® wireless sensors

You can connect a Wireless Adapter to LGR25's **Rnet** port. The Wireless Adapter communicates with up to 15 wireless sensors. When using wireless sensors, the Rnet can have:

- Up to 15 wireless and ZS sensors (any combination)
- One Wireless Adapter
- One Equipment Touch

ZS sensors

You can wire up to 15 ZS sensors to the LGR25's **Rnet** port. ZS sensors can share the Rnet with the devices listed above.

NOTE A control program can use no more than 5 ZS Sensors, so you must use multiple control programs if your Rnet network has more than 5 sensors.

RS sensors

You can wire RS sensors to the LGR25's **Rnet** port. An Rnet can consist of any of the following combinations of devices wired in a daisy-chain or star configuration:

- 1 RS Plus, RS Pro, or RS Pro-F
- 1–4 RS Standards
- 1–4 RS Standards, and 1 RS Plus, RS Pro, or RS Pro-F

NOTE RS sensors cannot share the Rnet with other devices.

Equipment Touch devices

You can wire an Equipment Touch to the LGR25's Rnet port to view or change the controller's property values, schedule equipment, view trends and alarms, and more, without having to access the system's server. The Rnet can have one Equipment Touch, one Wireless Adapter, and up to 15 ZS sensors. RS sensors cannot share the Rnet with an Equipment Touch.

To mount the LGR25

Screw the LGR25 into an enclosed panel using the mounting holes provided on the cover plate. Leave about 2 in. (5 cm) on each side of the controller for wiring.

Wiring for power



WARNING Do not apply line voltage (mains voltage) to the controller's ports and terminals.



CAUTIONS

- The LGR25 is powered by a Class 2 power source. Take appropriate isolation measures when mounting it in a control panel where non-Class 2 circuits are present.
- Automated Logic® controllers can share a power supply as long as you:
 - Maintain the same polarity.
 - Use the power supply only for Automated Logic® controllers.

To wire for power

- 1 Make sure the LGR25's power switch is in the **OFF** position to prevent it from powering up before you can verify the correct voltage.
- 2 Remove power from the power supply.
- 3 Pull the screw terminal connector from the controller's power terminals labeled **24V ac/dc** and **Ground**.
- 4 Connect the transformer wires to the screw terminal connector.
- 5 Apply power to the power supply.
- 6 Measure the voltage at the LGR25's power input terminals to verify that the voltage is within the operating range of 21.6–26.4 Vac.
- 7 Insert the screw terminal connector into the LGR25's power terminals.
- 8 Turn **on** the LGR25's power.
- 9 Verify that the Run LED (a dot in the lower right corner of the **Module Status** LED) begins blinking. The **Module Status** LED will show a chase pattern when the controller is running with no errors.

Addressing the LGR25

The LGR25 needs two addresses, one for the controller network and one for the Ethernet.

The LGR25 needs...	That is unique on the...	Notes	See...
A MAC address	controller network	You set the MAC address on the controller's rotary switches.	<i>To set the controller network MAC address (page 5)</i>
An IP address	Ethernet	You can use one of the following: - The default IP address that your system creates: - IP address = 192.168.168.x where x is the controller network MAC address. - Subnet mask = 255.255.255.0 - A DHCP IP address - Assign a custom IP address	<i>To use a default IP address (page 6)</i> <i>To use a DHCP IP address (page 6)</i> <i>To use a custom IP address (page 7)</i>

NOTES

- Carefully plan your addressing scheme to avoid duplicating addresses. If third-party devices are integrated into the system, make sure your addresses do not conflict with their addresses.
- The controller network MAC address and IP address are defined in SiteBuilder in the controller's properties dialog box.
- You can address the LGR25 before or after you wire it for power.

To set the controller network MAC address



CAUTIONS

- The MAC address must be unique on the controller network.
- If you are using default IP addressing, the MAC address must match the last octet of the **Address** field in the controller's properties dialog box in SiteBuilder.

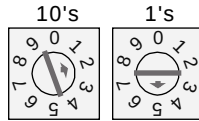
1 If wired for power, turn off the controller's power.



2 The controller only reads the rotary switch positions during power up or upon reset.

3 Use the rotary switches to set the address. Set the **Tens (10's)** switch to the tens digit of the address, and set the **Ones (1's)** switch to the ones digit.

EXAMPLE If the controller's address is 25, point the arrow on the **Tens (10's)** switch to 2 and the arrow on the **Ones (1's)** switch to 5.



To use a default IP address

CAUTION The IP address must be unique on the Ethernet.

- 1 If wired for power, turn off the controller's power.
- 2 **CAUTION** The controller only reads the rotary switch positions during power up or upon reset.
- 3 Set the **Default/Assigned** DIP switch to the **Default** position.
- 4 Set the **+100/0** DIP switch to **On** to add 100 to **x** in the IP address.

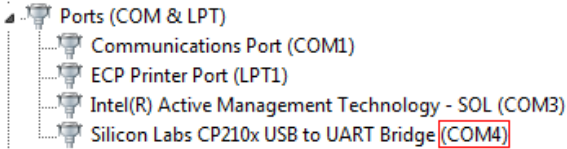
EXAMPLE If you turn on this DIP switch and the controller network MAC address is 25, the IP address is 192.168.168.125.

NOTE The default address is an intranet address. Data packets from this address are not routable to the Internet.

To use a DHCP IP address

PREREQUISITE v6.0 or later driver

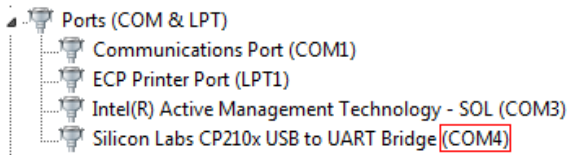
- 1 Set the LGR25's **Enhanced Access** DIP switch to **ON**.
- 2 Set the **Default/Assigned** DIP switch to **Default**.
- 3 Turn the controller's power off, then on again.
- 4 Connect a laptop with the WebCTRL® Server to the LGR25's **Local Access** port. See *To communicate through the local access port* (page 23).
- 5 In SiteBuilder, set your **Configure > Preferences > Connections** tab settings.

Field	Value
Port	The computer's port number that the USB cable is connected to. NOTE To find the port number, plug the USB cable into the computer's USB port, then select Start > Control Panel > System > Device Manager > Ports (Com & LPT). The COM port number is beside Silicon Labs CP210x USB to UART Bridge. 
Baud Rate	115200
Data Bits	8
Parity	None
Stop Bits	1

- 6 On the **Network** tree, double-click the LGR25.
- 7 On the **Address** tab, click **Module Status**.
- 8 Note the LGR25's **Ethernet MAC address**.
- 9 Give the Ethernet MAC address to your DHCP network administrator and request that he reserve an IP address for that MAC address.
- 10 Get from him the reserved IP address, subnet mask, and default gateway address for the LGR25.
- 11 Repeat steps 1–6.
- 12 On the **Address** tab, select **Specify a custom or DHCP IP Address**.
- 13 Type the **IP Address**, **Subnet Mask**, and **Default Gateway Address** that the DHCP network administrator gave you.
- 14 When finished, set the LGR25's **Enhanced Access** DIP switch to **OFF** to restore normal functionality to the **Local Access** port.
- 15 Turn the controller's power off, then on again.

To use a custom IP address

- 1 Obtain the IP address, subnet mask, and default gateway address for the controller from the facility network administrator.
- 2 Set the LGR25's **Enhanced Access** DIP switch to **ON**.
- 3 Set the **Default/Assigned** DIP switch to **Assigned**.
- 4 Turn the controller's power off, then on again.
- 5 Connect a laptop with the WebCTRL® Server to the LGR25's **Local Access** port. See *To communicate through the local access port* (page 23).
- 6 In SiteBuilder, set your **Configure > Preferences > Connections** tab settings.

Field	Value
Port	The computer's port number that the USB cable is connected to. NOTE To find the port number, plug the USB cable into the computer's USB port, then select Start > Control Panel > System > Device Manager > Ports (Com & LPT). The COM port number is beside Silicon Labs CP210x USB to UART Bridge. 
Baud Rate	115200
Data Bits	8
Parity	None
Stop Bits	1

- 7 On the **Network** tree, double-click the controller.
- 8 On the **Address** tab, select **Specify a custom or DHCP IP Address**.
- 9 Type the **IP Address**, **Subnet Mask**, and **Default Gateway Address**.
- 10 Click **Download Address**.

- 11 When the download is complete, click **Module Status** in the same dialog box to verify the controller's address.
- 12 When finished, set the LGR25's **Enhanced Access** DIP switch to **OFF** to restore normal functionality to the **Local Access** port.
- 13 Turn the controller's power off, then on again.

Wiring for communications

The LGR25 communicates using BACnet and/or third-party protocols, and can connect to a variety of port types at multiple baud rates. See table below.

Port	Protocol	Port type(s)	Baud rate(s)
Ethernet Port E1	BACnet/IP	Ethernet	10 Mbps
	BACnet/Ethernet		100 Mbps
	Telnet Diagnostics		
	Proprietary third-party over TCP/IP		
	NOTE All protocols can run simultaneously.		
BACnet	BACnet/ARC156 ¹	EIA-485 (2-wire)	156 kbps
S1 ²	BACnet MS/TP	EIA-485 (2-wire)	9600 bps 19.2 kbps 38.4 kbps 76.8 kbps (default)
	Third-party	EIA-232 EIA-485 (2-wire) EIA-422 (EIA-485 4-wire)	Various
S2 ²	BACnet PTP	EIA-232	9600 bps 19.2 kbps 38.4 kbps (default) 57.6 kbps 115.2 kbps
	Third-party	EIA-232 EIA-485 (2-wire)	Various
Local Access	Enhanced Access	Rnet ³	115.2 kbps

¹ ARC156 is a unique implementation of the industry standard ARCNET. For a summary of differences between ARCNET and ARC156, see the *ARC156 Wiring Technical Instructions*.

² This port supports only one protocol and one wire type at a time.

³ See *To communicate through the local access port* (page 23).

Wiring specifications

For...	Use...	Maximum Length
Ethernet	CAT5e or higher Ethernet cable	328 feet (100 meters)
ARC156 ¹ or MS/TP ²	22 AWG, low-capacitance, twisted, stranded, shielded copper wire	2000 feet (610 meters)
PTP	18–28 AWG; twisted pair preferable	50 feet (15.24 meters)

¹ See the *ARC156 Wiring Technical Instructions*.

² See the *MS/TP Networking and Wiring Technical Instructions*.



WARNING Do not apply line voltage (mains voltage) to the controller's ports and terminals.

To connect the LGR25 to the Ethernet

Connect an Ethernet cable to the Ethernet port.

NOTE If your system has controllers on different IP subnets separated by an IP router, you must configure one controller on each subnet as a BACnet Broadcast Management Device (BBMD). Do not configure more than one BBMD per subnet as this would cause circular routes. To avoid this problem:

- Let SiteBuilder automatically configure your BBMD tables. (SiteBuilder defines only one controller per IP subnet as a BBMD.)
- Use the BBMD Configuration Tool to make sure that a controller's BBMD table does not contain the IP addresses of other controllers on the same IP subnet.

To wire to a BACnet/ARC156 network

- 1 Turn **off** the LGR25's power.
- 2 Check the communications wiring for shorts and grounds.
- 3 Connect the communications wiring to the controller's screw terminals labeled **Net +**, **Net -**, and **Shield**.

NOTE Use the same polarity throughout the network segment.

- 4 If the LGR25 is at either end of a network segment, connect a BT485 to the LGR25.
- 5 Turn **on** the LGR25's power.
- 6 Verify communication with the network by viewing a Module Status report in the WebCTRL® interface.

To wire to a BACnet MS/TP network

- 1 Turn **off** the LGR25's power.
- 2 Check the communications wiring for shorts and grounds.
- 3 Connect the communications wiring to the controller's screw terminals labeled **Net+** and **Net-** on **Port S1**.
NOTE Use the same polarity throughout the network segment.
- 4 Set the **MSTP on S1** DIP switch to **Enable (ON)**.
- 5 If the LGR25 is at either end of a network segment, connect a BT485 to the LGR25.
- 6 Turn **on** the LGR25's power.
- 7 To change the port's baud rate, see *To set a port's baud rate using PuTTY* (page 11).
NOTE Use the same baud rate for all controllers on the network segment.

To wire to a BACnet PTP network

- 1 Turn **off** the LGR25's power.
- 2 Check the communications wiring for shorts and grounds.
- 3 Connect the communications wiring to the controller's screw terminals labeled **Tx**, **Rx**, and **Signal Ground** on **Port S2**, and jumper the **DTR** and **DCD** terminals.
NOTE Use the same polarity throughout the network segment.
- 4 Set the **PTP on S2** DIP switch to **Enable (ON)**.
- 5 Turn **on** the LGR25's power.
- 6 To change the port's baud rate, see *To set a port's baud rate using PuTTY* (page 11).
NOTE Use the same baud rate for all controllers on the network segment.

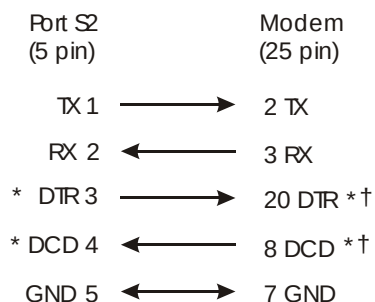
To wire a third-party device

See the *Integration Guide* for the third-party device or protocol.

To wire a modem for half-router communications

If using the LGR25 as a BACnet half-router:

- 1 Turn **off** the LGR25's power.
- 2 Connect the modem to **Port S2** using a standard modem cable connected to an S2-DB9 adapter (available from Automated Logic®) or a cable you create using the following wiring diagram:

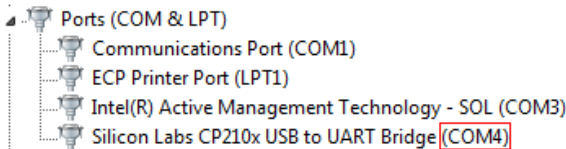


- * Wire connection usually not needed
- ** Needed only if hardware handshaking is used
- † DCD can be hooked up to the DTR signal for self-handshaking

- 3 Set the **PTP on S2** DIP switch to **Enable (ON)**.
- 4 Turn **on** the LGR25's power.
- 5 Set the port baud rate to 38400 using PuTTY. See *To set a port's baud rate using PuTTY* (page 11).

To set a port's baud rate using PuTTY

- 1 Download and install PuTTY from the *PuTTY website* (<http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html>).
- 2 Connect a computer to the LGR25's **Local Access** port. See *To communicate through the local access port* (page 23).
- 3 Set the LGR25's **Enhanced Access** DIP switch to **ON**.
- 4 Turn the LGR25's power **Off**, then **On**.
- 5 Start PuTTY.
- 6 Under **Category > Connection**, select **Serial**.
- 7 Under **Options controlling local serial lines**, enter the following settings:

Field	Value
Serial line to connect to	Replace X with the computer's port number that the USB Link Kit cable is connected to. NOTE To find the port number, select Start > Control Panel > System > Device Manager > Ports (Com & LPT) . The COM port number is beside Silicon Labs CP210x USB to UART Bridge .
	
Speed (baud)	115200
Data Bits	8
Stop Bits	1
Parity	None
Flow Control	None

- 8 Click **Open**. A window similar to the one below appears.

```
BACnet Router, Ethernet MAC address = 00-E0-C9-00-4E-B8
1) Restart
2) Display Modstat
3) IP Address [192.168.168.1]
4) Subnet Mask [255.255.255.0]
5) Default Gateway [0.0.0.0]
6) BACnet/IP UDP Port [0xBAC0]
7) BACnet/IP Network [4824]
8) BACnet/Ethernet Network [4829]
9) BACnet/ARCNET Network [4825]
10) BACnet/MSTP Network [4834]
11) Display B/IP PAD Table
12) Add B/IP PAD Table Entry
13) Delete B/IP PAD Table Entry
14) Clear B/IP PAD Table
15) Set baud rate for MSTP [76800]
16) Set baud rate for PTP [38400]

• The HOME network is updated each time a network number
  is changed (#7-10).

Enter selection: _
```

- 9 Type the number of the baud rate field, then press **Enter**.
- 10 Type the new baud rate, then press **Enter**.
- 11 Type **1**, then press **Enter** to restart the controller.
- 12 When finished, set the LGR25's **Enhanced Access** DIP switch to **OFF** to restore normal functionality to the **Local Access** port.
- 13 Turn the LGR25's power **Off**, then **On**.

Wiring devices to the LGR25's Rnet port

You can wire the following devices to the LGR25's Rnet port in a daisy-chain or star configuration:

- *ZS or RS sensors* (page 13)
- *Wireless Adapter* (page 14) that communicates with wireless sensors
- *Equipment Touch* (page 15)

NOTE ZS sensors, a Wireless Adapter, and an Equipment Touch can share the same Rnet, but not RS sensors.

The Rnet communicates at a rate of 115 kbps.

Rnet wiring specifications

NOTE Use the specified type of wire and cable for maximum signal integrity.

Description	4 conductor, shielded or unshielded, CMP, plenum rated cable
Conductor	22 AWG (7x0096) bare copper
Maximum length	500 feet (152 meters)
Insulation	Low-smoke PVC (or equivalent)
Color Code	Black, white, green, red
Shielding	If shielded, Aluminum/Mylar shield (100% coverage) with TC drain wire
UL temperature rating	32–167 °F (0–75 °C)
Voltage	300 Vac, power limited
Listing	UL: NEC CL2P, or better

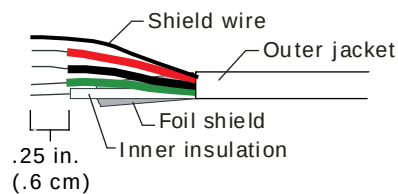
To wire a ZS or an RS sensor to the LGR25

For complete sensor installation instructions, including ZS sensor power requirements, see:

- *ZS Sensors Technical Instructions*
- *RS Sensors Technical Instructions*

1 Turn **off** the LGR25's power.

Partially cut, then bend and pull off the outer jacket of the Rnet cable(s). Do not nick the inner insulation.



2 Strip about .25 inch (.6 cm) of the inner insulation from each wire.

3 Wire each terminal on the LGR25's **Rnet** port to the terminal of the same name on the sensor.

NOTES

- If using shielded wire, connect the shield wire and the ground wire to the **Gnd** terminal.
- Verify that the **Enhanced Access** DIP switch is set to **Off**.

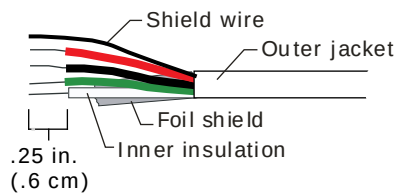
4 Turn **on** the LGR25's power.

To wire a Wireless Adapter to the LGR25

NOTES

- The Wireless Adapter requires a 24 Vac power supply. It is not powered by the Rnet.
- If the Wireless Adapter will be:
 - Daisy-chained on the Rnet with ZS sensors or an Equipment Touch, use the standard 4-conductor Rnet cable.
 - The only device on the Rnet, you can use a 3-conductor cable instead of the standard 4-conductor Rnet cable.
- For complete Wireless Adapter installation instructions, see the *Wireless Sensors Technical Instructions*.

- 1 Turn **off** the LGR25's power.
- 2 Partially cut, then bend and pull off the outer jacket of the Rnet cable(s). Do not nick the inner insulation.



- 3 Strip about .25 inch (.6 cm) of the inner insulation from each wire.
- 4 Wire the LGR25's **Rnet+**, **Rnet-**, and **Gnd** terminals to the terminals of the same name on the Wireless Adapter's Rnet connector.



NOTES

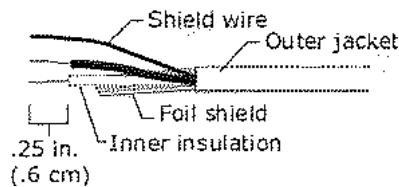
- If using shielded wire, connect the shield wire and the ground wire to the **Gnd** terminal.
 - Verify that the **Enhanced Access** DIP switch is set to **Off**.
- 5 Turn **on** the LGR25's power.

To wire an Equipment Touch to the LGR25

NOTES

- The Equipment Touch requires a 24 Vac power supply. It is not powered by the Rnet.
- If the Equipment Touch will be:
 - Daisy-chained on the Rnet with ZS sensors or a Wireless Adapter, use the standard 4-conductor Rnet wiring and follow the wiring instructions *To wire a ZS or an RS sensor to the LGR25* (page 13).
 - The only device on the Rnet, you can use a 2-conductor cable instead of the standard 4-conductor Rnet cable and follow the instructions below.
- For complete Equipment Touch installation instructions including wiring diagrams, see the *Equipment Touch Installation and Setup Guide*.

- 1 Turn **off** the LGR25's power.
- 2 Partially cut, then bend and pull off the outer jacket of the cable. Do not nick the inner insulation.



- 3 Strip about .25 inch (.6 cm) of the inner insulation from each wire.
- 4 Wire the LGR25's **Rnet+** and **Rnet-** terminals to the terminals of the same name on the Equipment Touch's connector.

NOTES

- If using shielded wire, connect the shield wire and the ground wire to the **Gnd** terminal.
 - Verify that the **Enhanced Access** DIP switch is set to **Off**.
- 5 Turn **on** the LGR25's power.

Downloading the LGR25

Download to send the following items to the LGR25:

Item	Notes
Up to 999 control programs, depending on available memory	Must be in WebCTRLx.x\webroot\<system_name>\programs .
DRV_MELGR_VANILLA driver *	Must be in WebCTRLx.x\webroot\<system_name>\drivers . NOTE To verify that you have the driver's latest version, go to http://accounts.automatedlogic.com/download , then select Drivers > ExecB . Compare the latest version to the LGR25's driver in SiteBuilder.
Editable properties	
Schedules	

* To integrate a third-party device into your WebCTRL® system, you must use the driver for the specific protocol or device. Go to <http://accounts.automatedlogic.com/download>, then select **Third-party Integration > Third-party Interface (ME-LGR & LGR)**.

If you change any of the above items or the LGR25's address after the initial download, you must download again. The first download takes longer than subsequent downloads.



CAUTIONS

- The LGR25 will lose stored data when you download.
- Equipment controlled by the LGR25 will shut down and restart when you download.
- After you download, the **Archive Valid** LED lights to indicate the downloaded items are stored in the LGR25's flash memory. This type of memory is not dependent on power or battery backup. If you need to remove power from the controller after downloading, make sure this LED is lit.

To download from the WebCTRL® interface

If your network is complete, you can download from any network browser. If not complete, connect a laptop with a local copy of the system database to the LGR25's local access port. See *To communicate through the local access port* (page 23).

- 1 On the WebCTRL® **Network**  tree, select the controller.
- 2 Click **Downloads**.
- 3 Do one of the following:
 - If the controller is in the Downloads list, go to step 4.
 - If the controller is not in the list:
 - a. Click **Add**.
 - b. In the pop-up, select the controller.
 - c. Select **All Content**.
 - d. Click **Add**.
 - e. Click **Close**.
- 4 Select the controller in the Downloads list.
- 5 Click **Start**.

NOTES

- If the download fails, locate and resolve the problem, then retry the download.
- You can also download a controller from the **Devices** page.

To set up the driver

After you download the driver and control program(s) to the LGR25, you may want to change the driver's properties in the WebCTRL® interface to suit your application.

- 1 On the WebCTRL® **Network**  tree, click  to the left of your LGR25.
- 2 Click  to the left of **Driver** to see its children.
- 3 Make changes as needed on the **Properties** page for **Driver** and any of its children.

Driver

On the **Driver** page, you can change the following properties:

- Backup battery conservation settings. See table below.
- Module clock synchronization and failure. See table below.
- Network Input microblock communication properties.

Backup Battery

Turn off internal backup battery after ___ days to conserve battery life (shutoff date/time)

How long backup battery should run after power loss.



TIP Downloading activates the battery backup. To conserve battery life when you know the LGR25 will be without power for an extended period after downloading (for example, during shipment):

- 1 Verify the **Archive Valid** LED is lit, then set this field to 0.
- 2 After you install the LGR25 and apply power, enter a number greater than 0.

BACview Control

Keypad Inactivity timeout (minutes)

Log out the user (if a user-level password is required), turn off the backlight, and display the standby screen after this period of inactivity.

Keypad user-level password

Numeric password user must enter to access system through a BACview® device.

TouchScreen Control

TouchScreen Schedule Edit Enable

Check this field to allow a user to edit this controller's schedules from an Equipment Touch's Schedules screen.

Module Clock	
Clock Fail Date and Time	Date and time the control program uses when controller's real-time clock is invalid.  TIP Use an occupied date and time (such as a Tuesday at 10 a.m.) so the equipment does not operate in unoccupied mode if the controller loses power during occupancy.
Time Synch Sensitivity (seconds)	When the controller receives a time sync request, if the difference between the controller's time and the time sync's time is greater than this field's value, the controller's time is immediately changed. If the difference is less than this field's value, the controller's time is slowly adjusted until the time is correct.
Network Microblocks	
Number of poll retries before Network Input Microblocks indicate failure	The maximum number of retries after the initial attempt that a Network microblock will attempt to communicate with its target device. If unsuccessful, the point will transition to an idle state for 30 seconds before attempting to communicate again. Change this field only if directed by Technical Support.
Periodic rebinding interval	If a microblock uses a wildcard in its address, this timer determines how often the microblock will attempt to find the nearest instance of its target. For example, if an outside air temperature address uses a wildcard, a VAV application will look for the outside air temperature on the same network segment or on the nearest device containing that object.
BACnet COV Throttling	
Enable COV Throttling	Under normal circumstances, COV Throttling should be enabled to prevent excessive network traffic if an object's COV Increment is set too low. See EXCEPTION below. When enabled, if an object generates excessive COV broadcasts (5 updates in 3 seconds), the driver automatically throttles the broadcasts to 1 per second. Also, if the object's value updates excessively for 30 seconds, an alarm is sent to the WebCTRL® application listing <u>all</u> objects that are updating excessively. A Return-to-normal alarm is sent only after <u>all</u> objects have stopped updating excessively. EXCEPTION: In rare circumstances, such as process control, a subscribing object may require COV updates more frequently than once per second. For these situations, clear this checkbox, but make sure that your network can support the increased traffic. You will also need to disable the Excessive COV alarms under the driver's Common Alarms.
Trend Sampling	
Collect a daily midnight sample for all points in this controller that are sampling on COV	For values that change infrequently, select to verify at midnight daily that the point is still able to communicate trend values.

Device

On the **Device** page, you can change the following properties:

- BACnet device object properties for the LGR25
- LGR25 communication

Configuration	NOTE The three APDU fields refer to all networks over which the LGR25 communicates.
Max Masters and Max Info Frames	Apply only if the LGR25's MS/TP network is enabled.

Notification Classes

Alarms in the WebCTRL® application use Notification Class #1. A BACnet alarm's Notification Class defines:

- Alarm priority for Alarm, Fault, and Return to Normal states
- Options for BACnet alarm acknowledgment
- Where alarms should be sent (recipients)

Priorities	NOTE BACnet defines the following Network message priorities for Alarms and Events.										
	<table><tr><th>Priority range</th><th>Network message priority</th></tr><tr><td>00–63</td><td>Life Safety</td></tr><tr><td>64–127</td><td>Critical Equipment</td></tr><tr><td>128–191</td><td>Urgent</td></tr><tr><td>192–255</td><td>Normal</td></tr></table>	Priority range	Network message priority	00–63	Life Safety	64–127	Critical Equipment	128–191	Urgent	192–255	Normal
Priority range	Network message priority										
00–63	Life Safety										
64–127	Critical Equipment										
128–191	Urgent										
192–255	Normal										
Priority of Off-Normal	BACnet priority for Alarms.										
Priority of Fault	BACnet priority for Fault messages.										
Priority of Normal	BACnet priority for Return-to-normal messages.										
Ack Required for Off-Normal, Fault, and Normal	Specifies whether alarms associated with this Notification Class require a BACnet Acknowledgment for Off-Normal, Fault, or Normal alarms.  TIP You can require operator acknowledgment for an Alarm or Return-to-normal message (stored in the WebCTRL® database). In the WebCTRL® interface on the Alarm > Enable/Disable tab, change the acknowledgment settings for an alarm source or an alarm category.										
Recipient List											
Recipients	The first row in this list is the WebCTRL® application. Do not delete this row. Click Add if you want other BACnet devices to receive alarms associated with this Notification Class.										
Recipient Description	Name that appears in the Recipients table.										

Recipient Type	Use Address (static binding) for either of the following: - Third-party BACnet device recipients that do not support dynamic binding - When you want alarms to be broadcast (you must uncheck Issue Confirmed Notifications). This use is rare.
Days and times	The days and times during which the recipient will receive alarms.
Recipient Device Object Identifier	Type the Device Instance from SiteBuilder (or from the network administrator for third-party devices) in the # field.
Process Identifier	Change for third-party devices that use a BACnet Process Identifier other than 1. The WebCTRL® application processes alarms for any 32-bit Process Identifier.
Issue Confirmed Notifications	Select to have a device continue sending an alarm message until it receives delivery confirmation from the recipient.
Transitions to Send	Uncheck the types of alarms you do not want the recipient to get.

Calendars

Calendars are provided in the driver for BACnet compatibility only. Instead, use the **Schedules** feature in the WebCTRL® interface.

Common and Specific Alarms

On these pages, you can enable/disable, change BACnet alarm properties, or set delays for the following BACnet alarms:

Common alarms:

- Module Halted
- All Programs Stopped
- Duplicate Address
- Locked I/O
- Control Program
- Program Stopped
- Excessive COV

Specific alarm:

- Dead Module Timeout
- Low Battery Alarm
- Pneumatic Unstable Alarm
- Pneumatic Leak Alarm
- Low Main Air Alarm

NOTE To set up alarm actions for controller generated alarms, see *Setting up alarm actions* in WebCTRL® Help.

Module Generated Alarm	
Description	Short message shown on the Alarms page or in an alarm action when this type of alarm is generated.
Events	
Alarm Category and Alarm Template	See <i>Customizing alarms</i> in WebCTRL® Help.
Enable	Clear these checkboxes to disable Alarm or Return to normal messages of this type from this controller.
Notification Class	Do not change this field.

Custom Translation Tables

Does not apply to the LGR25.

I/O Tuning

Does not apply to the LGR25.

Pneumatic Lines

Does not apply to the LGR25.

BACnet router properties

On the **BACnet router properties** page, you can change the following properties:

- IP address of the router in the controller and the system database
- BACnet routing settings
- Color and prime variable caching settings

IP Configuration	
Allow remote management of IP configuration	For future use.
Enable IP configuration changeover	Select to remotely change the router's IP Address, Subnet Mask, and Default Gateway Address. Type the new addresses and the UDP Port that your server is using to communicate to all controllers. In the Changeover timeout field, enter: • 0:00 to have the controller use the Next settings as soon as the controller can communicate with the Next Default Gateway Address. • A specific length of time to have the controller use the Next settings as soon as the controller can communicate with the Next Default Gateway Address, or when the timeout expires, whichever occurs first. See "To remotely change a controller's IP address" in WebCTRL® Help for more information on using this feature.
BACnet Router Options	
Ignore all Reject-Message-to-Network, Reason=1 messages	Clear to delete and rediscover a router if a network's router indicates that the network is no longer present (reason=1). Select to continue routing messages to a network even if its router indicates that the network is no longer present.
Color/Prime Variable Caching	

Disable Color Cache	Clear (enable) to improve responsiveness in retrieving colors. Select (disable): • To reduce network traffic to third-party (non-color-supporting) devices • If using the LGR25 on the controller network, not as a router NOTE Selecting this checkbox also disables dead module alarms.
Dead Module Timeout	After this period (minutes:seconds) of non-response from an ExecB controller, the router sends an alarm to the server.

BACnet half-router properties

On the **BACnet Half Router Properties** page, you can change the communication settings for an LGR25 used as a BACnet half-router (dial-up connection) on a remote network. For more information, go to <http://accounts.automatedlogic.com/findinfo> and search for *Setting up a remote network*.

Alarm Store/Forward

On the **Alarm Store and Forward** page, you can change alarm delivery settings for the LGR25 used to store and forward alarms from a remote dial-up site.

BACnet firewall

Requires v6-02 or later driver

If this IP controller is accessible from the Internet, you can increase security by enabling its BACnet firewall. When enabled, this feature prevents the controller from receiving BACnet messages from unidentified sources and allows communication only with IP addresses that you define. These can be all private IP addresses and/or a list of IP addresses. Follow the instructions in the WebCTRL® interface to set up the BACnet firewall.

Protocols

On the **Protocols** page, you can enable or disable Telnet diagnostics. This allows you to write to a text file the communication between the controller and a third party device. This file is used for troubleshooting.

Xnet

Does not apply to the LGR25.

Expanders

Does not apply to the LGR25.

To communicate through the local access port

Using a computer and a USB Link Kit, you can communicate locally with the LGR25 to download or to troubleshoot.

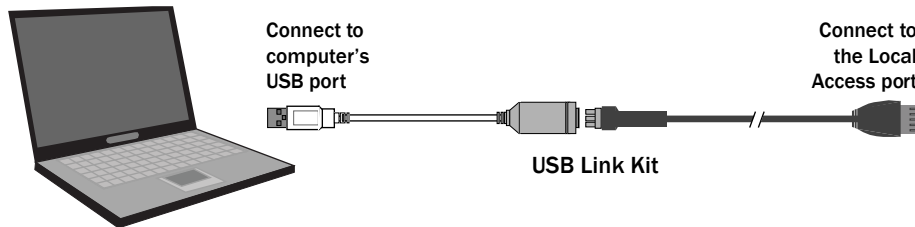
PREREQUISITES

- A computer with a USB port
- A USB Link Kit. See the *USB Link Kit Technical Instructions*.
NOTE The USB Link Kit driver is installed with a WebCTRL® v5 or later system. But if needed, you can get the latest driver from <http://www.silabs.com/products/mcu/Pages/USBtoUARTBridgeVCPDrivers.aspx>. Install the driver before you connect the USB Link Kit to your computer.
- The controller driver drv_melgr_vanilla v1.73a.038 or later



CAUTION If multiple controllers share power but polarity was not maintained when they were wired, the difference between the controller's ground and the computer's AC power ground could damage the USB Link Kit and the controller. If you are not sure of the wiring polarity, use a USB isolator between the computer and the USB Link Kit. Purchase a USB isolator online from a third-party manufacturer.

- 1 Connect the USB Link Kit to the computer and to the controller's Local Access port.



NOTE If using a USB isolator, plug the isolator into your computer's USB port, and then plug the USB Link Kit cable into the isolator.

- 2 Set the controller's **Enhanced Access** DIP switch.

To communicate in...	Set switch to...
The WebCTRL® application	Off
PuTTY or HyperTerminal	On
SiteBuilder to set a custom IP address	On

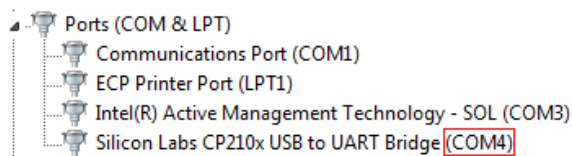
- 3 Turn the controller's power off, then on again.

To set up a Local Access connection in the WebCTRL® interface

For the WebCTRL® application to communicate with the Local Access port, you must do the following:

- 1 On the **System Configuration**  tree, select **Connections**.
- 2 On the **Configure** tab, click **Add**.
- 3 From the **Type** drop-down list, select **BACnet Local Access**.
- 4 Optional: Edit the **Description**.
- 5 Type the computer's **Port** number that the USB cable is connected to.

NOTE To find the port number, plug the USB cable into the computer's USB port, then select **Start** > **Control Panel** > **System** > **Device Manager** > **Ports (Com & LPT)**. The COM port number is beside **Silicon Labs CP210x USB to UART Bridge**.



- 6 Set the **Baud** rate to 115200.
- 7 Click **Accept**.
- 8 On the **View** tab, click the button next to the BACnet/IP network, then select **BACnet Local Access**.
- 9 Click **Accept**.
- 10 On the **Configure** tab, select **BACnet Local Access**, then click **Start**.
NOTE If an error message appears, make sure the COM port you selected is not in use. For example, PuTTY may be open and is holding the port open.
- 11 On the **Network**  tree, select the controller that you are connected to.
- 12 Click , then select **Manual Command**.
- 13 Type `rnet` here in the dialog box, then click **OK**.
- 14 On the **Properties** page, click **Module Status**. If a Modstat report appears, the WebCTRL® application is communicating with the controller.

Troubleshooting

If you have problems mounting, wiring, or addressing the LGR25, contact ALC Technical Support.

LEDs

The **Module Status** LED can display the following error codes.

Error Code...	Indicates...	Possible solutions
0	The control program or driver has not been downloaded.	Download All Content to the LGR25. See <i>Downloading the LGR25</i> (page 16).
1	A control program error	Obtain a Module Status Report (Modstat) and look for error conditions. See <i>To get the controller's serial number</i> (page 26) for instructions on obtaining a Modstat. If you cannot determine the error from the Modstat, send a screenshot of the Modstat to Technical Support.
2	The controller's memory is full	In the WebCTRL® interface, reduce the amount of trend data being stored in the controller. In SiteBuilder, reduce the amount of control programs.
3	A setup error	Verify: • The address has been set on the rotary switches. See <i>Addressing the LGR25</i> (page 5). • The address is unique on the network • DIP switches are set correctly
4	A system error	Obtain a Module Status Report (Modstat) and look for error messages. See <i>To get the controller's serial number</i> (page 26) for instructions on obtaining a Modstat. If you cannot determine the error from the Modstat, send a screenshot of the Modstat to Technical Support.
7	An abnormal restart	See solution above for #4.
8	The controller is formatting	The number 8 should display only during the short formatting period. If this number displays continuously or flashes intermittently with another number, try each of the following: • Turn the LGR25's power off, then on. • Format the LGR25. See <i>To format the controller</i> (page 26). • Download the controller. See <i>Downloading the LGR25</i> (page 16). • Replace the LGR25.

Other LED's show the status of certain functions.

If this LED is on...	Status is...
Power	The LGR25 has power.
Link	The controller is connected to the Ethernet.
LAN	The Ethernet port is transmitting or receiving data.
100	The connection speed is 100 Mbps. If LED is not lit, the connection speed is 10 Mbps.
CMnet transmit	The LGR25 is transmitting data over the controller network.
CMnet receive	The LGR25 is receiving data from the controller network.
Archive Valid	The controller's memory backup is valid.
Port S1 transmit	The LGR25 is transmitting data from Port S1 .
Port S1 receive	The LGR25 is receiving data on Port S1 .
Battery low	The battery is low.

Formatting the controller

If you cannot communicate with a controller after downloading it, as a last resort, you can manually format the controller to erase its memory.

- 1 Turn **off** the LGR25's power.
- 2  Make sure the address switches are not set to 0, 0.
- 3 Hold down the controller's **Format** button while you turn its power on.
- 4 Continue to hold down the **Format** button until the controller displays **8** and then **0**, then release the button.
- 5 Download the LGR25.

To get the LGR25's serial number

If you need the LGR25's serial number when troubleshooting, the number is on:

- a sticker on the back of the main controller board
- a Module Status report (Modstat) under **Core** (or **Main**) **board hardware**

```
Core board hardware:
Type=176, board=1, manufactured on 06/27/2013 S/N 021362247P
RAM: 512 kBytes; FLASH: 1024 kBytes, type = S
```

To obtain a modstat in the WebCTRL® interface:

- 1 Select the LGR25 in the **Network**  tree.
- 2 On the **Properties** page, click **Module Status**.

Recovering from a power outage

Battery function

The LGR25 has a 10-year Lithium CR123A battery that retains the following data for a maximum of 720 hours during power outages.

- Time
- Control programs
- Editable properties
- Schedules
- Trends

To conserve battery life, you can set the driver to turn off battery backup after a specified number of days and depend on the archive function to restore data when the power returns. See *To set up the driver > Driver* (page 17).

Archive function

The following items are archived to non-volatile Flash memory daily and after every power up or download.

- Control programs
- Editable properties
- Schedules

If a power outage occurs and the battery backup fails or is turned off after a specified number of days, the above data is automatically restored from the archive. If changes were made in the WebCTRL® interface since the last archive, you may need to download parameters after power returns to correct any mismatches.

You can see the status of the latest archive in the WebCTRL® interface on the controller's **Driver** page under **Flash Memory Archive**.

Replacing the LGR25's battery

If the LGR25's **Battery low** LED is lit or if the LGR25 sends a **Low Battery** alarm to the WebCTRL® application, replace the battery.

- 1 Verify that the LGR25's power is on.
- 2 Using a small flathead screwdriver, pry up each side of the black battery clip until it is free and you can remove it.
- 3 Remove the battery from the controller, making note of the battery's polarity.
- 4 Insert the new battery into the controller, matching the polarity of the battery you removed.
- 5 Push the black clip back onto the battery until you hear both sides click in place.
- 6 Download the LGR25.

To take the LGR25 out of service

If needed for troubleshooting or start-up, you can prevent the WebCTRL® application from communicating with the LGR25.

- 1 On the WebCTRL® **Network**  tree, select the LGR25.
- 2 On the **Properties** page, check **Out of Service**.
- 3 Click **Accept**.

Compliance

FCC Compliance

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.



CAUTION Changes or modifications not expressly approved by the responsible party for compliance could void the user's authority to operate the equipment.

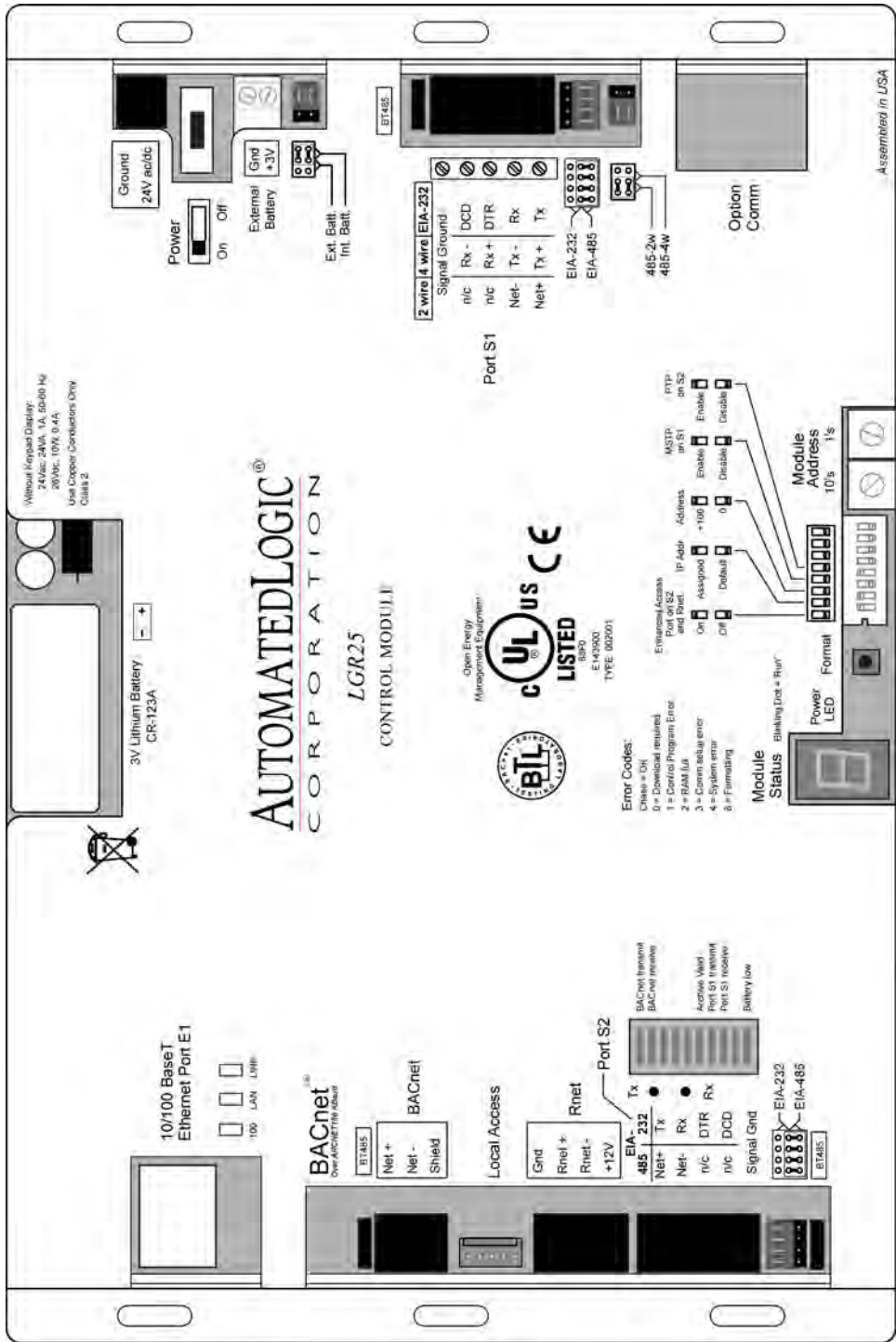
CE Compliance



WARNING This is a Class A product. In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate measures.

BACnet Compliance

Compliance of listed products to requirements of ASHRAE Standard 135 is the responsibility of BACnet International. BTL® is a registered trademark of BACnet International.



Document revision history

Important changes to this document are listed below. Minor changes such as typographical or formatting errors are not listed.

Date	Topic	Change description	Code*
2/6/17	Specifications	Added wireless sensors to the Rnet port specification.	X-D
	Zone sensors	Added wireless sensors to this topic.	
	Equipment Touch	Added Wireless Adapter to this topic.	
	Wiring devices to the Rnet port	Added Wireless Adapter to this topic.	
	To wire a Wireless Adapter to the LGR25	New topic.	
10/3/16	To set up a Local Access connection in the WebCTRL interface	Updated WebCTRL menu button in step 12.	A-D
	Appendix - LGR25 coverplate	Updated coverplate	A-D
8/12/16	LEDs	Added description of #7 LED to table.	X-TS-RB-F
3/1/16	BACnet firewall	New topic	A-D
4/16/15	Entire document	New look, no content changes	A-D
11/14/14	BACnet Compliance	Changed BACnet Manufacturers Association to BACnet International	X-D-CP-MW
10/7/14	Driver	Added the Network Microblock fields	A-TS-RB-F
7/22/14	Equipment Touch	Changed 5 ZS sensors to 15 ZS sensors	X-D
5/13/14	Specifications	Rnet Port: Added Equipment Touch and removed BACview® devices	A-D-CP-O-TC
	Zone sensors	Removed references to BACview	
	Equipment Touch	New topic	
	BACview devices	Removed topic	
	Wiring zone sensors to the LGR25	Changed to "Wiring devices to the LGR25's Rnet port"	
	To wire an Equipment Touch to the LGR25	New topic	
	To set up the driver > Driver	Added new driver property: TouchScreen Schedule Edit Enable	

* For internal use only

ME812u Controller

Technical Instructions

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Verify that you have the most current version of this document. Go to <https://accounts.automatedlogic.com>, then select **Support > Download > Documents > Hardware**. Important changes are listed in **Document revision history** at the end of this document.

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What is the ME812u?

The ME812u is a general-purpose controller that you can use to control multiple pieces of equipment simultaneously. The ME812u can communicate BACnet/ARCNET at 156 kbps or BACnet MS/TP at 9600 bps, 19.2 kbps, 38.4 kbps, or 76.8 kbps.

SOFTWARE REQUIREMENT WebCTRL® v6.0 or later

Using expanders

To add inputs or outputs to the ME812u, you can attach up to 5 MEx, MX, or X expanders to the ME812u. Do not attach MEx expanders to a controller with MX/X expanders. See an expander's *Technical Instructions* for more information.

Driver and control program

Driver	drv_melgr_vanilla  WARNING You must use v2-04-139 or later driver.
Maximum number of control programs*	999
Maximum number of BACnet objects*	12000

* Depends on available memory.

Specifications

Power	24 Vac $\pm 10\%$, 50–60 Hz, 50 VA 26 Vdc $\pm 10\%$, 23 W
BACnet port	For communication with the controller network using ARC156 or MS/TP (9600 bps–76.8 kbps)
Rnet port	Supports: • Up to 15 ZS sensors • One Wireless Adapter that communicates with up to 15 wireless sensors • One Equipment Touch • Up to 4 RS Standard sensors and one RS Plus, RS Pro, or RS Pro-F sensor NOTE ZS sensors, a Wireless Adapter, and an Equipment Touch can share the Rnet, but not RS sensors.
Rnet Local Access port	For system start-up and troubleshooting

Expansion	Up to 5 expanders with a maximum of 192 points
Inputs	12 inputs, configurable for 0–5 Vdc, 0–10 Vdc, 0–20 mA, RTD, thermistor, or dry contact
Input resolution	14 bit A/D
Input pulse frequency	40 pulses per second. Minimum pulse width (on or off time) required for each pulse is 25 msec.
Outputs	8 outputs for 24 Vdc relay driver, 0–10 Vdc, or 0–20 mA
Output resolution	12 bit D/A
Microprocessor	32-bit Motorola Power PC microprocessor with cache memory, Fast Ethernet controller, high performance 32-bit communication co-processor, ARCNET communication co-processor, and I/O expansion CAN co-processor
Memory	16 MB non-volatile battery-backed RAM (with 12 MB available for use), 8 MB Flash memory, 32-bit memory bus
Real-time clock	Battery-backed real-time clock keeps track of time in event of power failure
Battery	10-year Lithium CR123A battery retains the following data for a maximum of 720 hours during power outages: time, control programs, editable properties, schedules, and trends. To conserve battery life, you can set the driver to turn off battery backup after a specified number of days and depend on the archive function to restore data when the power returns. A low battery is indicated by the Battery low LED or a low battery alarm in the WebCTRL® application.
Data archive	Control programs, editable properties, and schedules are archived to non-volatile Flash memory daily and after every power up or download. If a power outage occurs and the battery backup fails or is turned off, the data is automatically restored from this archive.
Protection	Incoming power is protected by a replaceable 3 Amp Pico® fuse. Network connections are protected by non-replaceable internal solid-state polyswitches that reset themselves when the condition that causes a fault returns to normal. The power, network, input, and output connections are also protected against transient excess voltage/surge events lasting no more than 10 msec.
BT485 connector	You attach a BT485 (not included) to a controller at the beginning and end of a network segment to add bias and to terminate a network segment.
Status indicators	LED's indicate status of communications and low battery status. Seven segment display indicates running, error, and power status.
Environmental operating range	-20 to 140°F (-29 to 60°C), 10–90% relative humidity, non-condensing NOTE Install in a UL Listed enclosure only.
Physical	Rugged aluminum cover, removable screw-type terminal blocks
Overall dimensions	Height: 11 5/16 in. (28.7 cm) Width: 7 1/2 in. (19 cm)
Mounting dimensions	Height: 10 13/16 in. (27.5 cm) Width: 5 in. (12.7 cm)

Recommended panel depth	2 3/4 in. (7cm)
Weight	1.4 lbs (0.64 kg)
BACnet support	Conforms to the BACnet Advanced Application Controller (B-AAC) Standard Device Profile as defined in ANSI/ASHRAE Standard 135-2012 (BACnet) Annex L, Protocol Revision 9
Listed by	UL-916 (PAZX), cUL-916 (PAZX7), FCC Part 15-Subpart B-Class A, CE

Inputs

The ME812u has 12 inputs that accept the following signal types.

Signal Type	Description
Thermistor ¹	Precon type 2 (10 kOhm at 77 °F). Input voltages should be from 0.489 Vdc to 3.825 Vdc for thermistors.
Dry contact	A 5 Vdc wetting voltage detects contact position, resulting in a 1 mA maximum sense current when the contacts are closed.
0–5 Vdc 0–10 Vdc	The output impedance of a 0–5 Vdc or a 0–10 Vdc source must not exceed 200 Ohms. The input impedance of the ME812u is approximately 20 kOhm.
0–20 mA	The input resistance on the positive (+) terminal is 250 Ohms. The Aux Power Out connector is capable of supplying 24 Vdc to multiple 4–20 mA transducers, but the total current demanded must not exceed 200 mA. If the voltage measured from the Aux Power Out connector to Gnd is less than 18 Vdc, you need to use an external power supply.
RTD ¹	Platinum - 1 kOhm at 32 °F (0 °C) Nickel/Iron - 1 kOhm at 70 °F (21 °C) Balco TS8000 - 1 kOhm at 70 °F (21 °C) Input voltages should be from 0.6–1.2 V NOTE Automated Logic® recommends use of an external current transducer between an RTD and the ME812u.
Pulse counter ²	Pulse counting up to 40 pulses per second. Minimum pulse width (on or off time) required for each pulse is 25 msec.

¹ To use a thermistor or RTD not listed above, you can set up a *custom translation table* (page 25) for your sensor.

² The ME812u can perform pulse counting for dry contact or voltage inputs if you assign the input to a Pulse to Analog Input microblock. See *To assign inputs or outputs to points* (page 18).

NOTE If you have one or more RTD's connected to the inputs, the total current draw of all Thermistor, RTD, and Dry contact devices wired to the inputs should not exceed 10 mA. Exceeding this limit will affect the accuracy of the RTD's. Use the following approximations as a reference:

- 10 kOhm Thermistor draws approximately 0.334 mA
- 1 kOhm RTD draws approximately 0.834 mA
- Dry contact draws approximately 1 mA

For example, if you connect 12 RTD's to the inputs, you cannot use the remaining 4 inputs for Thermistor, RTD, or Dry contact devices. This assumes negligible wiring impedance (<10 Ohms) for each RTD input with up to 100 feet of 22 AWG cable.

Outputs

The ME812u has 8 universal outputs that you can use as digital outputs or analog outputs. The outputs support:

- driving external 24 Vdc relays
- 0-10 Vdc devices
- 0-20 mA devices



WARNING Do not apply 24 Vac to these universal outputs.

If output controls a...	Resistance to ground must be...
0–10 Vdc device	500 Ohms minimum
0–20 mA device	800 Ohms maximum

NOTES

- The device must share the same ground as the controller.
- The total output current from all outputs and the **Aux Power Out** connector must not exceed:
500 mA at 115 °F
300 mA at 140 °F
For temperatures above 115 °F, use the following equation to calculate the total current at 8 mA per degree:
$$500\text{mA} - ((\text{max. expected temp.} - 115^{\circ}\text{F}) * 8\text{mA})$$

Zone sensors

Automated Logic® wireless sensors

You can connect a Wireless Adapter to ME812u's **Rnet** port. The Wireless Adapter communicates with up to 15 wireless sensors. When using wireless sensors, the Rnet can have:

- Up to 15 wireless and ZS sensors (any combination)
- One Wireless Adapter
- One Equipment Touch

ZS sensors

You can wire up to 15 ZS sensors to the ME812u's **Rnet** port. ZS sensors can share the Rnet with the devices listed above.

NOTE A control program can use no more than 5 ZS Sensors, so you must use multiple control programs if your Rnet network has more than 5 sensors.

RS sensors

You can wire RS sensors to the ME812u's **Rnet** port. An Rnet can consist of any of the following combinations of devices wired in a daisy-chain or star configuration:

- 1 RS Plus, RS Pro, or RS Pro-F
- 1–4 RS Standards
- 1–4 RS Standards, and 1 RS Plus, RS Pro, or RS Pro-F

NOTE RS sensors cannot share the Rnet with other devices.

Equipment Touch devices

You can wire an Equipment Touch to the ME812u's Rnet port to view or change the controller's property values, schedule equipment, view trends and alarms, and more, without having to access the system's server. The Rnet can have one Equipment Touch, one Wireless Adapter, and up to 15 ZS sensors. RS sensors cannot share the Rnet with an Equipment Touch.

To mount the ME812u

Screw the ME812u into an enclosed panel using the mounting holes provided on the cover plate. Leave about 2 in. (5 cm) on each side of the controller for wiring.

If using expanders, see the following section(s) before mounting the controller.

To attach MEx expanders

See the MEx expander's *Technical Instructions* for mounting options.

Use ARC156 wiring to wire the MEx expander to the controller. Do not exceed 100 feet total wire length. See *Wiring for Communications* in the expander's *Technical Instructions* for complete wiring specifications.

- 1 Wire the ME812u's **Xnet Remote Expansion** port to the same port on the MEx expander.

NOTE To use more than one expander, wire their **Xnet Remote Expansion** ports together in a daisy-chain configuration. The ME812u must be the first device on the expander network.

- 2 Set the ME812u's **Xnet/Mx** DIP switch to **Xnet**.

NOTE You must set the Xnet baud rate to 500 kbps in the WebCTRL® interface on the driver's **Xnet** page. See *To set up the driver* (page 21).

To attach MX or X expanders

Arrange the ME812u and expanders in one or two columns, placing the ME812u at the top of a column.

- 1 Connect the devices' **Expansion** connectors.

NOTES

- To mount the expander, place spacers behind its mounting holes so that its **Expansion** connector will align with the connector on the ME812u. See table below to purchase the appropriate spacers.
- If you use 2 columns, use an MX expander cable to connect an **Expansion** connector in the first column to an **Expansion** connector in the second column. See the expander's *Technical Instructions* for more information.

- 2 Set the ME812u's **Xnet/Mx** DIP switch to **Mx**.

Expander...	Requires 2 spacers...	ALC part number
MX040, MX400, MX440	Small	254901
MX080, MX4106, MX4106p, MX800, MX8102, MX880	Medium	254900
MX0160, MX0320, MX1600, MX16160	Large	254902

Wiring for power



WARNING Do not apply line voltage (mains voltage) to the controller's ports and terminals.



CAUTIONS

- The ME812u is powered by a Class 2 power source. Take appropriate isolation measures when mounting it in a control panel where non-Class 2 circuits are present.
- Automated Logic® controllers can share a power supply as long as you:
 - Maintain the same polarity.
 - Use the power supply only for Automated Logic® controllers.

NOTE For the controller to recognize an attached expander, you must turn on the expander before you turn on the controller.

To wire for power

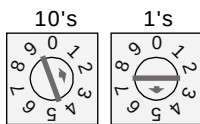
- 1 Make sure the ME812u's power switch is in the **OFF** position to prevent it from powering up before you can verify the correct voltage.
- 2 Remove power from the power supply.
- 3 Pull the screw terminal connector from the controller's power terminals labeled **24ac/26dc** and **Return** (Ground).
- 4 Connect the transformer wires to the screw terminal connector.
- 5 Apply power to the power supply.
- 6 Measure the voltage at the ME812u's power input terminals to verify that the voltage is within the operating range of 21.6–26.4 Vac.
- 7 Insert the screw terminal connector into the ME812u's power terminals.
- 8 Turn **on** the ME812u's power.
- 9 Verify that the Run LED (a dot in the lower right corner of the **Module Status** LED) begins blinking. The **Module Status** LED will show a chase pattern when the controller is running with no errors.

To address the ME812u

You must give the ME812u an address that is unique on the network. You can address the ME812u before or after you wire it for power.

- 1 If wired for power, turn off the controller's power.
- 2  The controller only reads the rotary switch positions during power up or upon reset.
- 3 Using the rotary switches, set the controller's address to match the **Address** in the controller's properties dialog box in SiteBuilder. Set the **Tens (10's)** switch to the tens digit of the address, and set the **Ones (1's)** switch to the ones digit.

EXAMPLE If the controller's address is 25, point the arrow on the **Tens (10's)** switch to 2 and the arrow on the **Ones (1's)** switch to 5.



Wiring for communications

The ME812u communicates on the following ports.

Port	Protocol	Port type(s)	Baud rate(s)
BACnet	BACnet/ARC156 ¹	EIA-485 (2-wire)	156 kbps
	BACnet MS/TP	EIA-485 (2-wire)	9600 bps
			19.2 kbps
			38.4 kbps
			76.8 kbps (default)
Local Access	Enhanced Access	Rnet ²	115.2 kbps

¹ ARC156 is a unique implementation of the industry standard ARCNET. For a summary of differences between ARCNET and ARC156, see the *ARC156 Wiring Technical Instructions*.

² See *To communicate through the local access port* (page 27).

Wiring specifications

For...	Use...	Maximum Length
ARC156 ¹ and MS/TP ²	22 AWG, low-capacitance, twisted, stranded, shielded copper wire	2000 feet (610 meters)

¹ See the *ARC156 Wiring Technical Instructions*.

² See the *MS/TP Networking and Wiring Technical Instructions*.



WARNING Do not apply line voltage (mains voltage) to the controller's ports and terminals.

To wire to a BACnet/ARC156 network

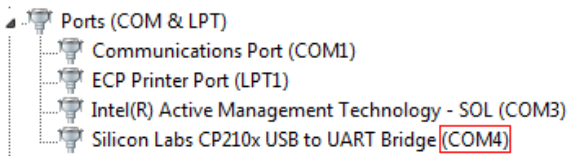
- 1 Turn **off** the ME812u's power.
- 2 Check the communications wiring for shorts and grounds.
- 3 Connect the communications wiring to the BACnet port's screw terminals labeled **Net +**, **Net -**, and **Shield**.
NOTE Use the same polarity throughout the network segment.
- 4 Set the **BACnet Mode** jumper to ARC156.
- 5 If the ME812u is at either end of a network segment, connect a BT485 to the ME812u.
- 6 Turn **on** the ME812u's power.
- 7 Verify communication with the network by viewing a Module Status report in the WebCTRL® interface.

To wire to a BACnet MS/TP network

- 1 Turn **off** the ME812u's power.
- 2 Check the communications wiring for shorts and grounds.
- 3 Connect the communications wiring to the BACnet port's screw terminals labeled **Net +**, **Net -**, and **Shield**.
NOTE Use the same polarity throughout the network segment.
- 4 Set the **BACnet Mode** jumper to MSTP.
- 5 If the ME812u is at either end of a network segment, connect a BT485 to the ME812u.
- 6 Turn **on** the ME812u's power.
- 7 To change the port's baud rate, see *To set a port's baud rate using PuTTY* (page 9).
NOTE Use the same baud rate for all controllers on the network segment.

To set a port's baud rate using PuTTY

- 1 Download and install PuTTY from the *PuTTY website* (<http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html>).
- 2 Connect a computer to the ME812u's **Local Access** port. See *To communicate through the local access port* (page 27).
- 3 Set the ME812u's **Enhanced Access** DIP switch to **ON**.
- 4 Turn the ME812u's power **Off**, then **On**.
- 5 Start PuTTY.
- 6 Under **Category > Connection**, select **Serial**.
- 7 Under **Options controlling local serial lines**, enter the following settings:

Field	Value
Serial line to connect to	Replace X with the computer's port number that the USB Link Kit cable is connected to. NOTE To find the port number, select Start > Control Panel > System > Device Manager > Ports (Com & LPT) . The COM port number is beside Silicon Labs CP210x USB to UART Bridge . 
Speed (baud)	115200
Data Bits	8
Stop Bits	1
Parity	None
Flow Control	None

- 8 Click **Open**. A window similar to the one below appears.

```
BACnet Router, Ethernet MAC address = 00-E0-C9-00-4E-B8
1) Restart
2) Display Modstat
3) IP Address [192.168.168.1]
4) Subnet Mask [255.255.255.0]
5) Default Gateway [0.0.0.0]
6) BACnet/IP UDP Port [0xBAC0]
7) BACnet/IP Network [4824]
8) BACnet/Ethernet Network [4829]
9) BACnet/ARCNET Network [4825]
10) BACnet/MSTP Network [4834]
11) Display B/IP PAD Table
12) Add B/IP PAD Table Entry
13) Delete B/IP PAD Table Entry
14) Clear B/IP PAD Table
15) Set baud rate for MSTP [76800]
16) Set baud rate for PTP [38400]

• The HOME network is updated each time a network number
  is changed (#7-10).

Enter selection: _
```

- 9 Type the number of the baud rate field, then press **Enter**.
- 10 Type the new baud rate, then press **Enter**.
- 11 Type **1**, then press **Enter** to restart the controller.
- 12 When finished, set the ME812u's **Enhanced Access** DIP switch to **OFF** to restore normal functionality to the **Local Access** port.
- 13 Turn the ME812u's power **Off**, then **On**.

Wiring inputs and outputs

Wiring specifications

Input wiring

Input	Maximum length	Minimum gauge	Shielding
Thermistor Dry contact	1000 feet (305 meters)	22 AWG	Shielded
0–5 Vdc 0–10 Vdc	1000 feet (305 meters)	26 AWG	Shielded
0–20 mA	3000 feet (914 meters)	26 AWG	Shielded or unshielded
RTD	100 feet (30 meters)	22 AWG	Shielded
ZS sensor RS sensor Wireless Adapter for wireless sensors Equipment Touch	See <i>Wiring devices to the ME812u's Rnet port</i> (page 13).		

NOTE Automated Logic® recommends use of an external current transducer between an RTD and the ME812u.

Output wiring

To size output wiring, consider the following:

- Total loop distance from the power supply to the controller, and then to the controlled device
NOTE Include the total distance of actual wire. For 2-conductor wires, this is twice the cable length.
- Acceptable voltage drop in the wire from the controller to the controlled device
- Resistance (Ohms) of the chosen wire gauge
- Maximum current (Amps) the controlled device requires to operate

To wire inputs and outputs



WARNING Do not apply line voltage (mains voltage) to the controller's ports and terminals.

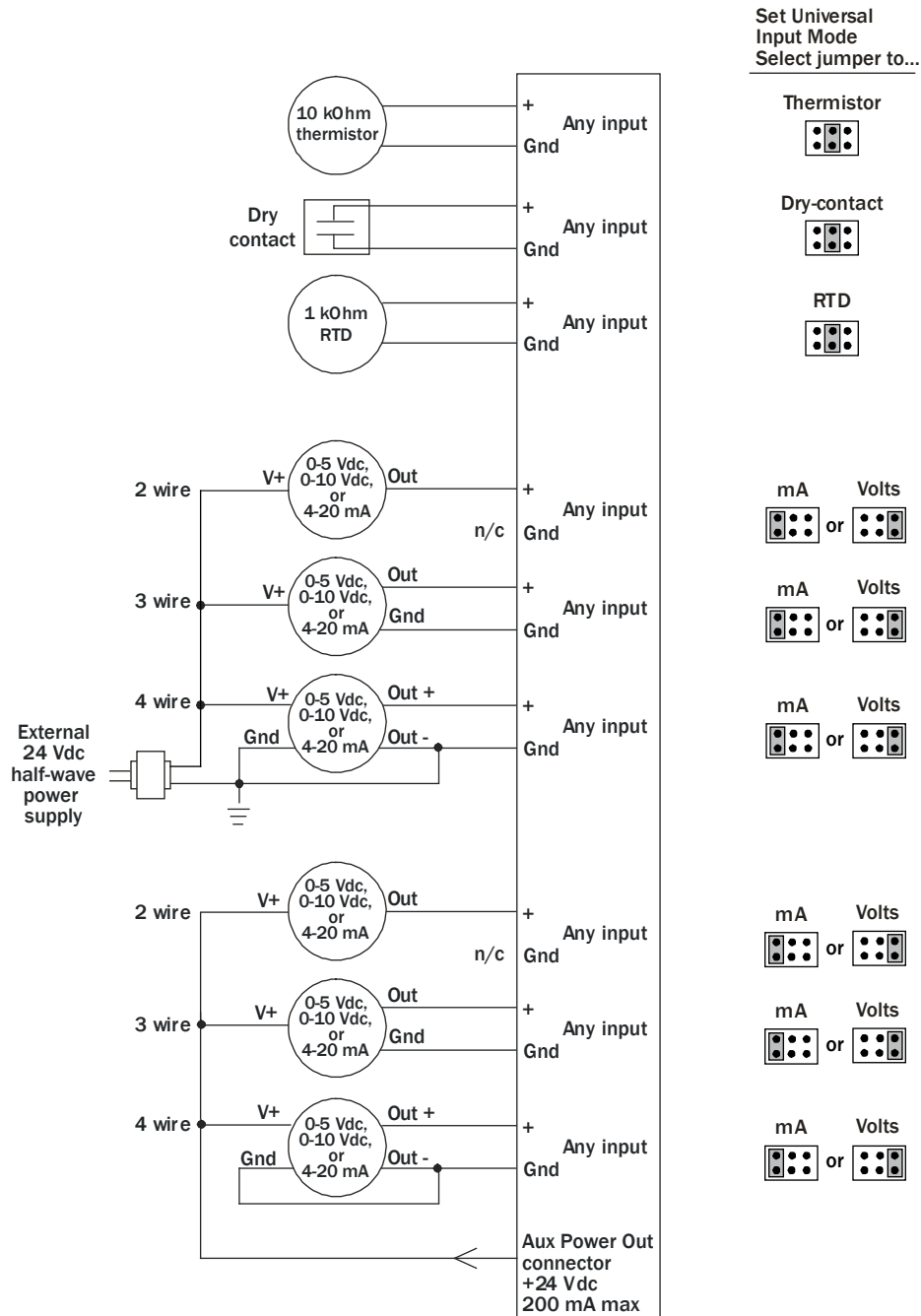
NOTE If the ME812u has an expander mounted to its coverplate, see *ME812u coverplate* (page 34) for the location of connectors, switches, and jumpers.

- 1 Verify that the ME812u's power and communications connections work properly.
- 2 Turn **off** the ME812u's power.

3 Connect the input wiring to the screw terminals on the ME812u. See figure below.

NOTES

- Connect the shield wire to the **GND** terminal with the ground wire.
- For a loop-powered 4-20 mA sensor, wire the sensor's positive terminal to the **+** terminal on the ME812u's **Aux Power Out** connector. Wire the sensor's negative terminal to an input's **+** terminal.

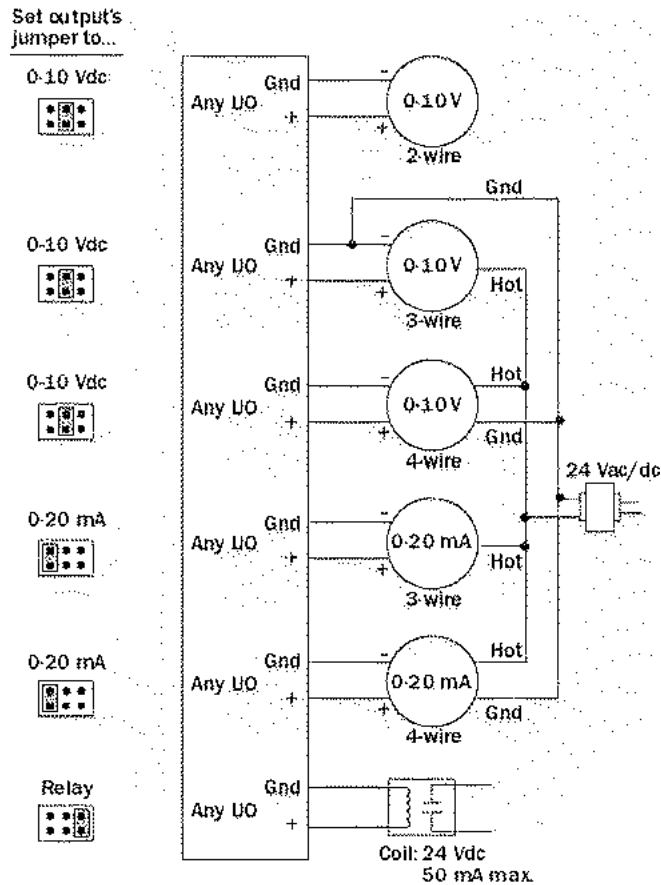


4 Set each input's **Universal Input Mode Select** jumper to indicate the type of input.

- 5 Connect digital and analog output wiring to the **UO** screw terminals on the ME812u and to the controlled device. Connect the ground wire to the UO's **Gnd** terminal.



WARNING Do not apply 24 Vac to these universal outputs.



- 6 Set each output's jumper to the type of device wired to the output.
- 7 For each digital output, turn the output's potentiometer clockwise until it stops (maximum output).
- 8 Turn **on** the ME812u's power.

Wiring devices to the ME812u's Rnet port

You can wire the following devices to the ME812u's Rnet port in a daisy-chain or star configuration:

- ZS or RS sensors (page 14)
- *Wireless Adapter* (page 15) that communicates with wireless sensors
- *Equipment Touch* (page 16)

NOTE ZS sensors, a Wireless Adapter, and an Equipment Touch can share the same Rnet, but not RS sensors.

The Rnet communicates at a rate of 115 kbps.

Rnet wiring specifications

NOTE Use the specified type of wire and cable for maximum signal integrity.

Description	4 conductor, shielded or unshielded, CMP, plenum rated cable
Conductor	22 AWG (7x0096) bare copper
Maximum length	500 feet (152 meters)
Insulation	Low-smoke PVC (or equivalent)
Color Code	Black, white, green, red
Shielding	If shielded, Aluminum/Mylar shield (100% coverage) with TC drain wire
UL temperature rating	32–167 °F (0–75 °C)
Voltage	300 Vac, power limited
Listing	UL: NEC CL2P, or better

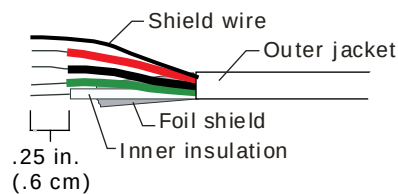
To wire a ZS or an RS sensor to the ME812u

For complete sensor installation instructions, including ZS sensor power requirements, see:

- *ZS Sensors Technical Instructions*
- *RS Sensors Technical Instructions*

- 1 Turn **off** the ME812u's power.

Partially cut, then bend and pull off the outer jacket of the Rnet cable(s). Do not nick the inner insulation.



- 2 Strip about .25 inch (.6 cm) of the inner insulation from each wire.
- 3 Wire each terminal on the ME812u's **Rnet** port to the terminal of the same name on the sensor.

NOTES

- If using shielded wire, connect the shield wire and the ground wire to the **Gnd** terminal.
- Verify that the **Enhanced Access** DIP switch is set to **Off**.

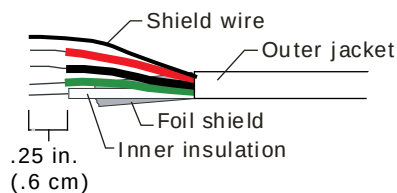
- 4 Turn **on** the ME812u's power.

To wire a Wireless Adapter to the ME812u

NOTES

- The Wireless Adapter requires a 24 Vac power supply. It is not powered by the Rnet.
- If the Wireless Adapter will be:
 - Daisy-chained on the Rnet with ZS sensors or an Equipment Touch, use the standard 4-conductor Rnet cable.
 - The only device on the Rnet, you can use a 3-conductor cable instead of the standard 4-conductor Rnet cable.
- For complete Wireless Adapter installation instructions, see the *Wireless Sensors Technical Instructions*.

- 1 Turn **off** the ME812u's power.
- 2 Partially cut, then bend and pull off the outer jacket of the Rnet cable(s). Do not nick the inner insulation.



- 3 Strip about .25 inch (.6 cm) of the inner insulation from each wire.
- 4 Wire the ME812u's **Rnet+**, **Rnet-**, and **Gnd** terminals to the terminals of the same name on the Wireless Adapter's Rnet connector.



NOTES

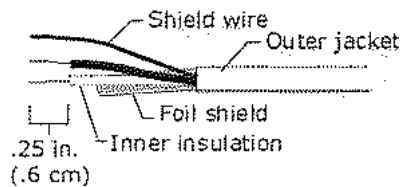
- If using shielded wire, connect the shield wire and the ground wire to the **Gnd** terminal.
 - Verify that the **Enhanced Access** DIP switch is set to **Off**.
- 5 Turn **on** the ME812u's power.

To wire an Equipment Touch to the ME812u

NOTES

- The Equipment Touch requires a 24 Vac power supply. It is not powered by the Rnet.
- If the Equipment Touch will be:
 - Daisy-chained on the Rnet with ZS sensors or a Wireless Adapter, use the standard 4-conductor Rnet wiring and follow the wiring instructions *To wire a ZS or an RS sensor to the ME812u* (page 14).
 - The only device on the Rnet, you can use a 2-conductor cable instead of the standard 4-conductor Rnet cable and follow the instructions below.
- For complete Equipment Touch installation instructions including wiring diagrams, see the *Equipment Touch Installation and Setup Guide*.

- 1 Turn **off** the ME812u's power.
- 2 Partially cut, then bend and pull off the outer jacket of the cable. Do not nick the inner insulation.



- 3 Strip about .25 inch (.6 cm) of the inner insulation from each wire.
- 4 Wire the ME812u's **Rnet+** and **Rnet-** terminals to the terminals of the same name on the Equipment Touch's connector.

NOTES

- If using shielded wire, connect the shield wire and the ground wire to the **Gnd** terminal.
 - Verify that the **Enhanced Access** DIP switch is set to **Off**.
- 5 Turn **on** the ME812u's power.

Downloading the ME812u

Download to send the following items to the ME812u:

Item	Notes
Up to 999 control programs, depending on available memory	Must be in WebCTRLx.x\webroot\<system_name>\programs .
DRV_MELGR_VANILLA driver	Must be in WebCTRLx.x\webroot\<system_name>\drivers . NOTE To verify that you have the driver's latest version, go to http://accounts.automatedlogic.com/download , then select Drivers > ExecB . Compare the latest version to the ME812u's driver in SiteBuilder.
Editable properties	
Schedules	

If you change any of the above items or the ME812u's address after the initial download, you must download again. The first download takes longer than subsequent downloads.



CAUTIONS

- The ME812u will lose stored data when you download.
- Equipment controlled by the ME812u will shut down and restart when you download.
- After you download, the **Archive Valid** LED lights to indicate the downloaded items are stored in the ME812u's flash memory. This type of memory is not dependent on power or battery backup. If you need to remove power from the controller after downloading, make sure this LED is lit.

To download from the WebCTRL® interface

If your network is complete, you can download from any network browser. If not complete, connect a laptop with a local copy of the system database to the ME812u's local access port. See *To communicate through the local access port* (page 27).

- 1 On the WebCTRL® **Network**  tree, select the controller.
- 2 Click **Downloads**.
- 3 Do one of the following:
 - If the controller is in the Downloads list, go to step 4.
 - If the controller is not in the list:
 - a. Click **Add**.
 - b. In the pop-up, select the controller.
 - c. Select **All Content**.
 - d. Click **Add**.
 - e. Click **Close**.
- 4 Select the controller in the Downloads list.
- 5 Click **Start**.

NOTES

- If the download fails, locate and resolve the problem, then retry the download.
- You can also download a controller from the **Devices** page.

To assign inputs or outputs to points

To use an input or output, you must assign it to its corresponding point in the control program.

- 1 In the WebCTRL® **Geographic**  tree, select the equipment controlled by the ME812u.
- 2 On the **Properties** page, select the **I/O Points** tab.
- 3 In each point's **Num** field, type the number of the controller's corresponding input or output. For example, if you use DO1 on the ME812u for the point **Pump S/S**, type 1 in the **Num** field for **Pump S/S**.

NOTES

- **Exp** (expander number) is 00 for the ME812u.
 - Do not assign the same output number to more than one point.
- 4 Enter the appropriate values for each input and output in the remaining columns. See *Input values*, *Output values*, *Resolution values* and *Offset/Polarity values* below.
NOTE You can also enter these values in the EIKON® LogicBuilder application.
 - 5 If you have not performed the initial download to the ME812u, you must download now so you can verify inputs and outputs.
 - 6 To verify each input's operation, force each sensor to a known value, then compare it to the **Value** shown on the **Properties** page on the **I/O Points** tab.
 - 7 To verify each output's operation, lock each output to a known condition on the **I/O Points** tab, then verify that the equipment operates correctly.

Input values

Input	I/O Type	Sensor/Actuator Type	Min/Max
Analog (BAI)			
0-5 Vdc	0-5 Volt	Linear Full Range	Engineering values associated with 0 Vdc (Min) and 5 Vdc (Max) ¹
0-10 Vdc	0-10 Volt	Linear Full Range	Engineering values associated with 0 Vdc (Min) and 10 Vdc (Max) ¹
2-10 Vdc	0-10 Volt	Linear w/Offset, 2-10 Volts	Engineering values associated with 2 Vdc (Min) and 10 Vdc (Max) ¹
0-20 mA	0-20 mA	Linear Full Range	Engineering values associated with 0 mA (Min) and 20 mA (Max) ¹
4-20 mA	0-20 mA	Linear w/Offset, 4-20 mA	Engineering values associated with 4 mA (Min) and 20 mA (Max) ¹

Input	I/O Type	Sensor/Actuator Type	Min/Max
RTD	RTD Input	Select your RTD type or set up and select a Non-Linear, Custom Table ²	N/A
Thermistor	Thermistor	Select your Thermistor type or set up and select a Non-Linear, Custom Table ²	N/A
Pulse to Analog (BPTA) ³			
Pulse Counter	Counter Input	N/A	N/A
Digital (Binary) (BBI)			
Dry Contact	Dry Contact	N/A	N/A

¹ The sensor reads a value and sends a corresponding signal (Volt, mA, or psi) to the ME812u's physical input. The Analog Input microblock uses the **Min** and **Max** values to linearly translate the signal into the engineering value used in subsequent control logic. For example, set **Min** to 0 and **Max** to 10 for a 4–20 mA sensor that measures velocity from 0.0 to 10.0 inches/second so that when the input reads 4 mA, the microblock outputs a value of 0. Similarly, when the input reads 8 mA, the microblock outputs a value of 2.5.

² You can set up a *custom translation table* (page 25) on the driver's **Custom Translation Tables** pages in the WebCTRL® interface.

³ The control program must have one Pulse to Analog Input microblock for each pulse counting input.

Output values

Output	I/O Type	Sensor/Actuator Type	Min/Max
Analog (BAO)			
0–10 Vdc	Electrical 0–10 Volt	Linear Full Range	Engineering values associated with 0 Vdc (Min) and 10 Vdc (Max) ¹
2–10 Vdc	Electrical 0–10 Volt	Linear w/Offset, 2–10 Volts	Engineering values associated with 2 Vdc (Min) and 10 Vdc (Max) ¹
0–20 mA	Electrical 0–20 mA	Linear Full Range	Engineering values associated with 0 mA (Min) and 20 mA (Max) ¹
4–20 mA	Electrical 0–20 mA	Linear w/Offset, 4–20 mA	Engineering values associated with 4 mA (Min) and 20 mA (Max) ¹
Digital (Binary) (BBO)			
Relay	Relay/Triac Output	N/A	N/A

¹ The Analog Output microblock uses the **Min** and **Max** values to linearly translate its EIKON® LogicBuilder wire value into a physical output signal (Volt, mA, or psi) sent from the ME812u to an actuator. For example, set **Min** to 0 and **Max** to 100 for an Analog Output microblock that receives a 0 to 100% open signal from a PID microblock and that controls a 0–10 Vdc actuator so that when the PID signal is 100%, the ME812u output is 10 Vdc. Similarly, when the PID signal is 50%, the ME812u output is 5 Vdc.

Resolution values

Resolution is not particular to a type of input or output, but the driver handles analog and digital (binary) inputs and outputs differently. To set these values appropriately, you should understand how the driver uses them.

Resolution	Notes
Analog Input (BAI)	The driver truncates the microblock's present value according to the resolution. EXAMPLE If the calculated present value is 13.789 and you set the Resolution to 0.1, the control program uses 13.7 for any calculations downstream from the microblock.
Analog Output (BAO)	The driver truncates the wire input value to the microblock before performing any scaling calculations. EXAMPLE If the wire input value is 13.789 and you set the Resolution to 0.1, the microblock uses 13.7 for any scaling calculations.
Digital Inputs and Outputs	N/A

Offset/Polarity values

Offset/Polarity is not particular to a type of input or output, but the driver handles analog and digital (binary) inputs and outputs differently. To set these values appropriately, you should understand how the driver uses them.

Offset/Polarity	Notes
Analog Input (BAI)	Offset value (positive or negative) adds a fine adjustment to a sensor reading after all scaling for calibration. EXAMPLE If a sensor reads 74.9°F when the actual measured value is 73.6°F, enter an Offset of -1.3 to calibrate the sensor to the measured value.
Analog Output (BAO)	You can use the Offset value (positive or negative) to calibrate an output, but you generally do not need to. If used, the driver adds the offset value to the wire input value before performing any scaling calculations to determine the ME812u's output.
Digital (Binary) Input (BBI)	Polarity determines the microblock's present value when no signal is received from the equipment. When no signal is received from the equipment, if Polarity is set to: normal —present value is off reversed —present value is on
Digital (Binary) Output (BBO)	Polarity determines the ME812u's output based on the control program's signal to the microblock. When the control program's signal to the microblock is on , if Polarity is set to: normal —output is on reversed —output is off NOTE Regardless of Polarity , the output will be off if the ME812u loses power.

To use the Auto-Off-On switches

NOTE If the ME812u has an expander mounted to its coverplate, see *ME812u coverplate* (page 34) for the location of switches.

You can control an output using the **Auto-Off-On** switch.

Set the switch to...	To...
On	Turn on the output.
Off	Turn off the output
Auto	Let the control program control the output

The potentiometer, located between the **Auto-Off-On** switch and the jumper, allows you to manually control the output level of an analog output. Place the **Auto-Off-On** switch in the **On** position, then turn the potentiometer counterclockwise to reduce the output, or clockwise to increase the output.



For a digital output, turn the potentiometer clockwise until it stops (maximum output) and leave it in this position.

The control program can monitor the status of an **Auto-Off-On** switch and display the status on the control program's **Properties** page > **I/O Points** tab in the WebCTRL® interface. The **Value** of the point monitoring the **Auto-Off-On** switch shows **Off** if the switch is set to **Auto**, and **On** if the switch is set to **Off** or **On**.

To monitor an Auto-Off-On switch

- 1 Insert a BACnet Binary Input microblock in the control program.
- 2 On the microblock's **Properties** page in the WebCTRL® interface, set the **I/O Type** field to **H-O-A Status Feedback**.
- 3 In the **Input Number** field, type the number of the output you want to monitor.

To set up the driver

After you download the driver and control program(s) to the ME812u, you may want to change the driver's properties in the WebCTRL® interface to suit your application.

- 1 On the WebCTRL® **Network**  tree, click  to the left of your ME812u.
- 2 Click  to the left of **Driver** to see its children.
- 3 Make changes as needed on the **Properties** page for **Driver** and any of its children.

Driver

On the **Driver** page, you can change the following properties:

- Backup battery conservation settings. See table below.
- Module clock synchronization and failure. See table below.
- Network Input microblock communication properties.

Backup Battery	
Turn off internal backup battery after ____ days to conserve battery life (shutoff date/time)	How long backup battery should run after power loss.  TIP Downloading activates the battery backup. To conserve battery life when you know the ME812u will be without power for an extended period after downloading (for example, during shipment): 1 Verify the Archive Valid LED is lit, then set this field to 0. 2 After you install the ME812u and apply power, enter a number greater than 0.
BACview Control	
Keypad Inactivity timeout (minutes)	Log out the user (if a user-level password is required), turn off the backlight, and display the standby screen after this period of inactivity.
Keypad user-level password	Numeric password user must enter to access system through a BACview® device.
TouchScreen Control	
TouchScreen Schedule Edit Enable	Check this field to allow a user to edit this controller's schedules from an Equipment Touch's Schedules screen.
Module Clock	
Clock Fail Date and Time	Date and time the control program uses when controller's real-time clock is invalid.  TIP Use an occupied date and time (such as a Tuesday at 10 a.m.) so the equipment does not operate in unoccupied mode if the controller loses power during occupancy.
Time Synch Sensitivity (seconds)	When the controller receives a time sync request, if the difference between the controller's time and the time sync's time is greater than this field's value, the controller's time is immediately changed. If the difference is less than this field's value, the controller's time is slowly adjusted until the time is correct.
Network Microblocks	
Number of poll retries before Network Input Microblocks indicate failure	The maximum number of retries after the initial attempt that a Network microblock will attempt to communicate with its target device. If unsuccessful, the point will transition to an idle state for 30 seconds before attempting to communicate again. Change this field only if directed by Technical Support.
Periodic rebinding interval	If a microblock uses a wildcard in its address, this timer determines how often the microblock will attempt to find the nearest instance of its target. For example, if an outside air temperature address uses a wildcard, a VAV application will look for the outside air temperature on the same network segment or on the nearest device containing that object.

BACnet COV Throttling	
Enable COV Throttling	Under normal circumstances, COV Throttling should be enabled to prevent excessive network traffic if an object's COV Increment is set too low. See EXCEPTION below. When enabled, if an object generates excessive COV broadcasts (5 updates in 3 seconds), the driver automatically throttles the broadcasts to 1 per second. Also, if the object's value updates excessively for 30 seconds, an alarm is sent to the WebCTRL® application listing <u>all</u> objects that are updating excessively. A Return-to-normal alarm is sent only after <u>all</u> objects have stopped updating excessively. EXCEPTION: In rare circumstances, such as process control, a subscribing object may require COV updates more frequently than once per second. For these situations, clear this checkbox, but make sure that your network can support the increased traffic. You will also need to disable the Excessive COV alarms under the driver's Common Alarms.
Trend Sampling	
Collect a daily midnight sample for all points in this controller that are sampling on COV	For values that change infrequently, select to verify at midnight daily that the point is still able to communicate trend values.

Device

On the **Device** page, you can change the following properties:

- BACnet device object properties for the ME812u
- ME812u communication

Configuration	NOTE The three APDU fields refer to all networks over which the ME812u communicates.
Max Masters and Max Info Frames	Apply only if the ME812u's MS/TP network is enabled.

Notification Classes

Alarms in the WebCTRL® application use Notification Class #1. A BACnet alarm's Notification Class defines:

- Alarm priority for Alarm, Fault, and Return to Normal states
- Options for BACnet alarm acknowledgment
- Where alarms should be sent (recipients)

Priorities	NOTE BACnet defines the following Network message priorities for Alarms and Events.	
	Priority range	Network message priority
	00–63	Life Safety
	64–127	Critical Equipment
	128–191	Urgent
	192–255	Normal
Priority of Off-Normal	BACnet priority for Alarms.	
Priority of Fault	BACnet priority for Fault messages.	
Priority of Normal	BACnet priority for Return-to-normal messages.	
Ack Required for Off-Normal, Fault, and Normal	Specifies whether alarms associated with this Notification Class require a BACnet Acknowledgment for Off-Normal, Fault, or Normal alarms.  TIP You can require operator acknowledgment for an Alarm or Return-to-normal message (stored in the WebCTRL® database). In the WebCTRL® interface on the Alarm > Enable/Disable tab, change the acknowledgment settings for an alarm source or an alarm category.	
Recipient List		
Recipients	The first row in this list is the WebCTRL® application. Do not delete this row. Click Add if you want other BACnet devices to receive alarms associated with this Notification Class.	
Recipient Description	Name that appears in the Recipients table.	
Recipient Type	Use Address (static binding) for either of the following: • Third-party BACnet device recipients that do not support dynamic binding • When you want alarms to be broadcast (you must uncheck Issue Confirmed Notifications). This use is rare.	
Days and times	The days and times during which the recipient will receive alarms.	
Recipient Device Object Identifier	Type the Device Instance from SiteBuilder (or from the network administrator for third-party devices) in the # field.	
Process Identifier	Change for third-party devices that use a BACnet Process Identifier other than 1. The WebCTRL® application processes alarms for any 32-bit Process Identifier.	
Issue Confirmed Notifications	Select to have a device continue sending an alarm message until it receives delivery confirmation from the recipient.	
Transitions to Send	Uncheck the types of alarms you do not want the recipient to get.	

Calendars

Calendars are provided in the driver for BACnet compatibility only. Instead, use the **Schedules** feature in the WebCTRL® interface.

Common and Specific Alarms

On these pages, you can enable/disable, change BACnet alarm properties, or set delays for the following BACnet alarms:

Common alarms:

- Module Halted
- All Programs Stopped
- Duplicate Address
- Locked I/O
- Control Program
- Program Stopped
- Excessive COV

Specific alarm:

- Dead Module Timeout
- Low Battery Alarm
- Pneumatic Unstable Alarm
- Pneumatic Leak Alarm
- Low Main Air Alarm

NOTE To set up alarm actions for controller generated alarms, see *Setting up alarm actions* in WebCTRL® Help.

Module Generated Alarm	
Description	Short message shown on the Alarms page or in an alarm action when this type of alarm is generated.
Events	
Alarm Category and Alarm Template	See <i>Customizing alarms</i> in WebCTRL® Help.
Enable	Clear these checkboxes to disable Alarm or Return to normal messages of this type from this controller.
Notification Class	Do not change this field.

Custom Translation Tables

You can set up a translation table that an analog input will use to translate the raw data from a non-linear sensor to the engineering units you want it to output on the wire. In the **Network**  tree, select **Custom Translation Table #1, #2, or #3**. The **Properties** page has instructions. For the input to use the translation table, navigate to the input in the **Geographic**  tree, select the **Details** tab, then set **Sensor Type (Scaling Method)** to **Non-Linear, Custom Table #__**.

I/O Tuning

Applies if an expander with pneumatic analog outputs is attached to the ME812u.

On the **I/O Tuning** page, you can change communication and control settings for pneumatic inputs and outputs.

Pneumatic control power up delay (seconds)	Delay after controller is reset before pneumatic control is available.
Refresh all channels every ____ seconds	Each pneumatic output is refreshed at this interval and when its setpoint changes.
Maximum service time per channel (seconds)	Time allowed for each output to reach setpoint.
Use coarse control when more than ____ PSI beyond setpoint	Coarse control allows faster but less accurate pressure changes. Use fine control when pressure is closer than this value to setpoint.
Fine control supply gain	Proportional gain used when setpoint is greater than current pressure. Larger actuators require higher gains.
Fine control bleed gain	Proportional gain used when setpoint is less than current pressure.
Fine control minimum valve pulse length (msec)	The shortest duration that a pneumatic valve is pulsed open when making fine adjustments to the line pressure. NOTE Enter an even multiple of 10msec between 20 and 4000.
"on" pressure for pneumatic digital outputs (psi)	Pressure maintained by digital outputs that are ON.
"off" pressure for pneumatic digital outputs (psi)	Pressure maintained by digital outputs that are OFF.
Main air low pressure limit (psi)	Trigger Low Main Air Alarm when main air pressure drops below this value.

Pneumatic Lines

Applies if an expander with pneumatic analog outputs is attached to the ME812u.
This page shows pneumatic line status information.

BACnet router properties

Select **Disable Color Cache**. The other BACnet router properties do not apply to the ME812u.

BACnet half-router properties

Does not apply to the ME812u.

Alarm Store/Forward

On the **Alarm Store and Forward** page, you can change alarm delivery settings for the ME812u used to store and forward alarms from a remote dial-up site.

BACnet firewall

Does not apply to the ME812u.

Xnet

If the ME812u has MEx expanders attached, you can change the baud rate and communications timeout on the **Xnet** page.

Xnet Configuration	
Data Rate	Set at 500 kbps.
Comm. Timeout (seconds)	If the expander does not receive communication from the controller for this amount of time, the expander will reset itself. The range is 15–300 seconds.

Expanders

If the ME812u has expanders attached, the **Expanders** page displays expander status information.

To communicate through the local access port

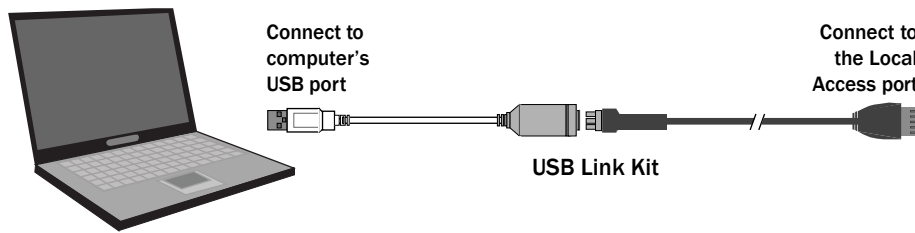
Using a computer and a USB Link Kit, you can communicate locally with the ME812u to download or to troubleshoot.

PREREQUISITES

- A computer with a USB port
- A USB Link Kit. See the *USB Link Kit Technical Instructions*.
NOTE The USB Link Kit driver is installed with a WebCTRL® v5 or later system. But if needed, you can get the latest driver from <http://www.silabs.com/products/mcu/Pages/USBtoUARTBridgeVCPDrivers.aspx>. Install the driver before you connect the USB Link Kit to your computer.
- The controller driver drv_melgr_vanilla v2-04-139 or later

 **CAUTION** If multiple controllers share power but polarity was not maintained when they were wired, the difference between the controller's ground and the computer's AC power ground could damage the USB Link Kit and the controller. If you are not sure of the wiring polarity, use a USB isolator between the computer and the USB Link Kit. Purchase a USB isolator online from a third-party manufacturer.

- 1 Connect the USB Link Kit to the computer and to the controller's Local Access port.



NOTE If using a USB isolator, plug the isolator into your computer's USB port, and then plug the USB Link Kit cable into the isolator.

- 2 Set the controller's **Enhanced Access** DIP switch.

To communicate In...	Set switch to...
The WebCTRL® application	Off
PuTTY or HyperTerminal	On
SiteBuilder to set a custom IP address	On

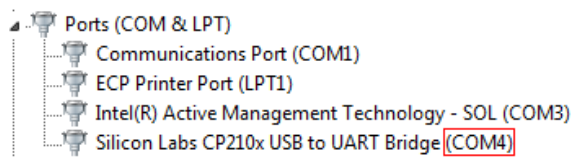
- 3 Turn the controller's power off, then on again.

To set up a Local Access connection in the WebCTRL® interface

For the WebCTRL® application to communicate with the Local Access port, you must do the following:

- 1 On the **System Configuration**  tree, select **Connections**.
- 2 On the **Configure** tab, click **Add**.
- 3 From the **Type** drop-down list, select **BACnet Local Access**.
- 4 Optional: Edit the **Description**.
- 5 Type the computer's **Port** number that the USB cable is connected to.

NOTE To find the port number, plug the USB cable into the computer's USB port, then select **Start > Control Panel > System > Device Manager > Ports (Com & LPT)**. The COM port number is beside **Silicon Labs CP210x USB to UART Bridge**.



- 6 Set the **Baud** rate to 115200.
- 7 Click **Accept**.
- 8 On the **View** tab, click the button next to the BACnet/IP network, then select **BACnet Local Access**.
- 9 Click **Accept**.
- 10 On the **Configure** tab, select **BACnet Local Access**, then click **Start**.

NOTE If an error message appears, make sure the COM port you selected is not in use. For example, PuTTY may be open and is holding the port open.

- 11 On the **Network**  tree, select the controller that you are connected to.
- 12 Click , then select **Manual Command**.
- 13 Type `rnet` here in the dialog box, then click **OK**.
- 14 On the **Properties** page, click **Module Status**. If a Modstat report appears, the WebCTRL® application is communicating with the controller.

Troubleshooting

If you have problems mounting, wiring, or addressing the ME812u, contact ALC Technical Support.

LED's

The **Module Status** LED can display the following error codes.

Error Code...	Indicates...	Possible solutions
0	The control program or driver has not been downloaded.	Download All Content to the ME812u. See <i>Downloading the ME812u</i> (page 17).
1	A control program error	Obtain a Module Status Report (Modstat) and look for error conditions. See <i>To get the controller's serial number</i> (page 31) for instructions on obtaining a Modstat. If you cannot determine the error from the Modstat, send a screenshot of the Modstat to Technical Support.
2	The controller's memory is full	In the WebCTRL® interface, reduce the amount of trend data being stored in the controller. In SiteBuilder, reduce the amount of control programs.
3	A setup error	Verify: • The address has been set on the rotary switches. See <i>Addressing the ME812u</i> (page 7). • The address is unique on the network • DIP switches are set correctly
4	A system error	Obtain a Module Status Report (Modstat) and look for error messages. See <i>To get the controller's serial number</i> (page 31) for instructions on obtaining a Modstat. If you cannot determine the error from the Modstat, send a screenshot of the Modstat to Technical Support.
7	An abnormal restart	See solution above for #4.

Error Code...	Indicates...	Possible solutions
8	The controller is formatting	The number 8 should display only during the short formatting period. If this number displays continuously or flashes intermittently with another number, try each of the following: • Turn the ME812u's power off, then on. • Format the ME812u. See <i>To format the controller</i> (page 30). • Download the controller. See <i>Downloading the ME812u</i> (page 17). • Replace the ME812u.

Other LED's show the status of certain functions.

If this LED is on...	Status is...
Power	The ME812u has power
BACnet TX	The ME812u is transmitting data over the controller network.
BACnet RX	The ME812u is receiving data from the controller network.
Archive Valid	The controller's memory backup is valid
Brownout	Incoming power is low
Battery low	The battery is low

Formatting the controller

If you cannot communicate with a controller after downloading it, as a last resort, you can manually format the controller to erase its memory.

- 1 Turn **off** the ME812u's power.
- 2  Make sure the address switches are not set to 0, 0.
- 3 Hold down the controller's **Format** button while you turn its power on.
- 4 Continue to hold down the **Format** button until the controller displays **8** and then **0**, then release the button.
- 5 Download the ME812u.

To get the ME812u's serial number

If you need the ME812u's serial number when troubleshooting, the number is on:

- a sticker on the back of the main controller board
- a Module Status report (Modstat) under **Core** (or **Main**) **board hardware**



To obtain a modstat in the WebCTRL® interface:

- 1 Select the ME812u in the **Network**  tree.
- 2 On the **Properties** page, click **Module Status**.

Recovering from a power outage

Battery function

The ME812u has a 10-year Lithium CR123A battery that retains the following data for a maximum of 720 hours during power outages.

- Time
- Control programs
- Editable properties
- Schedules
- Trends

To conserve battery life, you can set the driver to turn off battery backup after a specified number of days and depend on the archive function to restore data when the power returns. See *To set up the driver > Driver* (page 22).

Archive function

The following items are archived to non-volatile Flash memory daily and after every power up or download.

- Control programs
- Editable properties
- Schedules

If a power outage occurs and the battery backup fails or is turned off after a specified number of days, the above data is automatically restored from the archive. If changes were made in the WebCTRL® interface since the last archive, you may need to download parameters after power returns to correct any mismatches.

You can see the status of the latest archive in the WebCTRL® interface on the controller's **Driver** page under **Flash Memory Archive**.

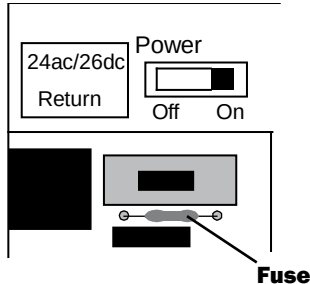
Replacing the ME812u's battery

If the ME812u's **Battery low** LED is lit or if the ME812u sends a **Low Battery** alarm to the WebCTRL® application, replace the battery.

- 1 Verify that the ME812u's power is on.
- 2 Using a small flathead screwdriver, pry up each side of the black battery clip until it is free and you can remove it.
- 3 Remove the battery from the controller, making note of the battery's polarity.
- 4 Insert the new battery into the controller, matching the polarity of the battery you removed.
- 5 Push the black clip back onto the battery until you hear both sides click in place.
- 6 Download the ME812u.

To replace the ME812u's fuse

If you turn on the ME812u's power switch and the Power LED is not lit, use a multimeter to see if the 3 Amp Pico fuse that protects the incoming power is blown.

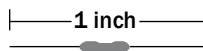


Before replacing the fuse, try to determine why the fuse blew.

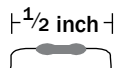
- Check the Power wiring polarity of the ME812u, any attached MEx expanders, and any other controllers that share the power supply. Use the same polarity for all of them.
- Verify that outputs are wired to the appropriate types of devices. See *Outputs* (page 4). For example, you cannot wire a 24 Vac device to an output.
- If the **Aux Power Out** connector is used, verify that it is wired correctly. See *To wire inputs and outputs* (page 11).

To replace the fuse:

- 1 Turn **off** the ME812u's power.
- 2 Using needle-nose pliers, pull the bad fuse from the ME812u.
- 3 Cut the wires on the new fuse so that the total length is approximately 1 inch and the fuse is centered.



- 4 Bend the wire ends so that the length is approximately 1/2 inch.



- 5 Use the pliers to grip one wire end of the fuse and push into a fuse socket on the ME812u.
- 6 Grip the other wire end of the fuse and push into the other fuse socket.
- 7 Turn on the power and verify that the Power LED is lit.

To take the ME812u out of service

If needed for troubleshooting or start-up, you can prevent the WebCTRL® application from communicating with the ME812u.

- 1 On the WebCTRL® **Network**  tree, select the ME812u.
- 2 On the **Properties** page, check **Out of Service**.
- 3 Click **Accept**.

Compliance

FCC Compliance

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.



CAUTION Changes or modifications not expressly approved by the responsible party for compliance could void the user's authority to operate the equipment.

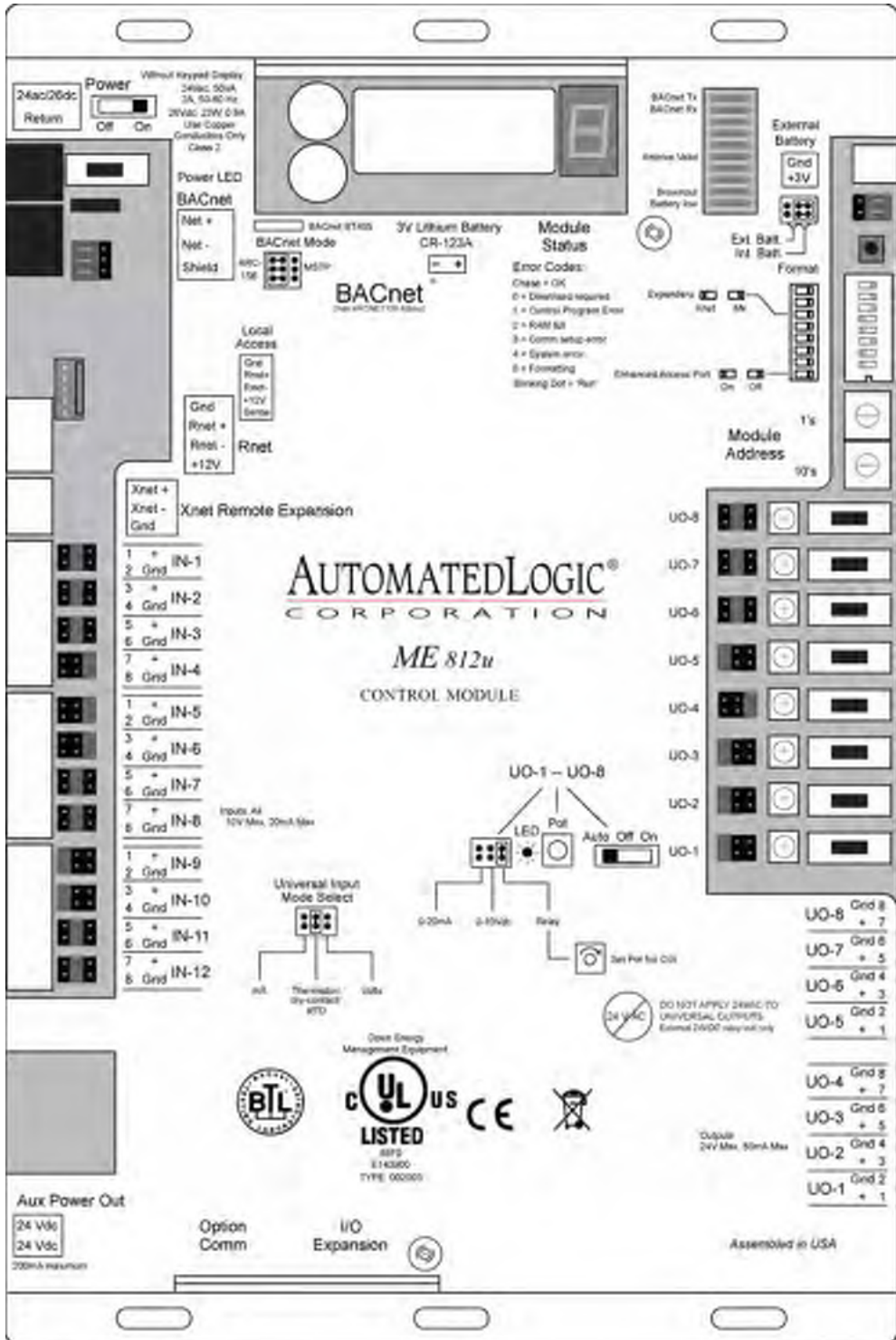
CE Compliance



WARNING This is a Class A product. In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate measures.

BACnet Compliance

Compliance of listed products to requirements of ASHRAE Standard 135 is the responsibility of BACnet International. BTL® is a registered trademark of BACnet International.



Document revision history

Important changes to this document are listed below. Minor changes such as typographical or formatting errors are not listed.

Date	Topic	Change description	Code*
2/6/17	Specifications	Added wireless sensors to the Rnet port specification.	X-D
	Zone sensors	Added wireless sensors to this topic.	
	Equipment Touch	Added Wireless Adapter to this topic.	
	Wiring inputs and outputs > Wiring specifications	Added Wireless Adapter to this topic.	
	Wiring devices to the Rnet port	Added Wireless Adapter to this topic.	
	To wire a Wireless Adapter to the ME812u	New topic.	
9/28/16	To set up a Local Access connection in the WebCTRL interface	Updated WebCTRL menu button in step 12.	A-D
	Appendix - ME812u coverplate	Updated coverplate	A-D
8/12/16	LEDs	Added description of #7 LED to table.	X-TS-RB-F
3/1/16	BACnet firewall	New topic	A-D
9/23/15	Specifications	Removed "(Replacement fuses available from Automated Logic, Part #FUSEPKG.)" from the Protection specification.	X-TS-JM-F
	To replace the ME812u's fuse	Removed sentence, "You can order replacement fuses from Automated Logic, Part #FUSEPKG."	
4/20/15	Entire document	New look, no content changes	A-D
11/14/14	BACnet Compliance	Changed BACnet Manufacturers Association to BACnet International	X-D-CP-MW
10/7/14	Driver	Added the Network Microblock fields	A-TS-RB-F
7/22/14	Equipment Touch	Changed 5 ZS sensors to 15 ZS sensors	X-D
5/13/14	Specifications	Rnet Port: Added Equipment Touch and removed BACview® devices	A-D-CP-O-TC
	Zone sensors	Removed references to BACview	
	Equipment Touch	New topic	
	BACview devices	Removed topic	
	Wiring zone sensors to the ME812u	Changed to "Wiring devices to the ME812u's Rnet port"	
	To wire an Equipment Touch to the ME812u	New topic	
	To set up the driver > Driver	Added new driver property: TouchScreen Schedule Edit Enable	

* For internal use only

MEx816u Expander

Technical Instructions

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770-429-3000 Fax 770-429-3001 | www.automatedlogic.com





Verify that you have the most current version of this document. Go to <https://accounts.automatedlogic.com>, then select **Support > Download > Documents > Hardware**. Important changes are listed in **Document revision history** at the end of this document.

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What is the MEx816u expander?

The MEx816u expander connects to an ME line controller to increase the number of inputs and outputs. You can connect up to 5 MEx816u's to the ME line controller.

Specifications

Power	24 Vac $\pm 10\%$, 50–60 Hz, 45 VA 26 Vdc $\pm 10\%$, 21 W
Inputs	16 inputs, configurable for 0–5 Vdc, 0–10 Vdc, 0–20 mA, RTD, thermistor, or dry contact
Input resolution	14 bit A/D
Input pulse frequency	40 pulses per second. Minimum pulse width (on or off time) required for each pulse is 12.5 msec.
Outputs	8 outputs for 24 Vdc relay driver, 0–10 Vdc, or 0–20 mA
Output resolution	12 bit D/A
Microprocessor	8-bit microprocessor with 60 kB Flash memory, 2 kB SRAM, and CAN controller
Protection	Incoming power is protected by 2 replaceable 3 Amp Pico® fuses. The power and network connections are also protected against transient excess voltage/surge events lasting no more than 10 msec.
Status indicators	LED's indicate status of communications, running, errors, and outputs
Environmental operating range	-20 to 140°F (-29 to 60°C), 10–90% relative humidity, non-condensing NOTE Install in a UL Listed enclosure only.
Physical	Rugged aluminum cover, removable, screw-type terminal blocks
Overall dimensions	Height: 9 in. (22.9 cm) Width: 5 1/2 in. (14 cm)
Mounting dimensions (in a panel)	Height: 8 9/16 in. (21.8 cm) Width: 3 5/16 in. (8.4 cm)
Recommended panel depth	2 3/4 in. (7cm)
Weight	13.3 oz. (.377 kg)
Listed by	UL-916 (PAZX), cUL-916 (PAZX7), FCC Part 15-Subpart B-Class A, CE

Inputs

The MEx816u has 16 inputs that accept the following signal types.

Signal Type	Description
Thermistor ¹	Precon type 2 (10 kOhm at 77 °F). Input voltages should be from 0.489 Vdc to 3.825 Vdc for thermistors. Accuracy: $\pm 0.5^{\circ}\text{F}$ ($\pm 0.28^{\circ}\text{C}$)
Dry contact	A 5 Vdc wetting voltage detects contact position, resulting in a 1 mA maximum sense current when the contacts are closed.
0–5 Vdc 0–10 Vdc	The output impedance of a 0–5 Vdc or a 0–10 Vdc source must not exceed 200 Ohms. The input impedance of the MEx816u is approximately 20 kOhm.
0–20 mA	The input resistance on the positive (+) terminal is 250 Ohms. The Aux Power Out connector is capable of supplying 24 Vdc to multiple 4–20 mA transducers, but the total current demanded must not exceed 200 mA. If the voltage measured from the Aux Power Out connector to Gnd is less than 18 Vdc, you need to use an external power supply.
RTD ¹	Platinum - 1 kOhm at 32 °F (0 °C) Nickel/Iron - 1 kOhm at 70 °F (21 °C) Balco TS8000 - 1 kOhm at 70 °F (21 °C) Input voltages should be from 0.6–1.2 V NOTE Automated Logic® recommends use of an external current transducer between an RTD and the MEx816u.
Pulse counter ²	Pulse counting up to 40 pulses per second. Minimum pulse width (on or off time) required for each pulse is 12.5 msec.

¹ To use a thermistor or RTD not listed above, you can set up a custom translation table for your sensor.

² The MEx816u can perform pulse counting for dry contact or voltage inputs if you assign the input to a Pulse to Analog Input microblock. See *To assign inputs or outputs to points* (page 10).

NOTE If you have one or more RTD's connected to the inputs, the total current draw of all Thermistor, RTD, and Dry contact devices wired to the inputs should not exceed 10 mA. Exceeding this limit will affect the accuracy of the RTD's. Use the following approximations as a reference:

- 10 kOhm Thermistor draws approximately 0.334 mA
- 1 kOhm RTD draws approximately 0.834 mA
- Dry contact draws approximately 1 mA

For example, if you connect 12 RTD's to the inputs, you cannot use the remaining 4 inputs for Thermistor, RTD, or Dry contact devices. This assumes negligible wiring impedance (<10 Ohms) for each RTD input with up to 100 feet of 22 AWG cable.

Outputs

The MEx816u has 8 universal outputs that you can use as digital outputs or analog outputs. The outputs support:

- driving external 24 Vdc relays
- 0-10 Vdc devices
- 0-20 mA devices



WARNING Do not apply 24 Vac to these universal outputs.

If output controls a...	Resistance to ground must be...
0–10 Vdc device	500 Ohms minimum
0–20 mA device	800 Ohms maximum

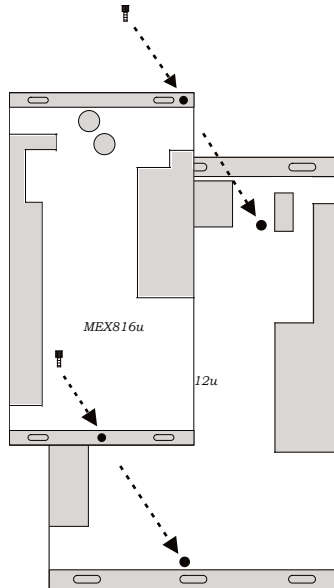
NOTES

- The device must share the same ground as the controller.
- The total output current from all outputs and the **Aux Power Out** connector must not exceed:
500 mA at 115 °F
300 mA at 140 °F
For temperatures above 115 °F, use the following equation to calculate the total current at 8 mA per degree:
$$500\text{mA} - ((\text{max. expected temp.} - 115^{\circ}\text{F}) * 8\text{mA})$$

To mount the MEx816u

You can mount an MEx816u in one of the following locations:

- On an ME812u, ME812u-E, or ME812u-LGR controller using the 2 provided 7/64 socket head cap screws, 6-32 thread.



- In an enclosed panel. Screw the MEx816u to the panel using the four mounting holes on the cover plate. Leave about 2 in. (5 cm) on each side for wiring.

See *Wiring for communications* (page 6) to wire the MEx816u to the controller.

Wiring for power

 **WARNING** Do not apply line voltage (mains voltage) to the controller's ports and terminals.

 **CAUTIONS**

- The MEx816u is powered by a Class 2 power source. Take appropriate isolation measures when mounting it in a control panel where non-Class 2 circuits are present.
- Automated Logic® controllers can share a power supply as long as you:
 - Maintain the same polarity.
 - Use the power supply only for Automated Logic® controllers.

NOTE For the controller to recognize an attached expander, you must turn on the expander before you turn on the controller.

To wire for power

- 1 Turn off the MEx816u's power to prevent it from powering up before you can verify the correct voltage.
- 2 Remove power from the power supply.
- 3 Pull the screw terminal connector from the MEx816u's power terminals labeled **24 Vac** and **Gnd (Return)**.
- 4 Connect the transformer wires to the screw terminal connector.
- 5 Apply power to the power supply.
- 6 Measure the voltage at the MEx816u's power input terminals to verify that the voltage is within the operating range of 21.6–26.4 Vac.
- 7 Insert the screw terminal connector into the MEx816u's power terminals.
- 8 Turn **on** the MEx816u's power.
- 9 Verify that the **Power** LED is on and the **Run** LED is blinking.

To address the MEx816u

You must give the MEx816u an address that is unique on the network. You can address the MEx816u before or after you wire it for power.

- 1 If wired for power, turn off the MEx816u's power and the attached controller's power.
- 2 Set the MEx816u's address on the rotary switch. For example, the switch below shows an address of 5.



- 3 Turn on the MEx816u's power, then turn on the attached controller's power. The controller reads the powered MEx816u's address each time you turn on the controller.

Wiring for communications

Use ARC156 wiring to wire the MEx expander to the controller. Do not exceed 100 feet total wire length.

ARC156 wiring specifications

Below are the specifications for ARC156 wiring. The wire jacket and UL temperature rating specifications list two acceptable alternatives. Halar has a higher temperature rating and a tougher outer jacket than SmokeGard, and it is appropriate for use in applications where you are concerned about abrasion. Halar is also less likely to crack in extremely low temperatures.

NOTE Use the specified type of wire and cable for maximum signal integrity.

Description	Single twisted pair, low capacitance (12pF), CL2P, 22 AWG (7x30), TC foam FEP, plenum rated cable
Conductor	22 AWG (7x30) stranded copper (tin plated) 0.030 in. (0.762 mm) O.D. NOTE 24 AWG can be used for segments <200 ft. (6.7 m).
Insulation	Foamed FEP 0.015 in. (0.381 mm) wall 0.060 in. (1.524 mm) O.D.
Color code	Black/white
Twist lay	2 in. (50.8 mm) lay on pair 6 twists/foot (20 twists/meter) nominal
Shielding	Aluminum/Mylar shield with 24 AWG (7x32) TC drain wire
Jacket	SmokeGard (SmokeGard PVC) 0.021 in. (0.5334 mm) wall 0.175 in. (4.445 mm) O.D. Halar (E-CTFE) 0.010 in. (0.254 mm) wall 0.144 in. (3.6576 mm) O.D.
DC resistance	15.2 Ohms/1000 feet (50 Ohms/km) nominal
Capacitance	12.5 pF/ft (41 pF/meter) nominal conductor to conductor
Characteristic impedance	100 Ohms nominal
Weight	12 lb/1000 feet (17.9 kg/km)
UL temperature rating	SmokeGard 167 °F (75 °C) Halar -40 to 302 °F (-40 to 150 °C)
Voltage	300 Vac, power limited
Listing	UL: NEC CL2P, or better

To wire the MEx816u to the controller

 **WARNING** Do not apply line voltage (mains voltage) to the controller's ports and terminals.

- 1 Wire the MEx816u's **Xnet Remote Expansion** port to the same port on the controller.
NOTE To use more than one expander, wire their **Xnet Remote Expansion** ports together in a daisy-chain configuration. The controller must be the first device on the expander network.
- 2 Set the MEx816u's **Baud Select** jumper to 500k.
- 3 If the expander network has more than one expander, place the **Term** jumper in the down position or remove it from all expanders except the one at the end of the expander network. The **Term** jumper must be in the up position on the expander at the end of the network.

Wiring inputs and outputs

Wiring specifications

Input wiring

Input	Maximum length	Minimum gauge	Shielding
Thermistor Dry contact	1000 feet (305 meters)	22 AWG	Shielded
0–5 Vdc 0–10 Vdc	1000 feet (305 meters)	26 AWG	Shielded
0–20 mA	3000 feet (914 meters)	26 AWG	Shielded or unshielded
RTD	100 feet (30 meters)	22 AWG	Shielded

NOTE Automated Logic® recommends use of an external current transducer between an RTD and the MEx816u.

Output wiring

To size output wiring, consider the following:

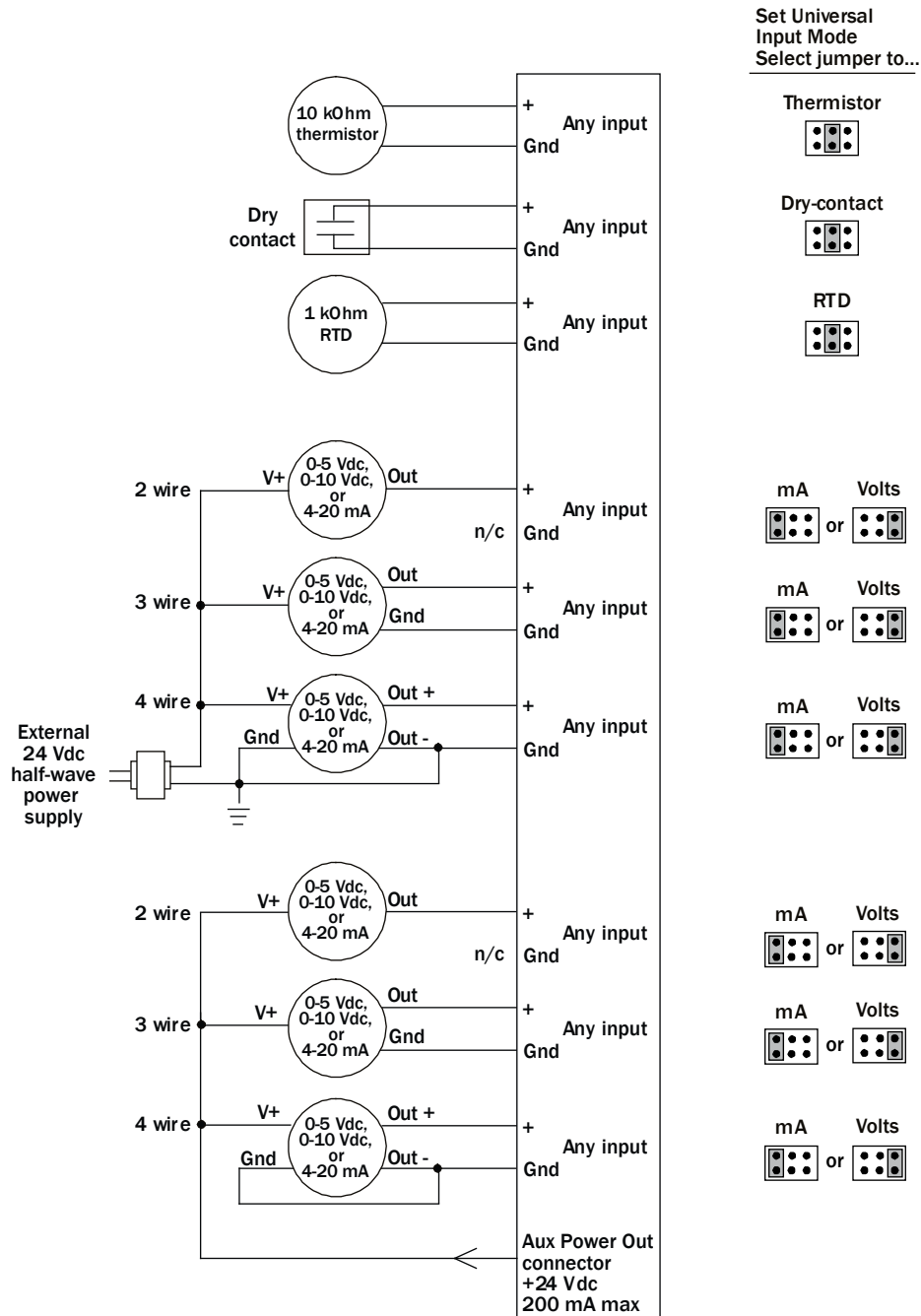
- Total loop distance from the power supply to the controller, and then to the controlled device
NOTE Include the total distance of actual wire. For 2-conductor wires, this is twice the cable length.
- Acceptable voltage drop in the wire from the controller to the controlled device
- Resistance (Ohms) of the chosen wire gauge
- Maximum current (Amps) the controlled device requires to operate

To wire inputs and outputs

WARNING Do not apply line voltage (mains voltage) to the controller's ports and terminals.

- 1 Verify that the MEx816u's power and communications connections work properly.
- 2 Turn **off** the MEx816u's power.
- 3 Connect the input wiring to the screw terminals on the MEx816u.

NOTE Connect the shield wire to the **GND** terminal with the ground wire.



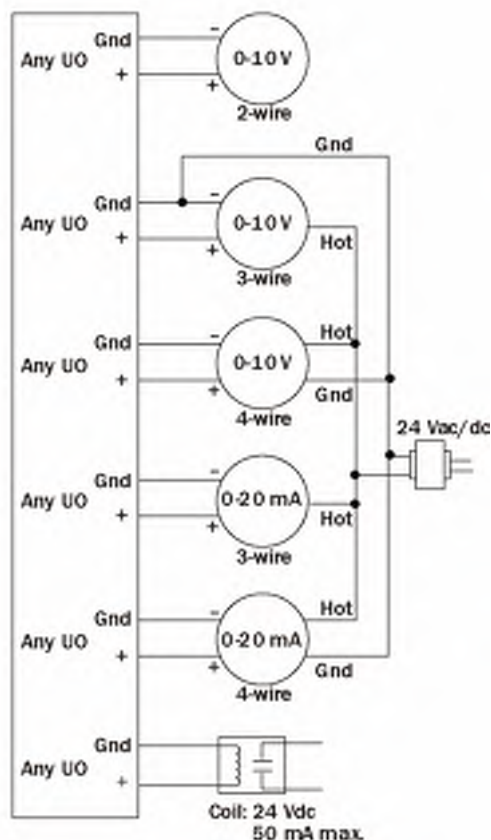
NOTE For a loop-powered 4-20 mA sensor, wire the sensor's positive terminal to the **+** terminal on the MEx816u's **Aux Power Out** connector. Wire the sensor's negative terminal to an input's **+** terminal.

- 4 Set each input's **Universal Input Mode Select** jumper to indicate the type of input.
- 5 Connect digital and analog output wiring to the **UO** screw terminals on the MEx816u and to the controlled device. Connect the ground wire to the UO's **Gnd** terminal.



WARNING Do not apply 24 Vac to these universal outputs.

Set output's jumper to...



- 6 Set each output's jumper to the type of device wired to the output.
- 7 For each digital output, turn the output's potentiometer clockwise until it stops (maximum output).
- 8 Turn **on** the MEx816u's power.

To assign inputs or outputs to points

To use an input or output, you must assign it to its corresponding point in the control program.

- 1 In the WebCTRL® **Geographic**  tree, select the equipment controlled by the MEx816u.
- 2 On the **Properties** page, select the **I/O Points** tab.
- 3 For each point, type the expander's rotary switch address in the **Exp** field and the number of the expander's corresponding input or output in the **Num** field.
EXAMPLE If DO1 on the MEx816u (which has a rotary switch address of 5) is used for the point **Fan S/S**, enter 5 : 1 in the **Exp:Num** column for **Fan S/S**.
NOTE Do not assign the same output number to more than one point.
- 4 Enter the appropriate values for each input and output in the remaining columns. See *Input values*, *Output values*, *Resolution values* and *Offset/Polarity values* below.
NOTE You can also enter these values in the EIKON® LogicBuilder application.
- 5 If you have not performed the initial download to the attached controller, you must download now to verify inputs and outputs.
- 6 To verify each input's operation, force each sensor to a known value, then compare it to the **Value** shown on the **Properties** page on the **I/O Points** tab.
- 7 To verify each output's operation, lock each output to a known condition on the **I/O Points** tab, then verify that the equipment operates correctly.

Input values

Input	I/O Type	Sensor/Actuator Type	Min/Max
Analog (BAI)			
0-5 Vdc	0-5 Volt	Linear Full Range	Engineering values associated with 0 Vdc (Min) and 5 Vdc (Max) ¹
0-10 Vdc	0-10 Volt	Linear Full Range	Engineering values associated with 0 Vdc (Min) and 10 Vdc (Max) ¹
2-10 Vdc	0-10 Volt	Linear w/Offset, 2-10 Volts	Engineering values associated with 2 Vdc (Min) and 10 Vdc (Max) ¹
0-20 mA	0-20 mA	Linear Full Range	Engineering values associated with 0 mA (Min) and 20 mA (Max) ¹
4-20 mA	0-20 mA	Linear w/Offset, 4-20 mA	Engineering values associated with 4 mA (Min) and 20 mA (Max) ¹
RTD	RTD Input	Select your RTD type or set up and select a Non-Linear, Custom Table ²	N/A
Thermistor	Thermistor	Select your Thermistor type or set up and select a Non-Linear, Custom Table ²	N/A
Pulse to Analog (BPTA) ³			
Pulse Counter	Counter Input	N/A	N/A

Input	I/O Type	Sensor/Actuator Type	Min/Max
Digital (Binary) (BBI)			
Dry Contact	Dry Contact	N/A	N/A

- ¹ The sensor reads a value and sends a corresponding signal (Volt, mA, or psi) to the MEx816u's physical input. The Analog Input microblock uses the **Min** and **Max** values to linearly translate the signal into the engineering value used in subsequent control logic. For example, set **Min** to 0 and **Max** to 10 for a 4–20 mA sensor that measures velocity from 0.0 to 10.0 inches/second so that when the input reads 4 mA, the microblock outputs a value of 0. Similarly, when the input reads 8 mA, the microblock outputs a value of 2.5.
- ² You can set up a custom translation table on the driver's **Custom Translation Tables** pages in the WebCTRL® interface.
- ³ The control program must have one Pulse to Analog Input microblock for each pulse counting input.

Output values

Output	I/O Type	Sensor/Actuator Type	Min/Max
Analog (BAO)			
0-10 Vdc	Electrical 0–10 Volt	Linear Full Range	Engineering values associated with 0 Vdc (Min) and 10 Vdc (Max) ¹
2-10 Vdc	Electrical 0–10 Volt	Linear w/Offset, 2–10 Volts	Engineering values associated with 2 Vdc (Min) and 10 Vdc (Max) ¹
0-20 mA	Electrical 0–20 mA	Linear Full Range	Engineering values associated with 0 mA (Min) and 20 mA (Max) ¹
4-20 mA	Electrical 0–20 mA	Linear w/Offset, 4–20 mA	Engineering values associated with 4 mA (Min) and 20 mA (Max) ¹
Digital (Binary) (BBO)			
Relay	Relay/Triac Output	N/A	N/A

- ¹ The Analog Output microblock uses the **Min** and **Max** values to linearly translate its EIKON® LogicBuilder wire value into a physical output signal (Volt, mA, or psi) sent from the MEx816u to an actuator. For example, set **Min** to 0 and **Max** to 100 for an Analog Output microblock that receives a 0 to 100% open signal from a PID microblock and that controls a 0–10 Vdc actuator so that when the PID signal is 100%, the MEx816u output is 10 Vdc. Similarly, when the PID signal is 50%, the MEx816u output is 5 Vdc.

Resolution values

Resolution is not particular to a type of input or output, but the driver handles analog and digital (binary) inputs and outputs differently. To set these values appropriately, you should understand how the driver uses them.

Resolution	Notes
Analog Input (BAI)	The driver truncates the microblock's present value according to the resolution. EXAMPLE If the calculated present value is 13.789 and you set the Resolution to 0.1, the control program uses 13.7 for any calculations downstream from the microblock.
Analog Output (BAO)	The driver truncates the wire input value to the microblock before performing any scaling calculations. EXAMPLE If the wire input value is 13.789 and you set the Resolution to 0.1, the microblock uses 13.7 for any scaling calculations.
Digital Inputs and Outputs	N/A

Offset/Polarity values

Offset/Polarity is not particular to a type of input or output, but the driver handles analog and digital (binary) inputs and outputs differently. To set these values appropriately, you should understand how the driver uses them.

Offset/Polarity	Notes
Analog Input (BAI)	Offset value (positive or negative) adds a fine adjustment to a sensor reading after all scaling for calibration. EXAMPLE If a sensor reads 74.9°F when the actual measured value is 73.6°F, enter an Offset of -1.3 to calibrate the sensor to the measured value.
Analog Output (BAO)	You can use the Offset value (positive or negative) to calibrate an output, but you generally do not need to. If used, the driver adds the offset value to the wire input value before performing any scaling calculations to determine the MEx816u's output.
Digital (Binary) Input (BBI)	Polarity determines the microblock's present value when no signal is received from the equipment. When no signal is received from the equipment, if Polarity is set to: normal —present value is off reversed —present value is on
Digital (Binary) Output (BBO)	Polarity determines the MEx816u's output based on the control program's signal to the microblock. When the control program's signal to the microblock is on , if Polarity is set to: normal —output is on reversed —output is off NOTE Regardless of Polarity , the output will be off if the MEx816u loses power.

To use the Auto-Off-On switches

You can control an output using the **Auto-Off-On** switch.

Set the switch to...	To...
On	Turn on the output.
Off	Turn off the output
Auto	Let the control program control the output

The potentiometer, located between the **Auto-Off-On** switch and the jumper, allows you to manually control the output level of an analog output. Place the **Auto-Off-On** switch in the **On** position, then turn the potentiometer counterclockwise to reduce the output, or clockwise to increase the output.



For a digital output, turn the potentiometer clockwise until it stops (maximum output) and leave it in this position.

The control program can monitor the status of an **Auto-Off-On** switch and display the status on the control program's **Properties** page > **I/O Points** tab in the WebCTRL® interface. The **Value** of the point monitoring the **Auto-Off-On** switch shows **Off** if the switch is set to **Auto**, and **On** if the switch is set to **Off** or **On**.

To monitor an Auto-Off-On switch

- 1 Insert a BACnet Binary Input microblock in the control program.
- 2 On the microblock's **Properties** page in the WebCTRL® interface, set the **I/O Type** field to **H-O-A Status Feedback**.
- 3 In the **Input Number** field, type the number of the output you want to monitor.

Troubleshooting

If you have problems mounting, wiring, or addressing the MEx816u, contact ALC Technical Support.

LED's

The LED's on the MEx816u show the status of certain functions.

If this LED is on...	Status is...
Power	The MEx816u has power
Rx	The MEx816u is receiving data from the network segment
Tx	The MEx816u is transmitting data over the network segment
DO#	The digital output is active

The **Run** and **Error** LED's indicate controller and network status.

If Run LED shows...	And Error LED shows...	Status is..
2 flashes per second	Off	Normal
5 flashes per second	2 flashes per second	Boot is running
5 flashes per second	On	Fatal error. Replace expander or return for repair.

To get the MEx816u's serial number

If you need the MEx816u's serial number when troubleshooting, the number is on a sticker on the back of the main controller board.

To monitor expander communication

You can add an analog input in a control program that will provide the communication status of the MEx816u. If the input reads a value of 55, the expander is communicating. If the input reads 0, the expander is not communicating.

To have the input provide the MEx816u's status, define the following properties for the input.

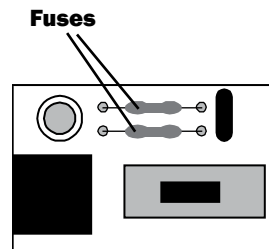
Expander: The expander number you want to read

Input Number: 1

Input Type: Special

To replace the MEx816u's fuses

If you turn on the MEx816u's power switch and the Power LED is not lit, use a multimeter to see if either of the 3 Amp Pico fuses that protect the incoming power is blown.

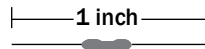


Before replacing the fuse, try to determine why the fuse blew.

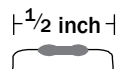
- Check the power wiring polarity of the MEx816u, the controller that the MEx is attached to, and any other controllers that share the power supply. Use the same polarity for all of them.
- Verify that outputs are wired to the appropriate types of devices. See *Outputs* (page 3). For example, you cannot wire a 24 Vac device to an output.

To replace the fuse:

- 1 Turn **off** the MEx816u's power.
- 2 Remove the MEx816u's coverplate.
- 3 Using needle-nose pliers, pull the bad fuse from the MEx816u.
- 4 Cut the wires on the new fuse so that the total length is approximately 1 inch and the fuse is centered.



- 5 Bend the wire ends so that the length is approximately 1/2 inch.



- 6 Use the pliers to grip one wire end of the fuse and push into a fuse socket on the MEx816u.
- 7 Grip the other wire end of the fuse and push into the other fuse socket.
- 8 Replace the MEx816u's coverplate.
- 9 Turn on the power and verify that the Power LED is lit.

Compliance

FCC Compliance

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.



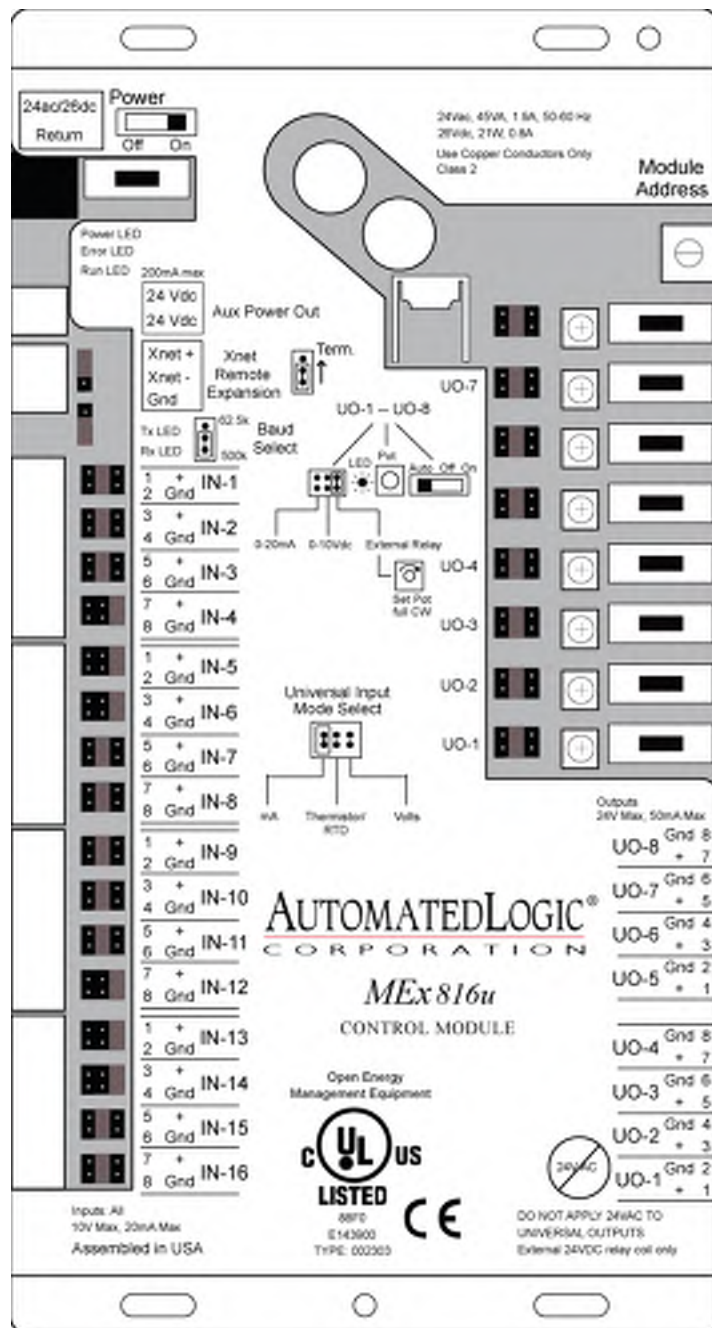
CAUTION Changes or modifications not expressly approved by the responsible party for compliance could void the user's authority to operate the equipment.

CE Compliance



WARNING This is a Class A product. In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate measures.

Appendix - MEx816u coverplate



Document revision history

Important changes to this document are listed below. Minor changes such as typographical or formatting errors are not listed.

Date	Topic	Change description	Code*
9/28/16	Appendix - MEx816u coverplate	Updated coverplate	A-D
	To wire the MEx816u to the controller	Clarified final step in connecting multiple expanders.	X-TS-RD-E-BR
9/23/15	Specifications	Removed "(Replacement fuses available from Automated Logic, Part #FUSEPKG.)" from the Protection specification.	X-TS-JM-F
	To replace the MEx816u's fuse	Removed sentence, "You can order replacement fuses from Automated Logic, Part #FUSEPKG."	
4/20/15	Entire document	New look, no content changes	A-D

* For internal use only

MEx48u Expander

Technical Instructions

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Verify that you have the most current version of this document. Go to <https://accounts.automatedlogic.com>, then select **Support > Download > Documents > Hardware**. Important changes are listed in **Document revision history** at the end of this document.

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What is the MEx48u expander?

The MEx48u expander connects to an ME line controller to increase the number of inputs and outputs. You can connect up to 5 MEx48u's to the ME line controller.

Specifications

Power	24 Vac $\pm 10\%$, 50–60 Hz, 40 VA 26 Vdc $\pm 10\%$, 21 W
Inputs	8 inputs, configurable for 0–5 Vdc, 0–10 Vdc, 0–20 mA, RTD, thermistor, or dry contact
Input resolution	14 bit A/D
Input pulse frequency	40 pulses per second. Minimum pulse width (on or off time) required for each pulse is 12.5 msec.
Outputs	4 outputs for 24 Vdc relay driver, 0–10 Vdc, or 0–20 mA
Output resolution	12 bit D/A
Microprocessor	8-bit microprocessor with 60 kB Flash memory, 2 kB SRAM, and CAN controller
Protection	Incoming power is protected by 2 replaceable 3 Amp Pico® fuses. The power and network connections are also protected against transient excess voltage/surge events lasting no more than 10 msec.
Status indicators	LED's indicate status of communications, running, errors, and outputs
Environmental operating range	-20 to 140 °F (-29 to 60 °C), 10–90% relative humidity, non-condensing NOTE Install in a UL Listed enclosure only.
Physical	Rugged aluminum cover, removable, screw-type terminal blocks
Overall dimensions	Height: 9 in. (22.9 cm) Width: 5 1/2 in. (14 cm)
Mounting dimensions (in a panel)	Height: 8 9/16 in. (21.8 cm) Width: 3 5/16 in. (8.4 cm)
Recommended panel depth	2 3/4 in. (7cm)
Weight	13.3 oz. (.377 kg)
Listed by	UL-916 (PAZX), cUL-916 (PAZX7), FCC Part 15-Subpart B-Class A, CE

Inputs

The MEx48u has 8 inputs that accept the following signal types.

Signal Type	Description
Thermistor ¹	Precon type 2 (10 kOhm at 77 °F). Input voltages should be from 0.489 Vdc to 3.825 Vdc for thermistors. Accuracy: $\pm 0.5^{\circ}\text{F}$ ($\pm 0.28^{\circ}\text{C}$)
Dry contact	A 5 Vdc wetting voltage detects contact position, resulting in a 1 mA maximum sense current when the contacts are closed.
0–5 Vdc 0–10 Vdc	The output impedance of a 0–5 Vdc or a 0–10 Vdc source must not exceed 200 Ohms. The input impedance of the MEx48u is approximately 20 kOhm.
0–20 mA	The input resistance on the positive (+) terminal is 250 Ohms. The Aux Power Out connector is capable of supplying 24 Vdc to multiple 4–20 mA transducers, but the total current demanded must not exceed 200 mA. If the voltage measured from the Aux Power Out connector to Gnd is less than 18 Vdc, you need to use an external power supply.
RTD ¹	Platinum - 1 kOhm at 32 °F (0 °C) Nickel/Iron - 1 kOhm at 70 °F (21 °C) Balco TS8000 - 1 kOhm at 70 °F (21 °C) Input voltages should be from 0.6–1.2 V NOTE Automated Logic® recommends use of an external current transducer between an RTD and the MEx48u.
Pulse counter ²	Pulse counting up to 40 pulses per second. Minimum pulse width (on or off time) required for each pulse is 12.5 msec.

¹ To use a thermistor or RTD not listed above, you can set up a custom translation table for your sensor.

² The MEx48u can perform pulse counting for dry contact or voltage inputs if you assign the input to a Pulse to Analog Input microblock. See *To assign inputs or outputs to points* (page 9).

Outputs

The MEx48u has 4 universal outputs that you can use as digital outputs or analog outputs. The outputs support:

- driving external 24 Vdc relays
- 0-10 Vdc devices
- 0-20 mA devices



WARNING Do not apply 24 Vac to these universal outputs.

If output controls a...	Resistance to ground must be...
0–10 Vdc device	500 Ohms minimum
0–20 mA device	800 Ohms maximum

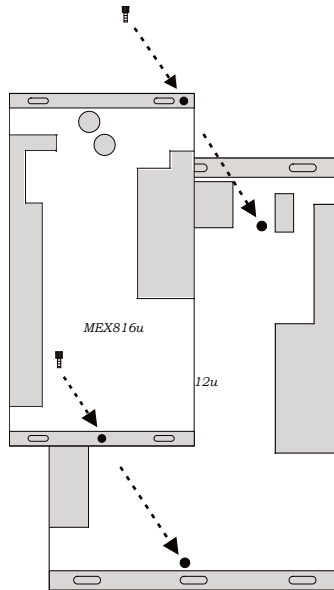
NOTES

- The device must share the same ground as the controller.
- The total output current from all outputs and the **Aux Power Out** connector must not exceed:
500 mA at 115°F
300 mA at 140°F
For temperatures above 115°F, use the following equation to calculate the total current at 8 mA per degree:
$$500\text{mA} - ((\text{max. expected temp.} - 115^\circ\text{F}) * 8\text{mA})$$

To mount the MEx48u

You can mount an MEx48u in one of the following locations:

- On an ME812u, ME812u-E, or ME812u-LGR controller using the 2 provided 7/64 socket head cap screws, 6-32 thread.



- In an enclosed panel. Screw the MEx48u to the panel using the four mounting holes on the cover plate. Leave about 2 in. (5 cm) on each side for wiring.

See *Wiring for communications* (page 5) to wire the MEx48u to the controller.

Wiring for power

 **WARNING** Do not apply line voltage (mains voltage) to the controller's ports and terminals.

 CAUTIONS

- The MEx48u is powered by a Class 2 power source. Take appropriate isolation measures when mounting it in a control panel where non-Class 2 circuits are present.
- Automated Logic® controllers can share a power supply as long as you:
 - Maintain the same polarity.
 - Use the power supply only for Automated Logic® controllers.

NOTE For the controller to recognize an attached expander, you must turn on the expander before you turn on the controller.

To wire for power

- 1 Turn off the MEx48u's power to prevent it from powering up before you can verify the correct voltage.
- 2 Remove power from the power supply.
- 3 Pull the screw terminal connector from the MEx48u's power terminals labeled **24 Vac** and **Gnd (Return)**.
- 4 Connect the transformer wires to the screw terminal connector.
- 5 Apply power to the power supply.
- 6 Measure the voltage at the MEx48u's power input terminals to verify that the voltage is within the operating range of 21.6–26.4 Vac.
- 7 Insert the screw terminal connector into the MEx48u's power terminals.
- 8 Turn **on** the MEx48u's power.
- 9 Verify that the **Power** LED is on and the **Run** LED is blinking.

To address the MEx48u

You must give the MEx48u an address that is unique on the network. You can address the MEx48u before or after you wire it for power.

- 1 If wired for power, turn off the MEx48u's power and the attached controller's power.
- 2 Set the MEx48u's address on the rotary switch. For example, the switch below shows an address of 5.



- 3 Turn on the MEx48u's power, then turn on the attached controller's power. The controller reads the powered MEx48u's address each time you turn on the controller.

Wiring for communications

Use ARC156 wiring to wire the MEx expander to the controller. Do not exceed 100 feet total wire length.

ARC156 wiring specifications

Below are the specifications for ARC156 wiring. The wire jacket and UL temperature rating specifications list two acceptable alternatives. Halar has a higher temperature rating and a tougher outer jacket than SmokeGard, and it is appropriate for use in applications where you are concerned about abrasion. Halar is also less likely to crack in extremely low temperatures.

NOTE Use the specified type of wire and cable for maximum signal integrity.

Description	Single twisted pair, low capacitance (12pF), CL2P, 22 AWG (7x30), TC foam FEP, plenum rated cable
Conductor	22 AWG (7x30) stranded copper (tin plated) 0.030 in. (0.762 mm) O.D. NOTE 24 AWG can be used for segments <200 ft. (6.7 m).
Insulation	Foamed FEP 0.015 in. (0.381 mm) wall 0.060 in. (1.524 mm) O.D.
Color code	Black/white
Twist lay	2 in. (50.8 mm) lay on pair 6 twists/foot (20 twists/meter) nominal
Shielding	Aluminum/Mylar shield with 24 AWG (7x32) TC drain wire
Jacket	SmokeGard (SmokeGard PVC) 0.021 in. (0.5334 mm) wall 0.175 in. (4.445 mm) O.D. Halar (E-CTFE) 0.010 in. (0.254 mm) wall 0.144 in. (3.6576 mm) O.D.
DC resistance	15.2 Ohms/1000 feet (50 Ohms/km) nominal
Capacitance	12.5 pF/ft (41 pF/meter) nominal conductor to conductor
Characteristic impedance	100 Ohms nominal
Weight	12 lb/1000 feet (17.9 kg/km)
UL temperature rating	SmokeGard 167 °F (75 °C) Halar -40 to 302 °F (-40 to 150 °C)
Voltage	300 Vac, power limited
Listing	UL: NEC CL2P, or better

To wire the MEx48u to the controller

 **WARNING** Do not apply line voltage (mains voltage) to the controller's ports and terminals.

- 1 Wire the MEx48u's **Xnet Remote Expansion** port to the same port on the controller.
NOTE To use more than one expander, wire their **Xnet Remote Expansion** ports together in a daisy-chain configuration. The controller must be the first device on the expander network.
- 2 Set the MEx48u's **Baud Select** jumper to 500k.
- 3 If the expander network has more than one expander, place the **Term** jumper in the down position or remove it from all expanders except the one at the end of the expander network. The **Term** jumper must be in the up position on the expander at the end of the network.

Wiring inputs and outputs

Wiring specifications

Input wiring

Input	Maximum length	Minimum gauge	Shielding
Thermistor Dry contact	1000 feet (305 meters)	22 AWG	Shielded
0–5 Vdc 0–10 Vdc	1000 feet (305 meters)	26 AWG	Shielded
0–20 mA	3000 feet (914 meters)	26 AWG	Shielded or unshielded
RTD	100 feet (30 meters)	22 AWG	Shielded

NOTE Automated Logic® recommends use of an external current transducer between an RTD and the MEx48u.

Output wiring

To size output wiring, consider the following:

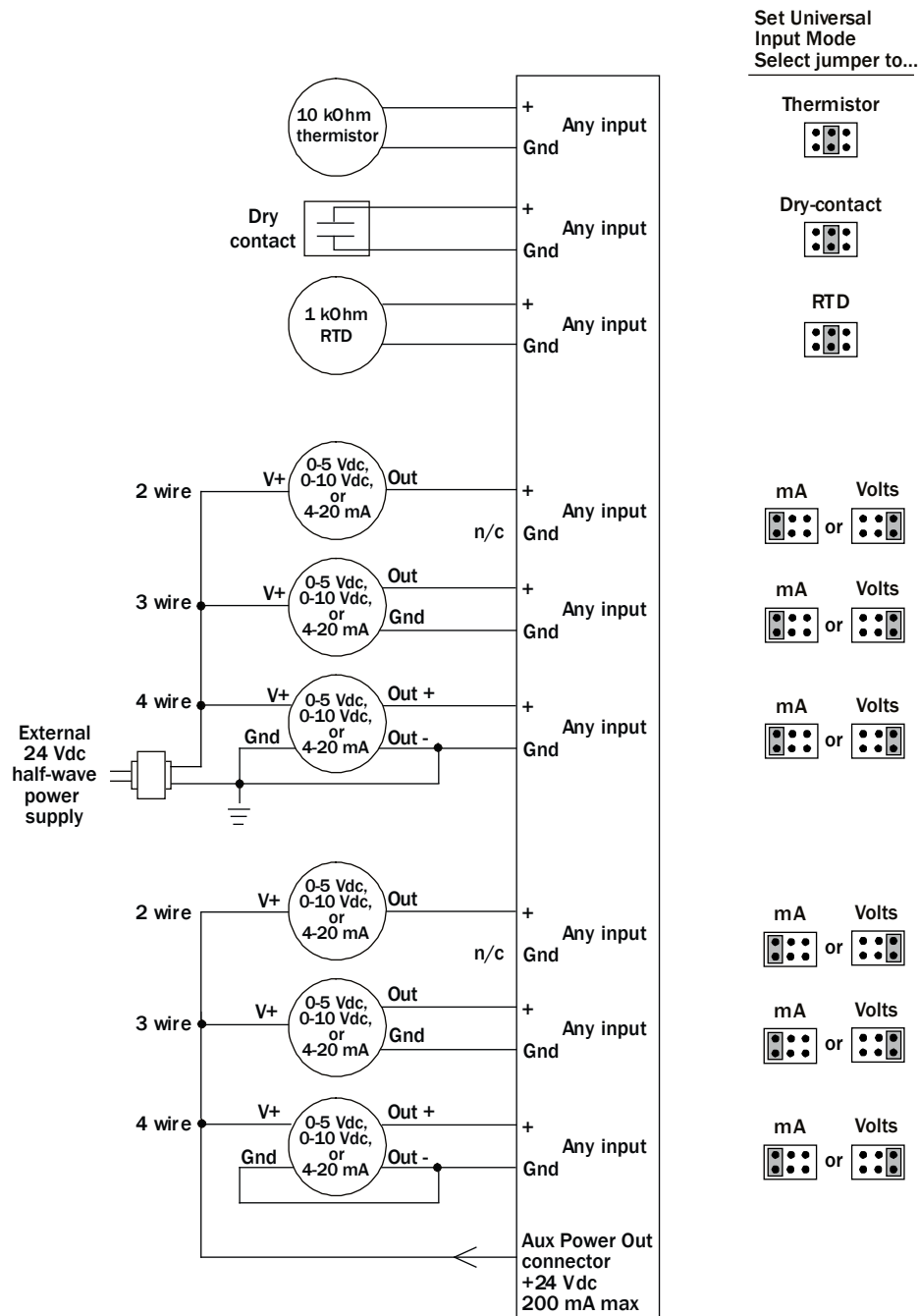
- Total loop distance from the power supply to the controller, and then to the controlled device
NOTE Include the total distance of actual wire. For 2-conductor wires, this is twice the cable length.
- Acceptable voltage drop in the wire from the controller to the controlled device
- Resistance (Ohms) of the chosen wire gauge
- Maximum current (Amps) the controlled device requires to operate

To wire inputs and outputs

WARNING Do not apply line voltage (mains voltage) to the controller's ports and terminals.

- 1 Verify that the MEx48u's power and communications connections work properly.
- 2 Turn **off** the MEx48u's power.
- 3 Connect the input wiring to the screw terminals on the MEx48u.

NOTE Connect the shield wire to the **GND** terminal with the ground wire.



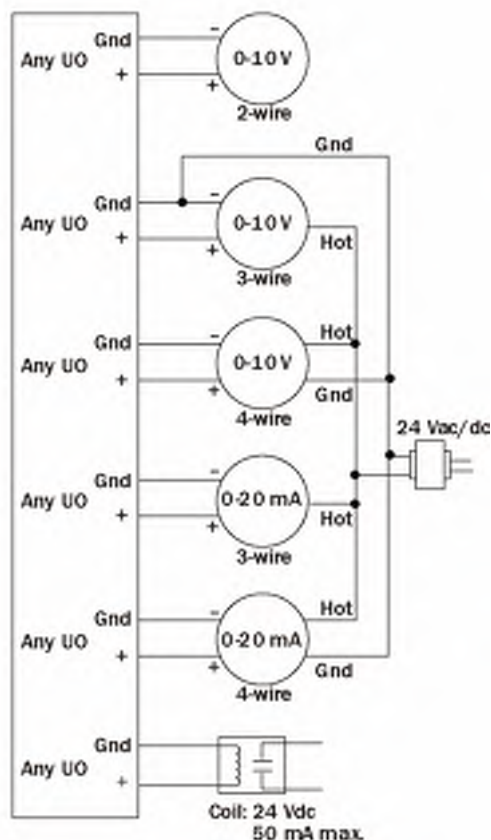
NOTE For a loop-powered 4-20 mA sensor, wire the sensor's positive terminal to the **+** terminal on the MEx48u's **Aux Power Out** connector. Wire the sensor's negative terminal to an input's **+** terminal.

- 4 Set each input's **Universal Input Mode Select** jumper to indicate the type of input.
- 5 Connect digital and analog output wiring to the **UO** screw terminals on the MEx48u and to the controlled device. Connect the ground wire to the UO's **Gnd** terminal.



WARNING Do not apply 24 Vac to these universal outputs.

Set output's jumper to...



- 6 Set each output's jumper to the type of device wired to the output.
- 7 For each digital output, turn the output's potentiometer clockwise until it stops (maximum output).
- 8 Turn **on** the MEx48u's power.

To assign inputs or outputs to points

To use an input or output, you must assign it to its corresponding point in the control program.

- 1 In the WebCTRL® **Geographic**  tree, select the equipment controlled by the MEx48u.
- 2 On the **Properties** page, select the **I/O Points** tab.
- 3 For each point, type the expander's rotary switch address in the **Exp** field and the number of the expander's corresponding input or output in the **Num** field.
EXAMPLE If DO1 on the MEx48u (which has a rotary switch address of 5) is used for the point **Fan S/S**, enter 5 : 1 in the **Exp:Num** column for **Fan S/S**.
NOTE Do not assign the same output number to more than one point.
- 4 Enter the appropriate values for each input and output in the remaining columns. See *Input values*, *Output values*, *Resolution values* and *Offset/Polarity values* below.
NOTE You can also enter these values in the EIKON® LogicBuilder application.
- 5 If you have not performed the initial download to the attached controller, you must download now to verify inputs and outputs.
- 6 To verify each input's operation, force each sensor to a known value, then compare it to the **Value** shown on the **Properties** page on the **I/O Points** tab.
- 7 To verify each output's operation, lock each output to a known condition on the **I/O Points** tab, then verify that the equipment operates correctly.

Input values

Input	I/O Type	Sensor/Actuator Type	Min/Max
Analog (BAI)			
0-5 Vdc	0-5 Volt	Linear Full Range	Engineering values associated with 0 Vdc (Min) and 5 Vdc (Max) ¹
0-10 Vdc	0-10 Volt	Linear Full Range	Engineering values associated with 0 Vdc (Min) and 10 Vdc (Max) ¹
2-10 Vdc	0-10 Volt	Linear w/Offset, 2-10 Volts	Engineering values associated with 2 Vdc (Min) and 10 Vdc (Max) ¹
0-20 mA	0-20 mA	Linear Full Range	Engineering values associated with 0 mA (Min) and 20 mA (Max) ¹
4-20 mA	0-20 mA	Linear w/Offset, 4-20 mA	Engineering values associated with 4 mA (Min) and 20 mA (Max) ¹
RTD	RTD Input	Select your RTD type or set up and select a Non-Linear, Custom Table ²	N/A
Thermistor	Thermistor	Select your Thermistor type or set up and select a Non-Linear, Custom Table ²	N/A
Pulse to Analog (BPTA) ³			
Pulse Counter	Counter Input	N/A	N/A

Input	I/O Type	Sensor/Actuator Type	Min/Max
Digital (Binary) (BBI)			
Dry Contact	Dry Contact	N/A	N/A

¹ The sensor reads a value and sends a corresponding signal (Volt, mA, or psi) to the MEx48u's physical input. The Analog Input microblock uses the **Min** and **Max** values to linearly translate the signal into the engineering value used in subsequent control logic. For example, set **Min** to 0 and **Max** to 10 for a 4–20 mA sensor that measures velocity from 0.0 to 10.0 inches/second so that when the input reads 4 mA, the microblock outputs a value of 0. Similarly, when the input reads 8 mA, the microblock outputs a value of 2.5.

² You can set up a custom translation table on the driver's **Custom Translation Tables** pages in the WebCTRL® interface.

³ The control program must have one Pulse to Analog Input microblock for each pulse counting input.

Output values

Output	I/O Type	Sensor/Actuator Type	Min/Max
Analog (BAO)			
0–10 Vdc	Electrical 0–10 Volt	Linear Full Range	Engineering values associated with 0 Vdc (Min) and 10 Vdc (Max) ¹
2–10 Vdc	Electrical 0–10 Volt	Linear w/Offset, 2–10 Volts	Engineering values associated with 2 Vdc (Min) and 10 Vdc (Max) ¹
0–20 mA	Electrical 0–20 mA	Linear Full Range	Engineering values associated with 0 mA (Min) and 20 mA (Max) ¹
4–20 mA	Electrical 0–20 mA	Linear w/Offset, 4–20 mA	Engineering values associated with 4 mA (Min) and 20 mA (Max) ¹
Digital (Binary) (BBO)			
Relay	Relay/Triac Output	N/A	N/A

¹ The Analog Output microblock uses the **Min** and **Max** values to linearly translate its EIKON® LogicBuilder wire value into a physical output signal (Volt, mA, or psi) sent from the MEx48u to an actuator. For example, set **Min** to 0 and **Max** to 100 for an Analog Output microblock that receives a 0 to 100% open signal from a PID microblock and that controls a 0–10 Vdc actuator so that when the PID signal is 100%, the MEx48u output is 10 Vdc. Similarly, when the PID signal is 50%, the MEx48u output is 5 Vdc.

Resolution values

Resolution is not particular to a type of input or output, but the driver handles analog and digital (binary) inputs and outputs differently. To set these values appropriately, you should understand how the driver uses them.

Resolution	Notes
Analog Input (BAI)	The driver truncates the microblock's present value according to the resolution. EXAMPLE If the calculated present value is 13.789 and you set the Resolution to 0.1, the control program uses 13.7 for any calculations downstream from the microblock.
Analog Output (BAO)	The driver truncates the wire input value to the microblock before performing any scaling calculations. EXAMPLE If the wire input value is 13.789 and you set the Resolution to 0.1, the microblock uses 13.7 for any scaling calculations.
Digital Inputs and Outputs	N/A

Offset/Polarity values

Offset/Polarity is not particular to a type of input or output, but the driver handles analog and digital (binary) inputs and outputs differently. To set these values appropriately, you should understand how the driver uses them.

Offset/Polarity	Notes
Analog Input (BAI)	Offset value (positive or negative) adds a fine adjustment to a sensor reading after all scaling for calibration. EXAMPLE If a sensor reads 74.9°F when the actual measured value is 73.6°F, enter an Offset of -1.3 to calibrate the sensor to the measured value.
Analog Output (BAO)	You can use the Offset value (positive or negative) to calibrate an output, but you generally do not need to. If used, the driver adds the offset value to the wire input value before performing any scaling calculations to determine the MEx48u's output.
Digital (Binary) Input (BBI)	Polarity determines the microblock's present value when no signal is received from the equipment. When no signal is received from the equipment, if Polarity is set to: normal —present value is off reversed —present value is on
Digital (Binary) Output (BBO)	Polarity determines the MEx48u's output based on the control program's signal to the microblock. When the control program's signal to the microblock is on , if Polarity is set to: normal —output is on reversed —output is off NOTE Regardless of Polarity , the output will be off if the MEx48u loses power.

To use the Auto-Off-On switches

You can control an output using the **Auto-Off-On** switch.

Set the switch to...	To...
On	Turn on the output.
Off	Turn off the output
Auto	Let the control program control the output

The potentiometer, located between the **Auto-Off-On** switch and the jumper, allows you to manually control the output level of an analog output. Place the **Auto-Off-On** switch in the **On** position, then turn the potentiometer counterclockwise to reduce the output, or clockwise to increase the output.



For a digital output, turn the potentiometer clockwise until it stops (maximum output) and leave it in this position.

The control program can monitor the status of an **Auto-Off-On** switch and display the status on the control program's **Properties** page > **I/O Points** tab in the WebCTRL® interface. The **Value** of the point monitoring the **Auto-Off-On** switch shows **Off** if the switch is set to **Auto**, and **On** if the switch is set to **Off** or **On**.

To monitor an Auto-Off-On switch

- 1 Insert a BACnet Binary Input microblock in the control program.
- 2 On the microblock's **Properties** page in the WebCTRL® interface, set the **I/O Type** field to **H-O-A Status Feedback**.
- 3 In the **Input Number** field, type the number of the output you want to monitor.

Troubleshooting

If you have problems mounting, wiring, or addressing the MEx48u, contact ALC Technical Support.

LED's

The LED's on the MEx48u show the status of certain functions.

If this LED is on...	Status is...
Power	The MEx48u has power
Rx	The MEx48u is receiving data from the network segment
Tx	The MEx48u is transmitting data over the network segment
DO#	The digital output is active

The **Run** and **Error** LED's indicate controller and network status.

If Run LED shows...	And Error LED shows...	Status is..
2 flashes per second	Off	Normal
5 flashes per second	2 flashes per second	Boot is running
5 flashes per second	On	Fatal error. Replace expander or return for repair.

To get the MEx48u's serial number

If you need the MEx48u's serial number when troubleshooting, the number is on a sticker on the back of the main controller board.

To monitor expander communication

You can add an analog input in a control program that will provide the communication status of the MEx48u. If the input reads a value of 64, the expander is communicating. If the input reads 0, the expander is not communicating.

To have the input provide the MEx48u's status, define the following properties for the input.

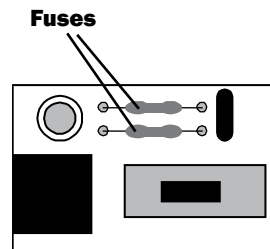
Expander: The expander number you want to read

Input Number: 1

Input Type: Special

To replace the MEx48u's fuses

If you turn on the MEx48u's power switch and the Power LED is not lit, use a multimeter to see if either of the 3 Amp Pico fuses that protect the incoming power is blown.

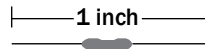


Before replacing the fuse, try to determine why the fuse blew.

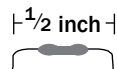
- Check the power wiring polarity of the MEx48u, the controller that the MEx is attached to, and any other controllers that share the power supply. Use the same polarity for all of them.
- Verify that outputs are wired to the appropriate types of devices. See *Outputs* (page 2). For example, you cannot wire a 24 Vac device to an output.

To replace the fuse:

- 1 Turn **off** the MEx48u's power.
- 2 Remove the MEx48u's coverplate.
- 3 Using needle-nose pliers, pull the bad fuse from the MEx48u.
- 4 Cut the wires on the new fuse so that the total length is approximately 1 inch and the fuse is centered.



- 5 Bend the wire ends so that the length is approximately 1/2 inch.



- 6 Use the pliers to grip one wire end of the fuse and push into a fuse socket on the MEx48u.
- 7 Grip the other wire end of the fuse and push into the other fuse socket.
- 8 Replace the MEx48u's coverplate.
- 9 Turn on the power and verify that the Power LED is lit.

Compliance

FCC Compliance

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.



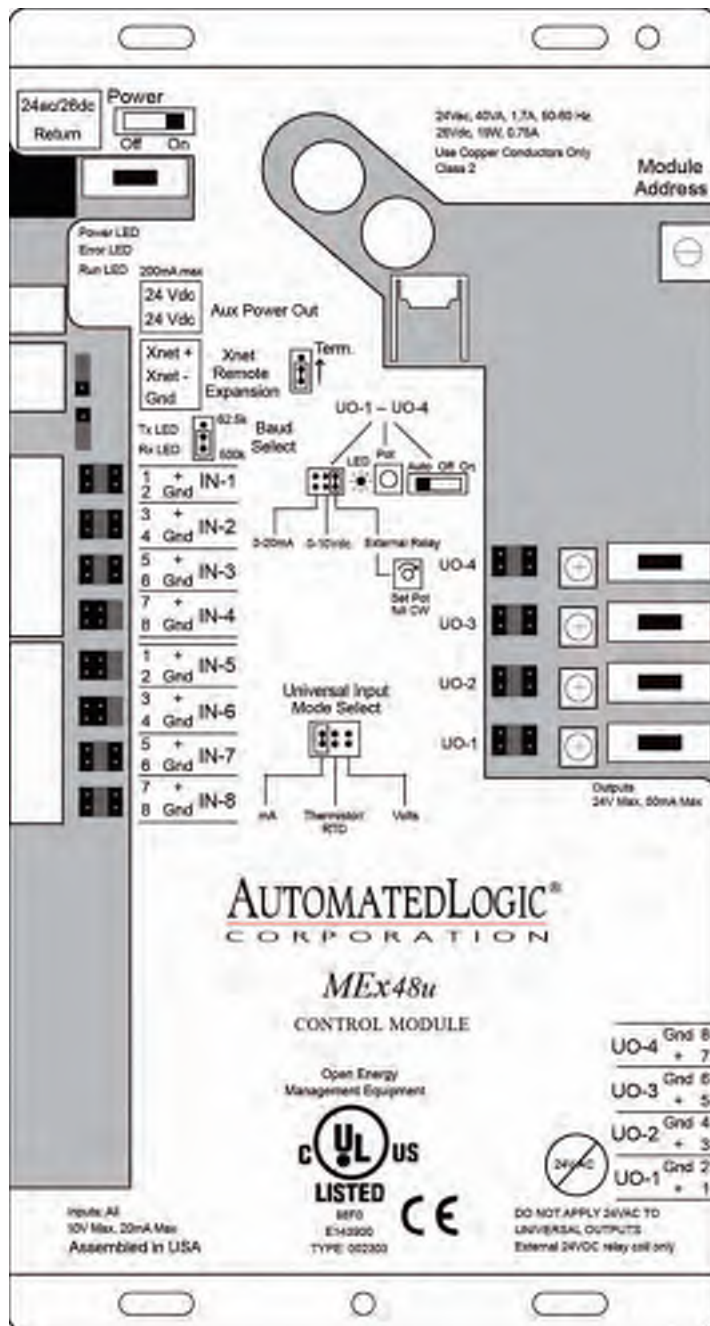
CAUTION Changes or modifications not expressly approved by the responsible party for compliance could void the user's authority to operate the equipment.

CE Compliance



WARNING This is a Class A product. In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate measures.

Appendix - MEx48u coverplate



Document revision history

Important changes to this document are listed below. Minor changes such as typographical or formatting errors are not listed.

Date	Topic	Change description	Code*
9/28/16	Appendix - MEx48u coverplate	Updated coverplate	A-D
	To wire the MEx48u to the controller	Clarified final step in connecting multiple expanders.	X-TS-RD-E-BR
9/23/15	Specifications	Removed "(Replacement fuses available from Automated Logic, Part #FUSEPKG.)" from the Protection specification.	X-TS-JM-F
	To replace the MEx48u's fuse	Removed sentence, "You can order replacement fuses from Automated Logic, Part #FUSEPKG."	
4/20/15	Entire document	New look, no content changes	A-D
11/10/14	Specifications	Changed Power specification from 45 VA to 40 VA	A-TS-SY-F

* For internal use only

SE6166 Controller

Technical Instructions

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Verify that you have the most current version of this document. Go to <https://accounts.automatedlogic.com>, then select **Support > Download > Documents > Hardware**. Important changes are listed in **Document revision history** at the end of this document.

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What is the SE6166 controller?

The SE6166 controller controls rooftop air handling units (AHUs), other large single pieces of equipment, or zones. You can mount the SE6166 on or inside the rooftop equipment.

Driver and control programs

Driver	DRV_SE
Maximum number of BACnet objects*	300*
Maximum number of control programs	999** NOTE To have more than one control program, you must use the v6.00a-067 or later driver.

* Any points that exceed this number will not be network visible.

** Depends on number of BACnet objects and available memory.

Specifications

Power	24 Vac $\pm 10\%$, 50–60 Hz, 20 VA power consumption (38.4 VA with a BACview® device attached) single Class 2 source only, 100 VA or less
BACnet port	For communication with the controller network using ARC156 or MS/TP (9600 bps–76.8 kbps)
Local Access port	For system start-up and troubleshooting
LogiStat port	For LogiStat and LogiStat Plus zone sensors. The LogiStat port uses two universal inputs. NOTE The SE6166 does not support the LogiStat Pro. Use an RS Pro on the Rnet port instead.
Rnet port	Supports: • Up to 15 ZS sensors • One Wireless Adapter that communicates with up to 15 wireless sensors • One Equipment Touch • Up to 4 RS Standard sensors and one RS Plus, RS Pro, or RS Pro-F sensor NOTES • ZS sensors, a Wireless Adapter, and an Equipment Touch can share the Rnet, but not RS sensors. • If you use the Rnet port, you cannot connect a LogiStat sensor to the LogiStat port.

Inputs	16 inputs, configurable for 0–10 Vdc, 0–20 mA, RTD, thermistor, or dry contact, and one LogiStat port. Inputs 1 and 2 are also configurable for pulse counter or timed local override (TLO). NOTE If using a LogiStat or LogiStat Plus, temperature and setpoint adjust inputs replace inputs 9 and 10, making 9 and 10 unavailable.
Input resolution	12 bit A/D
Input pulse frequency	40 pulses per second. Minimum pulse width (on or off time) required for each pulse is 12.5 msec.
Digital outputs	6 digital outputs, relay contacts rated at 3 A max @ 24 Vac. Configured normally open.
Analog outputs	6 analog outputs, 0–10 Vdc or 0–20 mA selectable
Output resolution	8 bit D/A
Microprocessor	High speed 16-bit microprocessor with ARCNET communication co-processor
Memory	1 MB non-volatile battery-backed RAM, 1 MB Flash memory, 16-bit memory bus
Real-time clock	Battery-backed real-time clock keeps track of time in event of power failure
Battery	10-year Lithium CR2032 battery retains the following data for a maximum of 10,000 hours during power outages: time, control programs, editable properties, schedules, and trends. A low battery is indicated by a low battery alarm in the WebCTRL® application.
Protection	Incoming power and network connections are protected by non-replaceable internal solid-state polyswitches that reset themselves when the condition that causes a fault returns to normal. The power, network, input, and output connections are also protected against transient excess voltage/surge events lasting no more than 10 msec.
BT485 connector	You attach a BT485 (not included) to a controller at the beginning and end of a network segment to add bias and to terminate a network segment.
Status indicators	LED's indicate status of communications, running, errors, power, and digital outputs
Environmental operating range	-20 to 140 °F (-29 to 60 °C), 10–90% relative humidity, non-condensing NOTE The controllers should be mounted in a protective enclosure.
Physical	Rugged aluminum cover, removable screw-type terminal blocks
Overall dimensions	Width: 8 5/16 in. (21.1 cm) Height: 7 in. (17.8 cm)
Mounting dimensions	Width: 7 7/8 in. (19.9 cm) Height: 5 in. (12.7 cm)
Recommended panel depth	1 1/2 in. (3.8 cm)
Weight	1.05 lbs (0.48 kg)

BACnet support	Conforms to the BACnet Advanced Application Controller (B-AAC) Standard Device Profile as defined in ANSI/ASHRAE Standard 135-2012 (BACnet) Annex L, Protocol Revision 9
Listed by	UL-916 (PAZX), cUL-916 (PAZX7), FCC Part 15-Subpart B-Class A, CE

Inputs

The SE6166 has 16 inputs that accept the following signal types.

These Inputs...	Support this signal type...	Description
All	Thermistor ¹	Precon type 2 (10 kOhm at 77 °F). Input voltages should be from 0.489 Vdc to 3.825 Vdc for thermistors.
All	Dry contact	A 5 Vdc wetting voltage detects contact position, resulting in a 1 mA maximum sense current when the contacts are closed.
All	0–5 Vdc 0–10 Vdc	The output impedance of a 0–5 Vdc or a 0–10 Vdc source must not exceed 200 Ohms. The input impedance of the SE6166 is approximately 20 kOhm.
All	0–20 mA	The input resistance on the positive (+) terminal is 250 Ohms. The Aux Power Out connector is capable of supplying 24 Vdc to multiple 4–20 mA transducers, but the total current demanded must not exceed 200 mA. If the voltage measured from the Aux Power Out connector to Gnd is less than 18 Vdc, you need to use an external power supply.
All	RTD ¹	Platinum - 1 kOhm at 32 °F (0 °C) Nickel/Iron - 1 kOhm at 70 °F (21 °C) Balco TS8000 - 1 kOhm at 70 °F (21 °C) Input voltages should be from 0.6–1.2 V NOTE Automated Logic® recommends use of an external current transducer between an RTD and the SE6166.
IN-1, IN-2	Pulse counter ²	Pulse counting up to 40 pulses per second. Minimum pulse width (on or off time) required for each pulse is 12.5 msec.
IN-1, IN-2	Timed local override	A momentary contact switch that overrides a schedule and turns equipment on for a defined period of time. The override time added for each push of the button and the maximum allowable On time are software adjustable.
IN-9, IN-10	LogiStat LogiStat Plus ³	IN-9–See Thermistor. IN-10–Setpoint adjust. Input voltages should be from 1.4–3.4 Vdc.

¹ To use a thermistor or RTD not listed above, you can set up a *custom translation table* (page 23) for your sensor.

² The SE6166 can perform pulse counting for dry contact or voltage inputs if you assign the input to a Pulse to Analog Input microblock. See *To assign inputs or outputs to points* (page 16).

³ A LogiStat or LogiStat Plus connected to the SE6166 uses IN-9 and IN-10. A LogiStat Pro, a ZS sensor, or an RS sensor does not use these inputs.

Digital outputs

The SE6166 has 6 digital outputs. You can connect each output to a maximum of 24 Vac. Each output is a dry contact rated at 3 A maximum and is normally open.

Analog outputs

The SE6166 has 6 analog outputs that support voltage or current devices. The controlled device must share the same ground as the controller and have the following resistance to ground:

0–10 Vdc	min 500 Ohms
0–20 mA	max 800 Ohms

NOTE The SE6166 supervises all outputs.

Zone sensors

Automated Logic® wireless sensors

You can connect a Wireless Adapter to SE6166's **Rnet** port. The Wireless Adapter communicates with up to 15 wireless sensors. When using wireless sensors, the Rnet can have:

- Up to 15 wireless and ZS sensors (any combination)
- One Wireless Adapter
- One Equipment Touch

ZS sensors

You can wire up to 15 ZS sensors to the SE6166's **Rnet** port. ZS sensors can share the Rnet with the devices listed above.

NOTE A control program can use no more than 5 ZS Sensors, so you must use multiple control programs if your Rnet network has more than 5 sensors.

RS sensors

You can wire RS sensors to the SE6166's **Rnet** port. An Rnet can consist of any of the following combinations of devices wired in a daisy-chain or star configuration:

- 1 RS Plus, RS Pro, or RS Pro-F
- 1–4 RS Standards
- 1–4 RS Standards, and 1 RS Plus, RS Pro, or RS Pro-F

LogiStats

You can wire a LogiStat or LogiStat Plus to the SE6166's **LogiStat** port.

NOTES

- The SE6166 does not support the LogiStat Pro.
- A LogiStat or LogiStat Plus wired to the SE6166 cannot be used for local access.
- If you use the Rnet port, you cannot connect a LogiStat sensor to the LogiStat port.

Equipment Touch devices

You can wire an Equipment Touch to the SE6166's Rnet port to view or change the controller's property values, schedule equipment, view trends and alarms, and more, without having to access the system's server. The Rnet can have one Equipment Touch, one Wireless Adapter, and up to 5 ZS sensors. RS sensors cannot share the Rnet with an Equipment Touch.

To mount the SE6166

Screw the SE6166 into an enclosed panel using the mounting holes provided on the cover plate. Leave about 2 in. (5 cm) on each side of the controller for wiring.

Wiring for power



WARNING Do not apply line voltage (mains voltage) to the controller's ports and terminals.



CAUTIONS

- The SE6166 is powered by a Class 2 power source. Take appropriate isolation measures when mounting it in a control panel where non-Class 2 circuits are present.
- Automated Logic® controllers can share a power supply as long as you:
 - Maintain the same polarity.
 - Use the power supply only for Automated Logic® controllers.

To wire for power

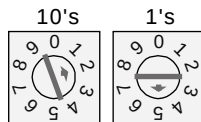
- 1 Turn off the SE6166's power to prevent it from powering up before you can verify the correct voltage.
- 2 Remove power from the 24 Vac transformer.
- 3 Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**.
- 4 Connect the transformer wires to the screw terminal connector.
- 5 Apply power to the transformer.
- 6 Measure the voltage at the SE6166's power input terminals to verify that the voltage is within the operating range of 21.6–26.4 Vac.
- 7 Insert the screw terminal connector into the SE6166's power terminals.
- 8 Turn **on** the SE6166's power.
- 9 Verify that the **Power** LED is on and the **Run** LED is blinking.

To address the SE6166

You must give the SE6166 an address that is unique on the network. You can address the SE6166 before or after you wire it for power.

- 1 If wired for power, turn off the controller's power.
- 2  The controller only reads the rotary switch positions during power up or upon reset.
- 3 Using the rotary switches, set the controller's address to match the **Address** in the controller's properties dialog box in SiteBuilder. Set the **Tens (10's)** switch to the tens digit of the address, and set the **Ones (1's)** switch to the ones digit.

EXAMPLE If the controller's address is 25, point the arrow on the **Tens (10's)** switch to 2 and the arrow on the **Ones (1's)** switch to 5.



Wiring for communications

The SE6166 communicates using BACnet on the following types of network segments:

- ARC156 communicating at 156 kbps
- MS/TP communicating at 9600 bps, 19.2 kbps, 38.4 kbps, or 76.8 kbps

NOTE ARC156 is a unique implementation of the industry standard ARCNET. For a summary of differences between ARCNET and ARC156, see the *ARC156 Wiring Technical Instructions*.

Wiring specifications

For...	Use...	Maximum Length
ARC156 ¹ and MS/TP ²	22 AWG, low-capacitance, twisted, stranded, shielded copper wire	2000 feet (610 meters)

¹ See the *ARC156 Wiring Technical Instructions*.

² See the *MS/TP Networking and Wiring Technical Instructions*.



WARNING Do not apply line voltage (mains voltage) to the controller's ports and terminals.

To wire the SE6166 for communications

- 1 Turn **off** the SE6166's power.
- 2 Check the communications wiring for shorts and grounds.
- 3 Connect the communications wiring to the controller's screw terminals labeled **Net +**, **Net -**, and **Shield**.

NOTE Use the same polarity throughout the network segment.

- 4 Set the communication type and baud rate.

For...	Set DIP switch 4 to...	Set DIP switches 1 and 2 to...
ARC156	ARC156	N/A. Baud rate will be 156 kbps regardless of the DIP switch settings.
MS/TP	MSTP	The appropriate baud rate. See the MSTP Baud diagram on the controller.

NOTE Use the same baud rate for all controllers on the network segment.

- 5 If the SE6166 is at either end of a network segment, connect a BT485 to the SE6166.
- 6 Turn **on** the SE6166's power.
- 7 Verify communication with the network by viewing a Module Status report in the WebCTRL® interface.

Wiring inputs and outputs

Wiring specifications

Input wiring

Input	Maximum length	Minimum gauge	Shielding
0–5 Vdc 0–10 Vdc	1000 feet (305 meters)	26 AWG	Shielded
0–20 mA	3000 feet (914 meters)	26 AWG	Shielded or unshielded
Thermistor Dry contact Pulse counter TLO	1000 feet (305 meters)	22 AWG	Shielded
RTD	100 feet (30 meters)	22 AWG	Shielded
ZS sensor RS sensor Wireless Adapter for wireless sensors Equipment Touch	See <i>Wiring devices to the SE6166's Rnet port</i> (page 11).		
LogiStat sensor	See <i>Wiring a LogiStat sensor to the SE6166</i> (page 14).		

NOTE Automated Logic® recommends use of an external current transducer between an RTD and the SE6166.

Output wiring

To size output wiring, consider the following:

- Total loop distance from the power supply to the controller, and then to the controlled device
NOTE Include the total distance of actual wire. For 2-conductor wires, this is twice the cable length.
- Acceptable voltage drop in the wire from the controller to the controlled device
- Resistance (Ohms) of the chosen wire gauge
- Maximum current (Amps) the controlled device requires to operate

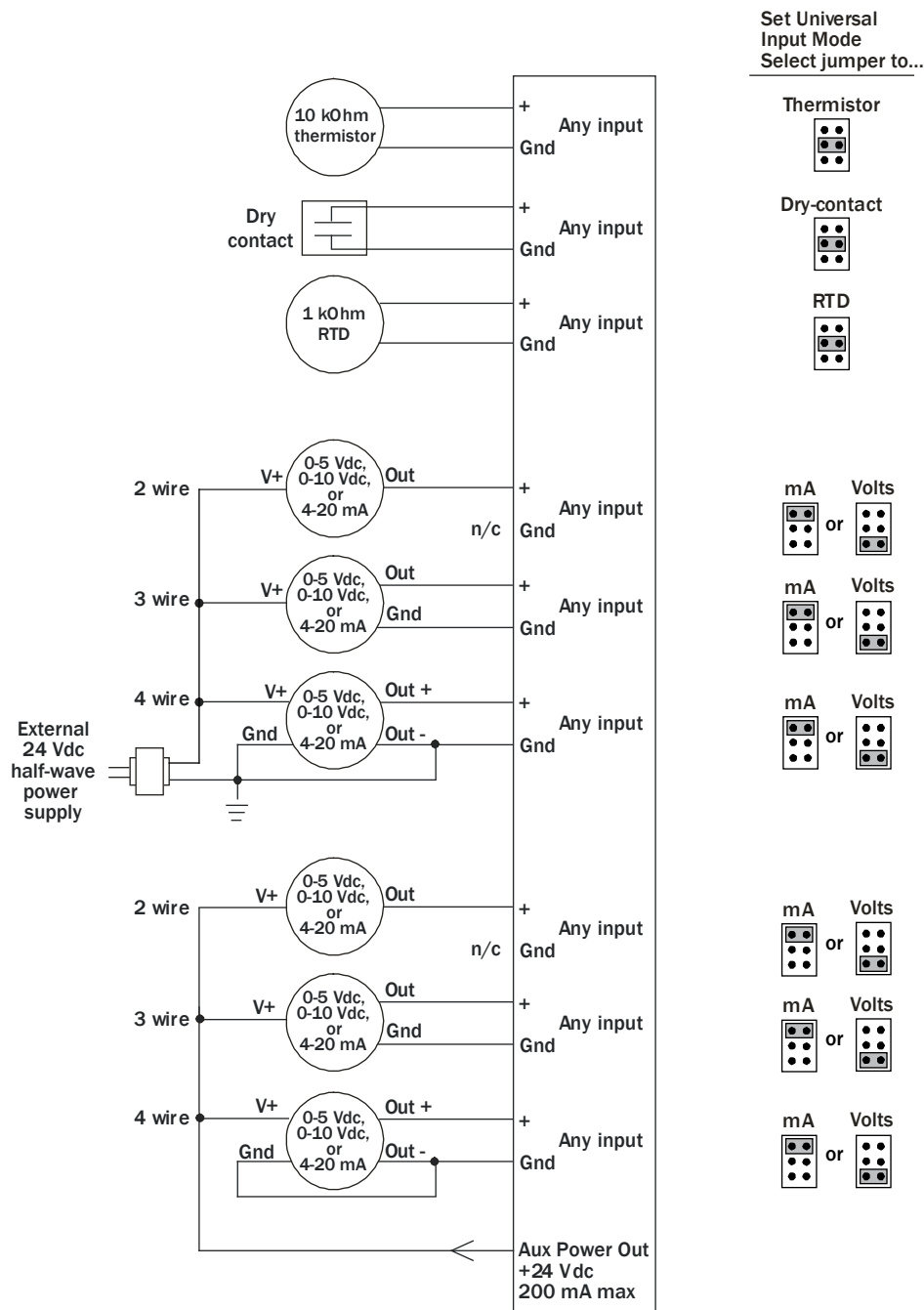
To wire inputs and outputs



WARNING Do not apply line voltage (mains voltage) to the controller's ports and terminals.

- 1 Verify that the SE6166's power and communications connections work properly.
- 2 Turn **off** the SE6166's power.

3 Connect the input wiring to the screw terminals on the SE6166.



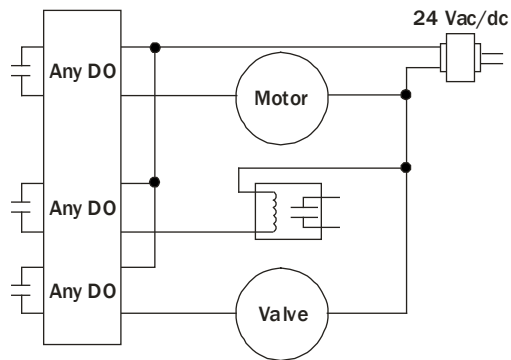
NOTES

- Connect the shield wire to the **GND** terminal with the ground wire.
- Use only IN-1 or IN-2 for pulse counter or timed local override.
- For a loop-powered 4-20 mA sensor, wire the sensor's positive terminal to the **+** terminal on the SE6166's **Aux Power Out** connector. Wire the sensor's negative terminal to an input's **+** terminal.

4 Set the appropriate jumpers on the SE6166.

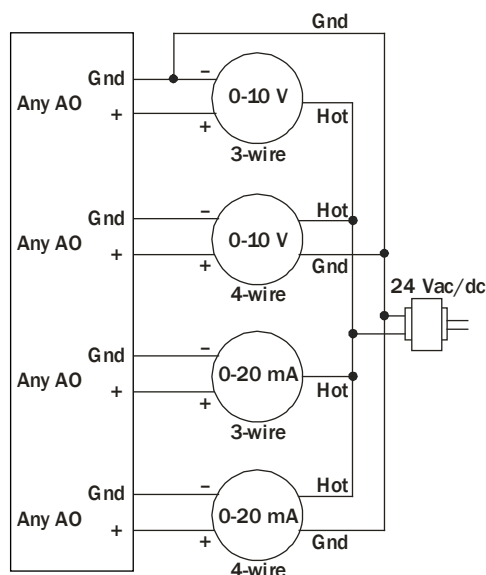
To use...	For...		
Any input	Thermistor Dry contract 0-5 Vdc 0-10 Vdc 0-20 mA RTD	Set each input's Universal Input Mode Select jumper to the type of signal the input will receive.	Jumpers for inputs... 1  2 3  4 5  6 7  8 9  10 11  12 13  14 15  16
Aux Power Out connector	Loop-powered 4-20 mA	Set the Select jumper to +5V or +24V as required by the sensor.	

5 Connect the digital output wiring to the screw terminals on the SE6166 and to the controlled device.



- 6 Connect the analog output wiring to the screw terminals on the SE6166 and to the controlled device.

Set AO
Mode Select
jumper to...



- 7 Set the **AO Mode Select** jumper to the type of device you are wiring the output to.
- 8 Turn **on** the SE6166's power.

Wiring devices to the SE6166's Rnet port

You can wire the following devices to the SE6166's Rnet port in a daisy-chain or star configuration:

- *ZS or RS sensors* (page 12)
- *Wireless Adapter* (page 13) that communicates with wireless sensors
- *Equipment Touch* (page 13)

NOTE ZS sensors, a Wireless Adapter, and an Equipment Touch can share the same Rnet, but not RS sensors.

The Rnet communicates at a rate of 115 kbps.

Rnet wiring specifications

NOTE Use the specified type of wire and cable for maximum signal integrity.

Description	4 conductor, shielded or unshielded, CMP, plenum rated cable
Conductor	22 AWG (7x0096) bare copper
Maximum length	500 feet (152 meters)
Insulation	Low-smoke PVC (or equivalent)
Color Code	Black, white, green, red
Shielding	If shielded, Aluminum/Mylar shield (100% coverage) with TC drain wire
UL temperature rating	32–167 °F (0–75 °C)
Voltage	300 Vac, power limited
Listing	UL: NEC CL2P, or better

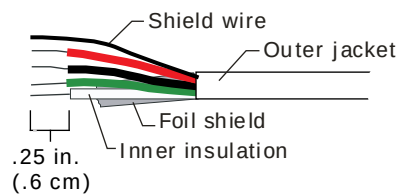
To wire a ZS or an RS sensor to the SE6166

For complete sensor installation instructions, including ZS sensor power requirements, see:

- *ZS Sensors Technical Instructions*
- *RS Sensors Technical Instructions*

- 1 Turn **off** the SE6166's power.

Partially cut, then bend and pull off the outer jacket of the Rnet cable(s). Do not nick the inner insulation.



- 2 Strip about .25 inch (.6 cm) of the inner insulation from each wire.
- 3 Wire each terminal on the SE6166's **Rnet** port to the terminal of the same name on the sensor.

NOTES

- If using shielded wire, connect the shield wire and the ground wire to the **Gnd** terminal.
- Verify that the **Enhanced Access** DIP switch is set to **Off**.

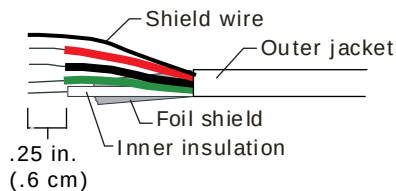
- 4 Turn **on** the SE6166's power.

To wire a Wireless Adapter to the SE6166

NOTES

- The Wireless Adapter requires a 24 Vac power supply. It is not powered by the Rnet.
- If the Wireless Adapter will be:
 - Daisy-chained on the Rnet with ZS sensors or an Equipment Touch, use the standard 4-conductor Rnet cable.
 - The only device on the Rnet, you can use a 3-conductor cable instead of the standard 4-conductor Rnet cable.
- For complete Wireless Adapter installation instructions, see the *Wireless Sensors Technical Instructions*.

- 1 Turn **off** the SE6166's power.
- 2 Partially cut, then bend and pull off the outer jacket of the Rnet cable(s). Do not nick the inner insulation.



- 3 Strip about .25 inch (.6 cm) of the inner insulation from each wire.
- 4 Wire the SE6166's **Rnet+**, **Rnet-**, and **Gnd** terminals to the terminals of the same name on the Wireless Adapter's Rnet connector.



NOTES

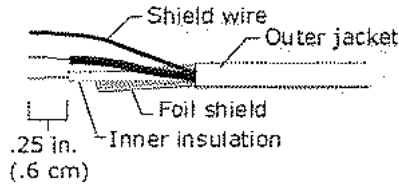
- If using shielded wire, connect the shield wire and the ground wire to the **Gnd** terminal.
 - Verify that the **Enhanced Access** DIP switch is set to **Off**.
- 5 Turn **on** the SE6166's power.

To wire an Equipment Touch to the SE6166

NOTES

- The Equipment Touch requires a 24 Vac power supply. It is not powered by the Rnet.
- If the Equipment Touch will be:
 - Daisy-chained on the Rnet with ZS sensors or a Wireless Adapter, use the standard 4-conductor Rnet wiring and follow the wiring instructions *To wire a ZS or an RS sensor to the SE6166* (page 12).
 - The only device on the Rnet, you can use a 2-conductor cable instead of the standard 4-conductor Rnet cable and follow the instructions below.
- For complete Equipment Touch installation instructions including wiring diagrams, see the *Equipment Touch Installation and Setup Guide*.

- 1 Turn **off** the SE6166's power.
- 2 Partially cut, then bend and pull off the outer jacket of the cable. Do not nick the inner insulation.



- 3 Strip about .25 inch (.6 cm) of the inner insulation from each wire.
- 4 Wire the SE6166's **Rnet+** and **Rnet-** terminals to the terminals of the same name on the Equipment Touch's connector.

NOTES

- If using shielded wire, connect the shield wire and the ground wire to the **Gnd** terminal.
 - Verify that the **Enhanced Access** DIP switch is set to **Off**.
- 5 Turn **on** the SE6166's power.

Wiring a LogiStat sensor to the SE6166

You can wire a LogiStat or LogiStat Plus to the SE6166's **Lstat** port

For complete sensor installation instructions, see the *LogiStat Sensors Technical Instructions*.

LogiStat wiring specifications

Use 22 AWG, unshielded wire, maximum length 100 feet (30 meters).

To wire a LogiStat sensor

- 1 Turn **off** the SE6166's power.
- 2 Wire each terminal on the SE6166's **LStat** port to the terminal of the same name on the LogiStat.
- 3 Set the **Stat Select** jumper to **LogiStat**.
- 4 Turn **on** the SE6166's power.

Downloading the SE6166

Download the following items to the SE6166's battery-backed memory:

Item	Notes
Control program	Must be in WebCTRLx.x\webroot\<system_name>\programs.
DRV_SE driver	Must be in WebCTRLx.x\webroot\<system_name>\drivers. NOTE To verify that you have the driver's latest version, go to http://accounts.automatedlogic.com/download , then select Drivers > ExecB . Compare the latest version to the SE6166's driver in SiteBuilder.
Editable properties	
Schedules	

If you change any of the above items or the SE6166's address after the initial download, you must download again. The first download takes longer than subsequent downloads.



CAUTIONS

- The SE6166 will lose stored data when you download.
- Equipment controlled by the SE6166 will shut down and restart when you download.

To download from the WebCTRL® interface

If your network is complete, you can download from any network browser. If not complete, connect a laptop with a local copy of the system database to the SE6166's local access port. See *To communicate through the local access port* (page 23).

- 1 On the WebCTRL® **Network**  tree, select the controller.
- 2 Click **Downloads**.
- 3 Do one of the following:
 - If the controller is in the Downloads list, go to step 4.
 - If the controller is not in the list:
 - a. Click **Add**.
 - b. In the pop-up, select the controller.
 - c. Select **All Content**.
 - d. Click **Add**.
 - e. Click **Close**.
- 4 Select the controller in the Downloads list.
- 5 Click **Start**.

NOTES

- If the download fails, locate and resolve the problem, then retry the download.
- You can also download a controller from the **Devices** page.

To assign inputs or outputs to points

To use an input or output, you must assign it to its corresponding point in the control program.

- 1 In the WebCTRL® **Geographic**  tree, select the equipment controlled by the SE6166.
- 2 On the **Properties** page, select the **I/O Points** tab.
- 3 In each point's **Num** field, type the number of the controller's corresponding input or output. For example, if you use DO1 on the SE6166 for the point **Pump S/S**, type 1 in the **Num** field for **Pump S/S**.

NOTES

- **Exp** (expander number) is 00 for the SE6166.
 - Do not assign the same output number to more than one point.
- 4 Enter the appropriate values for each input and output in the remaining columns. See *Input values*, *Output values*, *Resolution values* and *Offset/Polarity values* below.
NOTE You can also enter these values in the EIKON® application.
 - 5 If you have not performed the initial download to the SE6166, you must download now so you can verify inputs and outputs.
 - 6 To verify each input's operation, force each sensor to a known value, then compare it to the **Value** shown on the **Properties** page on the **I/O Points** tab.
 - 7 To verify each output's operation, lock each output to a known condition on the **I/O Points** tab, then verify that the equipment operates correctly.

Input values

Input	I/O Type	Sensor/Actuator Type	Min/Max
Analog (BAI)			
0-5 Vdc	0-5 Volt	Linear Full Range	Engineering values associated with 0 Vdc (Min) and 5 Vdc (Max) ¹
0-10 Vdc	0-10 Volt	Linear Full Range	Engineering values associated with 0 Vdc (Min) and 10 Vdc (Max) ¹
2-10 Vdc	0-10 Volt	Linear w/Offset, 2-10 Volts	Engineering values associated with 2 Vdc (Min) and 10 Vdc (Max) ¹
0-20 mA	0-20 mA	Linear Full Range	Engineering values associated with 0 mA (Min) and 20 mA (Max) ¹
4-20 mA	0-20 mA	Linear w/Offset, 4-20 mA	Engineering values associated with 4 mA (Min) and 20 mA (Max) ¹
RTD	RTD Input	Select your RTD type or set up and select a Non-Linear, Custom Table ²	N/A
Thermistor	Thermistor	Select your Thermistor type or set up and select a Non-Linear, Custom Table ²	N/A

Input	I/O Type	Sensor/Actuator Type	Min/Max
Pulse to Analog (BPTA) ³			
Pulse Counter	Counter Input	N/A	N/A
Digital (Binary) (BBI)			
Dry Contact	Dry Contact	N/A	N/A

¹ The sensor reads a value and sends a corresponding signal (Volt, mA, or psi) to the SE6166's physical input. The Analog Input microblock uses the **Min** and **Max** values to linearly translate the signal into the engineering value used in subsequent control logic. For example, set **Min** to 0 and **Max** to 10 for a 4–20 mA sensor that measures velocity from 0.0 to 10.0 inches/second so that when the input reads 4 mA, the microblock outputs a value of 0. Similarly, when the input reads 8 mA, the microblock outputs a value of 2.5.

² You can set up a *custom translation table* (page 23) on the driver's **Custom Translation Tables** pages in the WebCTRL® interface.

³ The control program must have one Pulse to Analog Input microblock for each pulse counting input.

Output values

Output	I/O Type	Sensor/Actuator Type	Min/Max
Analog (BAO)			
0-10 Vdc	Electrical 0–10 Volt	Linear Full Range	Engineering values associated with 0 Vdc (Min) and 10 Vdc (Max) ¹
2-10 Vdc	Electrical 0–10 Volt	Linear w/Offset, 2–10 Volts	Engineering values associated with 2 Vdc (Min) and 10 Vdc (Max) ¹
0-20 mA	Electrical 0–20 mA	Linear Full Range	Engineering values associated with 0 mA (Min) and 20 mA (Max) ¹
4-20 mA	Electrical 0–20 mA	Linear w/Offset, 4–20 mA	Engineering values associated with 4 mA (Min) and 20 mA (Max) ¹
Digital (Binary) (BBO)			
Relay	Relay/Triac Output	N/A	N/A

¹ The Analog Output microblock uses the **Min** and **Max** values to linearly translate its EIKON® wire value into a physical output signal (Volt, mA, or psi) sent from the SE6166 to an actuator. For example, set **Min** to 0 and **Max** to 100 for an Analog Output microblock that receives a 0 to 100% open signal from a PID microblock and that controls a 0–10 Vdc actuator so that when the PID signal is 100%, the SE6166 output is 10 Vdc. Similarly, when the PID signal is 50%, the SE6166 output is 5 Vdc.

Resolution values

Resolution is not particular to a type of input or output, but the driver handles analog and digital (binary) inputs and outputs differently. To set these values appropriately, you should understand how the driver uses them.

Resolution	Notes
Analog Input (BAI)	The driver truncates the microblock's present value according to the resolution. EXAMPLE If the calculated present value is 13.789 and you set the Resolution to 0.1, the control program uses 13.7 for any calculations downstream from the microblock.
Analog Output (BAO)	The driver truncates the wire input value to the microblock before performing any scaling calculations. EXAMPLE If the wire input value is 13.789 and you set the Resolution to 0.1, the microblock uses 13.7 for any scaling calculations.
Digital Inputs and Outputs	N/A

Offset/Polarity values

Offset/Polarity is not particular to a type of input or output, but the driver handles analog and digital (binary) inputs and outputs differently. To set these values appropriately, you should understand how the driver uses them.

Offset/Polarity	Notes
Analog Input (BAI)	Offset value (positive or negative) adds a fine adjustment to a sensor reading after all scaling for calibration. EXAMPLE If a sensor reads 74.9°F when the actual measured value is 73.6°F, enter an Offset of -1.3 to calibrate the sensor to the measured value.
Analog Output (BAO)	You can use the Offset value (positive or negative) to calibrate an output, but you generally do not need to. If used, the driver adds the offset value to the wire input value before performing any scaling calculations to determine the SE6166's output.
Digital (Binary) Input (BBI)	Polarity determines the microblock's present value when no signal is received from the equipment. When no signal is received from the equipment, if Polarity is set to: normal —present value is off reversed —present value is on
Digital (Binary) Output (BBO)	Polarity determines the SE6166's output based on the control program's signal to the microblock. When the control program's signal to the microblock is on , if Polarity is set to: normal —output is on reversed —output is off NOTE Regardless of Polarity , the output will be off if the SE6166 loses power.

To use the Auto-Off-On switches

You can control a digital output using the **Auto-Off-On** switch.

If switch position is...	Normally open output contacts are...
Auto	Determined by control program
Off	Locked open
On	Locked closed

The control program can monitor the status of an **Auto-Off-On** switch and display the status on the control program's **Properties** page > **I/O Points** tab in the WebCTRL® interface. The **Value** of the point monitoring the **Auto-Off-On** switch shows **Off** if the switch is set to **Auto**, and **On** if the switch is set to **Off** or **On**.

To monitor an Auto-Off-On switch

- 1 Insert a BACnet Binary Input microblock in the control program.
- 2 On the microblock's **Properties** page in the WebCTRL® interface, set the **I/O Type** field to **H-O-A Status Feedback**.
- 3 In the **Input Number** field, type the number of the output you want to monitor.

To set up the driver

After you download the driver and control program(s) to the SE6166, you may want to change the driver's properties in the WebCTRL® interface to suit your application.

- 1 On the WebCTRL® **Network**  tree, click  to the left of your SE6166.
- 2 Click  to the left of **Driver** to see its children.
- 3 Make changes as needed on the **Properties** page for **Driver** and any of its children.

Driver

On the **Driver** page, you can change the following properties:

- Module clock synchronization and failure. See table below.
- Network Input microblock communication properties.

BACview Control	
Keypad Inactivity timeout (minutes)	Log out the user (if a user-level password is required), turn off the backlight, and display the standby screen after this period of inactivity.
Keypad user-level password	Numeric password user must enter to access system through a BACview® device.

TouchScreen Control	
TouchScreen Schedule Edit Enable	Check this field to allow a user to edit this controller's schedules from an Equipment Touch's Schedules screen.
Module Clock	
Clock Fail Date and Time	Date and time the control program uses when controller's real-time clock is invalid.  TIP Use an occupied date and time (such as a Tuesday at 10 a.m.) so the equipment does not operate in unoccupied mode if the controller loses power during occupancy.
Time Synch Sensitivity (seconds)	When the controller receives a time sync request, if the difference between the controller's time and the time sync's time is greater than this field's value, the controller's time is immediately changed. If the difference is less than this field's value, the controller's time is slowly adjusted until the time is correct.
Network Microblocks	
Number of poll retries before Network Input Microblocks Indicate failure	The maximum number of retries after the initial attempt that a Network microblock will attempt to communicate with its target device. If unsuccessful, the point will transition to an idle state for 30 seconds before attempting to communicate again. Change this field only if directed by Technical Support.
Periodic rebinding interval	If a microblock uses a wildcard in its address, this timer determines how often the microblock will attempt to find the nearest instance of its target. For example, if an outside air temperature address uses a wildcard, a VAV application will look for the outside air temperature on the same network segment or on the nearest device containing that object.
BACnet COV Throttling	
Enable COV Throttling	Under normal circumstances, COV Throttling should be enabled to prevent excessive network traffic if an object's COV Increment is set too low. See EXCEPTION below. When enabled, if an object generates excessive COV broadcasts (5 updates in 3 seconds), the driver automatically throttles the broadcasts to 1 per second. Also, if the object's value updates excessively for 30 seconds, an alarm is sent to the WebCTRL® application listing <u>all</u> objects that are updating excessively. A Return-to-normal alarm is sent only after <u>all</u> objects have stopped updating excessively. EXCEPTION: In rare circumstances, such as process control, a subscribing object may require COV updates more frequently than once per second. For these situations, clear this checkbox, but make sure that your network can support the increased traffic. You will also need to disable the Excessive COV alarms under the driver's Common Alarms.
Trend Sampling	
Collect a daily midnight sample for all points in this controller that are sampling on COV	For values that change infrequently, select to verify at midnight daily that the point is still able to communicate trend values.

Device

On the **Device** page, you can change the following properties:

- BACnet device object properties for the SE6166
- SE6166 network communication

Configuration	NOTE The three APDU fields refer to all networks over which the SE6166 communicates.
Max Masters and Max Info Frames	Apply only if the SE6166 is on an MS/TP network.

Notification Classes

Alarms in the WebCTRL® application use Notification Class #1. A BACnet alarm's Notification Class defines:

- Alarm priority for Alarm, Fault, and Return to Normal states
- Options for BACnet alarm acknowledgment
- Where alarms should be sent (recipients)

Priorities	NOTE BACnet defines the following Network message priorities for Alarms and Events.										
	<table><tr><th>Priority range</th><th>Network message priority</th></tr><tr><td>00–63</td><td>Life Safety</td></tr><tr><td>64–127</td><td>Critical Equipment</td></tr><tr><td>128–191</td><td>Urgent</td></tr><tr><td>192–255</td><td>Normal</td></tr></table>	Priority range	Network message priority	00–63	Life Safety	64–127	Critical Equipment	128–191	Urgent	192–255	Normal
Priority range	Network message priority										
00–63	Life Safety										
64–127	Critical Equipment										
128–191	Urgent										
192–255	Normal										
Priority of Off-Normal	BACnet priority for Alarms.										
Priority of Fault	BACnet priority for Fault messages.										
Priority of Normal	BACnet priority for Return-to-normal messages.										
Ack Required for Off-Normal, Fault, and Normal	Specifies whether alarms associated with this Notification Class require a BACnet Acknowledgment for Off-Normal, Fault, or Normal alarms.  TIP You can require operator acknowledgment for an Alarm or Return-to-normal message (stored in the WebCTRL® database). In the WebCTRL® interface on the Alarm > Enable/Disable tab, change the acknowledgment settings for an alarm source or an alarm category.										
Recipient List											
Recipients	The first row in this list is the WebCTRL® application. Do not delete this row. Click Add if you want other BACnet devices to receive alarms associated with this Notification Class.										
Recipient Description	Name that appears in the Recipients table.										

Recipient Type	Use Address (static binding) for either of the following: • Third-party BACnet device recipients that do not support dynamic binding • When you want alarms to be broadcast (you must uncheck Issue Confirmed Notifications). This use is rare.
Days and times	The days and times during which the recipient will receive alarms.
Recipient Device Object Identifier	Type the Device Instance from SiteBuilder (or from the network administrator for third-party devices) in the # field.
Process Identifier	Change for third-party devices that use a BACnet Process Identifier other than 1. The WebCTRL® application processes alarms for any 32-bit Process Identifier.
Issue Confirmed Notifications	Select to have a device continue sending an alarm message until it receives delivery confirmation from the recipient.
Transitions to Send	Uncheck the types of alarms you do not want the recipient to get.

Calendars

Calendars are provided in the driver for BACnet compatibility only. Instead, use the **Schedules** feature in the WebCTRL® interface.

Common and Specific Alarms

On these pages, you can enable/disable, change BACnet alarm properties, or set delays for the following BACnet alarms:

Common alarms:

- Module Halted
- All Programs Stopped
- Duplicate Address
- Locked I/O
- Control Program
- Program Stopped
- Excessive COV

Specific alarm:

- Low Battery Alarm

NOTE To set up alarm actions for controller generated alarms, see *Setting up alarm actions* in WebCTRL® Help.

Module Generated Alarm	
Description	Short message shown on the Alarms page or in an alarm action when this type of alarm is generated.
Events	
Alarm Category and Alarm Template	See <i>Customizing alarms</i> in WebCTRL® Help.
Enable	Clear these checkboxes to disable Alarm or Return to normal messages of this type from this controller.
Notification Class	Do not change this field.

Custom Translation Tables

You can set up a translation table that an analog input will use to translate the raw data from a non-linear sensor to the engineering units you want it to output on the wire. In the **Network**  tree, select **Custom Translation Table #1, #2, or #3**. The **Properties** page has instructions. For the input to use the translation table, navigate to the input in the **Geographic**  tree, select the **Details** tab, then set **Sensor Type (Scaling Method)** to **Non-Linear, Custom Table #__**.

Switch and Jumper Positions

The **Switch and Jumper Positions** page shows the current physical settings on the SE6166.

To communicate through the Local Access port

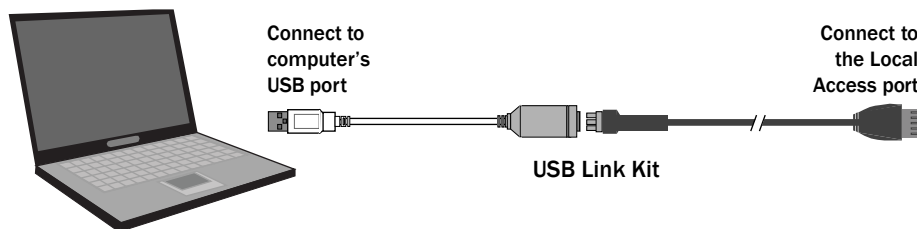
Using a computer and a USB Link Kit, you can communicate locally with the SE6166 to download or to troubleshoot.

PREREQUISITES

- A computer with a USB port
- A USB Link Kit. See the *USB Link Kit Technical Instructions*.
NOTE The USB Link Kit driver is installed with a WebCTRL® v5 or later system. But if needed, you can get the latest driver from <http://www.silabs.com/products/mcu/Pages/USBtoUARTBridgeVCPDrivers.aspx>. Install the driver before you connect the USB Link Kit to your computer.
- v1.70 or later controller driver

 **CAUTION** If multiple controllers share power but polarity was not maintained when they were wired, the difference between the controller's ground and the computer's AC power ground could damage the USB Link Kit and the controller. If you are not sure of the wiring polarity, use a USB isolator between the computer and the USB Link Kit. Purchase a USB isolator online from a third-party manufacturer.

Connect the USB Link Kit to the computer and to the controller's Local Access port.



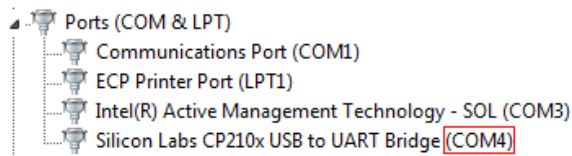
NOTE If using a USB isolator, plug the isolator into your computer's USB port, and then plug the USB Link Kit cable into the isolator.

To set up a Local Access connection in the WebCTRL® interface

For the WebCTRL® application to communicate with the Local Access port, you must do the following:

- 1 On the **System Configuration**  tree, select **Connections**.
- 2 On the **Configure** tab, click **Add**.
- 3 From the **Type** drop-down list, select **BACnet Local Access**.
- 4 Optional: Edit the **Description**.
- 5 Type the computer's **Port** number that the USB cable is connected to.

NOTE To find the port number, plug the USB cable into the computer's USB port, then select **Start** > **Control Panel** > **System** > **Device Manager** > **Ports (Com & LPT)**. The COM port number is beside **Silicon Labs CP210x USB to UART Bridge**.



- 6 Set the **Baud** rate to 115200.
- 7 Click **Accept**.
- 8 On the **View** tab, click the button next to the BACnet/IP network, then select **BACnet Local Access**.
- 9 Click **Accept**.
- 10 On the **Configure** tab, select **BACnet Local Access**, then click **Start**.
NOTE If an error message appears, make sure the COM port you selected is not in use. For example, PuTTY may be open and is holding the port open.
- 11 On the **Network**  tree, select the controller that you are connected to.
- 12 Click , then select **Manual Command**.
- 13 Type `rnet` here in the dialog box, then click **OK**.
- 14 On the **Properties** page, click **Module Status**. If a Modstat report appears, the WebCTRL® application is communicating with the controller.

Troubleshooting

If you have problems mounting, wiring, or addressing the SE6166, contact ALC Technical Support.

LED's

The LED's on the SE6166 show the status of certain functions.

If this LED is on...	Status is...
Power	The SE6166 has power
Rx	The SE6166 is receiving data from the network segment
Tx	The SE6166 is transmitting data over the network segment
DO#	The digital output is active

The **Run** and **Error** LED's indicate controller and network status.

If Run LED shows...	And Error LED shows...	Status is...
2 flashes per second	Off	Normal
2 flashes per second	2 flashes, alternating with Run LED	Five minute auto-restart delay after system error
2 flashes per second	3 flashes, then off	The controller has just been formatted
2 flashes per second	4 flashes, then pause	Two or more devices on this network have the same network address
2 flashes per second	1 flash per second	The controller is alone on the network
2 flashes per second	On	Obtain a Module Status Report (Modstat) to determine which of the following occurred: • Exec halted after frequent system errors • Control programs halted
5 flashes per second	On	Exec start-up aborted, Boot is running
5 flashes per second	Off	Firmware transfer in progress, Boot is running
7 flashes per second	7 flashes per second, alternating with Run LED	Ten second recovery period after brownout
14 flashes per second	14 flashes per second, alternating with Run LED	Brownout

If Run LED shows...	And Error LED shows...	Status is...
On	On	Failure. Try the following solutions: • Turn the SE6166 off, then on. • Format the SE6166. • Download the SE6166. • Replace the SE6166.

NOTE If you resolve the issue but the **Error** LED does not turn off, cycle power to the controller.

To format the controller

If you cannot communicate with a controller after downloading it, as a last resort, you can manually format the controller to erase its memory.

- 1 Turn **off** the SE6166's power.
- 2  Make sure the address switches are not set to 0, 0.
- 3 Hold down the controller's **Format** button while you turn its power on.
- 4 Continue to hold down the **Format** button until the **Error** LED stops flashing and turns on, then release the button.
- 5 Download the SE6166.

To get the SE6166's serial number

If you need the SE6166's serial number when troubleshooting, the number is on:

- a sticker on the back of the main controller board
- a Module Status report (Modstat) under **Core** (or **Main**) **board hardware**

```
Core board hardware:
Type=176, board=1, manufactured on 06/27/2013 S/N 021362247P
RAM: 512 kBytes; FLASH: 1024 kBytes, type = 3
```

To obtain a modstat in the WebCTRL® interface:

- 1 Select the SE6166 in the **Network**  tree.
- 2 On the **Properties** page, click **Module Status**.

Recovering from a power outage

The SE6166 has a 10-year Lithium CR2032 battery that retains the following data for a maximum of 10,000 hours during power outages.

- Time
- Control programs
- Editable properties
- Trends
- Schedules

If the above data is lost after power returns, replace the battery and then download the SE6166. See instructions below.

To replace the SE6166's battery

If the SE6166 sends a **Low Battery** alarm to the WebCTRL® application, replace the battery.

- 1 Verify that the SE6166's power is on.
- 2 Remove the battery from the controller, making note of the battery's polarity.
- 3 Insert the new battery into the controller, matching the polarity of the battery you removed.
- 4 Download the SE6166.

To take the SE6166 out of service

If needed for troubleshooting or start-up, you can prevent the WebCTRL® application from communicating with the SE6166.

- 1 On the WebCTRL® **Network**  tree, select the SE6166.
- 2 On the **Properties** page, check **Out of Service**.
- 3 Click **Accept**.

Compliance

FCC Compliance

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.



CAUTION Changes or modifications not expressly approved by the responsible party for compliance could void the user's authority to operate the equipment.

CE Compliance

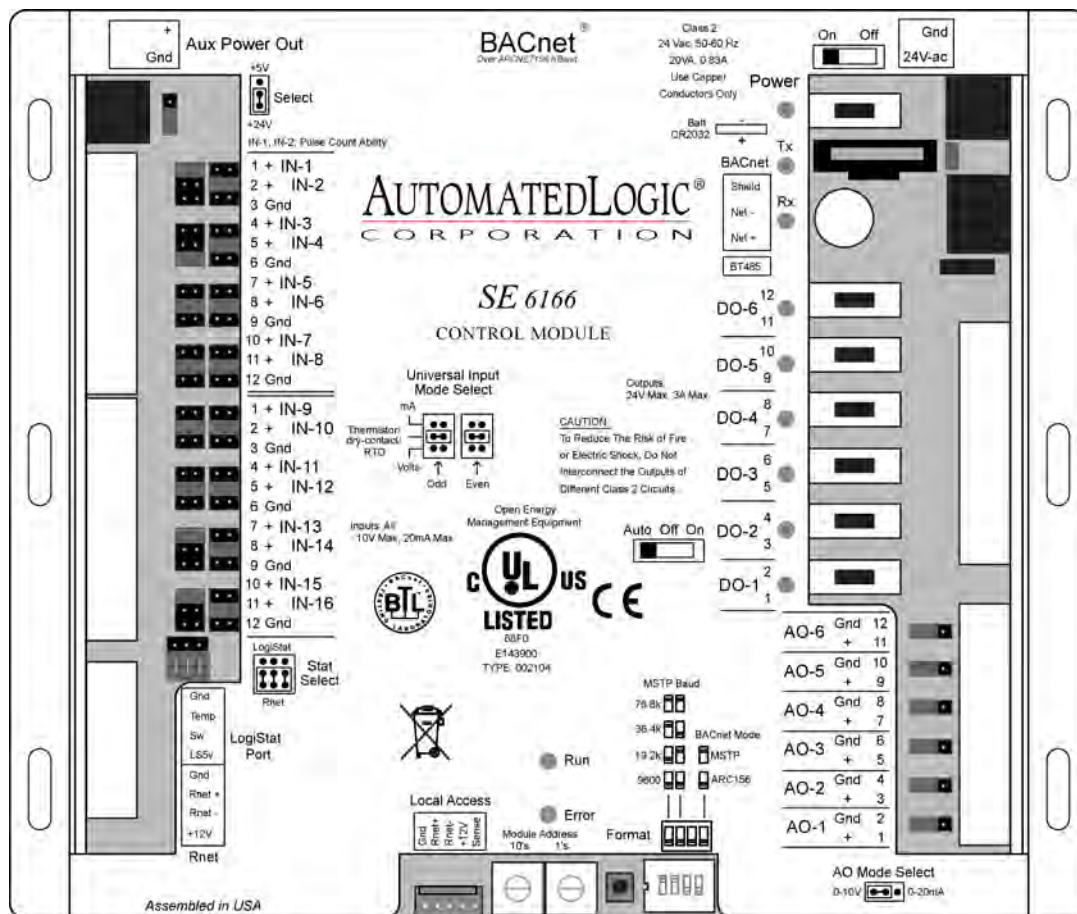


WARNING This is a Class A product. In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate measures.

BACnet Compliance

Compliance of listed products to requirements of ASHRAE Standard 135 is the responsibility of BACnet International. BTL® is a registered trademark of BACnet International.

Appendix - SE6166 coverplate



Document revision history

Important changes to this document are listed below. Minor changes such as typographical or formatting errors are not listed.

Date	Topic	Change description	Code*
2/7/17	Specifications	Added wireless sensors to the Rnet port specification.	X-D
	Zone sensors	Added wireless sensors to this topic.	
	Equipment Touch	Added Wireless Adapter to this topic.	
	Wiring inputs and outputs > Wiring specifications	Added Wireless Adapter to this topic.	
	Wiring devices to the Rnet port	Added Wireless Adapter to this topic.	
	To wire a Wireless Adapter to the SE6166	New topic.	
11/2/16	Specifications	Changed Weight to 1.05 lbs (0.48 kg).	A-D-DB
10/26/16	Zone sensors	Changed section under ZS Sensors from 5 sensors to 15.	A-TS-EE-O
9/27/16	To set up a Local Access connection in the WebCTRL interface	Updated WebCTRL menu button in step 12.	A-D
	Appendix - SE6166 coverplate	Updated coverplate	A-D
8/31/15	Driver and control programs	Changed maximum number of control programs from 1 to 999.	A-O-DY-O
4/17/15	Entire document	New look, no content changes	A-D
11/14/14	BACnet Compliance	Changed BACnet Manufacturers Association to BACnet International	X-D-CP-MW
10/7/14	Driver	Added the Network Microblock fields	A-TS-RB-F
9/8/14	LED's	Changed the Status description for when the Run LED shows 2 flashes per second and the Error LED is On. Also added a note below the table regarding cycling power to turn off Error LED.	A-TS-JM-F-BK
5/13/14	Specifications	Rnet Port: Added Equipment Touch and removed BACview® devices	A-D-CP-O-TC
	Zone sensors	Removed references to BACview	
	Equipment Touch devices	New topic	
	BACview devices	Removed topic	
	Wiring zone sensors to the SE6166	Changed to "Wiring devices to the SE6166's Rnet port"	
	To wire an Equipment Touch to the SE6166	New topic	
	Wiring a LogiStat sensor to the SE6166	New topic	
	To set up the driver > Driver	Added new driver property: TouchScreen Schedule Edit Enable	

* For internal use only

SE6104a Controller

Technical Instructions

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What is the SE6104a controller?

The SE6104a controller controls rooftop air handling units (AHUs), other large single pieces of equipment, or zones. You can mount the SE6104a on or inside the rooftop equipment.

Driver and control programs

Driver	DRV_SE
Maximum number of BACnet objects*	300*
Maximum number of control programs	999** NOTE To have more than one control program, you must use the v6.00a-067 or later driver.

* Any points that exceed this number will not be network visible.

** Depends on number of BACnet objects and available memory.

Specifications

Power	24 Vac $\pm 10\%$, 50–60 Hz, 20 VA power consumption (38.4 VA with a BACview® device attached) single Class 2 source only, 100 VA or less
BACnet port	For communication with the controller network using ARC156 or MS/TP (9600 bps–76.8 kbps)
Local Access port	For system start-up and troubleshooting
LogiStat port	For LogiStat and LogiStat Plus zone sensors. The LogiStat port uses two universal inputs. NOTE The SE6104a does not support the LogiStat Pro. Use an RS Pro on the Rnet port instead.
Rnet port	Supports: • Up to 15 ZS sensors • One Wireless Adapter that communicates with up to 15 wireless sensors • One Equipment Touch • Up to 4 RS Standard sensors and one RS Plus, RS Pro, or RS Pro-F sensor NOTES • ZS sensors, a Wireless Adapter, and an Equipment Touch can share the Rnet, but not RS sensors. • If you use the Rnet port, you cannot connect a LogiStat sensor to the LogiStat port.

Inputs	10 inputs, configurable for 0–10 Vdc, 0–20 mA, RTD, thermistor, or dry contact, and one LogiStat port. Inputs 1 and 2 are also configurable for pulse counter or timed local override (TLO). NOTE If using a LogiStat or LogiStat Plus, temperature and setpoint adjust inputs replace inputs 9 and 10, making 9 and 10 unavailable.
Input resolution	12 bit A/D
Input pulse frequency	40 pulses per second. Minimum pulse width (on or off time) required for each pulse is 12.5 msec.
Digital outputs	6 digital outputs, relay contacts rated at 3 A max @ 24 Vac. Configured normally open.
Analog outputs	4 analog outputs, 0–10 Vdc or 0–20 mA selectable
Output resolution	8 bit D/A
Microprocessor	High speed 16-bit microprocessor with ARCNET communication co-processor
Memory	1 MB non-volatile battery-backed RAM, 1 MB Flash memory, 16-bit memory bus
Real-time clock	Battery-backed real-time clock keeps track of time in event of power failure
Battery	10-year Lithium CR2032 battery retains the following data for a maximum of 10,000 hours during power outages: time, control programs, editable properties, schedules, and trends. A low battery is indicated by a low battery alarm in the WebCTRL® application.
Protection	Incoming power and network connections are protected by non-replaceable internal solid-state polyswitches that reset themselves when the condition that causes a fault returns to normal. The power, network, input, and output connections are also protected against transient excess voltage/surge events lasting no more than 10 msec.
BT485 connector	You attach a BT485 (not included) to a controller at the beginning and end of a network segment to add bias and to terminate a network segment.
Status indicators	LED's indicate status of communications, running, errors, power, and digital outputs
Environmental operating range	-20 to 140 °F (-29 to 60 °C), 10–90% relative humidity, non-condensing NOTE The controllers should be mounted in a protective enclosure.
Physical	Rugged aluminum cover, removable screw-type terminal blocks
Overall dimensions	Width: 8 5/16 in. (21.1 cm) Height: 7 in. (17.8 cm)
Mounting dimensions	Width: 7 7/8 in. (19.9 cm) Height: 5 in. (12.7 cm)
Recommended panel depth	1 1/2 in. (3.8 cm)
Weight	1.05 lbs (0.48 kg)

BACnet support	Conforms to the BACnet Advanced Application Controller (B-AAC) Standard Device Profile as defined in ANSI/ASHRAE Standard 135-2012 (BACnet) Annex L, Protocol Revision 9
Listed by	UL-916 (PAZX), cUL-916 (PAZX7), FCC Part 15-Subpart B-Class A, CE

Inputs

The SE6104a has 10 inputs that accept the following signal types.

These Inputs...	Support this signal type...	Description
All	Thermistor ¹	Precon type 2 (10 kOhm at 77 °F). Input voltages should be from 0.489 Vdc to 3.825 Vdc for thermistors.
All	Dry contact	A 5 Vdc wetting voltage detects contact position, resulting in a 1 mA maximum sense current when the contacts are closed.
All	0–5 Vdc 0–10 Vdc	The output impedance of a 0–5 Vdc or a 0–10 Vdc source must not exceed 200 Ohms. The input impedance of the SE6104a is approximately 20 kOhm.
All	0–20 mA	The input resistance on the positive (+) terminal is 250 Ohms. The Aux Power Out connector is capable of supplying 24 Vdc to multiple 4–20 mA transducers, but the total current demanded must not exceed 200 mA. If the voltage measured from the Aux Power Out connector to Gnd is less than 18 Vdc, you need to use an external power supply.
All	RTD ¹	Platinum - 1 kOhm at 32 °F (0 °C) Nickel/Iron - 1 kOhm at 70 °F (21 °C) Balco TS8000 - 1 kOhm at 70 °F (21 °C) Input voltages should be from 0.6–1.2 V NOTE Automated Logic® recommends use of an external current transducer between an RTD and the SE6104a.
IN-1, IN-2	Pulse counter ²	Pulse counting up to 40 pulses per second. Minimum pulse width (on or off time) required for each pulse is 12.5 msec.
IN-1, IN-2	Timed local override	A momentary contact switch that overrides a schedule and turns equipment on for a defined period of time. The override time added for each push of the button and the maximum allowable On time are software adjustable.
IN-9, IN-10	LogiStat LogiStat Plus ³	IN-9–See Thermistor. IN-10–Setpoint adjust. Input voltages should be from 1.4–3.4 Vdc.

¹ To use a thermistor or RTD not listed above, you can set up a *custom translation table* (page 23) for your sensor.

² The SE6104a can perform pulse counting for dry contact or voltage inputs if you assign the input to a Pulse to Analog Input microblock. See *To assign inputs or outputs to points* (page 16).

³ A LogiStat or LogiStat Plus connected to the SE6104a uses IN-9 and IN-10. A LogiStat Pro, a ZS sensor, or an RS sensor does not use these inputs.

Digital outputs

The SE6104a has 6 digital outputs. You can connect each output to a maximum of 24 Vac. Each output is a dry contact rated at 3 A maximum and is normally open.

Analog outputs

The SE6104a has 4 analog outputs that support voltage or current devices. The controlled device must share the same ground as the controller and have the following resistance to ground:

0–10 Vdc	min 500 Ohms
0–20 mA	max 800 Ohms

NOTE The SE6104a supervises all outputs.

Zone sensors

Automated Logic® wireless sensors

You can connect a Wireless Adapter to SE6104a's **Rnet** port. The Wireless Adapter communicates with up to 15 wireless sensors. When using wireless sensors, the Rnet can have:

- Up to 15 wireless and ZS sensors (any combination)
- One Wireless Adapter
- One Equipment Touch

ZS sensors

You can wire up to 15 ZS sensors to the SE6104a's **Rnet** port. ZS sensors can share the Rnet with the devices listed above.

NOTE A control program can use no more than 5 ZS Sensors, so you must use multiple control programs if your Rnet network has more than 5 sensors.

RS sensors

You can wire RS sensors to the SE6104a's **Rnet** port. An Rnet can consist of any of the following combinations of devices wired in a daisy-chain or star configuration:

- 1 RS Plus, RS Pro, or RS Pro-F
- 1–4 RS Standards
- 1–4 RS Standards, and 1 RS Plus, RS Pro, or RS Pro-F

LogiStats

You can wire a LogiStat or LogiStat Plus to the SE6104a's **LogiStat** port.

NOTES

- The SE6104a does not support the LogiStat Pro.
- A LogiStat or LogiStat Plus wired to the SE6104a cannot be used for local access.
- If you use the Rnet port, you cannot connect a LogiStat sensor to the LogiStat port.

Equipment Touch devices

You can wire an Equipment Touch to the SE6104a's Rnet port to view or change the controller's property values, schedule equipment, view trends and alarms, and more, without having to access the system's server. The Rnet can have one Equipment Touch, one Wireless Adapter, and up to 5 ZS sensors. RS sensors cannot share the Rnet with an Equipment Touch.

To mount the SE6104a

Screw the SE6104a into an enclosed panel using the mounting holes provided on the cover plate. Leave about 2 in. (5 cm) on each side of the controller for wiring.

Wiring for power



WARNING Do not apply line voltage (mains voltage) to the controller's ports and terminals.



CAUTIONS

- The SE6104a is powered by a Class 2 power source. Take appropriate isolation measures when mounting it in a control panel where non-Class 2 circuits are present.
- Automated Logic® controllers can share a power supply as long as you:
 - Maintain the same polarity.
 - Use the power supply only for Automated Logic® controllers.

To wire for power

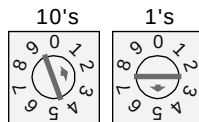
- 1 Turn off the SE6104a's power to prevent it from powering up before you can verify the correct voltage.
- 2 Remove power from the 24 Vac transformer.
- 3 Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**.
- 4 Connect the transformer wires to the screw terminal connector.
- 5 Apply power to the transformer.
- 6 Measure the voltage at the SE6104a's power input terminals to verify that the voltage is within the operating range of 21.6–26.4 Vac.
- 7 Insert the screw terminal connector into the SE6104a's power terminals.
- 8 Turn **on** the SE6104a's power.
- 9 Verify that the **Power** LED is on and the **Run** LED is blinking.

To address the SE6104a

You must give the SE6104a an address that is unique on the network. You can address the SE6104a before or after you wire it for power.

- 1 If wired for power, turn off the controller's power.
- 2  The controller only reads the rotary switch positions during power up or upon reset.
- 3 Using the rotary switches, set the controller's address to match the **Address** in the controller's properties dialog box in SiteBuilder. Set the **Tens (10's)** switch to the tens digit of the address, and set the **Ones (1's)** switch to the ones digit.

EXAMPLE If the controller's address is 25, point the arrow on the **Tens (10's)** switch to 2 and the arrow on the **Ones (1's)** switch to 5.



Wiring for communications

The SE6104a communicates using BACnet on the following types of network segments:

- ARC156 communicating at 156 kbps
- MS/TP communicating at 9600 bps, 19.2 kbps, 38.4 kbps, or 76.8 kbps

NOTE ARC156 is a unique implementation of the industry standard ARCNET. For a summary of differences between ARCNET and ARC156, see the *ARC156 Wiring Technical Instructions*.

Wiring specifications

For...	Use...	Maximum Length
ARC156 ¹ and MS/TP ²	22 AWG, low-capacitance, twisted, stranded, shielded copper wire	2000 feet (610 meters)

¹ See the *ARC156 Wiring Technical Instructions*.

² See the *MS/TP Networking and Wiring Technical Instructions*.



WARNING Do not apply line voltage (mains voltage) to the controller's ports and terminals.

To wire the SE6104a for communications

- 1 Turn **off** the SE6104a's power.
- 2 Check the communications wiring for shorts and grounds.
- 3 Connect the communications wiring to the controller's screw terminals labeled **Net +**, **Net -**, and **Shield**.
NOTE Use the same polarity throughout the network segment.
- 4 Set the communication type and baud rate.

For...	Set DIP switch 4 to...	Set DIP switches 1 and 2 to...
ARC156	ARC156	N/A. Baud rate will be 156 kbps regardless of the DIP switch settings.
MS/TP	MSTP	The appropriate baud rate. See the MSTP Baud diagram on the controller.

- NOTE** Use the same baud rate for all controllers on the network segment.
- 5 If the SE6104a is at either end of a network segment, connect a BT485 to the SE6104a.
 - 6 Turn **on** the SE6104a's power.
 - 7 Verify communication with the network by viewing a Module Status report in the WebCTRL® interface.

Wiring inputs and outputs

Wiring specifications

Input wiring

Input	Maximum length	Minimum gauge	Shielding
0–5 Vdc 0–10 Vdc	1000 feet (305 meters)	26 AWG	Shielded
0–20 mA	3000 feet (914 meters)	26 AWG	Shielded or unshielded
Thermistor Dry contact Pulse counter TLO	1000 feet (305 meters)	22 AWG	Shielded
RTD	100 feet (30 meters)	22 AWG	Shielded
ZS sensor RS sensor Wireless Adapter for wireless sensors Equipment Touch	See <i>Wiring devices to the SE6104a's Rnet port</i> (page 11).		
LogiStat sensor	See <i>Wiring a LogiStat sensor to the SE6104a</i> (page 14).		

NOTE Automated Logic® recommends use of an external current transducer between an RTD and the SE6104a.

Output wiring

To size output wiring, consider the following:

- Total loop distance from the power supply to the controller, and then to the controlled device
NOTE Include the total distance of actual wire. For 2-conductor wires, this is twice the cable length.
- Acceptable voltage drop in the wire from the controller to the controlled device
- Resistance (Ohms) of the chosen wire gauge
- Maximum current (Amps) the controlled device requires to operate

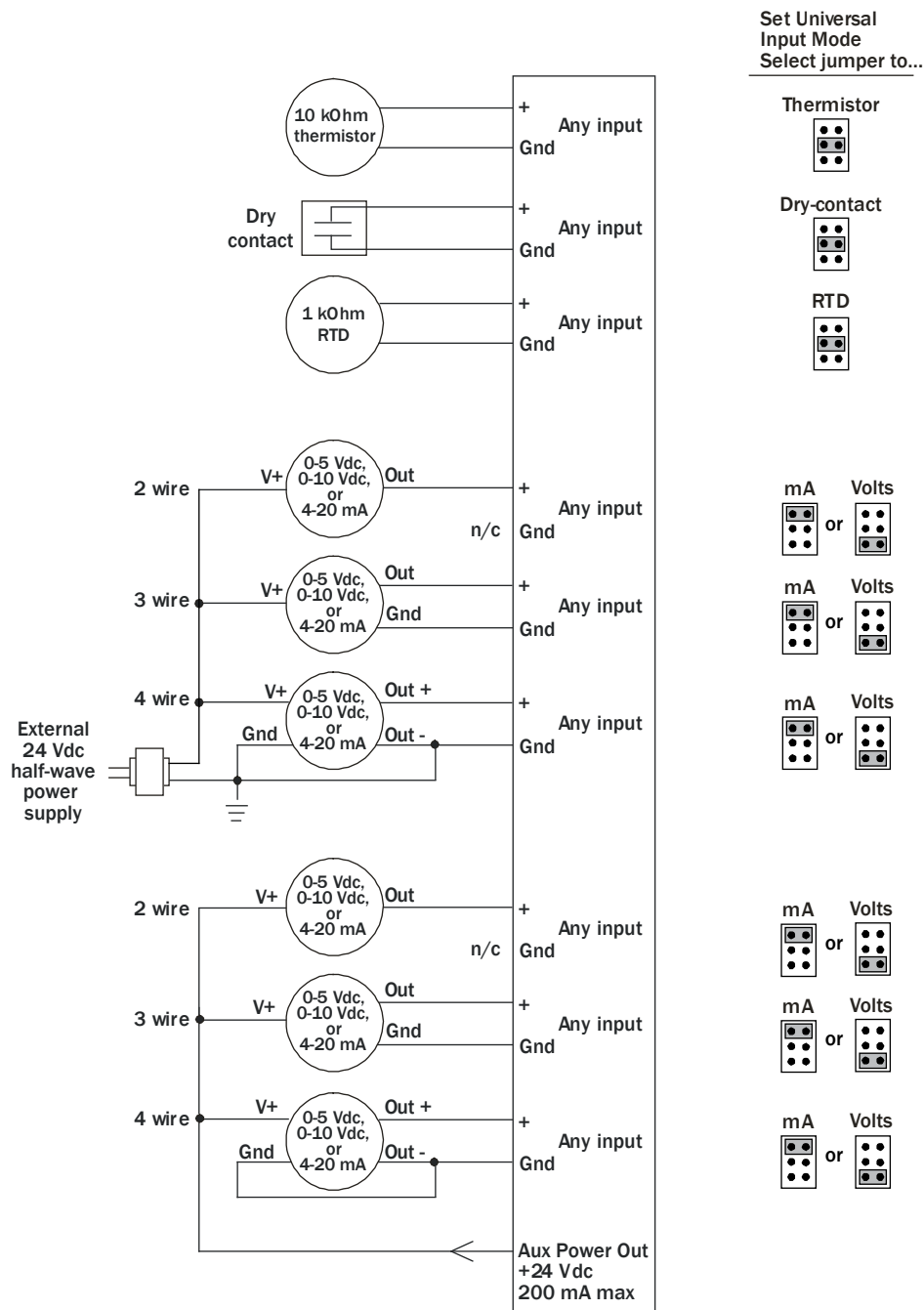
To wire inputs and outputs



WARNING Do not apply line voltage (mains voltage) to the controller's ports and terminals.

- 1 Verify that the SE6104a's power and communications connections work properly.
- 2 Turn **off** the SE6104a's power.

3 Connect the input wiring to the screw terminals on the SE6104a.



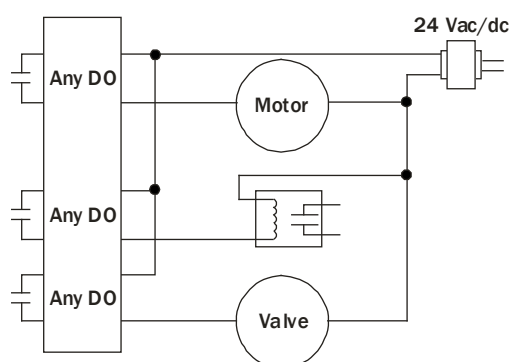
NOTES

- Connect the shield wire to the **GND** terminal with the ground wire.
- Use only IN-1 or IN-2 for pulse counter or timed local override.
- For a loop-powered 4-20 mA sensor, wire the sensor's positive terminal to the **+** terminal on the SE6104a's **Aux Power Out** connector. Wire the sensor's negative terminal to an input's **+** terminal.

4 Set the appropriate jumpers on the SE6104a.

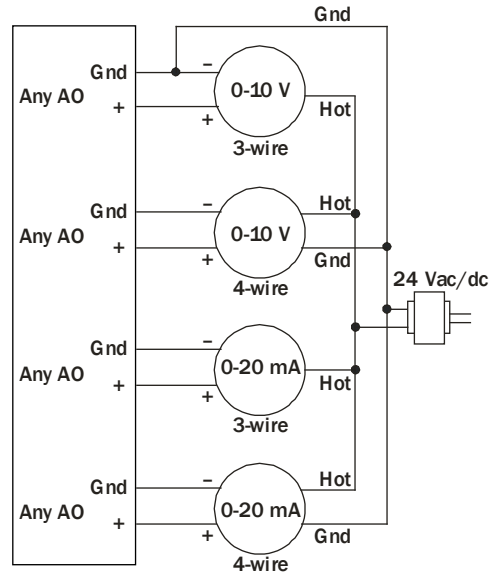
To use...	For...		
Any input	Thermistor Dry contract 0-5 Vdc 0-10 Vdc 0-20 mA RTD	Set each input's Universal Input Mode Select jumper to the type of signal the input will receive.	Jumpers for inputs... 1  2 3  4 5  6 7  8 9  10 11  12 13  14 15  16
Aux Power Out connector	Loop-powered 4-20 mA	Set the Select jumper to +5V or +24V as required by the sensor.	

5 Connect the digital output wiring to the screw terminals on the SE6104a and to the controlled device.



- 6 Connect the analog output wiring to the screw terminals on the SE6104a and to the controlled device.

Set AO
Mode Select
jumper to...



- 7 Set the **AO Mode Select** jumper to the type of device you are wiring the output to.
- 8 Turn **on** the SE6104a's power.

Wiring devices to the SE6104a's Rnet port

You can wire the following devices to the SE6104a's Rnet port in a daisy-chain or star configuration:

- *ZS or RS sensors* (page 12)
- *Wireless Adapter* (page 13) that communicates with wireless sensors
- *Equipment Touch* (page 13)

NOTE ZS sensors, a Wireless Adapter, and an Equipment Touch can share the same Rnet, but not RS sensors.

The Rnet communicates at a rate of 115 kbps.

Rnet wiring specifications

NOTE Use the specified type of wire and cable for maximum signal integrity.

Description	4 conductor, shielded or unshielded, CMP, plenum rated cable
Conductor	22 AWG (7x0096) bare copper
Maximum length	500 feet (152 meters)
Insulation	Low-smoke PVC (or equivalent)
Color Code	Black, white, green, red
Shielding	If shielded, Aluminum/Mylar shield (100% coverage) with TC drain wire
UL temperature rating	32–167 °F (0–75 °C)
Voltage	300 Vac, power limited
Listing	UL: NEC CL2P, or better

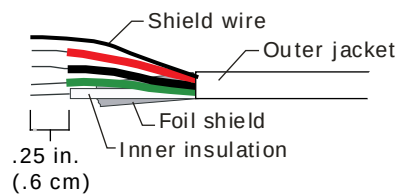
To wire a ZS or an RS sensor to the SE6104a

For complete sensor installation instructions, including ZS sensor power requirements, see:

- *ZS Sensors Technical Instructions*
- *RS Sensors Technical Instructions*

- 1 Turn **off** the SE6104a's power.

Partially cut, then bend and pull off the outer jacket of the Rnet cable(s). Do not nick the inner insulation.



- 2 Strip about .25 inch (.6 cm) of the inner insulation from each wire.
- 3 Wire each terminal on the SE6104a's **Rnet** port to the terminal of the same name on the sensor.

NOTES

- If using shielded wire, connect the shield wire and the ground wire to the **Gnd** terminal.
- Verify that the **Enhanced Access** DIP switch is set to **Off**.

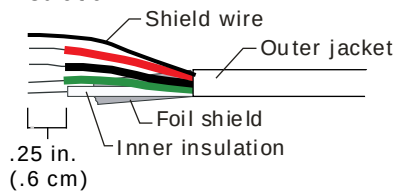
- 4 Turn **on** the SE6104a's power.

To wire a Wireless Adapter to the SE6104a

NOTES

- The Wireless Adapter requires a 24 Vac power supply. It is not powered by the Rnet.
- If the Wireless Adapter will be:
 - Daisy-chained on the Rnet with ZS sensors or an Equipment Touch, use the standard 4-conductor Rnet cable.
 - The only device on the Rnet, you can use a 3-conductor cable instead of the standard 4-conductor Rnet cable.
- For complete Wireless Adapter installation instructions, see the *Wireless Sensors Technical Instructions*.

- 1 Turn **off** the SE6104a's power.
- 2 Partially cut, then bend and pull off the outer jacket of the Rnet cable(s). Do not nick the inner insulation.



- 3 Strip about .25 inch (.6 cm) of the inner insulation from each wire.
- 4 Wire the SE6104a's **Rnet+**, **Rnet-**, and **Gnd** terminals to the terminals of the same name on the Wireless Adapter's Rnet connector.



NOTES

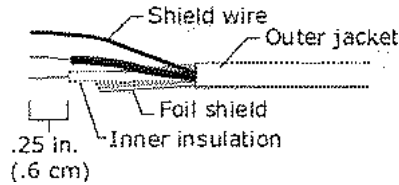
- If using shielded wire, connect the shield wire and the ground wire to the **Gnd** terminal.
 - Verify that the **Enhanced Access** DIP switch is set to **Off**.
- 5 Turn **on** the SE6104a's power.

To wire an Equipment Touch to the SE6104a

NOTES

- The Equipment Touch requires a 24 Vac power supply. It is not powered by the Rnet.
- If the Equipment Touch will be:
 - Daisy-chained on the Rnet with ZS sensors or a Wireless Adapter, use the standard 4-conductor Rnet wiring and follow the wiring instructions *To wire a ZS or an RS sensor to the SE6104a* (page 12).
 - The only device on the Rnet, you can use a 2-conductor cable instead of the standard 4-conductor Rnet cable and follow the instructions below.
- For complete Equipment Touch installation instructions including wiring diagrams, see the *Equipment Touch Installation and Setup Guide*.

- 1 Turn **off** the SE6104a's power.
- 2 Partially cut, then bend and pull off the outer jacket of the cable. Do not nick the inner insulation.



- 3 Strip about .25 inch (.6 cm) of the inner insulation from each wire.
- 4 Wire the SE6104a's **Rnet+** and **Rnet-** terminals to the terminals of the same name on the Equipment Touch's connector.

NOTES

- If using shielded wire, connect the shield wire and the ground wire to the **Gnd** terminal.
 - Verify that the **Enhanced Access** DIP switch is set to **Off**.
- 5 Turn **on** the SE6104a's power.

Wiring a LogiStat sensor to the SE6104a

You can wire a LogiStat or LogiStat Plus to the SE6104a's **Lstat** port

For complete sensor installation instructions, see the *LogiStat Sensors Technical Instructions*.

LogiStat wiring specifications

Use 22 AWG, unshielded wire, maximum length 100 feet (30 meters).

To wire a LogiStat sensor

- 1 Turn **off** the SE6104a's power.
- 2 Wire each terminal on the SE6104a's **LStat** port to the terminal of the same name on the LogiStat.
- 3 Set the **Stat Select** jumper to **LogiStat**.
- 4 Turn **on** the SE6104a's power.

Downloading the SE6104a

Download the following items to the SE6104a's battery-backed memory:

Item	Notes
Control program	Must be in WebCTRLx.x\webroot\<system_name>\programs.
DRV_SE driver	Must be in WebCTRLx.x\webroot\<system_name>\drivers. NOTE To verify that you have the driver's latest version, go to http://accounts.automatedlogic.com/download , then select Drivers > ExecB . Compare the latest version to the SE6104a's driver in SiteBuilder.
Editable properties	
Schedules	

If you change any of the above items or the SE6104a's address after the initial download, you must download again. The first download takes longer than subsequent downloads.



CAUTIONS

- The SE6104a will lose stored data when you download.
- Equipment controlled by the SE6104a will shut down and restart when you download.

To download from the WebCTRL® interface

If your network is complete, you can download from any network browser. If not complete, connect a laptop with a local copy of the system database to the SE6104a's local access port. See *To communicate through the local access port* (page 23).

- 1 On the WebCTRL® **Network**  tree, select the controller.
- 2 Click **Downloads**.
- 3 Do one of the following:
 - If the controller is in the Downloads list, go to step 4.
 - If the controller is not in the list:
 - a. Click **Add**.
 - b. In the pop-up, select the controller.
 - c. Select **All Content**.
 - d. Click **Add**.
 - e. Click **Close**.
- 4 Select the controller in the Downloads list.
- 5 Click **Start**.

NOTES

- If the download fails, locate and resolve the problem, then retry the download.
- You can also download a controller from the **Devices** page.

To assign inputs or outputs to points

To use an input or output, you must assign it to its corresponding point in the control program.

- 1 In the WebCTRL® **Geographic**  tree, select the equipment controlled by the SE6104a.
- 2 On the **Properties** page, select the **I/O Points** tab.
- 3 In each point's **Num** field, type the number of the controller's corresponding input or output. For example, if you use DO1 on the SE6104a for the point **Pump S/S**, type 1 in the **Num** field for **Pump S/S**.

NOTES

- **Exp** (expander number) is 00 for the SE6104a.
 - Do not assign the same output number to more than one point.
- 4 Enter the appropriate values for each input and output in the remaining columns. See *Input values*, *Output values*, *Resolution values* and *Offset/Polarity values* below.
NOTE You can also enter these values in the EIKON® LogicBuilder application.
 - 5 If you have not performed the initial download to the SE6104a, you must download now so you can verify inputs and outputs.
 - 6 To verify each input's operation, force each sensor to a known value, then compare it to the **Value** shown on the **Properties** page on the **I/O Points** tab.
 - 7 To verify each output's operation, lock each output to a known condition on the **I/O Points** tab, then verify that the equipment operates correctly.

Input values

Input	I/O Type	Sensor/Actuator Type	Min/Max
Analog (BAI)			
0-5 Vdc	0-5 Volt	Linear Full Range	Engineering values associated with 0 Vdc (Min) and 5 Vdc (Max) ¹
0-10 Vdc	0-10 Volt	Linear Full Range	Engineering values associated with 0 Vdc (Min) and 10 Vdc (Max) ¹
2-10 Vdc	0-10 Volt	Linear w/Offset, 2-10 Volts	Engineering values associated with 2 Vdc (Min) and 10 Vdc (Max) ¹
0-20 mA	0-20 mA	Linear Full Range	Engineering values associated with 0 mA (Min) and 20 mA (Max) ¹
4-20 mA	0-20 mA	Linear w/Offset, 4-20 mA	Engineering values associated with 4 mA (Min) and 20 mA (Max) ¹
RTD	RTD Input	Select your RTD type or set up and select a Non-Linear, Custom Table ²	N/A
Thermistor	Thermistor	Select your Thermistor type or set up and select a Non-Linear, Custom Table ²	N/A

Input	I/O Type	Sensor/Actuator Type	Min/Max
Pulse to Analog (BPTA) ³			
Pulse Counter	Counter Input	N/A	N/A
Digital (Binary) (BBI)			
Dry Contact	Dry Contact	N/A	N/A

¹ The sensor reads a value and sends a corresponding signal (Volt, mA, or psi) to the SE6104a's physical input. The Analog Input microblock uses the **Min** and **Max** values to linearly translate the signal into the engineering value used in subsequent control logic. For example, set **Min** to 0 and **Max** to 10 for a 4–20 mA sensor that measures velocity from 0.0 to 10.0 inches/second so that when the input reads 4 mA, the microblock outputs a value of 0. Similarly, when the input reads 8 mA, the microblock outputs a value of 2.5.

² You can set up a *custom translation table* (page 23) on the driver's **Custom Translation Tables** pages in the WebCTRL® interface.

³ The control program must have one Pulse to Analog Input microblock for each pulse counting input.

Output values

Output	I/O Type	Sensor/Actuator Type	Min/Max
Analog (BAO)			
0-10 Vdc	Electrical 0–10 Volt	Linear Full Range	Engineering values associated with 0 Vdc (Min) and 10 Vdc (Max) ¹
2-10 Vdc	Electrical 0–10 Volt	Linear w/Offset, 2–10 Volts	Engineering values associated with 2 Vdc (Min) and 10 Vdc (Max) ¹
0-20 mA	Electrical 0–20 mA	Linear Full Range	Engineering values associated with 0 mA (Min) and 20 mA (Max) ¹
4-20 mA	Electrical 0–20 mA	Linear w/Offset, 4–20 mA	Engineering values associated with 4 mA (Min) and 20 mA (Max) ¹
Digital (Binary) (BBO)			
Relay	Relay/Triac Output	N/A	N/A

¹ The Analog Output microblock uses the **Min** and **Max** values to linearly translate its EIKON® LogicBuilder wire value into a physical output signal (Volt, mA, or psi) sent from the SE6104a to an actuator. For example, set **Min** to 0 and **Max** to 100 for an Analog Output microblock that receives a 0 to 100% open signal from a PID microblock and that controls a 0–10 Vdc actuator so that when the PID signal is 100%, the SE6104a output is 10 Vdc. Similarly, when the PID signal is 50%, the SE6104a output is 5 Vdc.

Resolution values

Resolution is not particular to a type of input or output, but the driver handles analog and digital (binary) inputs and outputs differently. To set these values appropriately, you should understand how the driver uses them.

Resolution	Notes
Analog Input (BAI)	The driver truncates the microblock's present value according to the resolution. EXAMPLE If the calculated present value is 13.789 and you set the Resolution to 0.1, the control program uses 13.7 for any calculations downstream from the microblock.
Analog Output (BAO)	The driver truncates the wire input value to the microblock before performing any scaling calculations. EXAMPLE If the wire input value is 13.789 and you set the Resolution to 0.1, the microblock uses 13.7 for any scaling calculations.
Digital Inputs and Outputs	N/A

Offset/Polarity values

Offset/Polarity is not particular to a type of input or output, but the driver handles analog and digital (binary) inputs and outputs differently. To set these values appropriately, you should understand how the driver uses them.

Offset/Polarity	Notes
Analog Input (BAI)	Offset value (positive or negative) adds a fine adjustment to a sensor reading after all scaling for calibration. EXAMPLE If a sensor reads 74.9°F when the actual measured value is 73.6°F, enter an Offset of -1.3 to calibrate the sensor to the measured value.
Analog Output (BAO)	You can use the Offset value (positive or negative) to calibrate an output, but you generally do not need to. If used, the driver adds the offset value to the wire input value before performing any scaling calculations to determine the SE6104a's output.
Digital (Binary) Input (BBI)	Polarity determines the microblock's present value when no signal is received from the equipment. When no signal is received from the equipment, if Polarity is set to: normal —present value is off reversed —present value is on
Digital (Binary) Output (BBO)	Polarity determines the SE6104a's output based on the control program's signal to the microblock. When the control program's signal to the microblock is on , if Polarity is set to: normal —output is on reversed —output is off NOTE Regardless of Polarity , the output will be off if the SE6104a loses power.

To use the Auto-Off-On switches

You can control a digital output using the **Auto-Off-On** switch.

If switch position is...	Normally open output contacts are...
Auto	Determined by control program
Off	Locked open
On	Locked closed

The control program can monitor the status of an **Auto-Off-On** switch and display the status on the control program's **Properties** page > **I/O Points** tab in the WebCTRL® interface. The **Value** of the point monitoring the **Auto-Off-On** switch shows **Off** if the switch is set to **Auto**, and **On** if the switch is set to **Off** or **On**.

To monitor an Auto-Off-On switch

- 1 Insert a BACnet Binary Input microblock in the control program.
- 2 On the microblock's **Properties** page in the WebCTRL® interface, set the **I/O Type** field to **H-O-A Status Feedback**.
- 3 In the **Input Number** field, type the number of the output you want to monitor.

To set up the driver

After you download the driver and control program(s) to the SE6104a, you may want to change the driver's properties in the WebCTRL® interface to suit your application.

- 1 On the WebCTRL® **Network**  tree, click  to the left of your SE6104a.
- 2 Click  to the left of **Driver** to see its children.
- 3 Make changes as needed on the **Properties** page for **Driver** and any of its children.

Driver

On the **Driver** page, you can change the following properties:

- Module clock synchronization and failure. See table below.
- Network Input microblock communication properties.

BACview Control	
Keypad inactivity timeout (minutes)	Log out the user (if a user-level password is required), turn off the backlight, and display the standby screen after this period of inactivity.
Keypad user-level password	Numeric password user must enter to access system through a BACview® device.

TouchScreen Control	
TouchScreen Schedule Edit Enable	Check this field to allow a user to edit this controller's schedules from an Equipment Touch's Schedules screen.
Module Clock	
Clock Fail Date and Time	Date and time the control program uses when controller's real-time clock is invalid.  TIP Use an occupied date and time (such as a Tuesday at 10 a.m.) so the equipment does not operate in unoccupied mode if the controller loses power during occupancy.
Time Synch Sensitivity (seconds)	When the controller receives a time sync request, if the difference between the controller's time and the time sync's time is greater than this field's value, the controller's time is immediately changed. If the difference is less than this field's value, the controller's time is slowly adjusted until the time is correct.
Network Microblocks	
Number of poll retries before Network Input Microblocks Indicate failure	The maximum number of retries after the initial attempt that a Network microblock will attempt to communicate with its target device. If unsuccessful, the point will transition to an idle state for 30 seconds before attempting to communicate again. Change this field only if directed by Technical Support.
Periodic rebinding interval	If a microblock uses a wildcard in its address, this timer determines how often the microblock will attempt to find the nearest instance of its target. For example, if an outside air temperature address uses a wildcard, a VAV application will look for the outside air temperature on the same network segment or on the nearest device containing that object.
BACnet COV Throttling	
Enable COV Throttling	Under normal circumstances, COV Throttling should be enabled to prevent excessive network traffic if an object's COV Increment is set too low. See EXCEPTION below. When enabled, if an object generates excessive COV broadcasts (5 updates in 3 seconds), the driver automatically throttles the broadcasts to 1 per second. Also, if the object's value updates excessively for 30 seconds, an alarm is sent to the WebCTRL® application listing <u>all</u> objects that are updating excessively. A Return-to-normal alarm is sent only after <u>all</u> objects have stopped updating excessively. EXCEPTION: In rare circumstances, such as process control, a subscribing object may require COV updates more frequently than once per second. For these situations, clear this checkbox, but make sure that your network can support the increased traffic. You will also need to disable the Excessive COV alarms under the driver's Common Alarms.
Trend Sampling	
Collect a daily midnight sample for all points in this controller that are sampling on COV	For values that change infrequently, select to verify at midnight daily that the point is still able to communicate trend values.

Device

On the **Device** page, you can change the following properties:

- BACnet device object properties for the SE6104a
- SE6104a network communication

Configuration	NOTE The three APDU fields refer to all networks over which the SE6104a communicates.
Max Masters and Max Info Frames	Apply only if the SE6104a is on an MS/TP network.

Notification Classes

Alarms in the WebCTRL® application use Notification Class #1. A BACnet alarm's Notification Class defines:

- Alarm priority for Alarm, Fault, and Return to Normal states
- Options for BACnet alarm acknowledgment
- Where alarms should be sent (recipients)

Priorities	NOTE BACnet defines the following Network message priorities for Alarms and Events.										
	<table><tr><th>Priority range</th><th>Network message priority</th></tr><tr><td>00–63</td><td>Life Safety</td></tr><tr><td>64–127</td><td>Critical Equipment</td></tr><tr><td>128–191</td><td>Urgent</td></tr><tr><td>192–255</td><td>Normal</td></tr></table>	Priority range	Network message priority	00–63	Life Safety	64–127	Critical Equipment	128–191	Urgent	192–255	Normal
Priority range	Network message priority										
00–63	Life Safety										
64–127	Critical Equipment										
128–191	Urgent										
192–255	Normal										
Priority of Off-Normal	BACnet priority for Alarms.										
Priority of Fault	BACnet priority for Fault messages.										
Priority of Normal	BACnet priority for Return-to-normal messages.										
Ack Required for Off-Normal, Fault, and Normal	Specifies whether alarms associated with this Notification Class require a BACnet Acknowledgment for Off-Normal, Fault, or Normal alarms.  TIP You can require operator acknowledgment for an Alarm or Return-to-normal message (stored in the WebCTRL® database). In the WebCTRL® interface on the Alarm > Enable/Disable tab, change the acknowledgment settings for an alarm source or an alarm category.										
Recipient List											
Recipients	The first row in this list is the WebCTRL® application. Do not delete this row. Click Add if you want other BACnet devices to receive alarms associated with this Notification Class.										
Recipient Description	Name that appears in the Recipients table.										

Recipient Type	Use Address (static binding) for either of the following: • Third-party BACnet device recipients that do not support dynamic binding • When you want alarms to be broadcast (you must uncheck Issue Confirmed Notifications). This use is rare.
Days and times	The days and times during which the recipient will receive alarms.
Recipient Device Object Identifier	Type the Device Instance from SiteBuilder (or from the network administrator for third-party devices) in the # field.
Process Identifier	Change for third-party devices that use a BACnet Process Identifier other than 1. The WebCTRL® application processes alarms for any 32-bit Process Identifier.
Issue Confirmed Notifications	Select to have a device continue sending an alarm message until it receives delivery confirmation from the recipient.
Transitions to Send	Uncheck the types of alarms you do not want the recipient to get.

Calendars

Calendars are provided in the driver for BACnet compatibility only. Instead, use the **Schedules** feature in the WebCTRL® interface.

Common and Specific Alarms

On these pages, you can enable/disable, change BACnet alarm properties, or set delays for the following BACnet alarms:

Common alarms:

- Module Halted
- All Programs Stopped
- Duplicate Address
- Locked I/O
- Control Program
- Program Stopped
- Excessive COV

Specific alarm:

- Low Battery Alarm

NOTE To set up alarm actions for controller generated alarms, see *Setting up alarm actions* in WebCTRL® Help.

Module Generated Alarm	
Description	Short message shown on the Alarms page or in an alarm action when this type of alarm is generated.
Events	
Alarm Category and Alarm Template	See <i>Customizing alarms</i> in WebCTRL® Help.
Enable	Clear these checkboxes to disable Alarm or Return to normal messages of this type from this controller.
Notification Class	Do not change this field.

Custom Translation Tables

You can set up a translation table that an analog input will use to translate the raw data from a non-linear sensor to the engineering units you want it to output on the wire. In the **Network**  tree, select **Custom Translation Table #1, #2, or #3**. The **Properties** page has instructions. For the input to use the translation table, navigate to the input in the **Geographic**  tree, select the **Details** tab, then set **Sensor Type (Scaling Method)** to **Non-Linear, Custom Table #__**.

Switch and Jumper Positions

The **Switch and Jumper Positions** page shows the current physical settings on the SE6104a.

To communicate through the Local Access port

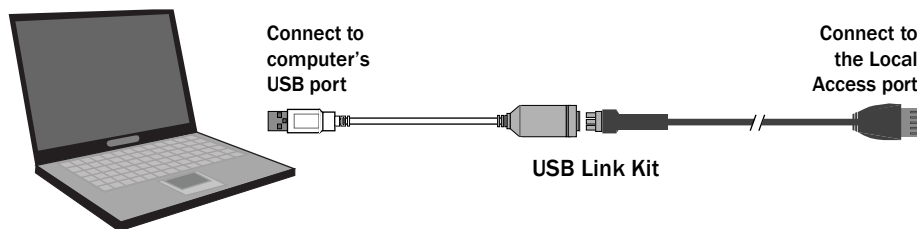
Using a computer and a USB Link Kit, you can communicate locally with the SE6104a to download or to troubleshoot.

PREREQUISITES

- A computer with a USB port
- A USB Link Kit. See the *USB Link Kit Technical Instructions*.
NOTE The USB Link Kit driver is installed with a WebCTRL® v5 or later system. But if needed, you can get the latest driver from <http://www.silabs.com/products/mcu/Pages/USBtoUARTBridgeVCPDrivers.aspx>. Install the driver before you connect the USB Link Kit to your computer.
- v1.70 or later controller driver

 **CAUTION** If multiple controllers share power but polarity was not maintained when they were wired, the difference between the controller's ground and the computer's AC power ground could damage the USB Link Kit and the controller. If you are not sure of the wiring polarity, use a USB isolator between the computer and the USB Link Kit. Purchase a USB isolator online from a third-party manufacturer.

Connect the USB Link Kit to the computer and to the controller's Local Access port.



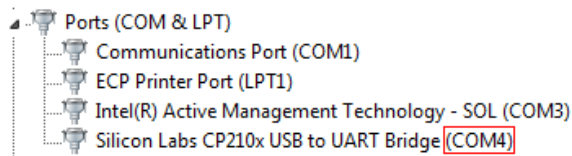
NOTE If using a USB isolator, plug the isolator into your computer's USB port, and then plug the USB Link Kit cable into the isolator.

To set up a Local Access connection in the WebCTRL® interface

For the WebCTRL® application to communicate with the Local Access port, you must do the following:

- 1 On the **System Configuration**  tree, select **Connections**.
- 2 On the **Configure** tab, click **Add**.
- 3 From the **Type** drop-down list, select **BACnet Local Access**.
- 4 Optional: Edit the **Description**.
- 5 Type the computer's **Port** number that the USB cable is connected to.

NOTE To find the port number, plug the USB cable into the computer's USB port, then select **Start** > **Control Panel** > **System** > **Device Manager** > **Ports (Com & LPT)**. The COM port number is beside **Silicon Labs CP210x USB to UART Bridge**.



- 6 Set the **Baud** rate to 115200.
- 7 Click **Accept**.
- 8 On the **View** tab, click the button next to the BACnet/IP network, then select **BACnet Local Access**.
- 9 Click **Accept**.
- 10 On the **Configure** tab, select **BACnet Local Access**, then click **Start**.
NOTE If an error message appears, make sure the COM port you selected is not in use. For example, PuTTY may be open and is holding the port open.
- 11 On the **Network**  tree, select the controller that you are connected to.
- 12 Click , then select **Manual Command**.
- 13 Type `rnet` here in the dialog box, then click **OK**.
- 14 On the **Properties** page, click **Module Status**. If a Modstat report appears, the WebCTRL® application is communicating with the controller.

Troubleshooting

If you have problems mounting, wiring, or addressing the SE6104a, contact ALC Technical Support.

LED's

The LED's on the SE6104a show the status of certain functions.

If this LED is on...	Status is...
Power	The SE6104a has power
Rx	The SE6104a is receiving data from the network segment
Tx	The SE6104a is transmitting data over the network segment
DO#	The digital output is active

The **Run** and **Error** LED's indicate controller and network status.

If Run LED shows...	And Error LED shows...	Status is...
2 flashes per second	Off	Normal
2 flashes per second	2 flashes, alternating with Run LED	Five minute auto-restart delay after system error
2 flashes per second	3 flashes, then off	The controller has just been formatted
2 flashes per second	4 flashes, then pause	Two or more devices on this network have the same network address
2 flashes per second	1 flash per second	The controller is alone on the network
2 flashes per second	On	Obtain a Module Status Report (Modstat) to determine which of the following occurred: • Exec halted after frequent system errors • Control programs halted
5 flashes per second	On	Exec start-up aborted, Boot is running
5 flashes per second	Off	Firmware transfer in progress, Boot is running
7 flashes per second	7 flashes per second, alternating with Run LED	Ten second recovery period after brownout
14 flashes per second	14 flashes per second, alternating with Run LED	Brownout

If Run LED shows...	And Error LED shows...	Status is...
On	On	Failure. Try the following solutions: • Turn the SE6104a off, then on. • Format the SE6104a. • Download the SE6104a. • Replace the SE6104a.

NOTE If you resolve the issue but the **Error** LED does not turn off, cycle power to the controller.

To format the controller

If you cannot communicate with a controller after downloading it, as a last resort, you can manually format the controller to erase its memory.

- 1 Turn **off** the SE6104a's power.
- 2  Make sure the address switches are not set to 0, 0.
- 3 Hold down the controller's **Format** button while you turn its power on.
- 4 Continue to hold down the **Format** button until the **Error** LED stops flashing and turns on, then release the button.
- 5 Download the SE6104a.

To get the SE6104a's serial number

If you need the SE6104a's serial number when troubleshooting, the number is on:

- a sticker on the back of the main controller board
- a Module Status report (Modstat) under **Core** (or **Main**) board hardware



To obtain a modstat in the WebCTRL® interface:

- 1 Select the SE6104a in the **Network**  tree.
- 2 On the **Properties** page, click **Module Status**.

Recovering from a power outage

The SE6104a has a 10-year Lithium CR2032 battery that retains the following data for a maximum of 10,000 hours during power outages.

- Time
- Control programs
- Editable properties
- Trends
- Schedules

If the above data is lost after power returns, replace the battery and then download the SE6104a. See instructions below.

To replace the SE6104a's battery

If the SE6104a sends a **Low Battery** alarm to the WebCTRL® application, replace the battery.

- 1 Verify that the SE6104a's power is on.
- 2 Remove the battery from the controller, making note of the battery's polarity.
- 3 Insert the new battery into the controller, matching the polarity of the battery you removed.
- 4 Download the SE6104a.

To take the SE6104a out of service

If needed for troubleshooting or start-up, you can prevent the WebCTRL® application from communicating with the SE6104a.

- 1 On the WebCTRL® **Network**  tree, select the SE6104a.
- 2 On the **Properties** page, check **Out of Service**.
- 3 Click **Accept**.

Compliance

FCC Compliance

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.



CAUTION Changes or modifications not expressly approved by the responsible party for compliance could void the user's authority to operate the equipment.

CE Compliance

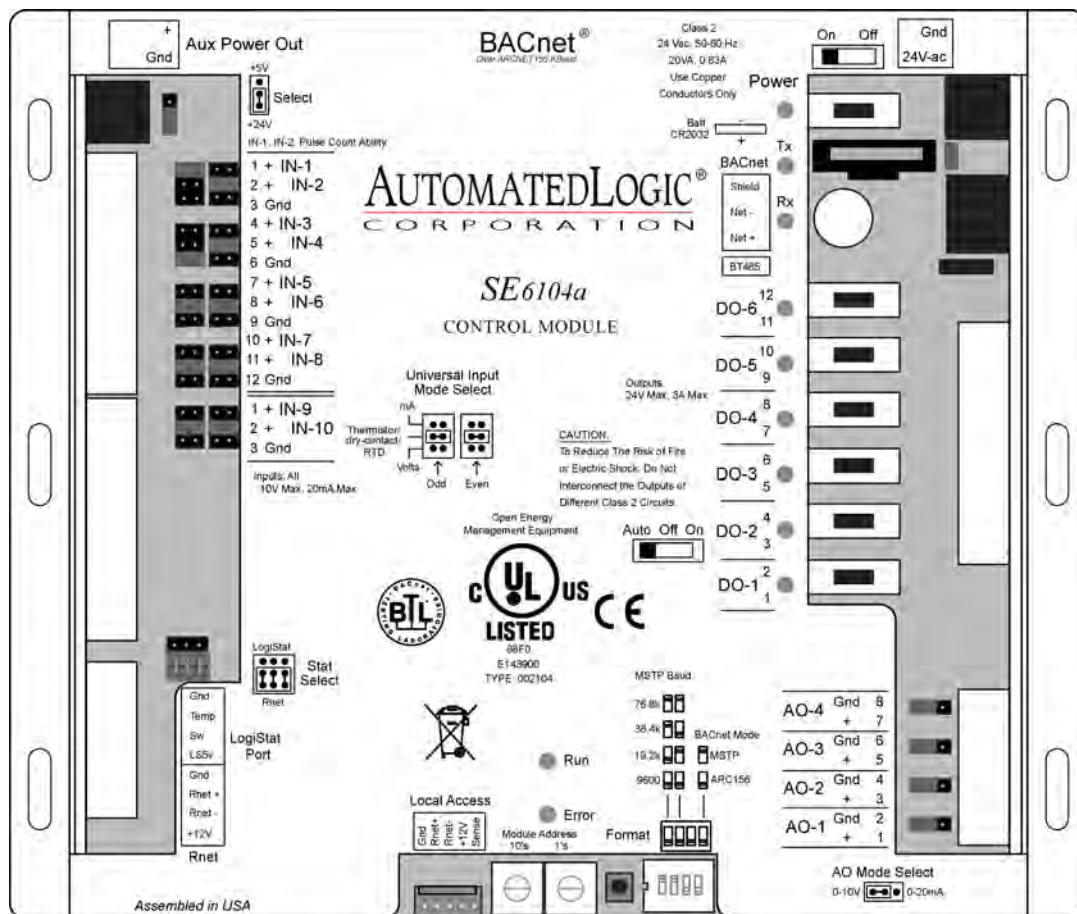


WARNING This is a Class A product. In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate measures.

BACnet Compliance

Compliance of listed products to requirements of ASHRAE Standard 135 is the responsibility of BACnet International. BTL® is a registered trademark of BACnet International.

Appendix - SE6104a coverplate



Document revision history

Important changes to this document are listed below. Minor changes such as typographical or formatting errors are not listed.

Date	Topic	Change description	Code*
2/7/17	Specifications	Added wireless sensors to the Rnet port specification.	X-D
	Zone sensors	Added wireless sensors to this topic.	
	Equipment Touch	Added Wireless Adapter to this topic.	
	Wiring inputs and outputs > Wiring specifications	Added Wireless Adapter to this topic.	
	Wiring devices to the Rnet port	Added Wireless Adapter to this topic.	
	To wire a Wireless Adapter to the SE6104a	New topic.	
11/2/16	Specifications	Changed Weight to 1.05 lbs (0.48 kg).	A-D-DB
10/26/16	Zone sensors	Changed section under ZS Sensors from 5 sensors to 15.	A-TS-EE-O
9/27/16	To set up a Local Access connection in the WebCTRL interface	Updated WebCTRL menu button in step 12.	A-D
	Appendix - SE6104a coverplate	Updated coverplate	A-D
8/31/15	Driver and control programs	Changed maximum number of control programs from 1 to 999.	A-O-DY-O
4/20/15	Entire document	New look, no content changes	A-D
11/14/14	BACnet Compliance	Changed BACnet Manufacturers Association to BACnet International	X-D-CP-MW
10/7/14	Driver	Added the Network Microblock fields	A-TS-RB-F
9/8/14	LED's	Changed the Status description for when the Run LED shows 2 flashes per second and the Error LED is On. Also added a note below the table regarding cycling power to turn off Error LED.	A-TS-JM-F-BK
5/13/14	Specifications	Rnet Port: Added Equipment Touch and removed BACview® devices	A-D-CP-O-TC
	Zone sensors	Removed references to BACview	
	Equipment Touch devices	New topic	
	BACview devices	Removed topic	
	Wiring zone sensors to the SE6104a	Changed to "Wiring devices to the SE6104a's Rnet port"	
	To wire an Equipment Touch to the SE6104a	New topic	
	Wiring a LogiStat sensor to the SE6104a	New topic	
	To set up the driver > Driver	Added new driver property: TouchScreen Schedule Edit Enable	

* For internal use only

ZN220 Controller

Technical Instructions

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Verify that you have the most current version of this document. Go to <https://accounts.automatedlogic.com>, then select **Support > Download > Documents > Hardware**. Important changes are listed in **Document revision history** at the end of this document.

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What is the ZN220 controller?

The ZN220 controller is used for simple zone control applications such as fan coil units or for miscellaneous control points such as room lighting or toilet exhaust fans.

Driver and control program

Driver	DRV_ZN ¹
Maximum number of control programs	1
Maximum number of BACnet objects ²	300

¹ To replace a U line controller with a ZN220, use the driver DRV_ZNPLUSU_<latest version>. See the *ZN U Line Emulation Technical Instructions*.

² Depends on available memory.

Specifications

Power	24 Vac $\pm 10\%$, 50–60 Hz, 12 VA 26 Vdc (25 V min, 30 V max)
BACnet port (This port may be labeled CMnet.)	For communication with the controller network using ARC156 or MS/TP (9600 bps–76.8 kbps)
Rnet port	Supports: • Up to 5 ZS sensors • One Wireless Adapter that communicates with up to 5 wireless sensors • One Equipment Touch • Up to 4 RS Standard sensors and one RS Plus, RS Pro, or RS Pro-F sensor. NOTE ZS sensors, a Wireless Adapter, and an Equipment Touch can share the Rnet, but not RS sensors.
Local Access port	For system start-up and troubleshooting
Inputs	2 universal inputs, configurable for 0–5 Vdc, thermistor, or dry contact
Input resolution	10 bit A/D
Input pulse frequency	10 pulses per second. Minimum pulse width (on or off time) required for each pulse is 50 msec.
Digital outputs	2 digital outputs, relay contacts rated at 1 A max. @ 24 Vac/Vdc. Configured normally open.
Microprocessor	High speed 16-bit microprocessor with ARCNET communication co-processor

Memory	512 kB non-volatile battery-backed RAM, 1 MB Flash memory, 16-bit memory bus
Battery	10-year Lithium CR2032 battery retains the following data for a maximum of 10,000 hours during power outages: control programs, editable properties, schedules, and trends.
Protection	Incoming power and network connections are protected by non-replaceable internal solid-state polyswitches that reset themselves when the condition that causes a fault returns to normal. The power, network, input, and output connections are also protected against transient excess voltage/surge events lasting no more than 10 msec.
BT485 connector	You attach a BT485 (not included) to a controller at the beginning and end of a network segment to add bias and to terminate a network segment.
Status indicators	LED's indicate status of communications, running, errors, power, and digital outputs
Environmental operating range	0 to 130 °F (-17.8 to 54.4 °C), 10–90% relative humidity, non-condensing
Physical	Rugged GE C2950 Cyclopy plastic
Overall dimensions	Width: 5 1/16 in. (12.9 cm) Height: 5 11/16 in. (14.4 cm)
Mounting dimensions	5 9/16" (14.1 cm) between mounting slot centerlines
Weight	0.6 lbs (0.27 kg)
BACnet support	Conforms to the BACnet Advanced Application Controller (B-AAC) Standard Device Profile as defined in ANSI/ASHRAE Standard 135-2012 (BACnet) Annex L, Protocol Revision 9
Listed by	UL-916 (PAZX), cUL-916 (PAZX7), FCC Part 15-Subpart B-Class A, CE

Inputs

The ZN220 has 2 inputs that accept the following signal types.

Signal Type	Description
Thermistor	Precon type 2 (10 kOhm at 77 °F). Input voltages will be from 0.33 Vdc to 2.52 Vdc for thermistors.
Dry contact	A 3.3 Vdc wetting voltage detects contact position, resulting in a 0.3 mA maximum sense current when the contacts are closed.
0–5 Vdc	The output impedance of a 0–5 Vdc source must not exceed 100 Ohms. The input impedance of the ZN220 is approximately 30 kOhm.
Timed local override	A momentary contact switch that overrides a schedule and turns equipment on for a defined period of time. The override time added for each push of the button and the maximum allowable On time are software adjustable.
Pulse counter*	Pulse counting up to 10 pulses per second. Minimum pulse width (on or off time) required for each pulse is 50 msec.

* The ZN220 can perform pulse counting for dry contact or voltage inputs if you assign the input to a Pulse to Analog Input microblock. See *To assign inputs or outputs to points* (page 13).

Digital outputs

The ZN220 has 2 digital outputs. You can connect each output to a maximum of 24 Vac/Vdc. Each output is a dry contact rated at 1 A, 24 V maximum and is normally open.

Zone sensors

Automated Logic® wireless sensors

You can connect a Wireless Adapter to ZN220's **Rnet** port. The Wireless Adapter communicates with up to 5 wireless sensors. When using wireless sensors, the Rnet can have:

- Up to 5 wireless and ZS sensors (any combination)
- One Wireless Adapter
- One Equipment Touch

ZS Sensors

You can wire up to 5 ZS sensors to the ZN220's Rnet port.

RS sensors

You can wire RS sensors to the ZN220's **Rnet** port. An Rnet can consist of any of the following combinations of devices wired in a daisy-chain or star configuration:

- 1 RS Plus, RS Pro, or RS Pro-F
- 1–4 RS Standards
- 1–4 RS Standards, and 1 RS Plus, RS Pro, or RS Pro-F

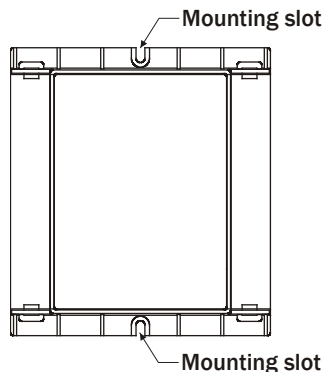
Equipment Touch devices

You can wire an Equipment Touch to the ZN220's Rnet port to view or change the controller's property values, schedule equipment, view trends and alarms, and more, without having to access the system's server. The Rnet can have one Equipment Touch, one Wireless Adapter, and up to 5 ZS sensors. RS sensors cannot share the Rnet with an Equipment Touch.

To mount the ZN220

NOTE You must mount the ZN220 inside the building. The ZN220's warranty will be void if you mount it outside.

Screw the ZN220 into an enclosed panel using the mounting slots shown below. Leave about 2 in. (5 cm) on each side of the controller for wiring.



Wiring for power



WARNING Do not apply line voltage (mains voltage) to the controller's ports and terminals.



CAUTIONS

- The ZN220 is powered by a Class 2 power source. Take appropriate isolation measures when mounting it in a control panel where non-Class 2 circuits are present.
- Automated Logic® controllers can share a power supply as long as you:
 - Maintain the same polarity.
 - Use the power supply only for Automated Logic® controllers.

To wire for power

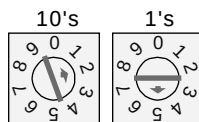
- 1 Remove power from the power supply.
- 2 Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**.
- 3 Connect the transformer wires to the screw terminal connector.
- 4 Apply power to the power supply.
- 5 Measure the voltage at the ZN220's power input terminals to verify that the voltage is within the operating range of 21.6–26.4 Vac.
- 6 Connect a 4-inch (10.2 cm) wire from **Gnd** to the control panel.
- 7 Insert the screw terminal connector into the ZN220's power terminals.
- 8 Verify that the **Power** LED is on and the **Run** LED is blinking.

To address the ZN220

You must give the ZN220 an address that is unique on the network. You can address the ZN220 before or after you wire it for power.

- 1 If the ZN220 has been wired for power, pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**. The controller reads the address each time you apply power to it.
- 2 Using the rotary switches, set the controller's address to match the **Address** in the controller's properties dialog box in SiteBuilder. Set the **Tens (10's)** switch to the tens digit of the address, and set the **Ones (1's)** switch to the ones digit.

EXAMPLE If the controller's address is 25, point the arrow on the **Tens (10's)** switch to 2 and the arrow on the **Ones (1's)** switch to 5.



Wiring for communications

The ZN220 communicates using BACnet on the following types of network segments:

- ARC156 communicating at 156 kbps
- MS/TP communicating at 9600 bps, 19.2 kbps, 38.4 kbps, or 76.8 kbps

NOTE ARC156 is a unique implementation of the industry standard ARCNET. For a summary of differences between ARCNET and ARC156, see the *ARC156 Wiring Technical Instructions*.

Wiring specifications

For...	Use...	Maximum Length
ARC156 ¹ and MS/TP ²	22 AWG, low-capacitance, twisted, stranded, shielded copper wire	2000 feet (610 meters)

¹ See the *ARC156 Wiring Technical Instructions*.

² See the *MS/TP Networking and Wiring Technical Instructions*.



WARNING Do not apply line voltage (mains voltage) to the controller's ports and terminals.

To wire the ZN220 for communications

- 1 Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**.
- 2 Check the communications wiring for shorts and grounds.
- 3 Connect the communications wiring to the controller's screw terminals labeled **Net +**, **Net -**, and **Shield**.
NOTE Use the same polarity throughout the network segment.
- 4 Set the communication type and baud rate.

For...	Set Communications Selection jumper to...	Set DIP switches 1 and 2 to...
ARC156	ARC156	N/A. Baud rate will be 156 kbps regardless of the DIP switch settings.
MS/TP	MSTP	The appropriate baud rate. See the MSTP Baud diagram on the controller.

NOTE Use the same baud rate for all controllers on the network segment.

- 5 If the ZN220 is at either end of a network segment, connect a BT485 to the ZN220.
- 6 Insert the power screw terminal connector into the ZN220's power terminals.
- 7 Verify communication with the network by viewing a Module Status report in the WebCTRL® interface.

Wiring inputs and outputs

Wiring specifications

Input wiring

Input	Maximum length	Minimum gauge	Shielding
0–5 Vdc	1000 feet (305 meters)	26 AWG	Shielded
Thermistor Dry contact	1000 feet (305 meters)	22 AWG	Shielded
ZS sensor RS sensor Wireless Adapter for wireless sensors Equipment Touch	See <i>Wiring devices to the ZN220's Rnet port</i> (page 9).		

Output wiring

To size output wiring, consider the following:

- Total loop distance from the power supply to the controller, and then to the controlled device
NOTE Include the total distance of actual wire. For 2-conductor wires, this is twice the cable length.
- Acceptable voltage drop in the wire from the controller to the controlled device
- Resistance (Ohms) of the chosen wire gauge
- Maximum current (Amps) the controlled device requires to operate

To wire inputs and outputs

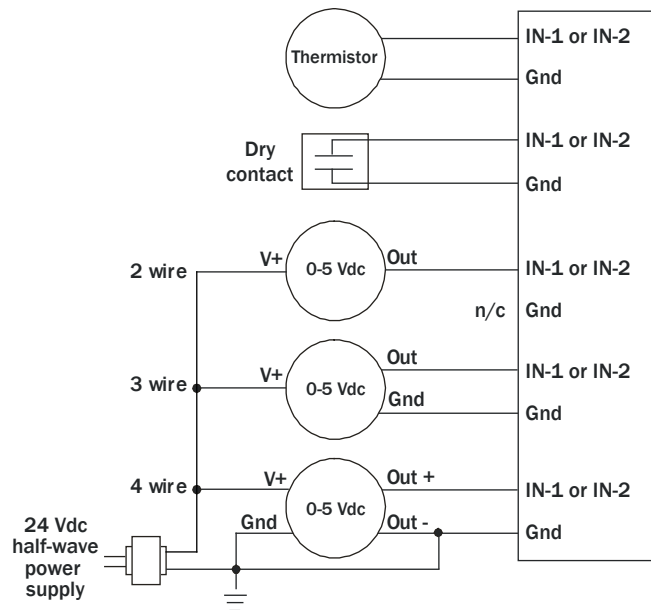


WARNING Do not apply line voltage (mains voltage) to the controller's ports and terminals.

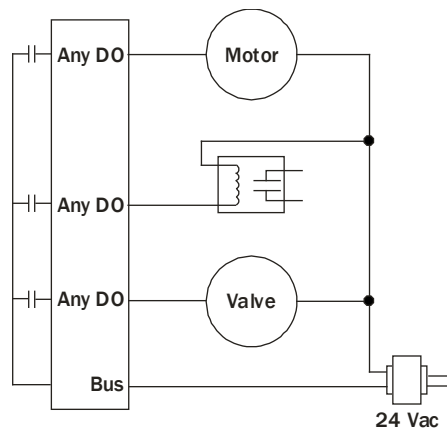
- 1 Verify that the ZN220's power and communications connections work properly.
- 2 Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**.

- 3 Connect the input wiring to the screw terminals on the ZN220.

NOTE Connect the shield wire to the **GND** terminal with the ground wire.



- 4 Set jumpers **IN-1** and **IN-2** to the type of signal the inputs will receive.
- 5 Connect the digital output wiring to the screw terminals on the ZN220 and to the controlled device.



- 6 Insert the power screw terminal connector into the ZN220's power terminals.

Wiring devices to the ZN220's Rnet port

You can wire the following devices to the ZN220's Rnet port in a daisy-chain or star configuration:

- *ZS or RS sensors* (page 9)
- *Wireless Adapter* (page 10) that communicates with wireless sensors
- *Equipment Touch* (page 11)

NOTE ZS sensors, a Wireless Adapter, and an Equipment Touch can share the same Rnet, but not RS sensors.

The Rnet communicates at a rate of 115 kbps.

Rnet wiring specifications

NOTE Use the specified type of wire and cable for maximum signal integrity.

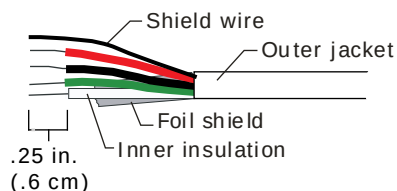
Description	4 conductor, shielded or unshielded, CMP, plenum rated cable
Conductor	22 AWG (7x0096) bare copper
Maximum length	500 feet (152 meters)
Insulation	Low-smoke PVC (or equivalent)
Color Code	Black, white, green, red
Shielding	If shielded, Aluminum/Mylar shield (100% coverage) with TC drain wire
UL temperature rating	32–167 °F (0–75 °C)
Voltage	300 Vac, power limited
Listing	UL: NEC CL2P, or better

To wire a ZS or an RS sensor to the ZN220

For complete sensor installation instructions, including ZS sensor power requirements, see:

- *ZS Sensors Technical Instructions*
- *RS Sensors Technical Instructions*

- 1 Remove power from the ZN220.
- 2 Partially cut, then bend and pull off the outer jacket of the Rnet cable(s). Do not nick the inner insulation.



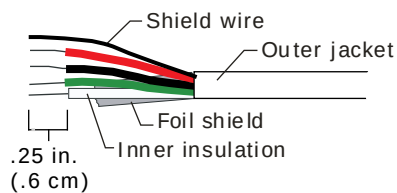
- 3 Strip about .25 inch (.6 cm) of the inner insulation from each wire.

- 4 Wire each terminal on the ZN220's **Rnet** port to the terminal of the same name on the sensor.
NOTE If using shielded wire, connect the shield wire and the ground wire to the **Gnd** terminal.
- 5 Apply power to the ZN220.

To wire a Wireless Adapter to the ZN220

NOTES

- The Wireless Adapter requires a 24 Vac power supply. It is not powered by the Rnet.
 - If the Wireless Adapter will be:
 - Daisy-chained on the Rnet with ZS sensors or an Equipment Touch, use the standard 4-conductor Rnet cable.
 - The only device on the Rnet, you can use a 3-conductor cable instead of the standard 4-conductor Rnet cable.
 - For complete Wireless Adapter installation instructions, see the *Wireless Sensors Technical Instructions*.
- 1 Remove power from the ZN220.
 - 2 Partially cut, then bend and pull off the outer jacket of the Rnet cable(s). Do not nick the inner insulation.



- 3 Strip about .25 inch (.6 cm) of the inner insulation from each wire.
- 4 Wire the ZN220's **Rnet+**, **Rnet-**, and **Gnd** terminals to the terminals of the same name on the Wireless Adapter's Rnet connector.



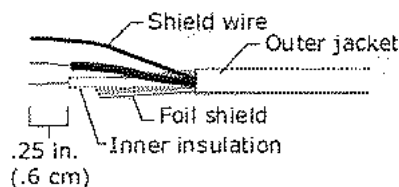
- NOTE** If using shielded wire, connect the shield wire and the ground wire to the **Gnd** terminal.
- 5 Apply power to the ZN220.

To wire an Equipment Touch to the ZN220

NOTES

- The Equipment Touch requires a 24 Vac power supply. It is not powered by the Rnet.
- If the Equipment Touch will be:
 - Daisy-chained on the Rnet with ZS sensors or a Wireless Adapter, use the standard 4-conductor Rnet wiring and follow the wiring instructions *To wire a ZS or an RS sensor to the ZN220* (page 9).
 - The only device on the Rnet, you can use a 2-conductor cable instead of the standard 4-conductor Rnet cable and follow the instructions below.
- For complete Equipment Touch installation instructions including wiring diagrams, see the *Equipment Touch Installation and Setup Guide*.

- 1 Remove power from the ZN220.
- 2 Partially cut, then bend and pull off the outer jacket of the cable. Do not nick the inner insulation.



- 3 Strip about .25 inch (.6 cm) of the inner insulation from each wire.
- 4 Wire the ZN220's **Rnet+** and **Rnet-** terminals to the terminals of the same name on the Equipment Touch's connector.
NOTE If using shielded wire, connect the shield wire and the ground wire to the **Gnd** terminal.
- 5 Apply power to the ZN220.

Downloading the ZN220

Download the following items to the ZN220's battery-backed memory:

Item	Notes
Control program	Must be in WebCTRLx.x\webroot\<system_name>\programs.
DRV_ZN driver	Must be in WebCTRLx.x\webroot\<system_name>\drivers. NOTE To verify that you have the driver's latest version, go to http://accounts.automatedlogic.com/download , then select Drivers > ExecB . Compare the latest version to the ZN220's driver in SiteBuilder.
Editable properties	
Schedules	

If you change any of the above items or the ZN220's address after the initial download, you must download again. The first download takes longer than subsequent downloads.



CAUTIONS

- The ZN220 will lose stored data when you download.
- Equipment controlled by the ZN220 will shut down and restart when you download.

To download from the WebCTRL® interface

If your network is complete, you can download from any network browser. If not complete, connect a laptop with a local copy of the system database to the ZN220's local access port. See *To communicate through the local access port* (page 19).

- 1 On the WebCTRL® **Network**  tree, select the controller.
- 2 Click **Downloads**.
- 3 Do one of the following:
 - If the controller is in the Downloads list, go to step 4.
 - If the controller is not in the list:
 - a. Click **Add**.
 - b. In the pop-up, select the controller.
 - c. Select **All Content**.
 - d. Click **Add**.
 - e. Click **Close**.
- 4 Select the controller in the Downloads list.
- 5 Click **Start**.

NOTES

- If the download fails, locate and resolve the problem, then retry the download.
- You can also download a controller from the **Devices** page.

To assign inputs or outputs to points

To use an input or output, you must assign it to its corresponding point in the control program.

- 1 In the WebCTRL® **Geographic**  tree, select the equipment controlled by the ZN220.
- 2 On the **Properties** page, select the **I/O Points** tab.
- 3 In each point's **Num** field, type the number of the controller's corresponding input or output. For example, if you use DO1 on the ZN220 for the point **Fan S/S**, type 1 in the **Num** field for **Fan S/S**.

NOTES

- **Exp** (expander number) is 00 for the ZN220.
 - Do not assign the same output number to more than one point.
- 4 Enter the appropriate values for each input and output in the remaining columns. See *Input values*, *Output values*, *Resolution values* and *Offset/Polarity values* below.
NOTE You can also enter these values in the EIKON® LogicBuilder application.
 - 5 If you have not performed the initial download to the ZN220, you must download now so you can verify inputs and outputs.
 - 6 To verify each input's operation, force each sensor to a known value, then compare it to the **Value** shown on the **Properties** page on the **I/O Points** tab.
 - 7 To verify each output's operation, lock each output to a known condition on the **I/O Points** tab, then verify that the equipment operates correctly.

Input values

Input	I/O Type	Sensor/Actuator Type	Min/Max
Analog (BAI)			
0-5 Vdc	0-5 Volt	Linear Full Range	Engineering values associated with 0 Vdc (Min) and 5 Vdc (Max) ¹
Thermistor	Thermistor	Select your Thermistor type or set up and select a Non-Linear, Custom Table ²	N/A
Pulse to Analog (BPTA) ³			
Pulse Counter	Counter Input	N/A	N/A
Digital (Binary) (BBI)			
Dry Contact	Dry Contact	N/A	N/A

¹ The sensor reads a value and sends a corresponding signal (Volt, mA, or psi) to the ZN220's physical input. The Analog Input microblock uses the **Min** and **Max** values to linearly translate the signal into the engineering value used in subsequent control logic. For example, set **Min** to 0 and **Max** to 10 for a 4-20 mA sensor that measures velocity from 0.0 to 10.0 inches/second so that when the input reads 4 mA, the microblock outputs a value of 0. Similarly, when the input reads 8 mA, the microblock outputs a value of 2.5.

² You can set up a *custom translation table* (page 18) on the driver's **Custom Translation Tables** pages in the WebCTRL® interface.

³ The control program must have one Pulse to Analog Input microblock for each pulse counting input.

Output values

Output	I/O Type	Sensor/Actuator Type	Min/Max
Relay	Relay/Triac Output	N/A	N/A

Resolution values

Resolution is not particular to a type of input or output, but the driver handles analog and digital (binary) inputs and outputs differently. To set these values appropriately, you should understand how the driver uses them.

Resolution	Notes
Analog Input (BAI)	The driver truncates the microblock's present value according to the resolution. EXAMPLE If the calculated present value is 13.789 and you set the Resolution to 0.1, the control program uses 13.7 for any calculations downstream from the microblock.
Digital Inputs and Outputs	N/A

Offset/Polarity values

Offset/Polarity is not particular to a type of input or output, but the driver handles analog and digital (binary) inputs and outputs differently. To set these values appropriately, you should understand how the driver uses them.

Offset/Polarity	Notes
Analog Input (BAI)	Offset value (positive or negative) adds a fine adjustment to a sensor reading after all scaling for calibration. EXAMPLE If a sensor reads 74.9°F when the actual measured value is 73.6°F, enter an Offset of -1.3 to calibrate the sensor to the measured value.
Digital (Binary) Input (BBI)	Polarity determines the microblock's present value when no signal is received from the equipment. When no signal is received from the equipment, if Polarity is set to: normal —present value is off reversed —present value is on
Digital (Binary) Output (BBO)	Polarity determines the ZN220's output based on the control program's signal to the microblock. When the control program's signal to the microblock is on , if Polarity is set to: normal —output is on reversed —output is off NOTE Regardless of Polarity , the output will be off if the ZN220 loses power.

To set up the driver

After you download the driver and control program to the ZN220, you may want to change the driver's properties in the WebCTRL® interface to suit your application.

- 1 On the WebCTRL® **Network**  tree, click  to the left of your ZN220.
- 2 Click  to the left of **Driver** to see its children.
- 3 Make changes as needed on the **Properties** page for **Driver** and any of its children.

Driver

On the **Driver** page, you can change the following properties:

- Module clock synchronization and failure. See table below.
- Network Input microblock communication properties.

Module Clock	
Clock Fail Date and Time	Date and time the control program uses when controller's real-time clock is invalid.  TIP Use an occupied date and time (such as a Tuesday at 10 a.m.) so the equipment does not operate in unoccupied mode if the controller loses power during occupancy.
Time Synch Sensitivity (seconds)	When the controller receives a time sync request, if the difference between the controller's time and the time sync's time is greater than this field's value, the controller's time is immediately changed. If the difference is less than this field's value, the controller's time is slowly adjusted until the time is correct.
Network Microblocks	
Number of poll retries before Network Input Microblocks indicate failure	The maximum number of retries after the initial attempt that a Network microblock will attempt to communicate with its target device. If unsuccessful, the point will transition to an idle state for 30 seconds before attempting to communicate again. Change this field only if directed by Technical Support.
Periodic rebinding interval	If a microblock uses a wildcard in its address, this timer determines how often the microblock will attempt to find the nearest instance of its target. For example, if an outside air temperature address uses a wildcard, a VAV application will look for the outside air temperature on the same network segment or on the nearest device containing that object.

BACnet COV Throttling	
Enable COV Throttling	Under normal circumstances, COV Throttling should be enabled to prevent excessive network traffic if an object's COV Increment is set too low. See EXCEPTION below. When enabled, if an object generates excessive COV broadcasts (5 updates in 3 seconds), the driver automatically throttles the broadcasts to 1 per second. Also, if the object's value updates excessively for 30 seconds, an alarm is sent to the WebCTRL® application listing <u>all</u> objects that are updating excessively. A Return-to-normal alarm is sent only after <u>all</u> objects have stopped updating excessively. EXCEPTION: In rare circumstances, such as process control, a subscribing object may require COV updates more frequently than once per second. For these situations, clear this checkbox, but make sure that your network can support the increased traffic. You will also need to disable the Excessive COV alarms under the driver's Common Alarms.
Trend Sampling	
Collect a daily midnight sample for all points in this controller that are sampling on COV	For values that change infrequently, select to verify at midnight daily that the point is still able to communicate trend values.
TouchScreen Control	
TouchScreen Schedule Edit Enable	Check this field to allow a user to edit this controller's schedules from an Equipment Touch's Schedules screen.

Device

On the **Device** page, you can change the following properties:

- BACnet device object properties for the ZN220
- ZN220 network communication

Configuration	NOTE The three APDU fields refer to all networks over which the ZN220 communicates.
Max Masters and Max Info Frames	Apply only if the ZN220 is on an MS/TP network.

Notification Classes

Alarms in the WebCTRL® application use Notification Class #1. A BACnet alarm's Notification Class defines:

- Alarm priority for Alarm, Fault, and Return to Normal states
- Options for BACnet alarm acknowledgment
- Where alarms should be sent (recipients)

Priorities	NOTE BACnet defines the following Network message priorities for Alarms and Events.										
	<table> <tr> <th>Priority range</th><th>Network message priority</th></tr> <tr> <td>00–63</td><td>Life Safety</td></tr> <tr> <td>64–127</td><td>Critical Equipment</td></tr> <tr> <td>128–191</td><td>Urgent</td></tr> <tr> <td>192–255</td><td>Normal</td></tr> </table>	Priority range	Network message priority	00–63	Life Safety	64–127	Critical Equipment	128–191	Urgent	192–255	Normal
Priority range	Network message priority										
00–63	Life Safety										
64–127	Critical Equipment										
128–191	Urgent										
192–255	Normal										
Priority of Off-Normal	BACnet priority for Alarms.										
Priority of Fault	BACnet priority for Fault messages.										
Priority of Normal	BACnet priority for Return-to-normal messages.										
Ack Required for Off-Normal, Fault, and Normal	Specifies whether alarms associated with this Notification Class require a BACnet Acknowledgment for Off-Normal, Fault, or Normal alarms.  TIP You can require operator acknowledgment for an Alarm or Return-to-normal message (stored in the WebCTRL® database). In the WebCTRL® interface on the Alarm > Enable/Disable tab, change the acknowledgment settings for an alarm source or an alarm category.										
Recipient List											
Recipients	The first row in this list is the WebCTRL® application. Do not delete this row. Click Add if you want other BACnet devices to receive alarms associated with this Notification Class.										
Recipient Description	Name that appears in the Recipients table.										
Recipient Type	Use Address (static binding) for either of the following: - Third-party BACnet device recipients that do not support dynamic binding - When you want alarms to be broadcast (you must uncheck Issue Confirmed Notifications). This use is rare.										
Days and times	The days and times during which the recipient will receive alarms.										
Recipient Device Object Identifier	Type the Device Instance from SiteBuilder (or from the network administrator for third-party devices) in the # field.										
Process Identifier	Change for third-party devices that use a BACnet Process Identifier other than 1. The WebCTRL® application processes alarms for any 32-bit Process Identifier.										
Issue Confirmed Notifications	Select to have a device continue sending an alarm message until it receives delivery confirmation from the recipient.										
Transitions to Send	Uncheck the types of alarms you do not want the recipient to get.										

Calendars

Calendars are provided in the driver for BACnet compatibility only. Instead, use the **Schedules** feature in the WebCTRL® interface.

Common Alarms

On these pages, you can enable/disable, change BACnet alarm properties, or set delays for the following BACnet alarms:

- Module Halted
- All Programs Stopped
- Duplicate Address
- Locked I/O
- Control Program
- Program Stopped
- Excessive COV

NOTE To set up alarm actions for controller generated alarms, see *Setting up alarm actions* in WebCTRL® Help.

Module Generated Alarm	
Description	Short message shown on the Alarms page or in an alarm action when this type of alarm is generated.
Events	
Alarm Category and Alarm Template	See <i>Customizing alarms</i> in WebCTRL® Help.
Enable	Clear these checkboxes to disable Alarm or Return to normal messages of this type from this controller.
Notification Class	Do not change this field.

Custom Translation Tables

You can set up a translation table that an analog input will use to translate the raw data from a non-linear sensor to the engineering units you want it to output on the wire. In the **Network**  tree, select **Custom Translation Table #1, #2, or #3**. The **Properties** page has instructions. For the input to use the translation table, navigate to the input in the **Geographic**  tree, select the **Details** tab, then set **Sensor Type (Scaling Method)** to **Non-Linear, Custom Table #__**.

Switch and Jumper Positions

The **Switch and Jumper Positions** page shows the current physical settings on the ZN220.

To communicate through the Local Access port

Using a computer and a USB Link Kit, you can communicate locally with the ZN220 to download or to troubleshoot.

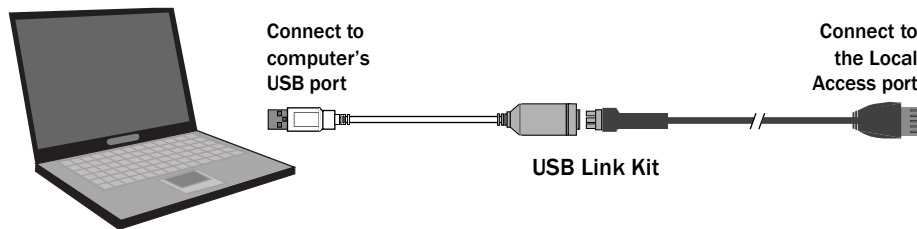
PREREQUISITES

- A computer with a USB port
- A USB Link Kit. See the *USB Link Kit Technical Instructions*.
NOTE The USB Link Kit driver is installed with a WebCTRL® v5 or later system. But if needed, you can get the latest driver from <http://www.silabs.com/products/mcu/Pages/USBtoUARTBridgeVCPDrivers.aspx>. Install the driver before you connect the USB Link Kit to your computer.
- v1.70 or later controller driver



CAUTION If multiple controllers share power but polarity was not maintained when they were wired, the difference between the controller's ground and the computer's AC power ground could damage the USB Link Kit and the controller. If you are not sure of the wiring polarity, use a USB isolator between the computer and the USB Link Kit. Purchase a USB isolator online from a third-party manufacturer.

Connect the USB Link Kit to the computer and to the controller's Local Access port.



NOTE If using a USB isolator, plug the isolator into your computer's USB port, and then plug the USB Link Kit cable into the isolator.

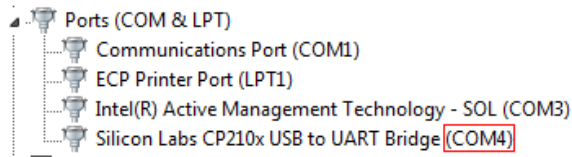
To set up a Local Access connection in the WebCTRL® interface

For the WebCTRL® application to communicate with the Local Access port, you must do the following:

- 1 On the **System Configuration**  tree, select **Connections**.
- 2 On the **Configure** tab, click **Add**.
- 3 From the **Type** drop-down list, select **BACnet Local Access**.
- 4 Optional: Edit the **Description**.

- 5 Type the computer's **Port** number that the USB cable is connected to.

NOTE To find the port number, plug the USB cable into the computer's USB port, then select **Start > Control Panel > System > Device Manager > Ports (Com & LPT)**. The COM port number is beside **Silicon Labs CP210x USB to UART Bridge**.



- 6 Set the **Baud** rate to 115200.
- 7 Click **Accept**.
- 8 On the **View** tab, click the button next to the BACnet/IP network, then select **BACnet Local Access**.
- 9 Click **Accept**.
- 10 On the **Configure** tab, select **BACnet Local Access**, then click **Start**.
- NOTE** If an error message appears, make sure the COM port you selected is not in use. For example, PuTTY may be open and is holding the port open.
- 11 On the **Network**  tree, select the controller that you are connected to.
- 12 Click , then select **Manual Command**.
- 13 Type `rnet` here in the dialog box, then click **OK**.
- 14 On the **Properties** page, click **Module Status**. If a Modstat report appears, the WebCTRL® application is communicating with the controller.

Troubleshooting

If you have problems mounting, wiring, or addressing the ZN220, contact ALC Technical Support.

LED's

The LED's on the ZN220 show the status of certain functions.

If this LED is on...	Status is...
Power	The ZN220 has power
Rx	The ZN220 is receiving data from the network segment
Tx	The ZN220 is transmitting data over the network segment
DO#	The digital output is active

The **Run** and **Error** LED's indicate controller and network status.

If Run LED shows...	And Error LED shows...	Status is...
2 flashes per second	Off	Normal
2 flashes per second	2 flashes, alternating with Run LED	Five minute auto-restart delay after system error
2 flashes per second	3 flashes, then off	The controller has just been formatted
2 flashes per second	4 flashes, then pause	Two or more devices on this network have the same network address
2 flashes per second	1 flash per second	The controller is alone on the network
2 flashes per second	On	Obtain a Module Status Report (Modstat) to determine which of the following occurred: • Exec halted after frequent system errors • Control programs halted
5 flashes per second	On	Exec start-up aborted, Boot is running
5 flashes per second	Off	Firmware transfer in progress, Boot is running
7 flashes per second	7 flashes per second, alternating with Run LED	Ten second recovery period after brownout
14 flashes per second	14 flashes per second, alternating with Run LED	Brownout

If Run LED shows...	And Error LED shows...	Status is...
On	On	Failure. Try the following solutions: • Turn the ZN220 off, then on. • Format the ZN220. • Download the ZN220. • Replace the ZN220.

NOTE If you resolve the issue but the **Error** LED does not turn off, cycle power to the controller.

Possible delay before control program starts

When you first apply power to the ZN220, it waits for up to 3 minutes to receive a time/date broadcast from its BACnet router. The ZN220 begins to run the control program only after it receives the time/date or when the 3 minute waiting period expires. If the ZN220 does not receive a time/date broadcast, it keeps the default setting of 6/12/2002 10:00:00 (am).

To format the controller

If you cannot communicate with a controller after downloading it, as a last resort, you can manually format the controller to erase its memory.

- 1 Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**.
- 2  Make sure the address switches are not set to 0, 0.
- 3 Short the **Format** jumper's pins and maintain the short for steps 3 and 4.
- 4 Insert the power screw terminal connector into the ZN220's power terminals.
- 5 Continue to short the jumper until the **Error** LED flashes three times in sync with the **Run** LED.
- 6 Remove the short.
- 7 Download the ZN220.

To get the ZN220's serial number

If you need the ZN220's serial number when troubleshooting, the number is on:

- a sticker on the back of the main controller board
- a Module Status report (Modstat) under **Core** (or **Main**) board hardware



```
Core board hardware:
Type=100, board=1, manufactured on 06/27/2013 S/N 021362247P
RAM: 512 kBytes; FLASH: 1024 kBytes, type = S
```

To obtain a modstat in the WebCTRL® interface:

- 1 Select the ZN220 in the **Network**  tree.
- 2 On the **Properties** page, click **Module Status**.

Recovering from a power outage

The ZN220 has a 10-year Lithium CR2032 battery that retains the following data for a maximum of 10,000 hours during power outages.

- Control programs
- Editable properties
- Trends
- Schedules

If the above data is lost after power returns, replace the battery and then download the ZN220. See instructions below.

To replace the ZN220's battery

If the ZN220 experiences a power outage and the control program stops functioning, replace the battery.

- 1 Verify that the ZN220's power is on.
- 2 Remove the battery from the controller, making note of the battery's polarity.
- 3 Insert the new battery into the controller, matching the polarity of the battery you removed.
- 4 Download the ZN220.

To take the ZN220 out of service

If needed for troubleshooting or start-up, you can prevent the WebCTRL® application from communicating with the ZN220.

- 1 On the WebCTRL® **Network**  tree, select the ZN220.
- 2 On the **Properties** page, check **Out of Service**.
- 3 Click **Accept**.

Compliance

FCC Compliance

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.



CAUTION Changes or modifications not expressly approved by the responsible party for compliance could void the user's authority to operate the equipment.

CE Compliance

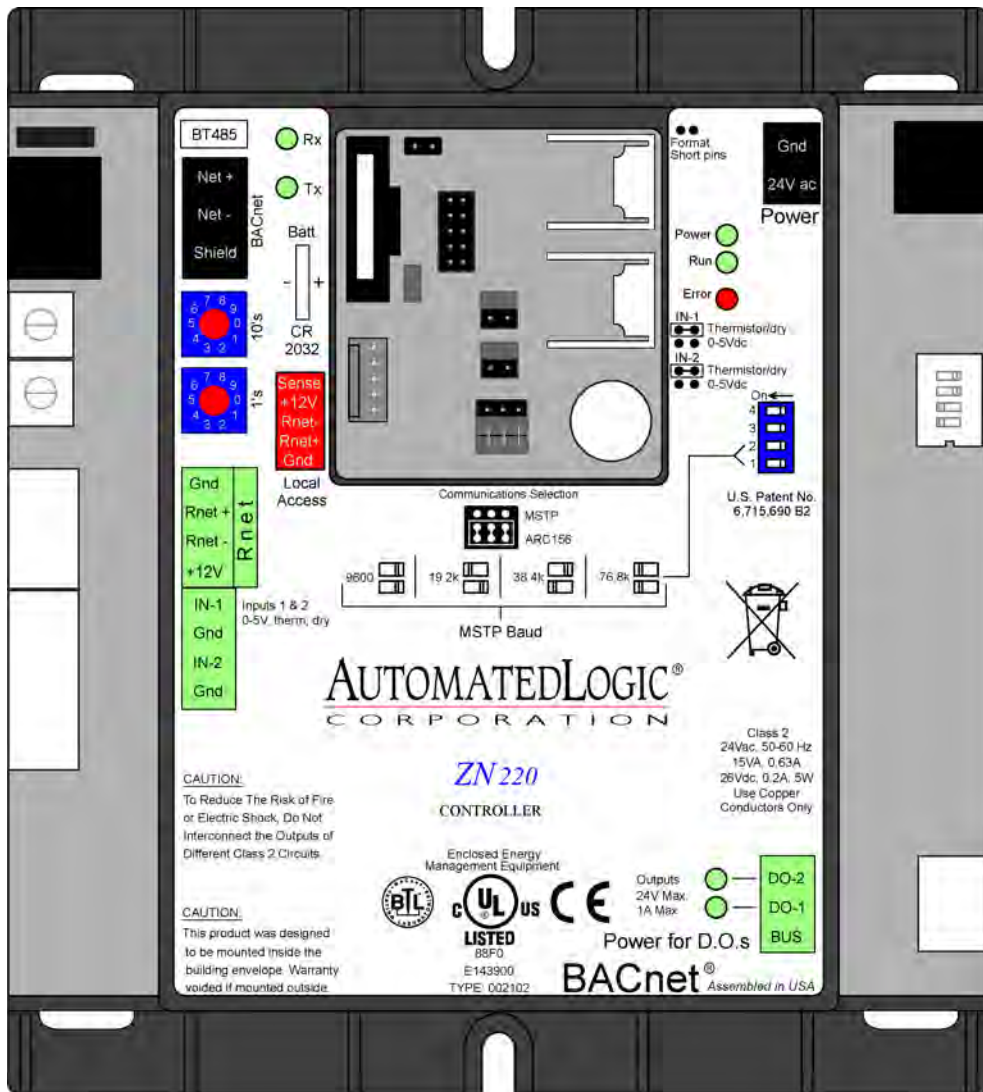


WARNING This is a Class A product. In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate measures.

BACnet Compliance

Compliance of listed products to requirements of ASHRAE Standard 135 is the responsibility of BACnet International. BTL® is a registered trademark of BACnet International.

Appendix - ZN220 coverplate



Document revision history

Important changes to this document are listed below. Minor changes such as typographical or formatting errors are not listed.

Date	Topic	Change description	Code*
2/7/17	Specifications	Added wireless sensors to the Rnet port specification.	X-D
	Zone sensors	Added wireless sensors to this topic.	
	Equipment Touch	Added Wireless Adapter to this topic.	
	Wiring inputs and outputs > Wiring specifications	Added Wireless Adapter to this topic.	
	Wiring devices to the Rnet port	Added Wireless Adapter to this topic.	
	To wire a Wireless Adapter to the ZN220	New topic.	
9/27/16	To set up a Local Access connection in the WebCTRL interface	Updated WebCTRL menu button in step 12.	A-D
	Appendix - ZN220 coverplate	Updated coverplate	A-D
4/20/15	Entire document	New look, no content changes	A-D
11/14/14	BACnet Compliance	Changed BACnet Manufacturers Association to BACnet International	X-D-CP-MW
10/7/14	Driver	Added the Network Microblock fields	A-TS-RB-F
9/4/14	LED's	Changed the Status description for when the Run LED shows 2 flashes per second and the Error LED is On. Also added a note below the table regarding cycling power to turn off Error LED.	A-TS-JM-F-BK
5/13/14	Specifications	Rnet Port: Added Equipment Touch and removed note about BACview® devices	A-D-CP-O-TC
	Equipment Touch devices	New topic	
	Wiring zone sensors to the ZN220	Changed to "Wiring devices to the ZN220's Rnet port"	
	To wire an Equipment Touch to the ZN220	New topic	
	Wiring a LogiStat sensor to the ZN220	New topic	
	To set up the driver > Driver	Added new driver property: TouchScreen Schedule Edit Enable	

* For internal use only

ZN253 Controller

Technical Instructions

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Verify that you have the most current version of this document. Go to <https://accounts.automatedlogic.com>, then select **Support > Download > Documents > Hardware**. Important changes are listed in **Document revision history** at the end of this document.

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What is the ZN253 controller?

The ZN253 controller is used for zone control.

Driver and control program

Driver	DRV_ZN ¹
Maximum number of control programs	1
Maximum number of BACnet objects ²	300

¹ To replace a U line controller with a ZN253, use the driver DRV_ZNPLUSU_<latest version>. See the *ZN U Line Emulation Technical Instructions*.

² Depends on available memory.

Specifications

Power	24 Vac $\pm 10\%$, 50–60 Hz, 12 VA 26 Vdc (25 V min, 30 V max)
BACnet port (This port may be labeled CMnet.)	For communication with the controller network using ARC156 or MS/TP (9600 bps–76.8 kbps)
Rnet port	Supports: • Up to 5 ZS sensors • One Wireless Adapter that communicates with up to 5 wireless sensors • One Equipment Touch • Up to 4 RS Standard sensors and one RS Plus, RS Pro, or RS Pro-F sensor. NOTE ZS sensors, a Wireless Adapter, and an Equipment Touch can share the Rnet, but not RS sensors.
LStat port	For LogiStat and LogiStat Plus zone sensors. The LogiStat port uses two universal inputs. NOTE The ZN253 does not support the LogiStat Pro. Use an RS Pro on the Rnet port instead.
Local Access port	For system start-up and troubleshooting
Flow sensor port	Provides flow inputs for a USF or UDF flow sensor.
Inputs	5 inputs configurable for thermistor or dry contact. Inputs 1 and 2 are also configurable for 0–5 Vdc. Inputs 4 and 5 are used when a LogiStat sensor is connected, but are available if an RS room sensor is connected.
Input resolution	10 bit A/D

Input pulse frequency	10 pulses per second. Minimum pulse width (on or off time) required for each pulse is 50 msec.
Digital outputs	2 digital outputs, relay contacts rated at 1 A max. @ 24 Vac/Vdc. Configured normally open.
Analog outputs	3 analog outputs, 0–10 Vdc (5 mA max)
Output resolution	8 bit D/A
Memory	512 kB non-volatile battery-backed RAM, 1 MB Flash memory, 16-bit memory bus
Battery	10-year Lithium CR2032 battery retains the following data for a maximum of 10,000 hours during power outages: control programs, editable properties, schedules, and trends.
Protection	Incoming power and network connections are protected by non-replaceable internal solid-state polyswitches that reset themselves when the condition that causes a fault returns to normal. The power, network, input, and output connections are also protected against transient excess voltage/surge events lasting no more than 10 msec.
BT485 connector	You attach a BT485 (not included) to a controller at the beginning and end of a network segment to add bias and to terminate a network segment.
Status indicators	LED's indicate status of communications, running, errors, power, and digital outputs
Environmental operating range	0 to 130 °F (-17.8 to 54.4 °C), 10–90% relative humidity, non-condensing
Physical	Rugged GE C2950 Cyclopy plastic
Overall dimensions	Width: 5 1/16 in. (12.9 cm) Height: 5 11/16 in. (14.4 cm)
Mounting dimensions	5 9/16" (14.1 cm) between mounting slot centerlines
Weight	0.6 lbs (0.27 kg)
BACnet support	Conforms to the BACnet Advanced Application Controller (B-AAC) Standard Device Profile as defined in ANSI/ASHRAE Standard 135-2012 (BACnet) Annex L, Protocol Revision 9
Listed by	UL-916 (PAZX), cUL-916 (PAZX7), FCC Part 15-Subpart B-Class A, CE

Inputs

The ZN253 has 5 inputs that accept the following signal types.

These inputs...	Support this signal type...	Description
All	Thermistor	Precon type 2 (10 kOhm at 77 °F). Input voltage for IN-4: 1 to 2.52 Vdc Input voltage for all other inputs: 0.33 to 2.52 Vdc
All	Dry contact	A 3.3 Vdc wetting voltage detects contact position, resulting in a 0.3 mA maximum sense current when the contacts are closed.
IN-1, IN-2	0–5 Vdc	The output impedance of a 0–5 Vdc source must not exceed 100 Ohms. The input impedance of the ZN253 is approximately 30 kOhm.
All	Timed local override	A momentary contact switch that overrides a schedule and turns equipment on for a defined period of time. The override time added for each push of the button and the maximum allowable On time are software adjustable.
All	Pulse counter ¹	Pulse counting up to 10 pulses per second. Minimum pulse width (on or off time) required for each pulse is 50 msec.
IN-4, IN-5	LogiStat ²	IN-4: See Thermistor. IN-5: Setpoint adjust. Input voltages should be from 1.4 to 3.4 Vdc.

¹ The ZN253 can perform pulse counting for dry contact or voltage inputs if you assign the input to a Pulse to Analog Input microblock. See *To assign inputs or outputs to points* (page 16).

² A LogiStat sensor connected to the ZN253 uses IN-4 and IN-5. A ZS or RS sensor connected to the **Rnet** port does not use these inputs.

Digital outputs

The ZN253 has 2 digital outputs. You can connect each output to a maximum of 24 Vac/Vdc. Each output is a dry contact rated at 1 A, 24 V maximum and is normally open.

Analog outputs

The ZN253 has 3 analog outputs that support voltage devices from 0-10 Vdc. The controlled device must have a minimum of 2000 Ohms resistance measured from its input to ground and must share the same ground as the controller.

Zone sensors

Automated Logic® wireless sensors

You can connect a Wireless Adapter to ZN253's **Rnet** port. The Wireless Adapter communicates with up to 5 wireless sensors. When using wireless sensors, the Rnet can have:

- Up to 5 wireless and ZS sensors (any combination)
- One Wireless Adapter
- One Equipment Touch

ZS Sensors

You can wire up to 5 ZS sensors to the ZN253's Rnet port.

RS sensors

You can wire RS sensors to the ZN253's **Rnet** port. An Rnet can consist of any of the following combinations of devices wired in a daisy-chain or star configuration:

- 1 RS Plus, RS Pro, or RS Pro-F
- 1–4 RS Standards
- 1–4 RS Standards, and 1 RS Plus, RS Pro, or RS Pro-F

LogiStats

You can wire a LogiStat or LogiStat Plus to the ZN253's **LStat** port.

NOTES

- The ZN253 does not support the LogiStat Pro.
- A LogiStat or LogiStat Plus wired to the ZN253 cannot be used for local access.

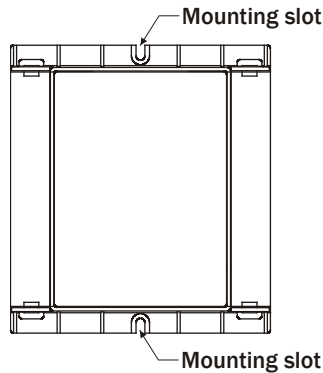
Equipment Touch devices

You can wire an Equipment Touch to the ZN253's Rnet port to view or change the controller's property values, schedule equipment, view trends and alarms, and more, without having to access the system's server. The Rnet can have one Equipment Touch, one Wireless Adapter, and up to 5 ZS sensors. RS sensors cannot share the Rnet with an Equipment Touch.

To mount the ZN253

NOTE You must mount the ZN253 inside the building. The ZN253's warranty will be void if you mount it outside.

Screw the ZN253 into an enclosed panel using the mounting slots shown below. Leave about 2 in. (5 cm) on each side of the controller for wiring.



Wiring for power



WARNING Do not apply line voltage (mains voltage) to the controller's ports and terminals.



CAUTIONS

- The ZN253 is powered by a Class 2 power source. Take appropriate isolation measures when mounting it in a control panel where non-Class 2 circuits are present.
- Automated Logic® controllers can share a power supply as long as you:
 - Maintain the same polarity.
 - Use the power supply only for Automated Logic® controllers.

To wire for power

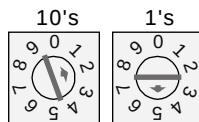
- 1 Remove power from the power supply.
- 2 Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**.
- 3 Connect the transformer wires to the screw terminal connector.
- 4 Apply power to the power supply.
- 5 Measure the voltage at the ZN253's power input terminals to verify that the voltage is within the operating range of 21.6–26.4 Vac.
- 6 Connect a 4-inch (10.2 cm) wire from **Gnd** to the control panel.
- 7 Insert the screw terminal connector into the ZN253's power terminals.
- 8 Verify that the **Power** LED is on and the **Run** LED is blinking.

To address the ZN253

You must give the ZN253 an address that is unique on the network. You can address the ZN253 before or after you wire it for power.

- 1 If the ZN253 has been wired for power, pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**. The controller reads the address each time you apply power to it.
- 2 Using the rotary switches, set the controller's address to match the **Address** in the controller's properties dialog box in SiteBuilder. Set the **Tens (10's)** switch to the tens digit of the address, and set the **Ones (1's)** switch to the ones digit.

EXAMPLE If the controller's address is 25, point the arrow on the **Tens (10's)** switch to 2 and the arrow on the **Ones (1's)** switch to 5.



Wiring for communications

The ZN253 communicates using BACnet on the following types of network segments:

- ARC156 communicating at 156 kbps
- MS/TP communicating at 9600 bps, 19.2 kbps, 38.4 kbps, or 76.8 kbps

NOTE ARC156 is a unique implementation of the industry standard ARCNET. For a summary of differences between ARCNET and ARC156, see the *ARC156 Wiring Technical Instructions*.

Wiring specifications

For...	Use...	Maximum Length
ARC156 ¹ and MS/TP ²	22 AWG, low-capacitance, twisted, stranded, shielded copper wire	2000 feet (610 meters)

¹ See the *ARC156 Wiring Technical Instructions*.

² See the *MS/TP Networking and Wiring Technical Instructions*.

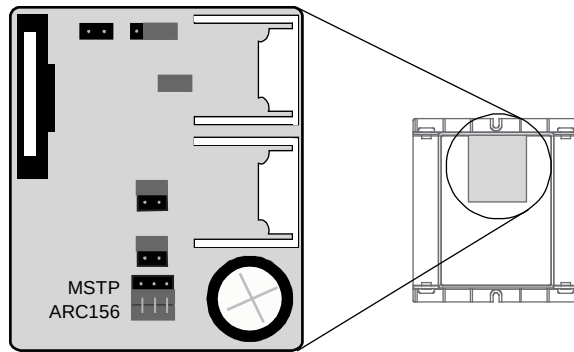


WARNING Do not apply line voltage (mains voltage) to the controller's ports and terminals.

To wire the ZN253 for communications

- 1 Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**.
- 2 Check the communications wiring for shorts and grounds.
- 3 Connect the communications wiring to the controller's screw terminals labeled **Net +**, **Net -**, and **Shield**.
NOTE Use the same polarity throughout the network segment.
- 4 Set the communication type and baud rate.

For...	Set Communications Selection Jumper to... (See figure below)	Set DIP switches 1 and 2 to...
ARC156	ARC156	N/A. Baud rate will be 156 kbps regardless of the DIP switch settings.
MS/TP	MSTP	The appropriate baud rate. See the MSTP Baud diagram on the controller.



- NOTE** Use the same baud rate for all controllers on the network segment.
- 5 If the ZN253 is at either end of a network segment, connect a BT485 to the ZN253.
 - 6 Insert the power screw terminal connector into the ZN253's power terminals.
 - 7 Verify communication with the network by viewing a Module Status report in the WebCTRL® interface.

Wiring inputs and outputs

Wiring specifications

Input wiring

Input	Maximum length	Minimum gauge	Shielding
0–5 Vdc	1000 feet (305 meters)	26 AWG	Shielded
Thermistor Dry contact	1000 feet (305 meters)	22 AWG	Shielded
ZS sensor RS sensor Wireless Adapter for wireless sensors Equipment Touch	See <i>Wiring devices to the ZN253's Rnet port</i> (page 11).		
LogiStat sensor	See <i>Wiring a LogiStat sensor to the ZN253</i> (page 13).		

Output wiring

To size output wiring, consider the following:

- Total loop distance from the power supply to the controller, and then to the controlled device
NOTE Include the total distance of actual wire. For 2-conductor wires, this is twice the cable length.
- Acceptable voltage drop in the wire from the controller to the controlled device
- Resistance (Ohms) of the chosen wire gauge
- Maximum current (Amps) the controlled device requires to operate

To wire inputs and outputs



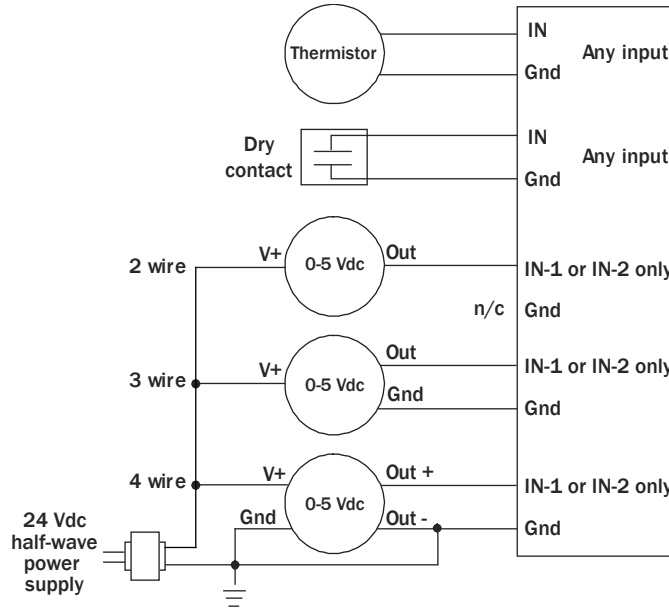
WARNING Do not apply line voltage (mains voltage) to the controller's ports and terminals.

- 1 Verify that the ZN253's power and communications connections work properly.
- 2 Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**.

3 Connect the input wiring to the screw terminals on the ZN253.

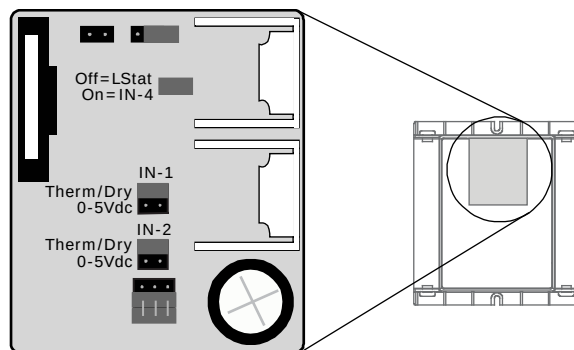
NOTES

- Connect the shield wire to the **GND** terminal with the ground wire.
- **IN-4** and **IN-5** share the **GND** terminal above **IN-4**.

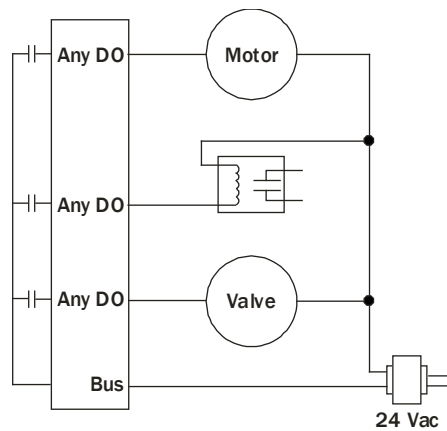


4 Set the appropriate jumpers on the ZN253.

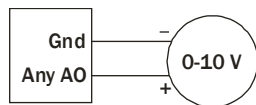
To use...	For...	
IN-1 or IN-2	Thermistor Dry contact 0-5 Vdc	Set jumpers IN-1 or IN-2 to the type of signal the input will receive. See figure below.
IN-4 or IN-5	Thermistor Dry contact	Verify the LStat/IN-4 jumper is on. See figure below.
IN-4 and IN-5	LogiStat	See <i>To wire a LogiStat sensor</i> (page 14).



- 5** Connect the digital output wiring to the screw terminals on the ZN253 and to the controlled device.



- 6** Connect the analog output wiring to the screw terminals on the ZN253 and to the controlled device.



- 7** Insert the power screw terminal connector into the ZN253's power terminals.

Wiring devices to the ZN253's Rnet port

You can wire the following devices to the ZN253's Rnet port in a daisy-chain or star configuration:

- *ZS or RS sensors* (page 11)
- *Wireless Adapter* (page 12) that communicates with wireless sensors
- *Equipment Touch* (page 13)

NOTE ZS sensors, a Wireless Adapter, and an Equipment Touch can share the same Rnet, but not RS sensors.

The Rnet communicates at a rate of 115 kbps.

Rnet wiring specifications

NOTE Use the specified type of wire and cable for maximum signal integrity.

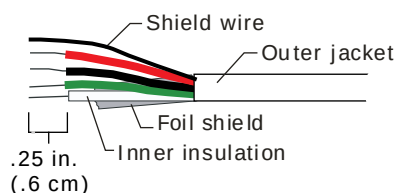
Description	4 conductor, shielded or unshielded, CMP, plenum rated cable
Conductor	22 AWG (7x0096) bare copper
Maximum length	500 feet (152 meters)
Insulation	Low-smoke PVC (or equivalent)
Color Code	Black, white, green, red
Shielding	If shielded, Aluminum/Mylar shield (100% coverage) with TC drain wire
UL temperature rating	32–167 °F (0–75 °C)
Voltage	300 Vac, power limited
Listing	UL: NEC CL2P, or better

To wire a ZS or an RS sensor to the ZN253

For complete sensor installation instructions, including ZS sensor power requirements, see:

- *ZS Sensors Technical Instructions*
- *RS Sensors Technical Instructions*

- 1 Remove power from the ZN253.
- 2 Partially cut, then bend and pull off the outer jacket of the Rnet cable(s). Do not nick the inner insulation.

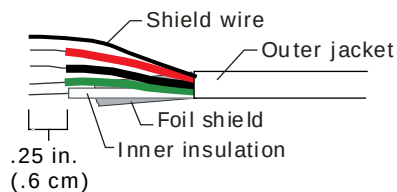


- 3 Strip about .25 inch (.6 cm) of the inner insulation from each wire.
- 4 Wire each terminal on the ZN253's **Rnet** port to the terminal of the same name on the sensor.
NOTE If using shielded wire, connect the shield wire and the ground wire to the **Gnd** terminal.
- 5 Apply power to the ZN253.

To wire a Wireless Adapter to the ZN253

NOTES

- The Wireless Adapter requires a 24 Vac power supply. It is not powered by the Rnet.
 - If the Wireless Adapter will be:
 - Daisy-chained on the Rnet with ZS sensors or an Equipment Touch, use the standard 4-conductor Rnet cable.
 - The only device on the Rnet, you can use a 3-conductor cable instead of the standard 4-conductor Rnet cable.
 - For complete Wireless Adapter installation instructions, see the *Wireless Sensors Technical Instructions*.
- 1 Remove power from the ZN253.
 - 2 Partially cut, then bend and pull off the outer jacket of the Rnet cable(s). Do not nick the inner insulation.



- 3 Strip about .25 inch (.6 cm) of the inner insulation from each wire.
- 4 Wire the ZN253's **Rnet+**, **Rnet-**, and **Gnd** terminals to the terminals of the same name on the Wireless Adapter's Rnet connector.



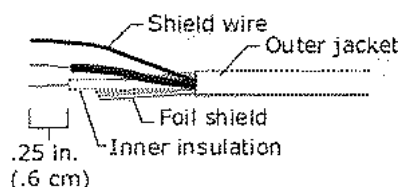
- NOTE** If using shielded wire, connect the shield wire and the ground wire to the **Gnd** terminal.
- 5 Apply power to the ZN253.

To wire an Equipment Touch to the ZN253

NOTES

- The Equipment Touch requires a 24 Vac power supply. It is not powered by the Rnet.
- If the Equipment Touch will be:
 - Daisy-chained on the Rnet with ZS sensors or a Wireless Adapter, use the standard 4-conductor Rnet wiring and follow the wiring instructions *To wire a ZS or an RS sensor to the ZN253* (page 11).
 - The only device on the Rnet, you can use a 2-conductor cable instead of the standard 4-conductor Rnet cable and follow the instructions below.
- For complete Equipment Touch installation instructions including wiring diagrams, see the *Equipment Touch Installation and Setup Guide*.

- 1 Remove power from the ZN253.
- 2 Partially cut, then bend and pull off the outer jacket of the cable. Do not nick the inner insulation.



- 3 Strip about .25 inch (.6 cm) of the inner insulation from each wire.
- 4 Wire the ZN253's **Rnet+** and **Rnet-** terminals to the terminals of the same name on the Equipment Touch's connector.
NOTE If using shielded wire, connect the shield wire and the ground wire to the **Gnd** terminal.
- 5 Apply power to the ZN253.

Wiring a LogiStat sensor to the ZN253

You can wire a LogiStat or LogiStat Plus to the ZN253's **Lstat** port

For complete sensor installation instructions, see the *LogiStat Sensors Technical Instructions*.

LogiStat wiring specifications

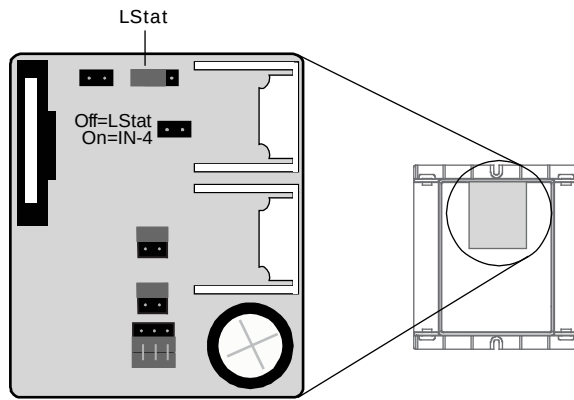
Use 22 AWG, unshielded wire, maximum length 100 feet (30 meters).

To wire a LogiStat sensor

- 1 Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**.
- 2 To connect the LogiStat sensor to the ZN253's **LStat** port.

Wire this terminal on the LStat port...	To this terminal on the LogiStat sensor
Gnd	Gnd
IN-4	Temp
IN-5	SW
LED	LS5v

- 3 Remove the jumper from **LStat/IN-4** (J12 on the circuit board).



- 4 Set the **LStat/Rnet** jumper to **LStat**.
- 5 Insert the power screw terminal connector into the ZN253's power terminals.

Downloading the ZN253

Download the following items to the ZN253's battery-backed memory:

Item	Notes
Control program	Must be in WebCTRLx.x\webroot\<system_name>\programs.
DRV_ZN driver	Must be in WebCTRLx.x\webroot\<system_name>\drivers. NOTE To verify that you have the driver's latest version, go to http://accounts.automatedlogic.com/download , then select Drivers > ExecB . Compare the latest version to the ZN253's driver in SiteBuilder.
Editable properties	
Schedules	

If you change any of the above items or the ZN253's address after the initial download, you must download again. The first download takes longer than subsequent downloads.



CAUTIONS

- The ZN253 will lose stored data when you download.
- Equipment controlled by the ZN253 will shut down and restart when you download.

To download from the WebCTRL® interface

If your network is complete, you can download from any network browser. If not complete, connect a laptop with a local copy of the system database to the ZN253's local access port. See *To communicate through the local access port* (page 24).

- 1 On the WebCTRL® **Network**  tree, select the controller.
- 2 Click **Downloads**.
- 3 Do one of the following:
 - If the controller is in the Downloads list, go to step 4.
 - If the controller is not in the list:
 - a. Click **Add**.
 - b. In the pop-up, select the controller.
 - c. Select **All Content**.
 - d. Click **Add**.
 - e. Click **Close**.
- 4 Select the controller in the Downloads list.
- 5 Click **Start**.

NOTES

- If the download fails, locate and resolve the problem, then retry the download.
- You can also download a controller from the **Devices** page.

To assign inputs or outputs to points

To use an input or output, you must assign it to its corresponding point in the control program.

- 1 In the WebCTRL® **Geographic**  tree, select the equipment controlled by the ZN253.
- 2 On the **Properties** page, select the **I/O Points** tab.
- 3 In each point's **Num** field, type the number of the controller's corresponding input or output. For example, if you use DO1 on the ZN253 for the point **Fan S/S**, type 1 in the **Num** field for **Fan S/S**.

NOTES

- **Exp** (expander number) is 00 for the ZN253.
 - Do not assign the same output number to more than one point.
- 4 Enter the appropriate values for each input and output in the remaining columns. See *Input values*, *Output values*, *Resolution values* and *Offset/Polarity values* below.
NOTE You can also enter these values in the EIKON® LogicBuilder application.
 - 5 If you have not performed the initial download to the ZN253, you must download now so you can verify inputs and outputs.
 - 6 To verify each input's operation, force each sensor to a known value, then compare it to the **Value** shown on the **Properties** page on the **I/O Points** tab.
 - 7 To verify each output's operation, lock each output to a known condition on the **I/O Points** tab, then verify that the equipment operates correctly.

Input values

Input	I/O Type	Sensor/Actuator Type	Min/Max
Analog (BAI)			
0-5 Vdc	0-5 Volt	Linear Full Range	Engineering values associated with 0 Vdc (Min) and 5 Vdc (Max) ¹
Thermistor	Thermistor	Select your Thermistor type or set up and select a Non-Linear, Custom Table ²	N/A
Pulse to Analog (BPTA) ³			
Pulse Counter	Counter Input	N/A	N/A
Digital (Binary) (BBI)			
Dry Contact	Dry Contact	N/A	N/A

¹ The sensor reads a value and sends a corresponding signal (Volt, mA, or psi) to the ZN253's physical input. The Analog Input microblock uses the **Min** and **Max** values to linearly translate the signal into the engineering value used in subsequent control logic. For example, set **Min** to 0 and **Max** to 10 for a 4-20 mA sensor that measures velocity from 0.0 to 10.0 inches/second so that when the input reads 4 mA, the microblock outputs a value of 0. Similarly, when the input reads 8 mA, the microblock outputs a value of 2.5.

² You can set up a *custom translation table* (page 23) on the driver's **Custom Translation Tables** pages in the WebCTRL® interface.

³ The control program must have one Pulse to Analog Input microblock for each pulse counting input.

Output values

Output	I/O Type	Sensor/Actuator Type	Min/Max
Analog (BAO)			
0-10 Vdc	Electrical 0-10 Volt	Linear Full Range	Engineering values associated with 0 Vdc (Min) and 10 Vdc (Max) ¹
2-10 Vdc	Electrical 0-10 Volt	Linear w/Offset, 2-10 Volts	Engineering values associated with 2 Vdc (Min) and 10 Vdc (Max) ¹
Digital (Binary) (BBO)			
Relay	Relay/Triac Output	N/A	N/A

¹ The Analog Output microblock uses the **Min** and **Max** values to linearly translate its EIKON® LogicBuilder wire value into a physical output signal (Volt, mA, or psi) sent from the ZN253 to an actuator. For example, set **Min** to 0 and **Max** to 100 for an Analog Output microblock that receives a 0 to 100% open signal from a PID microblock and that controls a 0-10 Vdc actuator so that when the PID signal is 100%, the ZN253 output is 10 Vdc. Similarly, when the PID signal is 50%, the ZN253 output is 5 Vdc.

Resolution values

Resolution is not particular to a type of input or output, but the driver handles analog and digital (binary) inputs and outputs differently. To set these values appropriately, you should understand how the driver uses them.

Resolution	Notes
Analog Input (BAI)	The driver truncates the microblock's present value according to the resolution. EXAMPLE If the calculated present value is 13.789 and you set the Resolution to 0.1, the control program uses 13.7 for any calculations downstream from the microblock.
Analog Output (BAO)	The driver truncates the wire input value to the microblock before performing any scaling calculations. EXAMPLE If the wire input value is 13.789 and you set the Resolution to 0.1, the microblock uses 13.7 for any scaling calculations.
Digital Inputs and Outputs	N/A

Offset/Polarity values

Offset/Polarity is not particular to a type of input or output, but the driver handles analog and digital (binary) inputs and outputs differently. To set these values appropriately, you should understand how the driver uses them.

Offset/Polarity	Notes
Analog Input (BAI)	Offset value (positive or negative) adds a fine adjustment to a sensor reading after all scaling for calibration. EXAMPLE If a sensor reads 74.9°F when the actual measured value is 73.6°F, enter an Offset of -1.3 to calibrate the sensor to the measured value.
Analog Output (BAO)	You can use the Offset value (positive or negative) to calibrate an output, but you generally do not need to. If used, the driver adds the offset value to the wire input value before performing any scaling calculations to determine the ZN253's output.
Digital (Binary) Input (BBI)	Polarity determines the microblock's present value when no signal is received from the equipment. When no signal is received from the equipment, if Polarity is set to: normal —present value is off reversed —present value is on
Digital (Binary) Output (BBO)	Polarity determines the ZN253's output based on the control program's signal to the microblock. When the control program's signal to the microblock is on , if Polarity is set to: normal —output is on reversed —output is off NOTE Regardless of Polarity , the output will be off if the ZN253 loses power.

Using a flow sensor

In a single duct system, the ZN253 controls airflow in the zone using a USF flow sensor and an actuator. In a dual duct system, the ZN253 controls airflow in the zone using a UDF flow sensor and two actuators. Each actuator is connected to 2 digital outputs or 1 analog output.

To connect duct tubes to the flow sensor

USF

- 1 Connect the duct's total pressure tube to the USF's **High** connector.
- 2 Connect the duct's static pressure tube to the USF's **Low** connector.

UDF

Follow the procedure for a USF, but connect one duct's tubes to the UDF's **Flow #1** connectors and the other duct's tubes to the UDF's **Flow #2** connectors.

To wire the flow sensor to the ZN253

Use the cable included with the flow sensor (Automated Logic® part #235012) or a 20 AWG, 4-conductor cable, maximum length 4 feet (1.22 meters).

- 1 Turn off the controller's power.
- 2 Do one of the following:
 - If using the cable included with the flow sensor, connect one end of the cable to the flow sensor's 4-pin connector and the other end of the cable to the controller's 4-pin flow sensor connector.
 - If using a different cable:

To this terminal on the flow sensor...	Wire this terminal on the controller...
1	Flow 2
2	GND
3	+10V
4	Flow 1

To set up the Airflow Control microblock

The ZN253's control program must include one Airflow Control microblock for a single duct system or two of the microblocks for a dual duct system. Each Airflow Control microblock's **Damper Pos** output must have one Floating Motor microblock or an Analog Output microblock connected to it.

You must set up the Airflow Control microblock for each flow sensor.

For a single duct system

- 1 In the WebCTRL® interface on the control program's **Logic** page, select the Airflow Control microblock.
- 2 On the **Details** tab in the **Flow Sensor** field under **Hardware Configuration**, select **External flow sensor**.
- 3 In the **Damper Actuator** field, select **External actuator**.
- 4 In the **Input Number** field, type 1.
- 5 In the **I/O Type** field, select **Flow Input**.
- 6 At the bottom of the **Details** tab, click the plus sign (+) to the left of **Flow Input (AI) Configuration**.
- 7 In the **Sensor Type** field under **Calibration**, select **No Translation**.

For a dual duct system

- 1 In the WebCTRL® interface on the control program's **Logic** page, select the Airflow Control microblock for Flow #1.
- 2 On the **Details** tab in the **Flow Sensor** field under **Hardware Configuration**, select **External flow sensor**.
- 3 In the **Damper Actuator** field, select **External actuator**.
- 4 In the **Input Number** field, type 1.
- 5 In the **I/O Type** field, select **Flow Input**.

- 6 At the bottom of the **Details** tab, click the plus sign (+) to the left of **Flow Input (AI) Configuration**.
- 7 In the **Sensor Type** field under **Calibration**, select **No Translation**.
- 8 On the **Logic** page, select the Airflow Control microblock for Flow #2.
- 9 Repeat steps 2 through 6 for Flow #2, typing 2 in step 3.

NOTE When performing test and balance, follow the steps under **Test and Balance** on the Airflow Control microblock's **Properties** page **Details** tab.

To set up the driver

After you download the driver and control program to the ZN253, you may want to change the driver's properties in the WebCTRL® interface to suit your application.

- 1 On the WebCTRL® **Network**  tree, click  to the left of your ZN253.
- 2 Click  to the left of **Driver** to see its children.
- 3 Make changes as needed on the **Properties** page for **Driver** and any of its children.

Driver

On the **Driver** page, you can change the following properties:

- Module clock synchronization and failure. See table below.
- Network Input microblock communication properties.

Module Clock	
Clock Fail Date and Time	Date and time the control program uses when controller's real-time clock is invalid.  TIP Use an occupied date and time (such as a Tuesday at 10 a.m.) so the equipment does not operate in unoccupied mode if the controller loses power during occupancy.
Time Synch Sensitivity (seconds)	When the controller receives a time sync request, if the difference between the controller's time and the time sync's time is greater than this field's value, the controller's time is immediately changed. If the difference is less than this field's value, the controller's time is slowly adjusted until the time is correct.
Network Microblocks	
Number of poll retries before Network Input Microblocks Indicate failure	The maximum number of retries after the initial attempt that a Network microblock will attempt to communicate with its target device. If unsuccessful, the point will transition to an idle state for 30 seconds before attempting to communicate again. Change this field only if directed by Technical Support.

Periodic rebinding interval	If a microblock uses a wildcard in its address, this timer determines how often the microblock will attempt to find the nearest instance of its target. For example, if an outside air temperature address uses a wildcard, a VAV application will look for the outside air temperature on the same network segment or on the nearest device containing that object.
BACnet COV Throttling	
Enable COV Throttling	Under normal circumstances, COV Throttling should be enabled to prevent excessive network traffic if an object's COV Increment is set too low. See EXCEPTION below. When enabled, if an object generates excessive COV broadcasts (5 updates in 3 seconds), the driver automatically throttles the broadcasts to 1 per second. Also, if the object's value updates excessively for 30 seconds, an alarm is sent to the WebCTRL® application listing <u>all</u> objects that are updating excessively. A Return-to-normal alarm is sent only after <u>all</u> objects have stopped updating excessively. EXCEPTION: In rare circumstances, such as process control, a subscribing object may require COV updates more frequently than once per second. For these situations, clear this checkbox, but make sure that your network can support the increased traffic. You will also need to disable the Excessive COV alarms under the driver's Common Alarms.
Trend Sampling	
Collect a daily midnight sample for all points in this controller that are sampling on COV	For values that change infrequently, select to verify at midnight daily that the point is still able to communicate trend values.
TouchScreen Control	
TouchScreen Schedule Edit Enable	Check this field to allow a user to edit this controller's schedules from an Equipment Touch's Schedules screen.

Device

On the **Device** page, you can change the following properties:

- BACnet device object properties for the ZN253
- ZN253 network communication

Configuration	NOTE The three APDU fields refer to all networks over which the ZN253 communicates.
Max Masters and Max Info Frames	Apply only if the ZN253 is on an MS/TP network.

Notification Classes

Alarms in the WebCTRL® application use Notification Class #1. A BACnet alarm's Notification Class defines:

- Alarm priority for Alarm, Fault, and Return to Normal states
- Options for BACnet alarm acknowledgment
- Where alarms should be sent (recipients)

Priorities	NOTE BACnet defines the following Network message priorities for Alarms and Events.										
	<table> <tr> <th>Priority range</th><th>Network message priority</th></tr> <tr> <td>00–63</td><td>Life Safety</td></tr> <tr> <td>64–127</td><td>Critical Equipment</td></tr> <tr> <td>128–191</td><td>Urgent</td></tr> <tr> <td>192–255</td><td>Normal</td></tr> </table>	Priority range	Network message priority	00–63	Life Safety	64–127	Critical Equipment	128–191	Urgent	192–255	Normal
Priority range	Network message priority										
00–63	Life Safety										
64–127	Critical Equipment										
128–191	Urgent										
192–255	Normal										
Priority of Off-Normal	BACnet priority for Alarms.										
Priority of Fault	BACnet priority for Fault messages.										
Priority of Normal	BACnet priority for Return-to-normal messages.										
Ack Required for Off-Normal, Fault, and Normal	Specifies whether alarms associated with this Notification Class require a BACnet Acknowledgment for Off-Normal, Fault, or Normal alarms.  TIP You can require operator acknowledgment for an Alarm or Return-to-normal message (stored in the WebCTRL® database). In the WebCTRL® interface on the Alarm > Enable/Disable tab, change the acknowledgment settings for an alarm source or an alarm category.										
Recipient List											
Recipients	The first row in this list is the WebCTRL® application. Do not delete this row. Click Add if you want other BACnet devices to receive alarms associated with this Notification Class.										
Recipient Description	Name that appears in the Recipients table.										
Recipient Type	Use Address (static binding) for either of the following: • Third-party BACnet device recipients that do not support dynamic binding • When you want alarms to be broadcast (you must uncheck Issue Confirmed Notifications). This use is rare.										
Days and times	The days and times during which the recipient will receive alarms.										
Recipient Device Object Identifier	Type the Device Instance from SiteBuilder (or from the network administrator for third-party devices) in the # field.										
Process Identifier	Change for third-party devices that use a BACnet Process Identifier other than 1. The WebCTRL® application processes alarms for any 32-bit Process Identifier.										
Issue Confirmed Notifications	Select to have a device continue sending an alarm message until it receives delivery confirmation from the recipient.										
Transitions to Send	Uncheck the types of alarms you do not want the recipient to get.										

Calendars

Calendars are provided in the driver for BACnet compatibility only. Instead, use the **Schedules** feature in the WebCTRL® interface.

Common Alarms

On these pages, you can enable/disable, change BACnet alarm properties, or set delays for the following BACnet alarms:

- Module Halted
- All Programs Stopped
- Duplicate Address
- Locked I/O
- Control Program
- Program Stopped
- Excessive COV

NOTE To set up alarm actions for controller generated alarms, see *Setting up alarm actions* in WebCTRL® Help.

Module Generated Alarm	
Description	Short message shown on the Alarms page or in an alarm action when this type of alarm is generated.
Events	
Alarm Category and Alarm Template	See <i>Customizing alarms</i> in WebCTRL® Help.
Enable	Clear these checkboxes to disable Alarm or Return to normal messages of this type from this controller.
Notification Class	Do not change this field.

Custom Translation Tables

You can set up a translation table that an analog input will use to translate the raw data from a non-linear sensor to the engineering units you want it to output on the wire. In the **Network**  tree, select **Custom Translation Table #1, #2, or #3**. The **Properties** page has instructions. For the input to use the translation table, navigate to the input in the **Geographic**  tree, select the **Details** tab, then set **Sensor Type (Scaling Method)** to **Non-Linear, Custom Table #__**.

Switch and Jumper Positions

The **Switch and Jumper Positions** page shows the current physical settings on the ZN253.

To communicate through the Local Access port

Using a computer and a USB Link Kit, you can communicate locally with the ZN253 to download or to troubleshoot.

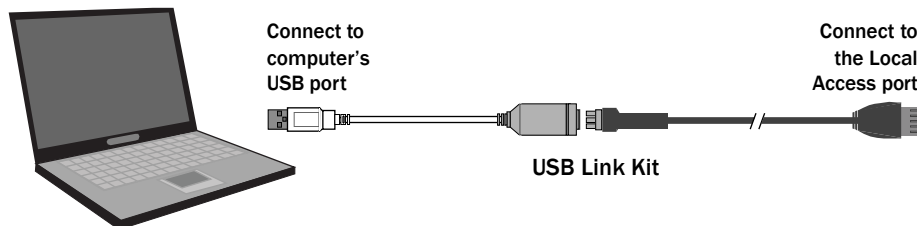
PREREQUISITES

- A computer with a USB port
- A USB Link Kit. See the *USB Link Kit Technical Instructions*.
NOTE The USB Link Kit driver is installed with a WebCTRL® v5 or later system. But if needed, you can get the latest driver from <http://www.silabs.com/products/mcu/Pages/USBtoUARTBridgeVCPDrivers.aspx>. Install the driver before you connect the USB Link Kit to your computer.
- v1.70 or later controller driver



CAUTION If multiple controllers share power but polarity was not maintained when they were wired, the difference between the controller's ground and the computer's AC power ground could damage the USB Link Kit and the controller. If you are not sure of the wiring polarity, use a USB isolator between the computer and the USB Link Kit. Purchase a USB isolator online from a third-party manufacturer.

Connect the USB Link Kit to the computer and to the controller's Local Access port.



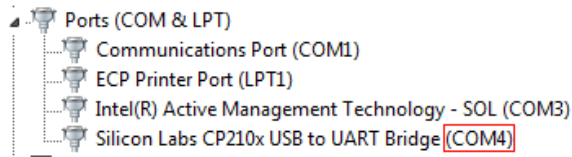
NOTE If using a USB isolator, plug the isolator into your computer's USB port, and then plug the USB Link Kit cable into the isolator.

To set up a Local Access connection in the WebCTRL® interface

For the WebCTRL® application to communicate with the Local Access port, you must do the following:

- 1 On the **System Configuration**  tree, select **Connections**.
- 2 On the **Configure** tab, click **Add**.
- 3 From the **Type** drop-down list, select **BACnet Local Access**.
- 4 Optional: Edit the **Description**.

- 5 Type the computer's **Port** number that the USB cable is connected to.
- NOTE** To find the port number, plug the USB cable into the computer's USB port, then select **Start > Control Panel > System > Device Manager > Ports (Com & LPT)**. The COM port number is beside **Silicon Labs CP210x USB to UART Bridge**.



- 6 Set the **Baud** rate to 115200.
- 7 Click **Accept**.
- 8 On the **View** tab, click the button next to the BACnet/IP network, then select **BACnet Local Access**.
- 9 Click **Accept**.
- 10 On the **Configure** tab, select **BACnet Local Access**, then click **Start**.
- NOTE** If an error message appears, make sure the COM port you selected is not in use. For example, PuTTY may be open and is holding the port open.
- 11 On the **Network**  tree, select the controller that you are connected to.
- 12 Click , then select **Manual Command**.
- 13 Type `rnet` here in the dialog box, then click **OK**.
- 14 On the **Properties** page, click **Module Status**. If a Modstat report appears, the WebCTRL® application is communicating with the controller.

Troubleshooting

If you have problems mounting, wiring, or addressing the ZN253, contact ALC Technical Support.

LED's

The LED's on the ZN253 show the status of certain functions.

If this LED is on...	Status is...
Power	The ZN253 has power
Rx	The ZN253 is receiving data from the network segment
Tx	The ZN253 is transmitting data over the network segment
DO#	The digital output is active

The **Run** and **Error** LED's indicate controller and network status.

If Run LED shows...	And Error LED shows...	Status is...
2 flashes per second	Off	Normal
2 flashes per second	2 flashes, alternating with Run LED	Five minute auto-restart delay after system error
2 flashes per second	3 flashes, then off	The controller has just been formatted
2 flashes per second	4 flashes, then pause	Two or more devices on this network have the same network address
2 flashes per second	1 flash per second	The controller is alone on the network
2 flashes per second	On	Obtain a Module Status Report (Modstat) to determine which of the following occurred: • Exec halted after frequent system errors • Control programs halted
5 flashes per second	On	Exec start-up aborted, Boot is running
5 flashes per second	Off	Firmware transfer in progress, Boot is running
7 flashes per second	7 flashes per second, alternating with Run LED	Ten second recovery period after brownout
14 flashes per second	14 flashes per second, alternating with Run LED	Brownout
On	On	Failure. Try the following solutions: • Turn the ZN253 off, then on. • Format the ZN253. • Download the ZN253. • Replace the ZN253.

NOTE If you resolve the issue but the **Error** LED does not turn off, cycle power to the controller.

Possible delay before control program starts

When you first apply power to the ZN253, it waits for up to 3 minutes to receive a time/date broadcast from its BACnet router. The ZN253 begins to run the control program only after it receives the time/date or when the 3 minute waiting period expires. If the ZN253 does not receive a time/date broadcast, it keeps the default setting of 6/12/2002 10:00:00 (am).

To format the controller

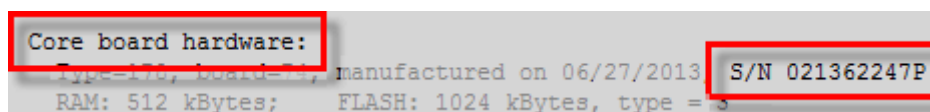
If you cannot communicate with a controller after downloading it, as a last resort, you can manually format the controller to erase its memory.

- 1 Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**.
- 2  Make sure the address switches are not set to 0, 0.
- 3 Short the **Format** jumper's pins and maintain the short for steps 3 and 4.
- 4 Insert the power screw terminal connector into the ZN253's power terminals.
- 5 Continue to short the jumper until the **Error** LED flashes three times in sync with the **Run** LED.
- 6 Remove the short.
- 7 Download the ZN253.

To get the ZN253's serial number

If you need the ZN253's serial number when troubleshooting, the number is on:

- a sticker on the back of the main controller board
- a Module Status report (Modstat) under **Core** (or **Main**) **board hardware**



To obtain a modstat in the WebCTRL® interface:

- 1 Select the ZN253 in the **Network**  tree.
- 2 On the **Properties** page, click **Module Status**.

Recovering from a power outage

The ZN253 has a 10-year Lithium CR2032 battery that retains the following data for a maximum of 10,000 hours during power outages.

- Control programs
- Editable properties
- Trends
- Schedules

If the above data is lost after power returns, replace the battery and then download the ZN253. See instructions below.

To replace the ZN253's battery

If the ZN253 experiences a power outage and the control program stops functioning, replace the battery.

- 1 Verify that the ZN253's power is on.
- 2 Remove the battery from the controller, making note of the battery's polarity.
- 3 Insert the new battery into the controller, matching the polarity of the battery you removed.
- 4 Download the ZN253.

To take the ZN253 out of service

If needed for troubleshooting or start-up, you can prevent the WebCTRL® application from communicating with the ZN253.

- 1 On the WebCTRL® **Network**  tree, select the ZN253.
- 2 On the **Properties** page, check **Out of Service**.
- 3 Click **Accept**.

Compliance

FCC Compliance

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.



CAUTION Changes or modifications not expressly approved by the responsible party for compliance could void the user's authority to operate the equipment.

CE Compliance

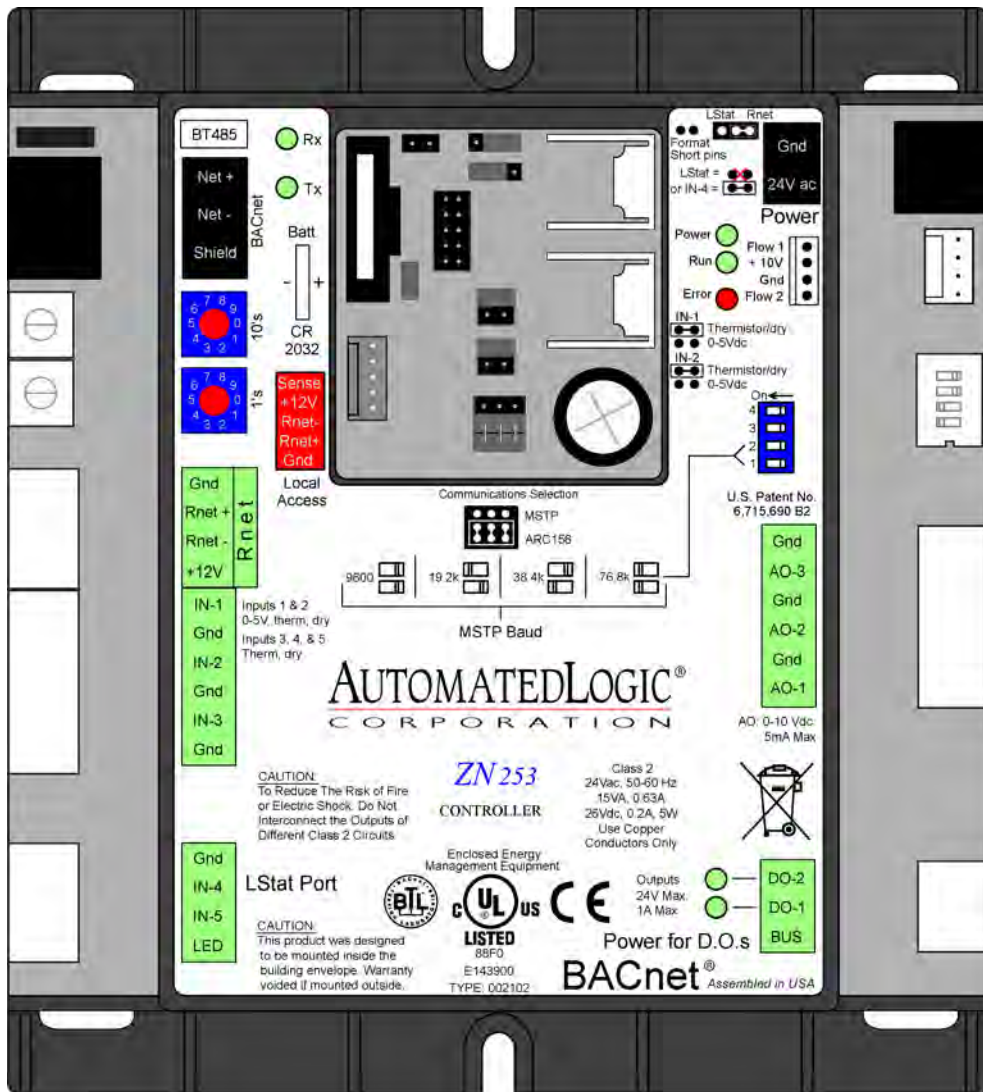


WARNING This is a Class A product. In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate measures.

BACnet Compliance

Compliance of listed products to requirements of ASHRAE Standard 135 is the responsibility of BACnet International. BTL® is a registered trademark of BACnet International.

Appendix - ZN253 coverplate



Document revision history

Important changes to this document are listed below. Minor changes such as typographical or formatting errors are not listed.

Date	Topic	Change description	Code*
2/7/17	Specifications	Added wireless sensors to the Rnet port specification.	X-D
	Zone sensors	Added wireless sensors to this topic.	
	Equipment Touch	Added Wireless Adapter to this topic.	
	Wiring inputs and outputs > Wiring specifications	Added Wireless Adapter to this topic.	
	Wiring devices to the Rnet port	Added Wireless Adapter to this topic.	
	To wire a Wireless Adapter to the ZN253	New topic.	
9/27/16	To set up a Local Access connection in the WebCTRL interface	Updated WebCTRL menu button in step 12.	A-D
	Appendix - ZN253 coverplate	Updated coverplate	A-D
4/20/15	Entire document	New look, no content changes	A-D
11/14/14	BACnet Compliance	Changed BACnet Manufacturers Association to BACnet International	X-D-CP-MW
10/7/14	Driver	Added the Network Microblock fields	A-TS-RB-F
9/4/14	LED's	Changed the Status description for when the Run LED shows 2 flashes per second and the Error LED is On. Also added a note below the table regarding cycling power to turn off Error LED.	A-TS-JM-F-BK
5/13/14	Specifications	Rnet Port: Added Equipment Touch and removed note about BACview® devices	A-D-CP-O-TC
	Equipment Touch devices	New topic	
	Wiring zone sensors to the ZN253	Changed to "Wiring devices to the ZN253's Rnet port"	
	To wire an Equipment Touch to the ZN253	New topic	
	Wiring a LogiStat sensor to the ZN253	New topic	
	To set up the driver > Driver	Added new driver property: TouchScreen Schedule Edit Enable	

* For internal use only

ZN341v+ Controller

Technical Instructions

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Verify that you have the most current version of this document. Go to <https://accounts.automatedlogic.com>, then select **Support > Download > Documents > Hardware**. Important changes are listed in **Document revision history** at the end of this document.

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What is the ZN341v+ controller?

The ZN341v+ controller is used for zone control. It has a built-in flow sensor and actuator, uses a patented flow control algorithm, and mounts directly on the VAV box damper shaft.

Driver and control program

Driver	DRV_ZNPLUS ¹  WARNING You must use the v2-04-005 or later driver for a ZN341v+ with a serial number of Z3P622621N or later.
Maximum number of control programs	1
Maximum number of BACnet objects ²	300

¹ To replace a U line controller with a ZN341v+, use the driver DRV_ZNPLUSU_<latest version>. See the *ZN U Line Emulation Technical Instructions*.

² Depends on available memory.

Specifications

Power	24 Vac $\pm 10\%$, 50–60 Hz, 14 VA 26 Vdc (25 V min, 30 V max)
BACnet port (This port may be labeled CMnet.)	For communication with the controller network using ARC156 or MS/TP (9600 bps–76.8 kbps)
Rnet port	Supports: • Up to 5 ZS sensors • One Wireless Adapter that communicates with up to 5 wireless sensors • One Equipment Touch • Up to 4 RS Standard sensors and one RS Plus, RS Pro, or RS Pro-F sensor. NOTE ZS sensors, a Wireless Adapter, and an Equipment Touch can share the Rnet, but not RS sensors.
LStat/ZASF Port	For a LogiStat or LogiStat Plus zone sensor or a ZASF. This port uses Inputs 3 and 4, making them unavailable. NOTE The ZN341v+ does not support the LogiStat Pro. Use a ZS Pro or an RS Pro on the Rnet port instead.
Local Access port	For system start-up and troubleshooting

Inputs	4 inputs configurable for thermistor or dry contact. Inputs 1 and 2 are also configurable for 0–5 Vdc. Inputs 3 and 4 are used when a LogiStat sensor is connected, but are available if a ZS or an RS sensor is connected.
Input resolution	10 bit A/D
Input pulse frequency	10 pulses per second. Minimum pulse width (on or off time) required for each pulse is 50 msec.
Digital outputs	3 digital output, relay contact rated at 1 A max. @ 24 Vac/Vdc. Configured normally open.
Analog output	1 analog output, 0–10 Vdc (5 mA max)
Output resolution	8 bit D/A
Integral airflow sensor	Precision low flow AWM series 0–2 in. H2O, sensitive down to ± 0.001 in. H2O. Barbed tapered airflow connections accept 3/16 in. (4.75 mm) I.D. tubing. Allows for readings across the 0–2 in. H2O range, accurate to $\pm 5\%$ of full flow at 2 in. H2O.
Integral actuator	Brushless DC motor, torque 35 inch-pounds (4 Nm), runtime 205 seconds for 90 degree travel during control, or 25 seconds in high-speed test and balance mode
Microprocessor	High speed 16-bit microprocessor with ARCNET communication co-processor
Memory	512 kB non-volatile battery-backed RAM, 1 MB Flash memory, 16-bit memory bus
Battery	10-year Lithium CR2032 battery retains the following data for a maximum of 10,000 hours during power outages: control programs, editable properties, schedules, and trends.
Protection	Incoming power and network connections are protected by non-replaceable internal solid-state polyswitches that reset themselves when the condition that causes a fault returns to normal. The power, network, input, and output connections are also protected against transient excess voltage/surge events lasting no more than 10 msec.
BT485 connector	You attach a BT485 (not included) to a controller at the beginning and end of a network segment to add bias and to terminate a network segment.
Status indicators	LED's indicate status of communications, running, errors, power, and digital outputs
Environmental operating range	0 to 130 °F (-17.8 to 54.4 °C), 10–90% relative humidity, non-condensing
Physical	UL94-5VA plenum rated enclosure for installation in plenum (or other space for environmental air) in accordance with NEC Section 300.22 (c) and (d)
Overall dimensions	Width: 5 7/8 in. (15 cm) Height: 7 in. (17.8 cm)
Mounting dimensions	5 5/8 in. (14.3 cm) from shaft centerline to mounting hole centerline
Weight	0.6 lbs (0.27 kg)

BACnet support	Conforms to the BACnet Advanced Application Controller (B-AAC) Standard Device Profile as defined in ANSI/ASHRAE Standard 135-2012 (BACnet) Annex L, Protocol Revision 9
Listed by	UL-916 (PAZX), cUL-916 (PAZX7), FCC Part 15-Subpart B-Class A, CE

Inputs

The ZN341v+ has 4 inputs that accept the following signal types.

These inputs...	Support this signal type...	Description
All	Thermistor	Precon type 2 (10 kOhm at 77 °F). Input voltage for IN-3: 1 to 2.52 Vdc Input voltage for all other inputs: 0.33 to 2.52 Vdc
All	Dry contact	A 3.3 Vdc wetting voltage detects contact position, resulting in a 0.3 mA maximum sense current when the contacts are closed.
IN-1, IN-2	0–5 Vdc	The output impedance of a 0–5 Vdc source must not exceed 100 Ohms. The input impedance of the ZN341v+ is approximately 30 kOhm.
All	Timed local override	A momentary contact switch that overrides a schedule and turns equipment on for a defined period of time. The override time added for each push of the button and the maximum allowable On time are software adjustable.
All	Pulse counter ¹	Pulse counting up to 10 pulses per second. Minimum pulse width (on or off time) required for each pulse is 50 msec.
IN-3, IN-4	LogiStat ²	IN-3: See Thermistor. IN-4: Setpoint adjust. Input voltages should be from 1.4 to 3.4 Vdc.
IN-3, IN-4	ZASF	IN-3 and IN-4 serve as a bi-directional communication port. They command the ZASF actuator and read the ZASF flow sensor.

¹ The ZN341v+ can perform pulse counting for dry contact or voltage inputs if you assign the input to a Pulse to Analog Input microblock. See *To assign inputs or outputs to points* (page 15).

² A LogiStat sensor or ZASF connected to the **LStat/ZASF Port** uses IN-3 and IN-4. A ZS or an RS sensor connected to the **Rnet** port does not use these inputs.

Digital outputs

The ZN341v+ has 3 digital outputs. You can connect each output to a maximum of 24 Vac/Vdc. Each output is a dry contact rated at 1 A, 24 V maximum and is normally open.

Analog outputs

The ZN341v+ has 1 analog output that supports voltage devices from 0-10 Vdc. The controlled device must have a minimum of 2000 Ohms resistance measured from its input to ground and must share the same ground as the controller.

Zone sensors

Automated Logic® wireless sensors

You can connect a Wireless Adapter to ZN341v+'s **Rnet** port. The Wireless Adapter communicates with up to 5 wireless sensors. When using wireless sensors, the Rnet can have:

- Up to 5 wireless and ZS sensors (any combination)
- One Wireless Adapter
- One Equipment Touch

ZS sensors

You can wire up to 5 ZS sensors to the ZN341v+'s Rnet port.

RS sensors

You can wire RS sensors to the ZN341v+'s **Rnet** port. An Rnet can consist of any of the following combinations of devices wired in a daisy-chain or star configuration:

- 1 RS Plus, RS Pro, or RS Pro-F
- 1-4 RS Standards
- 1-4 RS Standards, and 1 RS Plus, RS Pro, or RS Pro-F

LogiStats

You can wire a LogiStat or LogiStat Plus to the ZN341v+'s **LStat/ZASF** port.

NOTES

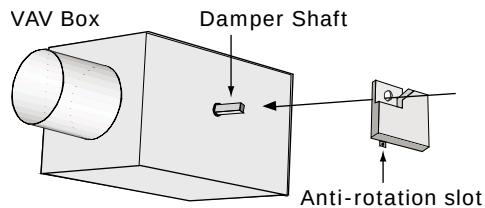
- The ZN341v+ does not support the LogiStat Pro.
- A LogiStat or LogiStat Plus wired to the ZN341v+ cannot be used for local access.

Equipment Touch devices

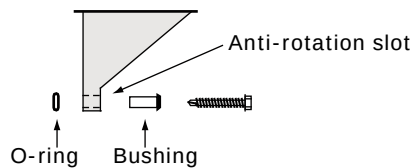
You can wire an Equipment Touch to the ZN341v+'s Rnet port to view or change the controller's property values, schedule equipment, view trends and alarms, and more, without having to access the system's server. The Rnet can have one Equipment Touch, one Wireless Adapter, and up to 5 ZS sensors. RS sensors cannot share the Rnet with an Equipment Touch.

To mount the ZN341v+

- 1 Turn the damper shaft to fully close the damper.
- 2 Remove the ZN341v+'s cover.
- 3 Mount the ZN341v+ to the VAV box by sliding the clamp assembly onto the damper shaft.

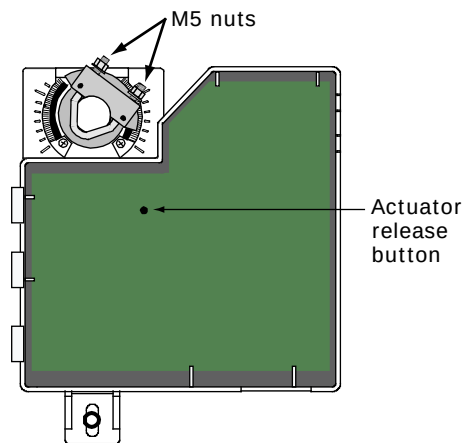


- 4 Secure the ZN341v+ by installing the screw provided through the anti-rotation slot's bushing and o-ring.



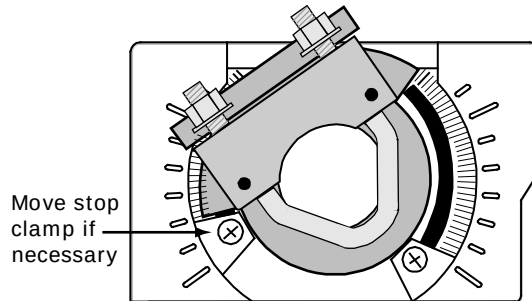
NOTE Center the bushing in the slot. Failure to do so may cause the actuator to stick or bind.

- 5 Hold down the ZN341v+'s actuator release button and rotate the actuator clamp in the same direction that closed the damper. Rotate the clamp until it stops, then rotate it back one notch.



- 6 Release the button.
- 7 Tighten the actuator clamp to the damper shaft by tightening the two M5 nuts.

- 8 Hold down the actuator release button and rotate the damper from fully closed to fully open. If the damper traveled less than 90 degrees, do the following to prevent the damper opening past fully open:
 - a) Loosen the appropriate stop clamp screw.
 - b) Move the stop clamp until it contacts the edge of the actuator cam.
 - c) Tighten the screw.



- 9 Hold down the actuator release button, rotate the damper to verify that it opens and closes, then release the button.

Wiring for power



WARNING Do not apply line voltage (mains voltage) to the controller's ports and terminals.



CAUTIONS

- The ZN341v+ is powered by a Class 2 power source. Take appropriate isolation measures when mounting it in a control panel where non-Class 2 circuits are present.
- Automated Logic® controllers can share a power supply as long as you:
 - Maintain the same polarity.
 - Use the power supply only for Automated Logic® controllers.

To wire for power

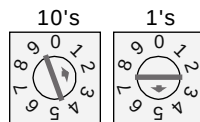
- 1 Remove power from the power supply.
- 2 Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**.
- 3 Connect the transformer wires to the screw terminal connector.
- 4 Apply power to the power supply.
- 5 Measure the voltage at the ZN341v+'s power input terminals to verify that the voltage is within the operating range of 21.6–26.4 Vac.
- 6 Connect a 4-inch (10.2 cm) wire from **Gnd** to the control panel.
- 7 Insert the screw terminal connector into the ZN341v+'s power terminals.
- 8 Verify that the **Power** LED is on and the **Run** LED is blinking.

To address the ZN341v+

You must give the ZN341v+ an address that is unique on the network. You can address the ZN341v+ before or after you wire it for power.

- 1 If the ZN341v+ has been wired for power, pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**. The controller reads the address each time you apply power to it.
- 2 Using the rotary switches, set the controller's address to match the **Address** in the controller's properties dialog box in SiteBuilder. Set the **Tens (10's)** switch to the tens digit of the address, and set the **Ones (1's)** switch to the ones digit.

EXAMPLE If the controller's address is 25, point the arrow on the **Tens (10's)** switch to 2 and the arrow on the **Ones (1's)** switch to 5.



Wiring for communications

The ZN341v+ communicates using BACnet on the following types of network segments:

- ARC156 communicating at 156 kbps
- MS/TP communicating at 9600 bps, 19.2 kbps, 38.4 kbps, or 76.8 kbps

NOTE ARC156 is a unique implementation of the industry standard ARCNET. For a summary of differences between ARCNET and ARC156, see the *ARC156 Wiring Technical Instructions*.

Wiring specifications

For...	Use...	Maximum Length
ARC156 ¹ and MS/TP ²	22 AWG, low-capacitance, twisted, stranded, shielded copper wire	2000 feet (610 meters)

¹ See the *ARC156 Wiring Technical Instructions*.

² See the *MS/TP Networking and Wiring Technical Instructions*.



WARNING Do not apply line voltage (mains voltage) to the controller's ports and terminals.

To wire the ZN341v+ for communications

- 1 Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**.
- 2 Check the communications wiring for shorts and grounds.
- 3 Connect the communications wiring to the controller's screw terminals labeled **Net +**, **Net -**, and **Shield**.
NOTE Use the same polarity throughout the network segment.
- 4 Set the communication type and baud rate.

For...	Set ARC156/MSTP jumper to...	Set DIP switches 1 and 2 to...
ARC156	ARC156	N/A. Baud rate will be 156 kbps regardless of the DIP switch settings.
MS/TP	MSTP	The appropriate baud rate. See the MSTP Baud diagram on the controller.

- NOTE** Use the same baud rate for all controllers on the network segment.
- 5 If the ZN341v+ is at either end of a network segment, connect a BT485 to the ZN341v+.
 - 6 Insert the power screw terminal connector into the ZN341v+'s power terminals.
 - 7 Verify communication with the network by viewing a Module Status report in the WebCTRL® interface.

Wiring inputs and outputs

Wiring specifications

Input wiring

Input	Maximum length	Minimum gauge	Shielding
0–5 Vdc	1000 feet (305 meters)	26 AWG	Shielded
Thermistor Dry contact	1000 feet (305 meters)	22 AWG	Shielded
ZS sensor RS sensor Wireless Adapter for wireless sensors Equipment Touch	See <i>Wiring devices to the ZN341v+'s Rnet port</i> (page 11).		
LogiStat sensor	See <i>Wiring a LogiStat sensor to the ZN341v+</i> (page 13).		

Output wiring

To size output wiring, consider the following:

- Total loop distance from the power supply to the controller, and then to the controlled device
NOTE Include the total distance of actual wire. For 2-conductor wires, this is twice the cable length.
- Acceptable voltage drop in the wire from the controller to the controlled device
- Resistance (Ohms) of the chosen wire gauge
- Maximum current (Amps) the controlled device requires to operate

To wire inputs and outputs

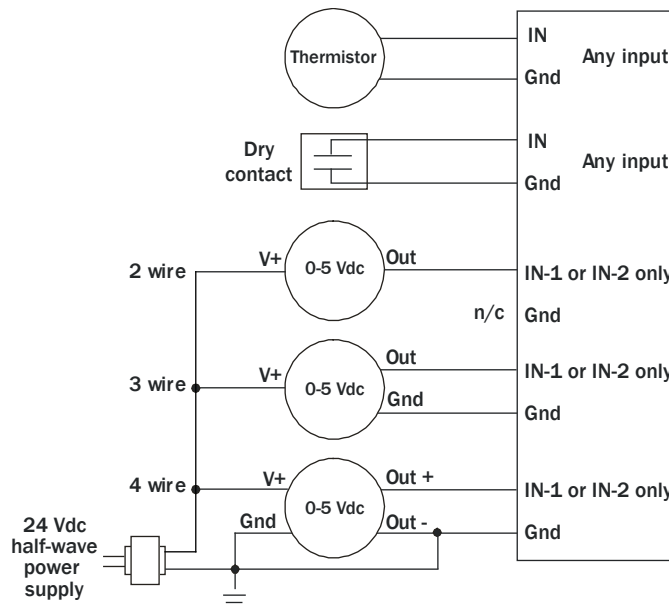


WARNING Do not apply line voltage (mains voltage) to the controller's ports and terminals.

- 1 Verify that the ZN341v+'s power and communications connections work properly.
- 2 Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**.
- 3 Connect the input wiring to the screw terminals on the ZN341v+.

NOTES

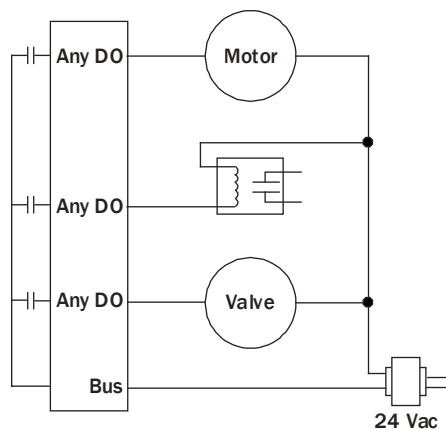
- Connect the shield wire to the **GND** terminal with the ground wire.
- **IN-3** and **IN-4** share the **GND** terminal beside **IN-3**.



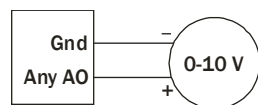
4 Set the appropriate jumpers on the ZN341v+.

To use...	For...	
IN-1 or IN-2	Thermistor Dry contact 0–5 Vdc	Set jumpers IN-1 or IN-2 to the type of signal the input will receive.
IN-3 or IN-4	Thermistor Dry contact	1. Verify the LStat/IN-3 jumper is on. 2. Set LogiStat/IN3 & 4/ZASF jumper to LogiStat/IN3 & 4 .
IN-3 and IN-4	LogiStat	See <i>To wire a LogiStat sensor</i> (page 14).
IN-3 and IN-4	ZASF	See <i>Using flow sensors</i> (page 18).

5 Connect the digital output wiring to the screw terminals on the ZN341v+ and to the controlled device.



6 Connect the analog output wiring to the screw terminals on the ZN341v+ and to the controlled device.



7 Insert the power screw terminal connector into the ZN341v+'s power terminals.

Wiring devices to the ZN341v+'s Rnet port

You can wire the following devices to the ZN341v+'s Rnet port in a daisy-chain or star configuration:

- *ZS or RS sensors* (page 11)
- *Wireless Adapter* (page 12) that communicates with wireless sensors
- *Equipment Touch* (page 13)

NOTE ZS sensors, a Wireless Adapter, and an Equipment Touch can share the same Rnet, but not RS sensors.

The Rnet communicates at a rate of 115 kbps.

Rnet wiring specifications

NOTE Use the specified type of wire and cable for maximum signal integrity.

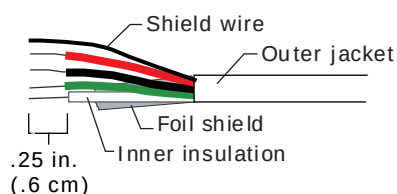
Description	4 conductor, shielded or unshielded, CMP, plenum rated cable
Conductor	22 AWG (7x0096) bare copper
Maximum length	500 feet (152 meters)
Insulation	Low-smoke PVC (or equivalent)
Color Code	Black, white, green, red
Shielding	If shielded, Aluminum/Mylar shield (100% coverage) with TC drain wire
UL temperature rating	32–167 °F (0–75 °C)
Voltage	300 Vac, power limited
Listing	UL: NEC CL2P, or better

To wire a ZS or an RS sensor to the ZN341v+

For complete sensor installation instructions, including ZS sensor power requirements, see:

- *ZS Sensors Technical Instructions*
- *RS Sensors Technical Instructions*

- 1 Remove power from the ZN341v+.
- 2 Partially cut, then bend and pull off the outer jacket of the Rnet cable(s). Do not nick the inner insulation.



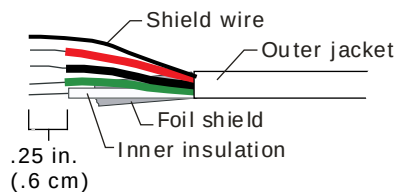
- 3 Strip about .25 inch (.6 cm) of the inner insulation from each wire.
- 4 Wire each terminal on the ZN341v+'s **Rnet** port to the terminal of the same name on the sensor.
NOTE If using shielded wire, connect the shield wire and the ground wire to the **Gnd** terminal.
- 5 Apply power to the ZN341v+.

To wire a Wireless Adapter to the ZN341v+

NOTES

- The Wireless Adapter requires a 24 Vac power supply. It is not powered by the Rnet.
- If the Wireless Adapter will be:
 - Daisy-chained on the Rnet with ZS sensors or an Equipment Touch, use the standard 4-conductor Rnet cable.
 - The only device on the Rnet, you can use a 3-conductor cable instead of the standard 4-conductor Rnet cable.
- For complete Wireless Adapter installation instructions, see the *Wireless Sensors Technical Instructions*.

- 1 Remove power from the ZN341v+.
- 2 Partially cut, then bend and pull off the outer jacket of the Rnet cable(s). Do not nick the inner insulation.



- 3 Strip about .25 inch (.6 cm) of the inner insulation from each wire.
- 4 Wire the ZN341v+'s **Rnet+**, **Rnet-**, and **Gnd** terminals to the terminals of the same name on the Wireless Adapter's Rnet connector.



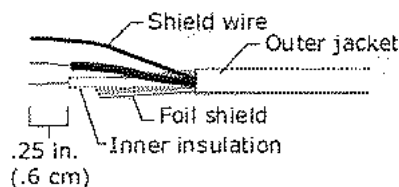
- NOTE** If using shielded wire, connect the shield wire and the ground wire to the **Gnd** terminal.
- 5 Apply power to the ZN341v+.

To wire an Equipment Touch to the ZN341v+

NOTES

- The Equipment Touch requires a 24 Vac power supply. It is not powered by the Rnet.
- If the Equipment Touch will be:
 - Daisy-chained on the Rnet with ZS sensors or a Wireless Adapter, use the standard 4-conductor Rnet wiring and follow the wiring instructions *To wire a ZS or an RS sensor to the ZN341v+* (page 11).
 - The only device on the Rnet, you can use a 2-conductor cable instead of the standard 4-conductor Rnet cable and follow the instructions below.
- For complete Equipment Touch installation instructions including wiring diagrams, see the *Equipment Touch Installation and Setup Guide*.

- 1 Remove power from the ZN341v+.
- 2 Partially cut, then bend and pull off the outer jacket of the cable. Do not nick the inner insulation.



- 3 Strip about .25 inch (.6 cm) of the inner insulation from each wire.
- 4 Wire the ZN341v+'s **Rnet+** and **Rnet-** terminals to the terminals of the same name on the Equipment Touch's connector.
NOTE If using shielded wire, connect the shield wire and the ground wire to the **Gnd** terminal.
- 5 Apply power to the ZN341v+.

Wiring a LogiStat sensor to the ZN341v+

You can wire a LogiStat or LogiStat Plus to the ZN341v+'s **Lstat** port

For complete sensor installation instructions, see the *LogiStat Sensors Technical Instructions*.

LogiStat wiring specifications

Use 22 AWG, unshielded wire, maximum length 100 feet (30 meters).

To wire a LogiStat sensor

- 1 Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**.
- 2 To connect the LogiStat sensor to the ZN341v+'s **LStat** port.

Wire this terminal on the LStat port...	To this terminal on the LogiStat sensor
Gnd	Gnd
IN-3	Temp
IN-4	SW
LED	LS5v

- 3 Remove the jumper from **LStat/IN-3**.
- 4 Set the **Rnet/LogiStat** jumper to **LogiStat**.
- 5 Set **LogiStat/IN3 & 4/ZASF** jumper to **LogiStat**.
- 6 Insert the power screw terminal connector into the ZN341v+'s power terminals.

Downloading the ZN341v+

Download the following items to the ZN341v+'s battery-backed memory:

Item	Notes
Control program	Must be in WebCTRLx.x\webroot\<system_name>\programs .
DRV_ZNPLUS driver	Must be in WebCTRLx.x\webroot\<system_name>\drivers . NOTE To verify that you have the driver's latest version, go to http://accounts.automatedlogic.com/download , then select Drivers > ExecB . Compare the latest version to the ZN341v+'s driver in SiteBuilder.
Editable properties	
Schedules	

If you change any of the above items or the ZN341v+'s address after the initial download, you must download again. The first download takes longer than subsequent downloads.



CAUTIONS

- The ZN341v+ will lose stored data when you download.
- Equipment controlled by the ZN341v+ will shut down and restart when you download.

To download from the WebCTRL® interface

If your network is complete, you can download from any network browser. If not complete, connect a laptop with a local copy of the system database to the ZN341v+'s local access port. See *To communicate through the local access port* (page 23).

- 1 On the WebCTRL® **Network**  tree, select the controller.
- 2 Click **Downloads**.
- 3 Do one of the following:
 - If the controller is in the Downloads list, go to step 4.
 - If the controller is not in the list:
 - a. Click **Add**.
 - b. In the pop-up, select the controller.
 - c. Select **All Content**.
 - d. Click **Add**.
 - e. Click **Close**.
- 4 Select the controller in the Downloads list.
- 5 Click **Start**.

NOTES

- If the download fails, locate and resolve the problem, then retry the download.
- You can also download a controller from the **Devices** page.

To assign inputs or outputs to points

To use an input or output, you must assign it to its corresponding point in the control program.

- 1 In the WebCTRL® **Geographic**  tree, select the equipment controlled by the ZN341v+.
- 2 On the **Properties** page, select the **I/O Points** tab.
- 3 In each point's **Num** field, type the number of the controller's corresponding input or output. For example, if you use DO1 on the ZN341v+ for the point **Fan S/S**, type 1 in the **Num** field for **Fan S/S**.

NOTES

- **Exp** (expander number) is 00 for the ZN341v+.
 - Do not assign the same output number to more than one point.
- 4 Enter the appropriate values for each input and output in the remaining columns. See *Input values*, *Output values*, *Resolution values* and *Offset/Polarity values* below.
NOTE You can also enter these values in the EIKON® LogicBuilder application.
 - 5 If you have not performed the initial download to the ZN341v+, you must download now so you can verify inputs and outputs.
 - 6 To verify each input's operation, force each sensor to a known value, then compare it to the **Value** shown on the **Properties** page on the **I/O Points** tab.
 - 7 To verify each output's operation, lock each output to a known condition on the **I/O Points** tab, then verify that the equipment operates correctly.

Input values

Input	I/O Type	Sensor/Actuator Type	Min/Max
Analog (BAI)			
0-5 Vdc	0–5 Volt	Linear Full Range	Engineering values associated with 0 Vdc (Min) and 5 Vdc (Max) ¹
Thermistor	Thermistor	Select your Thermistor type or set up and select a Non-Linear, Custom Table ²	N/A
Pulse to Analog (BPTA) ³			
Pulse Counter	Counter Input	N/A	N/A
Digital (Binary) (BBI)			
Dry Contact	Dry Contact	N/A	N/A

¹ The sensor reads a value and sends a corresponding signal (Volt, mA, or psi) to the ZN341v+'s physical input. The Analog Input microblock uses the **Min** and **Max** values to linearly translate the signal into the engineering value used in subsequent control logic. For example, set **Min** to 0 and **Max** to 10 for a 4–20 mA sensor that measures velocity from 0.0 to 10.0 inches/second so that when the input reads 4 mA, the microblock outputs a value of 0. Similarly, when the input reads 8 mA, the microblock outputs a value of 2.5.

² You can set up a *custom translation table* (page 23) on the driver's **Custom Translation Tables** pages in the WebCTRL® interface.

³ The control program must have one Pulse to Analog Input microblock for each pulse counting input.

Output values

Output	I/O Type	Sensor/Actuator Type	Min/Max
Analog (BAO)			
0-10 Vdc	Electrical 0–10 Volt	Linear Full Range	Engineering values associated with 0 Vdc (Min) and 10 Vdc (Max) ¹
2-10 Vdc	Electrical 0–10 Volt	Linear w/Offset, 2–10 Volts	Engineering values associated with 2 Vdc (Min) and 10 Vdc (Max) ¹
Digital (Binary) (BBO)			
Relay	Relay/Trlac Output	N/A	N/A

¹ The Analog Output microblock uses the **Min** and **Max** values to linearly translate its EIKON® LogicBuilder wire value into a physical output signal (Volt, mA, or psi) sent from the ZN341v+ to an actuator. For example, set **Min** to 0 and **Max** to 100 for an Analog Output microblock that receives a 0 to 100% open signal from a PID microblock and that controls a 0–10 Vdc actuator so that when the PID signal is 100%, the ZN341v+ output is 10 Vdc. Similarly, when the PID signal is 50%, the ZN341v+ output is 5 Vdc.

Resolution values

Resolution is not particular to a type of input or output, but the driver handles analog and digital (binary) inputs and outputs differently. To set these values appropriately, you should understand how the driver uses them.

Resolution	Notes
Analog Input (BAI)	The driver truncates the microblock's present value according to the resolution. EXAMPLE If the calculated present value is 13.789 and you set the Resolution to 0.1, the control program uses 13.7 for any calculations downstream from the microblock.
Analog Output (BAO)	The driver truncates the wire input value to the microblock before performing any scaling calculations. EXAMPLE If the wire input value is 13.789 and you set the Resolution to 0.1, the microblock uses 13.7 for any scaling calculations.
Digital Inputs and Outputs	N/A

Offset/Polarity values

Offset/Polarity is not particular to a type of input or output, but the driver handles analog and digital (binary) inputs and outputs differently. To set these values appropriately, you should understand how the driver uses them.

Offset/Polarity	Notes
Analog Input (BAI)	Offset value (positive or negative) adds a fine adjustment to a sensor reading after all scaling for calibration. EXAMPLE If a sensor reads 74.9°F when the actual measured value is 73.6°F, enter an Offset of -1.3 to calibrate the sensor to the measured value.
Analog Output (BAO)	You can use the Offset value (positive or negative) to calibrate an output, but you generally do not need to. If used, the driver adds the offset value to the wire input value before performing any scaling calculations to determine the ZN341v+'s output.
Digital (Binary) Input (BBI)	Polarity determines the microblock's present value when no signal is received from the equipment. When no signal is received from the equipment, if Polarity is set to: normal —present value is off reversed —present value is on
Digital (Binary) Output (BBO)	Polarity determines the ZN341v+'s output based on the control program's signal to the microblock. When the control program's signal to the microblock is on , if Polarity is set to: normal —output is on reversed —output is off NOTE Regardless of Polarity , the output will be off if the ZN341v+ loses power.

Using flow sensors

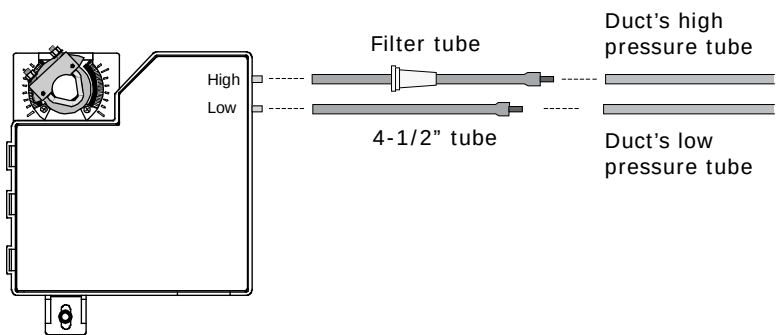
In a single duct system, the ZN341v+ controls airflow using the built-in actuator and flow sensor.

In a dual duct system, the ZN341v+ controls airflow for one duct using the built-in actuator and flow sensor. For the other duct, the ZN341v+ uses a ZASF connected to the LStat/ZASF Port.

To connect duct tubes to the flow sensors

For a single duct system

- 1 Turn off the ZN341v+'s power.
- 2 Connect the filter tube to the ZN341v+'s **High** connector and the tube without the filter to the **Low** connector. Then connect those tubes to the duct's high and low pressure tubes. Avoid sharp bends in the tubing.



For a dual duct system

- 1 Follow the single duct procedure above to connect the ZN341v+ to the first duct's tubes.
- 2 To connect the ZASF to the second duct's tubes, turn off the ZASF's power.
- 3 Connect the filter tube to the ZASF's **High** connector and the tube without the filter to the **Low** connector. Then connect those tubes to the duct's high and low pressure tubes. Avoid sharp bends in the tubing.

To wire the ZASF to the ZN341v+

Use a 22 AWG wire, maximum length 9.8 feet (3 meters).

- 1 Wire the ZASF's screw terminal connector to the ZN341v+'s **LStat/ZASF Port**.

Wire this terminal on the ZN341v+...	To this terminal on the ZASF
Gnd	Gnd
IN-3	Tx
IN-4	Rx
LED	+12v

- 2 Set the **LogiStat/ZASF** jumper on the controller to **ZASF**.

To set up the Airflow Control microblock

The ZN341v+'s control program must include one Airflow Control microblock for a single duct system or two of the microblocks for a dual duct system. You must set up the Airflow Control microblock for each flow sensor.

In a single duct system

- 1 In the WebCTRL® interface on the control program's **Logic** page, select the Airflow Control microblock.
- 2 On the **Details** tab in the **Flow Sensor** field under **Hardware**, select **Built-in flow sensor**.
- 3 In the **Damper Actuator** field, select **Built-in actuator**.

In a dual duct system

- 1 In the WebCTRL® interface on the control program's **Logic** page, select the Airflow Control microblock for Flow #1.
- 2 On the **Details** tab under **Hardware** in the **Flow Sensor** field, select **Built-in flow sensor**.
- 3 In the **Damper Actuator** field, select **Built-in actuator**.
- 4 On the **Logic** page, select the Airflow Control microblock for Flow #2.
- 5 On the **Details** tab under **Hardware** in the **Flow Sensor** field, select **ZASF flow sensor**.
- 6 In the **Damper Actuator** field, select **ZASF actuator**.

NOTE When performing test and balance, follow the steps under **Test and Balance** on the Airflow Control microblock's **Properties** page **Details** tab.

To set up the driver

After you download the driver and control program to the ZN341v+, you may want to change the driver's properties in the WebCTRL® interface to suit your application.

- 1 On the WebCTRL® **Network**  tree, click ▶ to the left of your ZN341v+.
- 2 Click ▶ to the left of **Driver** to see its children.
- 3 Make changes as needed on the **Properties** page for **Driver** and any of its children.

Driver

On the **Driver** page, you can change the following properties:

- Module clock synchronization and failure. See table below.
- Network Input microblock communication properties.

Module Clock	
Clock Fail Date and Time	Date and time the control program uses when controller's real-time clock is invalid.  TIP Use an occupied date and time (such as a Tuesday at 10 a.m.) so the equipment does not operate in unoccupied mode if the controller loses power during occupancy.
Time Synch Sensitivity (seconds)	When the controller receives a time sync request, if the difference between the controller's time and the time sync's time is greater than this field's value, the controller's time is immediately changed. If the difference is less than this field's value, the controller's time is slowly adjusted until the time is correct.
Network Microblocks	
Number of poll retries before Network Input Microblocks indicate failure	The maximum number of retries after the initial attempt that a Network microblock will attempt to communicate with its target device. If unsuccessful, the point will transition to an idle state for 30 seconds before attempting to communicate again. Change this field only if directed by Technical Support.
Periodic rebinding interval	If a microblock uses a wildcard in its address, this timer determines how often the microblock will attempt to find the nearest instance of its target. For example, if an outside air temperature address uses a wildcard, a VAV application will look for the outside air temperature on the same network segment or on the nearest device containing that object.
BACnet COV Throttling	
Enable COV Throttling	Under normal circumstances, COV Throttling should be enabled to prevent excessive network traffic if an object's COV Increment is set too low. See EXCEPTION below. When enabled, if an object generates excessive COV broadcasts (5 updates in 3 seconds), the driver automatically throttles the broadcasts to 1 per second. Also, if the object's value updates excessively for 30 seconds, an alarm is sent to the WebCTRL® application listing <u>all</u> objects that are updating excessively. A Return-to-normal alarm is sent only after <u>all</u> objects have stopped updating excessively. EXCEPTION: In rare circumstances, such as process control, a subscribing object may require COV updates more frequently than once per second. For these situations, clear this checkbox, but make sure that your network can support the increased traffic. You will also need to disable the Excessive COV alarms under the driver's Common Alarms.
Trend Sampling	
Collect a daily midnight sample for all points in this controller that are sampling on COV	For values that change infrequently, select to verify at midnight daily that the point is still able to communicate trend values.
TouchScreen Control	
TouchScreen Schedule Edit Enable	Check this field to allow a user to edit this controller's schedules from an Equipment Touch's Schedules screen.

Device

On the **Device** page, you can change the following properties:

- BACnet device object properties for the ZN341v+
- ZN341v+ network communication

Configuration	NOTE The three APDU fields refer to all networks over which the ZN341v+ communicates.
Max Masters and Max Info Frames	Apply only if the ZN341v+ is on an MS/TP network.

Notification Classes

Alarms in the WebCTRL® application use Notification Class #1. A BACnet alarm's Notification Class defines:

- Alarm priority for Alarm, Fault, and Return to Normal states
- Options for BACnet alarm acknowledgment
- Where alarms should be sent (recipients)

Priorities	NOTE BACnet defines the following Network message priorities for Alarms and Events.										
	<table><tr><th>Priority range</th><th>Network message priority</th></tr><tr><td>00–63</td><td>Life Safety</td></tr><tr><td>64–127</td><td>Critical Equipment</td></tr><tr><td>128–191</td><td>Urgent</td></tr><tr><td>192–255</td><td>Normal</td></tr></table>	Priority range	Network message priority	00–63	Life Safety	64–127	Critical Equipment	128–191	Urgent	192–255	Normal
Priority range	Network message priority										
00–63	Life Safety										
64–127	Critical Equipment										
128–191	Urgent										
192–255	Normal										
Priority of Off-Normal	BACnet priority for Alarms.										
Priority of Fault	BACnet priority for Fault messages.										
Priority of Normal	BACnet priority for Return-to-normal messages.										
Ack Required for Off-Normal, Fault, and Normal	Specifies whether alarms associated with this Notification Class require a BACnet Acknowledgment for Off-Normal, Fault, or Normal alarms.  TIP You can require operator acknowledgment for an Alarm or Return-to-normal message (stored in the WebCTRL® database). In the WebCTRL® interface on the Alarm > Enable/Disable tab, change the acknowledgment settings for an alarm source or an alarm category.										
Recipient List											
Recipients	The first row in this list is the WebCTRL® application. Do not delete this row. Click Add if you want other BACnet devices to receive alarms associated with this Notification Class.										
Recipient Description	Name that appears in the Recipients table.										

Recipient Type	Use Address (static binding) for either of the following: • Third-party BACnet device recipients that do not support dynamic binding • When you want alarms to be broadcast (you must uncheck Issue Confirmed Notifications). This use is rare.
Days and times	The days and times during which the recipient will receive alarms.
Recipient Device Object Identifier	Type the Device Instance from SiteBuilder (or from the network administrator for third-party devices) in the # field.
Process Identifier	Change for third-party devices that use a BACnet Process Identifier other than 1. The WebCTRL® application processes alarms for any 32-bit Process Identifier.
Issue Confirmed Notifications	Select to have a device continue sending an alarm message until it receives delivery confirmation from the recipient.
Transitions to Send	Uncheck the types of alarms you do not want the recipient to get.

Calendars

Calendars are provided in the driver for BACnet compatibility only. Instead, use the **Schedules** feature in the WebCTRL® interface.

Common and Specific Alarms

On these pages, you can enable/disable, change BACnet alarm properties, or set delays for the following BACnet alarms:

Common alarms:

- Module Halted
- All Programs Stopped
- Duplicate Address
- Locked I/O
- Control Program
- Program Stopped
- Excessive COV

Specific alarm:

- Flow Control Alarm

NOTE To set up alarm actions for controller generated alarms, see *Setting up alarm actions* in WebCTRL® Help.

Module Generated Alarm	
Description	Short message shown on the WebCTRL Alarms page or in an alarm action when this type of alarm is generated.
Events	
Alarm Category and Alarm Template	See <i>Customizing alarms</i> in WebCTRL® Help.
Enable	Clear these checkboxes to disable Alarm or Return to normal messages of this type from this controller.
Notification Class	Do not change this field.

Custom Translation Tables

You can set up a translation table that an analog input will use to translate the raw data from a non-linear sensor to the engineering units you want it to output on the wire. In the **Network**  tree, select **Custom Translation Table #1, #2, or #3**. The **Properties** page has instructions. For the input to use the translation table, navigate to the input in the **Geographic**  tree, select the **Details** tab, then set **Sensor Type (Scaling Method)** to **Non-Linear, Custom Table #__**.

Switch and Jumper Positions

The **Switch and Jumper Positions** page shows the current physical settings on the ZN341v+.

Flow Calibration Archive

The **Flow Calibration Archive** page shows measured flow and sensor readings that were entered in the WebCTRL® interface Test and Balance or through the stand-alone Airflow Test and Balance Utility. Editing Airflow microblock properties outside of Test and Balance will not change the values on this page.

To communicate through the Local Access port

Using a computer and a USB Link Kit, you can communicate locally with the ZN341v+ to download or to troubleshoot.

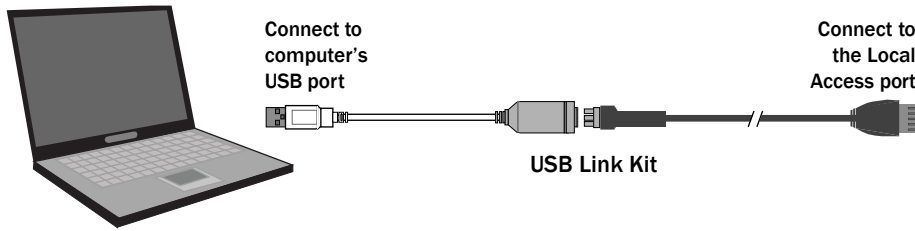
PREREQUISITES

- A computer with a USB port
- A USB Link Kit. See the *USB Link Kit Technical Instructions*.
NOTE The USB Link Kit driver is installed with a WebCTRL® v5 or later system. But if needed, you can get the latest driver from <http://www.silabs.com/products/mcu/Pages/USBtoUARTBridgeVCPDrivers.aspx>. Install the driver before you connect the USB Link Kit to your computer.
- v1.70 or later controller driver



CAUTION If multiple controllers share power but polarity was not maintained when they were wired, the difference between the controller's ground and the computer's AC power ground could damage the USB Link Kit and the controller. If you are not sure of the wiring polarity, use a USB isolator between the computer and the USB Link Kit. Purchase a USB isolator online from a third-party manufacturer.

Connect the USB Link Kit to the computer and to the controller's Local Access port.



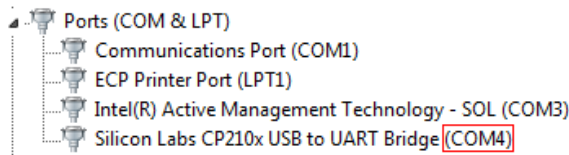
NOTE If using a USB isolator, plug the isolator into your computer's USB port, and then plug the USB Link Kit cable into the isolator.

To set up a Local Access connection in the WebCTRL® interface

For the WebCTRL® application to communicate with the Local Access port, you must do the following:

- 1 On the **System Configuration**  tree, select **Connections**.
- 2 On the **Configure** tab, click **Add**.
- 3 From the **Type** drop-down list, select **BACnet Local Access**.
- 4 Optional: Edit the **Description**.
- 5 Type the computer's **Port** number that the USB cable is connected to.

NOTE To find the port number, plug the USB cable into the computer's USB port, then select **Start > Control Panel > System > Device Manager > Ports (Com & LPT)**. The COM port number is beside **Silicon Labs CP210x USB to UART Bridge**.



- 6 Set the **Baud** rate to 115200.
- 7 Click **Accept**.
- 8 On the **View** tab, click the button next to the BACnet/IP network, then select **BACnet Local Access**.
- 9 Click **Accept**.
- 10 On the **Configure** tab, select **BACnet Local Access**, then click **Start**.
NOTE If an error message appears, make sure the COM port you selected is not in use. For example, PuTTY may be open and is holding the port open.
- 11 On the **Network**  tree, select the controller that you are connected to.
- 12 Click , then select **Manual Command**.
- 13 Type `rnet here` in the dialog box, then click **OK**.
- 14 On the **Properties** page, click **Module Status**. If a Modstat report appears, the WebCTRL® application is communicating with the controller.

Troubleshooting

If you have problems mounting, wiring, or addressing the ZN341v+, contact ALC Technical Support.

LED's

The LED's on the ZN341v+ show the status of certain functions.

If this LED is on...	Status is...
Power	The ZN341v+ has power
Rx	The ZN341v+ is receiving data from the network segment
Tx	The ZN341v+ is transmitting data over the network segment
DO#	The digital output is active
CW	The actuator motor is turning clockwise
CCW	The actuator motor is turning counterclockwise

The **Run** and **Error** LED's indicate controller and network status.

If Run LED shows...	And Error LED shows...	Status is...
2 flashes per second	Off	Normal
2 flashes per second	2 flashes, alternating with Run LED	Five minute auto-restart delay after system error
2 flashes per second	3 flashes, then off	The controller has just been formatted
2 flashes per second	4 flashes, then pause	Two or more devices on this network have the same ARC156 network address
2 flashes per second	1 flash per second	The controller is alone on the network
2 flashes per second	On	Obtain a Module Status Report (Modstat) to determine which of the following occurred: • Exec halted after frequent system errors • Control programs halted • ZN341v+ stopped communicating with the ZASF
5 flashes per second	On	Exec start-up aborted, Boot is running
5 flashes per second	Off	Firmware transfer in progress, Boot is running
7 flashes per second	7 flashes per second, alternating with Run LED	Ten second recovery period after brownout
14 flashes per second	14 flashes per second, alternating with Run LED	Brownout

If Run LED shows...	And Error LED shows...	Status is...
On	On	Failure. Try the following solutions: • Turn the ZN341v+ off, then on. • Format the ZN341v+. • Download the ZN341v+. • Replace the ZN341v+.

NOTE If you resolve the issue but the **Error** LED does not turn off, cycle power to the controller.

Possible delay before control program starts

When you first apply power to the ZN341v+, it waits for up to 3 minutes to receive a time/date broadcast from its BACnet router. The ZN341v+ begins to run the control program only after it receives the time/date or when the 3 minute waiting period expires. If the ZN341v+ does not receive a time/date broadcast, it keeps the default setting of 6/12/2002 10:00:00 (am).

To format the controller

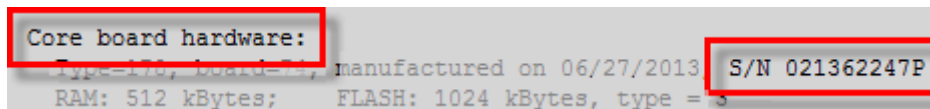
If you cannot communicate with a controller after downloading it, as a last resort, you can manually format the controller to erase its memory.

- 1 Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**.
- 2  Make sure the address switches are not set to 0, 0.
- 3 Short the **Format** jumper's pins and maintain the short for steps 3 and 4.
- 4 Insert the power screw terminal connector into the ZN341v+'s power terminals.
- 5 Continue to short the jumper until the **Error** LED flashes three times in sync with the **Run** LED.
- 6 Remove the short.
- 7 Download the ZN341v+.

To get the ZN341v+'s serial number

If you need the ZN341v+'s serial number when troubleshooting, the number is on:

- a sticker on the back of the main controller board
- a Module Status report (Modstat) under **Core** (or **Main**) board hardware



Core board hardware:
 Type=100, board=1, manufactured on 06/27/2013 S/N 021362247P
 RAM: 512 kBytes; FLASH: 1024 kBytes, type = S

To obtain a modstat in the WebCTRL® interface:

- 1 Select the ZN341v+ in the **Network**  tree.
- 2 On the **Properties** page, click **Module Status**.

Recovering from a power outage

The ZN341v+ has a 10-year Lithium CR2032 battery that retains the following data for a maximum of 10,000 hours during power outages.

- Control programs
- Editable properties
- Trends
- Schedules

If the above data is lost after power returns, replace the battery and then download the ZN341v+. See instructions below.

To replace the ZN341v+'s battery

If the ZN341v+ experiences a power outage and the control program stops functioning, replace the battery.

- 1 Verify that the ZN341v+'s power is on.
- 2 Remove the ZN341v+'s cover.
- 3 Remove the battery from the controller, making note of the battery's polarity.
- 4 Insert the new battery, matching the battery's polarity with the polarity indicated on the controller's cover.
- 5 Replace the ZN341v+'s cover.
- 6 Download the ZN341v+.

To clean the airflow sensor orifice and replace the filter

In less than .02% of installations, small particulates (micron/submicron-level) can build up in the airflow sensor's internal orifice or clog the airflow filter, causing airflow restriction. Symptoms of airflow restriction are:

- Diffuser noise increases over time
- Space overcools at minimum airflow
- Frequency of dampers opening to maintain flow setpoint increases over time
- AHU fan speed increases over time

To check for these symptoms, set up trending of:

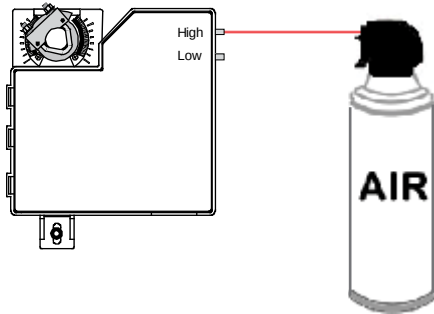
- Damper position to look for long term increase
- AHU fan speed for maintaining static pressure

If you see these symptoms, you should clean the flow sensor and replace the filter.

To clean the flow sensor

You can use a can of compressed air to clean the sensors while the controller is installed or on a repair bench.

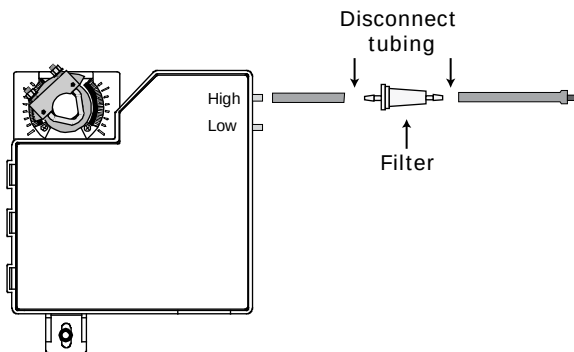
- 1 Disconnect the **High** and **Low** flow sensor tubes.
- 2 Insert the compressed air straw 1/4" into the controller's **High** connector.



- 3 Press the air can's trigger twice for no more than 2 seconds each time.
- 4 Reconnect tubing to the **High** and **Low** flow sensor tubes.

To replace the filter

- 1 Order a replacement filter from Automated Logic®.
- 2 Pull the tubing from both ends of the existing filter.



- 3 Attach tubing to the new filter.

To take the ZN341v+ out of service

If needed for troubleshooting or start-up, you can prevent the WebCTRL® application from communicating with the ZN341v+.

- 1 On the WebCTRL® **Network**  tree, select the ZN341v+.
- 2 On the **Properties** page, check **Out of Service**.
- 3 Click **Accept**.

Compliance

FCC Compliance

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.



CAUTION Changes or modifications not expressly approved by the responsible party for compliance could void the user's authority to operate the equipment.

CE Compliance

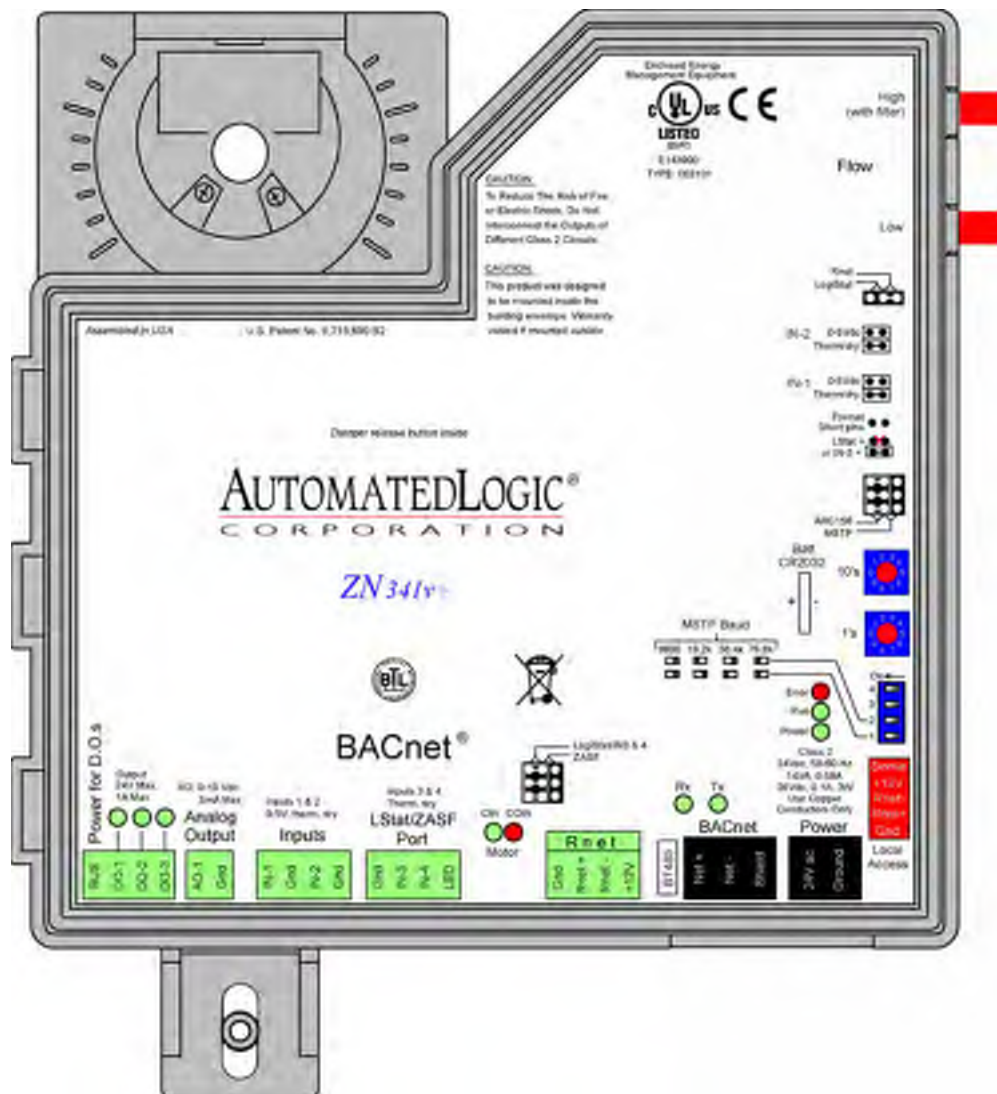


WARNING This is a Class A product. In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate measures.

BACnet Compliance

Compliance of listed products to requirements of ASHRAE Standard 135 is the responsibility of BACnet International. BTL® is a registered trademark of BACnet International.

Appendix - ZN341v+ coverplate



Document revision history

Important changes to this document are listed below. Minor changes such as typographical or formatting errors are not listed.

Date	Topic	Change description	Code*
2/7/17	Specifications	Added wireless sensors to the Rnet port specification.	X-D
	Zone sensors	Added wireless sensors to this topic.	
	Equipment Touch	Added Wireless Adapter to this topic.	
	Wiring inputs and outputs > Wiring specifications	Added Wireless Adapter to this topic.	
	Wiring devices to the Rnet port	Added Wireless Adapter to this topic.	
	To wire a Wireless Adapter to the ZN341v+	New topic.	
9/26/16	To set up a Local Access connection in the WebCTRL interface	Updated WebCTRL menu button in step 12.	A-D
	Appendix - ZN341v+ coverplate	Updated coverplate	A-D
8/11/15	To clean the airflow sensor orifice	New topic	AC-TS-TS-E
4/20/15	Entire document	New look, no content changes	A-D
11/14/14	BACnet Compliance	Changed BACnet Manufacturers Association to BACnet International	X-D-CP-MW
10/7/14	Driver	Added the Network Microblock fields	A-TS-RB-F
9/4/14	LED's	Changed the Status description for when the Run LED shows 2 flashes per second and the Error LED is On. Also added a note below the table regarding cycling power to turn off Error LED.	A-TS-JM-F-BK
5/13/14	Specifications	Rnet Port: Added Equipment Touch and removed note about BACview® devices	A-D-CP-O-TC
	Equipment Touch devices	New topic	
	Wiring zone sensors to the ZN341v+	Changed to "Wiring devices to the ZN341v+'s Rnet port"	
	To wire an Equipment Touch to the ZN341v+	New topic	
	Wiring a LogiStat sensor to the ZN341v+	New topic	
	To set up the driver > Driver	Added new driver property: TouchScreen Schedule Edit Enable	

* For internal use only

ZN141v+ Controller

Technical Instructions

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Verify that you have the most current version of this document. Go to <https://accounts.automatedlogic.com>, then select **Support > Download > Documents > Hardware**. Important changes are listed in **Document revision history** at the end of this document.

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What is the ZN141v+ controller?

The ZN141v+ controller is used for zone control. It has a built-in flow sensor and actuator, uses a patented flow control algorithm, and mounts directly on the VAV box damper shaft.

Driver and control program

Driver	DRV_ZNPLUS ¹  WARNING You must use the v2-04-005 or later driver for a ZN141v+ with a serial number of Z1P620401N or later.
Maximum number of control programs	1
Maximum number of BACnet objects ²	300

¹ To replace a U line controller with a ZN141v+, use the driver DRV_ZNPLUSU_<latest version>. See the *ZN U Line Emulation Technical Instructions*.

² Depends on available memory.

Specifications

Power	24 Vac $\pm 10\%$, 50–60 Hz, 14 VA 26 Vdc (25 V min, 30 V max)
BACnet port (This port may be labeled CMnet.)	For communication with the controller network using ARC156 or MS/TP (9600 bps–76.8 kbps)
Rnet port	Supports: • Up to 5 ZS sensors • One Wireless Adapter that communicates with up to 5 wireless sensors • One Equipment Touch • Up to 4 RS Standard sensors and one RS Plus, RS Pro, or RS Pro-F sensor. NOTE ZS sensors, a Wireless Adapter, and an Equipment Touch can share the Rnet, but not RS sensors.
LStat/ZASF port	For a LogiStat or LogiStat Plus zone sensor or a ZASF. This port uses Inputs 3 and 4, making them unavailable. NOTE The ZN141v+ does not support the LogiStat Pro. Use a ZS Pro or an RS Pro on the Rnet port instead.
Local Access port	For system start-up and troubleshooting

Inputs	4 inputs configurable for thermistor or dry contact. Inputs 1 and 2 are also configurable for 0–5 Vdc. Inputs 3 and 4 are used when a LogiStat sensor is connected, but are available if a ZS or an RS sensor is connected.
Input resolution	10 bit A/D
Input pulse frequency	10 pulses per second. Minimum pulse width (on or off time) required for each pulse is 50 msec.
Digital outputs	1 digital output, relay contact rated at 1 A max. @ 24 Vac/Vdc. Configured normally open.
Analog output	1 analog output, 0–10 Vdc (5 mA max)
Output resolution	8 bit D/A
Integral airflow sensor	Precision low flow AWM series 0–2 in. H ₂ O, sensitive down to ±0.001 in. H ₂ O. Barbed tapered airflow connections accept 3/16 in. (4.75 mm) I.D. tubing. Allows for readings across the 0–2 in. H ₂ O range, accurate to ±5% of full flow at 2 in. H ₂ O.
Integral actuator	Brushless DC motor, torque 35 inch-pounds (4 Nm), runtime 205 seconds for 90 degree travel during control, or 25 seconds in high-speed test and balance mode
Microprocessor	High speed 16-bit microprocessor with ARCNET communication co-processor
Memory	512 kB non-volatile battery-backed RAM, 1 MB Flash memory, 16-bit memory bus
Battery	10-year Lithium CR2032 battery retains the following data for a maximum of 10,000 hours during power outages: control programs, editable properties, schedules, and trends.
Protection	Incoming power and network connections are protected by non-replaceable internal solid-state polyswitches that reset themselves when the condition that causes a fault returns to normal. The power, network, input, and output connections are also protected against transient excess voltage/surge events lasting no more than 10 msec.
BT485 connector	You attach a BT485 (not included) to a controller at the beginning and end of a network segment to add bias and to terminate a network segment.
Status indicators	LED's indicate status of communications, running, errors, power, and digital outputs
Environmental operating range	0 to 130 °F (-17.8 to 54.4 °C), 10–90% relative humidity, non-condensing
Physical	UL94-5VA plenum rated enclosure for installation in plenum (or other space for environmental air) in accordance with NEC Section 300.22 (c) and (d)
Overall dimensions	Width: 5 7/8 in. (15 cm) Height: 7 in. (17.8 cm)
Mounting dimensions	5 5/8 in. (14.3 cm) from shaft centerline to mounting hole centerline
Weight	0.6 lbs (0.27 kg)

BACnet support	Conforms to the BACnet Advanced Application Controller (B-AAC) Standard Device Profile as defined in ANSI/ASHRAE Standard 135-2012 (BACnet) Annex L, Protocol Revision 9
Listed by	UL-916 (PAZX), cUL-916 (PAZX7), FCC Part 15-Subpart B-Class A, CE

Inputs

The ZN141v+ has 4 inputs that accept the following signal types.

These inputs...	Support this signal type...	Description
All	Thermistor	Precon type 2 (10 kOhm at 77 °F). Input voltage for IN-3: 1 to 2.52 Vdc Input voltage for all other inputs: 0.33 to 2.52 Vdc
All	Dry contact	A 3.3 Vdc wetting voltage detects contact position, resulting in a 0.3 mA maximum sense current when the contacts are closed.
IN-1, IN-2	0–5 Vdc	The output impedance of a 0–5 Vdc source must not exceed 100 Ohms. The input impedance of the ZN141v+ is approximately 30 kOhm.
All	Timed local override	A momentary contact switch that overrides a schedule and turns equipment on for a defined period of time. The override time added for each push of the button and the maximum allowable On time are software adjustable.
All	Pulse counter ¹	Pulse counting up to 10 pulses per second. Minimum pulse width (on or off time) required for each pulse is 50 msec.
IN-3, IN-4	LogiStat ²	IN-3: See Thermistor. IN-4: Setpoint adjust. Input voltages should be from 1.4 to 3.4 Vdc.
IN-3, IN-4	ZASF	IN-3 and IN-4 serve as a bi-directional communication port. They command the ZASF actuator and read the ZASF flow sensor.

¹ The ZN141v+ can perform pulse counting for dry contact or voltage inputs if you assign the input to a Pulse to Analog Input microblock. See *To assign inputs or outputs to points* (page 15).

² A LogiStat sensor or ZASF connected to the **Lstat/ZASF Port** uses IN-3 and IN-4. A ZS or an RS sensor connected to the **Rnet** port does not use these inputs.

Digital outputs

The ZN141v+ has 1 digital output that you can connect to a maximum of 24 Vac/Vdc. The output is a dry contact (rated at 1 A, 24 V maximum) and is normally open.

Analog outputs

The ZN141v+ has 1 analog output that supports voltage devices from 0-10 Vdc. The controlled device must have a minimum of 2000 Ohms resistance measured from its input to ground and must share the same ground as the controller.

Zone sensors

Automated Logic® wireless sensors

You can connect a Wireless Adapter to ZN141v+'s **Rnet** port. The Wireless Adapter communicates with up to 5 wireless sensors. When using wireless sensors, the Rnet can have:

- Up to 5 wireless and ZS sensors (any combination)
- One Wireless Adapter
- One Equipment Touch

ZS sensors

You can wire up to 5 ZS sensors to the ZN141v+'s Rnet port.

RS sensors

You can wire RS sensors to the ZN141v+'s **Rnet** port. An Rnet can consist of any of the following combinations of devices wired in a daisy-chain or star configuration:

- 1 RS Plus, RS Pro, or RS Pro-F
- 1-4 RS Standards
- 1-4 RS Standards, and 1 RS Plus, RS Pro, or RS Pro-F

LogiStats

You can wire a LogiStat or LogiStat Plus to the ZN141v+'s **LStat/ZASF** port.

NOTES

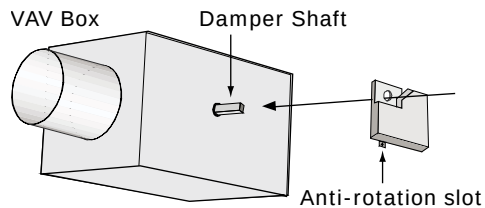
- The ZN141v+ does not support the LogiStat Pro.
- A LogiStat or LogiStat Plus wired to the ZN141v+ cannot be used for local access.

Equipment Touch devices

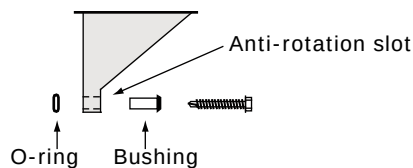
You can wire an Equipment Touch to the ZN141v+'s Rnet port to view or change the controller's property values, schedule equipment, view trends and alarms, and more, without having to access the system's server. The Rnet can have one Equipment Touch, one Wireless Adapter, and up to 5 ZS sensors. RS sensors cannot share the Rnet with an Equipment Touch.

To mount the ZN141v+

- 1 Turn the damper shaft to fully close the damper.
- 2 Remove the ZN141v+'s cover.
- 3 Mount the ZN141v+ to the VAV box by sliding the clamp assembly onto the damper shaft.

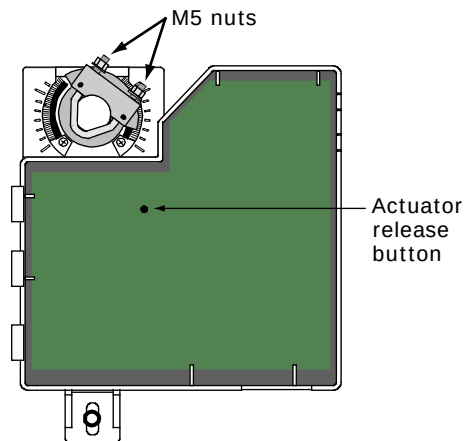


- 4 Secure the ZN141v+ by installing the screw provided through the anti-rotation slot's bushing and o-ring.



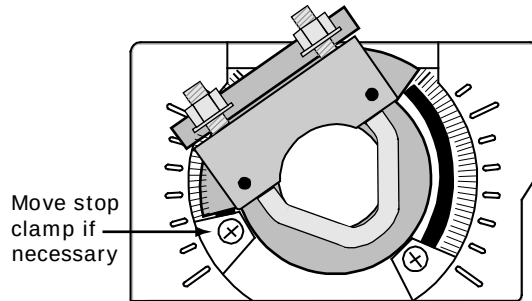
NOTE Center the bushing in the slot. Failure to do so may cause the actuator to stick or bind.

- 5 Hold down the ZN141v+'s actuator release button and rotate the actuator clamp in the same direction that closed the damper. Rotate the clamp until it stops, then rotate it back one notch.



- 6 Release the button.
- 7 Tighten the actuator clamp to the damper shaft by tightening the two M5 nuts.

- 8 Hold down the actuator release button and rotate the damper from fully closed to fully open. If the damper traveled less than 90 degrees, do the following to prevent the damper opening past fully open:
- Loosen the appropriate stop clamp screw.
 - Move the stop clamp until it contacts the edge of the actuator cam.
 - Tighten the screw.



- 9 Hold down the actuator release button, rotate the damper to verify that it opens and closes, then release the button.

Wiring for power



WARNING Do not apply line voltage (mains voltage) to the controller's ports and terminals.



CAUTIONS

- The ZN141v+ is powered by a Class 2 power source. Take appropriate isolation measures when mounting it in a control panel where non-Class 2 circuits are present.
- Automated Logic® controllers can share a power supply as long as you:
 - Maintain the same polarity.
 - Use the power supply only for Automated Logic® controllers.

To wire for power

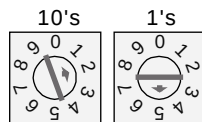
- Remove power from the power supply.
- Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**.
- Connect the transformer wires to the screw terminal connector.
- Apply power to the power supply.
- Measure the voltage at the ZN141v+'s power input terminals to verify that the voltage is within the operating range of 21.6–26.4 Vac.
- Connect a 4-inch (10.2 cm) wire from **Gnd** to the control panel.
- Insert the screw terminal connector into the ZN141v+'s power terminals.
- Verify that the **Power** LED is on and the **Run** LED is blinking.

To address the ZN141v+

You must give the ZN141v+ an address that is unique on the network. You can address the ZN141v+ before or after you wire it for power.

- 1 If the ZN141v+ has been wired for power, pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**. The controller reads the address each time you apply power to it.
- 2 Using the rotary switches, set the controller's address to match the **Address** in the controller's properties dialog box in SiteBuilder. Set the **Tens (10's)** switch to the tens digit of the address, and set the **Ones (1's)** switch to the ones digit.

EXAMPLE If the controller's address is 25, point the arrow on the **Tens (10's)** switch to 2 and the arrow on the **Ones (1's)** switch to 5.



Wiring for communications

The ZN141v+ communicates using BACnet on the following types of network segments:

- ARC156 communicating at 156 kbps
- MS/TP communicating at 9600 bps, 19.2 kbps, 38.4 kbps, or 76.8 kbps

NOTE ARC156 is a unique implementation of the industry standard ARCNET. For a summary of differences between ARCNET and ARC156, see the *ARC156 Wiring Technical Instructions*.

Wiring specifications

For...	Use...	Maximum Length
ARC156 ¹ and MS/TP ²	22 AWG, low-capacitance, twisted, stranded, shielded copper wire	2000 feet (610 meters)

¹ See the *ARC156 Wiring Technical Instructions*.

² See the *MS/TP Networking and Wiring Technical Instructions*.



WARNING Do not apply line voltage (mains voltage) to the controller's ports and terminals.

To wire the ZN141v+ for communications

- 1 Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**.
- 2 Check the communications wiring for shorts and grounds.
- 3 Connect the communications wiring to the controller's screw terminals labeled **Net +**, **Net -**, and **Shield**.
NOTE Use the same polarity throughout the network segment.
- 4 Set the communication type and baud rate.

For...	Set ARC156/MSTP jumper to...	Set DIP switches 1 and 2 to...
ARC156	ARC156	N/A. Baud rate will be 156 kbps regardless of the DIP switch settings.
MS/TP	MSTP	The appropriate baud rate. See the MSTP Baud diagram on the controller.

- NOTE** Use the same baud rate for all controllers on the network segment.
- 5 If the ZN141v+ is at either end of a network segment, connect a BT485 to the ZN141v+.
 - 6 Insert the power screw terminal connector into the ZN141v+'s power terminals.
 - 7 Verify communication with the network by viewing a Module Status report in the WebCTRL® interface.

Wiring inputs and outputs

Wiring specifications

Input wiring

Input	Maximum length	Minimum gauge	Shielding
0–5 Vdc	1000 feet (305 meters)	26 AWG	Shielded
Thermistor Dry contact	1000 feet (305 meters)	22 AWG	Shielded
ZS sensor RS sensor Wireless Adapter for wireless sensors Equipment Touch	See <i>Wiring devices to the ZN141v+'s Rnet port</i> (page 11).		
LogiStat sensor	See <i>Wiring a LogiStat sensor to the ZN141v+</i> (page 13).		

Output wiring

To size output wiring, consider the following:

- Total loop distance from the power supply to the controller, and then to the controlled device
NOTE Include the total distance of actual wire. For 2-conductor wires, this is twice the cable length.
- Acceptable voltage drop in the wire from the controller to the controlled device
- Resistance (Ohms) of the chosen wire gauge
- Maximum current (Amps) the controlled device requires to operate

To wire inputs and outputs

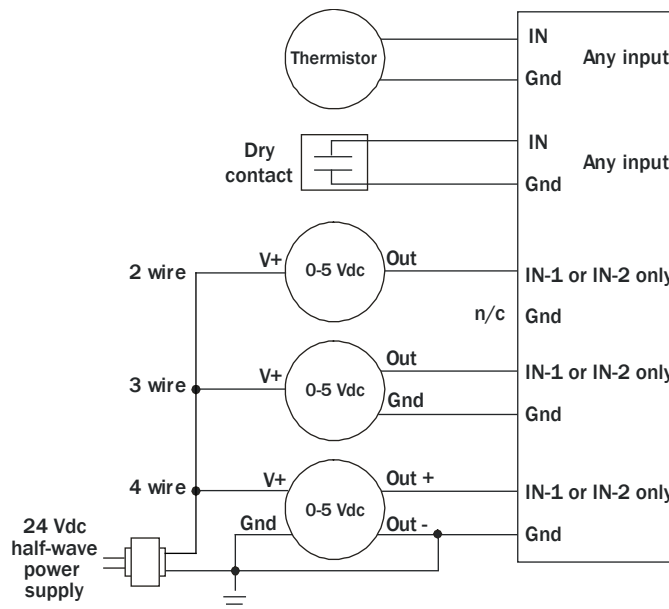


WARNING Do not apply line voltage (mains voltage) to the controller's ports and terminals.

- 1 Verify that the ZN141v+'s power and communications connections work properly.
- 2 Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**.
- 3 Connect the input wiring to the screw terminals on the ZN141v+.

NOTES

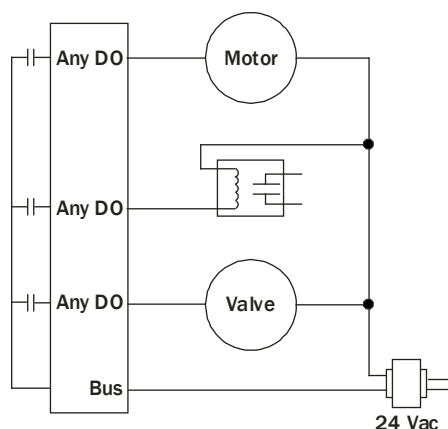
- Connect the shield wire to the **GND** terminal with the ground wire.
- **IN-3** and **IN-4** share the **GND** terminal beside **IN-3**.



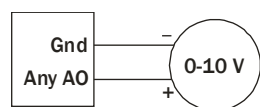
- 4 Set the appropriate jumpers on the ZN141v+.

To use...	For...	
IN-1 or IN-2	Thermistor Dry contact 0–5 Vdc	Set jumpers IN-1 or IN-2 to the type of signal the input will receive.
IN-3 or IN-4	Thermistor Dry contact	1. Verify the LStat/IN-3 jumper is on. 2. Set LogiStat/IN3 & 4/ZASF jumper to LogiStat/IN3 & 4 .
IN-3 and IN-4	LogiStat	See <i>To wire a LogiStat sensor</i> (page 14).
IN-3 and IN-4	ZASF	See <i>Using flow sensors</i> (page 18).

- 5 Connect the digital output wiring to the screw terminals on the ZN141v+ and to the controlled device.



- 6 Connect the analog output wiring to the screw terminals on the ZN141v+ and to the controlled device.



- 7 Insert the power screw terminal connector into the ZN141v+'s power terminals.

Wiring devices to the ZN141v+'s Rnet port

You can wire the following devices to the ZN141v+'s Rnet port in a daisy-chain or star configuration:

- *ZS or RS sensors* (page 11)
- *Wireless Adapter* (page 12) that communicates with wireless sensors
- *Equipment Touch* (page 13)

NOTE ZS sensors, a Wireless Adapter, and an Equipment Touch can share the same Rnet, but not RS sensors.

The Rnet communicates at a rate of 115 kbps.

Rnet wiring specifications

NOTE Use the specified type of wire and cable for maximum signal integrity.

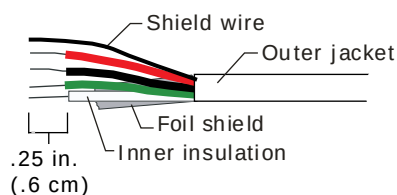
Description	4 conductor, shielded or unshielded, CMP, plenum rated cable
Conductor	22 AWG (7x0096) bare copper
Maximum length	500 feet (152 meters)
Insulation	Low-smoke PVC (or equivalent)
Color Code	Black, white, green, red
Shielding	If shielded, Aluminum/Mylar shield (100% coverage) with TC drain wire
UL temperature rating	32–167 °F (0–75 °C)
Voltage	300 Vac, power limited
Listing	UL: NEC CL2P, or better

To wire a ZS or an RS sensor to the ZN141v+

For complete sensor installation instructions, including ZS sensor power requirements, see:

- *ZS Sensors Technical Instructions*
- *RS Sensors Technical Instructions*

- 1 Remove power from the ZN141v+.
- 2 Partially cut, then bend and pull off the outer jacket of the Rnet cable(s). Do not nick the inner insulation.



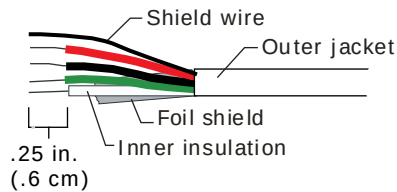
- 3 Strip about .25 inch (.6 cm) of the inner insulation from each wire.
- 4 Wire each terminal on the ZN141v+'s **Rnet** port to the terminal of the same name on the sensor.
NOTE If using shielded wire, connect the shield wire and the ground wire to the **Gnd** terminal.
- 5 Apply power to the ZN141v+.

To wire a Wireless Adapter to the ZN141v+

NOTES

- The Wireless Adapter requires a 24 Vac power supply. It is not powered by the Rnet.
- If the Wireless Adapter will be:
 - Daisy-chained on the Rnet with ZS sensors or an Equipment Touch, use the standard 4-conductor Rnet cable.
 - The only device on the Rnet, you can use a 3-conductor cable instead of the standard 4-conductor Rnet cable.
- For complete Wireless Adapter installation instructions, see the *Wireless Sensors Technical Instructions*.

- 1 Remove power from the ZN141v+.
- 2 Partially cut, then bend and pull off the outer jacket of the Rnet cable(s). Do not nick the inner insulation.



- 3 Strip about .25 inch (.6 cm) of the inner insulation from each wire.
- 4 Wire the ZN141v+'s **Rnet+**, **Rnet-**, and **Gnd** terminals to the terminals of the same name on the Wireless Adapter's Rnet connector.



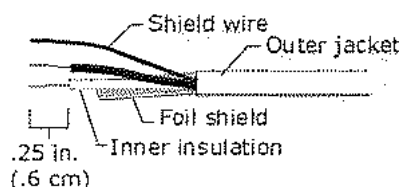
- NOTE** If using shielded wire, connect the shield wire and the ground wire to the **Gnd** terminal.
- 5 Apply power to the ZN141v+.

To wire an Equipment Touch to the ZN141v+

NOTES

- The Equipment Touch requires a 24 Vac power supply. It is not powered by the Rnet.
- If the Equipment Touch will be:
 - Daisy-chained on the Rnet with ZS sensors or a Wireless Adapter, use the standard 4-conductor Rnet wiring and follow the wiring instructions *To wire a ZS or an RS sensor to the ZN141v+* (page 11).
 - The only device on the Rnet, you can use a 2-conductor cable instead of the standard 4-conductor Rnet cable and follow the instructions below.
- For complete Equipment Touch installation instructions including wiring diagrams, see the *Equipment Touch Installation and Setup Guide*.

- 1 Remove power from the ZN141v+.
- 2 Partially cut, then bend and pull off the outer jacket of the cable. Do not nick the inner insulation.



- 3 Strip about .25 inch (.6 cm) of the inner insulation from each wire.
- 4 Wire the ZN141v+'s **Rnet+** and **Rnet-** terminals to the terminals of the same name on the Equipment Touch's connector.
NOTE If using shielded wire, connect the shield wire and the ground wire to the **Gnd** terminal.
- 5 Apply power to the ZN141v+.

Wiring a LogiStat sensor to the ZN141v+

You can wire a LogiStat or LogiStat Plus to the ZN141v+'s **Lstat** port

For complete sensor installation instructions, see the *LogiStat Sensors Technical Instructions*.

LogiStat wiring specifications

Use 22 AWG, unshielded wire, maximum length 100 feet (30 meters).

To wire a LogiStat sensor

- 1 Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**.
- 2 To connect the LogiStat sensor to the ZN141v+'s **LStat** port.

Wire this terminal on the LStat port...	To this terminal on the LogiStat sensor
Gnd	Gnd
IN-3	Temp
IN-4	SW
LED	LS5v

- 3 Remove the jumper from **LStat/IN-3**.
- 4 Set the **Rnet/LogiStat** jumper to **LogiStat**.
- 5 Set **LogiStat/IN3 & 4/ZASF** jumper to **LogiStat**.
- 6 Insert the power screw terminal connector into the ZN141v+'s power terminals.

Downloading the ZN141v+

Download the following items to the ZN141v+'s battery-backed memory:

Item	Notes
Control program	Must be in WebCTRLx.x\webroot\<system_name>\programs .
DRV_ZNPLUS driver	Must be in WebCTRLx.x\webroot\<system_name>\drivers . NOTE To verify that you have the driver's latest version, go to http://accounts.automatedlogic.com/download , then select Drivers > ExecB . Compare the latest version to the ZN141v+'s driver in SiteBuilder.
Editable properties	
Schedules	

If you change any of the above items or the ZN141v+'s address after the initial download, you must download again. The first download takes longer than subsequent downloads.



CAUTIONS

- The ZN141v+ will lose stored data when you download.
- Equipment controlled by the ZN141v+ will shut down and restart when you download.

To download from the WebCTRL® interface

If your network is complete, you can download from any network browser. If not complete, connect a laptop with a local copy of the system database to the ZN141v+'s local access port. See *To communicate through the local access port* (page 23).

- 1 On the WebCTRL® **Network**  tree, select the controller.
- 2 Click **Downloads**.
- 3 Do one of the following:
 - If the controller is in the Downloads list, go to step 4.
 - If the controller is not in the list:
 - a. Click **Add**.
 - b. In the pop-up, select the controller.
 - c. Select **All Content**.
 - d. Click **Add**.
 - e. Click **Close**.
- 4 Select the controller in the Downloads list.
- 5 Click **Start**.

NOTES

- If the download fails, locate and resolve the problem, then retry the download.
- You can also download a controller from the **Devices** page.

To assign inputs or outputs to points

To use an input or output, you must assign it to its corresponding point in the control program.

- 1 In the WebCTRL® **Geographic**  tree, select the equipment controlled by the ZN141v+.
- 2 On the **Properties** page, select the **I/O Points** tab.
- 3 In each point's **Num** field, type the number of the controller's corresponding input or output. For example, if you use DO1 on the ZN141v+ for the point **Fan S/S**, type 1 in the **Num** field for **Fan S/S**.

NOTES

- **Exp** (expander number) is 00 for the ZN141v+.
 - Do not assign the same output number to more than one point.
- 4 Enter the appropriate values for each input and output in the remaining columns. See *Input values*, *Output values*, *Resolution values* and *Offset/Polarity values* below.

NOTE You can also enter these values in the EIKON® LogicBuilder application.
 - 5 If you have not performed the initial download to the ZN141v+, you must download now so you can verify inputs and outputs.
 - 6 To verify each input's operation, force each sensor to a known value, then compare it to the **Value** shown on the **Properties** page on the **I/O Points** tab.
 - 7 To verify each output's operation, lock each output to a known condition on the **I/O Points** tab, then verify that the equipment operates correctly.

Input values

Input	I/O Type	Sensor/Actuator Type	Min/Max
Analog (BAI)			
0-5 Vdc	0-5 Volt	Linear Full Range	Engineering values associated with 0 Vdc (Min) and 5 Vdc (Max) ¹
Thermistor	Thermistor	Select your Thermistor type or set up and select a Non-Linear, Custom Table ²	N/A
Pulse to Analog (BPTA) ³			
Pulse Counter	Counter Input	N/A	N/A
Digital (Binary) (BBI)			
Dry Contact	Dry Contact	N/A	N/A

¹ The sensor reads a value and sends a corresponding signal (Volt, mA, or psi) to the ZN141v+'s physical input. The Analog Input microblock uses the **Min** and **Max** values to linearly translate the signal into the engineering value used in subsequent control logic. For example, set **Min** to 0 and **Max** to 10 for a 4-20 mA sensor that measures velocity from 0.0 to 10.0 inches/second so that when the input reads 4 mA, the microblock outputs a value of 0. Similarly, when the input reads 8 mA, the microblock outputs a value of 2.5.

² You can set up a *custom translation table* (page 23) on the driver's **Custom Translation Tables** pages in the WebCTRL® interface.

³ The control program must have one Pulse to Analog Input microblock for each pulse counting input.

Output values

Output	I/O Type	Sensor/Actuator Type	Min/Max
Analog (BAO)			
0-10 Vdc	Electrical 0-10 Volt	Linear Full Range	Engineering values associated with 0 Vdc (Min) and 10 Vdc (Max) ¹
2-10 Vdc	Electrical 0-10 Volt	Linear w/Offset, 2-10 Volts	Engineering values associated with 2 Vdc (Min) and 10 Vdc (Max) ¹
Digital (Binary) (BBO)			
Relay	Relay/Triac Output	N/A	N/A

¹ The Analog Output microblock uses the **Min** and **Max** values to linearly translate its EIKON® LogicBuilder wire value into a physical output signal (Volt, mA, or psi) sent from the ZN141v+ to an actuator. For example, set **Min** to 0 and **Max** to 100 for an Analog Output microblock that receives a 0 to 100% open signal from a PID microblock and that controls a 0-10 Vdc actuator so that when the PID signal is 100%, the ZN141v+ output is 10 Vdc. Similarly, when the PID signal is 50%, the ZN141v+ output is 5 Vdc.

Resolution values

Resolution is not particular to a type of input or output, but the driver handles analog and digital (binary) inputs and outputs differently. To set these values appropriately, you should understand how the driver uses them.

Resolution	Notes
Analog Input (BAI)	The driver truncates the microblock's present value according to the resolution. EXAMPLE If the calculated present value is 13.789 and you set the Resolution to 0.1, the control program uses 13.7 for any calculations downstream from the microblock.
Analog Output (BAO)	The driver truncates the wire input value to the microblock before performing any scaling calculations. EXAMPLE If the wire input value is 13.789 and you set the Resolution to 0.1, the microblock uses 13.7 for any scaling calculations.
Digital Inputs and Outputs	N/A

Offset/Polarity values

Offset/Polarity is not particular to a type of input or output, but the driver handles analog and digital (binary) inputs and outputs differently. To set these values appropriately, you should understand how the driver uses them.

Offset/Polarity	Notes
Analog Input (BAI)	Offset value (positive or negative) adds a fine adjustment to a sensor reading after all scaling for calibration. EXAMPLE If a sensor reads 74.9°F when the actual measured value is 73.6°F, enter an Offset of -1.3 to calibrate the sensor to the measured value.
Analog Output (BAO)	You can use the Offset value (positive or negative) to calibrate an output, but you generally do not need to. If used, the driver adds the offset value to the wire input value before performing any scaling calculations to determine the ZN141v+'s output.
Digital (Binary) Input (BBI)	Polarity determines the microblock's present value when no signal is received from the equipment. When no signal is received from the equipment, if Polarity is set to: normal —present value is off reversed —present value is on
Digital (Binary) Output (BBO)	Polarity determines the ZN141v+'s output based on the control program's signal to the microblock. When the control program's signal to the microblock is on , if Polarity is set to: normal —output is on reversed —output is off NOTE Regardless of Polarity , the output will be off if the ZN141v+ loses power.

Using flow sensors

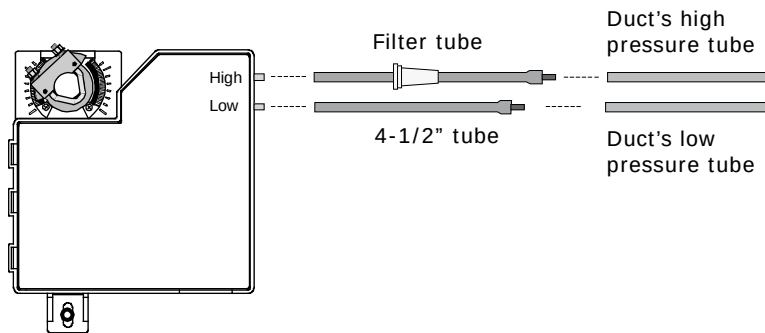
In a single duct system, the ZN141v+ controls airflow using the built-in actuator and flow sensor.

In a dual duct system, the ZN141v+ controls airflow for one duct using the built-in actuator and flow sensor. For the other duct, the ZN141v+ uses a ZASF connected to the LStat/ZASF Port.

To connect duct tubes to the flow sensors

For a single duct system

- 1 Turn off the ZN141v+'s power.
- 2 Connect the filter tube to the ZN141v+'s **High** connector and the tube without the filter to the **Low** connector. Then connect those tubes to the duct's high and low pressure tubes. Avoid sharp bends in the tubing.



For a dual duct system

- 1 Follow the single duct procedure above to connect the ZN141v+ to the first duct's tubes.
- 2 To connect the ZASF to the second duct's tubes, turn off the ZASF's power.
- 3 Connect the filter tube to the ZASF's **High** connector and the tube without the filter to the **Low** connector. Then connect those tubes to the duct's high and low pressure tubes. Avoid sharp bends in the tubing.

To wire the ZASF to the ZN141v+

Use a 22 AWG wire, maximum length 9.8 feet (3 meters).

- 1 Wire the ZASF's screw terminal connector to the ZN141v+'s **LStat/ZASF Port**.

Wire this terminal on the ZN141v+...	To this terminal on the ZASF
Gnd	Gnd
IN-3	Tx
IN-4	Rx
LED	+12v

- 2 Set the **LogiStat/ZASF** jumper on the controller to **ZASF**.

To set up the Airflow Control microblock

The ZN141v+'s control program must include one Airflow Control microblock for a single duct system or two of the microblocks for a dual duct system. You must set up the Airflow Control microblock for each flow sensor.

In a single duct system

- 1 In the WebCTRL® interface on the control program's **Logic** page, select the Airflow Control microblock.
- 2 On the **Details** tab in the **Flow Sensor** field under **Hardware**, select **Built-in flow sensor**.
- 3 In the **Damper Actuator** field, select **Built-in actuator**.

In a dual duct system

- 1 In the WebCTRL® interface on the control program's **Logic** page, select the Airflow Control microblock for Flow #1.
- 2 On the **Details** tab under **Hardware** in the **Flow Sensor** field, select **Built-in flow sensor**.
- 3 In the **Damper Actuator** field, select **Built-in actuator**.
- 4 On the **Logic** page, select the Airflow Control microblock for Flow #2.
- 5 On the **Details** tab under **Hardware** in the **Flow Sensor** field, select **ZASF flow sensor**.
- 6 In the **Damper Actuator** field, select **ZASF actuator**.

NOTE When performing test and balance, follow the steps under **Test and Balance** on the Airflow Control microblock's **Properties** page **Details** tab.

To set up the driver

After you download the driver and control program to the ZN141v+, you may want to change the driver's properties in the WebCTRL® interface to suit your application.

- 1 On the WebCTRL® **Network**  tree, click  to the left of your ZN141v+.
- 2 Click  to the left of **Driver** to see its children.
- 3 Make changes as needed on the **Properties** page for **Driver** and any of its children.

Driver

On the **Driver** page, you can change the following properties:

- Module clock synchronization and failure. See table below.
- Network Input microblock communication properties.

Module Clock	
Clock Fail Date and Time	Date and time the control program uses when controller's real-time clock is invalid.  TIP Use an occupied date and time (such as a Tuesday at 10 a.m.) so the equipment does not operate in unoccupied mode if the controller loses power during occupancy.
Time Synch Sensitivity (seconds)	When the controller receives a time sync request, if the difference between the controller's time and the time sync's time is greater than this field's value, the controller's time is immediately changed. If the difference is less than this field's value, the controller's time is slowly adjusted until the time is correct.
Network Microblocks	
Number of poll retries before Network Input Microblocks indicate failure	The maximum number of retries after the initial attempt that a Network microblock will attempt to communicate with its target device. If unsuccessful, the point will transition to an idle state for 30 seconds before attempting to communicate again. Change this field only if directed by Technical Support.
Periodic rebinding interval	If a microblock uses a wildcard in its address, this timer determines how often the microblock will attempt to find the nearest instance of its target. For example, if an outside air temperature address uses a wildcard, a VAV application will look for the outside air temperature on the same network segment or on the nearest device containing that object.
BACnet COV Throttling	
Enable COV Throttling	Under normal circumstances, COV Throttling should be enabled to prevent excessive network traffic if an object's COV Increment is set too low. See EXCEPTION below. When enabled, if an object generates excessive COV broadcasts (5 updates in 3 seconds), the driver automatically throttles the broadcasts to 1 per second. Also, if the object's value updates excessively for 30 seconds, an alarm is sent to the WebCTRL® application listing <u>all</u> objects that are updating excessively. A Return-to-normal alarm is sent only after <u>all</u> objects have stopped updating excessively. EXCEPTION: In rare circumstances, such as process control, a subscribing object may require COV updates more frequently than once per second. For these situations, clear this checkbox, but make sure that your network can support the increased traffic. You will also need to disable the Excessive COV alarms under the driver's Common Alarms.
Trend Sampling	
Collect a daily midnight sample for all points in this controller that are sampling on COV	For values that change infrequently, select to verify at midnight daily that the point is still able to communicate trend values.
TouchScreen Control	
TouchScreen Schedule Edit Enable	Check this field to allow a user to edit this controller's schedules from an Equipment Touch's Schedules screen.

Device

On the **Device** page, you can change the following properties:

- BACnet device object properties for the ZN141v+
- ZN141v+ network communication

Configuration	NOTE The three APDU fields refer to all networks over which the ZN141v+ communicates.
Max Masters and Max Info Frames	Apply only if the ZN141v+ is on an MS/TP network.

Notification Classes

Alarms in the WebCTRL® application use Notification Class #1. A BACnet alarm's Notification Class defines:

- Alarm priority for Alarm, Fault, and Return to Normal states
- Options for BACnet alarm acknowledgment
- Where alarms should be sent (recipients)

Priorities	NOTE BACnet defines the following Network message priorities for Alarms and Events.										
	<table><tr><th>Priority range</th><th>Network message priority</th></tr><tr><td>00–63</td><td>Life Safety</td></tr><tr><td>64–127</td><td>Critical Equipment</td></tr><tr><td>128–191</td><td>Urgent</td></tr><tr><td>192–255</td><td>Normal</td></tr></table>	Priority range	Network message priority	00–63	Life Safety	64–127	Critical Equipment	128–191	Urgent	192–255	Normal
Priority range	Network message priority										
00–63	Life Safety										
64–127	Critical Equipment										
128–191	Urgent										
192–255	Normal										
Priority of Off-Normal	BACnet priority for Alarms.										
Priority of Fault	BACnet priority for Fault messages.										
Priority of Normal	BACnet priority for Return-to-normal messages.										
Ack Required for Off-Normal, Fault, and Normal	Specifies whether alarms associated with this Notification Class require a BACnet Acknowledgment for Off-Normal, Fault, or Normal alarms.  TIP You can require operator acknowledgment for an Alarm or Return-to-normal message (stored in the WebCTRL® database). In the WebCTRL® interface on the Alarm > Enable/Disable tab, change the acknowledgment settings for an alarm source or an alarm category.										
Recipient List											
Recipients	The first row in this list is the WebCTRL® application. Do not delete this row. Click Add if you want other BACnet devices to receive alarms associated with this Notification Class.										
Recipient Description	Name that appears in the Recipients table.										

Recipient Type	Use Address (static binding) for either of the following: • Third-party BACnet device recipients that do not support dynamic binding • When you want alarms to be broadcast (you must uncheck Issue Confirmed Notifications). This use is rare.
Days and times	The days and times during which the recipient will receive alarms.
Recipient Device Object Identifier	Type the Device Instance from SiteBuilder (or from the network administrator for third-party devices) in the # field.
Process Identifier	Change for third-party devices that use a BACnet Process Identifier other than 1. The WebCTRL® application processes alarms for any 32-bit Process Identifier.
Issue Confirmed Notifications	Select to have a device continue sending an alarm message until it receives delivery confirmation from the recipient.
Transitions to Send	Uncheck the types of alarms you do not want the recipient to get.

Calendars

Calendars are provided in the driver for BACnet compatibility only. Instead, use the **Schedules** feature in the WebCTRL® interface.

Common and Specific Alarms

On these pages, you can enable/disable, change BACnet alarm properties, or set delays for the following BACnet alarms:

Common alarms:

- Module Halted
- All Programs Stopped
- Duplicate Address
- Locked I/O
- Control Program
- Program Stopped
- Excessive COV

Specific alarm:

- Flow Control Alarm

NOTE To set up alarm actions for controller generated alarms, see *Setting up alarm actions* in WebCTRL® Help.

Module Generated Alarm	
Description	Short message shown on the WebCTRL Alarms page or in an alarm action when this type of alarm is generated.
Events	
Alarm Category and Alarm Template	See <i>Customizing alarms</i> in WebCTRL® Help.
Enable	Clear these checkboxes to disable Alarm or Return to normal messages of this type from this controller.
Notification Class	Do not change this field.

Custom Translation Tables

You can set up a translation table that an analog input will use to translate the raw data from a non-linear sensor to the engineering units you want it to output on the wire. In the **Network**  tree, select **Custom Translation Table #1, #2, or #3**. The **Properties** page has instructions. For the input to use the translation table, navigate to the input in the **Geographic**  tree, select the **Details** tab, then set **Sensor Type (Scaling Method)** to **Non-Linear, Custom Table #__**.

Switch and Jumper Positions

The **Switch and Jumper Positions** page shows the current physical settings on the ZN141v+.

Flow Calibration Archive

The **Flow Calibration Archive** page shows measured flow and sensor readings that were entered in the WebCTRL® interface Test and Balance or through the stand-alone Airflow Test and Balance Utility. Editing Airflow microblock properties outside of Test and Balance will not change the values on this page.

To communicate through the Local Access port

Using a computer and a USB Link Kit, you can communicate locally with the ZN141v+ to download or to troubleshoot.

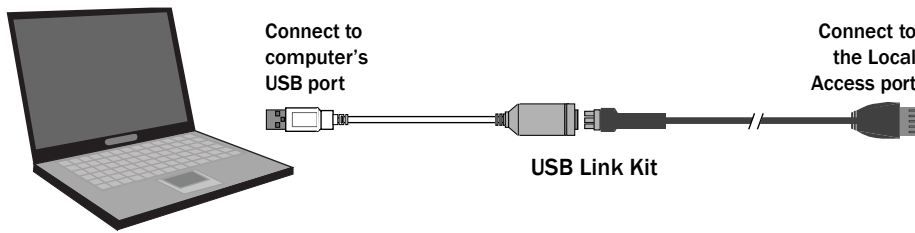
PREREQUISITES

- A computer with a USB port
- A USB Link Kit. See the *USB Link Kit Technical Instructions*.
NOTE The USB Link Kit driver is installed with a WebCTRL® v5 or later system. But if needed, you can get the latest driver from <http://www.silabs.com/products/mcu/Pages/USBtoUARTBridgeVCPDrivers.aspx>. Install the driver before you connect the USB Link Kit to your computer.
- v1.70 or later controller driver



CAUTION If multiple controllers share power but polarity was not maintained when they were wired, the difference between the controller's ground and the computer's AC power ground could damage the USB Link Kit and the controller. If you are not sure of the wiring polarity, use a USB isolator between the computer and the USB Link Kit. Purchase a USB isolator online from a third-party manufacturer.

Connect the USB Link Kit to the computer and to the controller's Local Access port.



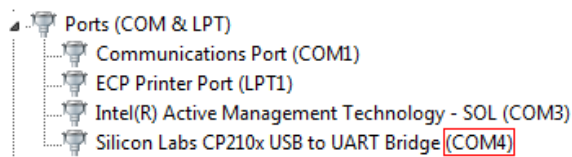
NOTE If using a USB isolator, plug the isolator into your computer's USB port, and then plug the USB Link Kit cable into the isolator.

To set up a Local Access connection in the WebCTRL® interface

For the WebCTRL® application to communicate with the Local Access port, you must do the following:

- 1 On the **System Configuration**  tree, select **Connections**.
- 2 On the **Configure** tab, click **Add**.
- 3 From the **Type** drop-down list, select **BACnet Local Access**.
- 4 Optional: Edit the **Description**.
- 5 Type the computer's **Port** number that the USB cable is connected to.

NOTE To find the port number, plug the USB cable into the computer's USB port, then select **Start > Control Panel > System > Device Manager > Ports (Com & LPT)**. The COM port number is beside **Silicon Labs CP210x USB to UART Bridge**.



- 6 Set the **Baud** rate to 115200.
- 7 Click **Accept**.
- 8 On the **View** tab, click the button next to the BACnet/IP network, then select **BACnet Local Access**.
- 9 Click **Accept**.
- 10 On the **Configure** tab, select **BACnet Local Access**, then click **Start**.
NOTE If an error message appears, make sure the COM port you selected is not in use. For example, PuTTY may be open and is holding the port open.
- 11 On the **Network**  tree, select the controller that you are connected to.
- 12 Click , then select **Manual Command**.
- 13 Type `rnet here` in the dialog box, then click **OK**.
- 14 On the **Properties** page, click **Module Status**. If a Modstat report appears, the WebCTRL® application is communicating with the controller.

Troubleshooting

If you have problems mounting, wiring, or addressing the ZN141v+, contact ALC Technical Support.

LED's

The LED's on the ZN141v+ show the status of certain functions.

If this LED is on...	Status is...
Power	The ZN141v+ has power
Rx	The ZN141v+ is receiving data from the network segment
Tx	The ZN141v+ is transmitting data over the network segment
DO#	The digital output is active
CW	The actuator motor is turning clockwise
CCW	The actuator motor is turning counterclockwise

The **Run** and **Error** LED's indicate controller and network status.

If Run LED shows...	And Error LED shows...	Status is...
2 flashes per second	Off	Normal
2 flashes per second	2 flashes, alternating with Run LED	Five minute auto-restart delay after system error
2 flashes per second	3 flashes, then off	The controller has just been formatted
2 flashes per second	4 flashes, then pause	Two or more devices on this network have the same ARC156 network address
2 flashes per second	1 flash per second	The controller is alone on the network
2 flashes per second	On	Obtain a Module Status Report (Modstat) to determine which of the following occurred: • Exec halted after frequent system errors • Control programs halted • ZN141v+ stopped communicating with the ZASF
5 flashes per second	On	Exec start-up aborted, Boot is running
5 flashes per second	Off	Firmware transfer in progress, Boot is running
7 flashes per second	7 flashes per second, alternating with Run LED	Ten second recovery period after brownout
14 flashes per second	14 flashes per second, alternating with Run LED	Brownout

If Run LED shows...	And Error LED shows...	Status is...
On	On	Failure. Try the following solutions: • Turn the ZN141v+ off, then on. • Format the ZN141v+. • Download the ZN141v+. • Replace the ZN141v+.

NOTE If you resolve the issue but the **Error** LED does not turn off, cycle power to the controller.

Possible delay before control program starts

When you first apply power to the ZN141v+, it waits for up to 3 minutes to receive a time/date broadcast from its BACnet router. The ZN141v+ begins to run the control program only after it receives the time/date or when the 3 minute waiting period expires. If the ZN141v+ does not receive a time/date broadcast, it keeps the default setting of 6/12/2002 10:00:00 (am).

To format the controller

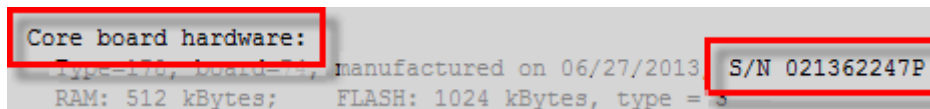
If you cannot communicate with a controller after downloading it, as a last resort, you can manually format the controller to erase its memory.

- 1 Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**.
- 2  Make sure the address switches are not set to 0, 0.
- 3 Short the **Format** jumper's pins and maintain the short for steps 3 and 4.
- 4 Insert the power screw terminal connector into the ZN141v+'s power terminals.
- 5 Continue to short the jumper until the **Error** LED flashes three times in sync with the **Run** LED.
- 6 Remove the short.
- 7 Download the ZN141v+.

To get the ZN141v+'s serial number

If you need the ZN141v+'s serial number when troubleshooting, the number is on:

- a sticker on the back of the main controller board
- a Module Status report (Modstat) under **Core** (or **Main**) board hardware



Core board hardware:
 Type=100, board=1, manufactured on 06/27/2013 S/N 021362247P
 RAM: 512 kBytes; FLASH: 1024 kBytes, type = S

To obtain a modstat in the WebCTRL® interface:

- 1 Select the ZN141v+ in the **Network**  tree.
- 2 On the **Properties** page, click **Module Status**.

Recovering from a power outage

The ZN141v+ has a 10-year Lithium CR2032 battery that retains the following data for a maximum of 10,000 hours during power outages.

- Control programs
- Editable properties
- Trends
- Schedules

If the above data is lost after power returns, replace the battery and then download the ZN141v+. See instructions below.

To replace the ZN141v+'s battery

If the ZN141v+ experiences a power outage and the control program stops functioning, replace the battery.

- 1 Verify that the ZN141v+'s power is on.
- 2 Remove the ZN141v+'s cover.
- 3 Remove the battery from the controller, making note of the battery's polarity.
- 4 Insert the new battery, matching the battery's polarity with the polarity indicated on the controller's cover.
- 5 Replace the ZN141v+'s cover.
- 6 Download the ZN141v+.

To clean the airflow sensor orifice and replace the filter

In less than .02% of installations, small particulates (micron/submicron-level) can build up in the airflow sensor's internal orifice or clog the airflow filter, causing airflow restriction. Symptoms of airflow restriction are:

- Diffuser noise increases over time
- Space overcools at minimum airflow
- Frequency of dampers opening to maintain flow setpoint increases over time
- AHU fan speed increases over time

To check for these symptoms, set up trending of:

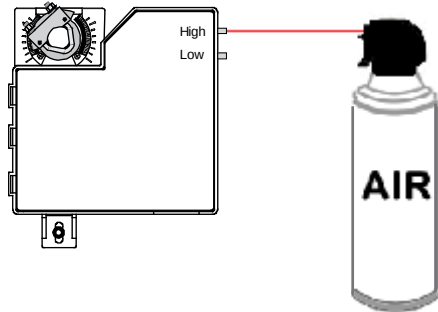
- Damper position to look for long term increase
- AHU fan speed for maintaining static pressure

If you see these symptoms, you should clean the flow sensor and replace the filter.

To clean the flow sensor

You can use a can of compressed air to clean the sensors while the controller is installed or on a repair bench.

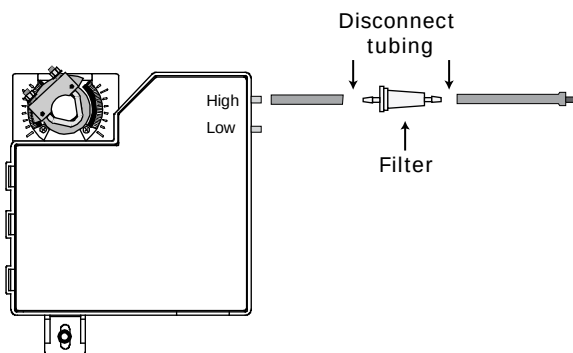
- 1 Disconnect the **High** and **Low** flow sensor tubes.
- 2 Insert the compressed air straw 1/4" into the controller's **High** connector.



- 3 Press the air can's trigger twice for no more than 2 seconds each time.
- 4 Reconnect tubing to the **High** and **Low** flow sensor tubes.

To replace the filter

- 1 Order a replacement filter from Automated Logic®.
- 2 Pull the tubing from both ends of the existing filter.



- 3 Attach tubing to the new filter.

To take the ZN141v+ out of service

If needed for troubleshooting or start-up, you can prevent the WebCTRL® application from communicating with the ZN141v+.

- 1 On the WebCTRL® **Network**  tree, select the ZN141v+.
- 2 On the **Properties** page, check **Out of Service**.
- 3 Click **Accept**.

Compliance

FCC Compliance

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.



CAUTION Changes or modifications not expressly approved by the responsible party for compliance could void the user's authority to operate the equipment.

CE Compliance

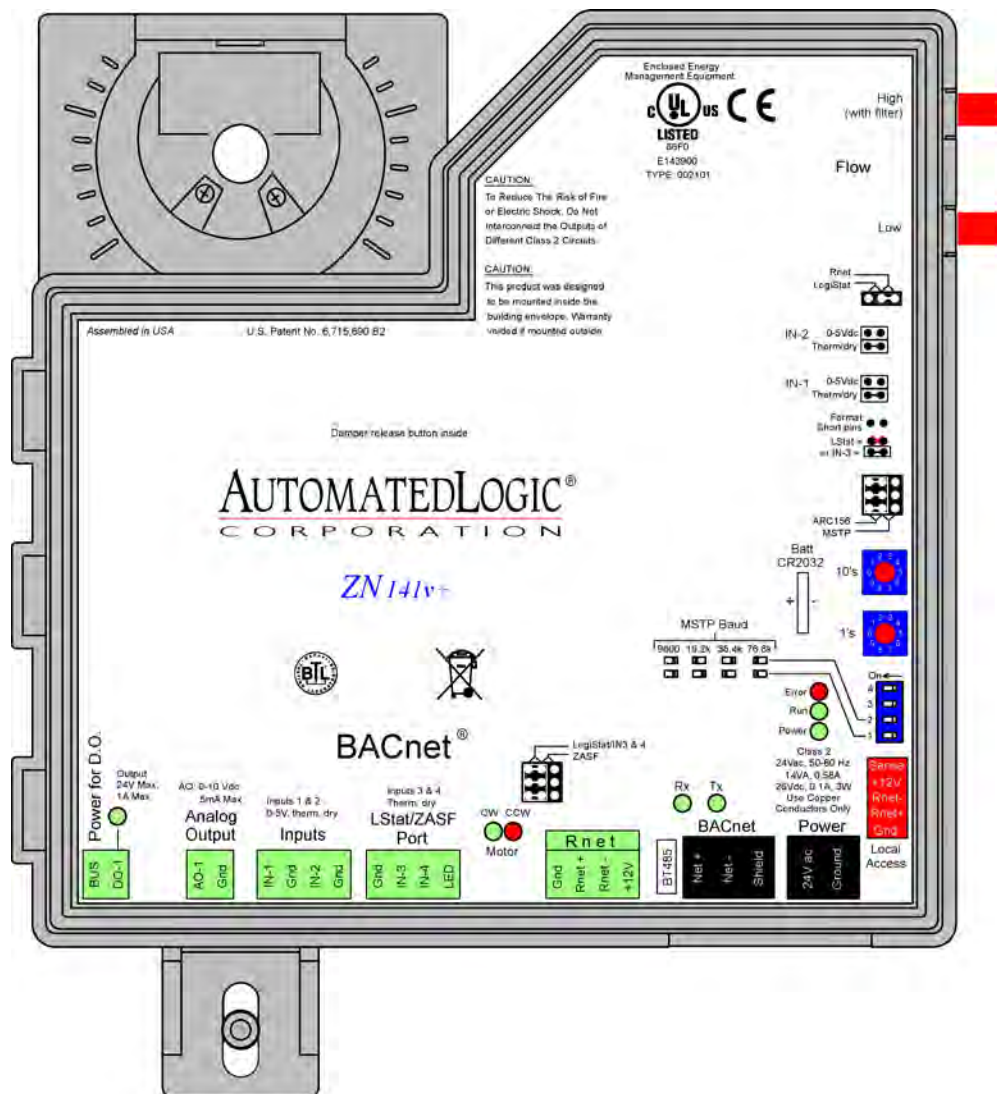


WARNING This is a Class A product. In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate measures.

BACnet Compliance

Compliance of listed products to requirements of ASHRAE Standard 135 is the responsibility of BACnet International. BTL® is a registered trademark of BACnet International.

Appendix - ZN141v+ coverplate



Document revision history

Important changes to this document are listed below. Minor changes such as typographical or formatting errors are not listed.

Date	Topic	Change description	Code*
2/7/17	Specifications	Added wireless sensors to the Rnet port specification.	X-D
	Zone sensors	Added wireless sensors to this topic.	
	Equipment Touch	Added Wireless Adapter to this topic.	
	Wiring inputs and outputs > Wiring specifications	Added Wireless Adapter to this topic.	
	Wiring devices to the Rnet port	Added Wireless Adapter to this topic.	
	To wire a Wireless Adapter to the ZN141v+	New topic.	
9/26/16	To set up a Local Access connection in the WebCTRL interface	Updated WebCTRL menu button in step 12.	A-D
	Appendix - ZN141v+ coverplate	Updated coverplate	A-D
8/11/15	To clean the airflow sensor orifice	New topic	AC-TS-TS-E
4/20/15	Entire document	New look, no content changes	A-D
11/14/14	BACnet Compliance	Changed BACnet Manufacturers Association to BACnet International	X-D-CP-MW
10/7/14	Driver	Added the Network Microblock fields	A-TS-RB-F
9/4/14	LED's	Changed the Status description for when the Run LED shows 2 flashes per second and the Error LED is On. Also added a note below the table regarding cycling power to turn off Error LED.	A-TS-JM-F-BK
5/13/14	Specifications	Rnet Port: Added Equipment Touch and removed note about BACview® devices	A-D-CP-O-TC
	Equipment Touch devices	New topic	
	Wiring zone sensors to the ZN141v+	Changed to "Wiring devices to the ZN141v+'s Rnet port"	
	To wire an Equipment Touch to the ZN141v+	New topic	
	Wiring a LogiStat sensor to the ZN141v+	New topic	
	To set up the driver > Driver	Added new driver property: TouchScreen Schedule Edit Enable	

* For internal use only

ZN551 Controller

Technical Instructions

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Verify that you have the most current version of this document. Go to <https://accounts.automatedlogic.com>, then select **Support > Download > Documents > Hardware**. Important changes are listed in **Document revision history** at the end of this document.

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What is the ZN551 controller?

The ZN551 controller is used for zone control.

Driver and control program

Driver	DRV_ZN ¹
Maximum number of control programs	1
Maximum number of BACnet objects ²	300

¹ To replace a U line controller with a ZN551, use the driver DRV_ZNPLUSU_<latest version>. See the *ZN U Line Emulation Technical Instructions*.

² Depends on available memory.

Specifications

Power	24 Vac $\pm 10\%$, 50–60 Hz, 15 VA 26 Vdc (25 V min, 30 V max)
BACnet port (This port may be labeled CMnet.)	For communication with the controller network using ARC156 or MS/TP (9600 bps–76.8 kbps)
Rnet port	Supports: • Up to 5 ZS sensors • One Wireless Adapter that communicates with up to 5 wireless sensors • One Equipment Touch • Up to 4 RS Standard sensors and one RS Plus, RS Pro, or RS Pro-F sensor. NOTE ZS sensors, a Wireless Adapter, and an Equipment Touch can share the Rnet, but not RS sensors.
LStat port	For LogiStat and LogiStat Plus zone sensors. The LogiStat port uses two universal inputs. NOTE The ZN551 does not support the LogiStat Pro. Use an RS Pro on the Rnet port instead.
Local Access port	For system start-up and troubleshooting
Flow sensor port	Provides flow inputs for a USF or UDF flow sensor.
Inputs	5 inputs configurable for thermistor or dry contact. Inputs 1 and 2 are also configurable for 0–5 Vdc. Inputs 4 and 5 are used when a LogiStat sensor is connected, but are available if an RS room sensor is connected.
Input resolution	10 bit A/D

Input pulse frequency	10 pulses per second. Minimum pulse width (on or off time) required for each pulse is 50 msec.
Digital outputs	5 digital outputs, relay contacts rated at 1 A max. @ 24 Vac/Vdc. Configured normally open.
Analog output	1 analog output, 0–10 Vdc (5 mA max)
Output resolution	8 bit D/A
Memory	512 kB non-volatile battery-backed RAM, 1 MB Flash memory, 16-bit memory bus
Battery	10-year Lithium CR2032 battery retains the following data for a maximum of 10,000 hours during power outages: control programs, editable properties, schedules, and trends.
Protection	Incoming power and network connections are protected by non-replaceable internal solid-state polyswitches that reset themselves when the condition that causes a fault returns to normal. The power, network, input, and output connections are also protected against transient excess voltage/surge events lasting no more than 10 msec.
BT485 connector	You attach a BT485 (not included) to a controller at the beginning and end of a network segment to add bias and to terminate a network segment.
Status indicators	LED's indicate status of communications, running, errors, power, and digital outputs
Environmental operating range	0 to 130 °F (-17.8 to 54.4 °C), 10–90% relative humidity, non-condensing
Physical	Rugged GE C2950 Cyclopy plastic
Overall dimensions	Width: 5 1/16 in. (12.9 cm) Height: 5 11/16 in. (14.4 cm)
Mounting dimensions	5 9/16" (14.1 cm) between mounting slot centerlines
Weight	0.6 lbs (0.27 kg)
BACnet support	Conforms to the BACnet Advanced Application Controller (B-AAC) Standard Device Profile as defined in ANSI/ASHRAE Standard 135-2012 (BACnet) Annex L, Protocol Revision 9
Listed by	UL-916 (PAZX), cUL-916 (PAZX7), FCC Part 15-Subpart B-Class A, CE

Inputs

The ZN551 has 5 inputs that accept the following signal types.

These inputs...	Support this signal type...	Description
All	Thermistor	Precon type 2 (10 kOhm at 77 °F). Input voltage for IN-4: 1 to 2.52 Vdc Input voltage for all other inputs: 0.33 to 2.52 Vdc
All	Dry contact	A 3.3 Vdc wetting voltage detects contact position, resulting in a 0.3 mA maximum sense current when the contacts are closed.
IN-1, IN-2	0–5 Vdc	The output impedance of a 0–5 Vdc source must not exceed 100 Ohms. The input impedance of the ZN551 is approximately 30 kOhm.
All	Timed local override	A momentary contact switch that overrides a schedule and turns equipment on for a defined period of time. The override time added for each push of the button and the maximum allowable On time are software adjustable.
All	Pulse counter ¹	Pulse counting up to 10 pulses per second. Minimum pulse width (on or off time) required for each pulse is 50 msec.
IN-4, IN-5	LogiStat ²	IN-4: See Thermistor. IN-5: Setpoint adjust. Input voltages should be from 1.4 to 3.4 Vdc.

¹ The ZN551 can perform pulse counting for dry contact or voltage inputs if you assign the input to a Pulse to Analog Input microblock. See *To assign inputs or outputs to points* (page 16).

² A LogiStat sensor connected to the ZN551 uses IN-4 and IN-5. A ZS or RS sensor connected to the **Rnet** port does not use these inputs.

Digital outputs

The ZN551 has 5 digital outputs. You can connect each output to a maximum of 24 Vac/Vdc. Each output is a dry contact rated at 1 A, 24 V maximum and is normally open.

Analog outputs

The ZN551 has 1 analog output that supports voltage devices from 0-10 Vdc. The controlled device must have a minimum of 2000 Ohms resistance measured from its input to ground and must share the same ground as the controller.

Zone sensors

Automated Logic® wireless sensors

You can connect a Wireless Adapter to ZN551's **Rnet** port. The Wireless Adapter communicates with up to 5 wireless sensors. When using wireless sensors, the Rnet can have:

- Up to 5 wireless and ZS sensors (any combination)
- One Wireless Adapter
- One Equipment Touch

ZS Sensors

You can wire up to 5 ZS sensors to the ZN551's Rnet port.

RS sensors

You can wire RS sensors to the ZN551's **Rnet** port. An Rnet can consist of any of the following combinations of devices wired in a daisy-chain or star configuration:

- 1 RS Plus, RS Pro, or RS Pro-F
- 1–4 RS Standards
- 1–4 RS Standards, and 1 RS Plus, RS Pro, or RS Pro-F

LogiStats

You can wire a LogiStat or LogiStat Plus to the ZN551's **LStat** port.

NOTES

- The ZN551 does not support the LogiStat Pro.
- A LogiStat or LogiStat Plus wired to the ZN551 cannot be used for local access.

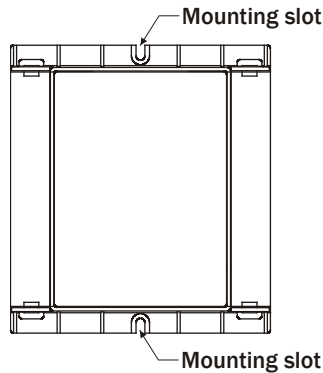
Equipment Touch devices

You can wire an Equipment Touch to the ZN551's Rnet port to view or change the controller's property values, schedule equipment, view trends and alarms, and more, without having to access the system's server. The Rnet can have one Equipment Touch, one Wireless Adapter, and up to 5 ZS sensors. RS sensors cannot share the Rnet with an Equipment Touch.

To mount the ZN551

NOTE You must mount the ZN551 inside the building. The ZN551's warranty will be void if you mount it outside.

Screw the ZN551 into an enclosed panel using the mounting slots shown below. Leave about 2 in. (5 cm) on each side of the controller for wiring.



Wiring for power



WARNING Do not apply line voltage (mains voltage) to the controller's ports and terminals.



CAUTIONS

- The ZN551 is powered by a Class 2 power source. Take appropriate isolation measures when mounting it in a control panel where non-Class 2 circuits are present.
- Automated Logic® controllers can share a power supply as long as you:
 - Maintain the same polarity.
 - Use the power supply only for Automated Logic® controllers.

To wire for power

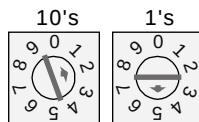
- 1 Remove power from the power supply.
- 2 Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**.
- 3 Connect the transformer wires to the screw terminal connector.
- 4 Apply power to the power supply.
- 5 Measure the voltage at the ZN551's power input terminals to verify that the voltage is within the operating range of 21.6–26.4 Vac.
- 6 Connect a 4-inch (10.2 cm) wire from **Gnd** to the control panel.
- 7 Insert the screw terminal connector into the ZN551's power terminals.
- 8 Verify that the **Power** LED is on and the **Run** LED is blinking.

To address the ZN551

You must give the ZN551 an address that is unique on the network. You can address the ZN551 before or after you wire it for power.

- 1 If the ZN551 has been wired for power, pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**. The controller reads the address each time you apply power to it.
- 2 Using the rotary switches, set the controller's address to match the **Address** in the controller's properties dialog box in SiteBuilder. Set the **Tens (10's)** switch to the tens digit of the address, and set the **Ones (1's)** switch to the ones digit.

EXAMPLE If the controller's address is 25, point the arrow on the **Tens (10's)** switch to 2 and the arrow on the **Ones (1's)** switch to 5.



Wiring for communications

The ZN551 communicates using BACnet on the following types of network segments:

- ARC156 communicating at 156 kbps
- MS/TP communicating at 9600 bps, 19.2 kbps, 38.4 kbps, or 76.8 kbps

NOTE ARC156 is a unique implementation of the industry standard ARCNET. For a summary of differences between ARCNET and ARC156, see the *ARC156 Wiring Technical Instructions*.

Wiring specifications

For...	Use...	Maximum Length
ARC156 ¹ and MS/TP ²	22 AWG, low-capacitance, twisted, stranded, shielded copper wire	2000 feet (610 meters)

¹ See the *ARC156 Wiring Technical Instructions*.

² See the *MS/TP Networking and Wiring Technical Instructions*.



WARNING Do not apply line voltage (mains voltage) to the controller's ports and terminals.

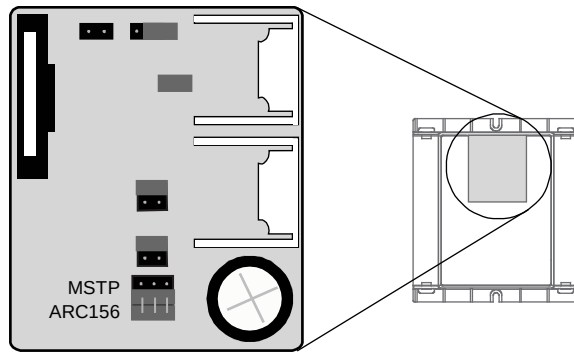
To wire the ZN551 for communications

- 1 Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**.
- 2 Check the communications wiring for shorts and grounds.
- 3 Connect the communications wiring to the controller's screw terminals labeled **Net +**, **Net -**, and **Shield**.

NOTE Use the same polarity throughout the network segment.

- 4 Set the communication type and baud rate.

For...	Set Communications Selection Jumper to... (See figure below)	Set DIP switches 1 and 2 to...
ARC156	ARC156	N/A. Baud rate will be 156 kbps regardless of the DIP switch settings.
MS/TP	MSTP	The appropriate baud rate. See the MSTP Baud diagram on the controller.



NOTE Use the same baud rate for all controllers on the network segment.

- 5 If the ZN551 is at either end of a network segment, connect a BT485 to the ZN551.
- 6 Insert the power screw terminal connector into the ZN551's power terminals.
- 7 Verify communication with the network by viewing a Module Status report in the WebCTRL® interface.

Wiring inputs and outputs

Wiring specifications

Input wiring

Input	Maximum length	Minimum gauge	Shielding
0–5 Vdc	1000 feet (305 meters)	26 AWG	Shielded
Thermistor Dry contact	1000 feet (305 meters)	22 AWG	Shielded
ZS sensor RS sensor Wireless Adapter for wireless sensors Equipment Touch	See <i>Wiring devices to the ZN551's Rnet port</i> (page 10).		
LogiStat sensor	See <i>Wiring a LogiStat sensor to the ZN551</i> (page 13).		

Output wiring

To size output wiring, consider the following:

- Total loop distance from the power supply to the controller, and then to the controlled device
NOTE Include the total distance of actual wire. For 2-conductor wires, this is twice the cable length.
- Acceptable voltage drop in the wire from the controller to the controlled device
- Resistance (Ohms) of the chosen wire gauge
- Maximum current (Amps) the controlled device requires to operate

To wire inputs and outputs



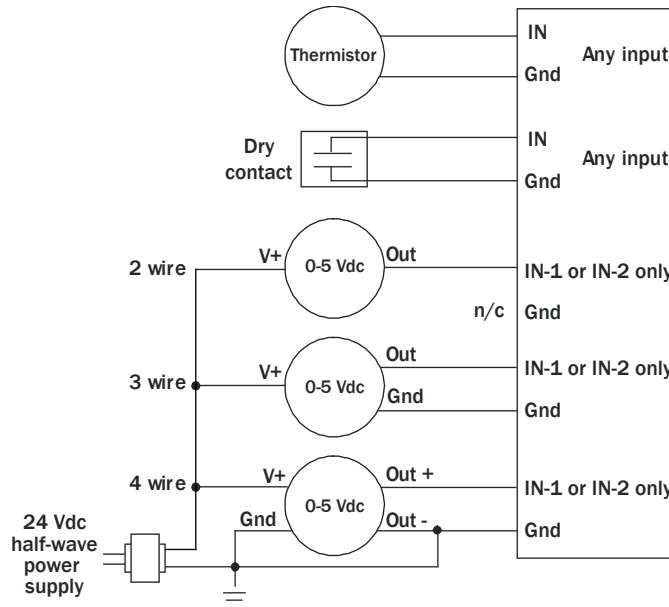
WARNING Do not apply line voltage (mains voltage) to the controller's ports and terminals.

- 1 Verify that the ZN551's power and communications connections work properly.
- 2 Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**.

3 Connect the input wiring to the screw terminals on the ZN551.

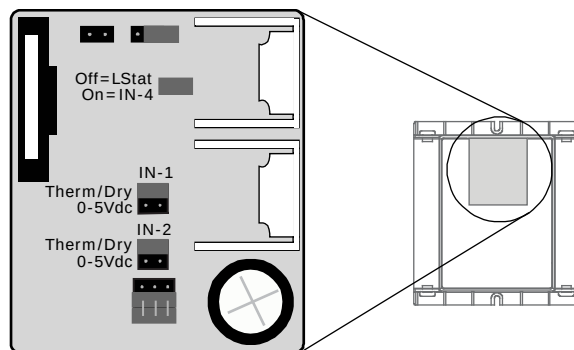
NOTES

- Connect the shield wire to the **GND** terminal with the ground wire.
- **IN-4** and **IN-5** share the **GND** terminal above **IN-4**.

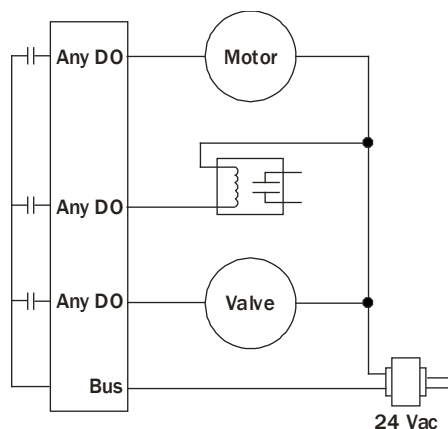


4 Set the appropriate jumpers on the ZN551.

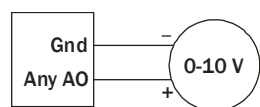
To use...	For...	
IN-1 or IN-2	Thermistor Dry contact 0-5 Vdc	Set jumpers IN-1 or IN-2 to the type of signal the input will receive. See figure below.
IN-4 or IN-5	Thermistor Dry contact	Verify the LStat/IN-4 jumper is on. See figure below.
IN-4 and IN-5	LogiStat	See <i>To wire a LogiStat sensor</i> (page 14).



- 5 Connect the digital output wiring to the screw terminals on the ZN551 and to the controlled device.



- 6 Connect the analog output wiring to the screw terminals on the ZN551 and to the controlled device.



- 7 Insert the power screw terminal connector into the ZN551's power terminals.

Wiring devices to the ZN551's Rnet port

You can wire the following devices to the ZN551's Rnet port in a daisy-chain or star configuration:

- *ZS or RS sensors* (page 11)
- *Wireless Adapter* (page 12) that communicates with wireless sensors
- *Equipment Touch* (page 13)

NOTE ZS sensors, a Wireless Adapter, and an Equipment Touch can share the same Rnet, but not RS sensors.

The Rnet communicates at a rate of 115 kbps.

Rnet wiring specifications

NOTE Use the specified type of wire and cable for maximum signal integrity.

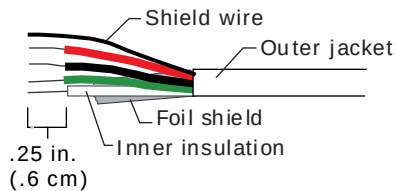
Description	4 conductor, shielded or unshielded, CMP, plenum rated cable
Conductor	22 AWG (7x0096) bare copper
Maximum length	500 feet (152 meters)
Insulation	Low-smoke PVC (or equivalent)
Color Code	Black, white, green, red
Shielding	If shielded, Aluminum/Mylar shield (100% coverage) with TC drain wire
UL temperature rating	32–167 °F (0–75 °C)
Voltage	300 Vac, power limited
Listing	UL: NEC CL2P, or better

To wire a ZS or an RS sensor to the ZN551

For complete sensor installation instructions, including ZS sensor power requirements, see:

- *ZS Sensors Technical Instructions*
- *RS Sensors Technical Instructions*

- 1 Remove power from the ZN551.
- 2 Partially cut, then bend and pull off the outer jacket of the Rnet cable(s). Do not nick the inner insulation.



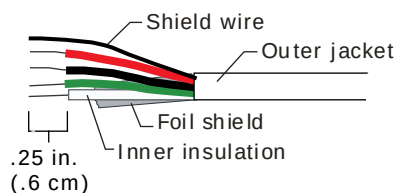
- 3 Strip about .25 inch (.6 cm) of the inner insulation from each wire.
- 4 Wire each terminal on the ZN551's **Rnet** port to the terminal of the same name on the sensor.
NOTE If using shielded wire, connect the shield wire and the ground wire to the **Gnd** terminal.
- 5 Apply power to the ZN551.

To wire a Wireless Adapter to the ZN551

NOTES

- The Wireless Adapter requires a 24 Vac power supply. It is not powered by the Rnet.
- If the Wireless Adapter will be:
 - Daisy-chained on the Rnet with ZS sensors or an Equipment Touch, use the standard 4-conductor Rnet cable.
 - The only device on the Rnet, you can use a 3-conductor cable instead of the standard 4-conductor Rnet cable.
- For complete Wireless Adapter installation instructions, see the *Wireless Sensors Technical Instructions*.

- 1 Remove power from the ZN551.
- 2 Partially cut, then bend and pull off the outer jacket of the Rnet cable(s). Do not nick the inner insulation.



- 3 Strip about .25 inch (.6 cm) of the inner insulation from each wire.
- 4 Wire the ZN551's **Rnet+**, **Rnet-**, and **Gnd** terminals to the terminals of the same name on the Wireless Adapter's Rnet connector.



NOTE If using shielded wire, connect the shield wire and the ground wire to the **Gnd** terminal.

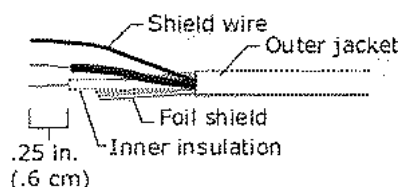
- 5 Apply power to the ZN551.

To wire an Equipment Touch to the ZN551

NOTES

- The Equipment Touch requires a 24 Vac power supply. It is not powered by the Rnet.
- If the Equipment Touch will be:
 - Daisy-chained on the Rnet with ZS sensors or a Wireless Adapter, use the standard 4-conductor Rnet wiring and follow the wiring instructions *To wire a ZS or an RS sensor to the ZN551* (page 11).
 - The only device on the Rnet, you can use a 2-conductor cable instead of the standard 4-conductor Rnet cable and follow the instructions below.
- For complete Equipment Touch installation instructions including wiring diagrams, see the *Equipment Touch Installation and Setup Guide*.

- 1 Remove power from the ZN551.
- 2 Partially cut, then bend and pull off the outer jacket of the cable. Do not nick the inner insulation.



- 3 Strip about .25 inch (.6 cm) of the inner insulation from each wire.
- 4 Wire the ZN551's **Rnet+** and **Rnet-** terminals to the terminals of the same name on the Equipment Touch's connector.
NOTE If using shielded wire, connect the shield wire and the ground wire to the **Gnd** terminal.
- 5 Apply power to the ZN551.

Wiring a LogiStat sensor to the ZN551

You can wire a LogiStat or LogiStat Plus to the ZN551's **Lstat** port

For complete sensor installation instructions, see the *LogiStat Sensors Technical Instructions*.

LogiStat wiring specifications

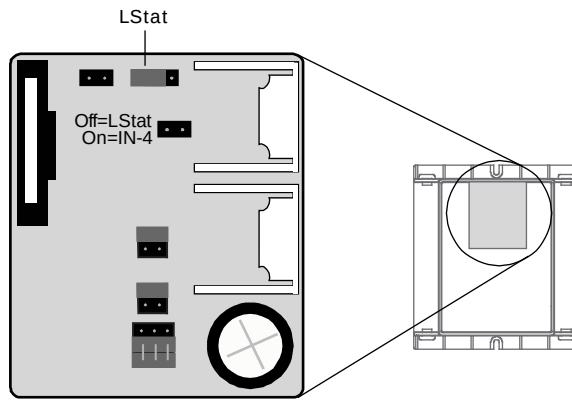
Use 22 AWG, unshielded wire, maximum length 100 feet (30 meters).

To wire a LogiStat sensor

- 1 Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**.
- 2 To connect the LogiStat sensor to the ZN551's **LStat** port.

Wire this terminal on the LStat port...	To this terminal on the LogiStat sensor
Gnd	Gnd
IN-4	Temp
IN-5	SW
LED	LS5v

- 3 Remove the jumper from **LStat/IN-4** (J12 on the circuit board).



- 4 Set the **LStat/Rnet** jumper to **LStat**.
- 5 Insert the power screw terminal connector into the ZN551's power terminals.

Downloading the ZN551

Download the following items to the ZN551's battery-backed memory:

Item	Notes
Control program	Must be in WebCTRLx.x\webroot\<system_name>\programs .
DRV_ZN driver	Must be in WebCTRLx.x\webroot\<system_name>\drivers . NOTE To verify that you have the driver's latest version, go to http://accounts.automatedlogic.com/download , then select Drivers > ExecB . Compare the latest version to the ZN551's driver in SiteBuilder.
Editable properties	
Schedules	

If you change any of the above items or the ZN551's address after the initial download, you must download again. The first download takes longer than subsequent downloads.



CAUTIONS

- The ZN551 will lose stored data when you download.
- Equipment controlled by the ZN551 will shut down and restart when you download.

To download from the WebCTRL® interface

If your network is complete, you can download from any network browser. If not complete, connect a laptop with a local copy of the system database to the ZN551's local access port. See *To communicate through the local access port* (page 24).

- 1 On the WebCTRL® **Network**  tree, select the controller.
- 2 Click **Downloads**.
- 3 Do one of the following:
 - If the controller is in the Downloads list, go to step 4.
 - If the controller is not in the list:
 - a. Click **Add**.
 - b. In the pop-up, select the controller.
 - c. Select **All Content**.
 - d. Click **Add**.
 - e. Click **Close**.
- 4 Select the controller in the Downloads list.
- 5 Click **Start**.

NOTES

- If the download fails, locate and resolve the problem, then retry the download.
- You can also download a controller from the **Devices** page.

To assign inputs or outputs to points

To use an input or output, you must assign it to its corresponding point in the control program.

- 1 In the WebCTRL® **Geographic**  tree, select the equipment controlled by the ZN551.
- 2 On the **Properties** page, select the **I/O Points** tab.
- 3 In each point's **Num** field, type the number of the controller's corresponding input or output. For example, if you use DO1 on the ZN551 for the point **Fan S/S**, type 1 in the **Num** field for **Fan S/S**.

NOTES

- **Exp** (expander number) is 00 for the ZN551.
 - Do not assign the same output number to more than one point.
- 4 Enter the appropriate values for each input and output in the remaining columns. See *Input values*, *Output values*, *Resolution values* and *Offset/Polarity values* below.
NOTE You can also enter these values in the EIKON® LogicBuilder application.
 - 5 If you have not performed the initial download to the ZN551, you must download now so you can verify inputs and outputs.
 - 6 To verify each input's operation, force each sensor to a known value, then compare it to the **Value** shown on the **Properties** page on the **I/O Points** tab.
 - 7 To verify each output's operation, lock each output to a known condition on the **I/O Points** tab, then verify that the equipment operates correctly.

Input values

Input	I/O Type	Sensor/Actuator Type	Min/Max
Analog (BAI)			
0-5 Vdc	0-5 Volt	Linear Full Range	Engineering values associated with 0 Vdc (Min) and 5 Vdc (Max) ¹
Thermistor	Thermistor	Select your Thermistor type or set up and select a Non-Linear, Custom Table ²	N/A
Pulse to Analog (BPTA) ³			
Pulse Counter	Counter Input	N/A	N/A
Digital (Binary) (BBI)			
Dry Contact	Dry Contact	N/A	N/A

¹ The sensor reads a value and sends a corresponding signal (Volt, mA, or psi) to the ZN551's physical input. The Analog Input microblock uses the **Min** and **Max** values to linearly translate the signal into the engineering value used in subsequent control logic. For example, set **Min** to 0 and **Max** to 10 for a 4-20 mA sensor that measures velocity from 0.0 to 10.0 inches/second so that when the input reads 4 mA, the microblock outputs a value of 0. Similarly, when the input reads 8 mA, the microblock outputs a value of 2.5.

² You can set up a *custom translation table* (page 23) on the driver's **Custom Translation Tables** pages in the WebCTRL® interface.

³ The control program must have one Pulse to Analog Input microblock for each pulse counting input.

Output values

Output	I/O Type	Sensor/Actuator Type	Min/Max
Analog (BAO)			
0-10 Vdc	Electrical 0-10 Volt	Linear Full Range	Engineering values associated with 0 Vdc (Min) and 10 Vdc (Max) ¹
2-10 Vdc	Electrical 0-10 Volt	Linear w/Offset, 2-10 Volts	Engineering values associated with 2 Vdc (Min) and 10 Vdc (Max) ¹
Digital (Binary) (BBO)			
Relay	Relay/Triac Output	N/A	N/A

¹ The Analog Output microblock uses the **Min** and **Max** values to linearly translate its EIKON® LogicBuilder wire value into a physical output signal (Volt, mA, or psi) sent from the ZN551 to an actuator. For example, set **Min** to 0 and **Max** to 100 for an Analog Output microblock that receives a 0 to 100% open signal from a PID microblock and that controls a 0-10 Vdc actuator so that when the PID signal is 100%, the ZN551 output is 10 Vdc. Similarly, when the PID signal is 50%, the ZN551 output is 5 Vdc.

Resolution values

Resolution is not particular to a type of input or output, but the driver handles analog and digital (binary) inputs and outputs differently. To set these values appropriately, you should understand how the driver uses them.

Resolution	Notes
Analog Input (BAI)	The driver truncates the microblock's present value according to the resolution. EXAMPLE If the calculated present value is 13.789 and you set the Resolution to 0.1, the control program uses 13.7 for any calculations downstream from the microblock.
Analog Output (BAO)	The driver truncates the wire input value to the microblock before performing any scaling calculations. EXAMPLE If the wire input value is 13.789 and you set the Resolution to 0.1, the microblock uses 13.7 for any scaling calculations.
Digital Inputs and Outputs	N/A

Offset/Polarity values

Offset/Polarity is not particular to a type of input or output, but the driver handles analog and digital (binary) inputs and outputs differently. To set these values appropriately, you should understand how the driver uses them.

Offset/Polarity	Notes
Analog Input (BAI)	Offset value (positive or negative) adds a fine adjustment to a sensor reading after all scaling for calibration. EXAMPLE If a sensor reads 74.9°F when the actual measured value is 73.6°F, enter an Offset of -1.3 to calibrate the sensor to the measured value.
Analog Output (BAO)	You can use the Offset value (positive or negative) to calibrate an output, but you generally do not need to. If used, the driver adds the offset value to the wire input value before performing any scaling calculations to determine the ZN551's output.
Digital (Binary) Input (BBI)	Polarity determines the microblock's present value when no signal is received from the equipment. When no signal is received from the equipment, if Polarity is set to: normal —present value is off reversed —present value is on
Digital (Binary) Output (BBO)	Polarity determines the ZN551's output based on the control program's signal to the microblock. When the control program's signal to the microblock is on , if Polarity is set to: normal —output is on reversed —output is off NOTE Regardless of Polarity , the output will be off if the ZN551 loses power.

Using a flow sensor

In a single duct system, the ZN551 controls airflow in the zone using a USF flow sensor and an actuator. In a dual duct system, the ZN551 controls airflow in the zone using a UDF flow sensor and two actuators. Each actuator is connected to 2 digital outputs or 1 analog output.

To connect duct tubes to the flow sensor

USF

- 1 Connect the duct's total pressure tube to the USF's **High** connector.
- 2 Connect the duct's static pressure tube to the USF's **Low** connector.

UDF

Follow the procedure for a USF, but connect one duct's tubes to the UDF's **Flow #1** connectors and the other duct's tubes to the UDF's **Flow #2** connectors.

To wire the flow sensor to the ZN551

Use the cable included with the flow sensor (Automated Logic® part #235012) or a 20 AWG, 4-conductor cable, maximum length 4 feet (1.22 meters).

- 1 Turn off the controller's power.
- 2 Do one of the following:
 - If using the cable included with the flow sensor, connect one end of the cable to the flow sensor's 4-pin connector and the other end of the cable to the controller's 4-pin flow sensor connector.
 - If using a different cable:

To this terminal on the flow sensor...	Wire this terminal on the controller...
1	Flow 2
2	GND
3	+10V
4	Flow 1

To set up the Airflow Control microblock

The ZN551's control program must include one Airflow Control microblock for a single duct system or two of the microblocks for a dual duct system. Each Airflow Control microblock's **Damper Pos** output must have one Floating Motor microblock or an Analog Output microblock connected to it.

You must set up the Airflow Control microblock for each flow sensor.

For a single duct system

- 1 In the WebCTRL® interface on the control program's **Logic** page, select the Airflow Control microblock.
- 2 On the **Details** tab in the **Flow Sensor** field under **Hardware Configuration**, select **External flow sensor**.
- 3 In the **Damper Actuator** field, select **External actuator**.
- 4 In the **Input Number** field, type 1.
- 5 In the **I/O Type** field, select **Flow Input**.
- 6 At the bottom of the **Details** tab, click the plus sign (+) to the left of **Flow Input (AI) Configuration**.
- 7 In the **Sensor Type** field under **Calibration**, select **No Translation**.

For a dual duct system

- 1 In the WebCTRL® interface on the control program's **Logic** page, select the Airflow Control microblock for Flow #1.
- 2 On the **Details** tab in the **Flow Sensor** field under **Hardware Configuration**, select **External flow sensor**.
- 3 In the **Damper Actuator** field, select **External actuator**.
- 4 In the **Input Number** field, type 1.
- 5 In the **I/O Type** field, select **Flow Input**.
- 6 At the bottom of the **Details** tab, click the plus sign (+) to the left of **Flow Input (AI) Configuration**.

- 7 In the **Sensor Type** field under **Calibration**, select **No Translation**.
- 8 On the **Logic** page, select the Airflow Control microblock for Flow #2.
- 9 Repeat steps 2 through 6 for Flow #2, typing 2 in step 3.

NOTE When performing test and balance, follow the steps under **Test and Balance** on the Airflow Control microblock's **Properties** page **Details** tab.

To set up the driver

After you download the driver and control program to the ZN551, you may want to change the driver's properties in the WebCTRL® interface to suit your application.

- 1 On the WebCTRL® **Network**  tree, click ▶ to the left of your ZN551.
- 2 Click ▶ to the left of **Driver** to see its children.
- 3 Make changes as needed on the **Properties** page for **Driver** and any of its children.

Driver

On the **Driver** page, you can change the following properties:

- Module clock synchronization and failure. See table below.
- Network Input microblock communication properties.

Module Clock	
Clock Fail Date and Time	Date and time the control program uses when controller's real-time clock is invalid.  TIP Use an occupied date and time (such as a Tuesday at 10 a.m.) so the equipment does not operate in unoccupied mode if the controller loses power during occupancy.
Time Synch Sensitivity (seconds)	When the controller receives a time sync request, if the difference between the controller's time and the time sync's time is greater than this field's value, the controller's time is immediately changed. If the difference is less than this field's value, the controller's time is slowly adjusted until the time is correct.
Network Microblocks	
Number of poll retries before Network Input Microblocks indicate failure	The maximum number of retries after the initial attempt that a Network microblock will attempt to communicate with its target device. If unsuccessful, the point will transition to an idle state for 30 seconds before attempting to communicate again. Change this field only if directed by Technical Support.
Periodic rebinding interval	If a microblock uses a wildcard in its address, this timer determines how often the microblock will attempt to find the nearest instance of its target. For example, if an outside air temperature address uses a wildcard, a VAV application will look for the outside air temperature on the same network segment or on the nearest device containing that object.

BACnet COV Throttling	
Enable COV Throttling	Under normal circumstances, COV Throttling should be enabled to prevent excessive network traffic if an object's COV Increment is set too low. See EXCEPTION below. When enabled, if an object generates excessive COV broadcasts (5 updates in 3 seconds), the driver automatically throttles the broadcasts to 1 per second. Also, if the object's value updates excessively for 30 seconds, an alarm is sent to the WebCTRL® application listing <u>all</u> objects that are updating excessively. A Return-to-normal alarm is sent only after <u>all</u> objects have stopped updating excessively. EXCEPTION: In rare circumstances, such as process control, a subscribing object may require COV updates more frequently than once per second. For these situations, clear this checkbox, but make sure that your network can support the increased traffic. You will also need to disable the Excessive COV alarms under the driver's Common Alarms.
Trend Sampling	
Collect a daily midnight sample for all points in this controller that are sampling on COV	For values that change infrequently, select to verify at midnight daily that the point is still able to communicate trend values.
TouchScreen Control	
TouchScreen Schedule Edit Enable	Check this field to allow a user to edit this controller's schedules from an Equipment Touch's Schedules screen.

Device

On the **Device** page, you can change the following properties:

- BACnet device object properties for the ZN551
- ZN551 network communication

Configuration	NOTE The three APDU fields refer to all networks over which the ZN551 communicates.
Max Masters and Max Info Frames	Apply only if the ZN551 is on an MS/TP network.

Notification Classes

Alarms in the WebCTRL® application use Notification Class #1. A BACnet alarm's Notification Class defines:

- Alarm priority for Alarm, Fault, and Return to Normal states
- Options for BACnet alarm acknowledgment
- Where alarms should be sent (recipients)

Priorities	NOTE BACnet defines the following Network message priorities for Alarms and Events.										
	<table> <tr> <th>Priority range</th><th>Network message priority</th></tr> <tr> <td>00–63</td><td>Life Safety</td></tr> <tr> <td>64–127</td><td>Critical Equipment</td></tr> <tr> <td>128–191</td><td>Urgent</td></tr> <tr> <td>192–255</td><td>Normal</td></tr> </table>	Priority range	Network message priority	00–63	Life Safety	64–127	Critical Equipment	128–191	Urgent	192–255	Normal
Priority range	Network message priority										
00–63	Life Safety										
64–127	Critical Equipment										
128–191	Urgent										
192–255	Normal										
Priority of Off-Normal	BACnet priority for Alarms.										
Priority of Fault	BACnet priority for Fault messages.										
Priority of Normal	BACnet priority for Return-to-normal messages.										
Ack Required for Off-Normal, Fault, and Normal	Specifies whether alarms associated with this Notification Class require a BACnet Acknowledgment for Off-Normal, Fault, or Normal alarms.  TIP You can require operator acknowledgment for an Alarm or Return-to-normal message (stored in the WebCTRL® database). In the WebCTRL® interface on the Alarm > Enable/Disable tab, change the acknowledgment settings for an alarm source or an alarm category.										
Recipient List											
Recipients	The first row in this list is the WebCTRL® application. Do not delete this row. Click Add if you want other BACnet devices to receive alarms associated with this Notification Class.										
Recipient Description	Name that appears in the Recipients table.										
Recipient Type	Use Address (static binding) for either of the following: - Third-party BACnet device recipients that do not support dynamic binding - When you want alarms to be broadcast (you must uncheck Issue Confirmed Notifications). This use is rare.										
Days and times	The days and times during which the recipient will receive alarms.										
Recipient Device Object Identifier	Type the Device Instance from SiteBuilder (or from the network administrator for third-party devices) in the # field.										
Process Identifier	Change for third-party devices that use a BACnet Process Identifier other than 1. The WebCTRL® application processes alarms for any 32-bit Process Identifier.										
Issue Confirmed Notifications	Select to have a device continue sending an alarm message until it receives delivery confirmation from the recipient.										
Transitions to Send	Uncheck the types of alarms you do not want the recipient to get.										

Calendars

Calendars are provided in the driver for BACnet compatibility only. Instead, use the **Schedules** feature in the WebCTRL® interface.

Common Alarms

On these pages, you can enable/disable, change BACnet alarm properties, or set delays for the following BACnet alarms:

- Module Halted
- All Programs Stopped
- Duplicate Address
- Locked I/O
- Control Program
- Program Stopped
- Excessive COV

NOTE To set up alarm actions for controller generated alarms, see *Setting up alarm actions* in WebCTRL® Help.

Module Generated Alarm	
Description	Short message shown on the Alarms page or in an alarm action when this type of alarm is generated.
Events	
Alarm Category and Alarm Template	See <i>Customizing alarms</i> in WebCTRL® Help.
Enable	Clear these checkboxes to disable Alarm or Return to normal messages of this type from this controller.
Notification Class	Do not change this field.

Custom Translation Tables

You can set up a translation table that an analog input will use to translate the raw data from a non-linear sensor to the engineering units you want it to output on the wire. In the **Network**  tree, select **Custom Translation Table #1, #2, or #3**. The **Properties** page has instructions. For the input to use the translation table, navigate to the input in the **Geographic**  tree, select the **Details** tab, then set **Sensor Type (Scaling Method)** to **Non-Linear, Custom Table #__**.

Switch and Jumper Positions

The **Switch and Jumper Positions** page shows the current physical settings on the ZN551.

To communicate through the Local Access port

Using a computer and a USB Link Kit, you can communicate locally with the ZN551 to download or to troubleshoot.

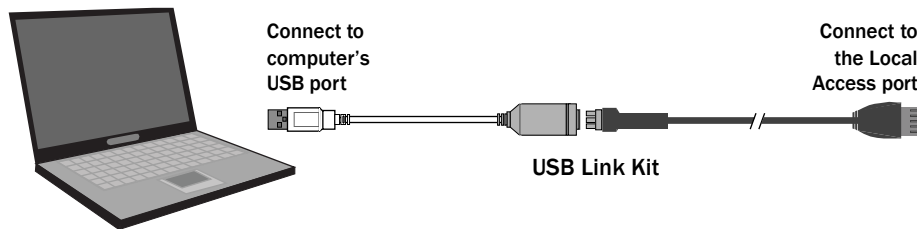
PREREQUISITES

- A computer with a USB port
- A USB Link Kit. See the *USB Link Kit Technical Instructions*.
NOTE The USB Link Kit driver is installed with a WebCTRL® v5 or later system. But if needed, you can get the latest driver from <http://www.silabs.com/products/mcu/Pages/USBtoUARTBridgeVCPDrivers.aspx>. Install the driver before you connect the USB Link Kit to your computer.
- v1.70 or later controller driver



CAUTION If multiple controllers share power but polarity was not maintained when they were wired, the difference between the controller's ground and the computer's AC power ground could damage the USB Link Kit and the controller. If you are not sure of the wiring polarity, use a USB isolator between the computer and the USB Link Kit. Purchase a USB isolator online from a third-party manufacturer.

Connect the USB Link Kit to the computer and to the controller's Local Access port.



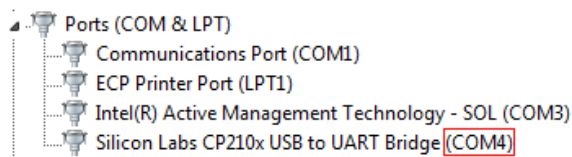
NOTE If using a USB isolator, plug the isolator into your computer's USB port, and then plug the USB Link Kit cable into the isolator.

To set up a Local Access connection in the WebCTRL® interface

For the WebCTRL® application to communicate with the Local Access port, you must do the following:

- 1 On the **System Configuration**  tree, select **Connections**.
- 2 On the **Configure** tab, click **Add**.
- 3 From the **Type** drop-down list, select **BACnet Local Access**.
- 4 Optional: Edit the **Description**.

- 5 Type the computer's **Port** number that the USB cable is connected to.
NOTE To find the port number, plug the USB cable into the computer's USB port, then select **Start > Control Panel > System > Device Manager > Ports (Com & LPT)**. The COM port number is beside **Silicon Labs CP210x USB to UART Bridge**.



- 6 Set the **Baud** rate to 115200.
- 7 Click **Accept**.
- 8 On the **View** tab, click the button next to the BACnet/IP network, then select **BACnet Local Access**.
- 9 Click **Accept**.
- 10 On the **Configure** tab, select **BACnet Local Access**, then click **Start**.
NOTE If an error message appears, make sure the COM port you selected is not in use. For example, PuTTY may be open and is holding the port open.
- 11 On the **Network**  tree, select the controller that you are connected to.
- 12 Click , then select **Manual Command**.
- 13 Type `rnet` here in the dialog box, then click **OK**.
- 14 On the **Properties** page, click **Module Status**. If a Modstat report appears, the WebCTRL® application is communicating with the controller.

Troubleshooting

If you have problems mounting, wiring, or addressing the ZN551, contact ALC Technical Support.

LED's

The LED's on the ZN551 show the status of certain functions.

If this LED is on...	Status is...
Power	The ZN551 has power
Rx	The ZN551 is receiving data from the network segment
Tx	The ZN551 is transmitting data over the network segment
DO#	The digital output is active

The **Run** and **Error** LED's indicate controller and network status.

If Run LED shows...	And Error LED shows...	Status is...
2 flashes per second	Off	Normal
2 flashes per second	2 flashes, alternating with Run LED	Five minute auto-restart delay after system error
2 flashes per second	3 flashes, then off	The controller has just been formatted
2 flashes per second	4 flashes, then pause	Two or more devices on this network have the same network address
2 flashes per second	1 flash per second	The controller is alone on the network
2 flashes per second	On	Obtain a Module Status Report (Modstat) to determine which of the following occurred: • Exec halted after frequent system errors • Control programs halted
5 flashes per second	On	Exec start-up aborted, Boot is running
5 flashes per second	Off	Firmware transfer in progress, Boot is running
7 flashes per second	7 flashes per second, alternating with Run LED	Ten second recovery period after brownout
14 flashes per second	14 flashes per second, alternating with Run LED	Brownout
On	On	Failure. Try the following solutions: • Turn the ZN551 off, then on. • Format the ZN551. • Download the ZN551. • Replace the ZN551.

NOTE If you resolve the issue but the **Error** LED does not turn off, cycle power to the controller.

Possible delay before control program starts

When you first apply power to the ZN551, it waits for up to 3 minutes to receive a time/date broadcast from its BACnet router. The ZN551 begins to run the control program only after it receives the time/date or when the 3 minute waiting period expires. If the ZN551 does not receive a time/date broadcast, it keeps the default setting of 6/12/2002 10:00:00 (am).

To format the controller

If you cannot communicate with a controller after downloading it, as a last resort, you can manually format the controller to erase its memory.

- 1 Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**.
- 2  Make sure the address switches are not set to 0, 0.
- 3 Short the **Format** jumper's pins and maintain the short for steps 3 and 4.
- 4 Insert the power screw terminal connector into the ZN551's power terminals.
- 5 Continue to short the jumper until the **Error** LED flashes three times in sync with the **Run** LED.
- 6 Remove the short.
- 7 Download the ZN551.

To get the ZN551's serial number

If you need the ZN551's serial number when troubleshooting, the number is on:

- a sticker on the back of the main controller board
- a Module Status report (Modstat) under **Core** (or **Main**) **board hardware**



```
Core board hardware:
Type=178, board=1, manufactured on 06/27/2013 S/N 021362247P
RAM: 512 kBytes; FLASH: 1024 kBytes, type = S
```

To obtain a modstat in the WebCTRL® interface:

- 1 Select the ZN551 in the **Network**  tree.
- 2 On the **Properties** page, click **Module Status**.

Recovering from a power outage

The ZN551 has a 10-year Lithium CR2032 battery that retains the following data for a maximum of 10,000 hours during power outages.

- Control programs
- Editable properties
- Trends
- Schedules

If the above data is lost after power returns, replace the battery and then download the ZN551. See instructions below.

To replace the ZN551's battery

If the ZN551 experiences a power outage and the control program stops functioning, replace the battery.

- 1 Verify that the ZN551's power is on.
- 2 Remove the battery from the controller, making note of the battery's polarity.
- 3 Insert the new battery into the controller, matching the polarity of the battery you removed.
- 4 Download the ZN551.

To take the ZN551 out of service

If needed for troubleshooting or start-up, you can prevent the WebCTRL® application from communicating with the ZN551.

- 1 On the WebCTRL® **Network**  tree, select the ZN551.
- 2 On the **Properties** page, check **Out of Service**.
- 3 Click **Accept**.

Compliance

FCC Compliance

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.



CAUTION Changes or modifications not expressly approved by the responsible party for compliance could void the user's authority to operate the equipment.

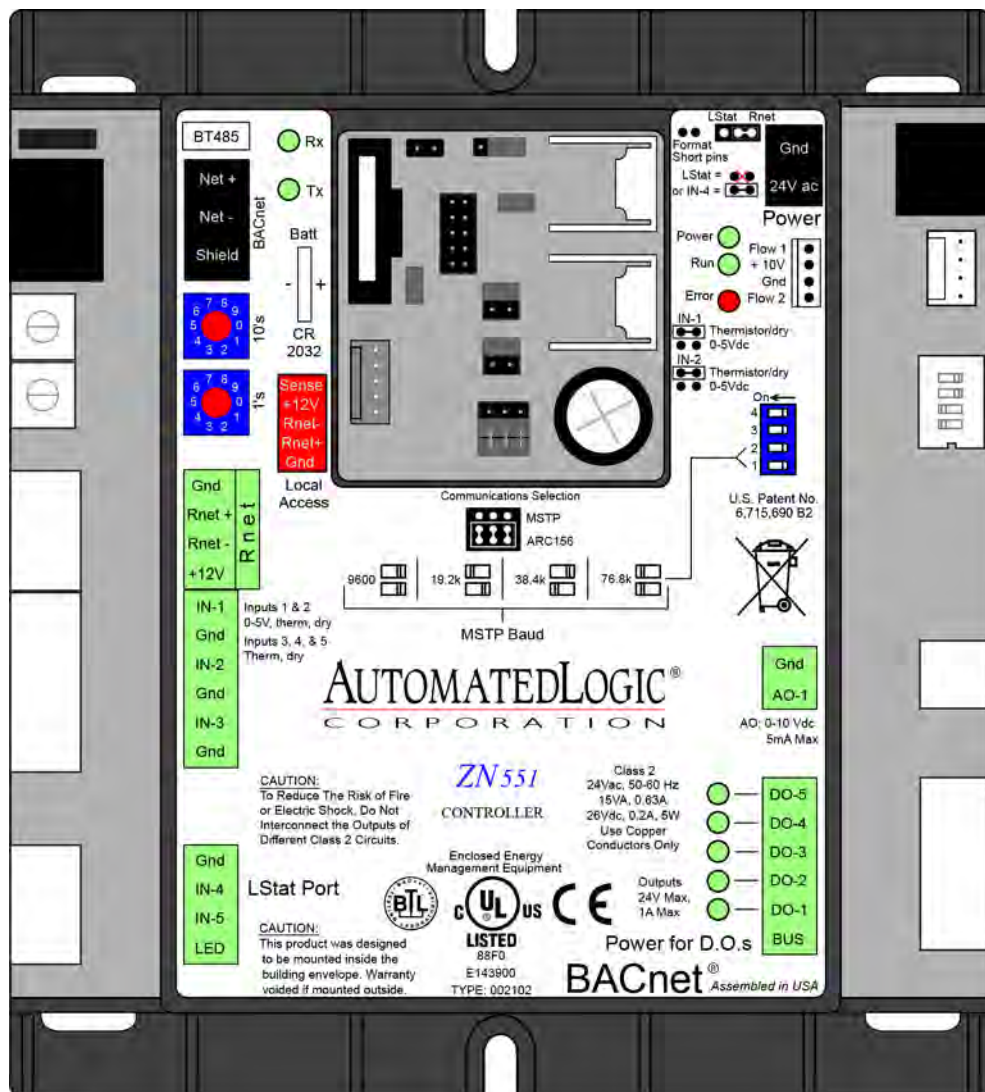
CE Compliance



WARNING This is a Class A product. In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate measures.

BACnet Compliance

Compliance of listed products to requirements of ASHRAE Standard 135 is the responsibility of BACnet International. BTL® is a registered trademark of BACnet International.



Document revision history

Important changes to this document are listed below. Minor changes such as typographical or formatting errors are not listed.

Date	Topic	Change description	Code*
2/7/17	Specifications	Added wireless sensors to the Rnet port specification.	X-D
	Zone sensors	Added wireless sensors to this topic.	
	Equipment Touch	Added Wireless Adapter to this topic.	
	Wiring inputs and outputs > Wiring specifications	Added Wireless Adapter to this topic.	
	Wiring devices to the Rnet port	Added Wireless Adapter to this topic.	
	To wire a Wireless Adapter to the ZN551	New topic.	
9/27/16	To set up a Local Access connection in the WebCTRL interface	Updated WebCTRL menu button in step 12.	A-D
	Appendix - ZN551 coverplate	Updated coverplate	A-D
4/20/15	Entire document	New look, no content changes	A-D
11/14/14	BACnet Compliance	Changed BACnet Manufacturers Association to BACnet International	X-D-CP-MW
10/7/14	Driver	Added the Network Microblock fields	A-TS-RB-F
9/4/14	LED's	Changed the Status description for when the Run LED shows 2 flashes per second and the Error LED is On. Also added a note below the table regarding cycling power to turn off Error LED.	A-TS-JM-F-BK
5/13/14	Specifications	Rnet Port: Added Equipment Touch and removed note about BACview® devices	A-D-CP-O-TC
	Equipment Touch devices	New topic	
	Wiring zone sensors to the ZN551	Changed to "Wiring devices to the ZN551's Rnet port"	
	To wire an Equipment Touch to the ZN551	New topic	
	Wiring a LogiStat sensor to the ZN551	New topic	
	To set up the driver > Driver	Added new driver property: TouchScreen Schedule Edit Enable	

* For internal use only

ZS Sensors

Technical Instructions

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Verify that you have the most current version of this document. Go to <https://accounts.automatedlogic.com>, then select **Support** > **Download** > **Documents** > **Hardware**. Important changes are listed in **Document revision history** at the end of this document.

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What are ZS sensors?

The ZS line of thermistor-based temperature sensors consist of:

- Zone sensors that may optionally sense humidity, CO₂, VOC, or motion
- Duct sensors for sensing temperature, temperature/humidity, or averaging temperature
- A pipe temperature sensor
- An immersion sensor
- Outdoor air sensors for sensing temperature or temperature/humidity

ZS Sensors are wired to the Rnet of the following Automated Logic® controllers:

- LGR line
- ME line
- SE line
- ZN line
- WebZONE
- Equipment Portal

The following table shows the ZS Sensor models, their features, and the available configurations.

Zone Sensors	Features	Available configurations
ZS Standard 	• Local access port • No user control	• Temperature only • Temperature and humidity • Temperature and VOC • Temperature and CO₂ • Temperature, humidity, and VOC • Temperature, humidity, and CO₂

Zone Sensors	Features	Available configurations
ZS Plus 	• Slide potentiometer to make the zone warmer or cooler •  button to override the schedule and put the zone in an occupied state, or force the zone to an unoccupied state • Green LED to indicate occupied state • Local access port	• Temperature only • Temperature and humidity • Temperature and VOC • Temperature and CO2 • Temperature, humidity, and VOC • Temperature, humidity, and CO2
ZS Pro 	• LCD display •  button to override the schedule and put the zone in an occupied state, or force the zone to an unoccupied state •  and  buttons to change any editable property, such as the setpoint temperature •  button to cycle through information defined in the control program • Green LED to indicate occupied state • Local access port • Optional motion sensor 	• Temperature only • Temperature and humidity • Temperature and VOC • Temperature and CO2 • Temperature, humidity, and VOC • Temperature, humidity, and CO2 • Temperature and motion • Temperature, humidity, and motion • Temperature, VOC, and motion • Temperature, CO2, and motion • Temperature, humidity, VOC, and motion • Temperature, humidity, CO2, and motion

Zone Sensors	Features	Available configurations
ZS Pro-F 	All of the ZS Pro's features plus: •  button to turn on heating, cooling, or fan only, or set to auto control. •  button to adjust fan speed • F/C button to set temperatures to Fahrenheit or Celsius	• Temperature only • Temperature and humidity • Temperature and VOC • Temperature and CO2 • Temperature, humidity, and VOC • Temperature, humidity, and CO2
Duct Sensors	Available configurations	
Temperature Sensor 	• 4 in. (10.16 cm) probe • 8 in. (20.32 cm) probe • Back or bottom probe *	
Temperature/Humidity Sensor 	• 5.3 in. (13.5 cm) probe • Back or bottom probe *	

Averaging Temperature Sensor



- 8 ft (2.44 m) flexible probe
- 12 ft (3.66 m) flexible probe
- 24 ft (7.32 m) flexible probe
- Back or bottom probe *

Pipe Sensor

Clamp-on Temperature Sensor



Immersion Sensor

Temperature Sensor



- 2 in. (5.08 cm) probe
- 4 in. (10.16 cm) probe
- Back or bottom probe *

Outdoor Air Sensor

Temperature Sensor

- Bottom probe *

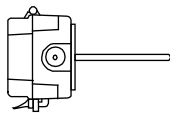


Temperature/Humidity Sensor

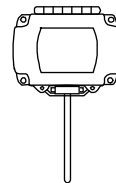
- Bottom probe *



* Back probe:



Bottom probe:



See the *ZS Sensor Application Guide* to configure the control program for the desired user interaction with the sensor.

See the *ZS Zone Sensor User Guide* to for basic user instructions for zone sensors.

Rnet configuration

You can use wireless sensors, ZS sensors, and an Equipment Touch on the same Rnet. The number of sensors you can use on a controller's Rnet depends on how many control programs it can have. If the controller supports:

- Only one control program, the Rnet can consist of:
 - Up to 5 ZS sensors
 - One Wireless Adapter supporting up to 5 wireless sensors
 - One Equipment Touch

NOTE You can have any combination of ZS and wireless sensors, but no more than 5 sensors total.

- Multiple control programs, the Rnet can consist of:
 - Up to 15 ZS sensors
 - One Wireless Adapter supporting up to 15 wireless sensors
 - One Equipment Touch

NOTES

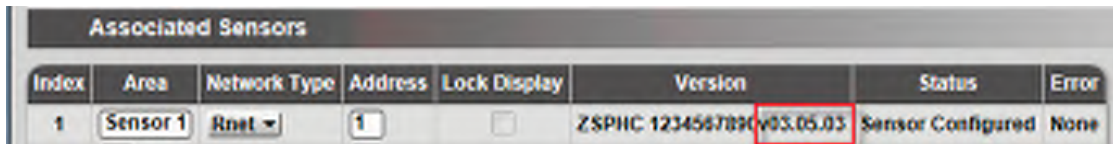
- You can have any combination of ZS and wireless sensors, but no more than 15 sensors total.
- You can have no more than 5 sensors per control program.

WARNING

Using Rnet tags 5, 6, or 7 in a control program that has a ZS Pro or Pro-F version 3.3.11 or earlier in a Sensor Binder microblock will disable the display on the ZS sensor. You must do one of the following to prevent this occurrence:

- Replace the ZS Pro or Pro-F with a newer one (v03.05.03 or later), and then contact ALC Technical Support for more information.
- Use 2 control programs if the controller supports multiple control programs, splitting the ZS Pro and wireless sensors between them.

To determine the ZS Pro or Pro-F version, go to the control program's **Logic** page in the WebCTRL® interface, and double-click the Sensor Binder microblock that contains the ZS sensor.



Index	Area	Network Type	Address	Lock Display	Version	Status	Error
1	Sensor 1	Rnet	1	☐	ZSPHC 123456789 v03.05.03	Sensor Configured	None

CAUTIONS

- You cannot have RS sensors on the same Rnet with any of the above devices.
- An Rnet can have more than one wireless Pro-F sensor, however, changing the setpoint on one Pro-F will not be reflected on the display of another Pro or Pro-F, possibly causing confusion for the user.

Rnet wiring specifications

The Rnet communicates at a rate of 115 kbps and should be wired in a daisy-chain, star, or hybrid configuration.

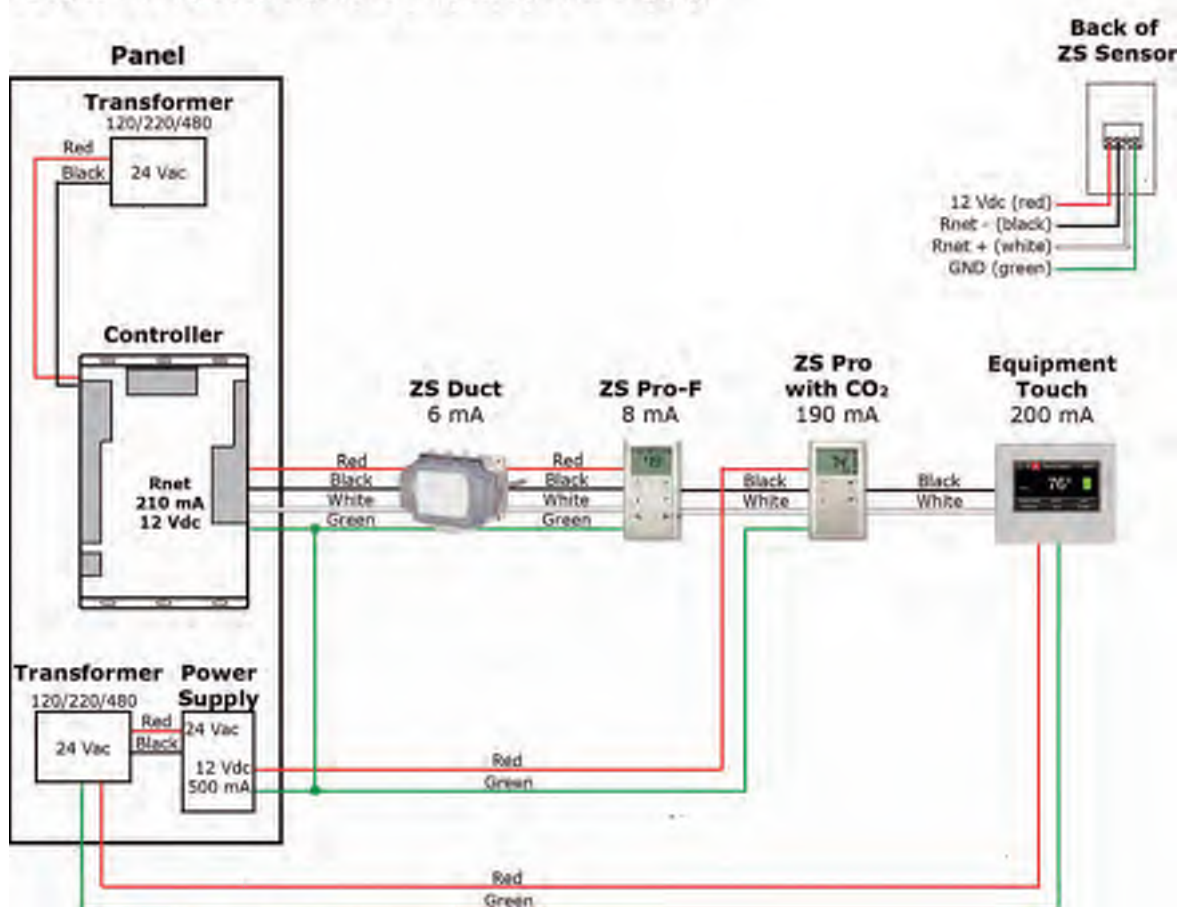
NOTE Use the specified type of wire and cable for maximum signal integrity.

Description	4 conductor, shielded or unshielded, CMP, plenum rated cable
Conductor	22 AWG (7x0096) bare copper
Maximum length	500 feet (152 meters)
Insulation	Low-smoke PVC (or equivalent)
Color Code	Black, white, green, red
Shielding	If shielded, Aluminum/Mylar shield (100% coverage) with TC drain wire
UL temperature rating	32–167 °F (0–75 °C)
Voltage	300 Vac, power limited
Listing	UL: NEC CL2P, or better

Power requirements

See the sensor specifications for power requirements and power supply information.

Sample wiring diagram with external power supply:



CAUTION Do not share power between controller's power and external 12 Vdc unless both devices are half wave.

ZS zone sensors

ZS Standard



ZS Plus



ZS Pro



ZS Pro with motion sensor



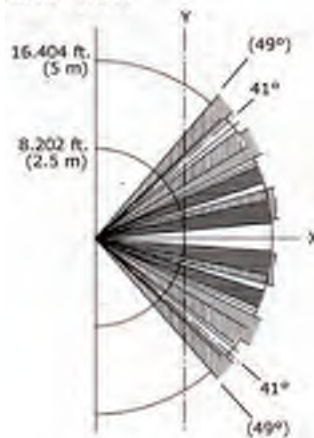
ZS Pro-F



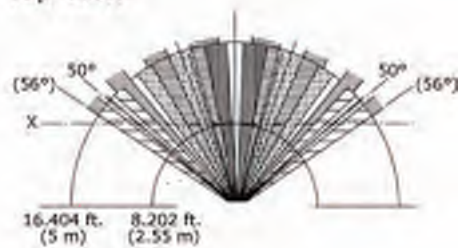
Specifications for ZS zone sensors

Sensing element accuracy		
Temperature	Temperature only: 32° to 122°F (0° to 50°C): ±0.36°F (0.2°C)	Temperature if humidity is included: 50° to 104°F (10° to 40°C): ±0.54°F (0.3°C)
Humidity	10% to 90%: ±1.8% typical. Less than 0.5% drift per year.	
CO ₂	400 to 1250 PPM: ±30 PPM or 3% of reading, whichever is greater 1250 to 2000 PPM: ±5% of reading plus 30 PPM See <i>CO₂ sensor installation</i> (page 11).	
VOC	0 to 2,000 CO ₂ PPM Equivalent: ±100PPM	
CO ₂ sensor type	Non-Dispersive Infrared (NDIR)	
Motion sensor type	Passive infrared (PIR)	
Motion sensor specifications	Detector distance:	16.4 in. (5 m)
	Detection range (HxV):	100° x 82°
	Movement speed:	2.62 to 3.94 ft/s (0.8 to 1.2 m/s)
	Detection object:	27.56 x 9.84 in. (700 x 250 mm)

Side View



Top View



Power requirements *	Temperature only		
	ZS Standard or ZS Plus:		12 Vdc @ 6 mA
	ZS Pro or Pro-F:		12 Vdc @ 7 mA
	Temperature with humidity		
	ZS Standard or ZS Plus:		12 Vdc @ 7 mA
	ZS Pro or Pro-F:		12 Vdc @ 8 mA
	Temperature with humidity and VOC - All models		12 Vdc @ 60 mA
	Temperature with humidity and CO ₂ - All models		12 Vdc @ 15 mA (idle) to 190 mA (CO ₂ measurement cycle)
	Temperature and CO ₂ - All models		12 Vdc @ 15 mA (idle) to 190 mA (CO ₂ measurement cycle)
* A ZS Pro with motion sensor has the same power requirements as a ZS Pro without a motion sensor.			
Power supply	The 4-conductor Rnet cable from a controller supplies +12 Vdc @ 210 mA. For additional power, use an external power supply. Use the above power requirements to calculate the size of the external power supply. The controller and the external power supply must share a common ground.		
Communication	115 kbps		
Local access port	For local access to start up and troubleshoot the system		
Environmental operating range	32 to 122 °F (0 to 50 °C), 10 to 90% relative humidity, non-condensing		
Mounting	Standard 4x2-in. electrical box using the 6-32 x 1/2" mounting screws provided		
Overall dimensions	Temperature sensor or temperature with humidity sensor	Width:	3 in. (7.62 cm)
		Height:	4-13/16 in. (12.22 cm)
		Depth:	13/16 in. (2.01 cm)
	Sensor with CO ₂ or VOC	Width:	2-7/8 in. (7.3 cm)
		Height:	4-13/16 in. (12.22 cm)
		Depth:	1-1/4 in. (3.18 cm)
Listed by	FCC Part 15-Subpart B-Class B, CE		

CO2 sensor installation

⚠ IMPORTANT Do not install ZS CO₂ sensors in continuous occupancy applications. For a ZS CO₂ sensor to maintain accuracy, it must be installed only in a zone that is unoccupied for at least 4 hours a day with enough air movement during the unoccupied period to return CO₂ to background levels.

A ZS sensor with CO₂ uses Automatic Background Calibration which waits for the lowest value in a 24-hour period that deviates no more than 40PPM for at least 15 minutes, and assigns that value to the 400PPM baseline. This daily Automatic Background Calibration may take up to 21 days to fully calibrate the sensor.

NOTE Dropping a sensor can upset the calibration, and it may require 21 days to return to our stated accuracy.

Motion sensor installation

The motion sensor on a ZS Pro needs to have a direct line of sight to the occupants in the room.

If the size of the room exceeds the maximum detector range, use multiple sensors to adequately monitor the area.

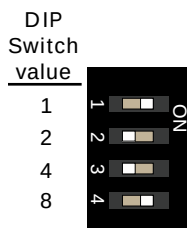
Avoid placing the sensor:

- In a location that has a direct line of sight through an open door to a hallway where the sensor could detect movement of people in the hallway.
- Near air ducts. Rapidly changing air currents from the air ducts could lead to false sensor readings.

To address a ZS zone sensor

Each ZS Sensor on an Rnet must have a unique address, but addresses do not have to be sequential.

Use the DIP switches on the back of the ZS zone sensor to set an address from 0 to 14. (0 is factory default.) Each DIP switch has the value shown in the figure below. Turn on as many DIP switches as you need so that their total value equals the address.



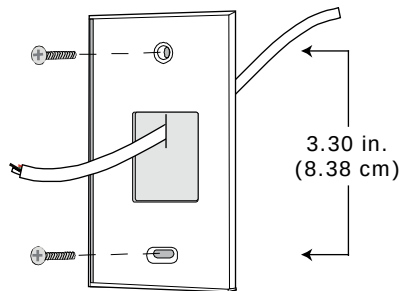
EXAMPLE DIP switches 1 and 4 above are on. Their values (1 + 4) total 5, so the sensor's address is 5.

To wire and mount a ZS zone sensor

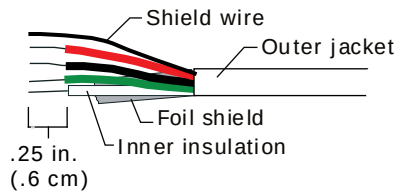
The Rnet communicates at a rate of 115 kbps and should be wired in a daisy-chain, star, or hybrid configuration.

PREREQUISITE The Rnet cable is wired to the controller. The shield wire and the ground wire should be inserted into the controller's GND terminal.

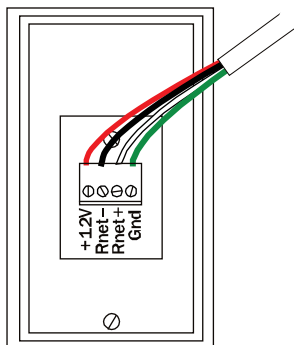
- 1 Turn off the controller's power.
- 2 Pull the backplate off the ZS Sensor. You may need to turn the setscrews in the bottom of the sensor clockwise until you can remove the backplate.
- 3 Pull the Rnet communication cable through the slit in the insulated backing material.



- 4 Use 2 screws to mount the backplate to the wall or outlet box.
Partially cut, then bend and pull off the outer jacket of the Rnet cable(s). Do not nick the inner insulation.



- 5 Strip about .25 inch (.6 cm) of the inner insulation from each wire.
- 6 If wiring 1 cable to the ZS Sensor, cut the shield wire off at the outer jacket, then wrap the cable with tape at the outer jacket to cover the end of the shield wire.
If wiring 2 cables in a daisy-chain configuration, twist together the shield wires, then wrap the shield wires with tape.
- 7 Insert the other 4 wires into the ZS Sensor's screw terminal connector. If wiring 2 cables, insert like-colored wires into each terminal.

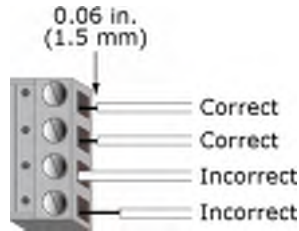


Automated Logic® recommends that you use the following Rnet wiring scheme:

Connect this wire...	To this terminal...
Red	+12V
Black	Rnet-
White	Rnet+
Green	Gnd



CAUTION Allow no more than 0.06 inch (1.5 mm) bare communication wire to protrude. If bare communication wire contacts the cable's foil shield, shield wire, or a metal surface other than the terminal block, the device may not communicate correctly.



- 8 Attach the sensor's cover and circuit board to the mounted backplate, inserting the top first.
- 9 Turn the setscrews one full turn counterclockwise so that the cover cannot be removed.
- 10 Turn on the controller's power.

NOTE Use the same polarity throughout the Rnet.

To communicate through a ZS zone sensor's local access port

You can connect to the Local Access port of a ZS zone sensor to perform test and balance or to make changes to any device on the network.

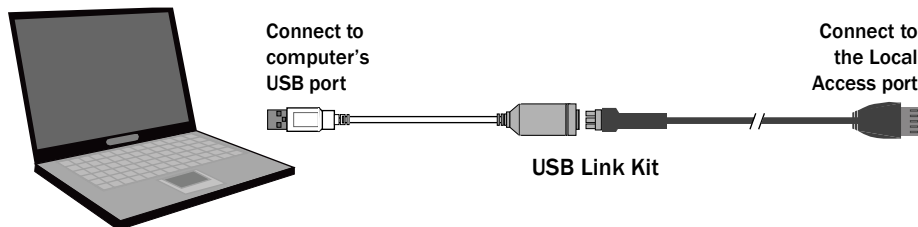
PREREQUISITES

- A computer with a USB port
- A USB Link Kit



CAUTION If multiple controllers share power but polarity was not maintained when they were wired, the difference between the controller's ground and the computer's AC power ground could damage the USB Link Kit and the controller. If you are not sure of the wiring polarity, use a USB isolator between the computer and the USB Link Kit. Purchase a USB isolator online from a third-party manufacturer.

Connect the USB Link Kit to the computer and to the ZS Sensor's Local Access port.



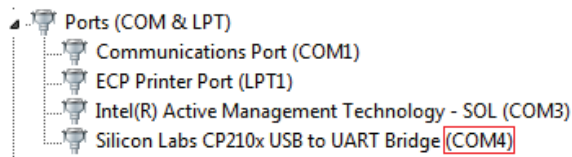
NOTE If using a USB isolator, plug the isolator into your computer's USB port, and then plug the USB Link Kit cable into the isolator.

To set up a Local Access connection in the WebCTRL® interface

For the WebCTRL® application to communicate with the Local Access port, you must do the following:

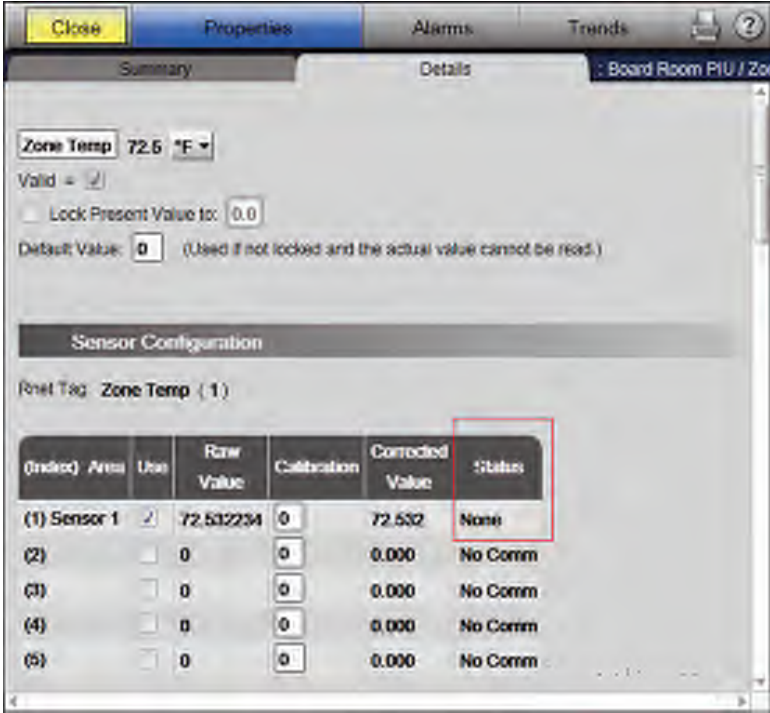
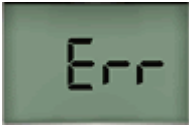
- 1 On the **System Configuration**  tree, select **Connections**.
- 2 On the **Configure** tab, click **Add**.
- 3 From the **Type** drop-down list, select **BACnet Local Access**.
- 4 Optional: Edit the **Description**.
- 5 Type the computer's **Port** number that the USB cable is connected to.

NOTE To find the port number, plug the USB cable into the computer's USB port, then select **Start > Control Panel > System > Device Manager > Ports (Com & LPT)**. The COM port number is beside **Silicon Labs CP210x USB to UART Bridge**.



- 6 Set the **Baud** rate to 115200.
- 7 Click **Accept**.
- 8 On the **View** tab, click the button next to the BACnet/IP network, then select **BACnet Local Access**.
- 9 Click **Accept**.
- 10 On the **Configure** tab, select **BACnet Local Access**, then click **Start**.
NOTE If an error message appears, make sure the COM port you selected is not in use. For example, PuTTY may be open and is holding the port open.
- 11 On the **Network**  tree, select the controller that you are connected to.
- 12 Click , then select **Manual Command**.
- 13 Type `rnet` here in the dialog box, then click **OK**.
- 14 On the **Properties** page, click **Module Status**. If a Modstat report appears, the WebCTRL® application is communicating with the controller.

Troubleshooting a ZS Pro or ZS Pro-F

If display shows...	Then...
Incorrect or missing values	Check for errors in WebCTRL®. On the control program's Properties page, select the Rnet Points tab. Verify that values coming in from the sensors and those going out to the sensors are expected values. On the control program's Logic page, double-click the Sensor Binder and ASVI microblocks to check for problems in the Status and/or Error columns.
	
	If the Error column shows Resource Allocation, try formatting the sensor. If the error is not corrected by formatting, the control program engineer should reduce the number of items that the sensor is trying to display.
Nothing	The sensor has no power.
	The sensor is not communicating with the network. Check: • Software/addressing setup • Wiring connections • Controller operating status
Characters that seem out of place	The sensor may have a memory problem. Try formatting the sensor.

Effective setpoints fields

These fields display the effective setpoint values. They can display a maximum value of 99 or 99.5 if the **Edit Increment** is set to 0.5. If the effective setpoint exceeds this maximum value or if the **Edit Increment** is set to 0.1, the value will flash.



TIP If you need an Edit Increment of 0.1, put the effective setpoints on the Information screen in the Primary Value field. Hide the effective setpoints on the Home screen by selecting **Sensor Setpoint Adjust Option 4** on the **BACnet Setpoint** microblock's **Rnet** tab.

ZS duct sensors

Duct Temperature Sensor



Available with:

- 4 in. (10.16 cm) probe
- 8 in. (20.32 cm) probe
- Back or bottom probe *

Duct Temperature/Humidity Sensor



Available with:

- 5.3 in. (13.5 cm) probe
- Back or bottom probe *

Duct Temperature Averaging Sensor



Available with:

- 8 ft (2.44 m) flexible probe
- 12 ft (3.66 m) flexible probe
- 24 ft (7.32 m) flexible probe
- Back or bottom probe *

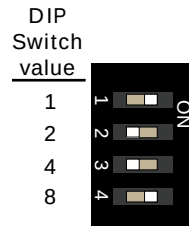
* Sensors with back probes (as shown) are to be mounted on the outside of ductwork. Sensors with bottom probes are to be mounted on the inside of ductwork.

Specifications for ZS duct sensors

Sensing element		
Temperature	Range: Accuracy:	20° to 120°F (-5° to 50°C) ±0.36°F (0.2°C)
Humidity	Range: Accuracy:	10% to 90% Humidity is calibrated at 73°F (23°C). ±2.0% typical. Less than 0.5% drift per year.
Sensor		
Temperature	Range: Accuracy:	20° to 120°F (-5° to 50°C) ±0.9°F (0.5°C)
Humidity	Range: Accuracy:	10% to 90% Humidity is calibrated at 73°F (23°C). ±2.0% typical. Less than 0.5% drift per year.
Enclosure material	Polycarbonate, UL94V-0	
Enclosure rating	NEMA 4, IP66, UV rated	
Enclosure dimensions	Width: Height: Depth:	5 in. (12.7 cm) 4.15 in. (10.54 cm) 2.5 in. (6.35 cm)
Probe	- Temperature sensor probe: 304 SS 0.25 in. (0.64 cm) diameter Length (4 or 8 in.) specified at time of order - Temperature/humidity sensor probe: ABS with SS filter 1.0 in. (2.5 cm) diameter 5.3 in. (13.5 cm) length - Averaging temperature sensor probe: Bendable aluminum 3/16 in. diameter Length of 8, 12, or 24 ft. specified at time of order	
Power requirements	12 Vdc @ 6 mA	
Power supply	The 4-conductor Rnet cable from a controller supplies +12 Vdc @ 210 mA. For additional power, use an external power supply. Use the above power requirements to calculate the size of the external power supply. The controller and the external power supply must share a common ground.	
Communication	115 kbps	
Environmental operating range	-40 to 158°F (-40 to 70°C)	
Mounting	Duct mount with #8 sheet metal screws	
Listed by	FCC Part 15-Subpart B-Class B, CE	

To address a ZS duct sensor

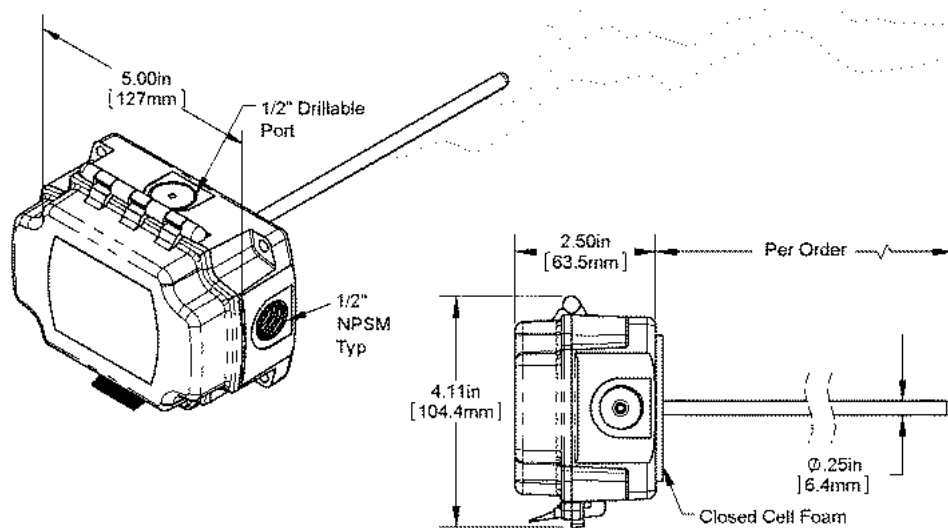
Each ZS Sensor on an Rnet must have a unique address, but addresses do not have to be sequential. Open the hinged cover on the sensor enclosure, and then use the DIP switches to set an address from 0 to 14. (0 is factory default.) Each DIP switch has the value shown in the figure below. Turn on as many DIP switches as you need so that their total value equals the address.



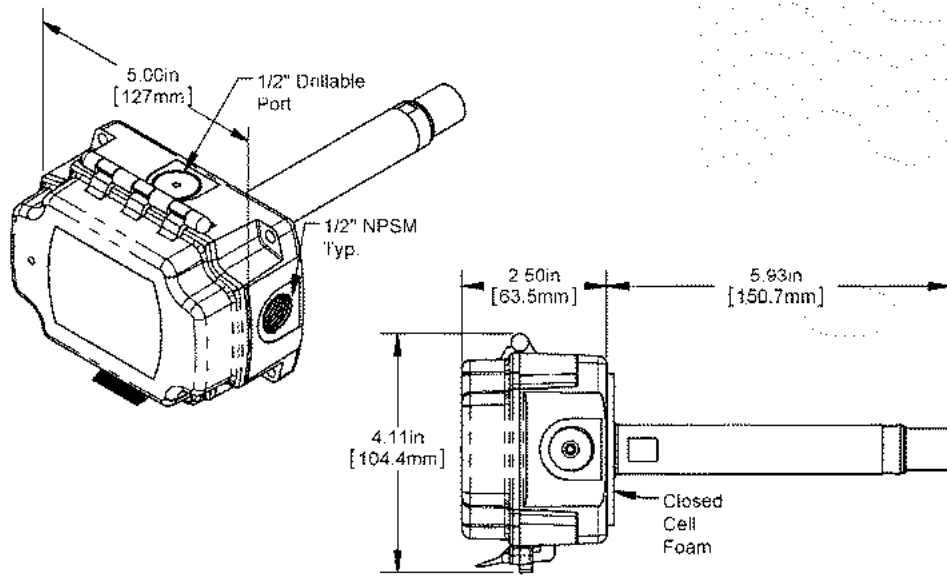
EXAMPLE DIP switches 1 and 4 above are on. Their values (1 + 8) total 9, so the sensor's address is 9.

To mount a ZS duct temperature or temperature/humidity sensor

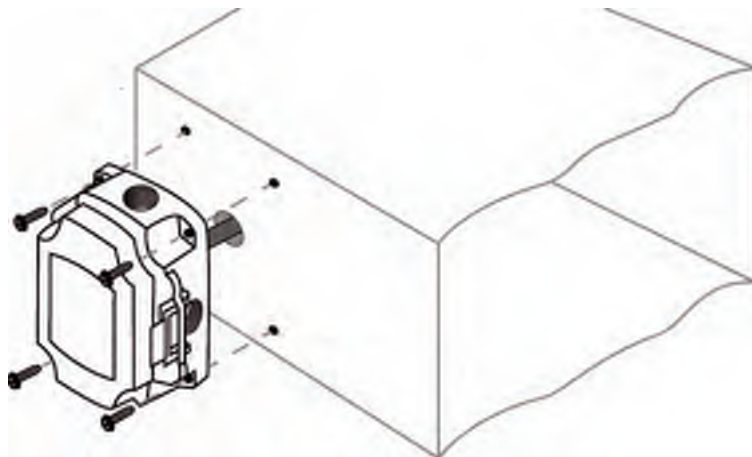
Temperature sensor



Temperature/Humidity sensor

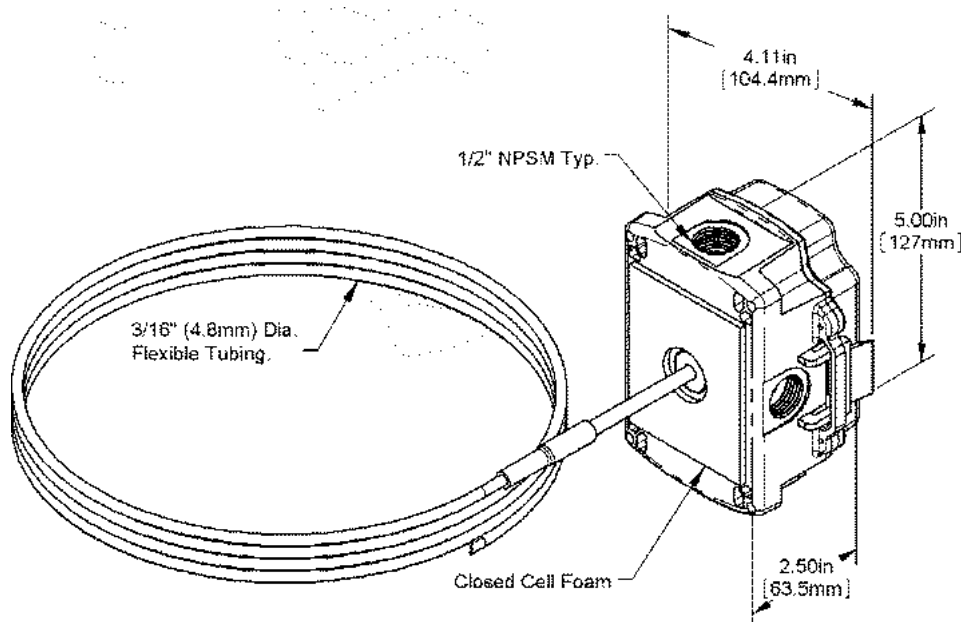


- 1 Determine the best location on the duct for the sensor. Mount the sensor:
 - In the middle of the duct away from temperature stratified air, coils, or humidifiers
 - At least 3 duct diameters away from humidifiers.
 - 2 Unlatch and open the hinged door on the sensor's enclosure.
 - 3 Remove the sensor's knockout that is appropriate for your application. When you wire the sensor, you will pull the Rnet communication cable through this hole. See *To wire a ZS duct sensor* (page 21).
 - 4 Close the enclosure door until it latches.
 - 5 If mounting the sensor to the outside of the duct, drill a hole in the duct for the probe, and then insert the probe into the hole.
 - Temperature probe - Drill a .38 in. (.96 cm) hole
 - Temperature/humidity probe - Drill a 1 in. (2.54 cm) hole
 - 6 Push the sensor enclosure against the duct and mark the location of each screw hole in the 4 corners of the enclosure.
 - 7 Remove the sensor, and a drill 1/8 inch pilot screw hole where you made each mark in the previous step.
 - 8 Use #8 sheet metal screws to attach the enclosure to the duct.
- NOTE** You must use a minimum of 2 mounting screws in opposite corners of the enclosure.



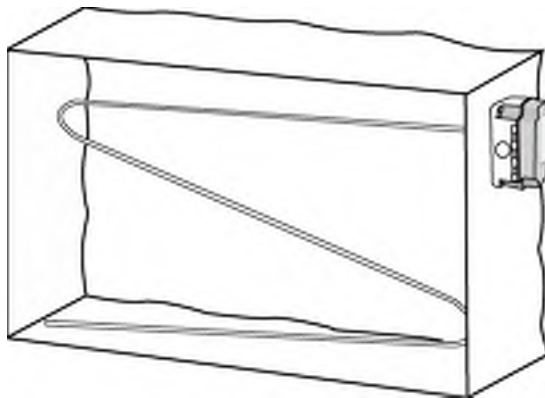
- 9 Tighten the screws so that the foam backing on the enclosure is depressed to prevent air leakage, but do not overtighten or strip the screw threads.

To mount a ZS duct averaging temperature sensor

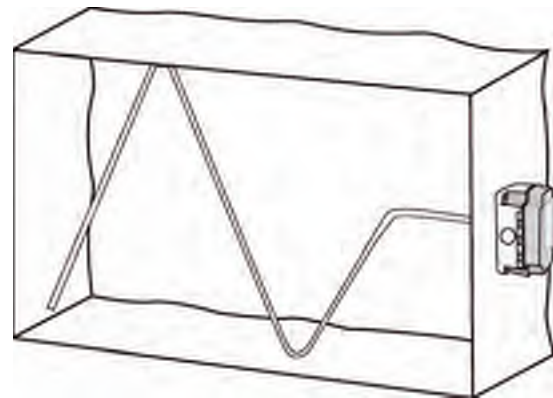


- 1 Determine the best location on the duct for the sensor. Mount the sensor in the middle or top of the duct as shown below so that the flexible probe can enter the duct in a convenient place.
- 2 Unlatch and open the hinged door on the sensor's enclosure.
- 3 Remove the sensor's knockout that is appropriate for your application. The knockouts for indoor versus outdoor applications are noted inside the enclosure. When you wire the sensor, you will pull the Rnet communication cable through this hole. See *To wire a ZS duct sensor* (page 21).
- 4 Close the enclosure door until it latches.

- 5 If mounting the sensor to the outside of the duct, drill a .38 in. (.96 cm) hole in the duct for the sensor probe. Insert the sensor probe into the hole by unrolling it into the duct carefully to avoid kinking it.
 - 6 Push the sensor enclosure against the duct and mark the location of each screw hole in the 4 corners of the enclosure.
 - 7 Pull the enclosure away from the duct, and a drill 1/8 inch pilot screw hole where you made each mark in the previous step.
 - 8 Push the enclosure against the duct, and then use #8 sheet metal screws to attach the enclosure to the duct.
- NOTE** You must use a minimum of 2 mounting screws in opposite corners of the enclosure.
- 9 Tighten the screws so that the foam backing on the enclosure is depressed to prevent air leakage, but do not overtighten or strip the screw threads.
 - 10 Serpentine the duct with the sensor probe at least twice across the stratified air in the duct to achieve the best average temperature reading. At the turns, use the provided cable ties to attach the sensor probe to the duct.



Best for vertical stratification



Best for horizontal stratification

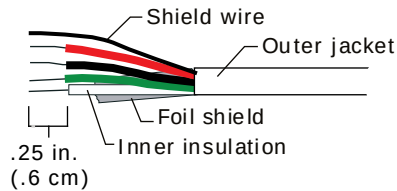
To wire a ZS duct sensor

NOTES

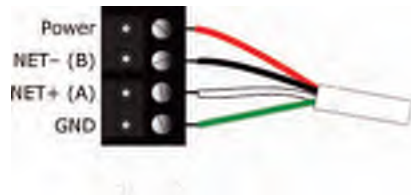
- Do not drill into the sensor's watertight enclosure which will violate the NEMA and/or IP rating.
- Use caulk or Teflon tape for your conduit entries to maintain the appropriate NEMA or IP rating for your application.
- For outdoor or wet applications, conduit entry should be from the bottom of the enclosure.

PREREQUISITE The Rnet cable is wired to the controller. The shield wire and the ground wire should be inserted into the controller's GND terminal.

- 1 Turn off the controller's power.
- 2 Partially cut, then bend and pull off the outer jacket of the Rnet cable(s). Do not nick the inner insulation.



- 3 Strip about .25 inch (.6 cm) of the inner insulation from each wire.
- 4 Unlatch and open the hinged door on the sensor's enclosure.
- 5 Pull the Rnet communication cable through the knockout hole.
- 6 If wiring 1 cable to the sensor, cut the shield wire off at the outer jacket, then wrap the cable with tape at the outer jacket to cover the end of the shield wire.
If wiring 2 cables in a daisy-chain configuration, twist together the shield wires, then wrap the shield wires with tape.
- 7 Insert the other 4 wires into the sensor's screw terminal connector. If wiring 2 cables, insert like-colored wires into each terminal.

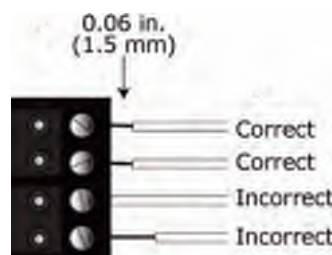


Automated Logic® recommends that you use the following Rnet wiring scheme:

Connect this wire...	To this terminal...
Red	Power
Black	NET-
White	NET+
Green	GND



CAUTION Allow no more than 0.06 inch (1.5 mm) bare communication wire to protrude. If bare communication wire contacts the cable's foil shield, shield wire, or a metal surface other than the terminal block, the device may not communicate correctly.



- 8 Close and latch the sensor's door.
- 9 Turn on the controller's power.

NOTE Use the same polarity throughout the Rnet.

Humidity filter maintenance

The temperature/humidity sensor has a sintered filter that protects the humidity sensor from various airborne particles. The filter can become dirty and may need periodic cleaning. Symptoms of a dirty filter are that the humidity sensor is slow to respond or consistently reports incorrect values.

To clean the filter:

- 1 Gently unscrew the filter from the probe.
- 2 Rinse the filter in warm soapy water, and then rinse in clean water. You can use a nylon brush if needed.
- 3 Gently screw the clean filter all the way into the probe. Hand tighten only.

ZS pipe clamp-on temperature sensor

This sensor is primarily used to determine the fluid temperature in a pipe by reading the temperature of the pipe.

Pipe Clamp-on Temperature Sensor



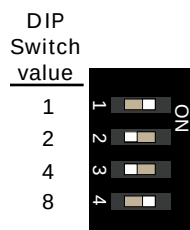
Specifications for ZS pipe temperature sensor

Sensing element	Range:	20° to 120° F (-5° to 50° C)
	Accuracy:	±0.36° F (0.2° C)
Sensor	Range:	20° to 120° F (-5° to 50° C)
	Accuracy:	±0.9° F (0.5° C)
Enclosure material	Polycarbonate, UL94V-0	
Enclosure rating	NEMA 4, IP66, UV rated	

Enclosure dimensions	Width: 5 in. (12.7 cm) Height: 4.15 in. (10.54 cm) Depth: 2.5 in. (6.35 cm)
Sensor pad	1.25" (3.18 cm) diameter copper
Power requirements	12 Vdc @ 6 mA
Power supply	The 4-conductor Rnet cable from a controller supplies +12 Vdc @ 210 mA. For additional power, use an external power supply. Use the above power requirements to calculate the size of the external power supply. The controller and the external power supply must share a common ground.
Communication	115 kbps
Environmental operating range	-40 to 158°F (-40 to 70°C)
Mounting	.5 in. (1.27 cm) stainless steel worm gear hose clamp
Listed by	FCC Part 15-Subpart B-Class B, CE

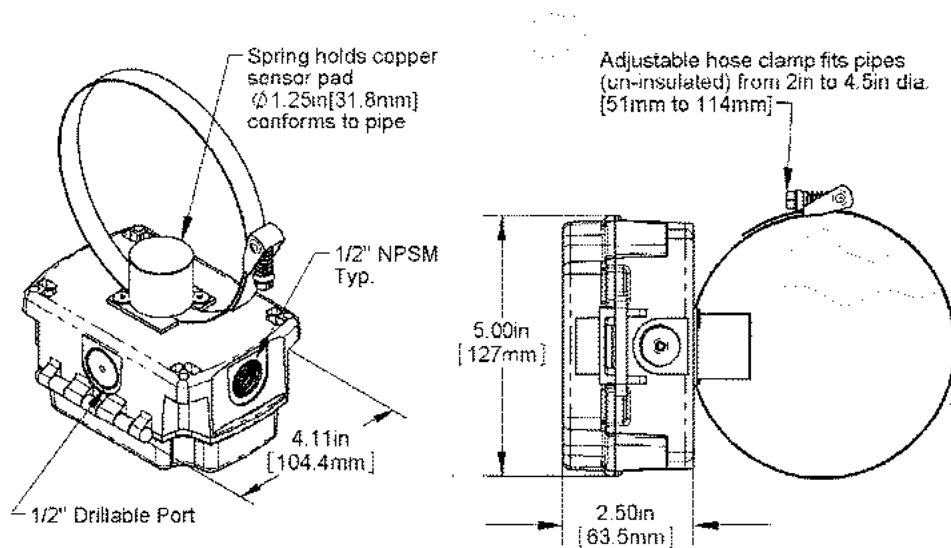
To address a ZS pipe temperature sensor

Each ZS Sensor on an Rnet must have a unique address, but addresses do not have to be sequential. Open the hinged cover on the sensor enclosure, and then use the DIP switches to set an address from 0 to 14. (0 is factory default.) Each DIP switch has the value shown in the figure below. Turn on as many DIP switches as you need so that their total value equals the address.



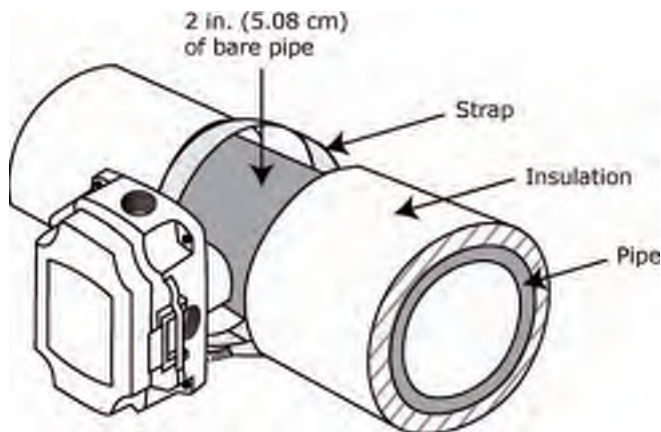
EXAMPLE DIP switches 1 and 4 above are on. Their values (1 + 8) total 9, so the sensor's address is 9.

To mount a ZS pipe temperature sensor



- 1 Unlatch and open the hinged door on the sensor's enclosure.
- 2 Remove the sensor's knockout that is appropriate for your application. The knockouts for indoor versus outdoor applications are noted inside the enclosure. When you wire the sensor, you will pull the Rnet communication cable through this hole. See *To wire a ZS pipe temperature sensor* (page 26).
- 3 Close the enclosure door until it latches.
- 4 If the pipe has insulation, remove a 2 in. (5.08 cm) strip around the circumference of the pipe where the sensor will be located. The copper sensor plate and stainless steel strap must directly contact the metal or plastic pipe. Nothing should be between the copper plate and the bare pipe.
- 5 Lift up on the clamp screw to release the stainless steel strap from the clamp.
- 6 Wrap the sensor's strap around the pipe, and then insert the strap into the clamp.
- 7 Push the clamp screw down against the strap, and then turn the screw to tighten the strap enough so that the sensor does not rotate around the pipe, but only enough so that the foam is compressed no more than 50%.

- 8** If the pipe does not have insulation, add pipe insulation on either side of the sensor to prevent airflow from affecting the temperature readings. The insulation should:
- Be at least 1 in. thick, but only cover the sensor enclosure to the door hinge.
 - Extend a minimum of 4 pipe diameters away from the sensor. For example, a 2 in. (5.08 cm) pipe should have 8 in. (20.32 cm) of insulation on each side of the sensor.



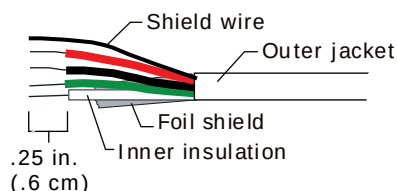
To wire a ZS pipe temperature sensor

NOTES

- Do not drill into the sensor's watertight enclosure which will violate the NEMA and/or IP rating.
- Use caulk or Teflon tape for your conduit entries to maintain the appropriate NEMA or IP rating for your application.
- For outdoor or wet applications, conduit entry should be from the bottom of the enclosure.

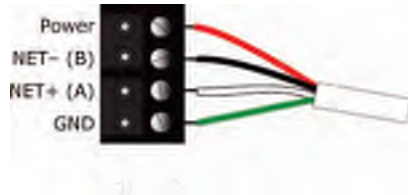
PREREQUISITE The Rnet cable is wired to the controller. The shield wire and the ground wire should be inserted into the controller's GND terminal.

- 1** Turn off the controller's power.
- 2** Partially cut, then bend and pull off the outer jacket of the Rnet cable(s). Do not nick the inner insulation.



- 3** Strip about .25 inch (.6 cm) of the inner insulation from each wire.
- 4** Unlatch and open the hinged door on the sensor's enclosure.
- 5** Pull the Rnet communication cable through the knockout hole.

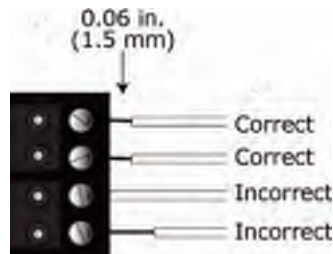
- 6 If wiring 1 cable to the sensor, cut the shield wire off at the outer jacket, then wrap the cable with tape at the outer jacket to cover the end of the shield wire.
If wiring 2 cables in a daisy-chain configuration, twist together the shield wires, then wrap the shield wires with tape.
- 7 Insert the other 4 wires into the sensor's screw terminal connector. If wiring 2 cables, insert like-colored wires into each terminal.



Automated Logic® recommends that you use the following Rnet wiring scheme:

Connect this wire...	To this terminal...
Red	Power
Black	NET-
White	NET+
Green	GND

CAUTION Allow no more than 0.06 inch (1.5 mm) bare communication wire to protrude. If bare communication wire contacts the cable's foil shield, shield wire, or a metal surface other than the terminal block, the device may not communicate correctly.



- 8 Close and latch the sensor's door.
- 9 Turn on the controller's power.

NOTE Use the same polarity throughout the Rnet.

ZS immersion temperature sensor

This sensor is primarily used to measure temperature in water pipes, water tanks, or cooling tower sump applications. An immersion sensor is mounted in a thermowell (purchased separately from Automated Logic®).

Immersion Temperature Sensor



Available with:

- 2 in. (5.08 cm) probe
- 4 in. (10.16 cm) probe
- Back or bottom probe

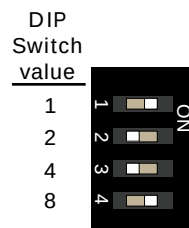
Specifications for ZS immersion temperature sensor

Sensing element	Range: 20° to 120° F (-5° to 50° C) Accuracy: ±0.36° F (0.2° C)
Sensor	Range: 20° to 120° F (-5° to 50° C) Accuracy: ±0.9° F (0.5° C)
Enclosure material	Polycarbonate, UL94V-0
Enclosure rating	NEMA 4, IP66, UV rated
Enclosure dimensions	Width: 5 in. (12.7 cm) Height: 4.15 in. (10.54 cm) Depth: 2.5 in. (6.35 cm)
Probe	304 SS 0.25" (0.64 cm) diameter 2 or 4 in. (5.08 or 10.16 cm) length specified at time of order
Power requirements	12 Vdc @ 6 mA
Power supply	The 4-conductor Rnet cable from a controller supplies +12 Vdc @ 210 mA. For additional power, use an external power supply. Use the above power requirements to calculate the size of the external power supply. The controller and the external power supply must share a common ground.
Communication	115 kbps
Environmental operating range	-40 to 158° F (-40 to 70° C)

Mounting	Sensor's 1/2 in. NPSM plastic threads are screwed into a thermowell
Listed by	FCC Part 15-Subpart B-Class B, CE

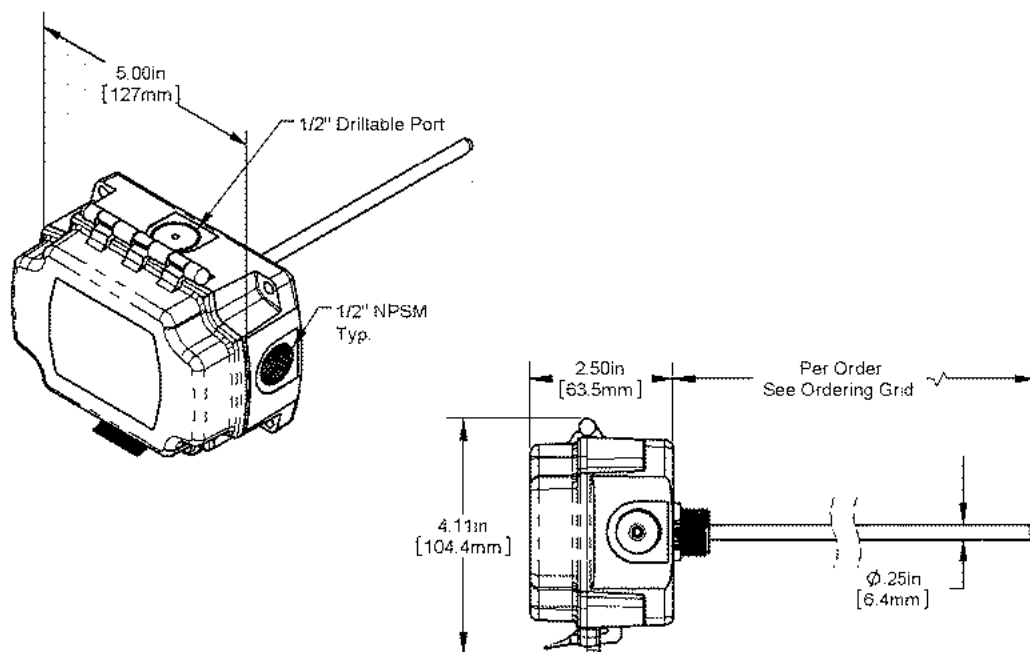
To address a ZS immersion temperature sensor

Each ZS Sensor on an Rnet must have a unique address, but addresses do not have to be sequential. Open the hinged cover on the sensor enclosure, and then use the DIP switches to set an address from 0 to 14. (0 is factory default.) Each DIP switch has the value shown in the figure below. Turn on as many DIP switches as you need so that their total value equals the address.

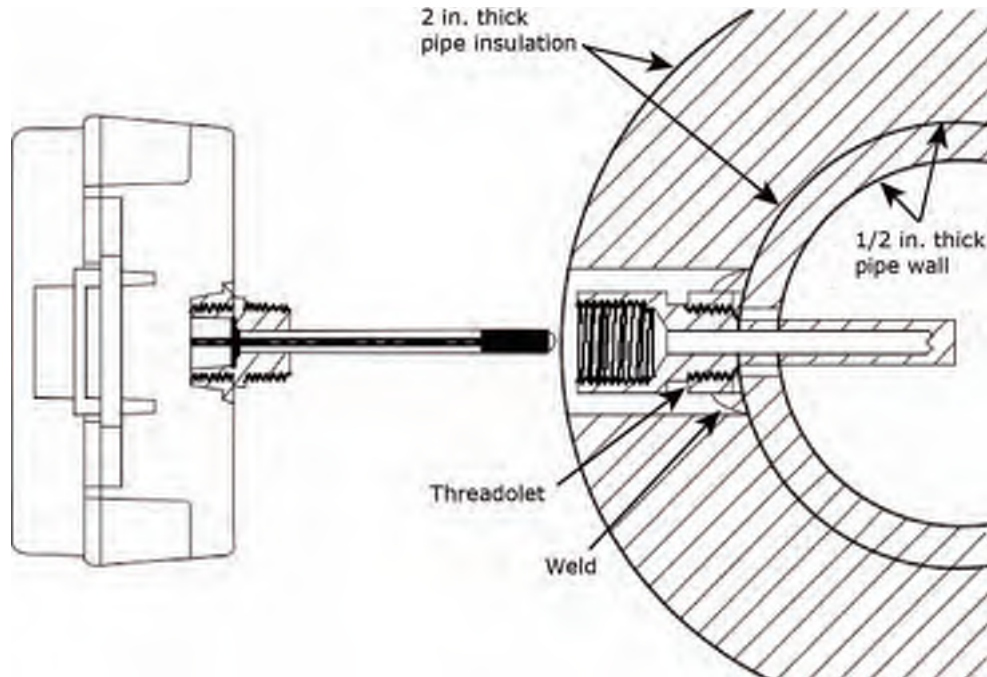


EXAMPLE DIP switches 1 and 4 above are on. Their values (1 + 8) total 9, so the sensor's address is 9.

To mount a ZS immersion temperature sensor



An immersion sensor is mounted in a thermowell (purchased separately from Automated Logic®), a hollow tube closed off on one end and threaded at the other end. A thermowell is permanently installed in pipes, tanks or sumps so that an immersion sensor can be inserted into the thermowell to measure the content's temperature. The temperature is transferred through the wall to the thermowell to the sensor. The thermowell prevents the contents of the pipe from escaping and holds in the pressure of pressurized pipes.



To install the thermowell (typically performed by a pipe fitter)

- 1 Drill a 3/4 in. hole in the pipe where the thermowell is needed.
- 2 Weld a Threadolet or Weldolet fitting (not provided) over the hole.
- 3 Thread sealant such as Teflon tape or pipe dope to the 1/2 in. NPT threads of the thermowell.
- 4 Insert the thermowell into the threadolet and tighten.

To install the immersion sensor

- 1 Insert the immersion sensor probe into the thermowell.
- 2 Screw the sensor's enclosure into the thermowell; hand-tighten until snug.
- 3 Unlatch and open the hinged door on the sensor's enclosure.
- 4 Push on the probe until it stops so that the probe is touching the bottom of the thermowell.
- 5 Close the enclosure door until it latches.

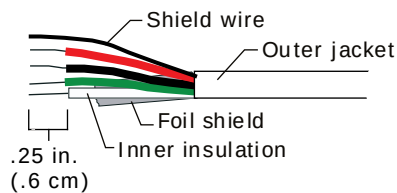
To wire a ZS immersion temperature sensor

NOTES

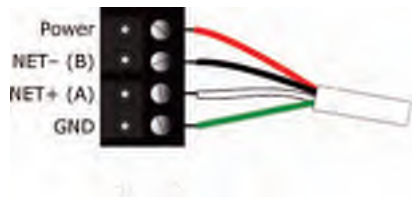
- Do not drill into the sensor's watertight enclosure which will violate the NEMA and/or IP rating.
- Use caulk or Teflon tape for your conduit entries to maintain the appropriate NEMA or IP rating for your application.
- For outdoor or wet applications, conduit entry should be from the bottom of the enclosure.

PREREQUISITE The Rnet cable is wired to the controller. The shield wire and the ground wire should be inserted into the controller's GND terminal.

- 1 Turn off the controller's power.
- 2 Partially cut, then bend and pull off the outer jacket of the Rnet cable(s). Do not nick the inner insulation.



- 3 Strip about .25 inch (.6 cm) of the inner insulation from each wire.
- 4 Unlatch and open the hinged door on the sensor's enclosure.
- 5 Pull the Rnet communication cable through the knockout hole.
- 6 If wiring 1 cable to the sensor, cut the shield wire off at the outer jacket, then wrap the cable with tape at the outer jacket to cover the end of the shield wire.
If wiring 2 cables in a daisy-chain configuration, twist together the shield wires, then wrap the shield wires with tape.
- 7 Insert the other 4 wires into the sensor's screw terminal connector. If wiring 2 cables, insert like-colored wires into each terminal.

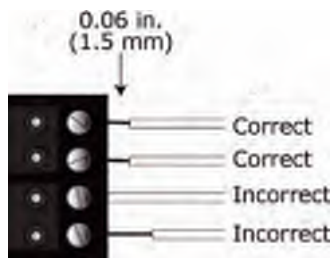


Automated Logic® recommends that you use the following Rnet wiring scheme:

Connect this wire...	To this terminal...
Red	Power
Black	NET-
White	NET+
Green	GND



CAUTION Allow no more than 0.06 inch (1.5 mm) bare communication wire to protrude. If bare communication wire contacts the cable's foil shield, shield wire, or a metal surface other than the terminal block, the device may not communicate correctly.



8 Close and latch the sensor's door.

9 Turn on the controller's power.

NOTE Use the same polarity throughout the Rnet.

ZS outdoor air temperature sensors

ZS outdoor sensors measure temperature or temperature/humidity.

Outdoor Temperature Sensor



Bottom probe only

Outdoor Temperature/Humidity Sensor

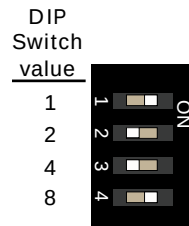


Specifications for ZS outdoor air sensors

Sensing element		
Temperature	Range: Accuracy:	20° to 120°F (-5° to 50°C) ±0.36°F (0.2°C)
Humidity	Range: Accuracy:	10% to 90% Humidity is calibrated at 73°F (23°C). ±2.0% typical. Less than 0.5% drift per year.
Sensor		
Temperature	Range: Accuracy:	20° to 120°F (-5° to 50°C) ±0.9°F (0.5°C)
Humidity	Range: Accuracy:	10% to 90% Humidity is calibrated at 73°F (23°C). ±2.0% typical. Less than 0.5% drift per year.
Enclosure material	Polycarbonate, UL94V-0	
Enclosure rating	NEMA 4, IP66, UV rated	
Probe	- Temperature sensor probe: Vented polycarbonate shield, .5 in. (1.27 cm) OD 1.2 in. (3.05 cm) - Temperature/humidity sensor probe: ABS with SS filter 1.0 in. (2.5 cm) diameter 2.4 in. (6.1 cm) length	
Enclosure dimensions	Width: Height: Depth:	5 in. (12.7 cm) 4.15 in. (10.54 cm) 2.5 in. (6.35 cm)
Sensing element shield	Vented polycarbonate shield 0.5 in. (1.27 cm) outside diameter 1.2 in. (3.05 cm) long with 1/2 in. NPT threads	
Power requirements	12 Vdc @ 6 mA	
Power supply	The 4-conductor Rnet cable from a controller supplies +12 Vdc @ 210 mA. For additional power, use an external power supply. Use the above power requirements to calculate the size of the external power supply. The controller and the external power supply must share a common ground.	
Communication	115 kbps	
Environmental operating range	-40 to 158°F (-40 to 70°C)	
Mounting	3/16 in. holes	
Listed by	FCC Part 15-Subpart B-Class B, CE	

To address a ZS outdoor air temperature sensor

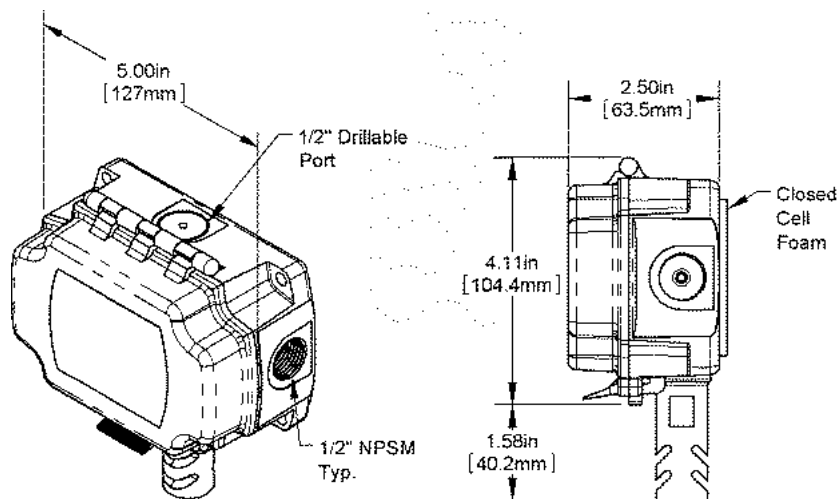
Each ZS Sensor on an Rnet must have a unique address, but addresses do not have to be sequential. Open the hinged cover on the sensor enclosure, and then use the DIP switches to set an address from 0 to 14. (0 is factory default.) Each DIP switch has the value shown in the figure below. Turn on as many DIP switches as you need so that their total value equals the address.



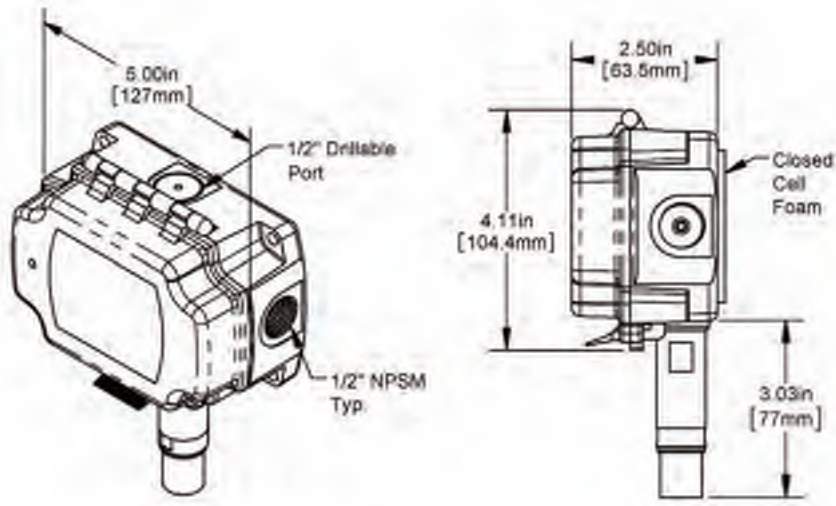
EXAMPLE DIP switches 1 and 4 above are on. Their values (1 + 8) total 9, so the sensor's address is 9.

To mount a ZS outdoor air temperature sensor

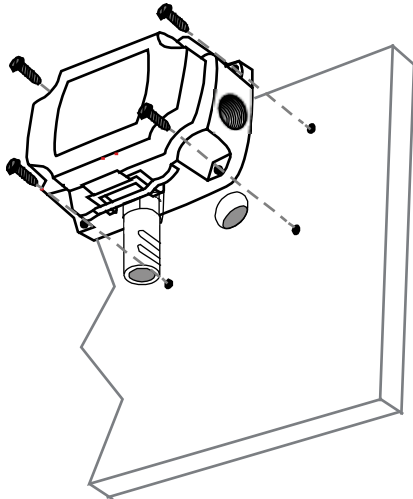
Outside Air Temperature sensor



Outside Air Temperature/Humidity sensor



- 1 Determine the best location for the sensor. Mount the sensor:
 - In the shade, never in the sunlight or you will have higher than expected temperature readings by as much as +30%.
 - Away from building windows, doors, or vents.
 - At least one foot below the eave to prevent measurement of trapped heat under the eave.
 - At least four feet about ground level.
- 2 Drill the mounting holes and mount as shown below with the probe pointing down. Tighten the mounting screws enough to ensure that the foam backing compresses to about 50% of its thickness to create a seal against the wall surface.



- 3 Unlatch and open the hinged door on the sensor's enclosure.
- 4 Route the Rnet cable into the back of the enclosure, and then connect the wiring as described in *To wire a ZS outside air sensor* (page 36).
- 5 After wiring the sensor, caulk the wiring hole.
- 6 Close the enclosure door until it latches. Secure with provided cover screws.

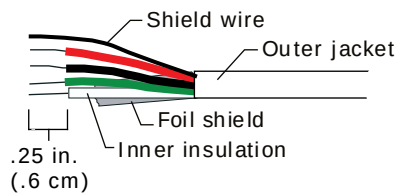
To wire a ZS outdoor air sensor

NOTES

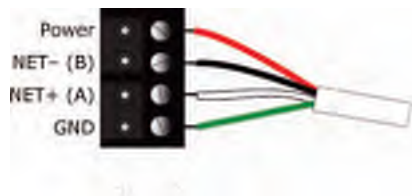
- Do not drill into the sensor's watertight enclosure which will violate the NEMA and/or IP rating.
- Use caulk or Teflon tape for your conduit entries to maintain the appropriate NEMA or IP rating for your application.

PREREQUISITE The Rnet cable is wired to the controller. The shield wire and the ground wire should be inserted into the controller's GND terminal.

- 1 Turn off the controller's power.
- 2 Partially cut, then bend and pull off the outer jacket of the Rnet cable(s). Do not nick the inner insulation.



- 3 Strip about .25 inch (.6 cm) of the inner insulation from each wire.
- 4 Unlatch and open the hinged door on the sensor's enclosure.
- 5 Pull the Rnet communication cable through the knockout hole.
- 6 If wiring 1 cable to the sensor, cut the shield wire off at the outer jacket, then wrap the cable with tape at the outer jacket to cover the end of the shield wire.
If wiring 2 cables in a daisy-chain configuration, twist together the shield wires, then wrap the shield wires with tape.
- 7 Insert the other 4 wires into the sensor's screw terminal connector. If wiring 2 cables, insert like-colored wires into each terminal.

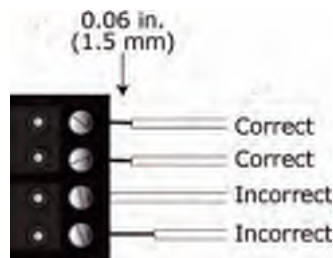


Automated Logic® recommends that you use the following Rnet wiring scheme:

Connect this wire...	To this terminal...
Red	Power
Black	NET-
White	NET+
Green	GND



CAUTION Allow no more than 0.06 inch (1.5 mm) bare communication wire to protrude. If bare communication wire contacts the cable's foil shield, shield wire, or a metal surface other than the terminal block, the device may not communicate correctly.



- 8 Close and latch the sensor's door.
- 9 Turn on the controller's power.

NOTE Use the same polarity throughout the Rnet.

Humidity filter maintenance

The temperature/humidity sensor has a sintered filter that protects the humidity sensor from various airborne particles. The filter can become dirty and may need periodic cleaning. Symptoms of a dirty filter are that the humidity sensor is slow to respond or consistently reports incorrect values.

To clean the filter:

- 1 Gently unscrew the filter from the probe.
- 2 Rinse the filter in warm soapy water, and then rinse in clean water. You can use a nylon brush if needed.
- 3 Gently screw the clean filter all the way into the probe. Hand tighten only.

To format a ZS Sensor

Formatting a sensor clears its flash memory. Do either of the following to format a sensor:

- Download the controller that the sensor is connected to.
- Do the following:
 - a) Remove the wiring connector from the sensor.
 - b) Note the current position of the DIP switches.
 - c) Set all DIP switches to the ON position.
 - d) Reattach the wiring connector to format.
 - e) After approximately 3 seconds, remove the wiring connector.
 - f) Set the DIP switches back to their original position.
 - g) Reattach the wiring connector.

NOTE If you move a sensor from one controller to another controller that has a different control program, format the sensor.

Document revision history

Important changes to this document are listed below. Minor changes such as typographical or formatting errors are not listed.

Date	Topic	Change description	Code*
5/10/17	Troubleshooting a ZS Pro or ZS Pro-F	Added Effective Setpoints Fields descriptions	X-TS-EE-BR
1/30/17	Specifications for ZS zone sensors	Added CO ₂ sensor type	X-TS-JM-F
1/19/17	Entire document	Major revisions to add a motion sensor to a ZS Pro, duct sensors, pipe sensor, immersion sensor, and outdoor air sensors.	X-D
3/8/16	Specifications	Added drift statement to Humidity specification.	X-TS-EE-F
4/27/15	Entire document	New look, no content changes.	A-D
2/27/15	CO ₂ sensor installation	New topic.	X-TS-RB-BR
11/11/14	Power requirements	Made corrections to wiring diagram.	X-TS-JM-O
7/22/14	Specifications	Revised the following specifications: Sensing element accuracy Environmental operating range Added following statement to Power supply specification: "The controller and the external power supply must share a common ground."	X-O-MW-E-SV
	Rnet configuration	Removed BACview® devices and added Equipment Touch.	X-D
	Power requirements	Removed table for power requirements and power supply. Added statement to see Specifications. Revised drawing to remove BACview and add Equipment Touch.	X-O-SV-O X-D-LZ
	Rnet wiring specifications	Removed mention of BACview.	X-D

* For internal use only

BT485

Technical Instructions

1150 Roberts Boulevard, Kennesaw, Georgia 30144
770-429-3000 Fax 770-429-3001 | www.automatedlogic.com

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Unified Technologies

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Verify that you have the most current version of this document. Go to <https://accounts.automatedlogic.com>, then select **Support > Download > Documents > Hardware Documents**.

Important changes are listed in **Document revision history** at the end of this document.

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Contents

- What is the BT485? 1
 - Automated Logic® products that support the BT485 1
 - Specifications 2
- To install a BT485 2
- Document revision history 3

What is the BT485?

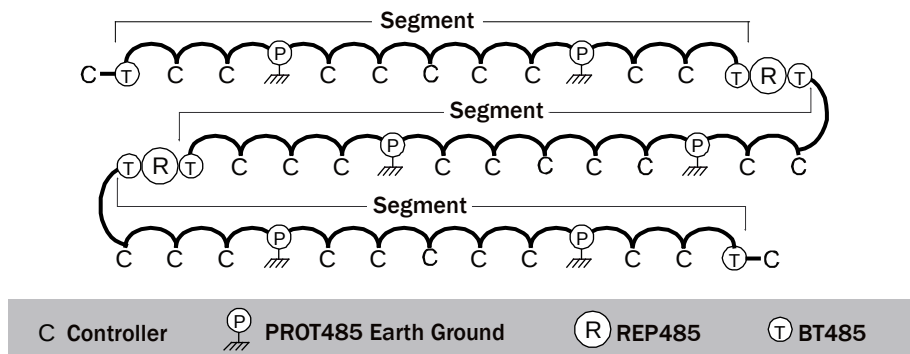


BT485

You attach a BT485 to the controller at the beginning and end of a network segment to:

- Terminate the network segment
- Add bias to reduce the effects of noise on the network

Sample daisy-chain network configuration with BT485's:



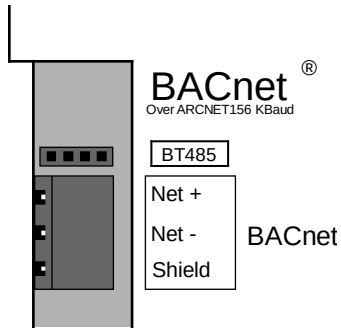
NOTE BT485's eliminate the need for DIAG485's and 120 Ohm terminators. You may still use the DIAG485 for diagnostic purposes, but you must remove its **BIAS** jumper.

Automated Logic® products that support the BT485

The BT485 can be attached to later versions of the following products:

- AAR and AMR controllers
- Equipment Portal controller
- LGR line controllers
- ME line controllers
- SE line controllers
- ZN line controllers
- REP485
- FIBER485 and FIBER485T

To determine if a product version supports the BT485, look for the **BT485** connector located near the **BACnet** connector.

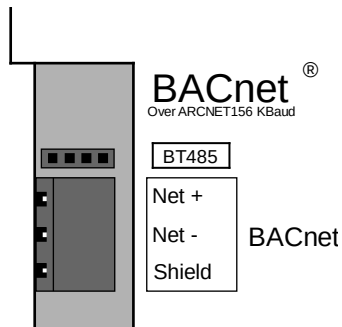


Specifications

Environmental operating range	Operating Temperature Range: -29 to 60.0 deg C; -20 to 140 deg F	
Overall dimensions	Width:	0.5 in. (1.2 cm)
	Height:	0.6 in. (1.5 cm)

To install a BT485

- 1 Push the BT485 onto the **BT485** connector located near the **BACnet** connector.



- NOTE** The BT485 has no polarity associated with it.
- 2 Verify that the LED turns on.

Document revision history

Important changes to this document are listed below. Minor changes such as typographical or formatting errors are not listed.

Date	Topic	Change description	Code*
4/27/15	Entire document	New look, no content changes	A-D

* For internal use only

Rev. 05/25/11

Features & Options

- Small Flush Pressure Port Mounting
- Accurate Air Pressure Measurement
- Paintable with Latex or Oil Base
- Five-Micron Filter
- Built in Surge Damper

The Low Profile "Button" Pressure Pickup Port is ideal for locations where aesthetics are as important as the pressure measurement. The inconspicuous sensor mounts easily by pushing through a 3/8" hole and secured with an adhesive ring. The only visible portion is a flush 7/8" dot on the wall. The built in surge damper provides five-micron filtering and smoothes out rapid variations in air pressure for a more stable reading.



**Low Profile "Button"
Pressure Pickup Port**

ORDERING INFORMATION

ALC/ZPS-ACC20 ... Low Profile "Button" Pickup Port

Specifications

Mounting: 3/8" hole, push in plastic sheath with an adhesive ring

Configuration: Round Flush Sensor Sheath

Dimensions:

Insertion 1.74" depth (44.2mm), into a 0.375" hole

Sleeve 0.375" (9.52mm) Diameter

Bezel 0.88" (22.2mm) Diameter

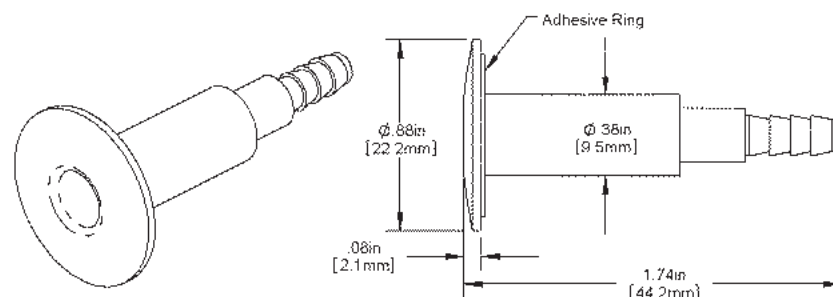
Material: White Delrin, UL94V-HB

Filter: 5 Micron

Ambient:

0 to 100% RH, Non-condensing

-40°F to 185°F, (-40° to 85°C)





Overview

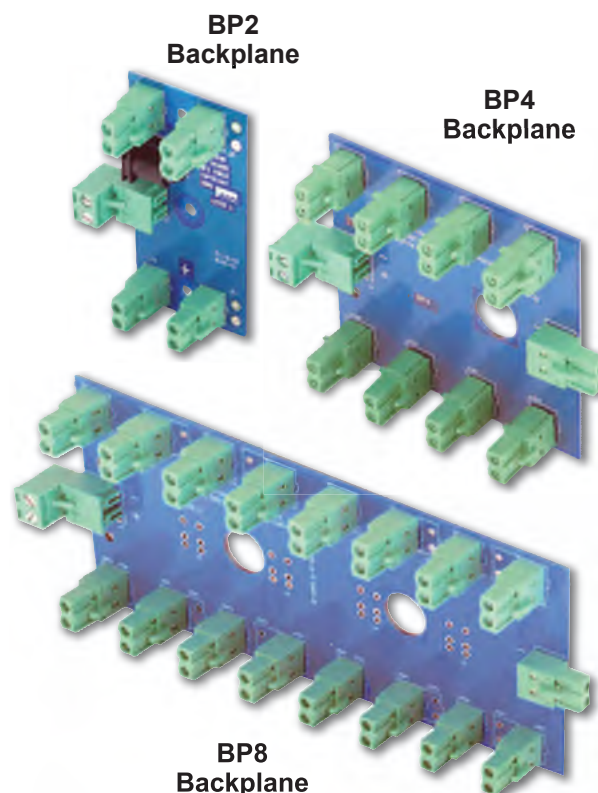
The BP2, BP4 and BP8 Backplanes provide a convenient way to mount and power the BAPI ETA interface devices which helps cut down on control panel and control room clutter. All three backplanes fit standard 2.75" snaptrack.

Connectors on the face of each Backplane plug into mating connectors on the ETA modules. The BP8 Backplane accommodates eight ETA interface modules while the BP4 Backplane accommodates four modules and the BP2 accommodates two modules.

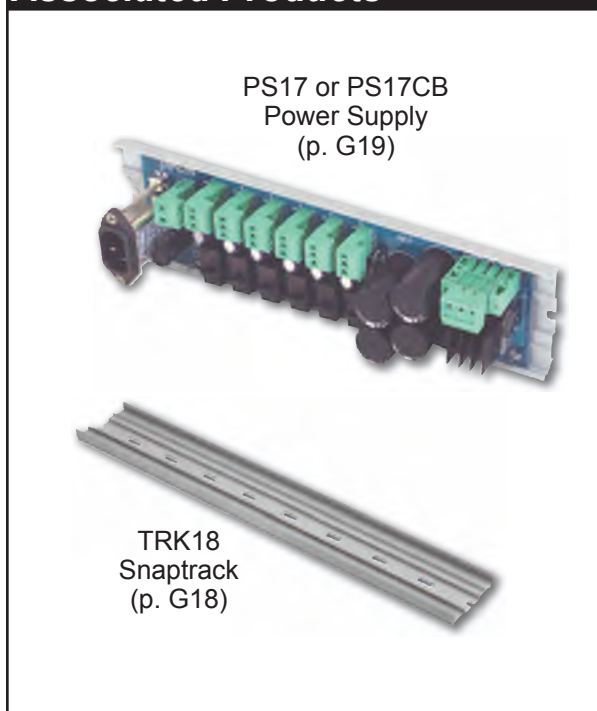
For large control systems, the Backplanes receive power from a PS17 or PS17CB Power Supply. The Backplanes can be plugged together using the end connectors to build large systems. For small control systems, the Backplanes can receive power from BAPI's VC100 or VC350 voltage converters (in Accessories section).

<u>Part Number</u>	<u>Description</u>
BA/BP2	2-Position Interface Backplane
BA/BP4	4-Position Interface Backplane
BA/BP8	8-Position Interface Backplane

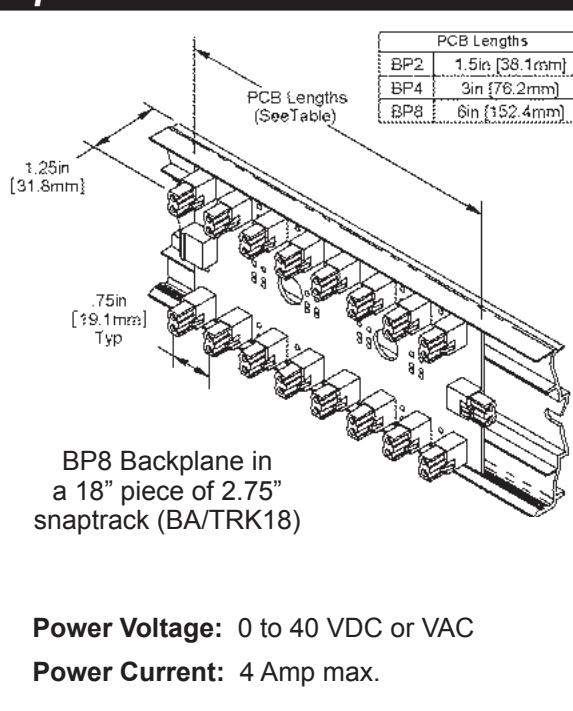
See end of Section G for list pricing.



Associated Products



Specifications





Features & Options

- Low Profile Delta Enclosure
- Optional Setpoint, Override or Bi-Metal Indicator
- Optional Communication Jack
- Optional Test and Balance Switch
- Wide Selection of Temperature Sensing Elements
- Limited Lifetime Warranty



Delta Style Enclosure

Setpoint & Legend

The optional Setpoint is a linear slidepot adjustment that comes in various ranges, and is available as Reverse or Direct Acting. An optional Setpoint Legend can be imprinted on the base of the enclosure. Common Legends include "Cool/Warm", "65 to 80" (°F), "55 to 85" (°F), and "5 to 30" (°C). (See ordering grid on opposite page for all Legend options.)

Override

The optional Override is a discreet momentary signal that can be configured to be compatible with any controller.

Communication Jack

Available with RJ11 (4 pin), RJ12 (6 pin), RJ45 (8 pin), RJ22 (4 pin) or a 3.5 mm phono plug style jack.

Bi-Metal Indicator

An optional Bi-Metal Indicator shows room temperature; accurate to ± 1 °F. The display is protected by an acrylic plate and comes with a 50 to 90 °F or 10 to 30 °C legend.

Test and Balance Switch

A three-position slider can be provided on the back of the unit to change the sensor output as follows—the "Low" setting is "Full Cool", "Normal" is the live sensor value, and "High" is "Full Heat".

For detailed specifications on the individual Sensors & Transmitters, turn to the Sensors section

* All Passive Thermistors 10K Ω and smaller are CE compliant.



Delta Style Enclosure with Setpoint, Override and Bi-Metal Indicator

The BAPI-Guard

- Prevents Tampering, Physical Damage and Unauthorized Adjustment
- Exceptional Airflow for Proper Thermostat Operation
- Two Sizes to Fit Most Thermostats

(See Accessories for more info.)



BAPI-Guard Mounted Over a Thermostat

Specifications

Environmental Operation Range:

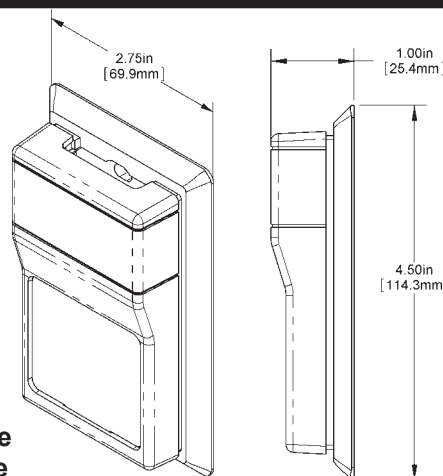
Temperature: 32 to 122 °F (0 to 50 °C)
Humidity: 0 to 95%, non-condensing

Material:

ABS Plastic

Material Rating:

UL 94, V-0



Delta Style Enclosure



Delta Style Room Units **A19**

Temperature Sensors

Rev. 11/24/10

Ordering Information		Delta Style Room Units - Temperature					
BA/							
Sensor Type	Must select one	Use the designator number (shown to the left in bold) to indicate the sensor					
#	THERMISTORS						
	1.8K	1.8K Ω @ 25 °C	100	100 Ω Platinum @ 0 °C, .385 Ω /°C temp. coeff.			
	3K	3K Ω @ 25 °C	100[3W]	3 Wire 100 Ω Platinum @ 0 °C, .385 Ω /°C temp. coeff.			
	3.25K	3.25K Ω @ 25 °C (T30 type)	1K[375]	1K Ω Platinum @ 0 °C, 3.75 Ω /°C temp. coeff.			
	3.3K	3.3K Ω @ 25 °C	1K[Ni]	1K Ω Nickel @ 21°C, 5 Ω /°C temp. coeff.			
	10K-2	10K Ω @ 25 °C	1K	1K Ω Platinum @ 0 °C, 3.85 Ω /°C temp. coeff.			
	10K-3	10K Ω @ 25 °C	2K	2K Ω Silicon @ 20 °C, 8 Ω /°C temp. coeff.			
	10K-3[11K]	5,238 Ω @ 25 °C	SEMICONDUCTORS				
	20K	20K Ω @ 25 °C	334	LM334 Semiconductor			
	50K	50K Ω @ 25 °C	592	AD592 Semiconductor, 273 μ A @ 0 °C			
100K	100K Ω @ 25 °C	592-10K	AD592 Semicond. w/ 10 k Ω shunt resistor, 2.73 V @ 0 °C				
Enclosure Style		Required selection					
-R	Delta Style Room Enclosure						
Optional Setpoint		If setpoint is required, must select Range and Legend					
##	SETPOINT OUTPUT VALUE RANGE (insert Designator #)						
	Desired Range	Designator	Desired Range	Designator			
	800 to 1200 Ω	25	15 to 5 k Ω	61			
	909 to 1309 Ω	26	0 to 20 k Ω	80			
	1800 to 2200 Ω	27	4.75 to 24.75 k Ω	81			
	0 to 1 k Ω	40	6.19 to 26.19 k Ω	82			
	500 to 1500 Ω	41	7.87 to 27.87 k Ω	83			
	2 to 3 k Ω	42	10 to 30 k Ω	84			
	0 to 10 k Ω	60	See App. Notes pg. I2 for other Setpoint Ranges				
	SETPOINT LEGEND (insert Designator #)						
Legend Range	Designator	Legend Range	Designator				
5-30 C	L1	68-70-72	L5				
55-85 F	L2	COOL/WARM	L6				
60-85 F	L3	WARM/COOL	L7				
65-80 F	L4	No Legend	L0				
Override Configuration		Must select one					
-J	Override as a Separate Input (Not available with transmitter)						
-N	Override in Parallel (//) with Sensor						
-P	Override in Parallel (//) with Setpoint (Only available with Resistive Setpoint)						
-Z	No Override						
Optional Communication Jack		Skip if not required					
-C35	3.5 mm Phono Style Jack						
-C11*	RJ11 (4 pin) Style Jack (Not available with Bi-Metal Indicator)						
-C12*	RJ12 (6 pin) Style Jack (Not available with Bi-Metal Indicator)						
-C45*	RJ45 (8 pin) Style Jack (Not available with Bi-Metal Indicator)						
-C22*	RJ22 (4 pin) Style Jack (Not available with Bi-Metal Indicator)						
Optional Indicator		Skip if not required					
-BM5090	Bi-Metal Indicator: 50 to 90 °F legend						
-BM1030	Bi-Metal Indicator: 10 to 30 °C legend						
Optional Test & Balance		Skip if not required					
-TB	Three Position Switch - "Low" & "High" values vary, "Normal" is live sensor value. Call for details.						
Connection Configuration		Must select one					
-CG	Common Ground (Required with Voltage Setpoint Units)						
-DF	Differential Inputs						
Optional Copla White Enclosure (Warm White is Standard)		Skip if not required					
-CPW	Copla White Enclosure Color						
EXAMPLE							
BA/	10K-2	-R	25L1	-J	-C35	-BM5090	-CG
Example Part Number: BA/10K-2-R25L1-J-C35-BM5090-CG							
Your Part Number:							

*Not available with Voltage Setpoint.

Call BAPI if you have questions about the above ordering/pricing grid or the configuration of the product you are ordering.



Rev. 10/16/12

DS6R - Dry Switch Monitor

ETA Line

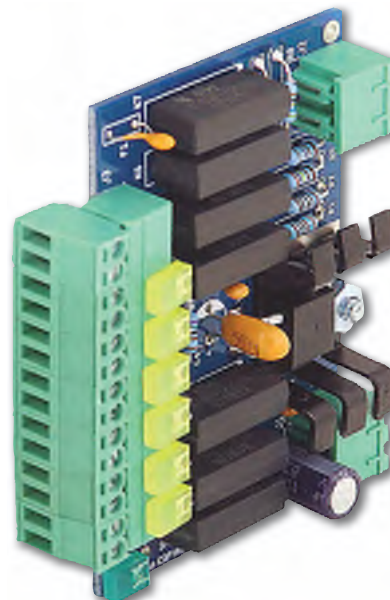
G13

Overview

The DS6R module monitors six dry switch closure devices and provides one resistive output to the controller.

Each switch closure subtracts a precise resistance from the output so a simple subtraction algorithm at the controller decodes which switches are set. Each switch terminates on an independent plug on the front of the DS6R module and an LED associated with each input indicates switch closure for simple troubleshooting.

The DS6R plugs into the BP2, BP4 or BP8 backplane.

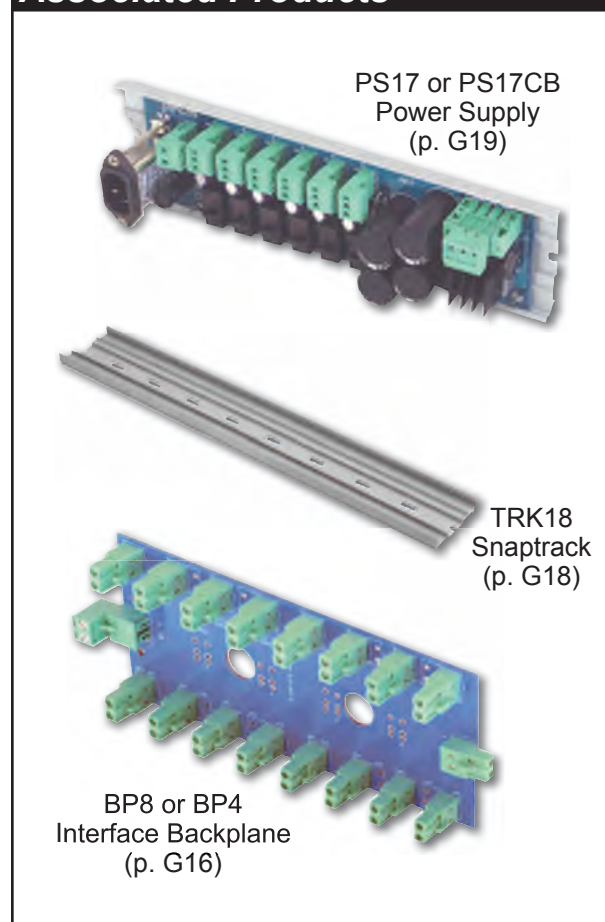


DS6R - Dry Switch Monitor

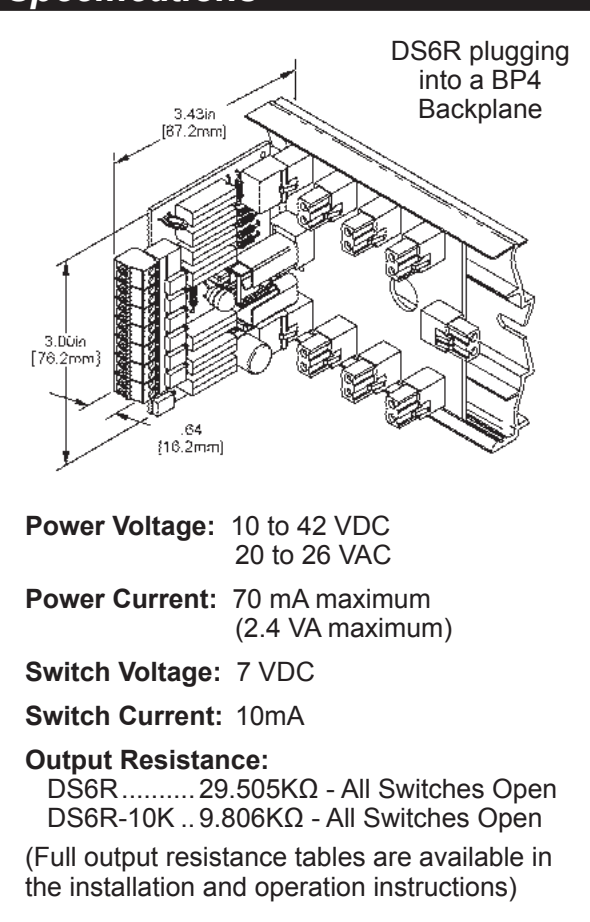
Part Number	Description
BA/DS6R.....	Dry Switch Monitor, 30K Output
BA/DS6R-10K.....	Dry Switch Monitor, 10K Output

See end of Section G for list pricing.

Associated Products



Specifications



Rev. 07/13/10

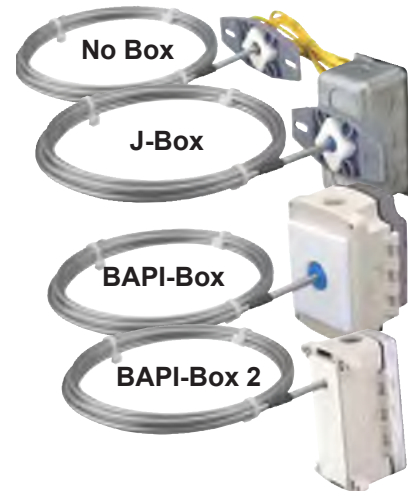
Features & Options

- Averaging Lengths: 8', 12' and 24'
- Optional BAPI-Box or BAPI-Box 2 Enclosure

Duct Averaging Units feature medical-grade closed cell foam to seal the probe insertion hole and to absorb vibration. Mounting tabs allow for easy installation directly to the wall of the duct. All units have etched Teflon leadwires and encapsulated sensors to create a watertight package that can perform under real world conditions.

The units come standard with a 2"x4" steel J-Box but are also available with no box or a watertight BAPI-Box or BAPI-Box 2.

*Some items may not be CE compliant, call BAPI for additional information.



Ordering Information/Part Numbers

ALC/10K-2-A-8' - 8' Duct Averaging Unit with a precision 10K-2 Thermistor Sensor

ALC/10K-2-A-12' - 12' Duct Averaging Unit with a precision 10K-2 Thermistor Sensor

ALC/10K-2-A-24' - 24' Duct Averaging Unit with a precision 10K-2 Thermistor Sensor

Duct Averaging Units come standard with a 2"x4" steel J-Box Enclosure. Add **-BB** or **-BB2** to the end of the part # for a watertight BAPI-Box or BAPI-Box 2 enclosure. Add **-NB** to the end of the part # for No Box (6" etched teflon leadwires).

Specifications for Duct Averaging Units

Enclosure Material:

BB or BB2: Polycarbonate, UL94, V-0

J-Box Model: Galv. Steel

Environmental Operation Range:

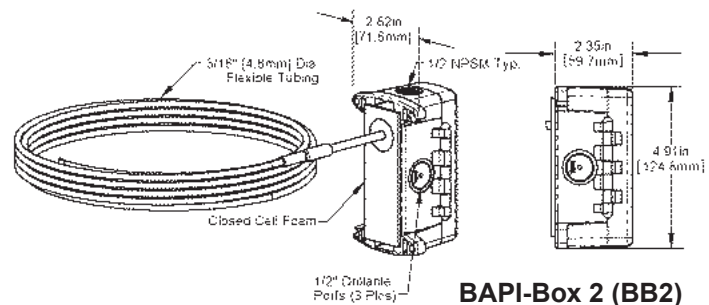
Temperature:

BB or BB2 Encl.: -40 °C to 85 °C

J-Box & NB: -40 °C to 100 °C

Humidity: 0 to 100%, non-condensing

Encl. Rating: BB or BB2 Models: IP66



BAPI-Box 2 (BB2)

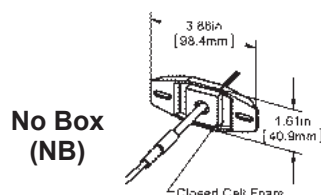
10K-2 Thermistor Sensor Specifications

Resistance: 10 kΩ @ 25°C, -55°C to 150°C range

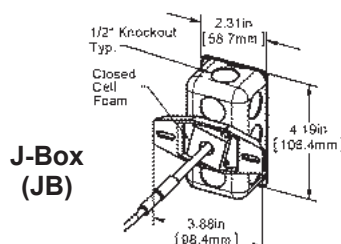
Standard Accuracy: 0.2°C (±0.36°F) at 0 to 70°C

Dissipation Constant: 2.7 mW/°C

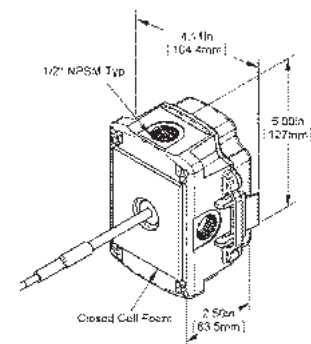
Stability(drift): Less than ±0.1°C (0.18°F) drift over 10 years.



No Box (NB)



J-Box (JB)



BAPI-Box (BB)

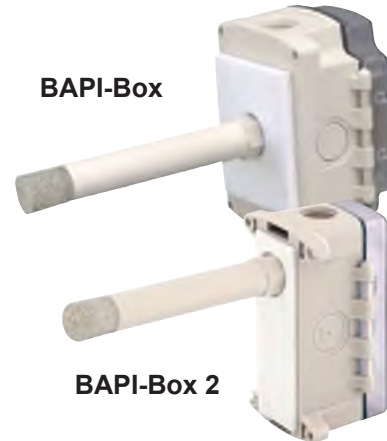
Rev. 03/25/11

Features & Options

- Humidity Only or Temp./Humidity Combination
- Etched Teflon Leadwires & Foamback Insulator
- Watertight BAPI-Box Enclosure
- Replaceable Filter & Humidity Probe
- 2% and 3% RH Accuracies

Humidity control is an important aspect of any climate control system. Therefore, humidity sensors must be both accurate and dependable. BAPI's humidity sensors are prescreened for accuracy, eliminating field calibration even when replacing a sensor or probe. The Duct Units are also extremely dependable, with a watertight BAPI-Box or BAPI-Box 2 enclosure.

All Duct Units feature medical-grade closed cell foam to seal the probe insertion hole and to absorb vibration. Mounting tabs allow for easy installation directly to the wall of the duct. All Duct Units have etched Teflon leadwires and are built to withstand high humidity and condensation and perform under real world conditions.



Ordering Information/Part Numbers

Humidity Only Units

ALC/H200-D-BB: 2%RH Duct Humidity Sensor

ALC/H300-D-BB: 3%RH Duct Humidity Sensor

Combination Temperature and Humidity Duct Sensor

ALC/10K-2-H200-D-BB: 2%RH Duct Temperature and Humidity Sensor

ALC/10K-2-H300-D-BB: 3%RH Duct Temperature and Humidity Sensor

Replace **-BB** with **-BB2** at the end of the part # for a watertight BAPI-Box 2 enclosure

Specifications

Power:

10 to 35 VDC (0 - 5 VDC or 4 - 20 mA outputs)

12 to 24 VAC (0 - 5 VDC Output)

Encl. Material:

UV-resistant polycarbonate, UL 94, V-0

Enclosure Rating: IP 66

Environmental Operation Range:

Temp: -30 °C to 70 °C

Humidity: 0% to 100% RH

Humidity Sensor:

Impedance Type, $\pm 2\%$ or $\pm 3\%$ RH

10K-2 Thermistor Sensor Specifications

Resistance: 10 k Ω @ 25°C, -55°C to 150°C range

Standard Accuracy: 0.2°C ($\pm 0.36^\circ\text{F}$) at 0 to 70°C

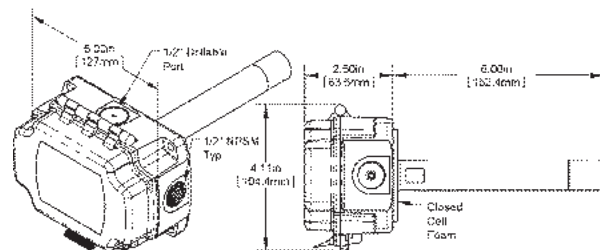
Dissipation Constant: 2.7 mW/°C

Stability(drift): Less than $\pm 0.1^\circ\text{C}$ (0.18°F) drift over 10 years.

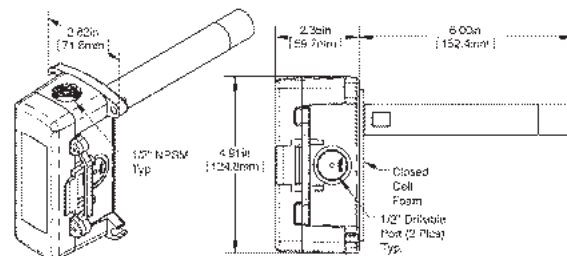
Power Consumption:

22 mA max. DC (0 - 5 VDC or 4 - 20 mA Outputs)

0.53 VA max. AC (0 - 5 VDC Output)



BAPI-Box (BB)



BAPI-Box 2 (BB2)

Rev. 07/13/10

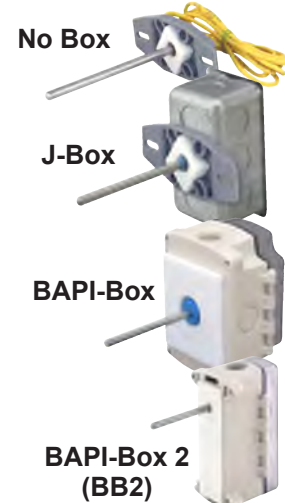
Features & Options

- Probe Lengths: 2", 4", 8", 12" and 18"
- Series 304 Stainless Steel Probes & Double Encapsulated Sensors
- Medical-Grade Foam Padding and Etched Teflon Leadwires
- Optional BAPI-Box or BAPI-Box 2 Enclosures

Single Point Duct Units feature medical-grade closed cell foam to seal the probe insertion hole and to absorb vibration. Mounting tabs allow for easy installation directly to the wall of the duct. All Duct Units have etched Teflon leadwires and double encapsulated sensors to create a watertight package that can perform under real world conditions. Duct Units have probe lengths from 2" to 18". Custom probe lengths are also available, call for details.

Duct Units come standard with a 2"x4" steel J-Box but are also available with no box, or a watertight BAPI-Box or BAPI-Box 2 enclosure.

*Some items may not be CE compliant, call BAPI for additional info.



Ordering Information/Part Numbers

ALC/10K-2-D-2": Duct Unit with 2" Probe

ALC/10K-2-D-4": Duct Unit with 4" Probe

ALC/10K-2-D-8": Duct Unit with 8" Probe

ALC/10K-2-D-12": Duct Unit with 12" Probe

ALC/10K-2-D-18": Duct Unit with 18" Probe

Duct Units come standard with a 2"x4" steel J-Box Enclosure.

Add **-BB** to the end of the part # for a BAPI-Box enclosure or **-BB2** for a BAPI-Box 2 enclosure

Add **-NB** to the end of the part # for No Box. Please also specify a lead length for the plenum-rated cable of **-18"**, **-5'**, **-10'** or **-15'**. Example **-NB-18"** for No Box with 18" lead length

Specifications

Enclosure Material:

BB or BB2 Models: Polycarbonate

J-Box Model: Galv. Steel

Environmental Operation Range:

Temperature: -40 °C to 100 °C

Humidity: 0 to 100%, non-condensing

Enclosure Material Rating:

BB or BB2 Models: UL94, V-0

Encl. Rating: BB or BB2 Models: IP66

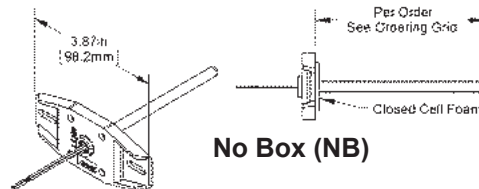
10K-2 Thermistor Sensor Specifications

Resistance: 10 kΩ @ 25°C, -55°C to 150°C range

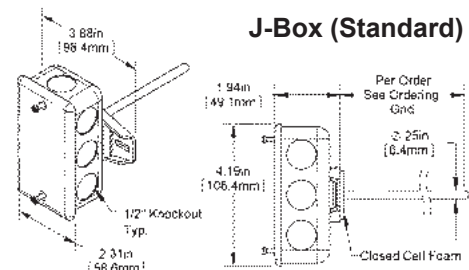
Standard Accuracy: 0.2°C (±0.36°F) at 0 to 70°C

Dissipation Constant: 2.7 mW/°C

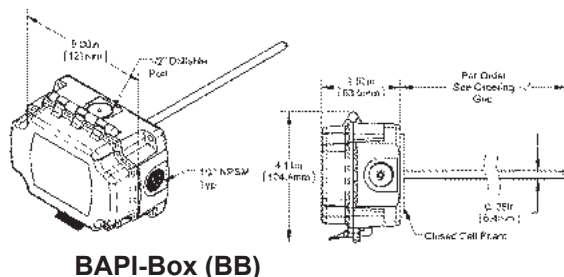
Stability(drift): Less than ±0.1°C (0.18°F) drift over 10 years.



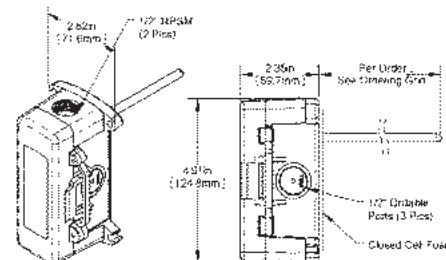
No Box (NB)



J-Box (Standard)



BAPI-Box (BB)



BAPI-Box 2 (BB2)

Rev. 07/13/10

Features & Options

- Watertight BAPI-Box or BAPI-Box 2 Enclosure
- Etched Teflon Leadwires
- Well-Vented, Light-Colored Sensor Guard

Outside Air Units are designed to be mounted outdoors. The 5¼" UV-resistant plastic shield keeps the sensor out of the sunlight and allows for excellent air circulation. The Outside Air Unit is available in a watertight BAPI-Box (**BB**) or BAPI-Box 2 (**BB2**) Enclosure.

All Outside Air Units have etched Teflon leadwires and can withstand high humidity and condensation and perform under real world conditions. This is especially important in an outside air application which can be exposed to rain, snow and large temperature swings.

*Some items may not be CE compliant, call BAPI for additional information.

Ordering Information/Part Numbers

ALC/10K-2-O-BB - Outside Air Temperature Sensor in a BAPI-Box Enclosure

ALC/10K-2-O-BB2 - Outside Air Temperature Sensor in a BAPI-Box 2 Enclosure

Specifications**Enclosure Material:**

UV-resistant polycarbonate, UL94, V-0

Enclosure Rating: IP66**Environmental Operation Range:**

Temperature: -40 °C to 85 °C

Humidity: 0 to 100%, non-condensing

10K-2 Thermistor Sensor Specifications**Resistance:**

10 kΩ @ 25°C, -55°C to 150°C range

Standard Accuracy:

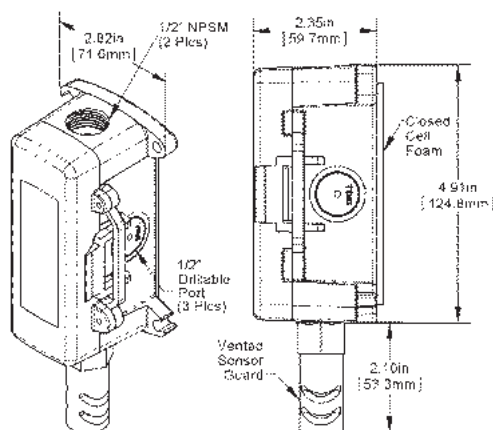
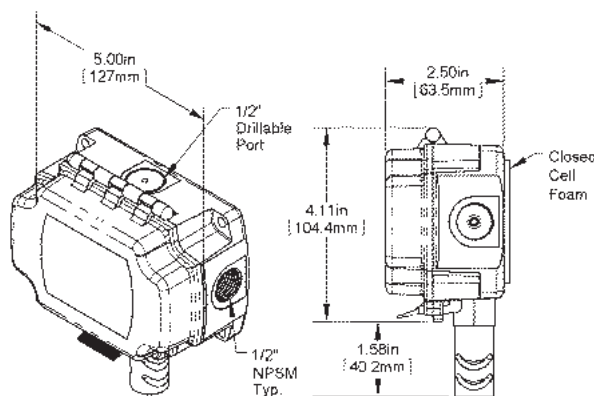
0.2°C (±0.36°F) at 0 to 70°C

Dissipation Constant:

2.7 mW/°C

Stability(drift):

Less than ±0.1°C (0.18°F)
drift over 10 years.

**BAPI-Box****BAPI-Box 2****BAPI-Box 2 (BB2)****BAPI-Box (BB)**

Rev. 05/25/11

Wall & Ceiling Pressure Pickup Ports & Temp./Pressure Pickup Combos

Features & Options

- Economical & Easy to Install
- Delta Enclosure or Stainless Steel Plate for Wall Mount
- Ceiling Mount with or without J-Box
- 100 Micron Filter
- Accommodates 1/8" I.D. to 5/32" I.D. Tubing

The Wall Pressure Pickup Port comes standard on a brushed stainless steel plate or in a Delta Style enclosure, both sized to fit a common 2" x 4" electrical box. A foam gasket seals the plate or enclosure to the wall to insure the integrity of the measured space. The Wall Plate and Delta Style Enclosure can be used for pressure alone or as a combination temperature sensor and pressure pickup port. BAPI also offers a Ceiling Mount Cover designed to fit a standard 3/4" thick suspended ceiling tile. If additional protection is required in the ceiling, a second ceiling cover fits on a common 2" x 4" electrical box. The brass fitting on the back of all Pickup Ports accommodates standard 1/8" to 5/32" I.D. tubing.



**Delta Style
Enclosure**



Wall Plate



**Ceiling Mount
Square Cover
(ALC/ZPS-ACC05)**



**Ceiling Mount
Cover & J-Box
(ALC/ZPS-ACC06)**

Specifications

Environmental Operation Range:

Temp. - 32 to 122 °F (0 to 50 °C)

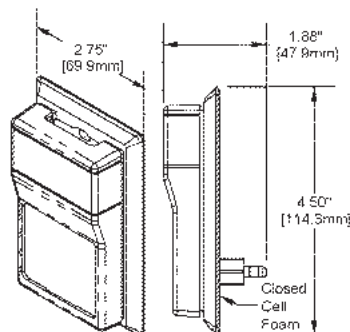
Humidity 0% to 95% RH, non-condensing

Material:

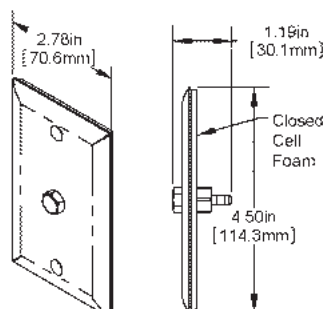
Delta Style Enclosure:

ABS Plastic, UL 94, V-0

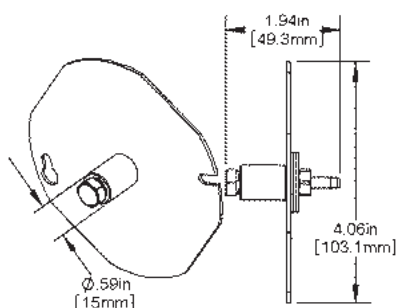
Wall Plate: Stainless Steel



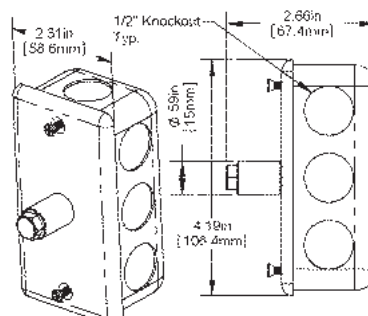
Delta Enclosure (ZPS-ACC03)



Wall Plate (ZPS-ACC01)



**Ceiling Mount Cover
(ZPS-ACC05)**



**Ceiling Mount Cover & J-Box
(ZPS-ACC06)**



Manufactured by Building Automation Products, Inc., 750 N. Royal Ave., Gays Mills, WI 54631 USA

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Rev. 05/25/11

ORDERING INFORMATION

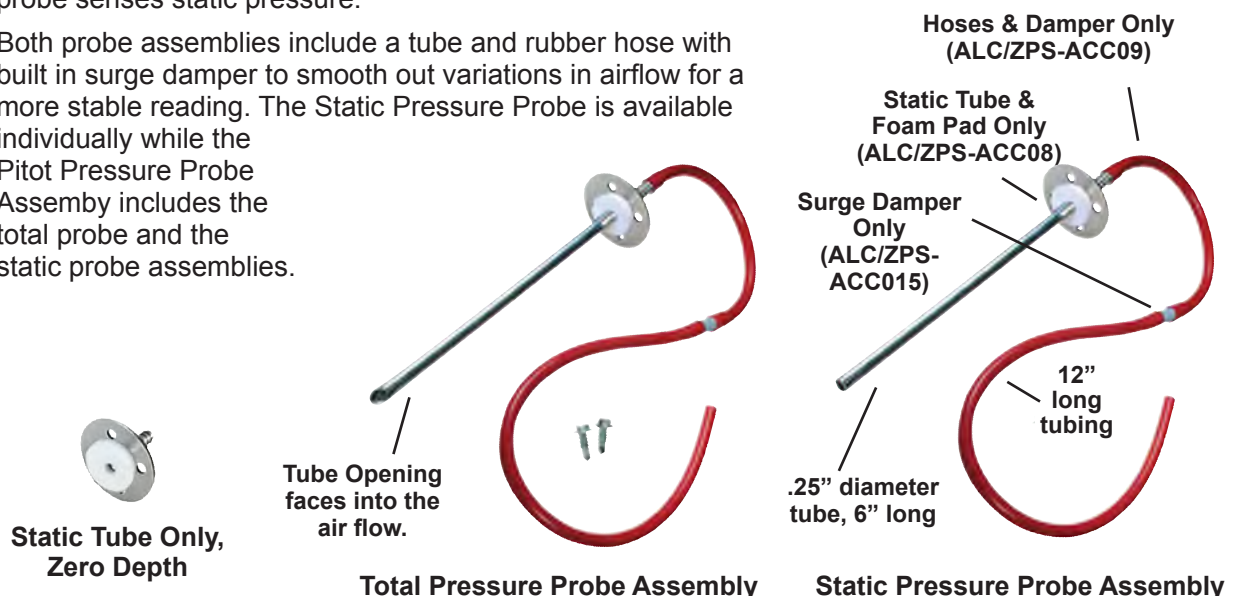
ALC/ZPS-ACC01	2" X 4" Stainless Steel Wall Plate with Static Pickup
ALC/ZPS-ACC01-102 ..	2" X 4" Stainless Steel Wall Plate with Static Pickup & 10K-2 Temp. Sensor
ALC/ZPS-ACC03	Room Mount Delta Style Enclosure with Static Pickup
ALC/ZPS-ACC03-102 ..	Room Mount Delta Style Encl. with Static Pickup & 10K-2 Temp. Sensor
ALC/ZPS-ACC05	Ceiling Mount Square Cover with Static Pickup
ALC/ZPS-ACC06	Ceiling Mount Rectangular 2" X 4" Cover and Box with Static Pickup
ALC/ZPS-ACC07	Static Pressure Probe Assembly, 6" long
ALC/ZPS-ACC08	Static Tube Only (6") with Circular Foam
ALC/ZPS-ACC09	Rubber Hoses with Surge Damper
ALC/ZPS-ACC11	Pitot Pressure Probe Assy, 3.5" long (includes the Static & Total Probe Assy)
ALC/ZPS-ACC12	Pitot Pressure Probe Assy, 6" long (includes Static & Total Probe Assy)
ALC/ZPS-ACC13	Total Tube Only (3.5") w/ Circular Foam (doesn't include hoses & damper)
ALC/ZPS-ACC14	Total Tube Only (6") with Circular Foam (doesn't include hoses & damper)
ALC/ZPS-ACC15	Surge Damper Only, 5 micron
ALC/ZPS-ACC17	Static Tube Only (0.5") with Circular Foam (doesn't include hoses & damper)
ALC/ZPS-ACC18	2 Static Pressure Tube Assemblies, 6" Long
ALC/ZPS-ACC21	Static Tube Only (6") with Circular Foam and Mounting Screws (doesn't include hoses & damper)
ALC/ZPS-ACC22	Static Tube Only, Zero Length, with Circular Foam and Mounting Screws

Static & Total Pressure Probe Assemblies

Features & Options

The Static Pressure Probe and Total Pressure Probe Assemblies connect to the BAPI Zone Pressure Sensor to provide duct static pressure or duct air velocity. The angled total probe faces into the airflow to sense the moving air's total pressure while the static probe senses static pressure.

Both probe assemblies include a tube and rubber hose with built in surge damper to smooth out variations in airflow for a more stable reading. The Static Pressure Probe is available individually while the Pitot Pressure Probe Assembly includes the total probe and the static probe assemblies.





Features & Options

- Probe Lengths: 2", 4" & 8" (fit standard BAPI Thermowell lengths)
- Series 304 Stainless Steel Probes and Six Enclosure Styles
- Double Encapsulated Sensors & Etched Teflon Leadwires

Immersion Units are available in 2", 4" and 8" probe lengths. The sensor is potted inside a 1/4" stainless steel probe with thermally conductive compound. All Immersion Units have etched Teflon leadwires and double encapsulated sensors to create a watertight package that can withstand high humidity and condensation.

Immersion Units come standard with a 2"x4" steel J-Box but are also available with a BAPI-Box 4 or three styles of watertight enclosure: Weatherproof, BAPI-Box or BAPI-Box 2. BAPI also offers optional liquid-tight fittings.



BAPI Thermowells

Immersion Unit Probes are designed to be inserted into a Thermowell. For more info on Thermowells, see page A48.

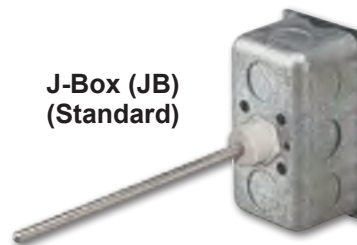
BAPI-Box 4 Knockout Plug

A Pierceable Knockout Plug is available for the open port in the BAPI-Box 4 enclosure. With the plug installed, the BAPI-Box 4 carries an IP44 rating. See "Accessories" for more info.

BAPI-Box 4 Immersion Sensor with Plug Installed



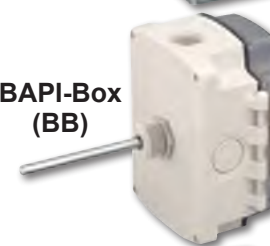
J-Box (JB)
(Standard)



Weatherproof
(WP)



BAPI-Box
(BB)



BAPI-Box 2
(BB2)



BAPI-Box 4
(BB4)



Specifications

Environmental Operation Range:

Temperature Sensor: -40 to 105 °C
Temperature Transmitter: -20 to 70 °C
Humidity: 0 to 100%, non-condensing

Enclosure Rating:

J-Box Model: IP20, NEMA 1
BB4 Model: IP10
(IP44 with Knockout Plug)
WP Model: NEMA 3R
BB Model: IP66, NEMA 4
BB2 Model: IP66, NEMA 4

Enclosure Material:

J-Box Model: Galv. Steel
WP Model: Cast Aluminum
BB & BB2: UV-resist. polycarb., UL94, V-0
BB4 Model: Nylon & Plastic, UL94, V-0

Encl. Dimensions: H x W x D

BAPI-Box (BB)	5 x 4.1 x 2.5" (127 x 104 x 63.5mm)
BAPI-Box 2 (BB2)	4.9 x 2.8 x 2.35" (125 x 71.6 x 60mm)
BAPI-Box 4 (BB4)	2.8 x 2.8 x 2.06" (72 x 71.4 x 52.3mm)
J-Box (JB)	4.2 x 3.9 x 1.94" (106 x 98.4 x 49mm)
Weatherproof (WP)	4.5 x 2.75 x 2.2" (114 x 70 x 55mm)

(For enclosure dimension drawings, turn to the end of the section.)

For detailed specifications on the Sensors & Transmitters, see the "Sensors" section.

*All Passive Thermistors 20KΩ and smaller are CE compliant.



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Rev. 02/25/15

Immersion Probes w/ nylon fitting

Temperature Sensors

A45

Ordering Information		Immersion Units - Temperature																	
BA/	Sensor Type Required selection Use the designator number (shown to the left in bold) to indicate the sensor																		
#		THERMISTORS	RTDs																
	1.8K	1.8K Ω @ 25 °C	1K[375] 1K Ω Platinum @ 0 °C, 3.75 Ω /°C temp. coeff.																
	2.2K	2.2K Ω @ 25 °C	1K[Ni] 1K Ω Nickel @ 21°C, 5 Ω /°C temp. coeff.																
	3K	3K Ω @ 25 °C	1K 1K Ω Platinum @ 0 °C, 3.85 Ω /°C temp. coeff.																
	3.25K	3.25K Ω @ 25 °C (T30 type)	2K 2K Ω Silicon @ 20 °C, 8 Ω /°C temp. coeff.																
	3.3K	3.3K Ω @ 25 °C																	
	10K-2	10K Ω @ 25 °C																	
	10K-3	10K Ω @ 25 °C	SEMICONDUCTORS																
	10K-3[11K]	5,238 Ω @ 25 °C	334 LM334 Semiconductor																
	20K	20K Ω @ 25 °C	592 AD592 Semiconductor, 273 μ A @ 0 °C																
	47K	47K Ω @ 25 °C	592-10K AD592 Semicond. w/ 10 k Ω shunt resistor, 2.73 V @ 0 °C																
	50K	50K Ω @ 25 °C																	
	100K	100K Ω @ 25 °C																	
		TEMPERATURE TRANSMITTERS <i>Must include a "range" figure. Requires an enclosure.</i> T1K[range] 1K Platinum RTD, 1,000 Ω @ 0 °C with 4 to 20 mA Output T1KM[range] 1K Platinum RTD, 1,000 Ω @ 0 °C with MATCHED* 4 to 20 mA Output T10K[range] 10K Thermistor, 10,000 Ω @ 25 °C with 4 to 20 mA Output** T10K5[range] 10K Thermistor, 10,000 Ω @ 25 °C with 0-5 VDC Output** T10K10[range] 10K Thermistor, 10,000 Ω @ 25 °C with 0-10 VDC Output**																	
		TEMPERATURE TRANSMITTER RANGES Custom temperature transmitter ranges are available. Common ranges are listed below <table border="1"> <tr> <td>30 TO 81F</td> <td>-1 TO 27C</td> <td>32 TO 212F</td> <td>0 TO 100C</td> </tr> <tr> <td>0 TO 100F</td> <td>-18 TO 38C</td> <td>40 TO 240F</td> <td>4 TO 116C</td> </tr> <tr> <td>20 TO 120F</td> <td>-7 TO 49C</td> <td>50 TO 250F</td> <td>10 TO 121C</td> </tr> <tr> <td>32 TO 134F</td> <td>0 TO 57C</td> <td></td> <td></td> </tr> </table>			30 TO 81F	-1 TO 27C	32 TO 212F	0 TO 100C	0 TO 100F	-18 TO 38C	40 TO 240F	4 TO 116C	20 TO 120F	-7 TO 49C	50 TO 250F	10 TO 121C	32 TO 134F	0 TO 57C	
30 TO 81F	-1 TO 27C	32 TO 212F	0 TO 100C																
0 TO 100F	-18 TO 38C	40 TO 240F	4 TO 116C																
20 TO 120F	-7 TO 49C	50 TO 250F	10 TO 121C																
32 TO 134F	0 TO 57C																		
	Configuration	Required selection																	
	-I-2"	2" length of 1/4" Diameter, Stainless Steel Probe (Use 2" BAPI Well)																	
	-I-4"	4" length of 1/4" Diameter, Stainless Steel Probe (Use 4" BAPI Well)																	
	-I-8"	8" length of 1/4" Diameter, Stainless Steel Probe (Use 8" BAPI Well)																	
	-I-XX	Custom lengths of 1/4" Diameter, Stainless Steel Probe are available. Call for Details (Custom well required)																	
		Enclosure Options 2"x4" J-Box comes standard																	
	-BB	BAPI-Box Enclosure - IP66 rated, UV-resistant polycarbonate																	
	-BB2	BAPI-Box 2 Enclosure - IP66 rated, UV-resistant polycarbonate																	
	-BB4	BAPI-Box 4 Enclosure - IP10 rated, nylon & plastic (Not for Transmitters) (IP44 rated if Pierceable Knockout Plug is installed in the open port.)																	
	-WP	Weatherproof Enclosure - NEMA 3R rated, cast aluminum																	
		Optional Terminal Block An enclosure is required																	
	-TS	Terminal Strip Connection (BB or BB2 required for units with a Thermistor, RTD or Semiconductor)***																	
EXAMPLE																			
BA/	10K-2	-I-8"	-EU																
Part Number: BA/10K-2-I-8"-EU																			
Your Part Number:																			

Call BAPI if you have questions about the above ordering grid or the configuration of the product you are ordering.

*Transmitters with matched outputs require a Class A sensor.

**Range is limited to -40 to 185°F (-40 to 85°C)

***TS option is not available with the 592-10K Semiconductor sensor or the T10K transmitters.



Building Automation Products, Inc. • 750 North Royal Avenue, Gays Mills, WI 54631 USA

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Ordering Information Thermowells		
BA/		
	Unit Type	
	2"	Two Part (Welded) 304 Stainless Steel - 2"
	4"	Two Part (Welded) 304 Stainless Steel - 4"
	8"	Two Part (Welded) 304 Stainless Steel - 8"
	2" M304	Machined 304 Stainless Steel - 2"
	4" M304	Machined 304 Stainless Steel - 4"
	8" M304	Machined 304 Stainless Steel - 8"
	2" M316	Machined 316 Stainless Steel - 2"
	4" M316	Machined 316 Stainless Steel - 4"
	8" M316	Machined 316 Stainless Steel - 8"
	2" MB	Machined Brass - 2"
	4" MB	Machined Brass - 4"
	8" MB	Machined Brass - 8"
EXAMPLE		
BA/	4" M304	
Example Part Number: BA/4"M304 4" Machined 304 Stainless Steel Thermowell		
Your Part Number:		

Note: Standard thread size is 1/2" NPT external, and 1/2" NPSM internal.

2" wells have an insertion length of 2.5" (11.43 cm).

4" wells have an insertion length of 4.5" (11.43 cm).

8" wells have an insertion length of 7.5" (19.05 cm).

Gray shaded items follow the Buy and Resale Multiplier.

Comparing the Wake Frequency and the Resonant Frequency

Well failures, in most cases, are not due to the effects of pressure or temperature on the well. The calculations necessary to provide adequate strength, under given conditions, are familiar enough to permit proper choice of wall thickness and material. The values shown in Table 1 are conservative, and intended primarily as a guide. Less familiar, and more dangerous, are the **vibration effects** to which wells are subjected. Fluid, flowing by the well, forms a turbulent wake (called the Von Karman Trail) which has a definite frequency, based on the diameter of the well and the velocity of the fluid. It is important that the well have sufficient stiffness so that the wake frequency will never equal the resonant (natural) frequency of the well itself. If the resonant frequency of the well coincided with the wake frequency, the well would vibrate to destruction and break off in the piping. Wells are also safe if the resonant frequency is well **below** the wake frequency or if the fluid velocity is constantly fluctuating through the critical velocity point. Nevertheless, if the installation is not hampered by the use of a sufficiently stiff well, we recommend the values given in Table 2 not be exceeded.

Table 1: Pressure Rating versus Temperature

Thermowell Material	Temperature in Degrees Fahrenheit						
	70°F	200°F	400°F	600°F	800°F	1000°F	1200°F
Pressure Rating (Pounds per Square Inch)							
Brass	5000	4200	1000	-	-	-	-
Welded 304 S.S.	982	820	675	604	550	510	299
304 S.S.	7000	6200	5600	5400	5200	4500	1650
316 S.S.	7000	7000	6400	6200	6100	5100	2500

Table 2:

Maximum Fluid Velocity versus Insertion Length

Thermowell Material	Fluid Type	Insertion Length (Inches)		
		1-2"	1-4"	1-8"
		Maximum Fluid Velocity (Feet per Second)		
Brass	Air/Steam	207	75.5	27.3
	Water	59.3	32.2	19.7
Welded 304 S.S.	Air/Steam	169	61	20
	Water	88	20	10
304 S.S.	Air/Steam	300	109	39.5
316 S.S.	Water	148	82.2	-

The values shown in Table Two are based on operating temperatures of 350°F for brass and 1,000°F for stainless steel (S.S.). Slightly higher velocities are possible at lower temperatures.



Features & Options

- Touch Interface Through the Cover, No More Dip Switches
- Field Selectable Output, Pressure Ranges and WC or Pascal Operation
- Free NIST Certificate Included with Each Pressure Unit
- 21 Field Selectable Pressure Ranges
- Adjustable Pressure Endpoints for Custom Pressure Ranges

BAPI's Zone Pressure "Touch" (ZPT) sensor is an accurate, rugged and economical solution for measuring and reporting duct/building static pressure, room-to-room differential pressure or air velocities/volumes. The heart of the unit is a micro-machined silicon pressure sensor with excellent accuracy, repeatability and stability.

The touch interface allows for quick and easy menu driven set up of all parameters including auto zero, pressure ranges, output ranges, W.C. or Pascal operation, and display format of pressure, percent output or "On". You can also use the interface to create custom ranges.

The LCD helps with troubleshooting because it displays the actual differential pressure over the entire operational range (-5 to +5 inches W.C. or -1,250 to 1,250 Pascals) regardless of which individual pressure range is selected for output to the system controller.

Patent
Pending



**Touch Pressure Sensor
in the BAPI-Box**

ZPT with Attached Static Tube

The unit is available with an Attached Static Tube so it doesn't require two trades to install the unit. Choose the **(-AT)** option in the Static Pressure Probe section of the ordering grid.



Specifications

Power:

7 to 40 VDC (4 to 20 mA Output)
7 to 40 VDC or 18 to 32 VAC (0 to 5 or 1 to 5 VDC Output)
13 to 40 VDC or 18 to 32 VAC (0 to 10 or 2 to 10 VDC Output)

Power Consumption:

20 mA max, DC only at 4 to 20 mA Output
4.9 mA max DC at 0 to 5 VDC or 0 to 10 VDC Output
0.12 VA max AC at 0 to 5 VDC or 0 to 10 VDC Output

Load Resistance:

4 to 20 mA Output 850 Ω Maximum @ 24 VDC
0 to 5 VDC or 0 to 10 VDC output 1K Ω minimum

Accuracy at 72°F: $\pm 0.25\%$ of range**Stability:** $\pm 0.25\%$ F.S. per year**Environmental Operation Range:**

-4 to 140°F (-20 to 60°C)

Storage Temperature: -40 to 203°F (-40 to 95°C)**Temperature Error:**

0.01% FS/°F (0.02% FS/°C) ($\pm 5.0"$ W.C. @ -4 to 140°F [-20 to 60°C])

Overpressure: Proof: 27.68 in W.C. (1 PSI),
Burst: 41.52 in W.C. (1.5 PSI)

Wiring: 2 wires (4 to 20mA Current loop)*
3 wires (AC or DC powered, Voltage out)*

Humidity: 0 to 95% RH, non-condensing

Port Connection:

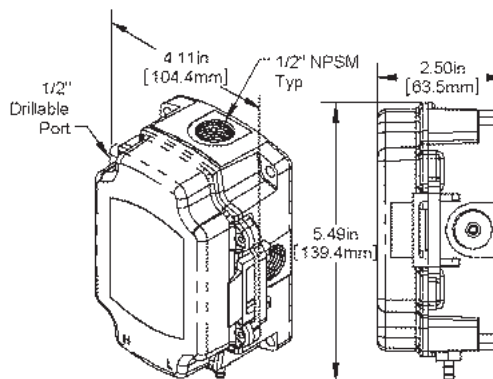
1 High Pressure & 1 Low Pressure
for push-on 1/4" tubing (1/8" to 3/16" I.D.)

Enclosure Material:

UV-resistant Polycarbonate, UL94, V-0

Enclosure Rating: IP66, NEMA 4**Mounting:**

Four external tabs with holes for #10 screws



*BAPI recommends that you do not run wiring for the pressure transmitter in the same conduit as line voltage wiring or with wiring used to supply highly inductive loads such as motors, generators and coils.

Note: Mount unit with the pressure fittings on the bottom to prevent condensation from entering the sensor.





Rev. 10/14/14

“Touch” Pressure Sensor

Zone Pressure Touch Sensors (ZPT)

C7

Ordering Information (for units without a factory specified range or output)

Part Number Description

ZPT-SR-BB-NT-D... Zone Pressure Touch sensor, Standard Ranges, No Tube/Probe included**ZPT-SR-BB-ST-D...** Zone Pressure Touch sensor, Standard Ranges, with Static Pressure Probe**ZPT-SR-BB-AT-D...** Zone Pressure Touch sensor, Standard Ranges, with Attached Static Tube

Note: Pressure Range and Output Range for these units will be selected in the field.

Part numbers for units with a factory specified range or output

Ordering Information		Zone Pressure Touch Sensor in a BAPI-Box, Standard Ranges	
ZPT			
Output Range (Must Select One)			
-20	4 to 20 mA (7 to 40 VDC Supply ONLY)		
-05	0 to 5 V (7 to 40 VDC Supply or 18 to 32 VAC Supply)		
-10	0 to 10 V (13 to 40 VDC Supply or 18 to 32 VAC Supply)		
-12	2 to 10 V (13 to 40 VDC Supply or 18 to 32 VAC Supply)		
-15	1 to 5 V (7 to 40 VDC Supply or 18 to 32 VAC Supply)		
Pressure Range (Must Select One)			
-SR(range)	Standard Pressure Ranges - replace (range) with option # shown below		
	Option	Range (inches W.C.)	Option Range (Pascals)
	71	0 to 1.00	81 0 to 250
	72	0 to 2.00	82 0 to 300
	73	0 to 2.50	83 0 to 500
	74	0 to 3.00	84 0 to 1,000
	75	0 to 5.00	85 0 to 1,250
	76	-1.00 to 1.00	86 -250 to 250
	77	-2.00 to 2.00	87 -300 to 300
	78	-2.50 to 2.50	88 -500 to 500
	79	-3.00 to 3.00	89 -1,000 to 1,000
	80	-5.00 to 5.00	90 -1,250 to 1,250
	Custom Range (W.C.) ***		Custom Range (Pascals) ***
	CI	[x.xx to y.yy]*	CP [xxxx to yyyy]*
Enclosure Style (Must Select One)			
-BB	BAPI-Box Enclosure - IP66 rated, UV-resistant polycarbonate		
Static Pressure Probe (Must Select One)			
-NT	No Tube or Probe Included		
-ST	Static Pressure Measurement Probe Included (not attached)		
-AT	Attached Static Pressure Probe (Not available with Back Mount [-BM])		
LCD Display (Optional, See note **** below)			
-D	LCD Display		
Back Mounting Options (Optional, omit if not required)			
-BM	Back Mount (pressure ports run out the back, not available with Attached Static Pressure Probe [-AT])		
EXAMPLE			
ZPT	-20	-SR71	-BB -NT -D -BM
Example Part Number: ZPT-20-SR71-BB-NT-D-BM			
Your Part Number:			

While field technicians can easily set up custom ranges in the field, BAPI will setup custom ranges in our factory. See the notes below for additional information and fees.

*For custom W.C. ranges, x.xx and y.yy can be any pressure from -5.00 to +5.00 inches W.C. However, y.yy - x.xx must be at least ±1 inch. (Example: ZPT-20-SRCI[0.00 to 3.50]-BB-NT-D-BM)

**For custom Pascal ranges, xxxx and yyyy can be any pressure between -1250 to +1250 Pascals. However, yyyy - xxxx must be at least ±250 Pascals. (Ex: ZPT-20-SRCP[0 to 750]-BB-NT-D-BM)

***There is a net add of \$30 for custom ranges. Multipliers do not apply to net adds. Custom Ranges include a certification of 3 points within the custom pressure range.

****If you do not wish to view the current pressure on the display, simply leave off the "-D" in the part number. Instead of showing the current pressure, the display will show the word "on".



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Application

This valve is typically used in air handling units on heating or cooling coils, and fan coil unit heating or cooling coils. Some other common applications include Unit Ventilators, VAV box re-heat coils and bypass loops. This valve is suitable for use in a hydronic system with variable flow.

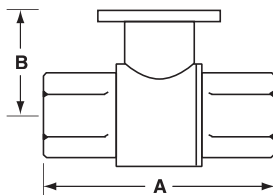
Technical Data	
Service	chilled or hot water, 60% glycol
Flow characteristic	A-port equal percentage
Controllable Flow Range	75°
Sizes	½", ¾"
Type of end fitting	NPT female ends
Materials:	
Body	forged brass, nickel plated
Ball	chrome plated brass
Stem	nickel plated brass
Seats	PTFE
Characterizing disc	Tefzel®
Packing	2 EPDM O-rings, lubricated
Body pressure rating	600 psi
Media temp. range	0°F to 250°F [-18°C to 120°C]
Close off pressure	200 psi
Maximum differential pressure (ΔP)	50 psi for typical applications
Leakage	0% for A to AB
External leakage	according to EN 12266-1:2003
C _v rating	A-port: see product chart for values

Tefzel® is a registered trademark of DuPont

Valve Nominal Size			Type	Suitable Actuators	
C _v	Inches	DN [mm]	2-way NPT	Non-Spring	Spring
0.3	½	15	B207B	TR Series	LR Series
0.46	½	15	B208B		
0.8	½	15	B209B		
1.2	½	15	B210B		
1.9	½	15	B211B		
3	½	15	B212B		
4.7	½	15	B213B		
7.4	½	15	B214B		
10	½	15	B215B		
16	½	15	B216B		
4.7	¾	20	B217B	TF Series	LF Series
7.4	¾	20	B218B		
10	¾	20	B219B		
14	¾	20	B220B		
24	¾	20	B221B*		

*Models without characterizing disc

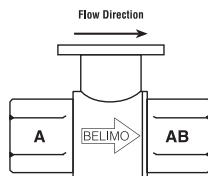
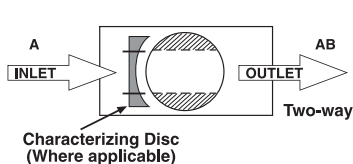
Dimensions



2WayValve-B207-B220

Valve Nominal Size			Dimensions (Inches [mm])	
Valve Body	Inches	DN [mm]	A	B
B207B-B211B	½"	15	2.38" [60.8]	1.39" [35.2]
B212B-B216B	½"	15	2.38" [60.8]	1.78" [45.2]
B217B-B221B	¾"	20	2.73" [69.3]	1.87" [47.4]

Flow Patterns



TFRB(X)24-SR Actuators, Proportional



Models

TFRB(X)24-SR

TFRB(X)24-SR-S w/built-in Aux. Switch

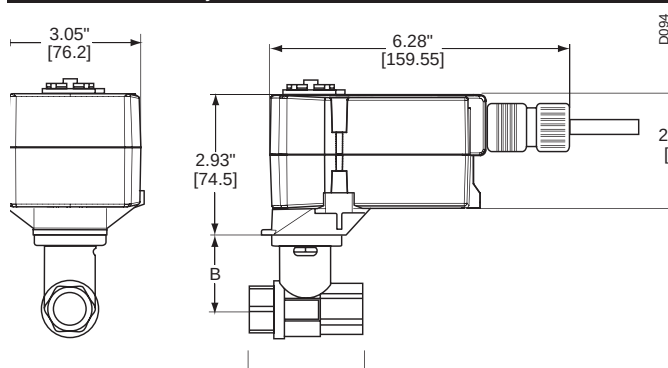
Technical Data	
Control	proportional
Power supply	24 VAC $\pm$ 20%, 50/60 Hz 24 VDC $\pm$ 10%
Power consumption	running 2.5 W holding 1.0 W
Transformer sizing	4 VA (class 2 power source)
Electrical connection (-S models have 2 cables)	1/2" conduit connector 18 GA plenum rated cable TFRB(X)24-SR... 3 ft [1m] 10 ft [3m] 16 ft [5m]
Electrical protection	actuators are double insulated
Overload protection	electronic throughout 0° to 95° rotation
Operating range Y	2 to 10 VDC, 4 to 20 mA
Input impedance	100k Ω (0.1mA), 500 Ω
Angle of rotation	95°
Direction of rotation	spring reversible with CW/CCW mounting motor reversible with built-in switch
Position indication	visual indicator, 0° to 95°
Running time	motor 95 sec constant, independent of load spring <25 sec @ -4°F to 122°F [-20°C to 50°C] <60 sec @ -22°F [-30°C]
Humidity	5 to 95% RH non-condensing
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA type 2/IP42
Housing material	UL94 - 5VA
Agency listings†	cULus according to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE according to 2004/108/EC and 2006/95/EC for line voltage and/or -S versions
Noise level (max)	running <35 db (A) spring return <62 db (A)
Quality standard	ISO 9001

TFRB(X)24-SR-S

Auxiliary switch	1 x SPDT, 3A (0.5A) @ 250 VAC, UL Listed, adjustable 0° to 95°
------------------	--

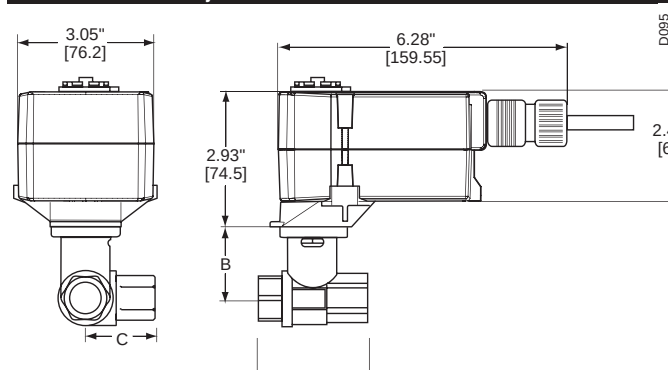
† Rated impulse voltage 800V (4kV for 120V model), Control pollution degree 3,
Type of action 1.AA (1.AA.B for -S models)

Dimensions with 2-Way Valve



Valve Body	Valve Nominal Size		Dimensions (Inches [mm])	
	Inches	DN [mm]	A	B
B207(B)-B211(B)	1/2"	15	2.41" [61.1]	1.39" [35.2]
B212(B)-B215(B)	1/2"	15	2.38" [60.4]	1.78" [45.2]
B217(B)-B221(B)	3/4"	20	2.73" [69.3]	1.87" [47.4]

Dimensions with 3-Way Valve



Valve Body	Valve Nominal Size		Dimensions (Inches [mm])		
	Inches	DN [mm]	A	B	C
B307(B)-B311(B)	1/2"	15	2.41" [61.1]	1.39" [35.2]	1.20" [30.6]
B312(B)-B315(B)	1/2"	15	2.38" [60.4]	1.78" [45.2]	1.29" [32.8]
B317(B)-B321(B)	3/4"	20	2.73" [69.3]	1.87" [47.4]	1.47" [37.3]

050905 - 05/12 - Subject to change. © Belimo Aircontrols (USA), Inc.

Wiring Diagrams

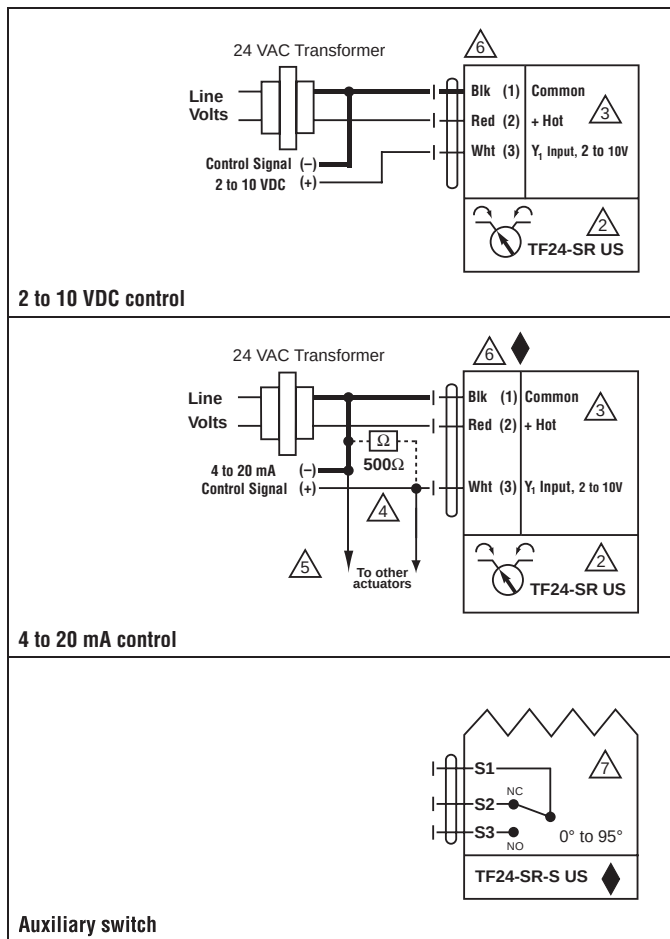
✂️ INSTALLATION NOTES

- ⚠️ **CAUTION Equipment damage!**
Actuators may be connected in parallel.
Power consumption and input impedance must be observed.
Up to 4 actuators may be connected in parallel. With 4 actuators wired to one 500 Ω resistor, a +2% shift of control signal may be required.
Power consumption must be observed.
- ⚠️ Up to 4 actuators may be connected in parallel. With 4 actuators wired to one 500 Ω resistor, a +2% shift of control signal may be required.
Power consumption must be observed.
- ⚠️ Actuators may also be powered by 24 VDC.
- ⚠️ Only connect common to neg. (—) leg of control circuits.
- ⚠️ Actuators with plenum rated cable do not have numbers on wires; use color codes instead.
- ⚠️ For end position indication, interlock control, fan startup, etc., TF24-SR-S US incorporates one built-in auxiliary switch: 1 x SPDT, 3A (0.5A) @250 VAC, UL listed, adjustable 0° to 95°.

📄 APPLICATION NOTES

- ◆ Meets cULus or UL and CSA requirements without the need of an electrical ground connection.

⚠️ **WARNING Live Electrical Components!**
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.





Application

This valve is typically used in air handling units on heating or cooling coils, and fan coil unit heating or cooling coils. Some other common applications include Unit Ventilators, VAV box re-heat coils and bypass loops. This valve is suitable for use in a hydronic system with variable flow.

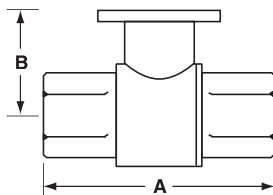
Technical Data	
Service	chilled or hot water, 60% glycol
Flow characteristic	A-port equal percentage
Controllable Flow Range	75°
Sizes	½", ¾"
Type of end fitting	NPT female ends
Materials:	
Body	forged brass, nickel plated
Ball	chrome plated brass
Stem	nickel plated brass
Seats	PTFE
Characterizing disc	Tefzel®
Packing	2 EPDM O-rings, lubricated
Body pressure rating	600 psi
Media temp. range	0°F to 250°F [-18°C to 120°C]
Close off pressure	200 psi
Maximum differential pressure (ΔP)	50 psi for typical applications
Leakage	0% for A to AB
External leakage	according to EN 12266-1:2003
C _v rating	A-port: see product chart for values

Tefzel® is a registered trademark of DuPont

Valve Nominal Size			Type	Suitable Actuators			
C _v	Inches	DN [mm]	2-way NPT	Non-Spring	Spring		
0.3	½	15	B207B	TR Series	LR Series	TF Series	LF Series
0.46	½	15	B208B				
0.8	½	15	B209B				
1.2	½	15	B210B				
1.9	½	15	B211B				
3	½	15	B212B				
4.7	½	15	B213B				
7.4	½	15	B214B				
10	½	15	B215B				
16	½	15	B216B				
4.7	¾	20	B217B				
7.4	¾	20	B218B				
10	¾	20	B219B				
14	¾	20	B220B				
24	¾	20	B221B*				

*Models without characterizing disc

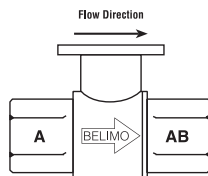
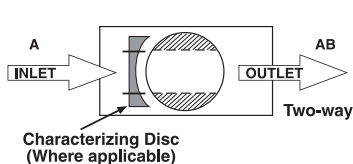
Dimensions



2WayValve-B207-B220

Valve Nominal Size			Dimensions (Inches [mm])	
Valve Body	Inches	DN [mm]	A	B
B207B-B211B	½"	15	2.38" [60.8]	1.39" [35.2]
B212B-B216B	½"	15	2.38" [60.8]	1.78" [45.2]
B217B-B221B	¾"	20	2.73" [69.3]	1.87" [47.4]

Flow Patterns



TR24-3 Actuators, On-Off, Floating Point



Models

TR24-3-T US

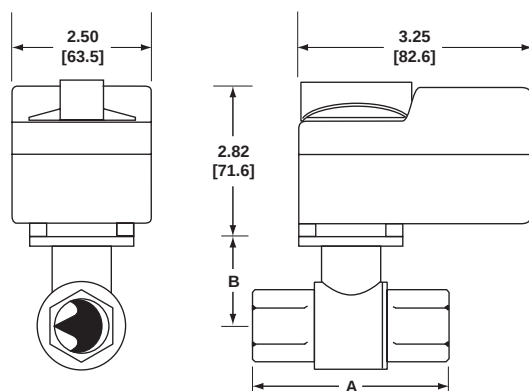
TR24-3 US	TR24-3-T US with 3 ft plenum rated cable
TR24-3/300 US	TR24-3-T US with 10 ft plenum rated cable
TR24-3/500 US	TR24-3-T US with 16 ft plenum rated cable

Technical Data

Control	On/Off, Floating Point
Nominal voltage	24 VAC 50/60 Hz
Nominal voltage range	19.2...28.8 VAC
Power consumption	1 W
Transformer sizing	1VA (class 2 power source)
Electrical connection	screw terminals accessible after removal of small cover (3 ft, 10 ft, 16 ft cables optional)
Input impedance	.36 kΩ
Angle of rotation	90°
Position indication	integrated into handle
Manual override	push down handle
Running time	90 seconds @ 60 hz, 108 seconds @ 50 hz
Humidity	5 to 95% non-condensing
Ambient temperature	-22°F to 122°F (-30°C to 50°C)
Storage temperature	-40°F to 176°F (-40°C to 80°C)
Housing	NEMA 1/IP40
Housing rating	UL94-5V(B)
Agency listing†	cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1, CSA C22.2 No. 24-93, CE acc. to 89/336/EEC
Noise level	Max. 35 db (A)
Quality standard	ISO 9001

† Rated impulse voltage 330V, Control pollution degree 2, Type of action 1

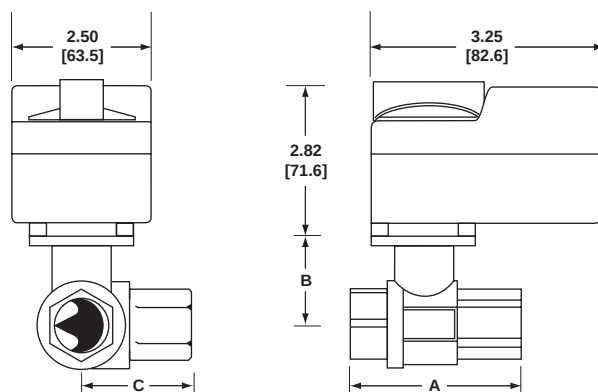
Dimensions with 2-Way Valve



D069

Valve Body	Valve Nominal Size		Dimensions (Inches [mm])	
	Inches	DN [mm]	A	B
B207(B)-B211(B)	½"	15	2.41" [61.1]	1.39" [35.2]
B212(B)-B215(B)	½"	15	2.38" [60.4]	1.72" [43.7]
B217(B)-B220(B)	¾"	20	2.73" [69.3]	1.81" [45.9]

Dimensions with 3-Way Valve



D072

Valve Body	Valve Nominal Size		Dimensions (Inches [mm])		
	Inches	DN [mm]	A	B	C
B307(B)-B311(B)	½"	15	2.41" [61.1]	1.39" [35.2]	1.20" [30.6]
B312(B)-B315(B)	½"	15	2.38" [60.4]	1.72" [43.7]	1.26" [32.1]
B317(B)-B320(B)	¾"	20	2.73" [69.3]	1.81" [45.9]	1.45" [36.8]

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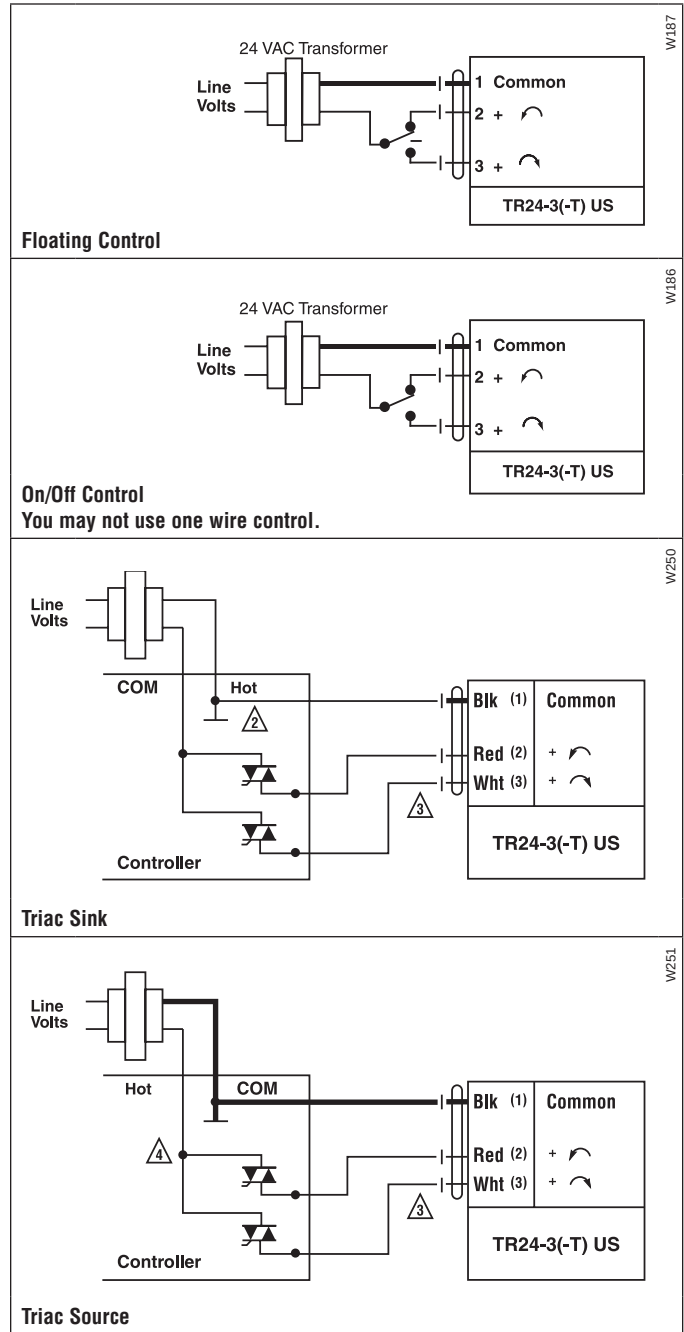
Wiring Diagrams

✂ INSTALLATION NOTES

- 2 The common connection from the actuator must be connected to the Hot connection of the controller.
- 3 Actuators with plenum rated cable do not have numbers on wires; use color codes instead.
- 4 The actuator Hot must be connected to the control board Hot.

⚠ WARNING Live Electrical Components!
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

NOTE: TR24-3(-T) US cannot be wired in parallel with themselves or any other actuator.





Application

This valve is typically used in air handling units on heating or cooling coils, and fan coil unit heating or cooling coils. Some other common applications include Unit Ventilators, VAV box re-heat coils and bypass loops. This valve is suitable for use in a hydronic system with variable flow.

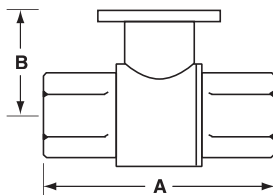
Technical Data	
Service	chilled or hot water, 60% glycol
Flow characteristic	A-port equal percentage
Controllable Flow Range	75°
Sizes	½", ¾"
Type of end fitting	NPT female ends
Materials:	
Body	forged brass, nickel plated
Ball	chrome plated brass
Stem	nickel plated brass
Seats	PTFE
Characterizing disc	Tefzel®
Packing	2 EPDM O-rings, lubricated
Body pressure rating	600 psi
Media temp. range	0°F to 250°F [-18°C to 120°C]
Close off pressure	200 psi
Maximum differential pressure (ΔP)	50 psi for typical applications
Leakage	0% for A to AB
External leakage	according to EN 12266-1:2003
C _v rating	A-port: see product chart for values

Tefzel® is a registered trademark of DuPont

Valve Nominal Size			Type	Suitable Actuators			
C _v	Inches	DN [mm]	2-way NPT	Non-Spring	Spring		
0.3	½	15	B207B	TR Series	LR Series	TF Series	LF Series
0.46	½	15	B208B				
0.8	½	15	B209B				
1.2	½	15	B210B				
1.9	½	15	B211B				
3	½	15	B212B				
4.7	½	15	B213B				
7.4	½	15	B214B				
10	½	15	B215B				
16	½	15	B216B				
4.7	¾	20	B217B	TR Series	LR Series	TF Series	LF Series
7.4	¾	20	B218B				
10	¾	20	B219B				
14	¾	20	B220B				
24	¾	20	B221B*				

*Models without characterizing disc

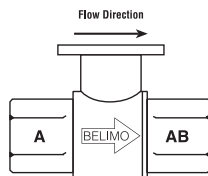
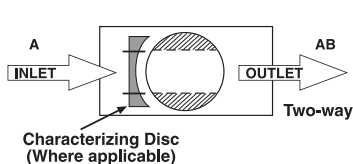
Dimensions



2WayValve-B207-B220

Valve Nominal Size			Dimensions (Inches [mm])	
Valve Body	Inches	DN [mm]	A	B
B207B-B211B	½"	15	2.38" [60.8]	1.39" [35.2]
B212B-B216B	½"	15	2.38" [60.8]	1.78" [45.2]
B217B-B221B	¾"	20	2.73" [69.3]	1.87" [47.4]

Flow Patterns



TR24-SR Actuators, Proportional



Models

TR24-SR-T US

TR24-SR US	TR24-SR-T US with 3 ft plenum rated cable
TR24-SR/300 US	TR24-SR-T US with 10 ft plenum rated cable
TR24-SR/500 US	TR24-SR-T US with 16 ft plenum rated cable

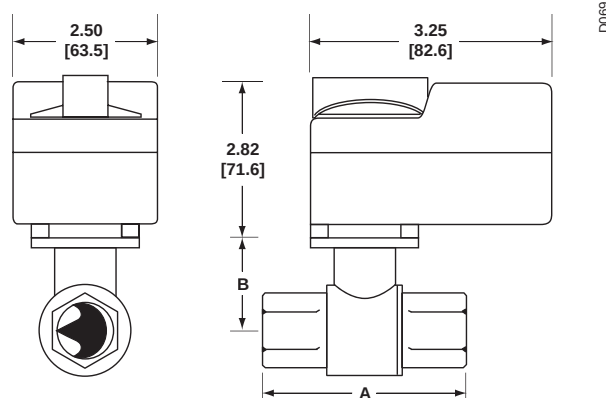
Technical Data

Control	proportional
Nominal voltage	24 VAC 50/60 Hz, 24 VDC
Nominal voltage range	19.2...28.8 VAC, 21.6...28.8 VDC
Power consumption	0.5 W
Transformer sizing	1VA (class 2 power source)
Electrical connection	screw terminals accessible after removal of small cover (3 ft, 10 ft, 16 ft cables optional)
Input impedance	100 kΩ
Angle of rotation	90°
Direction of rotation	reversible with switch under cover
Position indication	integrated into handle
Manual override	push down handle
Running time	90 seconds
Humidity	5 to 95% non-condensing
Ambient temperature	-22°F to 122°F (-30°C to 50°C)
Storage temperature	-40°F to 176°F (-40°C to 80°C)
Housing	NEMA 1/IP40
Housing rating	UL94-5V(B)
Agency listing†	cULus according to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE according to 2004/108/EC and 2006/95/EC for line voltage and/or -S versions
Noise level	max. 35 db (A)
Quality standard	ISO 9001

† Rated impulse voltage 500V, Control pollution degree 2, Type of action 1

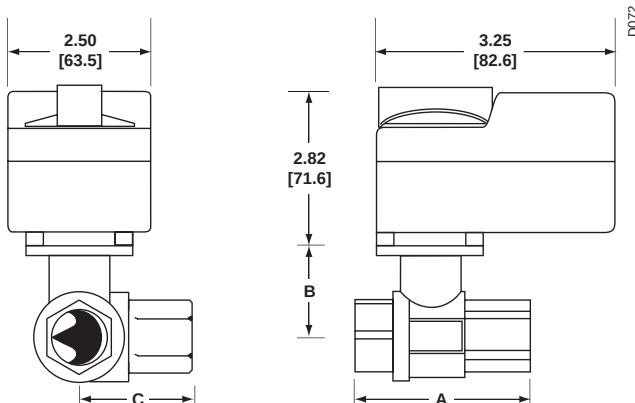
NOTE: Response sensitivity is 75mV

Dimensions with 2-Way Valve



Valve Body	Valve Nominal Size		Dimensions (Inches [mm])	
	Inches	DN [mm]	A	B
B207(B)-B211(B)	½"	15	2.41" [61.1]	1.39" [35.2]
B212(B)-B215(B)	½"	15	2.38" [60.4]	1.78" [45.2]
B217(B)-B221(B)	¾"	20	2.73" [69.3]	1.87" [47.4]

Dimensions with 3-Way Valve



Valve Body	Valve Nominal Size		Dimensions (Inches [mm])		
	Inches	DN [mm]	A	B	C
B307(B)-B311(B)	½"	15	2.41" [61.1]	1.39" [35.2]	1.20" [30.6]
B312(B)-B315(B)	½"	15	2.38" [60.4]	1.78" [45.2]	1.29" [32.8]
B317(B)-B321(B)	¾"	20	2.73" [69.3]	1.87" [47.4]	1.47" [37.3]

Wiring Diagrams



INSTALLATION NOTES



Actuators with color coded wires are optional.
Wire numbers are provided for reference.

CAUTION Equipment damage!

Actuators may be connected in parallel.

Power consumption and input impedance must be observed.

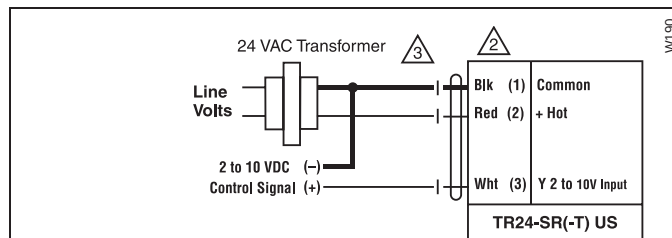


Actuators may also be powered by 24 VDC.

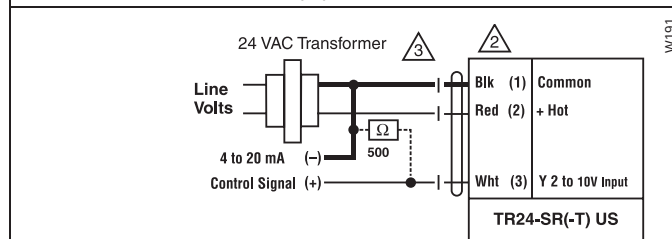


WARNING Live Electrical Components!

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2 to 10 VDC Control of TR24-SR(-T) US



4 to 20 mA Control of TR24-SR(-T) US

Direct/Reverse acting switch is under wiring cover.

R = CW with decrease in signal

L = CCW with decrease in signal

No feedback

B238, 2-Way, Characterized Control Valve

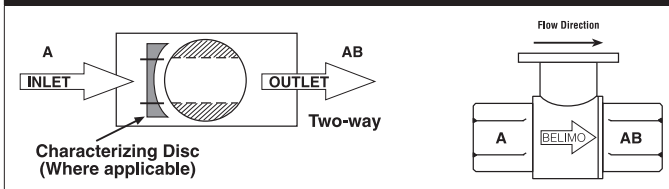
Stainless Steel Ball and Stem



Technical Data

Service	chilled, hot water, up to 60% glycol
Flow Characteristic	equal percentage
Controllable Flow Range	75°
Size [mm]	1.5" [40]
End Fitting	NPT female ends
Body	forged brass, nickel plated
Ball	stainless steel
Stem	stainless steel
Stem Packing	EPDM (lubricated)
Seat	Teflon® PTFE
Seat O-ring	EPDM (lubricated)
Characterized Disc	TEFZEL®
Body Pressure Rating [psi]	400
Media Temperature Range (Water)	0°F to 250°F [-18°C to 120°C]
Max Differential Pressure (Water)	50 psi (345 kPa)
Close-Off Pressure	200 psi
Cv	19
Weight	2 lb [0.9 kg]
Leakage	0% for A to AB
Servicing	maintenance free

Flow Pattern



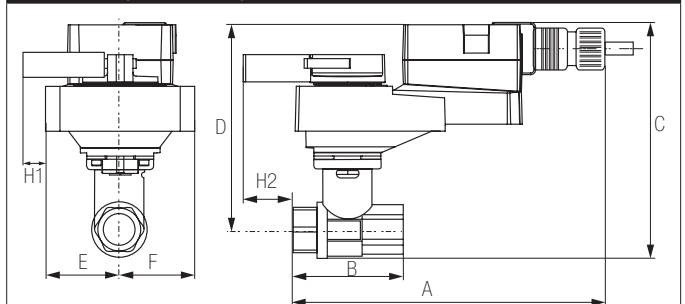
Application

This valve is typically used in air handling units on heating or cooling coils, and fan coil unit heating or cooling coils. Some other common applications include Unit Ventilators, VAV box re-heat coils and bypass loops. This valve is suitable for use in a hydronic system with variable flow.

Suitable Actuators

	Non-Spring	Spring
B238	ARB(X), NRQB(X)	AFRB(X)

Dimensions (Inches [mm])

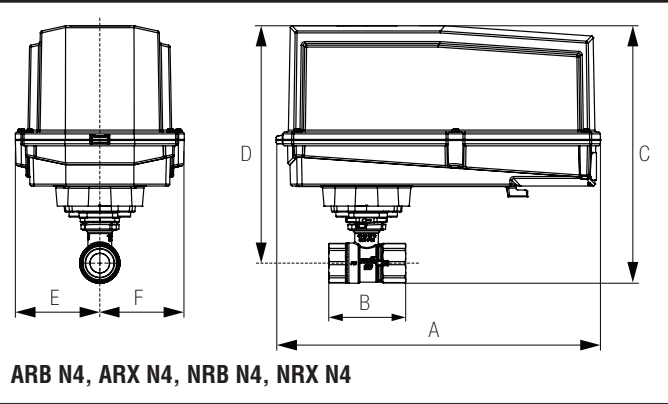


ARB, ARX

A	B	C	D	E	F	H1	H2
11"	3.88"	6.43"	5.28"	1.73"	[44]	1.18"	0.5"
[279]	[99]	[163]	[134]			[30]	[15]

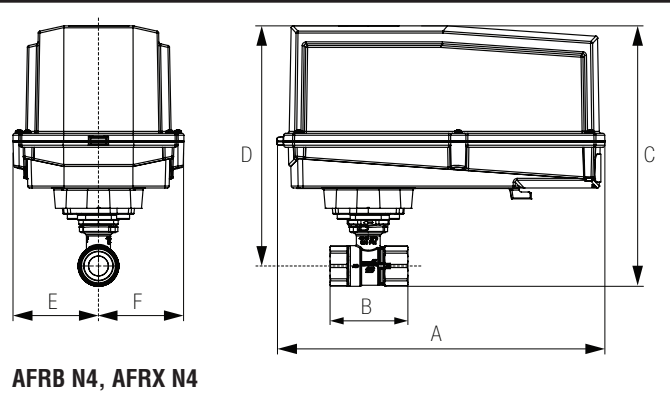
B238, 2-Way, Characterized Control Valve
Stainless Steel Ball and Stem

Dimensions (Inches [mm])



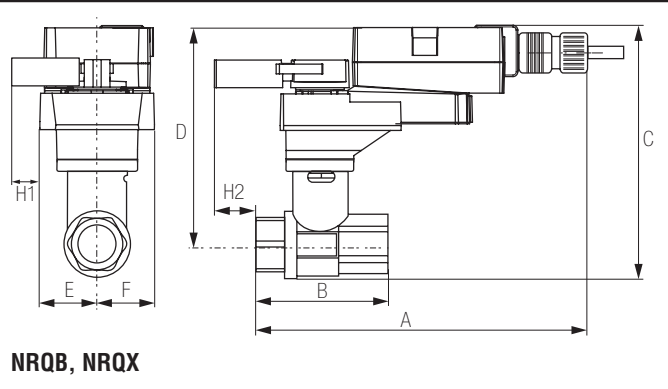
A	B	C	D	E	F
11.36" [289]	3.88" [99]	8.47" [215]	7.32" [186]	2.44" [62]	

Dimensions (Inches [mm])



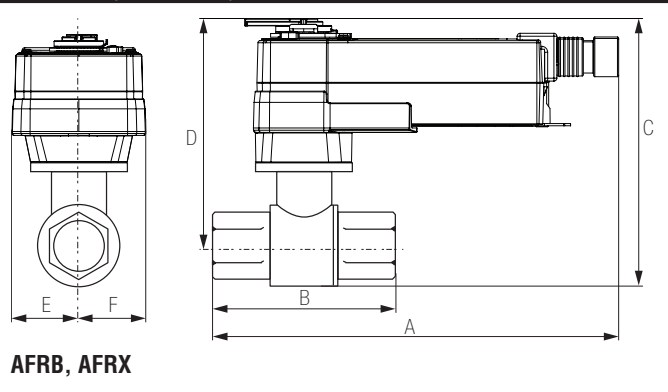
A	B	C	D	E	F
12.98" [330]	3.88" [99]	10.29" [261]	8.55" [217]	3.39" [86]	

Dimensions (Inches [mm])



A	B	C	D	E	F	H1	H2
11" [279]	3.88" [99]	7.12" [181]	5.97" [152]	1.73" [44]		1.39" [34]	0.5" [15]

Dimensions (Inches [mm])



A	B	C	D	E	F
10.77" [274]	3.88" [99]	8.96" [228]	7.81" [198]	2.02" [51]	

ARB24-3-S

On/Off, Floating Point, Non-Spring Return, 24 V



Technical Data	
Power Supply	24 VAC $\pm$ 20%, 50/60 Hz, 24 VDC $\pm$ 10%
Power Consumption Running	2.5 W
Power Consumption Holding	0.5 W
Transformer Sizing	5.5 VA (class 2 power source)
Electrical Connection	3 ft [1 m], 18 GA plenum cable with 1/2" conduit connector
Overload Protection	electronic throughout 0° to 95° rotation
Input Impedance	600 Ω
Angle of Rotation	90°
Direction of Rotation (Motor)	reversible with built-in switch
Position Indication	integrated into handle
Manual Override	external push button
Running Time (Motor)	90 sec
Ambient Temperature Range	-22°F to +122°F [-30°C to +50°C]
Storage Temperature Range	-40°F to +176°F [-40°C TO +80°C]
Housing	NEMA 2, IP54
Agency Listings†	cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC and 2006/95/EC
Noise Level (Motor)	<45 dB (A)
Servicing	maintenance free
Quality Standard	ISO 9001
Auxiliary Switch	1 x SPDT, 3A resistive (0.5A inductive) 250 VAC

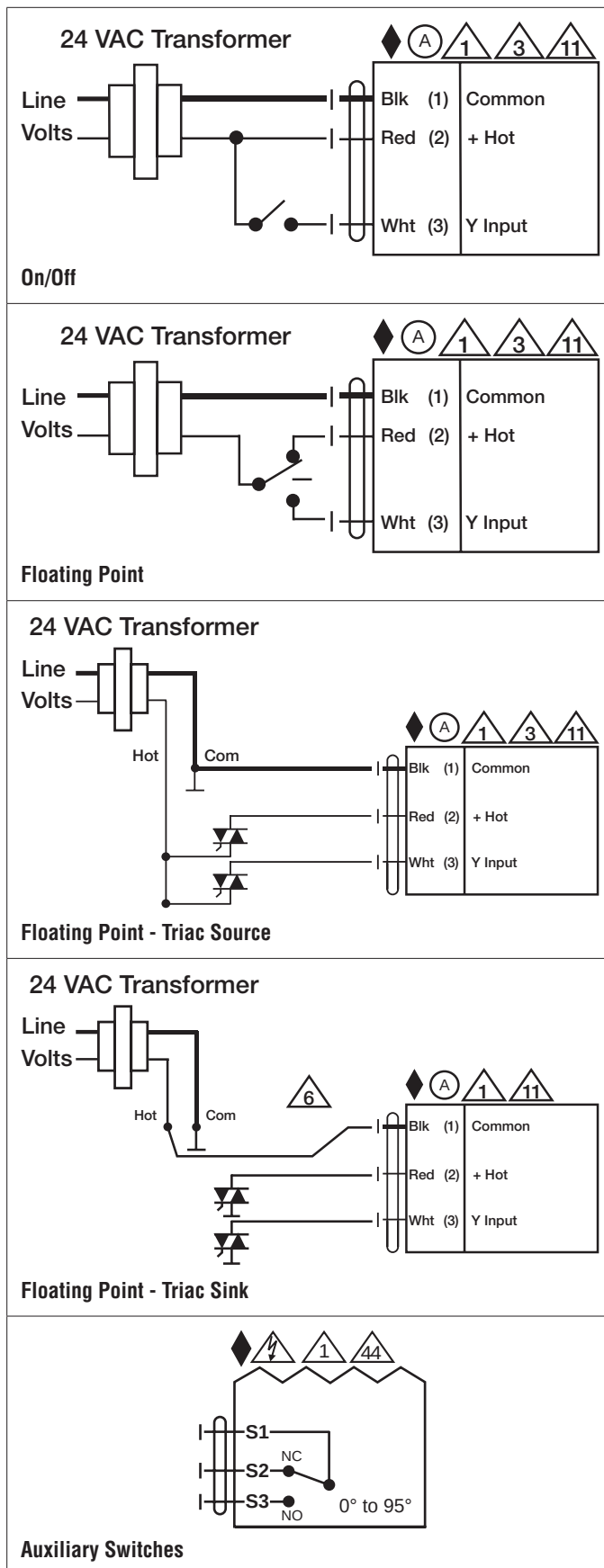
†Rated Impulse Voltage 800V, Type action 1.B , Control Pollution Degree 3.

Wiring Diagrams

INSTALLATION NOTES

- (A) Actuators with appliance cables are numbered.
- 1 Provide overload protection and disconnect as required.
- 3 Actuators may also be powered by 24 VDC.
- 6 Actuators Hot wire must be connected to the control board common. Only connect common to neg. (-) leg of control circuits. Terminal models (-T) have no-feedback.
- 11 Actuators may be connected in parallel if not mechanically linked. Power consumption and input impedance must be observed.
- 18 Actuators with plenum cable do not have numbers; use color codes instead.
- 44 One built-in auxiliary switch (1x SPDT), for end position indication, interlock control, fan startup, etc.
- ⚡ Apply only AC line voltage or only UL-Class 2 voltage to the terminals of auxiliary switches. Mixed or combined operation of line voltage/safety extra low voltage is not allowed.
- ◆ Meets cULus requirements without the need of an electrical ground connection.

WARNING! LIVE ELECTRICAL COMPONENTS!
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B3 Series, 3-Way, Characterized Control Valve Chrome Plated Brass Ball and Brass Stem

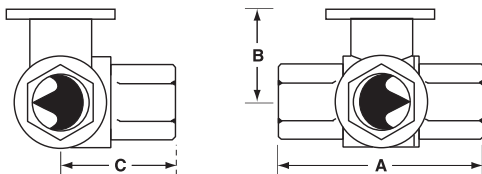


Technical Data

Service	chilled or hot water, 60% glycol
Flow characteristic	A-port equal percentage B-port modified for constant common port flow
Controllable Flow Range	75°
Sizes	½", ¾"
Type of end fitting	NPT female ends
Materials:	
Body	forged brass, nickel plated
Ball	chrome plated brass
Stem	nickel plated brass
Seats	PTFE
Characterizing disc	Tefzel®
Packing	2 EPDM O-rings, lubricated
Body pressure rating	600 psi
Media temp. range	0°F to 250°F [-18°C to 120°C]
Close off pressure	200 psi
Maximum differential pressure (ΔP)	50 psi for typical applications
Leakage	0% for A to AB <2.0% for B to AB
External leakage	according to EN 12266-1:2003
C _v rating	A-port: see product chart for values B-port: 70% of A to AB C _v

Tefzel® is a registered trademark of DuPont

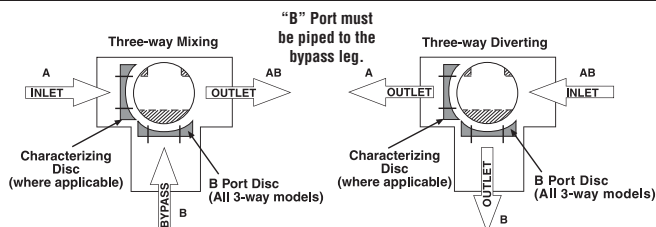
Dimensions



3WayValve-B307-B320

Valve Nominal Size			Dimensions (Inches [mm])		
Valve Body	Inches	DN [mm]	A	B	C
B307B-B311B	½"	15	2.41" [61.1]	1.39" [35.2]	1.20" [30.6]
B312B-B316B	½"	15	2.38" [60.4]	1.78" [45.2]	1.29" [32.8]
B317B-B321B	¾"	20	2.73" [69.3]	1.87" [47.4]	1.47" [37.3]

Flow Patterns



Application

This valve is typically used in air handling units on heating or cooling coils, and fan coil unit heating or cooling coils. Some other common applications include Unit Ventilators, VAV box re-heat coils and bypass loops. This valve is suitable for use in a hydronic system with variable or constant flow.

* (Not for use in change over applications)

Valve Nominal Size			Type	Suitable Actuators			
C _v	Inches	DN [mm]	3-way NPT	Non-Spring	Spring		
0.3	½	15	B307B	TR Series	LR Series	TF Series	LF Series
0.46	½	15	B308B				
0.8	½	15	B309B				
1.2	½	15	B310B				
1.9	½	15	B311B				
3	½	15	B312B				
4.7	½	15	B313B				
10	½	15	B315B				
16	½	15	B316B				
4.7	¾	20	B317B				
7.4	¾	20	B318B				
14	¾	20	B320B				
24	¾	20	B321B				

*Models without characterizing disc

TR24-SR Actuators, Proportional



Models

TR24-SR-T US

TR24-SR US	TR24-SR-T US with 3 ft plenum rated cable
TR24-SR/300 US	TR24-SR-T US with 10 ft plenum rated cable
TR24-SR/500 US	TR24-SR-T US with 16 ft plenum rated cable

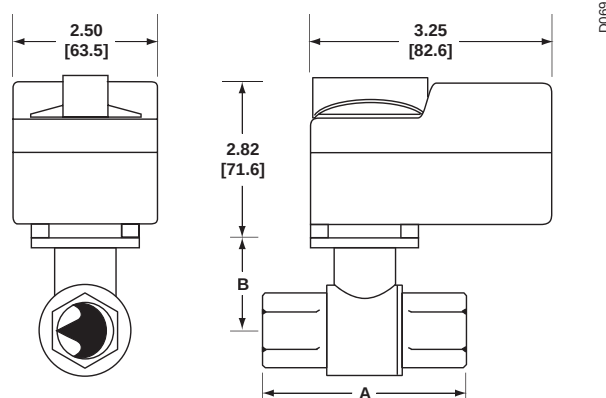
Technical Data

Control	proportional
Nominal voltage	24 VAC 50/60 Hz, 24 VDC
Nominal voltage range	19.2...28.8 VAC, 21.6...28.8 VDC
Power consumption	0.5 W
Transformer sizing	1VA (class 2 power source)
Electrical connection	screw terminals accessible after removal of small cover (3 ft, 10 ft, 16 ft cables optional)
Input impedance	100 kΩ
Angle of rotation	90°
Direction of rotation	reversible with switch under cover
Position indication	integrated into handle
Manual override	push down handle
Running time	90 seconds
Humidity	5 to 95% non-condensing
Ambient temperature	-22°F to 122°F (-30°C to 50°C)
Storage temperature	-40°F to 176°F (-40°C to 80°C)
Housing	NEMA 1/IP40
Housing rating	UL94-5V(B)
Agency listing†	cULus according to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE according to 2004/108/EC and 2006/95/EC for line voltage and/or -S versions
Noise level	max. 35 db (A)
Quality standard	ISO 9001

† Rated impulse voltage 500V, Control pollution degree 2, Type of action 1

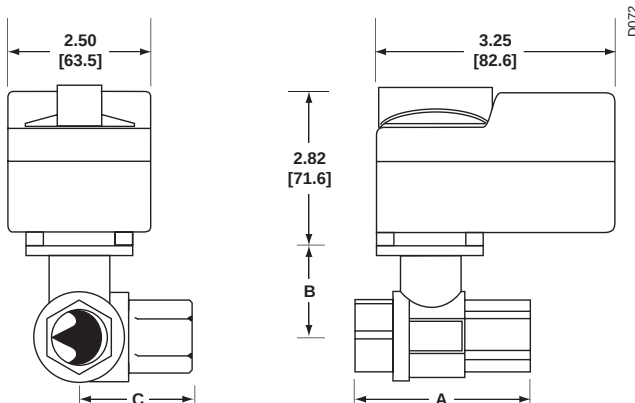
NOTE: Response sensitivity is 75mV

Dimensions with 2-Way Valve



Valve Body	Valve Nominal Size		Dimensions (Inches [mm])	
	Inches	DN [mm]	A	B
B207(B)-B211(B)	½"	15	2.41" [61.1]	1.39" [35.2]
B212(B)-B215(B)	½"	15	2.38" [60.4]	1.78" [45.2]
B217(B)-B221(B)	¾"	20	2.73" [69.3]	1.87" [47.4]

Dimensions with 3-Way Valve



Valve Body	Valve Nominal Size		Dimensions (Inches [mm])		
	Inches	DN [mm]	A	B	C
B307(B)-B311(B)	½"	15	2.41" [61.1]	1.39" [35.2]	1.20" [30.6]
B312(B)-B315(B)	½"	15	2.38" [60.4]	1.78" [45.2]	1.29" [32.8]
B317(B)-B321(B)	¾"	20	2.73" [69.3]	1.87" [47.4]	1.47" [37.3]

Wiring Diagrams

✂ INSTALLATION NOTES



Actuators with color coded wires are optional.
Wire numbers are provided for reference.

CAUTION Equipment damage!

Actuators may be connected in parallel.
Power consumption and input impedance must be observed.

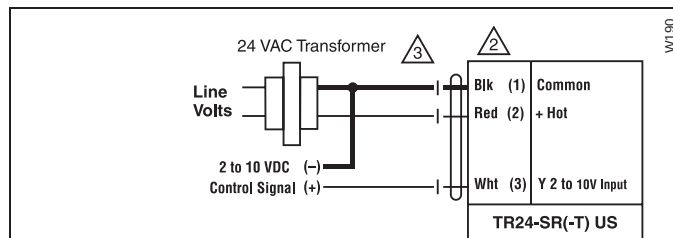


Actuators may also be powered by 24 VDC.

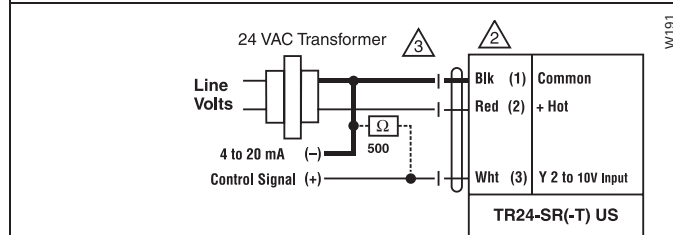


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2 to 10 VDC Control of TR24-SR(-T) US



4 to 20 mA Control of TR24-SR(-T) US

Direct/Reverse acting switch is under wiring cover.

R = CW with decrease in signal

L = CCW with decrease in signal

No feedback



Technical Data		AFB24, AFB24-S, AFX24, AFX24-S
Power supply		24 VAC $\pm$ 20% 50/60 Hz 24 VDC $\pm$ 20% / -10%
Power consumption	running	5 W
	holding	2.5 W
Transformer sizing		7.5 VA (class 2 power source)
Electrical connection		
AFB24...		3 ft, 18 GA appliance cable, 1/2" conduit connector -S models: two 3 ft, 18 gauge appliance cables with 1/2" conduit connectors
AFX24...		3 ft [1m], 10 ft [3m] or 16 ft [5m] 18 GA appliance or plenum cables, with or without 1/2" conduit connector -S models: two 3 ft [1m], 10 ft [3m] or 16 ft [5m] appliance cables, with or without 1/2" conduit connectors
Overload protection		electronic throughout 0 to 95° rotation
Control		on/off
Torque		180 in-lb [20 Nm] minimum
Direction of rotation	spring	reversible with CW/CCW mounting
Mechanical angle of rotation		95° (adjustable with mechanical end stop, 35° to 95°)
Running time	motor	< 75 seconds
	spring	20 seconds @ -4°F to 122°F [-20°C to 50°C]; < 60 seconds @ -22°F [-30°C]
Position indication		visual indicator, 0° to 95° (0° is full spring return position)
Manual override		5 mm hex crank (3/16" Allen), supplied
Humidity		max. 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		Nema 2, IP54, Enclosure Type2
Housing material		zinc coated metal and plastic casing
Agency listings †		cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC & 2006/95/EC
Noise level		<50dB(A) motor @ 75 seconds <62dB(A) spring return
Servicing		maintenance free
Quality standard		ISO 9001
Weight		4.6 lbs (2.1 kg); 4.9 lbs (2.25 kg) with switches
† Rated Impulse Voltage 800V, Type of action 1.AA (1.AA.B for -S version), Control Pollution Degree 3.		
AFB24-S, AFX24-S		
Auxiliary switches		2 x SPDT 3A (0.5A) @ 250 VAC, UL approved one set at +10°, one adjustable 10° to 90°

Torque min. 180 in-lb, for control of air dampers

Application

For On/Off, fail-safe control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications. Control is On/Off from an auxiliary contact, or a manual switch.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

Operation

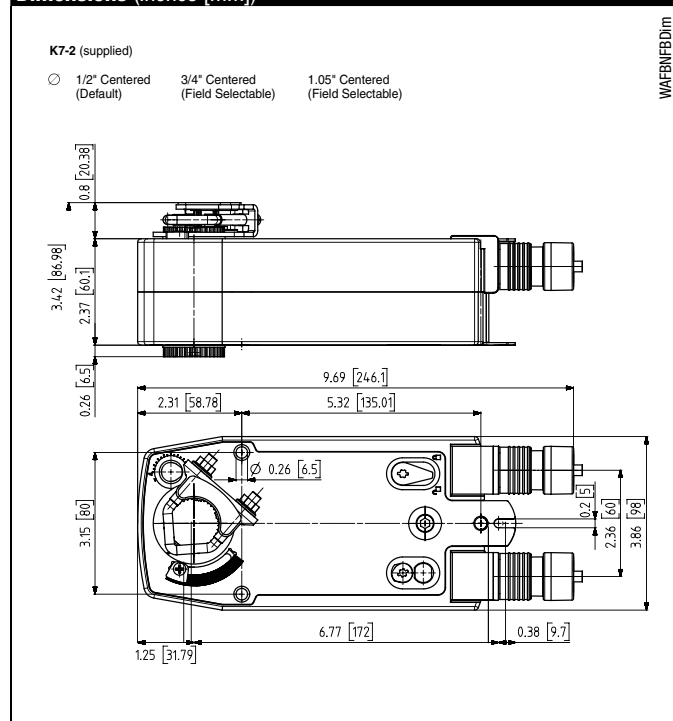
The AFB and AFX series actuators provide true spring return operation for reliable fail-safe application and positive close off on air tight dampers. The spring return system provides constant torque to the damper with, and without, power applied to the actuator.

The AFB and AFX series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 95°.

The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches.

The AFB24-S and AFX24-S versions are provided with two built-in auxiliary switches. These SPDT switches are provided for safety interfacing or signaling, for example, for fan start-up. The switching function at the fail-safe position is fixed at +10°, the other switch function is adjustable between +10° to +90°. The AFB24, AFB24-S, AFX24 and AFX24-S actuator is shipped at +5° (5° from full fail-safe) to provide automatic compression against damper gaskets for tight shut-off.

Dimensions (Inches [mm])



AFB24, AFB24-S, AFX24, AFX24-S

On/Off, Spring Return, 24 V



Accessories	
AV 8-25	Shaft extension
IND-AFB	Damper position indicator
KH-AFB	Crank arm
K7-2	Universal clamp for up to 1.05" dia jackshafts
TF-CC US	Conduit fitting
Tool-06	8mm and 10 mm wrench
ZG-100	Universal mounting bracket
ZG-101	Universal mounting bracket
ZG-118	Mounting bracket for Barber Colman® MA 3../4..., Honeywell® Mod III or IV or Johnson® Series 100 replacement or new crank arm type installations
ZG-AFB	Crank arm adaptor kit
ZG-AFB118	Crank arm adaptor kit
ZS-100	Weather shield (metal)
ZS-150	Weather shield (polycarbonate)
ZS-260	Explosion-proof housing
ZS-300	NEMA 4X housing

Note: When using AFB24, AFB24-S, AFX24, AFX24-S actuators, only use accessories listed on this page.

For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

Typical Specification

On/Off spring return damper actuators shall be direct coupled type which require no crank arm and linkage and be capable of direct mounting to a jackshaft up to a 1.05" diameter. The actuators must be designed so that they may be used for either clockwise or counterclockwise fail-safe operation. Actuators shall be protected from overload at all angles of rotation. If required, two SPDT auxiliary switch shall be provided having the capability of one being adjustable. Actuators with auxiliary switches must be constructed to meet the requirements for Double Insulation so an electrical ground is not required to meet agency listings. Actuators shall be cULus Approved and have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

Wiring Diagrams

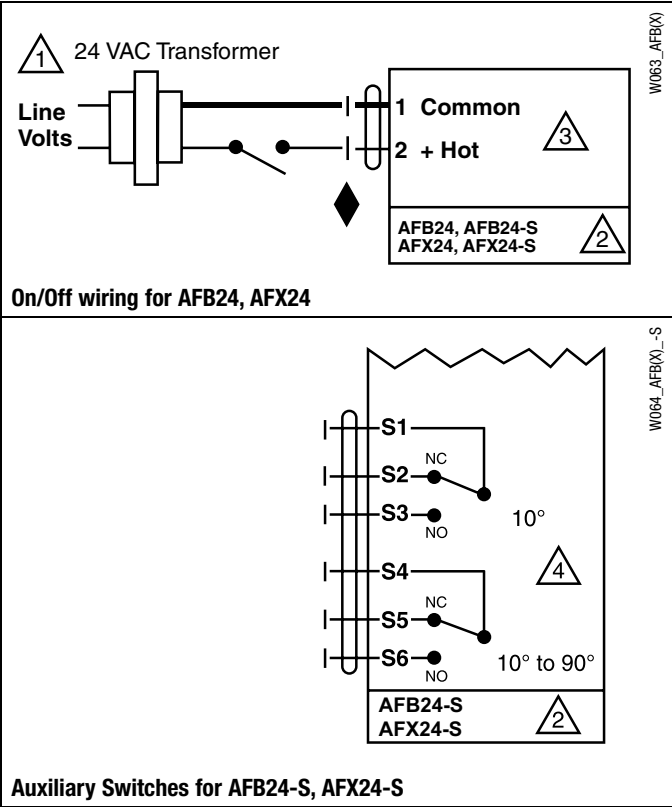
INSTALLATION NOTES

- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**
Actuators may be connected in parallel.
Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 For end position indication, interlock control, fan startup, etc., AFB24-S and AFX24-S incorporates two built-in auxiliary switches: 2 x SPDT, 3A (0.5A) @250 VAC, UL Approved, one switch is fixed at +10°, one is adjustable 10° to 90°.

APPLICATION NOTES

- Meets cULus requirements without the need of an electrical ground connection.

WARNING Live Electrical Components!
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



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EFB24, EFB24-S, EFX24, EFX24-S

On/Off, Spring Return, 24 V



Technical Data		EFB24, EFB24-S, EFX24, EFX24-S
Power supply		24 VAC $\pm$ 20% 50/60 Hz 24 VDC $\pm$ 20% / -10%
Power consumption	running	9.5 W
	holding	4.5 W
Transformer sizing		16 VA (class 2 power source)
Electrical connection	EFB24...	3 ft, 18 GA appliance cable, 1/2" conduit connector -S models: two 3 ft, 18 gauge appliance cables with 1/2" conduit connectors
	EFX24...	3 ft [1m], 10 ft [3m] or 16 ft [5m] 18 GA appliance or plenum cables, with or without 1/2" conduit connector -S models: two 3 ft [1m], 10 ft [3m] or 16 ft [5m] appliance cables, with or without 1/2" conduit connectors
Overload protection		electronic throughout 0 to 95° rotation
Control		on/off
Torque		270 in-lb [30 Nm] minimum
Direction of rotation	spring	reversible with CW/CCW mounting
Mechanical angle of rotation		max. 95° (adjustable with mechanical end stop, 35° to 95°)
Running time	motor	75 seconds
	spring	< 20 seconds @ -4°F to 122°F [-20°C to 50°C]; < 60 seconds @ -22°F [-30°C]
Position indication		visual indicator, 0° to 95° (0° is full spring return position)
Manual override		5 mm hex crank (3/16" Allen), supplied
Humidity		max. 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		Nema 2, IP54, Enclosure Type2
Housing material		aluminum diecast and plastic casing
Agency listings †		cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC & 2006/95/EC
Noise level		≤56.5dB(A) motor @ 75 seconds ≤71.4dB(A) spring return
Servicing		maintenance free
Quality standard		ISO 9001
Weight		9.82 lbs [4.45 kg], 10.14 lbs [4.6 kg] with switches
† Rated Impulse Voltage 800V, Type of action 1.AA (1.AA.B for -S version), Control Pollution Degree 3.		
EFB24-S, EFX24-S		
Auxiliary switches		2 x SPDT 3A (0.5A) @ 250 VAC, UL approved one set at +10°, one adjustable 10° to 85°

Torque min. 270 in-lb, for control of air dampers

Application

For on/off, fail-safe control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications. Control is On/Off from an auxiliary contact, or a manual switch.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

Operation

The EFB and EFX series actuators provide true spring return operation for reliable fail-safe application and positive close off on air tight dampers. The spring return system provides constant torque to the damper with, and without, power applied to the actuator.

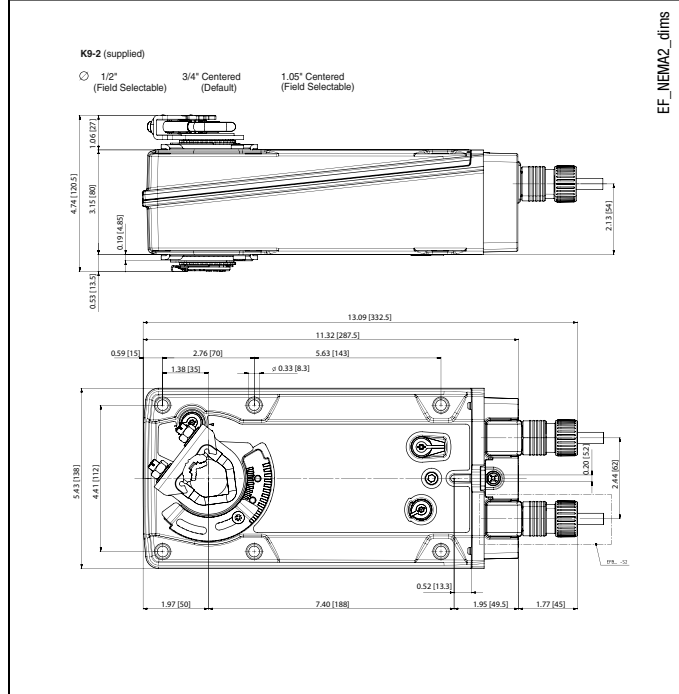
The EFB and EFX series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 95°.

The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches.

The EFB24-S and EFX24-S versions are provided with two built-in auxiliary switches. These SPDT switches are provided for safety interfacing or signaling, for example, for fan start-up. The switching function at the fail-safe position is fixed at +10°, the other switch function is adjustable between +10° to +85°. The EFB24, EFB24-S, EFX24 and EFX24-S actuator is shipped at +5° (5° from full fail-safe) to provide automatic compression against damper gaskets for tight shut-off.

Installation Note: Use flexible metal conduit. Push the UL listed conduit fitting device over the actuator's cable to butt against the enclosure. Screw in conduit connector. Jacket the actuators input wiring with UL listed flexible conduit. Properly terminate the conduit in a suitable junction box.

Dimensions (Inches [mm])



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Accessories

IND-EFB	Damper position indicator
KH-EFB	Crank arm
K9-2	Universal clamp for up to 1.05" diameter jackshafts
TF-CC US	Conduit fitting
Tool-07	13 mm wrench
ZG-EFB	Crank arm adaptor kit

Note: When using EFB24, EFB24-S, EFX24, EFX24-S actuators, only use accessories listed on this page.

For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

Typical Specification

On/Off spring return damper actuators shall be direct coupled type which require no crank arm and linkage and be capable of direct mounting to a jackshaft up to a 1.05" diameter. The actuators must be designed so that they may be used for either clockwise or counterclockwise fail-safe operation. Actuators shall be protected from overload at all angles of rotation. If required, two SPDT auxiliary switch shall be provided having the capability of one being adjustable. Actuators with auxiliary switches must be constructed to meet the requirements for Double Insulation so an electrical ground is not required to meet agency listings. Actuators shall be cULus Approved and have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

Wiring Diagrams

INSTALLATION NOTES

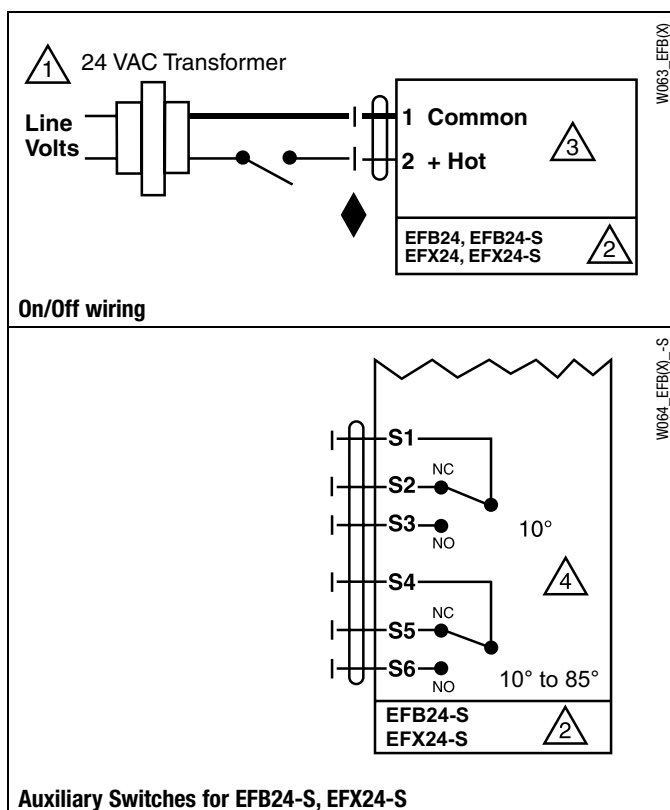
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**
Actuators may be connected in parallel.
Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 For end position indication, interlock control, fan startup, etc., EFB24-S and EFX24-S incorporates two built-in auxiliary switches: 2 x SPDT, 3A (0.5A) @250 VAC, UL Approved, one switch is fixed at +10°, one is adjustable 10° to 85°.

APPLICATION NOTES

- ◆ Meets cULus requirements without the need of an electrical ground connection.

WARNING Live Electrical Components!

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EFB24-SR, EFB24-SR-S, EFX24-SR, EFX24-SR-S

Proportional, Spring Return, 24 V, for 2 to 10 VDC or 4 to 20 mA Control Signal



Technical Data		EFB24-SR, EFB24-SR-S, EFX24-SR, EFX24-SR-S
Power supply		24 VAC $\pm 20\%$, 50/60 Hz 24 VDC $+20\%$ / -10%
Power consumption	running	8 W
	holding	4.5 W
Transformer sizing		14 VA (class 2 power source)
Electrical connection		
EFB...		3 ft, 18 GA appliance cable, 1/2" conduit connector -S models: two 3 ft, 18 gauge appliance cables with 1/2" conduit connectors
EFX...		3 ft [1m], 10 ft [3m] or 16 ft [5m] 18 GA appliance or plenum cables, with or without 1/2" conduit connector -S models: Two 3 ft [1m], 10 ft [3m] or 16 ft [5m] appliance cables, with or without 1/2" conduit connectors
Overload protection		electronic throughout 0 to 95° rotation
Operating range Y		2 to 10 VDC, 4 to 20mA
Input impedance		100 k Ω for 2 to 10 VDC (0.1 mA) 500 Ω for 4 to 20 mA
Feedback output U		2 to 10 VDC (max. 0.5 mA)
Torque		270 in-lb [30 Nm] minimum
Direction of rotation	spring motor	reversible with CW/CCW mounting reversible with built-in switch
Mechanical angle of rotation		max. 95° (adjustable with mechanical end stop, 35° to 95°)
Running time	spring	< 20 seconds @ -4°F to 122°F [-20°C to 50°C]; < 60 seconds @ -22°F [-30°C]
	motor	95 seconds
Position indication		visual indicator, 0° to 95° (0° is full spring return position)
Manual override		5 mm hex crank (3/16" Allen), supplied
Humidity		max. 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		Nema 2, IP54, Enclosure Type2
Housing material		aluminum diecast and plastic casing
Agency listings†		cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC & 2006/95/EC
Noise level		≤ 56.5 dB(A) motor @ 95 seconds ≤ 71.4 dB(A) spring return
Servicing		maintenance free
Quality standard		ISO 9001
Weight		9.82 lbs [4.45 kg], 10.14 lbs [4.6 kg] with switches

† Rated Impulse Voltage 800V, Type of action 1.AA (1.AA.B for -S version), Control Pollution Degree 3.

EFB24-SR-S, EFX24-SR-S	
Auxiliary switches	2 x SPDT 3A (0.5A) @ 250 VAC, UL approved one set at +10°, one adjustable 10° to 85°

Torque min. 270 in-lb, for control of air dampers

Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

The actuator operates in response to a 2 to 10 VDC, or with the addition of a 500 Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. A 2 to 10 VDC feedback signal is provided for position indication. Not to be used for a master-slave application.

Operation

The EFB and EFX series actuators provide true spring return operation for reliable fail-safe application and positive close-off on air tight dampers. The spring return system provides constant torque to the damper with, and without, power applied to the actuator.

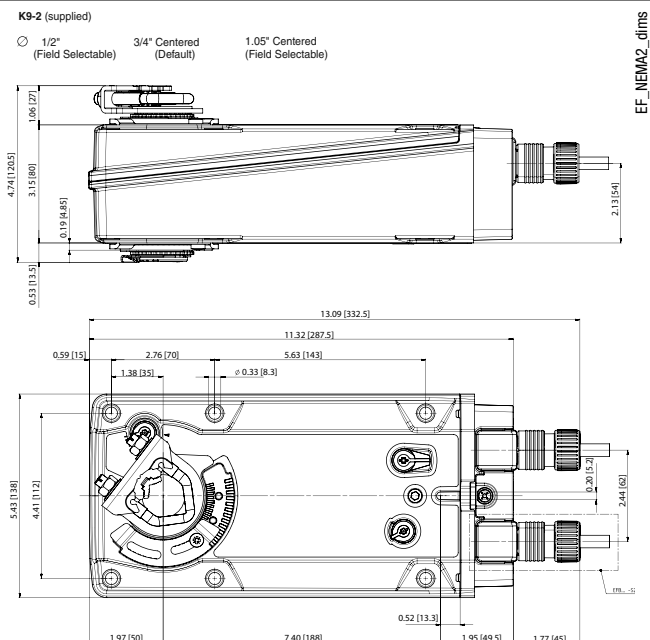
The EFB and EFX series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 95°.

The EFB24-SR and EFX24-SR uses a brushless DC motor which is controlled by an Application Specific Integrated Circuit (ASIC) and a microprocessor. The microprocessor provides the intelligence to the ASIC to provide a constant rotation rate and to know the actuator's exact fail-safe position. The ASIC monitors and controls the brushless DC motor's rotation and provides a digital rotation sensing function to prevent damage to the actuator in a stall condition. The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches.

The EFB24-SR-S and EFX24-SR-S versions are provided with two built-in auxiliary switches. These SPDT switches provide safety interfacing or signaling, for example, for fan start-up. The switching function at the fail-safe position is fixed at +10°, the other switch function is adjustable between +10° to +85°. The EFB24-SR, EFB24-SR-S, EFX24-SR and EFX24-SR-S actuator is shipped at +5° (5° from full fail-safe) to provide automatic compression against damper gaskets for tight shut-off.

Installation Note: Use flexible metal conduit. Push the UL listed conduit fitting device over the actuator's cable to butt against the enclosure. Screw in conduit connector. Jacket the actuators input wiring with UL listed flexible conduit. Properly terminate the conduit in a suitable junction box.

Dimensions (Inches [mm])



Accessories

IND-EFB	Damper position indicator
KH-EFB	Crank arm
K9-2	Universal clamp for up to 1.05" diameter jackshafts
TF-CC US	Conduit fitting
Tool-07	13 mm wrench
ZG-EFB	Crank arm adaptor kit

NOTE: When using EFB24-SR, EFB24-SR-S, EFX24-SR and EFX24-SR-S actuators, only use accessories listed on this page.

For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

Typical Specification

Spring return control damper actuators shall be direct coupled type which require no crank arm and linkage and be capable of direct mounting to a jackshaft up to a 1.05" diameter. The actuator must provide proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. The actuators must be designed so that they may be used for either clockwise or counterclockwise fail-safe operation. Actuators shall use a brushless DC motor controlled by a microprocessor and be protected from overload at all angles of rotation. Run time shall be constant, and independent of torque. A 2 to 10 VDC feedback signal shall be provided for position feedback. Actuators with auxiliary switches must be constructed to meet the requirements for Double Insulation so an electrical ground is not required to meet agency listings. Actuators shall be cULus Approved and have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

Wiring Diagrams

INSTALLATION NOTES

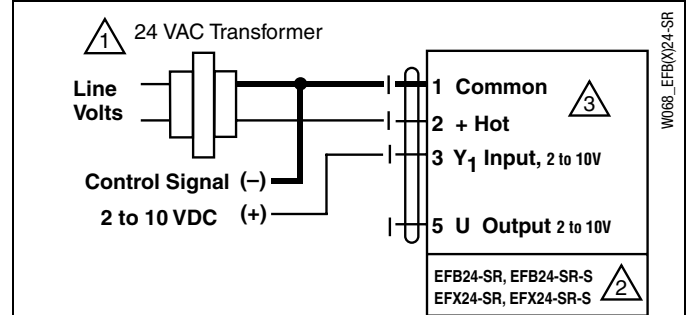
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**
Actuators may be connected in parallel.
Power consumption and input impedance must be observed.
Up to 4 actuators may be connected in parallel if not mechanically mounted to the same shaft. With 4 actuators wired to one 500 Ω resistor.
Power consumption must be observed.
- 3 Actuator may also be powered by 24 VDC.
- 4 For end position indication, interlock control, fan startup, etc., EFB24-SR-S and EFX24-SR-S incorporates two built-in auxiliary switches: 2 x SPDT, 3A (0.5A) @250 VAC, UL Approved, one switch is fixed at +10°, one is adjustable 10° to 85°.
- 5 Only connect common to neg. (-) leg of control circuits

APPLICATION NOTES

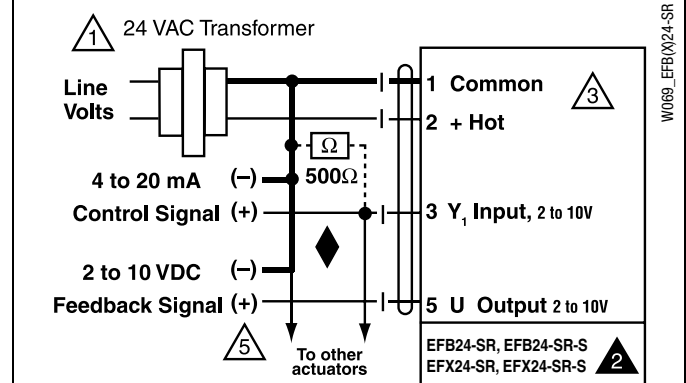
- ◆ The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC.

WARNING Live Electrical Components!

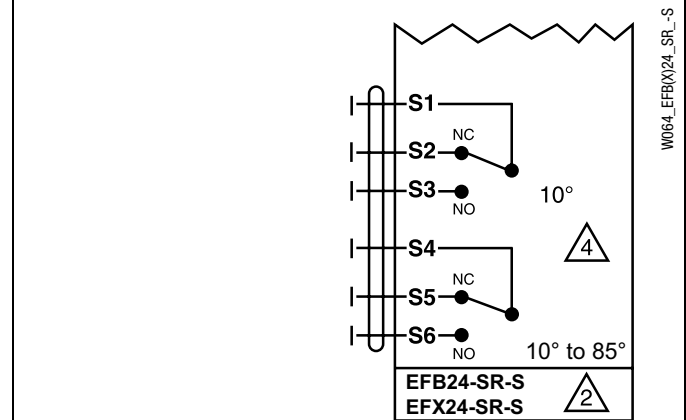
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2 to 10 VDC control



4 to 20 mA control with 2 to 10 VDC feedback output



Auxiliary switches for EFB24-SR-S, EFX24-SR-S

LF24(-S) US

On/Off, Spring Return, 24V



Technical Data		LF24(-S) US
Power supply		24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	running	5 W
	holding	2.5 W
Transformer sizing		7 VA (class 2 power source)
Electrical connection (LF24-S US has 2 cables)		3 ft, 18 GA appliance cable 1/2" conduit connector
Overload protection		electronic throughout 0 to 95° rotation
Angle of rotation		max. 95°, adjust. with mechanical stop
Torque		35 in-lb [4 Nm]
Direction of rotation		reversible with cw/ccw mounting
Position indication		visual indicator, 0° to 95° (0° is spring return position)
Running time (nominal)	motor	< 40 to 75 sec
	spring	< 25 sec @-4°F to 122°F [-20°C to 50°C] < 60 sec @-22°F [-30°C]
Humidity		5 to 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		NEMA type 2 / IP54
Housing material		zinc coated steel
Agency listings		cULus acc. to UL 873 and CAN/CSA C22.2 No. 24-93
Noise level (max)	running	< 50 db (A)
	spring return	62 db (A)
Servicing		maintenance free
Quality standard		ISO 9001
Weight	LF24	3.1 lbs (1.40 kg)
	LF24-S	3.2 lbs (1.45 kg)
LF24-S US		
Auxiliary switch		1 x SPDT 3A (0.5A) @ 250 VAC, UL Approved adjustable 0° to 95° (double insulated)

Torque min. 35 in-lb, for control of air dampers

Application

For On/Off, fail-safe control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications. Control is On/Off from an auxiliary contact, digital output, or a manual switch.

The actuator is mounted directly to a damper shaft from 3/8" up to 1/2" in diameter by means of its universal clamp, 1/2" shaft centered at delivery. For shafts up to 3/4" use K6-1 accessory. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

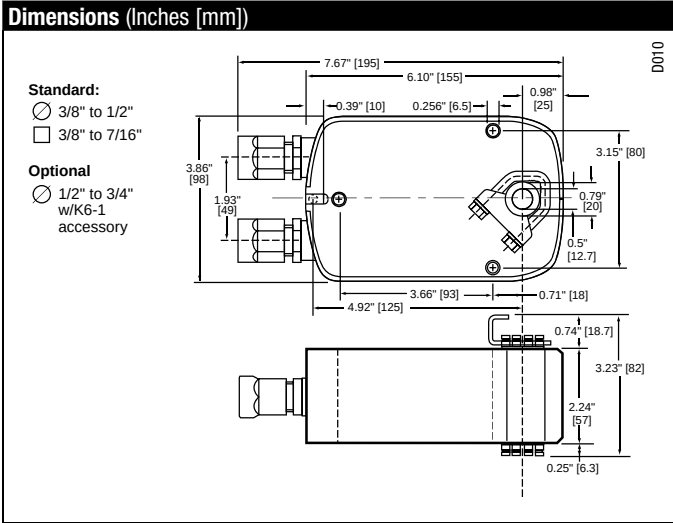
Operation

The LF series actuators provide true spring return operation for reliable fail-safe application and positive close off on air tight dampers. The spring return system provides consistent torque to the damper with, and without, power applied to the actuator.

The LF series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 95°.

The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches. Power consumption is reduced in holding mode.

The LF24-S US version is provided with one built in auxiliary switch. This SPDT switch is provided for safety interfacing or signaling, for example, for fan start-up. The switching function is adjustable between 0° and 95°. The auxiliary switch in the LF24-S is double insulated so an electrical ground connection is not necessary.



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Accessories

AV 10-18	Shaft extension (K6-1 is required)
IND-LF	Damper position indicator
K6-1	Universal clamp for up to 3/4" diameter shafts
KH-LF	Crank arm for up to 1/2" round shaft
Tool-06	8mm and 10 mm wrench
ZG-LF2	Crank arm adaptor kit for LF
ZG-112	Mounting bracket for Honeywell Mod IV, M6415 type actuators, and new installations
ZG-LF112	Crank arm adaptor kit for Honeywell Mod IV, M6415 type actuators, and new installations
ZS-100	Weather shield (metal)
ZS-150	Weather shield (polycarbonate)
ZS-260	Explosion-proof housing

NOTE: When using LF24 US and LF24-S US actuators, only use accessories listed on this page.

For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

Typical Specification

On/Off spring return damper actuators shall be direct coupled type which require no crank arm and linkage and be capable of direct mounting to a shaft up to a 3/4" diameter and center a 1/2" shaft. The actuators must be designed so that they may be used for either clockwise or counterclockwise fail-safe operation. Actuators shall be protected from overload at all angles of rotation. If required, one SPDT auxiliary switch shall be provided having the capability of being adjustable. Actuators with auxiliary switch must be constructed to meet the requirements for Double Insulation so an electrical ground is not required to meet agency listings. Actuators shall be cULus listed, have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

Wiring Diagrams

INSTALLATION NOTES

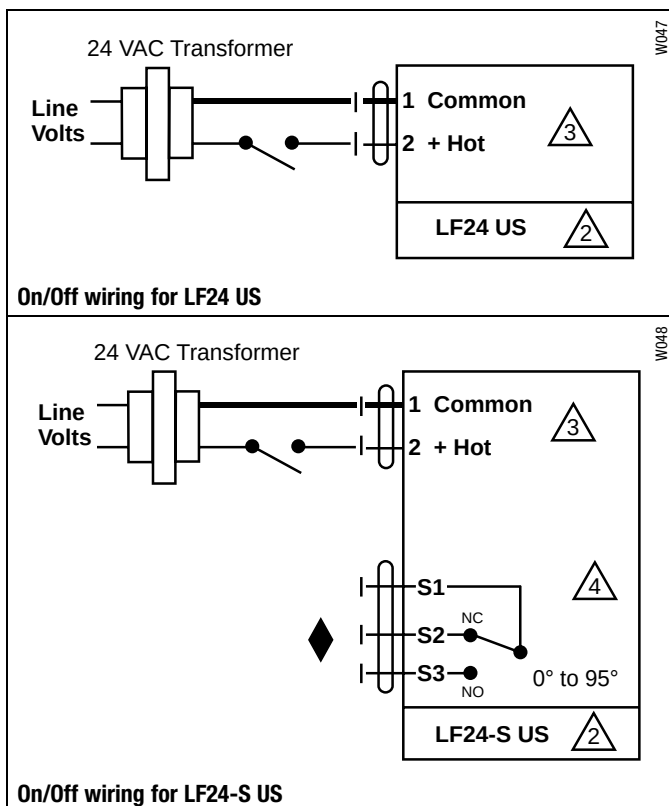
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**
Actuators may be connected in parallel.
Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 For end position indication, interlock control, fan startup, etc., LF24-S US incorporates a built-in auxiliary switch: 1 x SPDT, 3A (0.5A) @250 VAC, UL Approved, adjustable 0° to 95°.

APPLICATION NOTES

- ◆ Meets cULus requirements without the need of an electrical ground connection.

WARNING Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



On/Off, Spring Return, 24 V



Technical Data		NFB24-S, NFX24-S
Power supply		24 VAC ± 20% 50/60 Hz 24 VDC +20% / -10%
Power consumption	running	6 W
	holding	2.5 W
Transformer sizing		8.5 VA (class 2 power source)
Electrical connection		
NFB24...		3 ft, 18 GA appliance cable, 1/2" conduit connector -S models: two 3 ft, 18 gauge appliance cables with 1/2" conduit connectors
NFX24...		3 ft [1m], 10 ft [3m] or 16 ft [5m] 18 GA appliance or plenum cables, with or without 1/2" conduit connector -S models: two 3 ft [1m], 10 ft [3m] or 16 ft [5m] appliance cables, with or without 1/2" conduit connectors
Overload protection		electronic throughout 0 to 95° rotation
Control		on/off
Torque		90 in-lb [10 Nm] minimum
Direction of rotation	spring	reversible with CW/CCW mounting
Mechanical angle of rotation		95° (adjustable with mechanical end stop, 35° to 95°)
Running time	motor	< 75 seconds
	spring	20 seconds @ -4°F to 122°F [-20°C to 50°C]; < 60 seconds @ -22°F [-30°C]
Position indication		visual indicator, 0° to 95° (0° is full spring return position)
Manual override		5 mm hex crank (3/16" Allen), supplied
Humidity		max. 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		Nema 2, IP54, Enclosure Type2
Housing material		zinc coated metal and plastic casing
Agency listings †		cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC & 2006/95/EC
Noise level		<50dB(A) motor @ 75 seconds ≤62dB(A) spring return
Servicing		maintenance free
Quality standard		ISO 9001
Weight		4.15 lbs (1.9 kg); 4.4 lbs (2.0 kg) with switches

† Rated Impulse Voltage 800V, Type of action 1.AA (1.AA.B for -S version), Control Pollution Degree 3.

NFB24-S, NFX24-S	
Auxiliary switches	2 x SPDT 3A (0.5A) @ 250 VAC, UL approved one set at +10°, one adjustable 10° to 90°

- Torque min. 90 in-lb, for control of air dampers

Application

For On/Off, fail-safe control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications. Control is On/Off from an auxiliary contact, or a manual switch.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

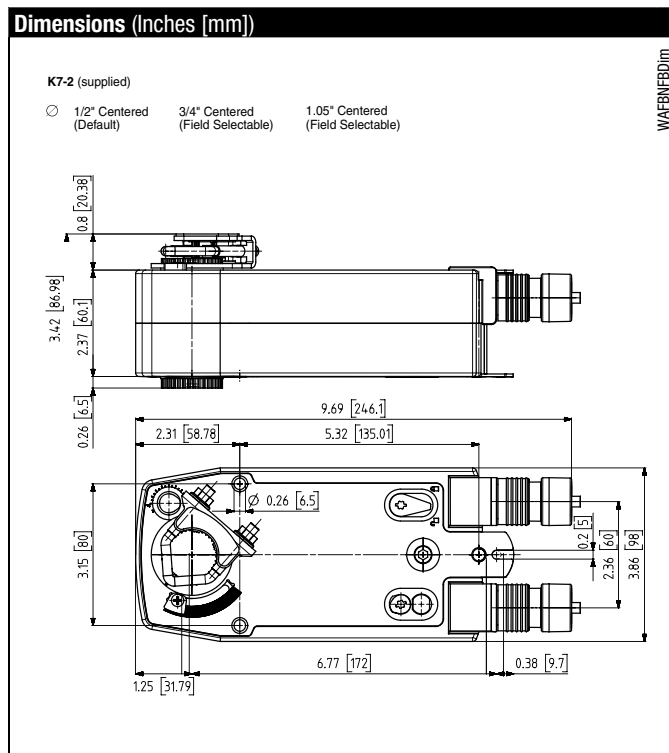
Operation

The NFB and NFX series actuators provide true spring return operation for reliable fail-safe application and positive close off on air tight dampers. The spring return system provides constant torque to the damper with, and without, power applied to the actuator.

The NFB and NFX series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 95°.

The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches.

The NFB24-S and NFX24-S versions are provided with two built-in auxiliary switches. These SPDT switches are provided for safety interfacing or signaling, for example, for fan start-up. The switching function at the fail-safe position is fixed at +10°, the other switch function is adjustable between +10° to +90°. The NFB24, NFB24-S, NFX24 and NFX24-S actuator is shipped at +5° (5° from full fail-safe) to provide automatic compression against damper gaskets for tight shut-off.



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Accessories

AV 8-25	Shaft extension
IND-AFB	Damper position indicator
KH-AFB	Crank arm
K7-2	Universal clamp for up to 1.05" dia jackshafts
TF-CC US	Conduit fitting
Tool-06	8mm and 10 mm wrench
ZG-100	Universal mounting bracket
ZG-101	Universal mounting bracket
ZG-118	Mounting bracket for Barber Colman® MA 3../4..., Honeywell® Mod III or IV or Johnson® Series 100 replacement or new crank arm type installations
ZG-AFB	Crank arm adaptor kit
ZG-AFB118	Crank arm adaptor kit
ZS-100	Weather shield (metal)
ZS-150	Weather shield (polycarbonate)
ZS-260	Explosion-proof housing
ZS-300	NEMA 4X housing

Note: When using NFB24, NFB24-S, NFX24, NFX24-S actuators, only use accessories listed on this page.

For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

Typical Specification

On/Off spring return damper actuators shall be direct coupled type which require no crank arm and linkage and be capable of direct mounting to a jackshaft up to a 1.05" diameter. The actuators must be designed so that they may be used for either clockwise or counterclockwise fail-safe operation. Actuators shall be protected from overload at all angles of rotation. If required, two SPDT auxiliary switch shall be provided having the capability of one being adjustable. Actuators with auxiliary switches must be constructed to meet the requirements for Double Insulation so an electrical ground is not required to meet agency listings. Actuators shall be cULus Approved and have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

Wiring Diagrams

INSTALLATION NOTES

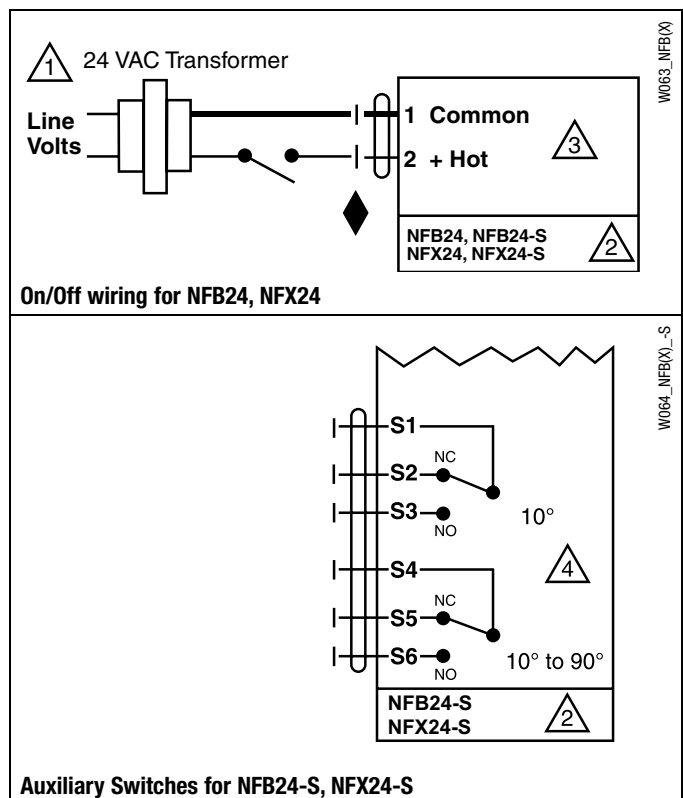
- 1 Provide overload protection and disconnect as required.
- 2 **CAUTION Equipment Damage!**
Actuators may be connected in parallel.
Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 4 For end position indication, interlock control, fan startup, etc., NFB24-S and NFX24-S incorporates two built-in auxiliary switches: 2 x SPDT, 3A (0.5A) @250 VAC, UL Approved, one switch is fixed at +10°, one is adjustable 10° to 90°.

APPLICATION NOTES

- ◆ Meets cULus requirements without the need of an electrical ground connection.

WARNING Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



Proportional, Spring Return, 24 V, for 2 or 10 VDC or 4 to 20 mA Control Signal

NEB24-SB-S NEY24-SB-S

The NFB24-SR-S and NFX24-SR-S versions are provided with two built-in auxiliary switches. These SPDT switches provide safety interfacing or signaling, for example, for fan start-up. The switching function at the fail-safe position is fixed at $+10^\circ$, the other switch function is adjustable between $+10^\circ$ to $+90^\circ$. The NFB24-SR, NFB24-SR-S, NFX24-SR and NFX24-SR-S actuator is shipped at $+5^\circ$ (5° from full fail-safe) to provide automatic compression against damper gaskets for tight shut-off.

K7-2 (supplied)

○ 1/2" Centered (Default) 3/4" Centered (Field Selectable) 1.05" Centered (Field Selectable)

Technical drawing of the K7-2 camera module. The drawing includes a side view (top) and a front view (bottom). Dimensions are provided in inches [millimeters].

Side View Dimensions:

- Overall height: 3.42 [86.98]
- Mounting bracket height: 0.8 [20.38]
- Mounting bracket width: 2.37 [60.1]
- Mounting bracket thickness: 0.26 [6.5]
- Module width: 9.69 [246.1]
- Module width (excluding mounting bracket): 5.32 [135.01]

Front View Dimensions:

- Overall width: 6.77 [172]
- Mounting bracket width: 1.25 [31.79]
- Mounting bracket height: 3.15 [80]
- Mounting bracket thickness: 0.26 [6.5]
- Module width: 3.86 [98]
- Module width (excluding mounting bracket): 2.36 [60]
- Module height: 0.2 [5]
- Module height (excluding mounting bracket): 0.38 [9.7]

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Accessories

AV 8-25	Shaft extension
IND-AFB	Damper position indicator
KH-AFB	Crank arm
K7-2	Universal clamp for up to 1.05" dia jackshafts
TF-CC US	Conduit fitting
Tool-06	8mm and 10 mm wrench
ZG-100	Universal mounting bracket
ZG-101	Universal mounting bracket
ZG-118	Mounting bracket for Barber Colman® MA 3../4..., Honeywell® Mod III or IV or Johnson® Series 100 replacement or new crank arm type installations
ZG-AFB	Crank arm adaptor kit
ZG-AFB118	Crank arm adaptor kit
ZS-100	Weather shield (metal)
ZS-150	Weather shield (polycarbonate)
ZS-260	Explosion-proof housing
ZS-300	NEMA 4X housing

NOTE: When using NFB24-SR, NFB24-SR-S, NFX24-SR and NFX24-SR-S actuators, only use accessories listed on this page.
For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

Typical Specification

Spring return control damper actuators shall be direct coupled type which require no crank arm and linkage and be capable of direct mounting to a jackshaft up to a 1.05" diameter. The actuator must provide proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. The actuators must be designed so that they may be used for either clockwise or counterclockwise fail-safe operation. Actuators shall use a brushless DC motor controlled by a microprocessor and be protected from overload at all angles of rotation. Run time shall be constant, and independent of torque. A 2 to 10 VDC feedback signal shall be provided for position feedback. Actuators shall be cULus Approved and have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

Wiring Diagrams



INSTALLATION NOTES



Provide overload protection and disconnect as required.



CAUTION Equipment Damage!

Actuators may be connected in parallel.
Power consumption and input impedance must be observed.



Up to 4 actuators may be connected in parallel. With 4 actuators wired to one 500 Ω resistor. Power consumption must be observed.



Actuator may also be powered by 24 VDC.



For end position indication, interlock control, fan startup, etc., NFB24-SR-S and NFX24-SR-S incorporates two built-in auxiliary switches: 2 x SPDT, 3A (0.5A) @250 VAC, UL Approved, one switch is fixed at +10°, one is adjustable 10° to 90°.



Only connect common to neg. (-) leg of control circuits



APPLICATION NOTES

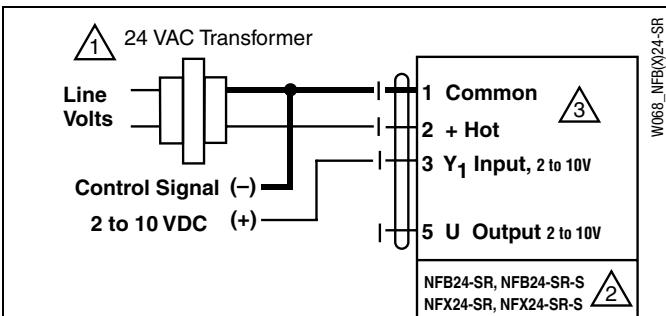


The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC.

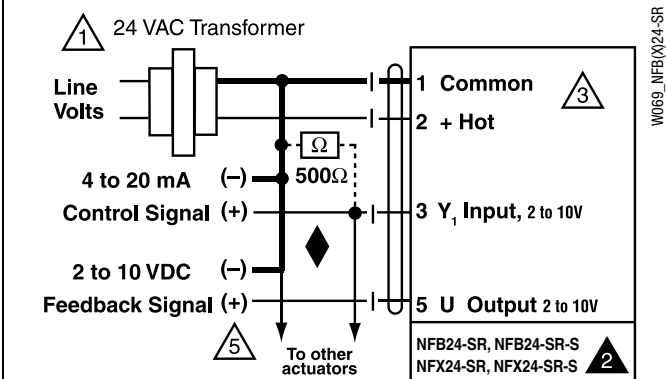


WARNING Live Electrical Components!

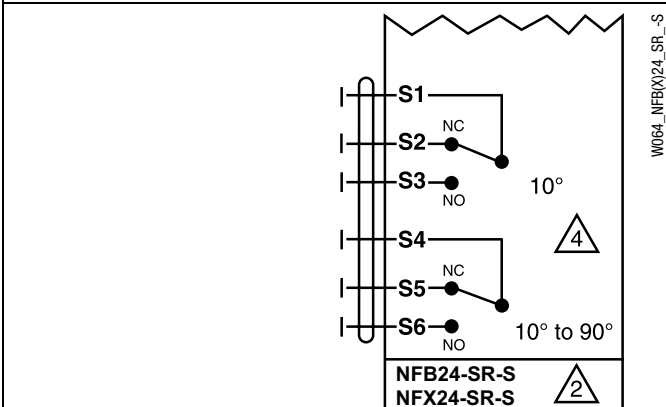
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



2 to 10 VDC control of NFB24-SR and NFX24-SR



4 to 20 mA control of NFB24-SR and NFX24-SR with 2 to 10 VDC feedback output



NMB(X)24-3(-T)

On/Off, Floating Point, Non-Spring Return, 24 V



Technical Data	NMB(X)24-3(-T)
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	2 W (0.2 W)
Transformer sizing	4 VA (Class 2 power source)
Electrical connection	18 GA plenum rated cable 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout 0 to 95° rotation
Control	on/off, floating point
Input impedance	600 Ω
Angle of rotation	max. 95°, adjust. with mechanical stop
Torque	90 in-lb [10 Nm]
Direction of rotation	reversible with switch
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time	95 seconds (default) constant independent of load
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	<45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	1.7 lbs [0.75 Kg]

NMB(X)24-3-T	
Electrical connection	screw terminal (for 26 to 14 GA wire) unprotected (NEMA 1/IP20)

†Rated Impulse Voltage 800V, Type of action 1, Control Pollution Degree 3.

Torque min. 90 in-lb for control of damper surfaces up to 22 sq ft.

Application

For on/off and floating point control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp, 1/2" self-centered default. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

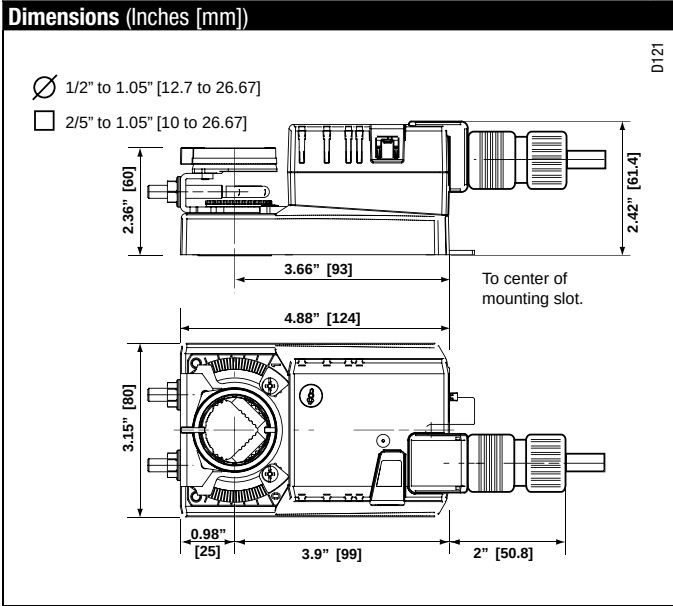
Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The NMB(X) series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The NMB(X)24-3... actuators use a sensorless brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.



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Accessories

K-NA	Reversible Clamp
ZG-100	Universal Mounting Bracket
ZG-101	Universal Mounting Bracket
ZG-103	Universal Mounting Bracket
ZG-104	Universal Mounting Bracket
ZG-NMA	Crank arm Adaptor Kit
AV8-25	Universal Shaft Extension
ZG-NMSA-1	Shaft Adaptor
ZS-T	Terminal Cover for NEMA 2
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
Tool-06	8 mm & 10 mm Wrench
S1A, S2A	Auxiliary Switch (es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers

NOTE: When using NMX24-3... actuators, only use accessories listed on this page.

Typical Specification

Floating point, on/off control damper actuators shall be electronic direct-coupled type, which require no crank arm and linkage and be capable of direct mounting to a shaft up to 1.05" diameter. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. If required, actuators will be provided with a screw terminal strip for electrical connections (NMX24-3-T). Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

Wiring Diagrams

INSTALLATION NOTES

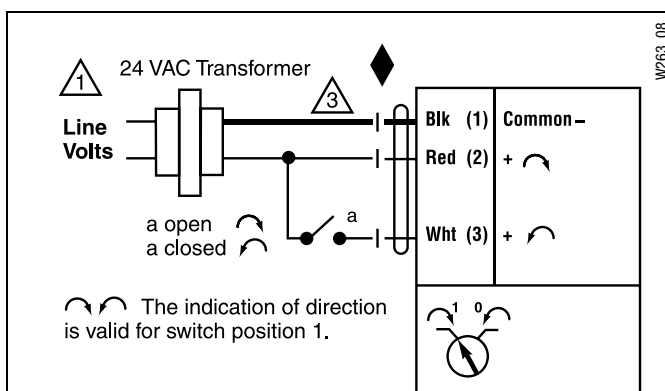
- 1 Provide overload protection and disconnect as required.
- 3 Actuators may also be powered by 24 VDC.

APPLICATION NOTES

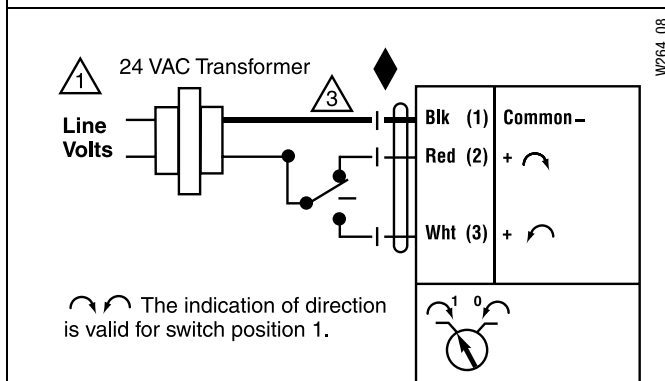
- Meets cULus or UL and CSA Standard requirements without the need of an electrical ground connection.

WARNING Live Electrical Components!

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On/Off control



Floating Point or On/Off control

F6100HD, 2-Way Butterfly Valve

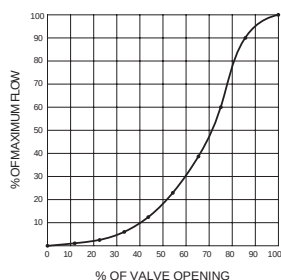
Resilient Seat, 304 Stainless Steel Disc



Technical data

Service	chilled, hot water, up to 60% glycol
Flow Characteristic	modified equal percentage
Controllable Flow Range	90° rotation
Size [mm]	4" [100]
End Fitting	for use with ANSI Class 125/150 flanges
Body	ductile iron ASTM A536
Body Finish	Epoxy powder coated
Stem Packing	EPDM (lubricated)
Seat	EPDM
Shaft	416 stainless steel
Bushings	RPTFE
Disc	304 stainless steel
Body Pressure Rating [psi]	ANSI 125, standard class B
Number of Bolt Holes	8
Lug Threads	5/8-11 UNC
Media Temperature Range (Water)	-22°F to 250°F [-30°C to 120°C]
Close-Off Pressure	200 psi
Rangeability	10:1 (for 30° to 70° range)
Maximum Velocity	12 FPS
Cv	600
Weight	12.6 lb [5.7 kg]
Leakage	0%
Servicing	maintenance free

Flow Pattern



Product Features

200 psi (2" to 12") and 150 psi (14" to 24") 0% leakage, Long stem design allows for 2" insulation, Valve face-to-face dimensions comply with API 609 & MSS-SP-67, Completely assembled and tested, Ready for installation.

Application

These valves are designed to meet the needs of HVAC and commercial applications requiring 0% leakage for liquids. Typical applications include chiller isolation, cooling tower isolation, change-over systems, large air handler coil control, bypass and process control applications. The large Cv values provide for an economical control valve solution for larger flow applications. Designed for use in ANSI flanged piping systems.

Jobsite Note

Valves should be stored in a weather protected area prior to construction. Complete installation recommendations can be found in Belimo's Installation and Maintenance Instructions for F6/F7... Butterfly Valves.

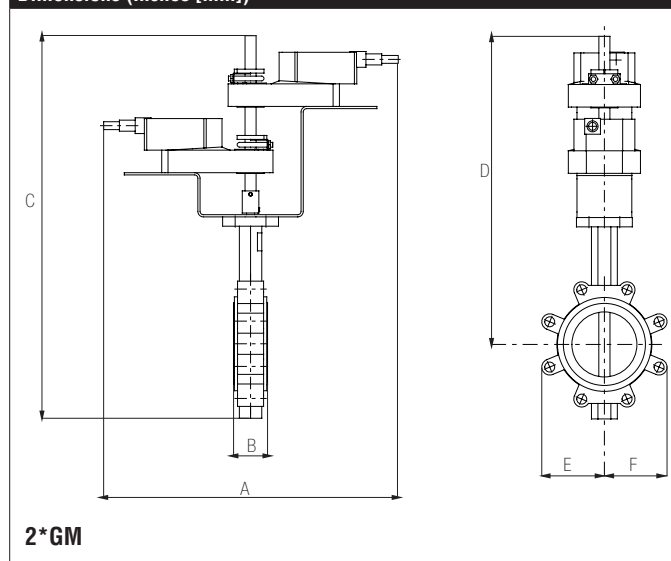
Flow/Cv

10°	20°	30°	40°	50°	60°	70°	80°	90°
0.3	17	36	78	139	230	364	546	600

Suitable Actuators

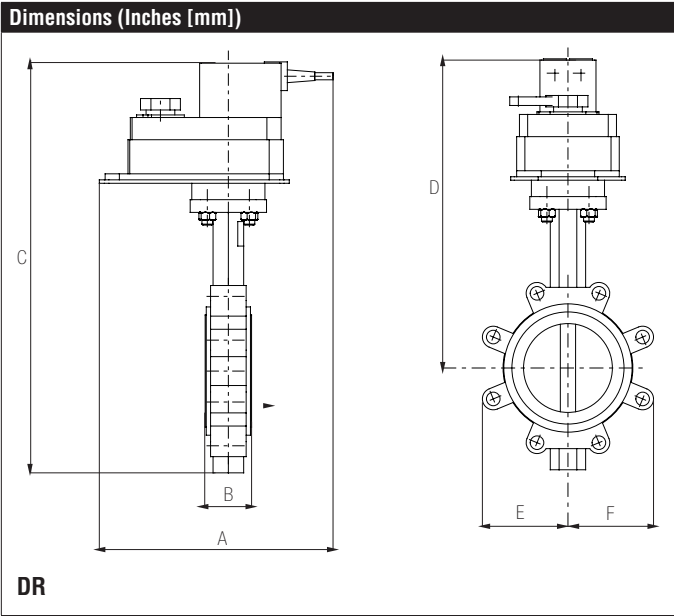
	Non-Spring	Electronic Fail-Safe
F6100HD	2*GMB(X), DRB(X), SY2	2*GKB(X), DKRB(X)

Dimensions (Inches [mm])

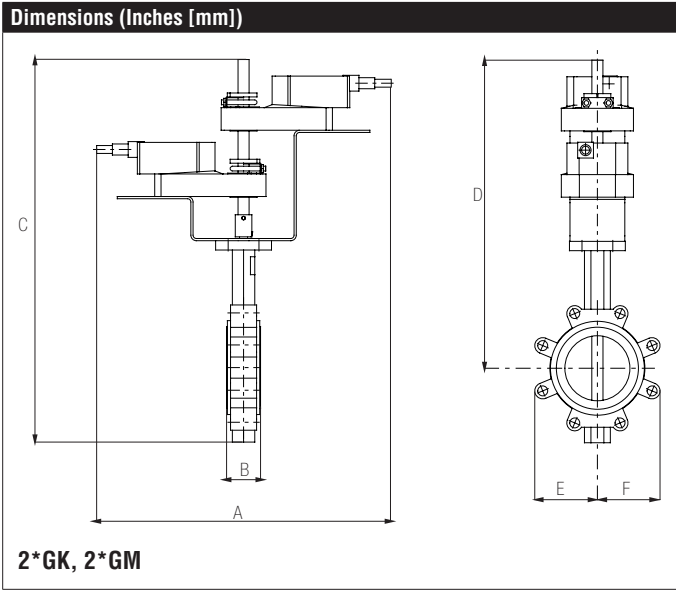


A	B	C	D	E	F
17.9" [454]	2.10" [53.3]	22.88" [580]	18.50" [470.0]	3.94" [100]	

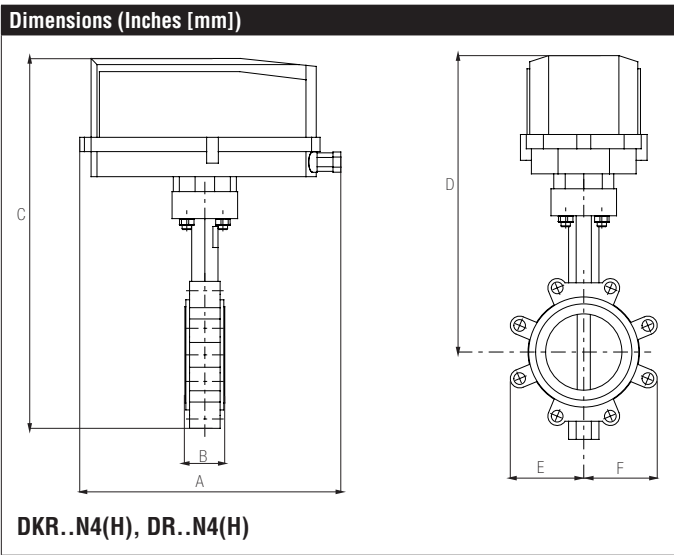
F6100HD, 2-Way Butterfly Valve
Resilient Seat, 304 Stainless Steel Disc



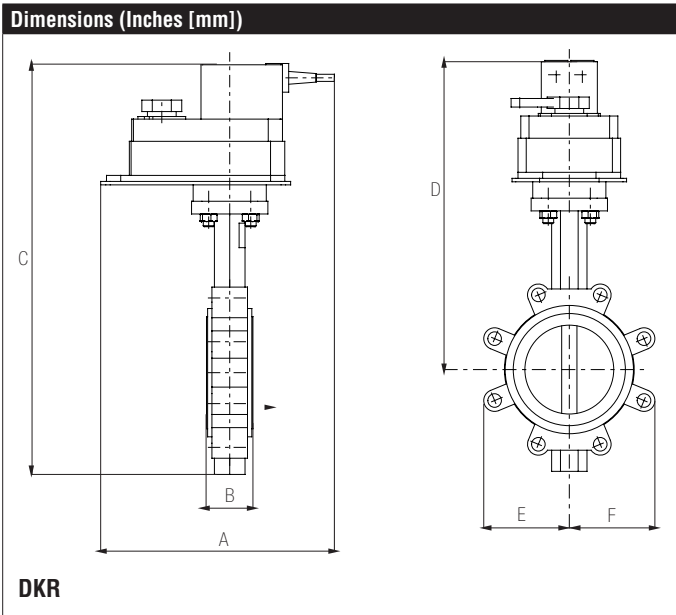
A	B	C	D	E	F
8.5" [217]	2.10" [53.3]	18.25" [464]	21" [533]	3.94" [100]	



A	B	C	D	E	F
17.9" [454]	2.10" [53.3]	22.88" [580]	18.50" [470.0]	3.94" [100]	



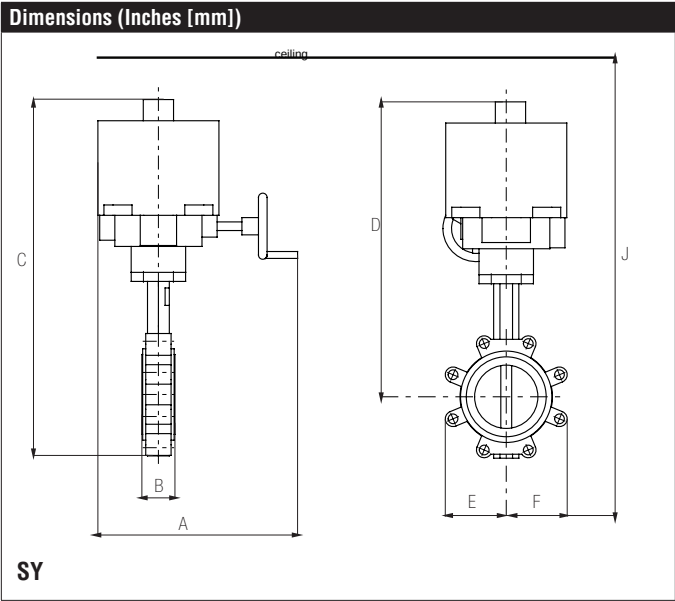
A	B	C	D	E	F
14.1" [358]	2.10" [53.3]	20.4" [516]	16.00" [406]	3.94" [100]	



A	B	C	D	E	F
8.5" [217]	2.10" [53.3]	18.39" [467.1]	14.30" [363]	3.94" [100]	

F6100HD, 2-Way Butterfly Valve

Resilient Seat, 304 Stainless Steel Disc



A	B	C	D	E	F
13" [332]	2.10" [53.3]	24.71" [628]	20.87" [530]	3.94" [100]	

DRCX24-3-T

On/Off, Floating Point, Non-Spring Return, 24 V



Technical Data	
Power Supply	24 VAC ± 20%, 50/60 Hz, 24 VDC ± 10%
Power Consumption Running	12 W
Power Consumption Holding	3 W
Transformer Sizing	21 VA (class 2 power source)
Electrical Connection	screw terminal (for 22 to 12 AWG wire)
Overload Protection	electronic throughout 0° to 90° rotation
Input Impedance	100 Ω
Position Indication	integrated into handle
Manual Override	external push button
Running Time (Motor)	35 sec constant, independent of load
Humidity	5 to 95% RH non condensing (EN 60730-1)
Storage Temperature Range	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing Material	UL94-5VA
Noise Level (Motor)	<45 dB (A)
Servicing	maintenance free
Quality Standard	ISO 9001

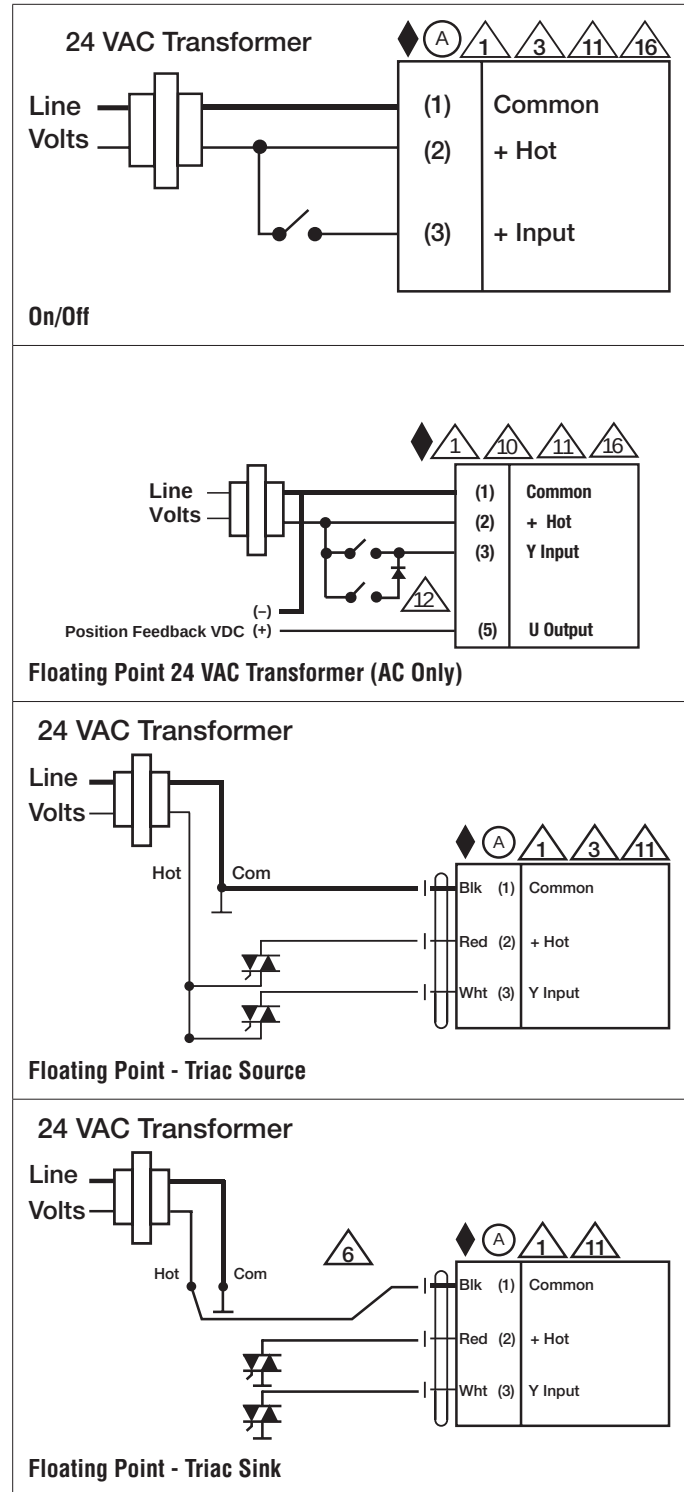
Date created, 07/07/2016 - Subject to change. © Belimo Aircontrols (USA), Inc.

Wiring Diagrams

INSTALLATION NOTES

- (A) Actuators with appliance cables are numbered.
- 1 Provide overload protection and disconnect as required.
- 3 Actuators may also be powered by 24 VDC.
- 6 Actuators Hot wire must be connected to the control board common. Only connect common to neg. (-) leg of control circuits. Terminal models (-T) have no-feedback.
- 10 For triac sink the Common connection from the actuator must be connected to the Hot connection of the controller. Position feedback cannot be used with a triac sink controller; the actuator internal common reference is not compatible.
- 11 Actuators may be connected in parallel if not mechanically linked. Power consumption and input impedance must be observed.
- 16 Actuators are provided with a numbered screw terminal strip instead of a cable.
- Meets cULus requirements without the need of an electrical ground connection.

WARNING! LIVE ELECTRICAL COMPONENTS!
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

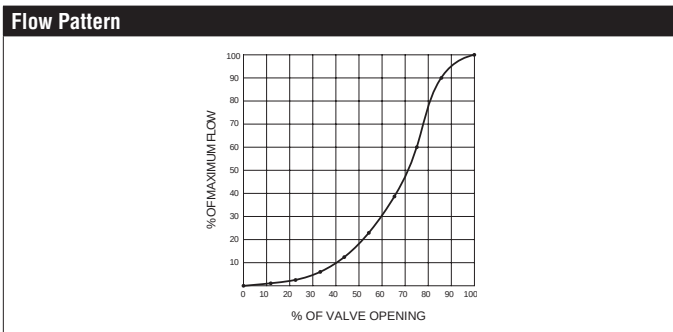


F680HD, 2-Way Butterfly Valve

Resilient Seat, 304 Stainless Steel Disc



Technical data	
Service	chilled, hot water, up to 60% glycol
Flow Characteristic	modified equal percentage
Controllable Flow Range	90° rotation
Size [mm]	3" [80]
End Fitting	for use with ANSI Class 125/150 flanges
Body	ductile iron ASTM A536
Body Finish	Epoxy powder coated
Stem Packing	EPDM (lubricated)
Seat	EPDM
Shaft	416 stainless steel
Bushings	RPTFE
Disc	304 stainless steel
Body Pressure Rating [psi]	ANSI 125, standard class B
Number of Bolt Holes	4
Lug Threads	5/8-11 UNC
Media Temperature Range (Water)	-22°F to 250°F [-30°C to 120°C]
Close-Off Pressure	200 psi
Rangeability	10:1 (for 30° to 70° range)
Maximum Velocity	12 FPS
Cv	302
Weight	6.8 lb [3.1 kg]
Leakage	0%
Servicing	maintenance free



Product Features

200 psi (2" to 12") and 150 psi (14" to 24") 0% leakage, Long stem design allows for 2" insulation, Valve face-to-face dimensions comply with API 609 & MSS-SP-67, Completely assembled and tested, Ready for installation.

Application

These valves are designed to meet the needs of HVAC and commercial applications requiring 0% leakage for liquids. Typical applications include chiller isolation, cooling tower isolation, change-over systems, large air handler coil control, bypass and process control applications. The large Cv values provide for an economical control valve solution for larger flow applications. Designed for use in ANSI flanged piping systems.

Jobsite Note

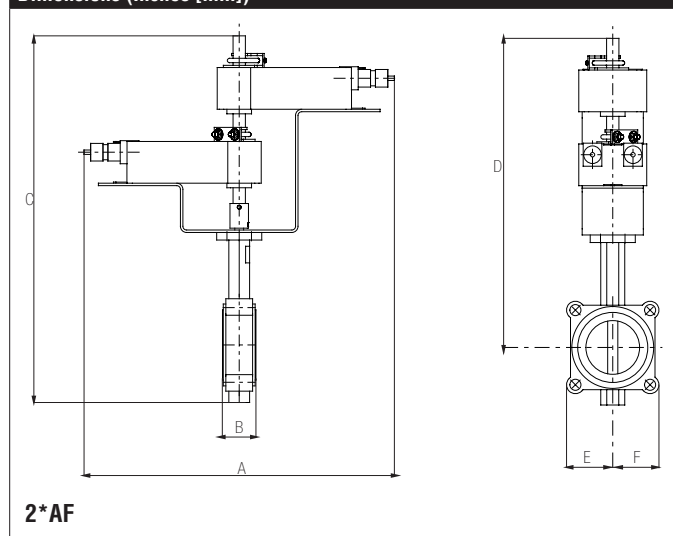
Valves should be stored in a weather protected area prior to construction. Complete installation recommendations can be found in Belimo's Installation and Maintenance Instructions for F6/F7... Butterfly Valves.

Flow/Cv								
10°	20°	30°	40°	50°	60°	70°	80°	90°
0.2	9	18	39	70	116	183	275	302

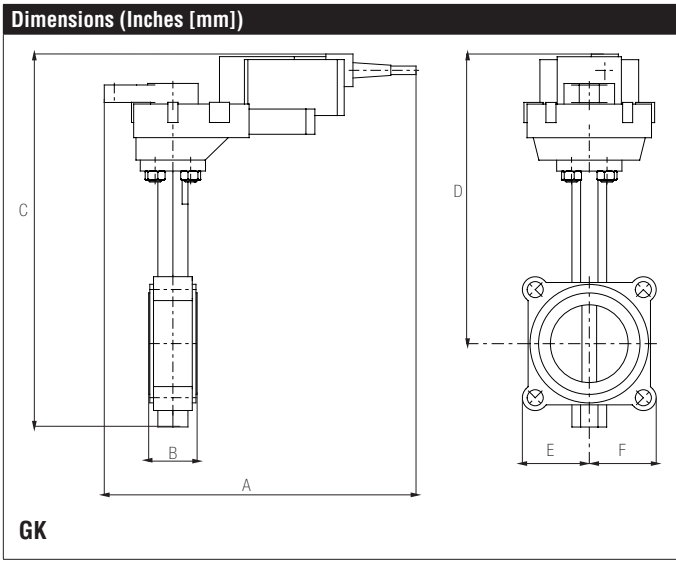
Suitable Actuators

	Non-Spring	Spring	Electronic Fail-Safe
F680HD	GRB(X), SY2	2*AFB(X)	GKRB(X)

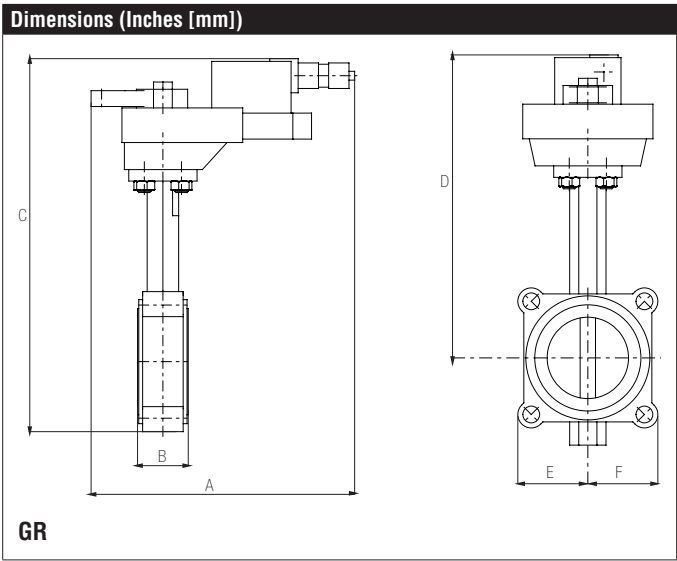
Dimensions (Inches [mm])



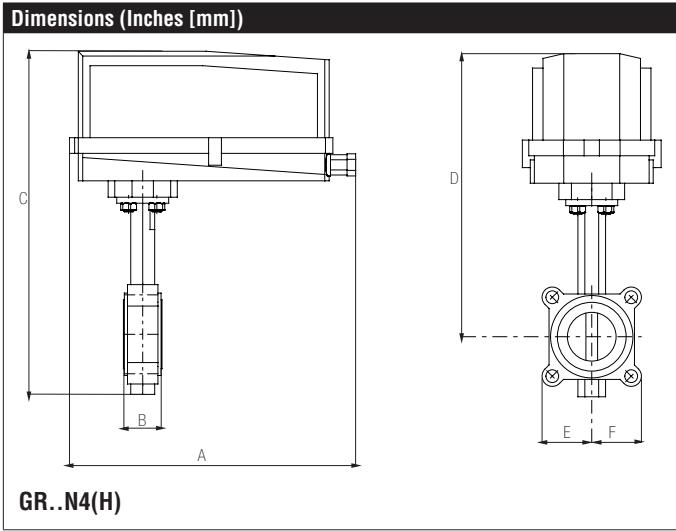
A	B	C	D	E	F
16.9" [429]	1.81" [46]	21.38" [544]	17.63" [448.0]	2.6" [66]	



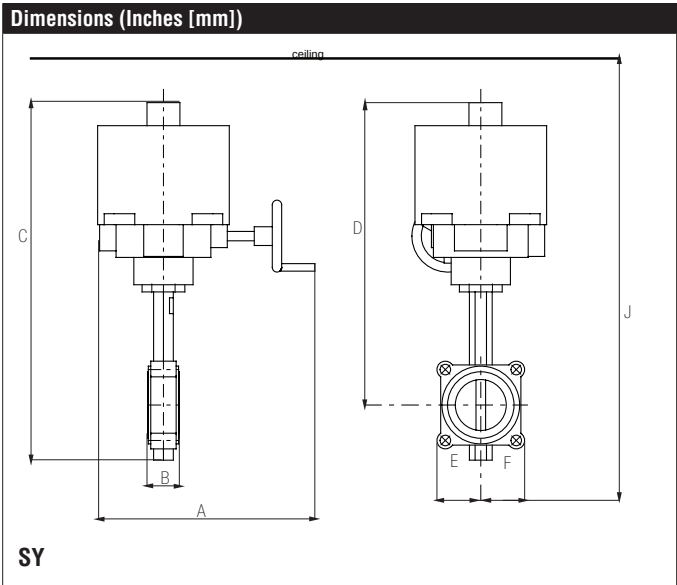
A	B	C	D	E	F
12.7" [323]	1.81" [46]	15.10" [384]	11.5" [292]	2.6" [66]	



A	B	C	D	E	F
12.7" [323]	1.81" [46]	15.10" [384]	11.16" [283]	2.6" [66]	



A	B	C	D	E	F
14.1" [358]	1.81" [46]	18.39" [467.1]	14.8" [328]	2.6" [66]	



A	B	C	D	E	F	J
7.92" [201]	1.81" [46]	21.38" [544]	17.75" [451]	2.6" [66]		30.2" [767]

GRX24-3

On/Off Floating Point, Non-Spring Return, 24 V



Technical Data

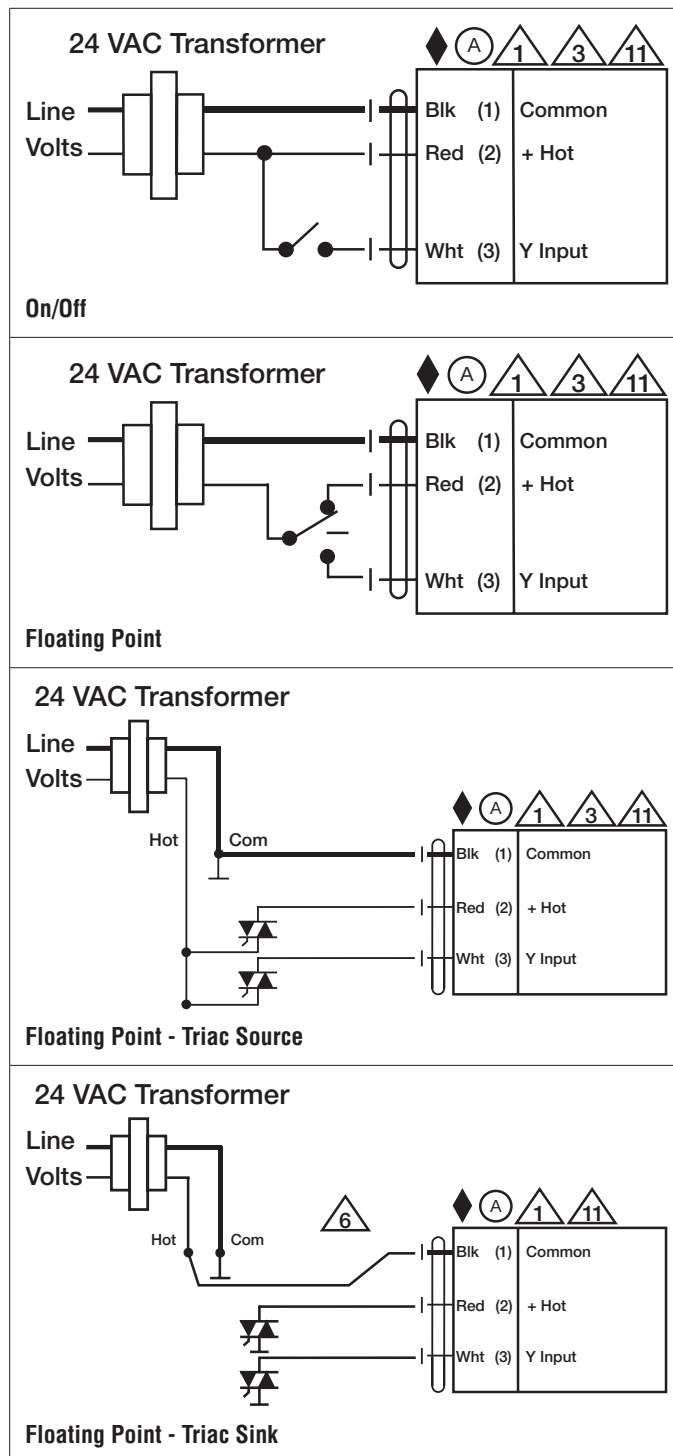
Power Supply	24 VAC $\pm$ 20%, 50/60 Hz, 24 VDC $\pm$ 10%
Power Consumption Running	4 W
Power Consumption Holding	2 W
Transformer Sizing	6 VA (class 2 power source)
Electrical Connection	3 ft, 18 GA plenum rated cable with 1/2" conduit connector protected NEMA 2 (IP54)
Overload Protection	electronic throughout 0° to 95° rotation
Operating Range Y	on/off, floating point
Input Impedance	600 Ω
Angle of Rotation	90°, adjustable with mechanical stop
Direction of Rotation (Motor)	reversible with built-in switch
Position Indication	reflective visual indicator (snap on)
Manual Override	external push button
Running Time (Motor)	150 sec constant, independent of load
Humidity	5 to 95% RH non-condensing
Ambient Temperature Range	-22°F to 122°F [-30°C to 50°C]
Storage Temperature Range	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing Material	UL94-5VA
Agency Listings†	cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC and 2006/95/EC
Noise Level (Motor)	<45 dB (A)
Servicing	maintenance free
Quality Standard	ISO 9001
Weight	3.4 lbs [1.55 kg]

Wiring Diagrams

✂️ INSTALLATION NOTES

- (A) Actuators with appliance cables are numbered.
- 1 Provide overload protection and disconnect as required.
- 3 Actuators may also be powered by 24 VDC.
- 6 Actuators Hot wire must be connected to the control board common. Only connect common to neg. (-) leg of control circuits. Terminal models (-T) have no-feedback.
- 11 Actuators may be connected in parallel if not mechanically linked. Power consumption and input impedance must be observed.
- Meets cULus requirements without the need of an electrical ground connection.

WARNING! LIVE ELECTRICAL COMPONENTS!
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



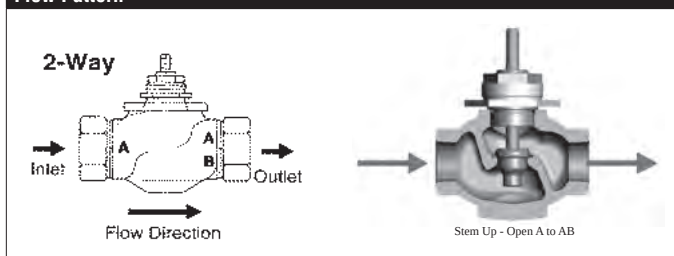
G220, 2-Way, Globe Valve, Bronze Trim



Technical data

Service	chilled or hot water, up to 60% glycol, steam
Flow characteristic	equal percentage
Controllable Flow Range	stem up - open A to AB
Size [mm]	0.75" [20]
End Fitting	NPT female ends
Body	bronze
Stem	stainless steel
Stem Packing	spring loaded Teflon V-ring
Seat	bronze
Plug	brass
Disc	composition (EPDM)
Body Pressure Rating [psi]	ANSI 250
ANSI Class	ANSI 250 (up to 400 psi below 150°F)
Max Inlet Pressure (Steam)	35 psi (241 kPa)
Media Temperature Range (Water)	20°F to 280°F [-7°C to 138°C]
Media Temperature Range (Steam)	32°F to 280°F [0°C to 138°C]
Maximum differential pressure (steam)	20 psi (103 kPa)
Max Differential Pressure (Water)	35 psi (241 kPa)
Leakage	ANSI Class IV
Rangeability	60:1
Cv	7.5
Weight	3 lbs
Servicing	Repack/Rebuild kits available

Flow Pattern



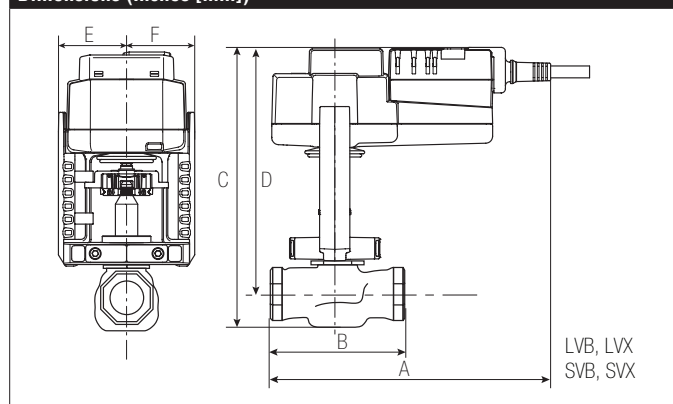
Application

This valve is typically used in Air handling units on heating or cooling coils, and fan coil unit heating or cooling coils. Some other common applications include Unit Ventilators, VAV box re-heat coils and bypass loops. This valve is suitable for use in hydronic system with variable flow. Bronze and stainless steel trim valves can be used for steam applications, depending on actuator and close-off combinations.

Suitable Actuators

	Non-Spring	Spring	Electronic Fail-Safe
G220	LVB(X)	LF	LVKB(X)

Dimensions (Inches [mm])

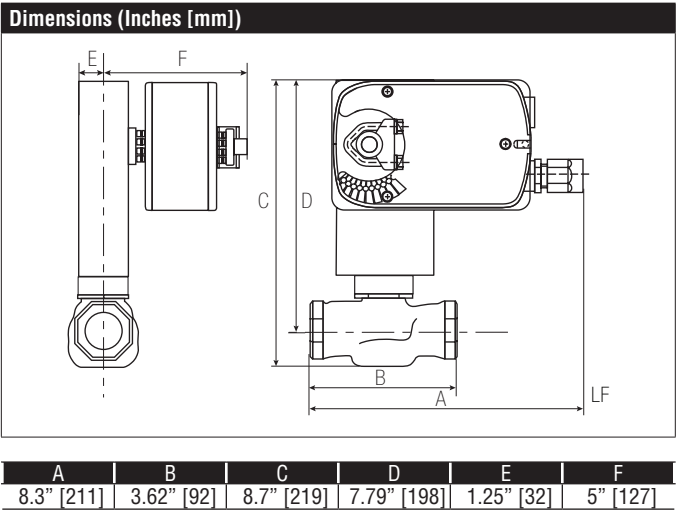
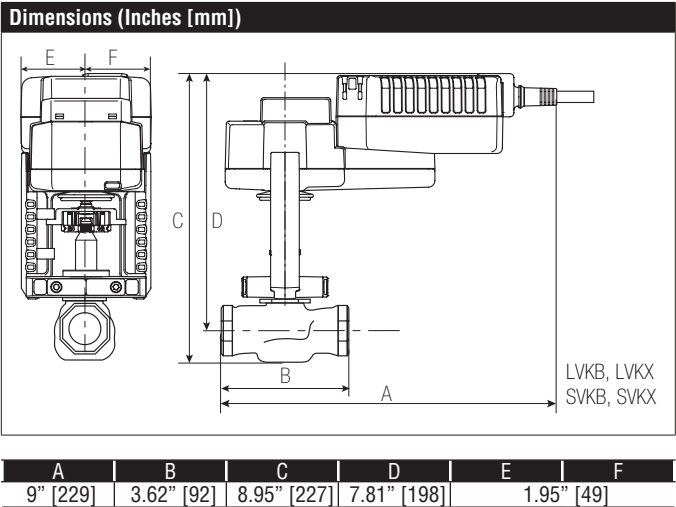


A	B	C	D	E	F
7.8" [200]	3.62" [92]	8.75" [222]	7.81" [198]	1.95" [49]	

Piping

The valves should be mounted in a weather-protected area in a location that is within the ambient limits of the actuator. Allow sufficient room for valve with actuator and for service. The G2(S) and G3(D) preferred mounting position of the valve is with the valve stem vertical above the valve body, for maximum life. However, the assemblies can be mounted with the valve stem vertical or horizontal in relation to the pipe. The actuators should never be mounted underneath the valve, as condensation can build up and result in a failure of the actuators. Do not reverse flow direction.

G220, 2-Way, Globe Valve, Bronze Trim



LF24-SR US, Valve Actuator

Modulating, Spring Return, 24 V for 2 to 10 VDC or 4 to 20 mA Control Signal



Technical Data

Power Supply	24 VAC $\pm$ 20%, 50/60 Hz, 24 VDC $\pm$ 10%
Power Consumption Running	2.5 W
Power Consumption Holding	1 W
Transformer Sizing	5 VA (class 2 power source)
Electrical Connection	3 ft, 18 GA plenum cable with 1/2" conduit connector
Overload Protection	electronic throughout 0° to 95° rotation
Operating Range Y	2 to 10 VDC, 4 to 20 mA (w/ 500 Ω , 1/2 W resistor) ZG-R01
Input Impedance	100 k Ω for 2 to 10 VDC (0.1 mA), 500 Ω for 4 to 20 mA
Feedback Output U	2 to 10 VDC (max 0.7 mA) for 95°
Angle of Rotation	max. 95°, adjustable with mechanical stop
Torque	35 in-lbs [4 Nm] minimum
Direction of Rotation (Motor)	reversible with built-in switch
Direction of Rotation (Fail-Safe)	reversible with CW/CCW mounting
Position Indication	visual indicator, 0° to 95° (0° is full spring return position)
Running Time (Motor)	150 seconds constant, independent of load per 90°
Running Time (Fail-Safe)	<20 seconds @ -4°F to 122°F [-20°C to 50°C], < 60 sec @ -22°F [-30°C]
Humidity	5 to 95% RH non-condensing
Ambient Temperature Range	-22°F to +122°F [-30°C to +50°C]
Storage Temperature Range	-40°F to +176°F [-40°C TO +80°C]
Housing	NEMA 2, IP54
Housing Material	zinc coated steel
Agency Listings†	cULus acc. To UL 873 and CAN/CSA C22.2 No. 24-93
Noise Level (Motor)	<30 dB (A)
Noise Level (Fail-Safe)	<62 dB (A)
Servicing	maintenance free
Quality Standard	ISO 9001

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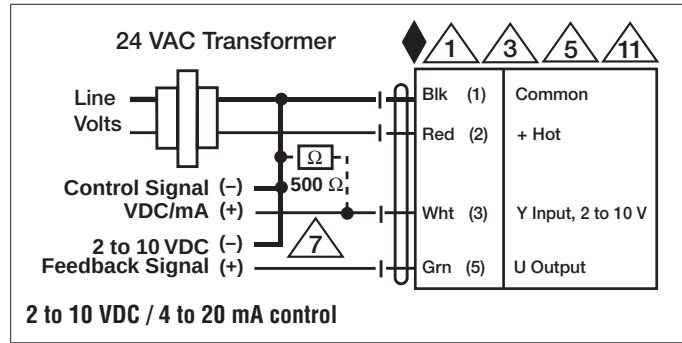
LF24-SR US, Valve Actuator

Modulating, Spring Return, 24 V for 2 to 10 VDC or 4 to 20 mA Control Signal

Wiring Diagrams

INSTALLATION NOTES

- (A)** Actuators with appliance cables are numbered.
- 1** Provide overload protection and disconnect as required.
- 3** Actuators may also be powered by 24 VDC.
- 5** Only connect common to negative (-) leg of control circuits.
- 7** A 500 Ω resistor (ZG-R01) converts the 4 to 20 mA control signal to 2 to 10 VDC.
- 11** Actuators may be connected in parallel if not mechanically linked. Power consumption and input impedance must be observed.
- ◆** Meets cULus requirements without the need of an electrical ground connection.
- ! WARNING! LIVE ELECTRICAL COMPONENTS!**
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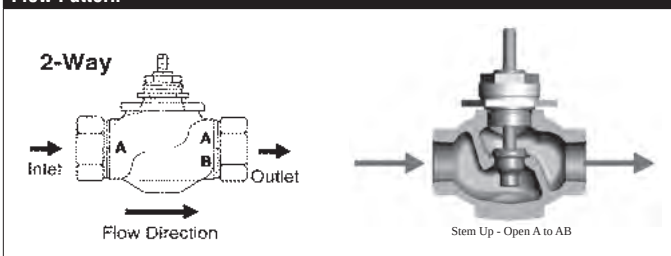
G232, 2-Way, Globe Valve, Bronze Trim



Technical data

Service	chilled or hot water, up to 60% glycol, steam
Flow Characteristic	equal percentage
Controllable Flow Range	stem up - open A to AB
Size [mm]	1.25" [32]
End Fitting	NPT female ends
Body	bronze
Stem	stainless steel
Stem Packing	spring loaded Teflon V-ring
Seat	bronze
Plug	brass
Disc	composition (EPDM)
Body Pressure Rating [psi]	ANSI 250
ANSI Class	ANSI 250 (up to 400 psi below 150°F)
Max Inlet Pressure (Steam)	35 psi (241 kPa)
Media Temperature Range (Water)	20°F to 280°F [-7°C to 138°C]
Media Temperature Range (Steam)	32°F to 280°F [0°C to 138°C]
Maximum differential pressure (steam)	20 psi (103 kPa)
Max Differential Pressure (Water)	35 psi (241 kPa)
Leakage	ANSI Class IV
Rangeability	75:1
Cv	20
Weight	3.7 lb [1.7 kg]
Servicing	Repack/Rebuild kits available

Flow Pattern



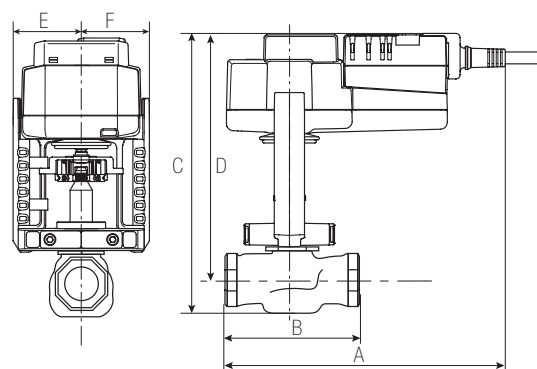
Application

This valve is typically used in Air handling units on heating or cooling coils, and fan coil unit heating or cooling coils. Some other common applications include Unit Ventilators, VAV box re-heat coils and bypass loops. This valve is suitable for use in hydronic system with variable flow. Bronze and stainless steel trim valves can be used for steam applications, depending on actuator and close-off combinations.

Suitable Actuators

	Non-Spring	Spring	Electronic Fail-Safe
G232	SVB(X)	NFB(X)	SVKB(X)

Dimensions (Inches [mm])



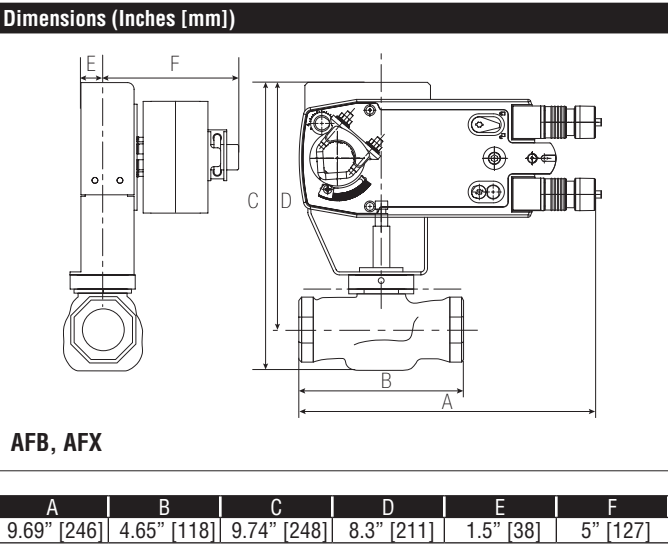
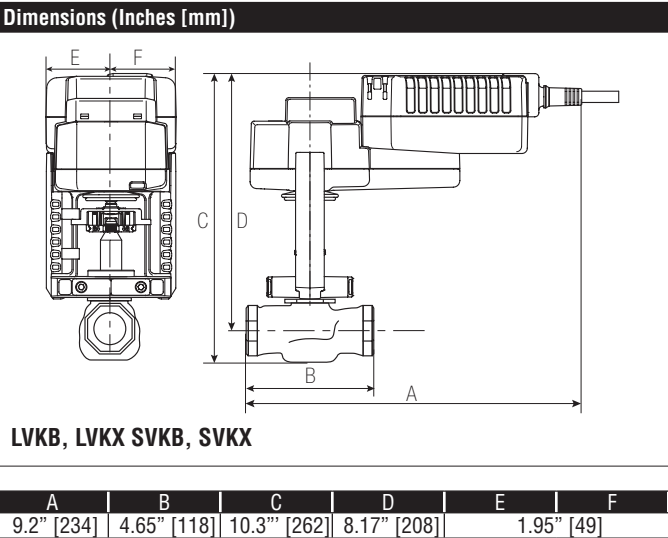
LVB, LVX SVB, SVX

A	B	C	D	E	F
8.7" [221]	4.65" [118]	9.5" [241]	8.17" [208]	1.95" [49]	

Piping

The valves should be mounted in a weather-protected area in a location that is within the ambient limits of the actuator. Allow sufficient room for valve with actuator and for service. The G2(S) and G3(D) preferred mounting position of the valve is with the valve stem vertical above the valve body, for maximum life. However, the assemblies can be mounted with the valve stem vertical or horizontal in relation to the pipe. The actuators should never be mounted underneath the valve, as condensation can build up and result in a failure of the actuators. Do not reverse flow direction.

G232, 2-Way, Globe Valve, Bronze Trim



SVB24-SR

Modulating, Non-Spring Return, Linear, 24 V, for 2 to 10 VDC or 4 to 20 mA



Technical Data	
Power Supply	24 VAC $\pm$ 20%, 50/60 Hz, 24 VDC $\pm$ 10%
Power Consumption Running	4 W
Power Consumption Holding	2.5 W
Transformer Sizing	6 VA (class 2 power source)
Electrical Connection	3 ft, 18 GA plenum rated cable with 1/2" conduit connector protected NEMA 2 (IP54)
Overload Protection	electronic throughout full stroke
Electrical Protection	actuators are double insulated
Operating Range	2 to 10 VDC, 4 to 20 mA w/ ZG-R01 (500 Ω , 1/4 W resistor)
Input Impedance	100 k Ω for 2 to 10 VDC (0.1 mA), 500 Ω for 4 to 20 mA
Position Feedback	2 to 10 VDC
Stroke	3/4" [20 mm]
Linear Force	337 lbf [1500 N force]
Direction of Rotation (Motor)	reversible with switch
Position Indication	stroke indicator on bracket
Manual Override	4 mm hex crank (shipped w/actuator)
Running Time (Motor)	90 sec, constant independent of load
Humidity	5 to 95% RH non-condensing
Ambient Temperature Range	-22°F to 122°F [-30°C to 50°C]
Storage Temperature Range	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP42, UL enclosure type 2
Housing Material	Aluminum die cast and plastic casing
Agency Listings†	cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC and 2006/95/EC
Noise Level (Motor)	764
Servicing	maintenance free
Quality Standard	ISO 9001
Weight	2.9 lb [1.3 kg]

† Use flexible metal conduit. Push the listed conduit fitting device over the actuator's cable to butt against the enclosure. Screw in conduit connector. Jacket the actuators input wiring with listed flexible conduit. Properly terminate the conduit in a suitable junction box. Rated impulse Voltage 800V. Type of action 1. Control pollution degree 3.

Wiring Diagrams

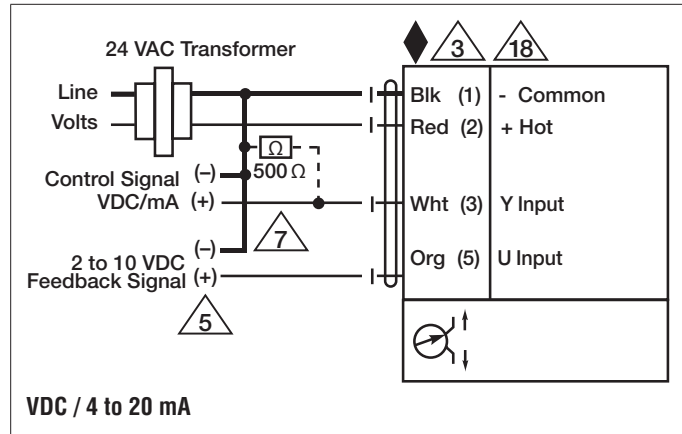
INSTALLATION NOTES

-  Actuators may also be powered by 24 VDC.
-  Only connect common to negative (-) leg of control circuits.
-  A 500 Ω resistor (ZG-R01) converts the 4 to 20 mA control signal to 2 to 10 VDC.
-  Actuators with plenum cable do not have numbers; use color codes instead.

APPLICATION NOTES

-  Meets cULus requirements without the need of an electrical ground connection.

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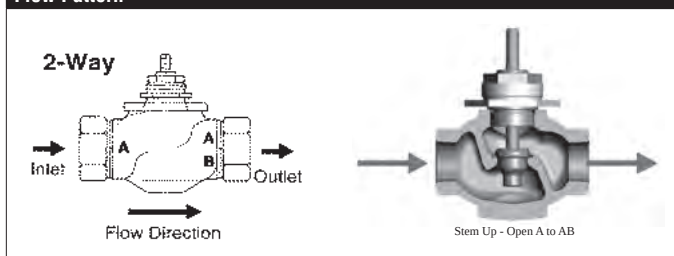
G250, 2-Way, Globe Valve, Bronze Trim



Technical data

Service	chilled or hot water, up to 60% glycol, steam
Flow Characteristic	equal percentage
Controllable Flow Range	stem up - open A to AB
Size [mm]	2" [50]
End Fitting	NPT female ends
Body	bronze
Stem	stainless steel
Stem Packing	spring loaded Teflon V-ring
Seat	bronze
Plug	brass
Disc	composition (EPDM)
Body Pressure Rating [psi]	ANSI 250
ANSI Class	ANSI 250 (up to 400 psi below 150°F)
Max Inlet Pressure (Steam)	35 psi (241 kPa)
Media Temperature Range (Water)	20°F to 280°F [-7°C to 138°C]
Media Temperature Range (Steam)	32°F to 280°F [0°C to 138°C]
Maximum differential pressure (steam)	20 psi (103 kPa)
Max Differential Pressure (Water)	35 psi (241 kPa)
Leakage	ANSI Class IV
Rangeability	75:1
Cv	40
Weight	13 lbs
Servicing	Repack/Rebuild kits available

Flow Pattern



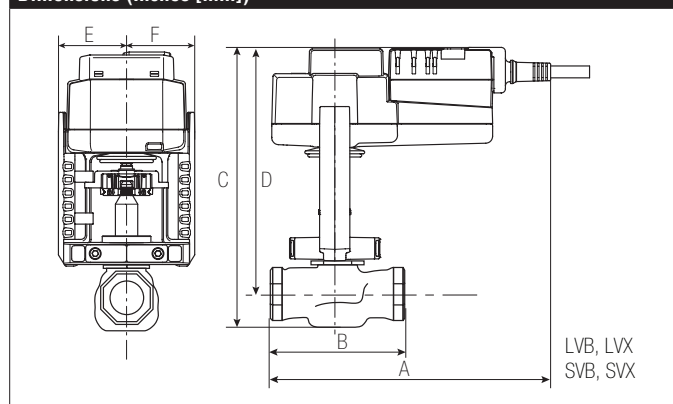
Application

This valve is typically used in Air handling units on heating or cooling coils, and fan coil unit heating or cooling coils. Some other common applications include Unit Ventilators, VAV box re-heat coils and bypass loops. This valve is suitable for use in hydronic system with variable flow. Bronze and stainless steel trim valves can be used for steam applications, depending on actuator and close-off combinations.

Suitable Actuators

	Non-Spring	Spring	Electronic Fail-Safe
G250	SVB(X)	AFB(X)	SVKB(X)

Dimensions (Inches [mm])

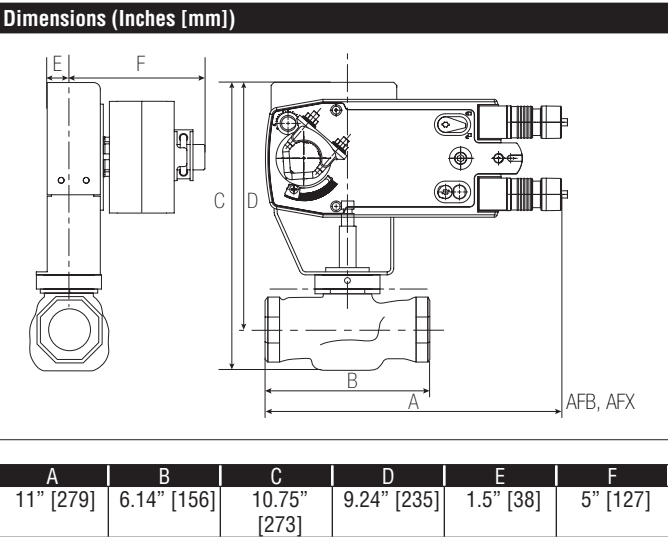
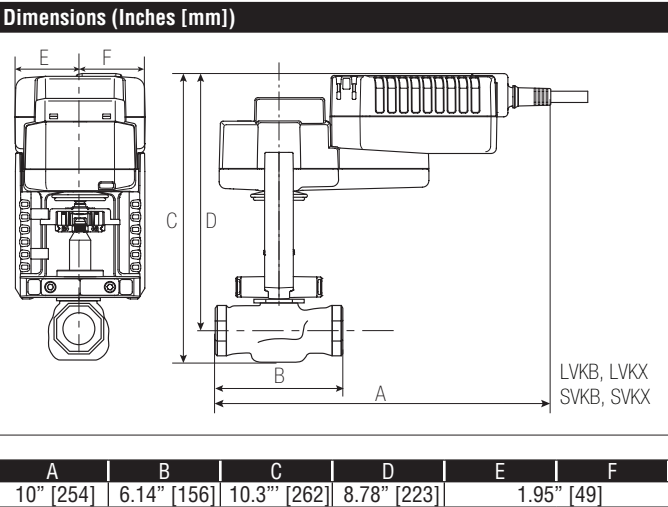


A	B	C	D	E	F
9.3" [236]	6.14" [156]	10.35" [263]	8.78" [223]	1.95" [49]	

Piping

The valves should be mounted in a weather-protected area in a location that is within the ambient limits of the actuator. Allow sufficient room for valve with actuator and for service. The G2(S) and G3(D) preferred mounting position of the valve is with the valve stem vertical above the valve body, for maximum life. However, the assemblies can be mounted with the valve stem vertical or horizontal in relation to the pipe. The actuators should never be mounted underneath the valve, as condensation can build up and result in a failure of the actuators. Do not reverse flow direction.

G250, 2-Way, Globe Valve, Bronze Trim



AFB24-SR-X1

Modulating, Spring Return, 24 V, for 2 to 10 VDC or 4 to 20 mA Control Signal



Technical Data	
Power Supply	24 VAC $\pm$ 20%, 50/60Hz, 24 VDC $\pm$ 20%/-10%
Power Consumption Running	5.5 W
Power Consumption Holding	3 W
Transformer Sizing	8.5 VA (class 2 power source)
Shaft Diameter	1/2" to 1.05" round, centers on 1/2" and 3/4" with insert, 1.05" without insert
Electrical Connection	3 ft, 18 GA appliance cable, 1/2" conduit connector
Overload Protection	electronic throughout 0° to 95° rotation
Operating Range Y	2 to 10 VDC, 4 to 20 mA (w/ 500 Ω , 1/2 W resistor) ZG-R01
Feedback Output U	2 to 10 VDC, 0.5 mA max
Angle of Rotation	95° (adjustable with mechanical end stop, 35° to 95°)
Torque	180 in-lbs [20 Nm] minimum
Direction of Rotation (Motor)	reversible with built-in switch
Direction of Rotation (Fail-Safe)	reversible with CW/CCW mounting
Position Indication	visual indicator, 0° to 95° (0° is full spring return position)
Manual Override	5 mm hex crank (3/16" Allen), supplied
Running Time (Motor)	95 seconds
Running Time (Fail-Safe)	<20 seconds @ -4°F to 122°F [-20°C to 50°C], < 60 sec @ -22°F [-30°C]
Humidity	max. 95% RH non-condensing
Ambient Temperature Range	-22°F to 122°F [-30°C to 50°C]
Storage Temperature Range	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing Material	zinc coated metal and plastic casing
Agency Listings†	cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC
Noise Level (Motor)	<40 dB (A)
Noise Level (Fail-Safe)	<62 dB (A)
Servicing	maintenance free
Quality Standard	ISO 9001
Weight	4.6 lbs [2.1 kg]

†Rated Impulse Voltage 800V, Type of action 1.AA, Control Pollution Degree 3

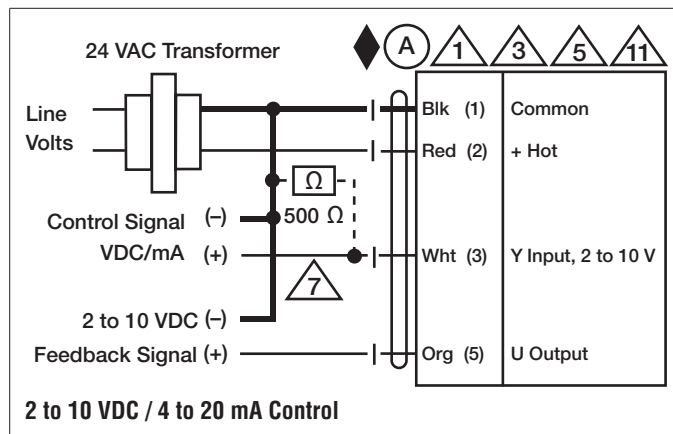
Date created, 12/18/2015 - Subject to change. © Belimo Aircontrols (USA), Inc.

Wiring Diagrams
✂ INSTALLATION NOTES

- (A)** Actuators with appliance cables are numbered.
- 1** Provide overload protection and disconnect as required.
- 3** Actuators may also be powered by 24 VDC.
- 5** Only connect common to negative (-) leg of control circuits.
- 7** A 500 Ω resistor (ZG-R01) converts the 4 to 20 mA control signal to 2 to 10 VDC.
- 11** Actuators may be connected in parallel if not mechanically linked. Power consumption and input impedance must be observed.
- ◆** Meets cULus requirements without the need of an electrical ground connection.

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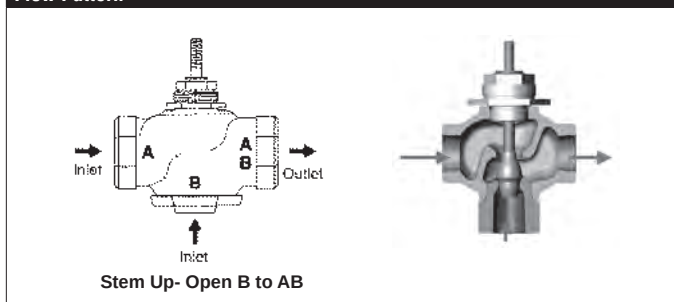
G340, 3-Way, Globe Valve, Bronze Trim, Mixing



Technical data

Service	chilled, hot water, up to 60% glycol
Flow Characteristic	linear
Controllable Flow Range	stem up - open B to AB
Size [mm]	1.5" [40]
End Fitting	NPT female ends
Body	bronze
Stem	stainless steel
Stem Packing	spring loaded Teflon V-ring
Seat	bronze
Plug	brass
Disc	composition (EPDM)
Body Pressure Rating [psi]	ANSI 250
ANSI Class	ANSI 250 (up to 400 psi below 150°F)
Media Temperature Range (Water)	20°F to 280°F [-7°C to 138°C]
Max Differential Pressure (Water)	35 psi (241 kPa)
Leakage	ANSI Class III
Rangeability	A-port 100:1, B-port 500:1
Cv	28
Weight	5.7 lb [2.6 kg]
Servicing	Repack/Rebuild kits available

Flow Pattern



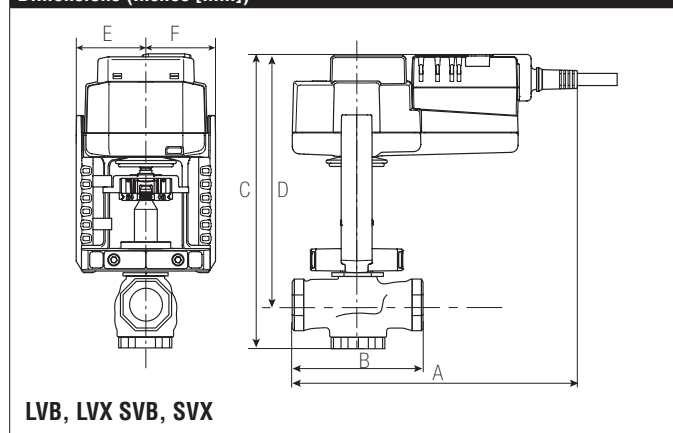
Application

This valve is typically used in Air handling units on heating or cooling coils, and fan coil unit heating or cooling coils. Some other common applications include Unit Ventilators, VAV box re-heat coils and bypass loops. This valve is suitable for use in hydronic system with constant or variable flow. 3-way valves are available with mixing or diverting flow patterns.

Suitable Actuators

	Non-Spring	Spring	Electronic Fail-Safe
G340	SVB(X)	AFB(X)	SVKB(X)

Dimensions (Inches [mm])

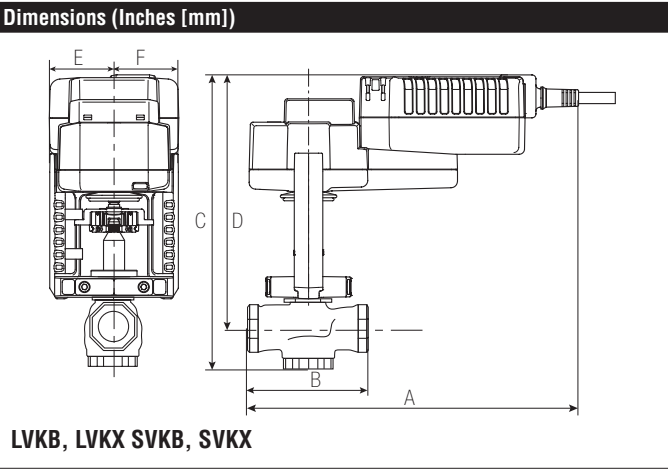


A	B	C	D	E	F
9" [229]	5.39" [137]	10.35" [263]	8.8" [224]	1.95" [49]	

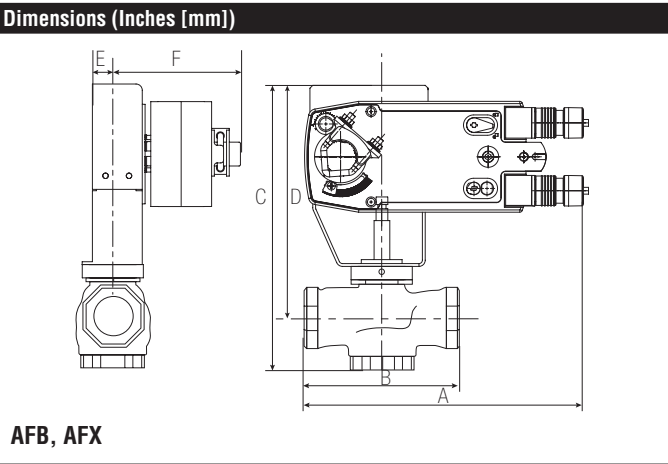
Piping

The valves should be mounted in a weather-protected area in a location that is within the ambient limits of the actuator. Allow sufficient room for valve with actuator and for service. The G2(S) and G3(D) preferred mounting position of the valve is with the valve stem vertical above the valve body, for maximum life. However, the assemblies can be mounted with the valve stem vertical or horizontal in relation to the pipe. The actuators should never be mounted underneath the valve, as condensation can build up and result in a failure of the actuators. Do not reverse flow direction.

G340, 3-Way, Globe Valve, Bronze Trim, Mixing



A	B	C	D	E	F
9.5" [241]	5.39" [137]	10.3" [262]	8.8" [224]	1.95" [49]	



A	B	C	D	E	F
10.5" [267]	5.37" [137]	10.24" [260]	9" [229]	1.5" [38]	5" [127]

SVB24-SR

Modulating, Non-Spring Return, Linear, 24 V, for 2 to 10 VDC or 4 to 20 mA



Technical Data	
Power Supply	24 VAC $\pm$ 20%, 50/60 Hz, 24 VDC $\pm$ 10%
Power Consumption Running	4 W
Power Consumption Holding	2.5 W
Transformer Sizing	6 VA (class 2 power source)
Electrical Connection	3 ft, 18 GA plenum rated cable with 1/2" conduit connector protected NEMA 2 (IP54)
Overload Protection	electronic throughout full stroke
Electrical Protection	actuators are double insulated
Operating Range	2 to 10 VDC, 4 to 20 mA w/ ZG-R01 (500 Ω , 1/4 W resistor)
Input Impedance	100 k Ω for 2 to 10 VDC (0.1 mA), 500 Ω for 4 to 20 mA
Position Feedback	2 to 10 VDC
Stroke	3/4" [20 mm]
Linear Force	337 lbf [1500 N force]
Direction of Rotation (Motor)	reversible with switch
Position Indication	stroke indicator on bracket
Manual Override	4 mm hex crank (shipped w/actuator)
Running Time (Motor)	90 sec, constant independent of load
Humidity	5 to 95% RH non-condensing
Ambient Temperature Range	-22°F to 122°F [-30°C to 50°C]
Storage Temperature Range	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP42, UL enclosure type 2
Housing Material	Aluminum die cast and plastic casing
Agency Listings†	cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC and 2006/95/EC
Noise Level (Motor)	764
Servicing	maintenance free
Quality Standard	ISO 9001
Weight	2.9 lb [1.3 kg]

† Use flexible metal conduit. Push the listed conduit fitting device over the actuator's cable to butt against the enclosure. Screw in conduit connector. Jacket the actuators input wiring with listed flexible conduit. Properly terminate the conduit in a suitable junction box. Rated impulse Voltage 800V. Type of action 1. Control pollution degree 3.

Wiring Diagrams

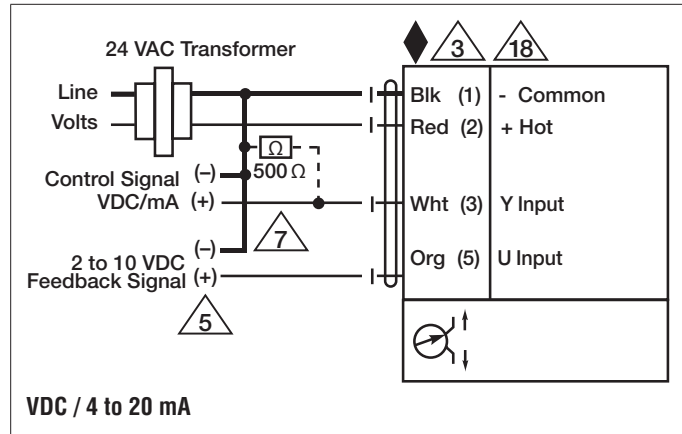
✂️ INSTALLATION NOTES

- △3 Actuators may also be powered by 24 VDC.
- △5 Only connect common to negative (-) leg of control circuits.
- △7 A 500 Ω resistor (ZG-R01) converts the 4 to 20 mA control signal to 2 to 10 VDC.
- △18 Actuators with plenum cable do not have numbers; use color codes instead.

📄 APPLICATION NOTES

- ◆ Meets cULus requirements without the need of an electrical ground connection.

⚠️ **WARNING! LIVE ELECTRICAL COMPONENTS!**
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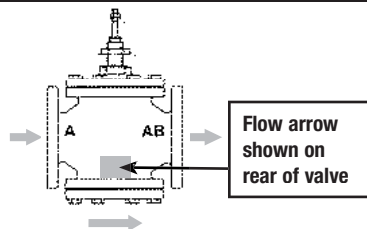
G6...C(S)(LCS) 2-way Pressure Compensated Flanged Globe Valve



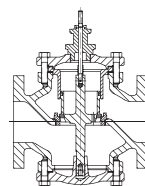
Technical Data			
	G6...C	G6...CS	G6...LCS
Service	chilled or hot water, 60% glycol, steam	chilled or hot water, 60% glycol, steam	chilled or hot water, 60% glycol, steam
Flow characteristic	modified equal percentage		linear
Action	stem up - open A to AB		
Sizes	2½" to 6"		
End fitting	125 lb. flanged		
Materials			
Body	iron	iron	iron
Seat	bronze	stainless steel	stainless steel
Stem	stainless steel	stainless steel	stainless steel
Plug	bronze	stainless steel	stainless steel
Packing	NLP (no lip packing)	NLP (no lip packing)	NLP (no lip packing)
ANSI class	ANSI 125		
Leakage	Class III		
Max inlet			
Steam	35 psi (241kPa)	100 psi (680kPa)	100 psi (680kPa)
Water	150 psi (1034kPa) @ 250°F	150 psi (1034kPa) @ 250°F	150 psi (1034kPa) @ 250°F
Media temperature			
Water	32°F to 300°F (0°C to 149°C)	32°F to 350°F (0°C to 176°C)	
Steam	32°F to 280°F (0°C to 138°C)	32°F to 338°F (0°C to 170°C)	
Maximum ΔP*			
Water	25 psi (172kPa)	50 psi (340kPa)	50 psi (340kPa)
Steam	15 psi (103kPa)	50 psi (340kPa)	50 psi (340kPa)
Rangeability	G665C 85:1 G680C 91:1	G6100C 98:1 G6125C 100:1	G6150C 98:1
Valve weights			
G665C(S)(LCS)		57 lbs	
G680C(S)(LCS)		75 lbs	
G6100C(S)(LCS)		127 lbs	
G6125C(S)(LCS)		149 lbs	
G6150C(S)(LCS)		197 lbs	

*(50% or more open)

G6...C(S)(LCS) 2-way Flow Patterns



Flow Pattern is marked on valve.



Stem Up - Open A to AB

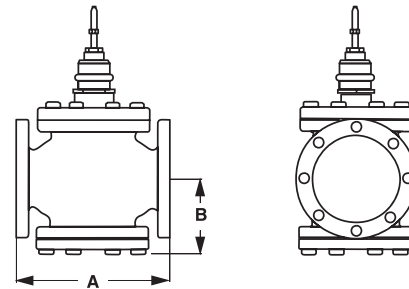
Application

This valve is typically used in Large Air Handling Units on heating or cooling coils. This valve is suitable for use in a hydronic system with variable flow.

Bronze or stainless steel trim valves can be used for steam applications, depending on actuator and close-off combination.

Valve		Type	Suitable Actuators			
Nominal Size						
C _v	Inches	2-way Flanged	Non-Spring	Spring Return	Electronic Fail-Safe	
65	2½	G665C(S)	EV Series	AF	AVK Series	
90	3	G680C(S)				
170	4	G6100C(S)		2*AF Series		
263	5	G6125C(S)				
344	6	G6150C(S)				
65	2½	G665LCS		AF		AVK Series
90	3	G680LCS				
170	4	G6100LCS		2*AF Series		
263	5	G6125LCS				
344	6	G6150LCS				

Dimensions



D166-2WF

Valve Nominal Size			Dimensions (Inches [mm])	
Valve Body	Inches	DN [mm]	A	B
G665C(S)	2½"	[65]	9" [229]	4.75" [120]
G680C(S)	3"	[80]	10" [254]	5.37" [137]
G6100C(S)	4"	[100]	13" [330]	6.87" [175]
G6125C(S)	5"	[125]	15.75" [400]	7.87" [200]
G6150C(S)	6"	[150]	17.75" [451]	8.50" [216]
G665LCS	2½"	[65]	9" [229]	4.75" [120]
G680LCS	3"	[80]	10" [254]	5.37" [137]
G6100LCS	4"	[100]	13" [330]	6.87" [175]
G6125LCS	5"	[125]	15.75" [400]	7.87" [200]
G6150LCS	6"	[150]	17.75" [451]	8.50" [216]

Piping

The valves should be mounted in a weather-protected area in a location that is within the ambient limits of the actuator. Allow sufficient room for valve with actuator and for service. Please allow 12" for complete actuator removal. The G6/G7 preferred mounting position of the valve is with the valve stem vertical above the valve body, for maximum life. However, the assemblies can be mounted with valve stem vertical above the valve or up to 45 degrees in relation to the horizontal pipe. The actuators should never be mounted underneath the valve, as condensation can build up and result in a failure of the actuators. Do not reverse flow direction.

EVB24-SR

Proportional, Non-Spring Return, Linear, 24 V, for 2 to 10 VDC or 4 to 20 mA



Technical Data

Power supply	24 VAC $\pm$ 20% 50/60 Hz, 24 VDC $\pm$ 10%
Power consumption running	6 W
Power consumption holding	3.5 W
Transformer sizing	7 VA (class 2 power source)
Electrical connection	3 ft, 18 GA plenum rated cable with 1/2" conduit connector protected NEMA 2 (IP54)
Overload protection	electronic throughout full stroke
Electrical protection	actuators are double insulated
Control	2-10 VDC
Operating Range Y	2 to 10 VDC, 4 to 20 mA (default)
Input impedance	100 k Ω for 2 to 10 VDC (0.1 mA), 500 Ω for 4 to 20 mA
Feedback Output U	2 to 10 VDC
Stroke	2" [50 mm]
Linear Force	562 lbf [2500 N]
Direction of rotation	reversible with switch
Position indication	stroke indicator on bracket
Manual override	5 mm hex crank (3/16" Allen), supplied
Running time motor	90 seconds (default), variable (90 to 150 seconds)
Humidity	5 to 95% RH non condensing
Ambient temperature	-22°F to +122°F [-30°C to +50°C]
Storage temperature	-40°F to +176°F [-40°C to +80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing material	Aluminum die cast and plastic casing
Agency listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC and 2006/95/EC
Noise level	<65dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	9 lbs

† Use flexible metal conduit. Push the Listed conduit fitting device over the actuator's cable to butt against the enclosure. Screw in conduit connector. Jacket the actuators input wiring with Listed flexible conduit. Properly terminate the conduit in a suitable junction box. Rated impulse Voltage 800V. Type of action 1. Control Pollution Degree 3.

Application

For multiple control types of globe valves in HVAC steam and hydronic systems.

Actuator sizing will be dictated by the valve size selection. All valve selections should be done in accordance with the flow parameters and system specifications. The actuator is mounted directly to the globe valve bonnet by means of its universal clamp and collar.

The actuator operates in response to a 2 to 10 VDC, or with the addition of a 500 resistor, a 4 to 20 mA control input from an electronic controller or positioner. A 2 to 10 VDC feedback signal is provided for position indication.

Operation

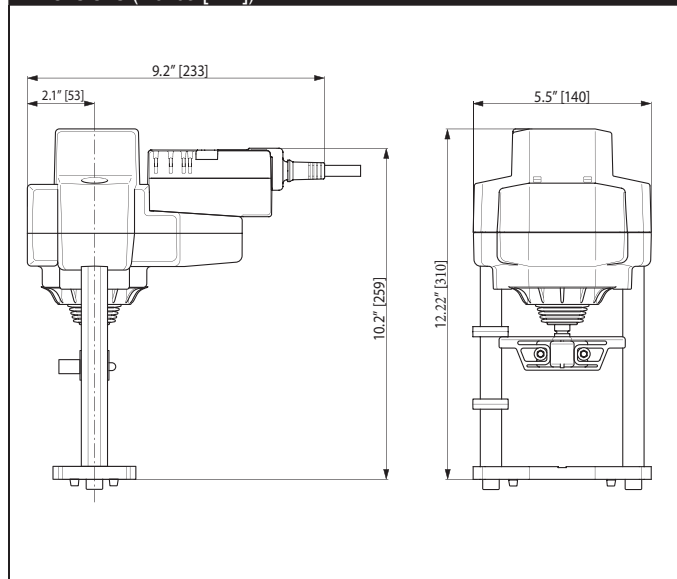
The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The EV series provides 50 mm of downward travel and a visual indicator indicates position of the actuator. When reaching the valve end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

The EV... series actuators use a sensorless brushless DC motor. The ASIC inside monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add-on auxiliary switches are easily fastened directly onto the actuator body for signaling and switching functions.

-SR and -MFT models will have an illuminated green Adaption/Power button to reset and relearn the valve stroke as well as indicate the actuator is powered. This feature allows the actuator to rescale itself based on the actual travel. Along with the Adaption button on -MFT models will have a yellow Status light to confirm communication.

Dimensions (Inches [mm])



PT10401 - 01/13 - Subject to change. © Belimo Aircontrols (USA), Inc.

Typical Specification

Proportional control globe valve actuators shall be electronic and direct coupled to the globe valve bonnet via an integrated linkage, which requires no secondary linkage and be capable of mounting to valves 2.5" to 6" in size. Actuators must provide control in response to a control input from an electronic controller or positioner. Actuators shall have brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

Wiring Diagrams

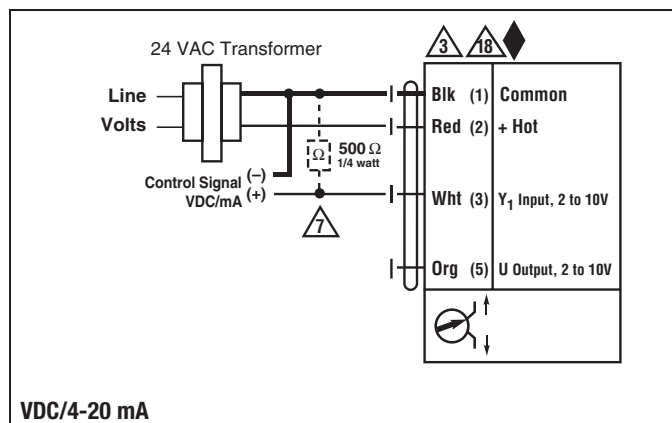
✂ INSTALLATION NOTES

- 3 Actuators may also be powered by 24 VDC.
- 7 a 500 Ω resistor converts the 4-20 mA control signal to 2-10 VDC
- 18 Actuators with plenum cable do not have numbers; use color codes instead.
- Meets cULus or UL and CSA Standard requirements without the need of an electrical ground connection.



WARNING Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



Close-Off Pressures (psi)

G2/G3 Non-Spring Return, Spring Return, and Electronic Fail-Safe



	Non-Spring Return		Spring Return			Electronic Fail-Safe	
	LV	SV	LF	NF	AFB	LVK	SVK
2-way							
G212(S)	250		250			250	
G213(S)	250		250			250	
G214(S)	250		250			250	
G215(S)	250		250			250	
G219(S)	211		140			211	
G220(S)	211		140			211	
G224(S)		250		220			207
G225(S)		250		220			207
G232(S)		236		140			236
G240(S)		159			210		159
G250(S)		85			120		85
3-way Mixing							
G314	250		210			250	
G315	250		210			250	
G320	211		140			250	
G325		250		220			250
G332		236		140			236
G340		159			210		159
G350		85			120		85
3-way Diverting							
G315D	250		250			250	
G320D	250		250			250	
G325D		250		250			250
G332D		250		250			250
G340D		250			250		250
G350D		250			250		250

G6/G7 Non-Spring Return, Spring Return, and Electronic Fail-Safe

	Non-Spring Return		Spring Return		Electronic Fail-Safe	
	EV	RV	AF	2*AF	AVK	2*GK
2-way Pressure Comp ANSI 125						
G665C	140		140		140	
G680C	140		140		140	
G6100C	140			140	140	
G6125C	140			140	140	
G6150C	140			110	140	
2-way Pressure Comp ANSI 125						
G665CS, G665LCS	125		125		125	
G680CS, G680LCS	125		125	125	125	
G6100CS, G6100LCS	125			125	125	
G6125CS, G6125LCS	125			125	125	
G6150C, G6150LCS	125			110	125	
2-way Pressure Comp ANSI 250						
G665C-250	310		310		310	
G680C-250	310		280		310	
G6100C-250	310			280	310	
G6125C-250	310			185	232	
G6150C-250	244			110	150	
2-way Pressure Comp ANSI 250						
G665CS-250, G665LCS-250	250		250		250	
G680CS-250, G680LCS-250	250		250		250	
G6100CS-250, G6100LCS-250	250			250	250	
G6125CS-250, G6125LCS-250	250			185	232	
G6150CS-250, G6150LCS-250	244			110	150	250
3-way ANSI 125 Mixing						
G765, G765S	94	125	40	100	71	125
G780, G780S	63	125	26	68	47	125
G7100, G7100S	33	68		12		37
G7125, G7125S		42				
G7150, G7150S		28				
3-way ANSI 250 Mixing						
G765-250, G765S-250	94	185	40	100	71	222
G780-250, G780S-250	63	125	26	68	47	152
G7100-250, G7100S-250	33	68		12		37
G7125-250, G7125S-250		42				22
G7150-250, G7150S-250		28				14
3-way ANSI 125/250 Diverting						
G765D, G765DS, G765DS-250	140		140		140	
G780D, G780DS, G780DS-250	140		140		140	
G7100D, G7100DS, G100DS-250	140		140		140	
G7125D, G7125DS, G7125DS-250	140			140		
G7150D, G7150DS, G7150DS-250	175			175		

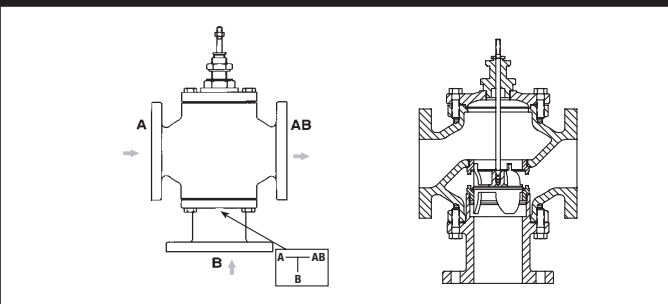
G765, 3-Way, Mixing Flanged Globe Valve



Technical Data

Service	chilled, hot water, up to 60% glycol
Flow Characteristic	linear
Controllable Flow Range	stem up - open B to AB
Size [mm]	2.5" [65]
End Fitting	125 lb. flanged
Body	Cast Iron - ASTM A126 Class B
Stem	stainless steel
Stem Packing	NLP EPDM (no lip packing)
Seat	316 stainless steel
Plug	bronze
Body Pressure Rating [psi]	ANSI 125
ANSI Class	ANSI 125 (up to 175 psi below 150°F)
Number of Bolt Holes	4
Max Inlet Pressure (Water)	150 psi (1034 kPa) @ 250°F
Media Temperature Range (Water)	32°F to 350°F [0°C to 176°C]
Max Differential Pressure (Water)	25 psi (172 kPa)
Rangeability	50:1
Cv	68
Weight	61.9 lb [28.1 kg]
Leakage	ANSI Class III
Servicing	Repack/Rebuild kits available

Flow Pattern



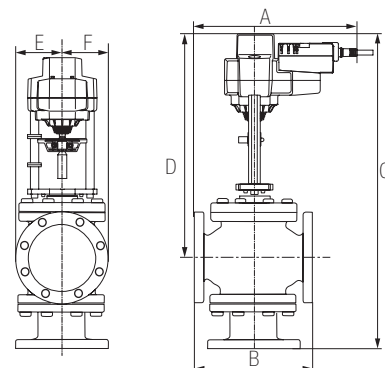
Application

This valve is typically used in large Air Handling Units (AHU) on heating or cooling coils. This valve is suitable for use in a hydronic system with variable flow.

Suitable Actuators

	Non-Spring	Spring	Electronic Fail-Safe
G765	EVB(X), RVB(X)	AFB(X), 2*AFB(X)	AVKB(X), 2*GKB(X)

Dimensions (Inches [mm])



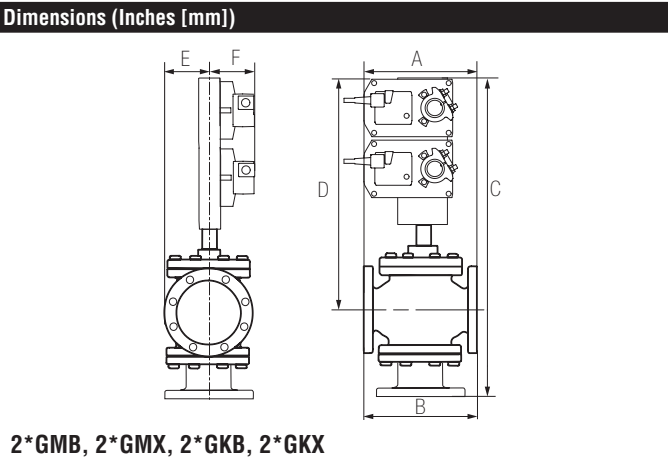
EVB, EVX, RVB, RVX

A	B	C	D	E	F
11.7" [297]	9" [229]	25.37" [644]	18.25" [464]	3.64" [92]	

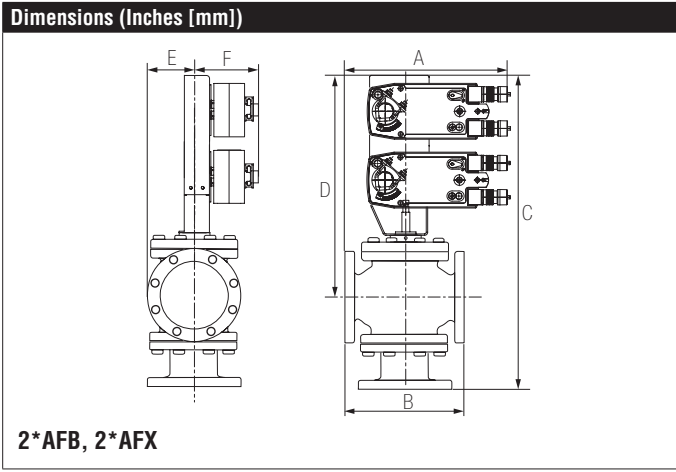
Piping

The valves should be mounted in a weather-protected area in a location that is within the ambient limits of the actuator. Allow sufficient room for valve with actuator and for service. The preferred mounting position of the valve is with the valve stem vertical above the valve body, for maximum life. However, the assemblies can be mounted with valve stem vertical above the valve or up to 45 degrees in relation to the horizontal pipe. The actuators should never be mounted underneath the valve, as condensation can build up and result in a failure of the actuators. Do not reverse flow direction.

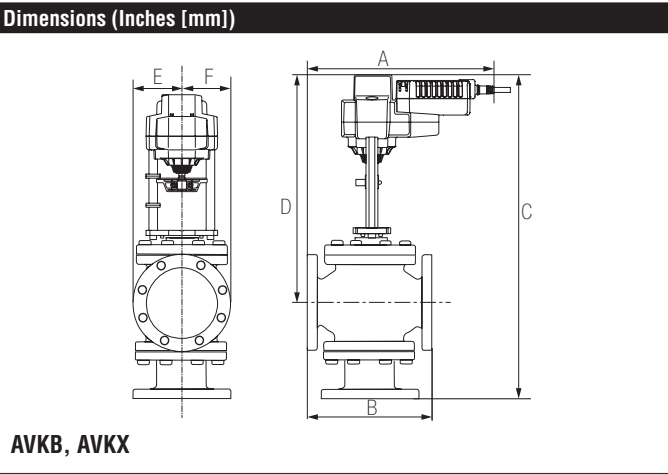
G765, 3-Way, Mixing Flanged Globe Valve



A	B	C	D	E	F
11.7" [297]	9" [229]	29" [736]	21.8" [554]	3.5" [89]	5.25" [135]

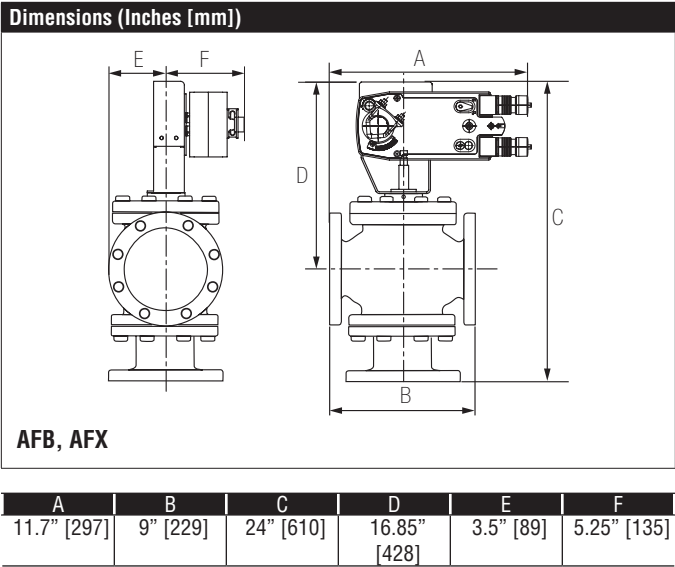


A	B	C	D	E	F
11.7" [297]	9" [229]	29" [736]	21.8" [554]	3.5" [89]	5.25" [135]



A	B	C	D	E	F
12.81" [325]	9" [229]	25.37" [644]	18.25" [464]	3.64" [92]	

G765, 3-Way, Mixing Flanged Globe Valve



AFX24-MFT-X1

Modulating, Spring Return, 24 V, Multi-Function Technology®



Technical Data	
Power Supply	24 VAC±20%, 50/60Hz, 24 VDC+20%/-10%
Power Consumption Running	7.5 W
Power Consumption Holding	3 W
Transformer Sizing	10 VA (class 2 power source)
Electrical Connection	18 GA appliance rated cable with 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] and 16 ft [5m]
Overload Protection	electronic throughout 0° to 95° rotation
Operating Range Y	2 to 10 VDC, 4 to 20 mA w/ ZG-R01 (500 Ω, 1/4 W resistor), variable (VDC, PWM, floating point, on/off)
Feedback Output U	2 to 10 VDC, 0.5 mA max, VDC variable
Angle of Rotation	95° (adjustable with mechanical end stop, 35° to 95°)
Direction of Rotation (Motor)	reversible with built-in switch
Direction of Rotation (Fail-Safe)	reversible with CW/CCW mounting
Position Indication	visual indicator, 0° to 95° (0° is full spring return position)
Manual Override	5 mm hex crank (3/16" Allen), supplied
Running Time (Motor)	150 sec (default), variable (70 to 220 sec)
Running Time (Fail-Safe)	<20 sec
Override Control	min. position = 0% , mid. Position = 50% , max. position = 100% (Default)
Humidity	max. 95% RH non-condensing
Ambient Temperature Range	-22°F to +122°F [-30°C to +50°C]
Storage Temperature Range	-40°F to +176°F [-40°C to +80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Housing Material	zinc coated metal and plastic casing
Agency Listings†	cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC
Noise Level (Motor)	<40 dB (A)
Noise Level (Fail-Safe)	<62 dB (A)
Servicing	maintenance free
Quality Standard	ISO 9001
Weight	4.6 lb [2.1 kg]

*Variable when configured with MFT options.

†Rated Impulse Voltage 800V, Type of action 1.AA, Control Pollution Degree 3

Date created, 09/01/2016 - Subject to change. © Belimo Aircontrols (USA), Inc.

Wiring Diagrams

WARNING! LIVE ELECTRICAL COMPONENTS!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



Meets cULus requirements without the need of an electrical ground connection.



Actuators with appliance cables are numbered.



Provide overload protection and disconnect as required.



Actuators may also be powered by 24 VDC.



Only connect common to negative (-) leg of control circuits.



A 500 Ω resistor (ZG-R01) converts the 4 to 20 mA control signal to 2 to 10 VDC.



Control signal may be pulsed from either the Hot (Source) or Common (Sink) 24 VAC line.



For triac sink the Common connection from the actuator must be connected to the Hot connection of the controller. Position feedback cannot be used with a triac sink controller; the actuator internal common reference is not compatible.



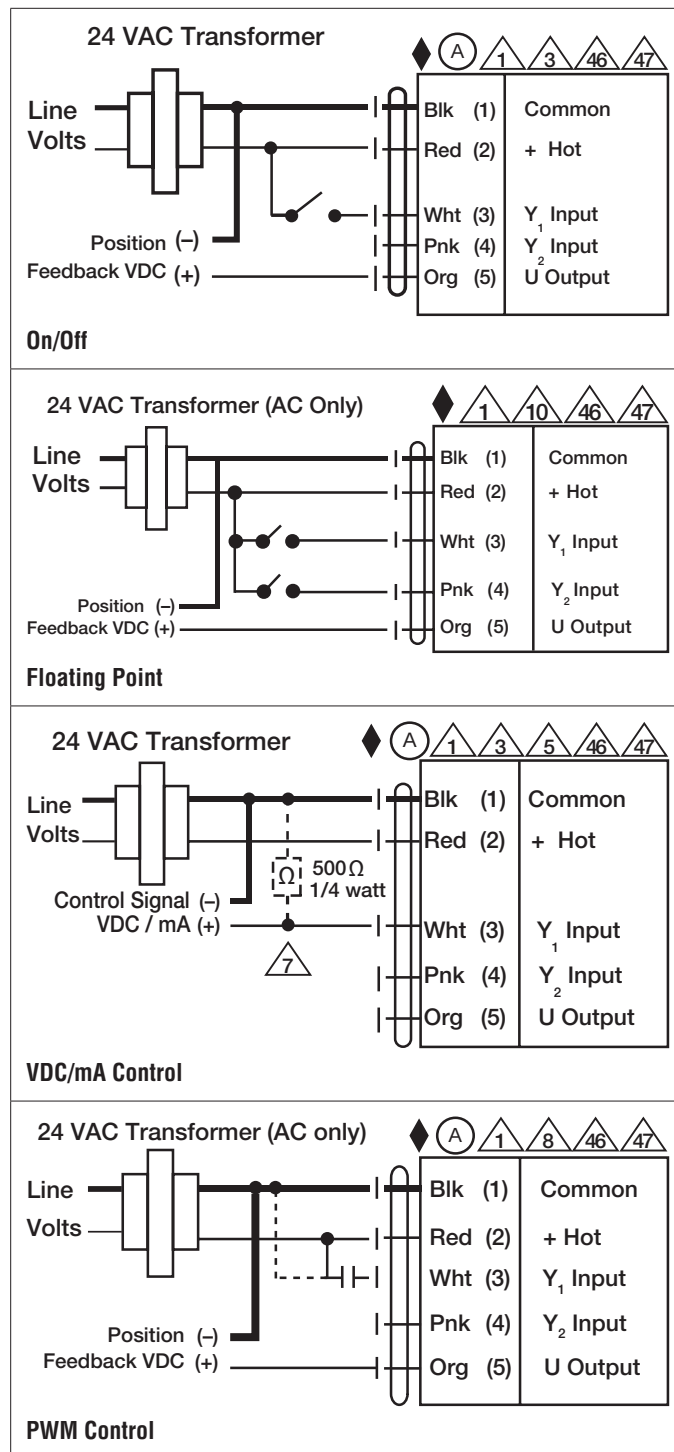
IN4004 or IN4007 diode. (IN4007 supplied, Belimo part number 40155).



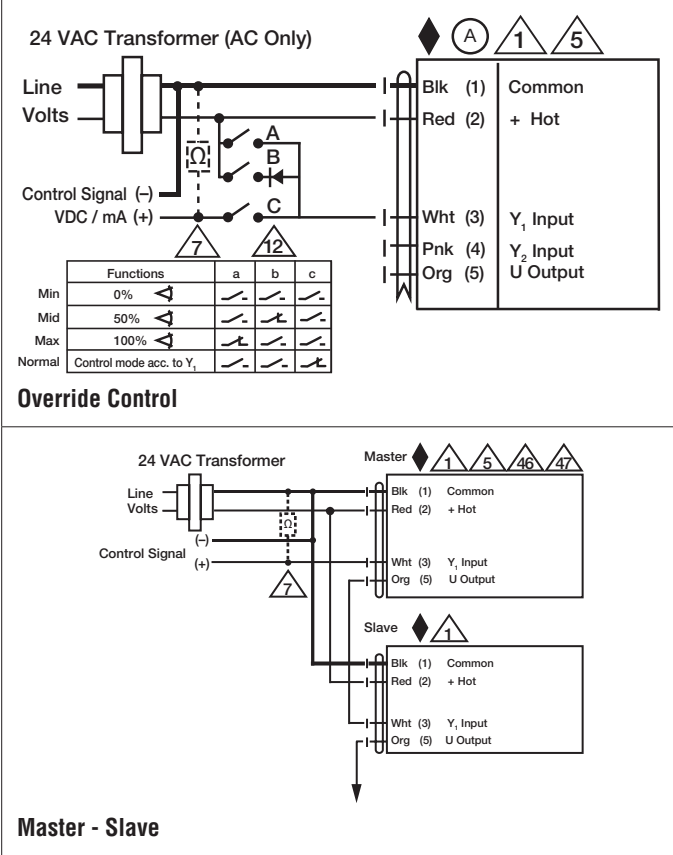
Actuators may be controlled in parallel. Current draw and input impedance must be observed.



Master-Slave wiring required for piggy-back applications. Feedback from Master to control input(s) of Slave(s).



AFX24-MFT-X1
Modulating, Spring Return, 24 V, Multi-Function Technology®



AFS SERIES



CAUS

CE



APPLICATION

- **Proving fan status**
- **Monitoring filter for excess pressure drop**
- **Monitoring duct static pressure**
- **Proving air flow**
- **Monitoring damper status**

Contact Rating		Overpressure	
AFS-145, 222, 262, 405	15A non-inductive, 277 VAC, 60 Hz 24 VAC @ 2.4A	Measurement Range	0.5 psig (3.5 kPa)
AFS-460, 460-DSS	15A @ 125-277 VAC 1/4 HP @ 125 VAC 1/2 HP @ 250 VAC 1/2A @ 125 VDC	AFS-145, 222, 405	0.05" to 12.0" W.C. (12.5 to 2989 Pa)
		AFS-262	0.05" to 2.0" W.C. (12.5 to 498 Pa)
		AFS-460	0.4" to 12.0" W.C. (99.3 to 2989 Pa)
		AFS-460-DSS	1.25" to 12.0" W.C. (311 to 2989 Pa)
Contact Type		Life Expectancy	AFS-145, 222, 262, 405: 100,000 cycles minimum @ 0.5 psig (3.5 kPa) maximum pressure each cycle and at maximum electrical load AFS-460: 6000 cycles
AFS-145, 222, 262, 405	SPDT		
AFS-136, 460-137	SPST N.C.		
AFS-460	2-SPST N.C.	Operating Temperature	-40° to 180°F (-40° to 82°C)
AFS-460-DSS		Process Connection	
Switch Differential		AFS-145	1/8" NPTF
AFS-145, 222, 262, 405	Progressive, increasing from approximately 0.02" W.C. (5.0 Pa) @ minimum set point to approximately 0.8" W.C. (199 Pa) @ maximum set point	All Others	Ferrule and nut compression for 1/4" OD tubing
AFS-460, 460-DSS	None, manual reset	Approvals	CE, UL File MH6213, cCSAus, RoHS
		Weight	1.2 lb (0.54 kg)
		Warranty	2 years

Action on a rise in differential pressure	Opens on a rise in differential pressure	Opens on a rise in differential pressure A Lead B Lag
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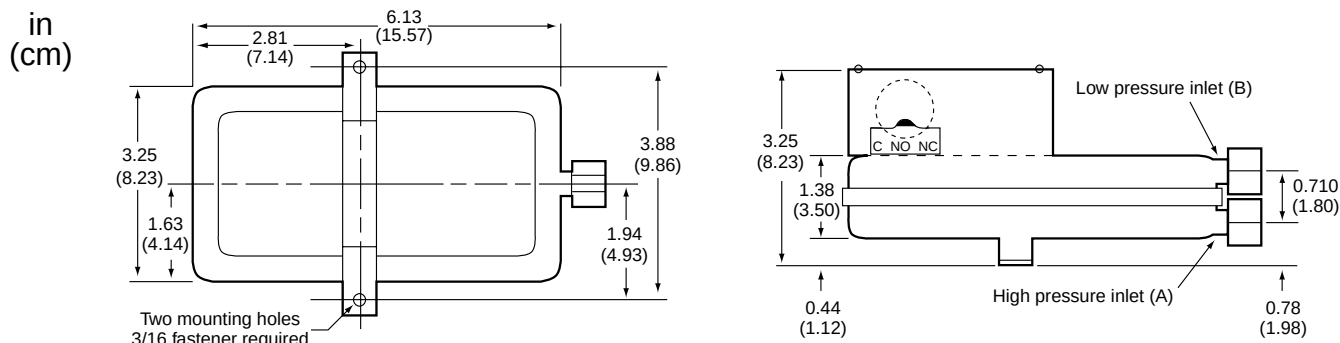


PRESSURE

ADJUSTABLE DIFFERENTIAL PRESSURE SWITCHES

AFS SERIES

DIMENSIONS



OPERATION

Select a mounting location that is free from vibration. The switch must be mounted with the diaphragm in any vertical plane in order to obtain the lowest specified operating setpoint. Avoid mounting with the sample line connections in the up position. Surface mount via the two 3/16" diameter holes in the integral mounting bracket.

The Model AFS-460-DSS has a lead switch (A) and a lag switch (B). The lead switch trips according to the setpoint knob and the lag switch trips after the lead switch. If dual-switch simultaneous operation is required, order AFS-460-136 (120 VAC power) or AFS-460-137 (24 VAC power).

Locate sampling probe a minimum of 1-1/2 duct diameters downstream from the air source. Install the sampling probe as close to the center of the airstream as possible.

Refer to the Dimensions drawing to identify the high pressure inlet (A) and the low pressure inlet (B), and connect the sample lines as follows:

Positive Pressure Only

Connect the sample line to (A);
(B) remains open to the atmosphere.

Negative Pressure Only

Connect the sample line to (B);
(A) remains open to the atmosphere.

Two Negative Samples

Connect the higher negative sample to (B);
Connect the lower negative sample to (A).

Two Positive Samples

Connect the higher positive sample to (A);
Connect the lower positive sample to (B).

One Positive and One Negative Sample

Connect the positive sample to (A);
Connect the negative sample to (B).

ORDERING INFORMATION

MODEL	DESCRIPTION
AFS-145*	Differential pressure switch 0.05" to 12" W.C. (12.5 to 2989 Pa), 1/8" NPTF
AFS-222*	Differential pressure switch 0.05" to 12" W.C. (12.5 to 2989 Pa), 1/4" compression fittings
AFS-222-112	Differential pressure switch 0.05" to 12" W.C. (12.5 to 2989 Pa), 1/4" barbed fittings
AFS-262*	Differential pressure switch 0.05" to 2" W.C. (12.5 to 498 Pa), 1/4" compression fittings
AFS-262-112	Differential pressure switch 0.05" to 2" W.C. (12.5 to 498 Pa), 1/4" barbed fittings
AFS-405	Differential pressure switch 0.05" to 12" W.C. (12.5 to 2989 Pa), gold contacts
AFS-460*	Manual reset differential pressure switch, 0.4" to 12" W.C. (99.3 to 2989 Pa), SPST
AFS-460-136	Manual reset differential pressure switch, 0.4" to 12" W.C. (99.3 to 2989 Pa), 120 VAC, SPDT
AFS-460-137	Manual reset differential pressure switch, 0.4" to 12" W.C. (99.3 to 2989 Pa), 24 VAC, SPDT
AFS-460-DSS*	Manual reset differential pressure switch, 1.25" to 12.0" WC (311 to 2989 Pa), 2 SPST switches

* C models Kele calibration available

	RELATED PRODUCTS	PAGE
21122	6" aluminum impact tube, 1/4" OD connection	1113
21122-112	6" aluminum impact tube for 1/8" thru 1/4" ID flexible plastic tubing	1113
60681	Static or total pressure sensing kit	1113
A-301-K	Duct static pressure tip, 1/4" compression	1113
A-302-K	Duct static pressure tip, 1/4" barb	1113
A-308-K	Duct static pressure fitting, 1/4" barb	1113
A-345-K	Flange mounting kit (1 required for each A-301-K or A-302-K)	1113
T-101	1/4" OD black poly tubing, 1 coil, 250 ft (76 m)	901

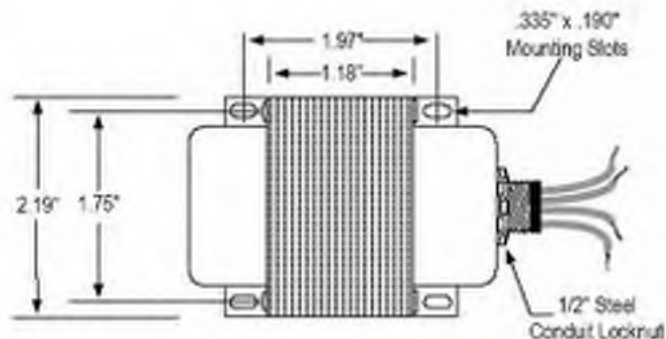
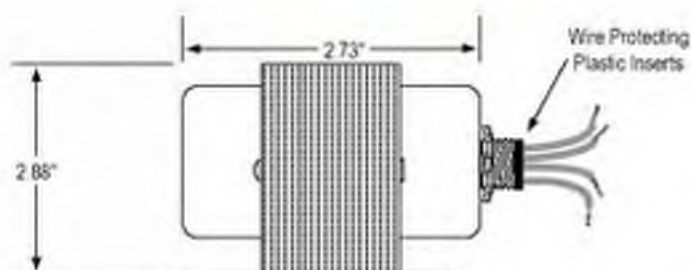
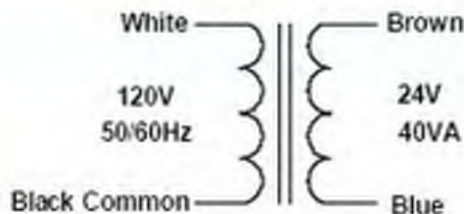
120-024-040-1TF

Catalog # LE11300

CORE
COMPONENTS

the
source

Enclosed Control Transformer



SPECIFICATIONS

Input:	120 Vac
Output:	24 Vac
VA Rating:	40VA
Frequency:	50/60Hz
Circuit Protection:	Internally Protected
Configuration:	Enclosed Split Bobbin Design with Steel End Bells
Mounting(s):	Slotted Foot Mounts & Threaded Flange Hubs
Primary Connections:	UL 1015 Insulated 18AWG Lead Wires, 7.5" Long, .375" ends Stripped & Tinned
Secondary Connections:	UL 1015 Insulated 18AWG Lead Wires, 7.5" Long, .375" ends Stripped & Tinned
Insulation System:	UL 1446 Recognized Component Class B Insulation System PG125 (130°C, 266°F)
Agency Approvals:	UL 1685 / UL 5085-1 / UL 5085-3 Listed for USA & Canada. Class 2, Class 3 Transformer CSA Certified



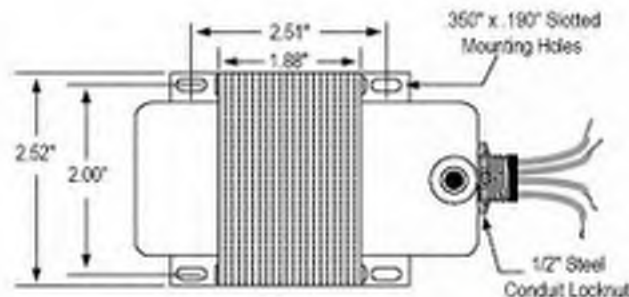
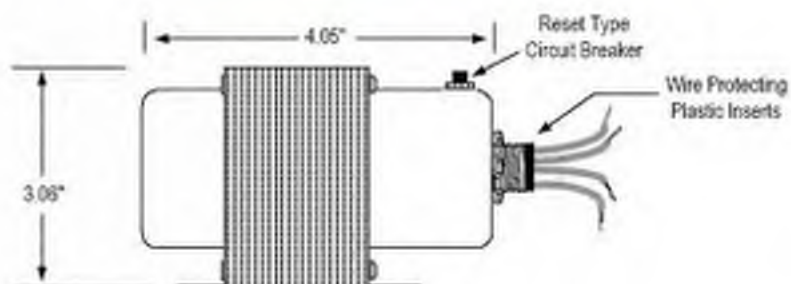
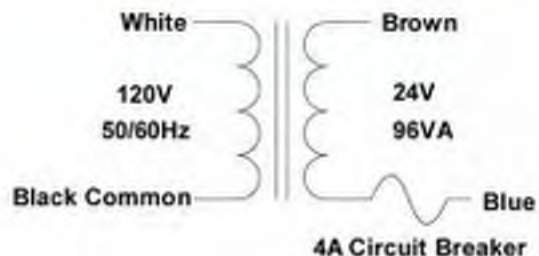
120-024-100-1TF-CB

Catalog # LE12100

CORE
COMPONENTS

the
source

Enclosed Control Transformer



SPECIFICATIONS

Input:	120 Vac
Output:	24 Vac
VA Rating:	96VA
Frequency:	50/60Hz
Circuit Protection:	Manual Reset Circuit Breaker
Configuration:	Enclosed Split Bobbin Design with Steel End Bells
Mounting(s):	Slotted Foot Mounts & Threaded Flange Hubs
Primary Connections:	UL 1015 Insulated 18AWG Lead Wires, 7.5" Long, .375" ends Stripped & Tinned
Secondary Connections:	UL 1015 Insulated 18AWG Lead Wires, 7.5" Long, .375" ends Stripped & Tinned
Insulation System:	UL 1446 Recognized Component Class B Insulation System PG125 (130°C, 266°F)
Agency Approvals:	UL 1585 / UL 5085-1 / UL 5085-3 Listed for USA & Canada. Class 2, Class 3 Transformer CSA Certified



Advantage III

Gold Series by Ebtron

Installation Guide

GTC116

“Plug & Play” Transmitter with
Combination RS-485 Network Output and Dual Analog Output

Document Name: IG_GTC116_R3A



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Models GTC116 and GTM116

Part Number 930-0220

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1 GTC116 TRANSMITTER INSTALLATION

The GTC116 transmitter is designed for use in an environment between -20° F to 120° F (-28.8° C to 48.8° C) where it will not be exposed to rain or snow. Install transmitter upright and in a field accessible location. The enclosure accepts 1/2 in. (12.7 mm) electrical fittings for signal and power wiring at both sides at the top of the enclosure.

Locate the transmitter so that the connecting cables from all of the sensor probes will reach the receptacles on the bottom of the transmitter enclosure.



In locations exposed to direct rain and/or snow, the transmitter must be enclosed in a NEMA4 enclosure.



Leave unobstructed space of at least 9 in. (228.6 mm) above, 2 in. (50.8 mm) to each side and 3.5 in. (88.9 mm) below the transmitter to allow for cover removal, sensor connections and heat dissipation.



Locate the transmitter in a location that can be reached by all connecting cables from the sensor probes.



Do not drill into the transmitter enclosure since metal shavings could damage the electronics.

1.1 GTC116 Mechanical Dimensions

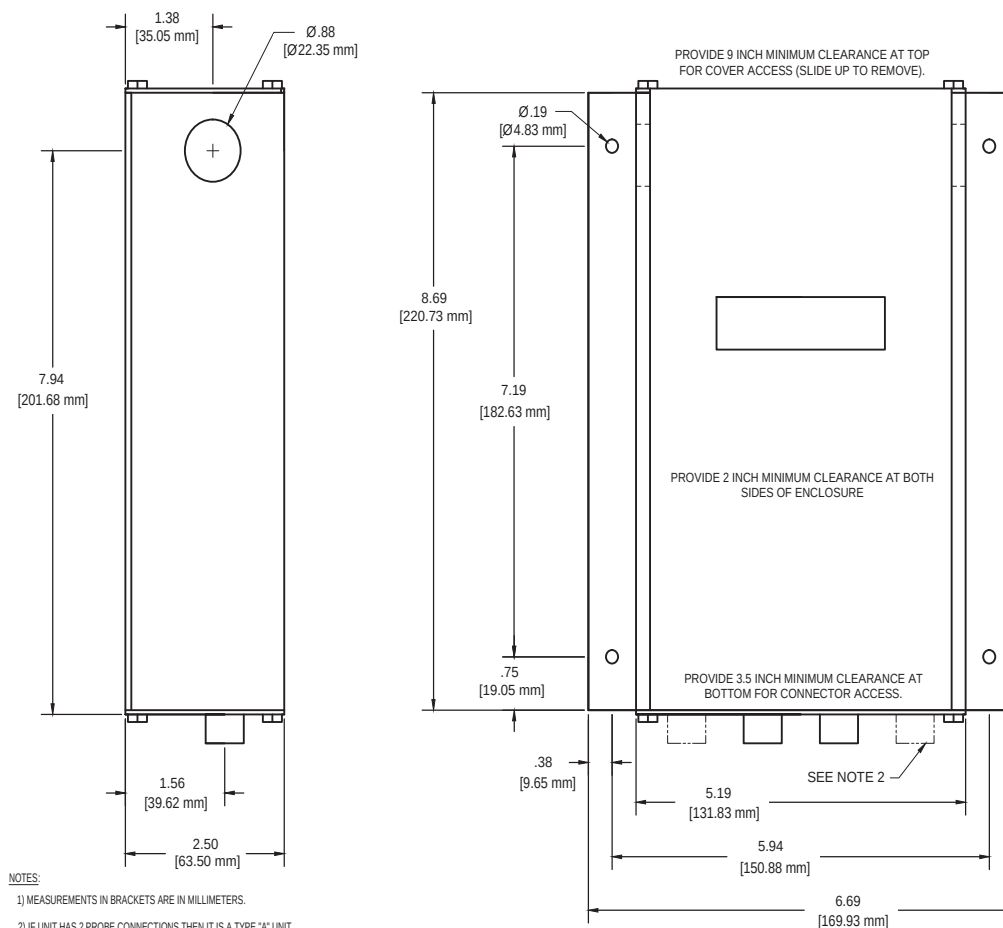


Figure 1. GTC116 Mechanical Dimensions

2 GTC116 TRANSMITTER INTERIOR VIEW/FEATURES

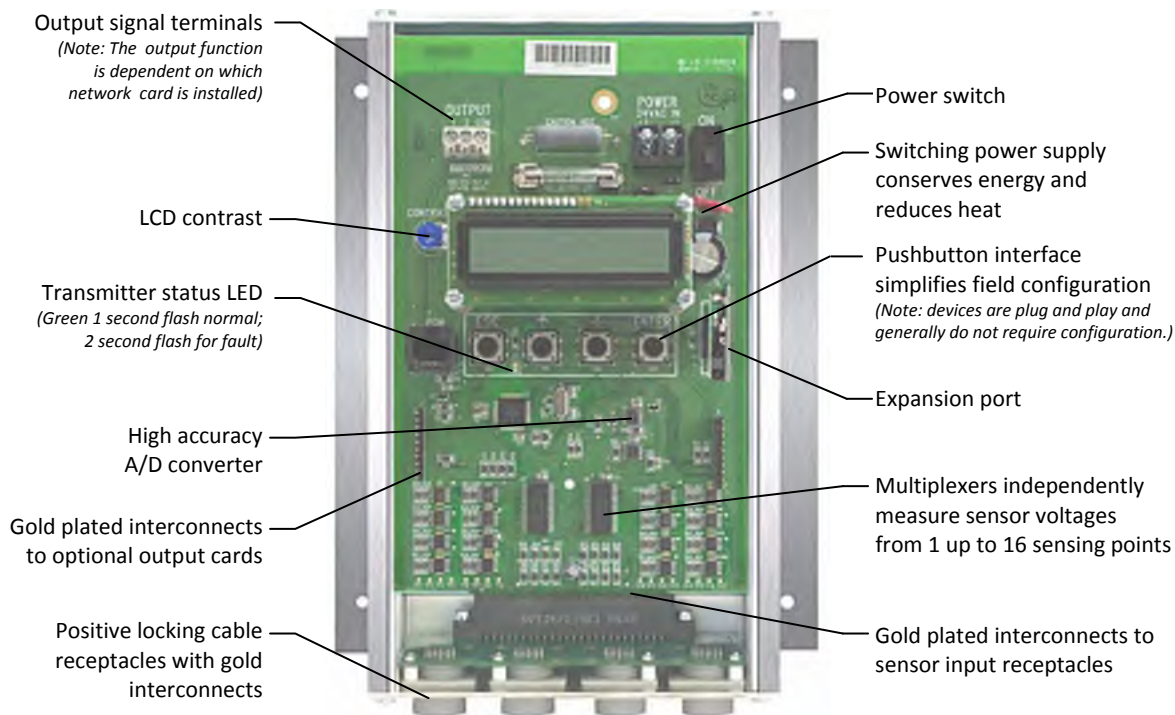


Figure 2. GTC116 Transmitter Interior View/Features

3 GTC116 TRANSMITTER POWER AND PROBE CONNECTIONS

3.1 Power Transformer Selection

Select a 24 VAC transformer based on the maximum power requirements indicated on the transmitter label (20 VA) or from the table below. The operating supply voltage (transmitter power “ON” with all sensor probes connected) should not be less than 22.8 VAC or greater than 26.4 VAC.

Table 1. GTC116 Power Transformer Selection Guide

Total Sensors	Minimum VA Req.	Total Sensors	Minimum VA Req.	Total Sensors	Minimum VA Req.	Total Sensors	Minimum VA Req.
1	12	5	14	9	17	13	19
2	13	6	15	10	17	14	19
3	13	7	15	11	18	15	20
4	14	8	16	12	18	16	20

3.2 Connecting Power to the Transmitter

Connect 24 VAC power to the large, two position power input terminal labeled “POWER” on the upper right hand side of the main circuit board (Figure 3). Since the output signals are isolated from the power supply, it is not necessary to provide an isolated (secondary not grounded) power source.



Multiple GTC116 transmitters wired to a single transformer must be wired “in-phase” (L1 to L1, L2 to L2).

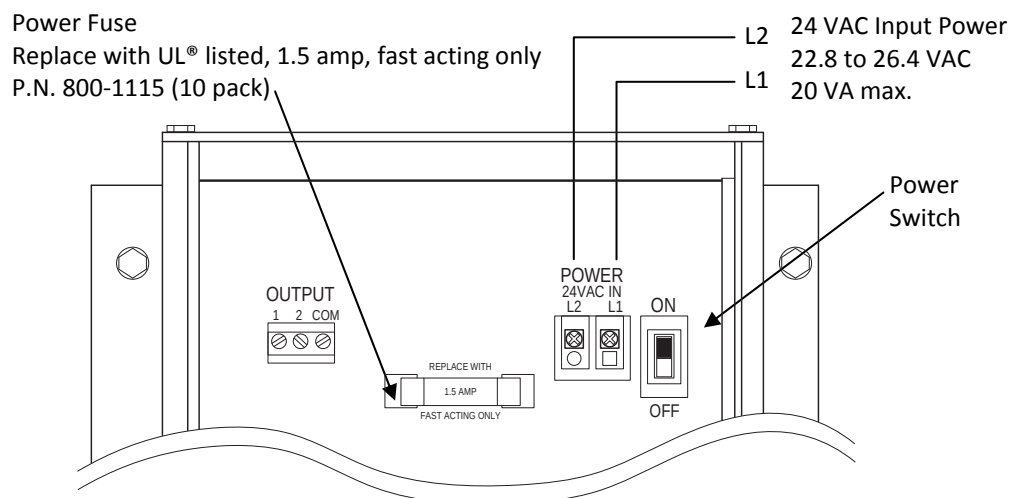


Figure 3. Connecting Power to the Transmitter

3.3 Connecting Sensor Probes to the Transmitter

After installing the sensor probes and transmitter, connect each of the sensor probe cable plugs to the circular receptacles located at the bottom of the GTC116 transmitter enclosure. Probes are “Plug and Play” and do not have to be connected to a specific receptacle on the transmitter unless traverse data is desired (see note below). Transmitters accept only GP1 and GB1 sensors.



Provide a “drip loop” at the transmitter if there will be the potential for water runoff or condensation along the sensor probe cable(s).



Sensor probe cable plugs are “keyed” as shown below. Line up plug with receptacle and push straight on to receptacle.



DO NOT TWIST. Squeeze cable plug “ribs” towards receptacle when removing. Forcing the cable plug in or out of the receptacle will damage the connectors and void warranty.



When traverse data is desired (especially when using the EB-Link Reader), probes should be installed and connected to the transmitter using the mounting convention specified in the separate GP1/GB1 sensor probe Installation Guide. Proper installation simplifies sensor location decoding during data analysis.

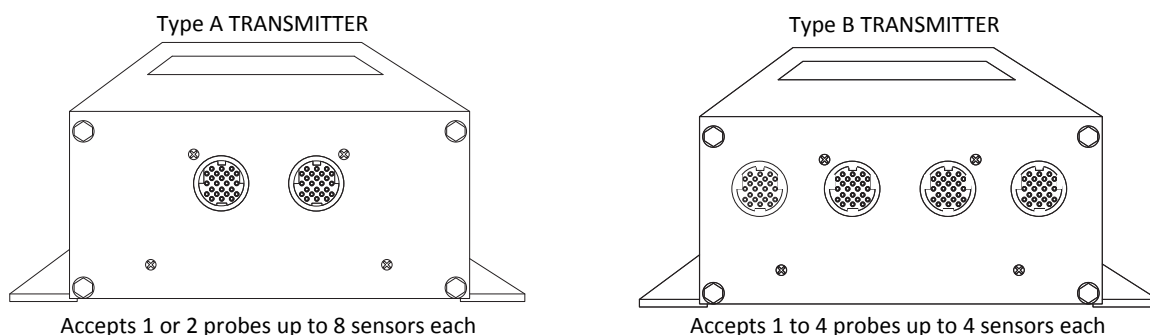
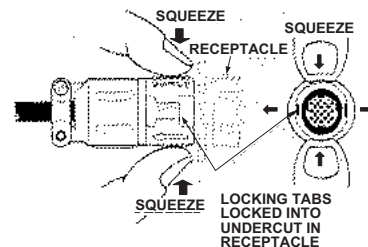
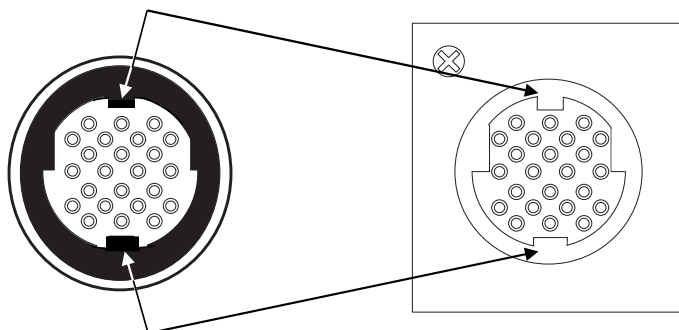


Figure 4. Type A and Type B Transmitter Connector Panel Detail



Squeeze and then pull to remove
DO NOT TWIST!

Figure 5. Connector Detail

4 GTC116 ANALOG OUTPUT AND NETWORK CONNECTIONS

This section contains analog and network output wiring instructions for the GTC116 transmitter with RS-485 and Dual Analog outputs.

4.1 GTC116 - ANALOG OUTPUT WIRING

Analog output connections are made at the top left of the transmitter main circuit board OUTPUT connector as shown in Figure 6. Independent linear analog outputs are provided for airflow at OUTPUT terminal 1, and for temperature (or alarm) at OUTPUT terminal 2, each with over voltage and over current protection. Airflow and temperature outputs are field selectable for either 0-5/0-10VDC or 4-20 mA. The OUTPUT terminal 2 can be assigned as an Alarm output to provide an active high, active low or trouble alarm output. Outputs are galvanically isolated from the main power supply to permit simple integration with virtually all building automation systems.



When configured for 4-20mA output, the GTC116 is a "4-wire" device. The host controls shall not provide any excitation voltage to the output of the GTC116.

For the analog outputs, shielded cable is recommended. To wire the analog outputs, slide the cover plate up and off of the enclosure. Ensure that the power switch is in the "OFF" position. Connect signal wires for airflow rate and temperature (or alarm) to the small, three position output terminal labeled "OUTPUT" on the upper left hand side of the main circuit board as shown in Figure 6.

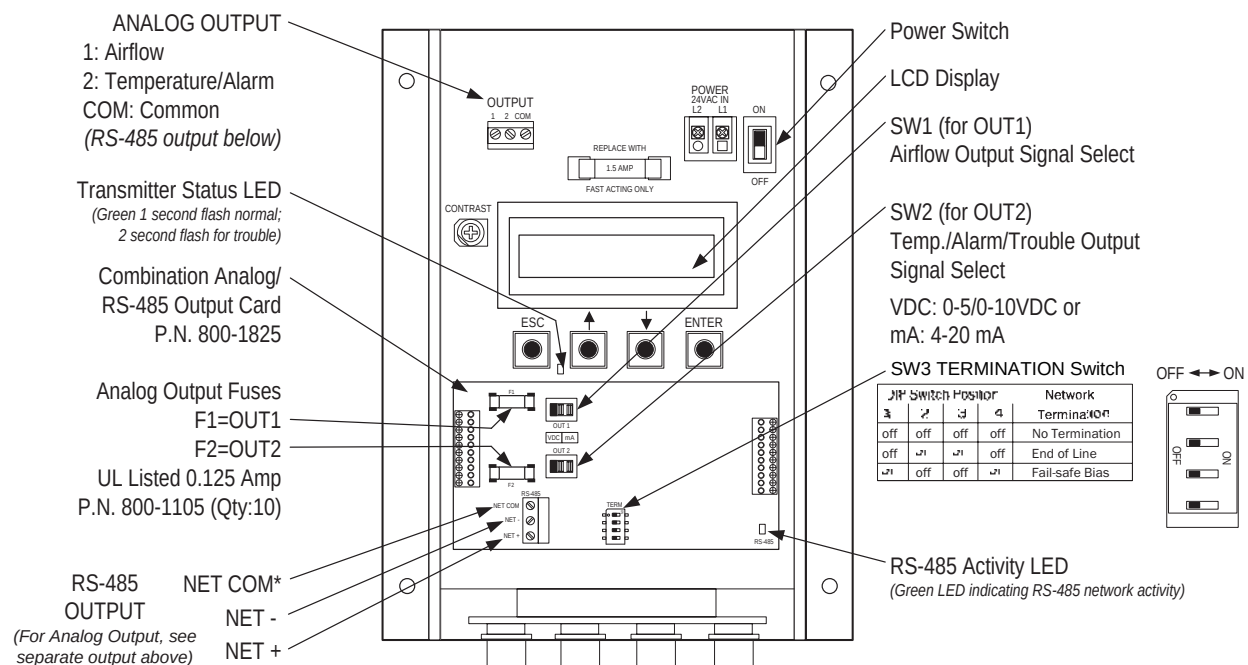


Figure 6. GTC116 Combination Analog/RS-485 Transmitter Interior Detail

4.2 GTC116 - RS-485 NETWORK WIRING CONNECTIONS

4.2.1 GTC116 - RS-485 Network Cable Specifications

The RS-485 network cable shall be shielded twisted pair with a characteristic impedance of 100 to 130 ohms. Distributed capacitance between conductors shall be less than 100 pF per meter. Distributed capacitance between conductors and shield shall be less than 200 pF per meter. The maximum recommended length of a network segment is 1200 meters with AWG 18 cable.

4.2.2 GTC116 - Connecting to an RS-485 Network:

Connect the NET+, NET- and COM terminals with shielded twisted pair cable meeting the specifications defined in the previous paragraph (typically using two pairs; one pair for +/- and (at least one of) the wires in other pair for COM when using 2-pair cable). The connection to the network must be made in a "daisy chain" configuration. "T" connections and stubs are NOT permitted. The shield should be terminated at one end on the network only.

***CAUTION**



For ISOLATED output, the COM connection MUST BE CONNECTED to the network common for proper operation. In addition, when the Analog Output is concurrently used with the RS-485 Output, the Common connection for both Analog and RS-485 Outputs must be at the same potential.



For NON-ISOLATED output, the COM connection MUST BE CONNECTED to the common ground that is used by the other network devices (typically the ground side of the 24VAC supply; terminal L2 at the POWER connector block in Figure 6). In addition, when the Analog Output is concurrently used with the RS-485 Output, the Common connection for both Analog and RS-485 Outputs must be at the same potential.

4.2.3 GTC116 - Setting Transmitter Termination for RS-485 Network

The GTC116 is shipped with the Termination switch set for No termination, which is the recommended setting for devices installed on the network bus anywhere EXCEPT at the ends of the bus/segment. EBTRON recommends the following termination strategy for devices connected at the ends of the network bus/segment:

When the transmitter is at one end of the network, it should be terminated with "End of Line" (or 120 ohm standard) termination, and the device at the other end should be terminated with "Fail Safe Bias" termination. This method provides proper network termination and ensures that the bus is in a known state during idle-line conditions (when no devices are driving the bus). EBTRON GTC116 transmitters include three termination options for "End of Line" (standard 120 ohm) and "Fail-safe Bias" (recommended at one end of the bus) or for "No Termination". Termination is selected by setting TERMINATION DIP switch SW3 as shown below.



Check the network/network segment to ensure that only one device is terminated with either method. If multiple devices are terminated as described above, network segment operation will be adversely affected.

4.3 GTC116 - Transmitter Setup for RS-485 Network Operation

For RS-485 operation, network connections are made on the GTC116 Combination board as shown in Figure 6, and set up is as follows. Network protocol, MS/TP address, device instance number and baud rate options are all selected with- in the NETWORK section of SETUP menu shown in Appendix A.

NOTE:

Prior to power up, network configuration and termination switches must be set as shown in Figure 6. Wiring to the RS-485 network is accomplished after setting the GTC116 network configuration switches.

4.3.1 GTC116 - RS-485 Network Options and Communications Menu Settings

The transmitter is shipped from the factory with the protocol set for BACnet MS/TP Master, address 2, MS/TP Device ID 2, Baud rate of 76,800 and no termination. Initial RS-485 communications settings are accomplished within the GTC116 NETWORK sub menu shown in Appendix A. Termination is set up by the TERM DIP switch SW3 located on the Combination card shown in Figure 6.

4.3.2 GTC116 - Setting RS-485 Network Protocol

Transmitter protocol can be set for MS/TP or MODBUS as shown in the NETWORK submenu (Appendix A).

Tables 2 and 3 list the specific features of each protocol.

4.3.3 GTC116 - Setting Transmitter Address

The GTC116 is factory set to an address of 2. Each transmitter must be assigned a unique address between 0 and 127 for BACnet or 1 and 247 for Modbus prior to connecting it to the network. Set the address in the NETWORK submenu (Appendix A).

4.3.4 GTC116 - Setting Baud Rate

The GTC116 transmitter default baud rate for MS/TP is 76,800 and for MODBUS is 19,200. Baud rate can be configured in the NETWORK sub menu (Appendix A).

4.3.5 GTC116 - Setting Modbus Parity

When using Modbus communications protocol, Parity can be changed in the NETWORK submenu. Parity can be set for Even (default), Odd, None 1 (with 1 stop bit), or None 2 (with 2 stop bits).

4.3.6 GTC116 - Setting BACnet Device Instance Number

When using BACnet communications protocol, the factory default Device Instance Number is 2. Device Instance Number can be set as shown in the NETWORK submenu. Device Instance Number can also be changed to any number between 0 and 4,194,302 by writing to the Device Object's Object Identifier Property over the network.

4.3.7 GTC116 - Resetting Communications Options to Factory Default Values

Communications options can be reset to factory default values (asterisk * values using the GTC116 RESET NET menu option.

Table 2. GTC116 BACnet Objects List

Analog Inputs			
Type, ID	Name	Default Units	
Device	GTC116		
AI, 1	Average Flow	CFM	
AI, 2	Average Temperature	°F	
AI, 3	Alarm Status		0: No alarm, 1: High Alarm, 2: Low Alarm, 3: Both



BACnet MS/TP

Analog Values			
AV, 1	Area	sq.ft.	
AV, 2	Traverse Data Status		0=None, 1=Flow, 2=Temp, 3=Both
AV, 3	Flow Traverse	FPM	
↑	↑	↑	
AV, 18	Flow Traverse	FPM	
AV, 19	Temperature Traverse	°F	
↑	↑	↑	
AV, 34	Temperature Traverse	°F	
Notes: 1. Flow and Temp traverse must be enabled through AV2. 2. User Executed Services Supported: Subscribe COV, Read Property, Write Property, Device Communication Control, Who-Is.			

Table 3. GTC116 Modbus Register Map

Function	Address	Type	Units	Description	Range/Value
2	10001	boolean		Trouble Status	0:OK, 1:Trbl
4	30001-30002	float	FPM	Average Airflow	0 to 15,000
4	30003-30004	float	°F	Average Temperature	-20 to 160
4	30005	word		Number of Inserts	0 to 16
4	30006	word			0
4	30007	word		Alarm Status	0: No alarm 1: High Alarm 2: Low Alarm 3: Both
4	30008	word		Connector C1 Sensors	0 to 8
4	30009	word		Connector C2 Sensors	0 to 8
4	30010	word		Connector C3 Sensors	0 to 8
4	30011	word		Connector C4 Sensors	0 to 8
4	30012-30043	float	FPM	Airflow Flow Traverse	0 to 15,000
	30012-30013			Insert 1 Flow	
	↕			↕	
	30042-30043			Insert 16 Flow	
4	30044-30075	float	°F	Temperature Traverse	-20 to 160
	30044-30045			Insert 1 Temp	
	↕			↕	
	30074-30075			Insert 16 Temp	
4	30076-30077	float	Sq.Ft.	Area	0 to 100
4	300202	word		Float word order	0: high word first; 1: low word first

5 GTC116 TRANSMITTER START-UP, INITIALIZATION AND SETUP MENUS

To ensure a successful start-up, verify that the airflow measuring station sensor probes and transmitter are installed in accordance with *EBTRON* guidelines.



Check the physical installation, power connections and model specific signal wiring prior to turning the power switch to the “ON” position.

Move the power switch to the “ON” position. The transmitter executes a complete self-check each time the power is turned on that takes 10 seconds to complete.

5.1 Changing the System of Units - IP or SI Units

The GTC116 transmitter is provided with the system of units set to IP. To change to SI units, simultaneously press and release the “ENT” and “ESC” buttons during normal operation. “IP/SI UNITS” will be indicated on the LCD display. Refer to Appendix A SYSTEM OF UNITS MENU for details on the System of Units menu. Note that Setup Menu items are shown in IP System Of Units. When SI System of Units is selected, the units of measure abbreviations used in the menus is shown in Table 4.

Table 4. Standard “IP” and “SI” Menu Units Abbreviations

“IP” System of Units	Description	“SI” System of Units	Description
FPM	Feet per minute	MPS	Meters per second
CFM	Cubic feet per minute	LPS	Liters per second
SQF	Square feet	SQM	Square meters
F	Fahrenheit	C	Celsius

5.2 GTC116 Transmitter Calibration

The GTC116 uses high quality industrial grade components and is designed for years of trouble-free operation. Periodic recalibration of the transmitter is neither required or recommended. Transmitter field calibration verifiers are available for purchase from *EBTRON* for installations requiring periodic validation of instrumentation. Contact *EBTRON* for more information.

5.3 GTC116 LCD Display Notifications

Following a brief initialization at power up, the LCD display automatically displays airflow and temperature with units of measurement in all upper case (caps) characters. The display provides additional information on system status and alarm conditions. Refer to the ALARM FEATURES section of this manual for additional detail on Alarm and Trouble Error code indications.

5.4 Factory Default Menu Settings for GP1 Sensor Probes

The GTC116 transmitter is “plug and play” and does not require setup unless a network option is selected that requires configuration. Table 5 shows the factory default settings for all compatible sensor probes.

To change the Factory Default Settings, see: CHANGING FACTORY DEFAULT SETUP MENU SETTINGS.

Table 5. Factory Default Menu Settings

Display	Description	I-P	S.I.
AIRFLOW=	Airflow measurement method, Actual or Standard.	ACT	ACT
*LCDU/M=	Airflow units of measure	ACFM	LPS
*AREA=	Free area where station is located (required for volumetric measurement)	0.00 sq.ft. (see note)	0.000 sq.meters (see note)
*AO1 SGNL=	Output 1 signal type voltage or mA (airflow)	mA	mA
*AO1 UM=	Output 1 units of measure	AFPM	MPS
*AO1 FS=	Output 1 signal full scale	5,000 FPM	25 MPS
*LLIMIT=	Low limit cutoff	0 AFPM	0 MPS
*FLOW ADJ=	Output 1 Offset-Gain On/Off	Off	Off
*GAIN=	Output 1 Gain factor	1.000	1.000
*OFF=	Output 1 Offset factor	0.000	0.000
*TEMP METH=	Temperature Averaging	Weighted Avg.	Weighted Avg.
*AO2 SGNL=	Output 2 signal voltage or mA (temperature or alarm)	mA (see alarms)	mA (see alarms)
*AO2 MS=	Output 2 signal minimum scale	-20° F	-30° C
*AO2 FS=	Output 2 signal full scale	160° F	70° C
*LCD INTG=	Number of flow calculations to be averaged for LCD display.	100	100
*AO1 INTG=	Number of flow calculations to be averaged for AO1 output.	30	30
*EB-LK INT=	Number of flow calculations to be averaged for EB-Link readings.	300	300
*ALT=	Altitude for flow correction relative to mean sea level (0 ft).	0 ft	0 m
*AO2 ASGN =	*AO2 ASGN = TEMP Output 2 Assigned Type is Temperature	TEMP	TEMP
*SETPNT=	Alarm setpoint value. For AO2 ASGN=ALARM , operates in conjunction with TOL=value.	0	0
*TOL=	Alarm range tolerance value. For AO2 ASGN=ALARM , this setting establishes the alarm range relative to the SETPNT= value.	10%	10%
*NO FAULT=	Sets the AO2 normal (not alarm) output state relative to the full scale analog output selected. HI provides maximum full scale under normal conditions and minimum scale during alarm. LO provides minimum full scale under normal conditions and maximum scale during alarm.	HI	HI
*DELAY=	Time that the alarm condition must exist before alarm output is activated.	2 minutes	2 minutes
*ZERO OFF =	Set to YES to inhibit LO alarm condition when flow reading is below LLIMIT= setting. Set to NO to disable this feature.	NO	NO
*RESET =	Set to AUTO to have alarm self-clear when alarm condition no longer exists. Set to MANUAL to require manual reset of alarm.	AUTO	AUTO

Note: For GP1 probes, area is stored in one-wire, but can be changed.

5.5 GTC116 Changing Factory Default Setup Menu Settings

5.5.1 Setup Menu Options

The GTC116 Transmitter is setup and tested at the factory to be fully operational when sensor probes are connected and power is applied (set the power switch to the “ON” position). Factory settings can easily be changed using the SETUP MENU by simultaneously pressing and releasing the “UP” and “DOWN” buttons while the transmitter is in its normal operating mode. Appendix A details the SETUP menus. Navigate through the SETUP menus to make changes to the transmitter configuration. The settings take effect immediately. The following are common field modifications to the factory default settings.

5.5.2 Adjusting the Low Limit Cutoff Feature

The low limit cutoff feature (menu item LLIMIT=) forces the output signal for the airflow rate to zero whenever the calculated airflow rate falls below the specified Low Limit value.

5.5.3 Selecting Actual and Standard Output Measurement Type

The transmitter is set from the factory to provide actual airflow measurement units (displayed as “ACFM” and “AFPM”). In this mode, airflow measurements are calculated for actual inlet conditions. If using actual airflow, corrections for altitude are entered through the ALT= setting in the Setup menu. If desired, the output can be set to provide standard airflow measurement units (displayed as “SCFM” and “SFPM”) which provides measurements that are corrected to standard conditions.

5.5.4 Output Scaling

EBTRON’s Gold Series sensors are individually calibrated between 0 and the factory default full scale in wind tunnels traceable to the National Institute of Standards and Technology (NIST). Sensors are independent and produce “percent of reading” accuracy. Changing the full scale value does not change the accuracy of the device. Factory default analog output scaling can be changed within the SETUP menus.

5.5.5 Changing the LCD Display from Volumetric Flow CFM to Velocity FPM

The GTC116 transmitter is shipped from the factory to indicate volumetric flow. To display velocity in FPM, enter the SETUP menu and in the DISPLAY submenu, change the “*LCD UM=ACFM” to “*LCD UM=AFPM”. Changing the LCD display units will not affect the analog output signal.

5.5.6 Converting the Analog Output Signal from FPM to CFM

The GTC116 transmitter is shipped from the factory with analog output “OUTPUT 1” set to indicate velocity in AFPM. To automatically convert this analog velocity output to volumetric flow (ACFM), simply set the *AO1 UM from AFPM (default) to ACFM in the SETUP menu. If you wish to manually convert the velocity output to volumetric flow (ACFM), simply multiply the indicated output velocity (in FPM) by the free area of the air flow probe installation location. Refer also to Table 7 for a complete listing of conversions for each of the analog outputs of the GTC116. The AO1 full scale analog output (OUTPUT1) value is determined by the AO1 FS setting within the SETUP menu.

5.5.7 Locking the Configuration Settings

The GTC116 transmitter configuration settings can be locked at one of three security levels within the SECURITY submenu using the LOCK SEC= item.

When LOW security level is selected (LOCK SEC=LOW) the last 4 digits of the board serial number are automatically assigned as the lock code. To see board serial number, navigate to DIAGNOSTICS menu in SERIAL NUMBERS item.

When the MED security level is selected (LOCK SEC=MED) the user enters and confirms a security code. In the event that this code is lost/misplaced, EBTRON can provide a key that is unique to the transmitter to unlock it. Contact EBTRON customer service for this code.

When the HIGH security level is selected (LOCK SEC=HIGH) the user enters and confirms a security code. In the event that this code is lost/misplaced, the transmitter must be returned to the factory in order to unlock it.



When LOCK SEC=HIGH is selected, the user defined setting can only be changed after entering the user defined code. STORE THE LOCK CODE IN A SAFE LOCATION! For security reasons, the HIGH level lock code can only be reset by returning the transmitter to the factory.

5.6 GTC116 - Alarm Features

Analog output AO2 (OUT2) can be assigned to function as an alarm output. The AO2 alarm output can be assigned in the SETUP menu to operate as an average alarm (AO2 ASGN=ALRM) or as a trouble alarm (AO2 ASGN=TRBL) for monitoring the status of the transmitter and sensors. The AO2 ASGN= setting is located in the ANALOG OUT submenu of the SETUP menu. The transmitter LCD display will indicate the Alarm status for 2 seconds, and will cycle through any other alarms if multiple alarm events are active for 2 seconds each, and then display the current actual flow for 2 seconds. Detailed set up of the Alarm features is shown in the Setup menu.

5.6.1 Average Alarm (AO2 ASGN=ALRM)

AO2 output is assigned as an average airflow alarm output. Useful for applications where a low flow alarm or a high flow alarm for operation outside of a defined range (setpoint and tolerance) is required.

5.6.2 Trouble Alarm (AO2 ASGN=TRBL)

AO2 output is assigned as a transmitter trouble alarm indicating a fault within the transmitter or a sensor of the airflow measurement system. The transmitter LCD will indicate a trouble code and a brief description of the trouble. Contact EBTRON customer service for additional information or assistance with trouble codes.

5.6.3 No Fault (NO FAULT=HI)

When AO2 output is assigned as an alarm, this setting configures the normal output condition to be HI or LO relative to the full scale analog output level selected when no fault condition exists.

5.6.4 Alarm Indications

Table 6 details the alarm types, LCD indications and AO2 alarm output indication. User can select either or both of the two Average Alarms or the Trouble Alarm.

5.6.5 Low Alarm - "LO ALRM= ON"

The Low Alarm is activated when the average airflow falls to a defined level below the SETPNT= value. The defined level is equal to the SETPNT= value minus the calculated value of (TOL= value * SETPNT= value). Once active, the alarm can be cleared when the average airflow rises above the set point minus calculated tolerance value.

5.6.6 High Alarm - "HI ALRM= ON"

The High Alarm is activated when the average airflow rises above a defined level above the SETPNT= value. The defined level is equal to the SETPNT= value plus the calculated value of (TOL= value * SETPNT= value). Once active, the alarm can be cleared when the average airflow falls below the set point + calculated tolerance value.

5.6.7 Trouble Alarm - "AO2 ASGN=TRBL"

The Trouble alarm provides trouble codes useful for isolating setup issues or problems within the transmitter or sensors. The transmitter LCD will indicate TROUBLE! regardless of whether AO2 is assigned to TRBLE. The Diagnostic submenu can be engaged for the error code and a brief description of the trouble. Contact EBTRON customer service for information on troubleshooting using the Trouble error codes.

Table 6. GTC116 Alarm Types and Notifications

ALARM OUTPUT ASSIGNMENT TYPE	LOCAL LCD DISPLAY OF ALARM TYPE AND NOTIFICATION	ANALOG OUTPUT 2 ALARM INDICATION	NETWORK ALARM INDICATION
LOW ALARM (Average Alarm)	Display alternates between **LOW ALARM** (then any other alarms) and actual reading for 2 seconds each.	On alarm or trouble, OUT2 is active high (or active low) relative to the full scale maximum (or minimum) analog value as determined by the SETUP Menu "NO FAULT=" selection. Individual sensor velocities can be viewed using the Diagnostics submenu.	Alarm Status is available at BACnet Objects and Modbus Registers. Refer to BACnet Objects List and Modbus Register Map for additional detail.
HIGH ALARM (Average Alarm)	Display alternates between **HIGH ALARM** (then any other alarms) and actual reading for 2 seconds each.		
TROUBLE ! (Trouble Alarm)	Display indicates TROUBLE ! (Refer to DIAGNOSTIC menu to obtain a brief description of the error and any other alarms).		

5.7 GTC116 - Analog Output Type Selection and Setup

The analog output signal type at AO1 (OUT1, airflow) and AO2 (OUT2, temperature/alarm) can be set for mA or VDC output by setting switches SW1/SW2 (Figures 6 and 7) and by selecting the 4-20mA, 0-5 VDC or 0-10VDC ranges in the ANALOG OUT sub menu options *AO1 RNGE= / *AO2 RNGE= settings. The transmitter is shipped from the factory with SW1/SW2 and Setup menu options *AO1 RNGE= and *AO2 RNGE= set for 4-20mA.

5.7.1 GTC116 - Converting Analog Output Signal Values to Airflow and Temperature

Table 7 lists specific conversion equations for analog voltage or current output options.

Table 7. GTC116 Converting Analog Output Values to Airflow/Temperature

When OUTPUT 1 is Configured as Linear Airflow (FPM, MPS):			
TO CONVERT TO	ANALOG OUTPUT SCALING AND TYPE		
	0-10 VDC	0-5 VDC	4-20 mA
Airflow (FPM, MPS)	Output Voltage/10 x FS1	Output Voltage/5 x FS1	(Output Current-4)/16 x FS1
Airflow (CFM)	Area (SQF) x Output/10 x FS1	Area (SQF) x Output/5 x FS1	Area (SQF) x (Output - 4)/16 x FS1
Airflow (LPS)	Area (SQM) x Output/10 x FS1 x 1000	Area (SQM) x Output/5 x FS1 x 1000	Area (SQM) x (Output - 4)/16 x FS1 x 1000

When OUTPUT 1 is Configured as Volumetric Airflow (CFM, LPS):			
TO CONVERT TO	ANALOG OUTPUT SCALING AND TYPE		
	0-10 VDC	0-5 VDC	4-20 mA
Airflow (CFM, LPS)	Output Voltage/10 x FS1	Output Voltage/5 x FS1	(Output Current - 4)/16 x FS1

When OUTPUT 2 is Configured as Temperature (°F,°C):			
TO CONVERT TO	ANALOG OUTPUT SCALING AND TYPE		
	0-10 VDC	0-5 VDC	4-20 mA
Temp (°F,°C)	Output Voltage/10 x (FS2-MS2) +MS2	Output Voltage/5 x (FS2-MS2) +MS2	(Output Current - 4)/16 x (FS2-MS2) +MS2

NOTES:

FS1 is AO1 full scale analog output value from ANALOG OUT MENU.

FS2 is AO2 full scale analog output value from ANALOG OUT MENU.

MS2 is AO2 minimum scale analog output value from ANALOG OUT MENU.

5.7.2 GTC116 - AO1/AO2 OUTPUT TEST - Sending a Test Output Signal to the Host Control System

A test output signal between 0 and 100% of the full scale output (4-20 mA or 0-5VDC/0-10VDC) can be provided by the GTC116 transmitter to verify proper conversion of the output signals from the transmitter at the host control system. To set a fixed output signal for airflow and temperature, navigate to the OUTPUT TEST submenu in the TOOLS menu. OUT1 and OUT2 tests are independently accessed, and the output will maintain the % selected until the "ESC" button is pressed and normal operation resumes.

5.8 Viewing Sensor Data

5.8.1 Viewing Sensor Data on the Local LCD Display

Airflow and temperature of individual sensors can be displayed on the local LCD display by entering the Diagnostic Menu. Simultaneously depress the up ↑ and down ↓ arrows to enter the GTC116 SETUP menu, and then navigate to the Diagnostic submenu.

5.8.2 Viewing Sensor Data via BACnet, Modbus networks or via EB-Link Reader

Airflow and temperature of individual sensors can be read across BACnet or Modbus networks, or downloaded directly to an EB-Link Reader if the infra-red *EB-Link* option has been installed. Refer to the following Sensor Addressing and Probe Positioning paragraph for the suggested probe installation configuration. Tables 2 and 3 provide BACnet objects and register addressing information for individual sensor data.

5.8.3 Sensor Addressing and Probe Positioning

Sensors are automatically addressed after power is applied to the transmitter as follows:

The probe connected to the left most connector, C1, is defined as probe 1. The sensor opposite the cable end of the probe is defined as sensor 1 when viewing individual sensor data. Refer to Figure 7 below for additional detail.

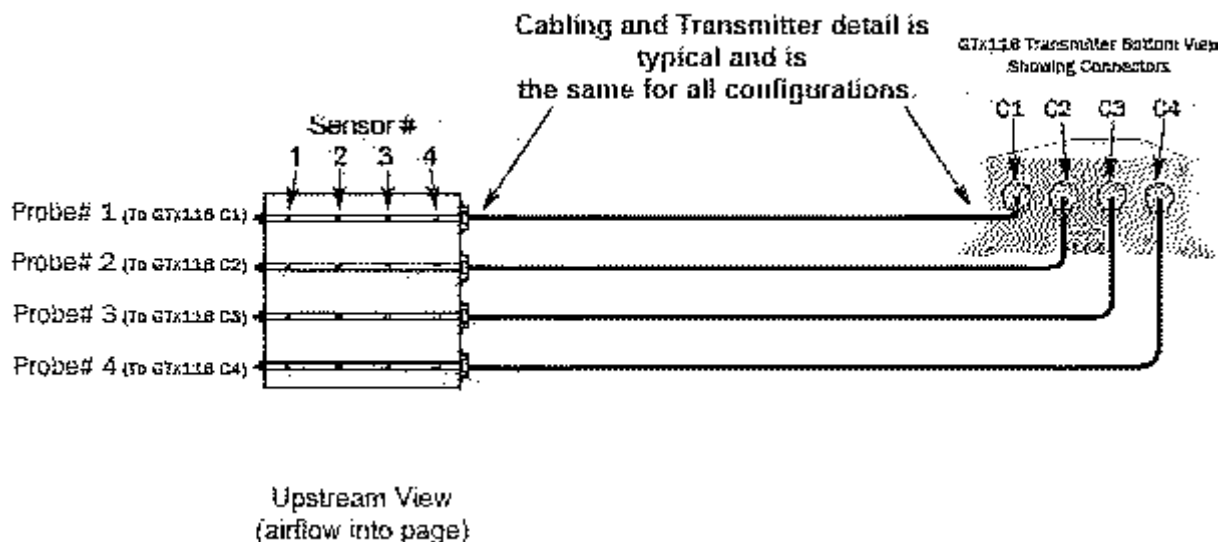


Figure 7. Sensor Addressing and Probe Positioning Detail

Note that if only average data is desired, the mounting position of the probes is not critical. When a probe is disconnected and then plugged in to a different port, the transmitter will re-discover it within 15 seconds and make any necessary addressing adjustments.

To standardize installation and decoding of data, particularly when using the EB-Link Reader product, *EBTRON* recommends a left to right (or top to bottom in vertical applications) sensor probe mounting convention as detailed in the separate sensor probe installation instructions.

6 SETUP MENUS

Appendix A details the various setup menus and submenus.

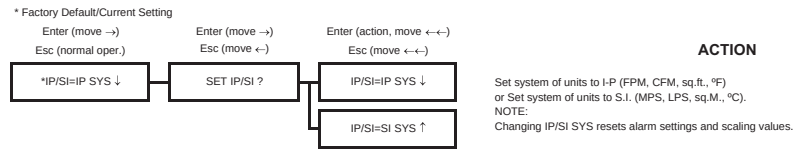
7 WIRING DIAGRAM

Appendix B is the wiring diagram for the GTC116 transmitter.

APPENDIX A - ADVANTAGE 3 - SETUP MENUS

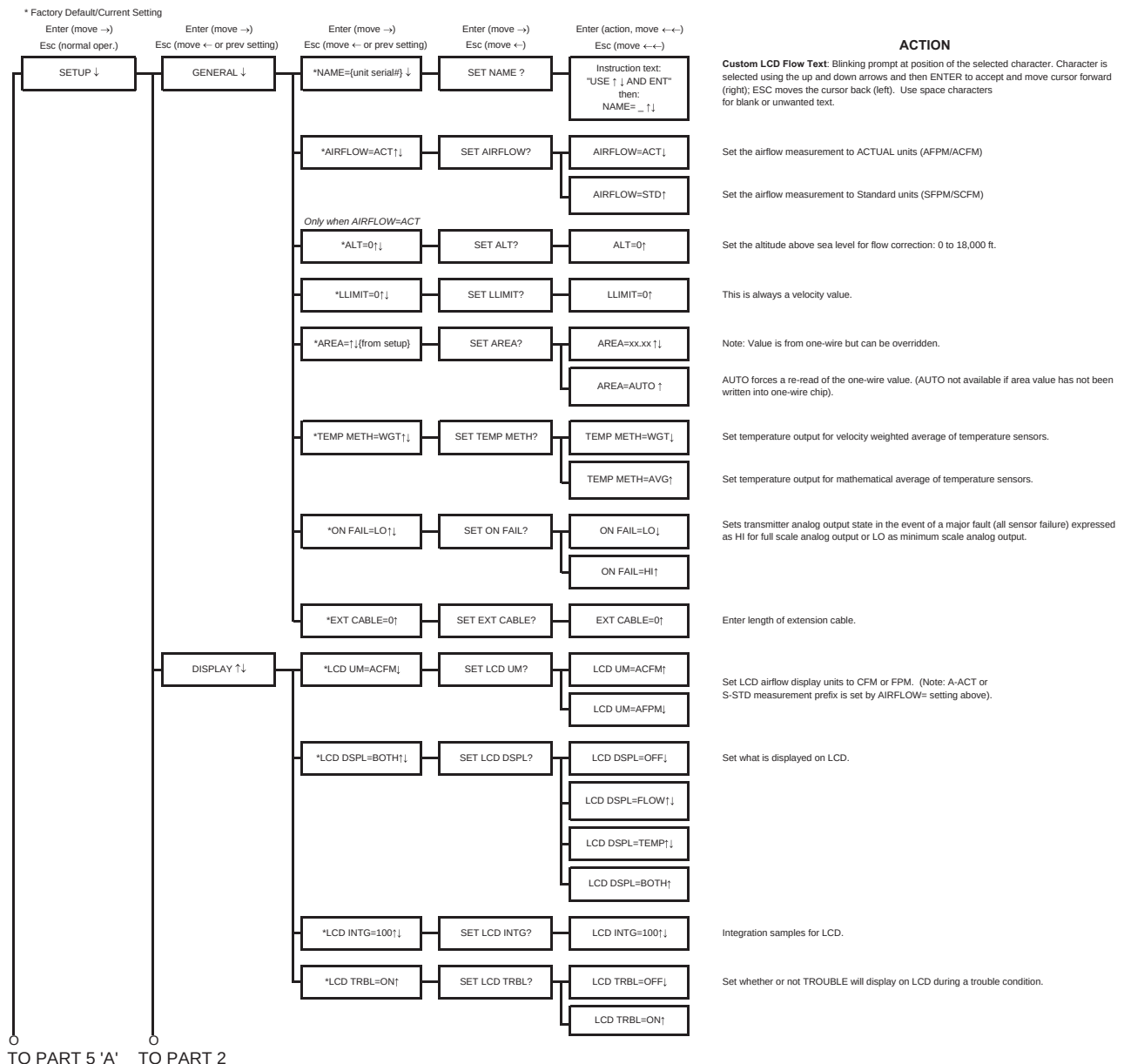
SYSTEM OF UNITS MENU

Simultaneously depress/release ENTER + ESC keys during normal operation to select



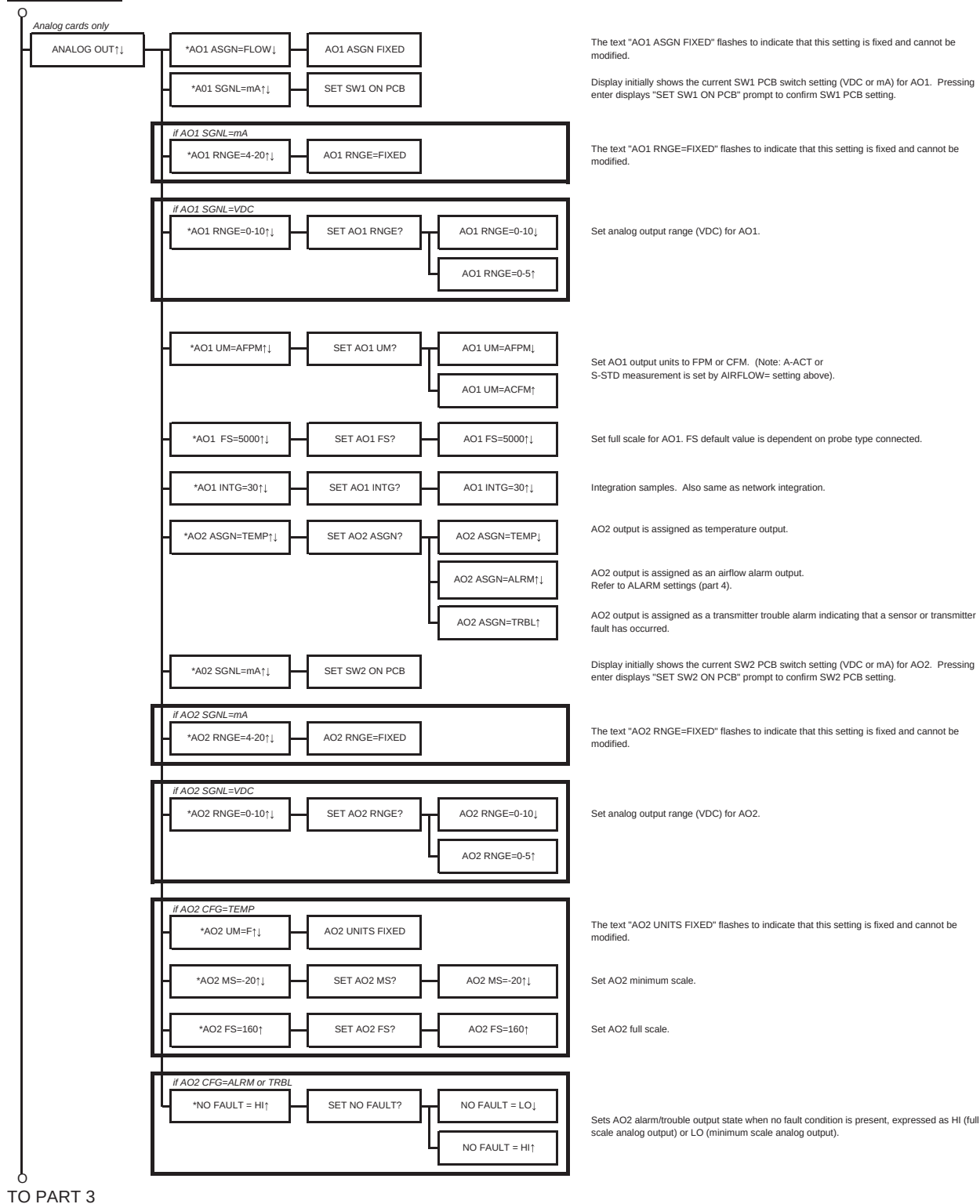
SETUP MENU

Simultaneously depress/release ↑ + ↓ keys during normal operation to select

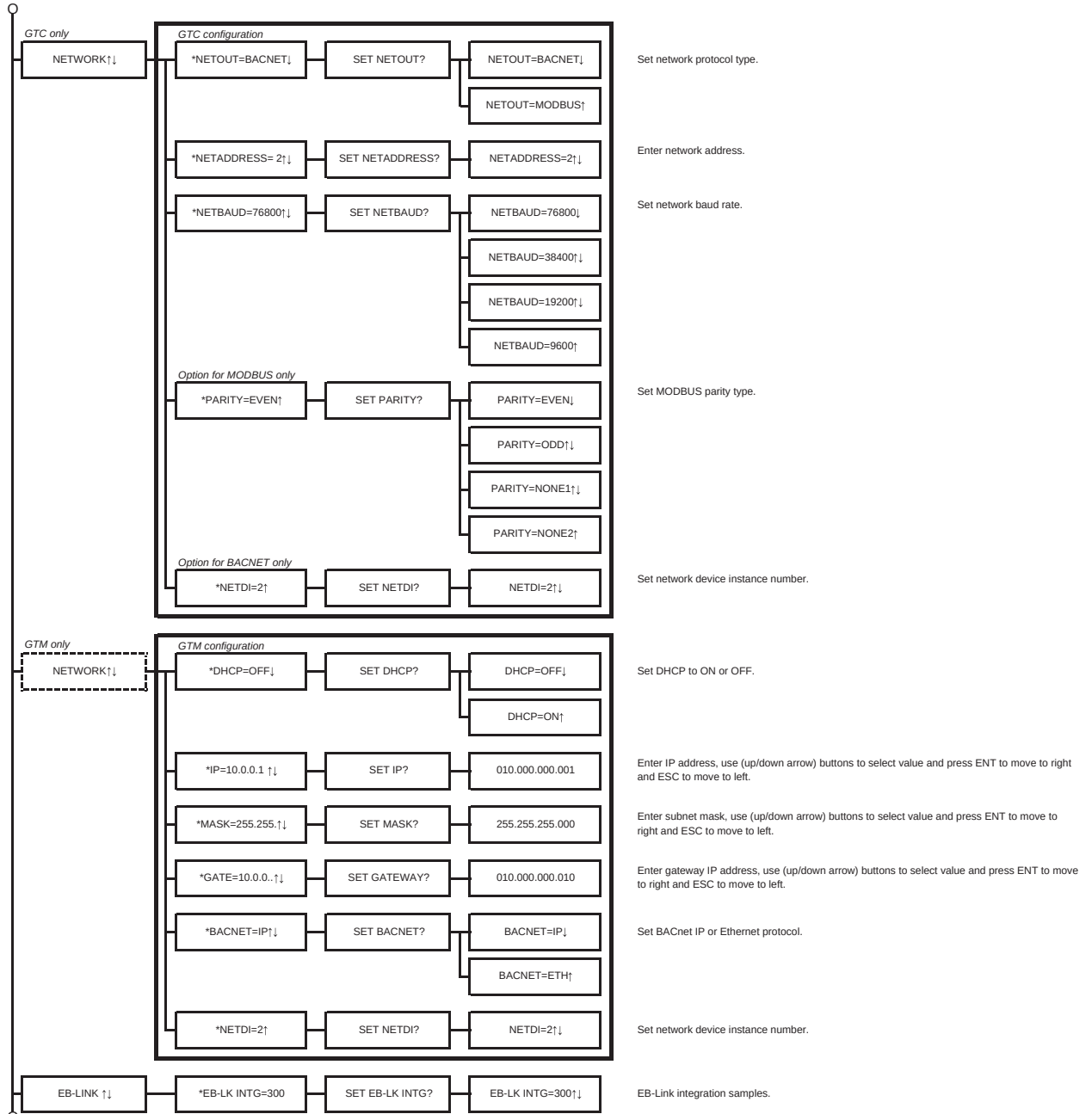


TO PART 5 'A' TO PART 2

FROM PART 1

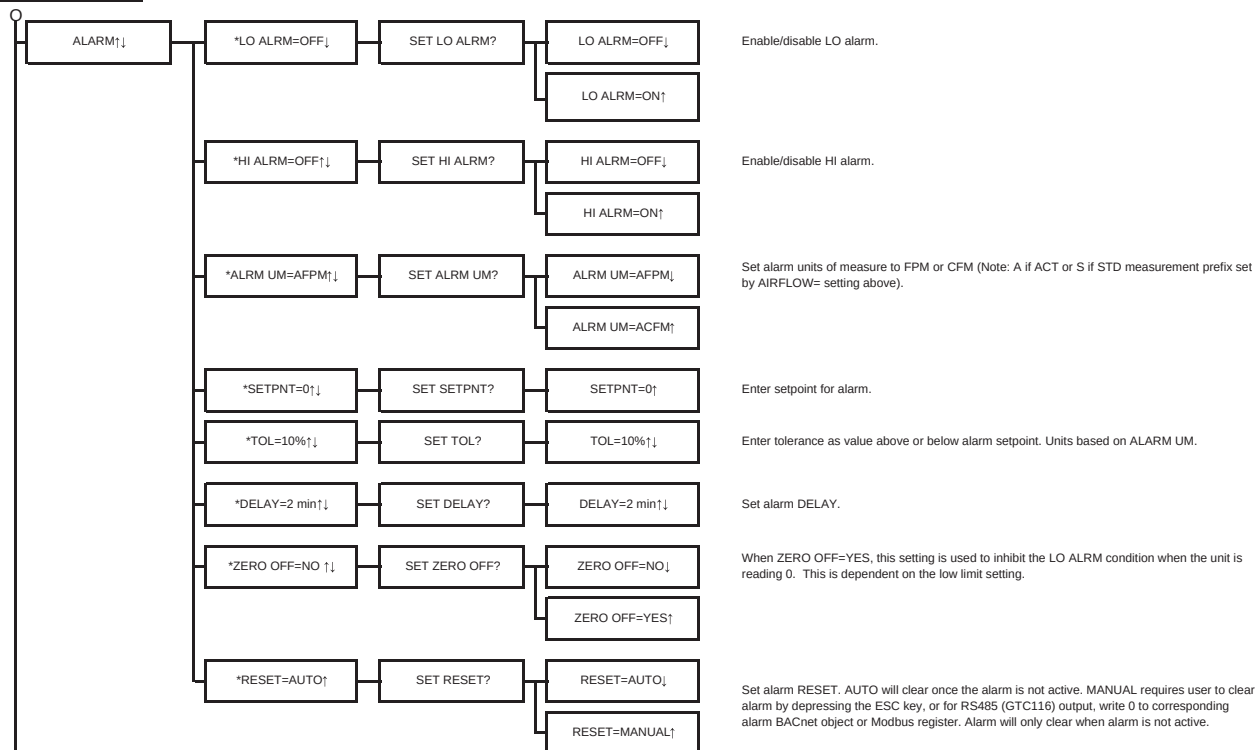


FROM PART 2



TO PART 4

FROM PART 3



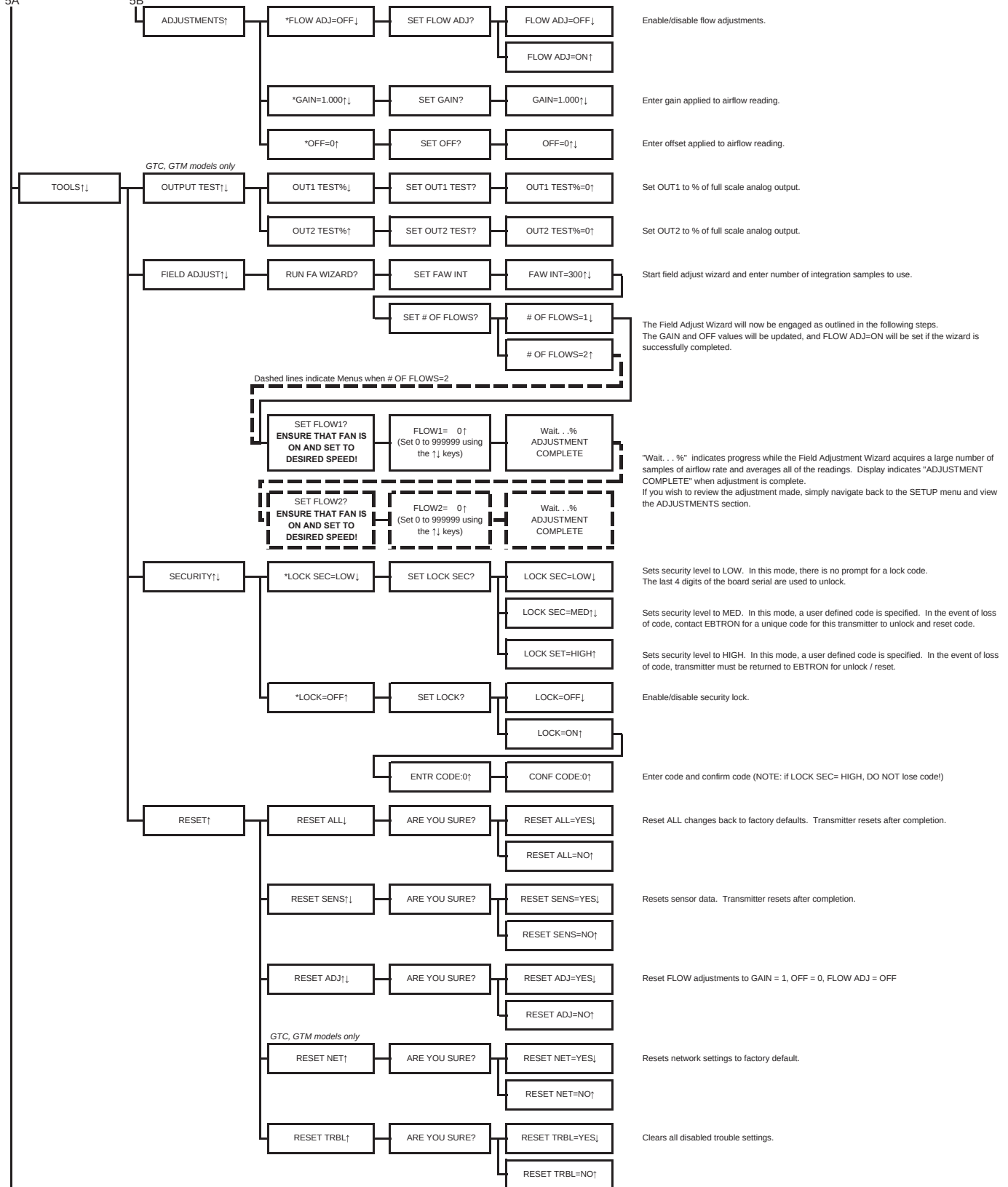
TO PART 5 'B'

FROM PART 1

5A

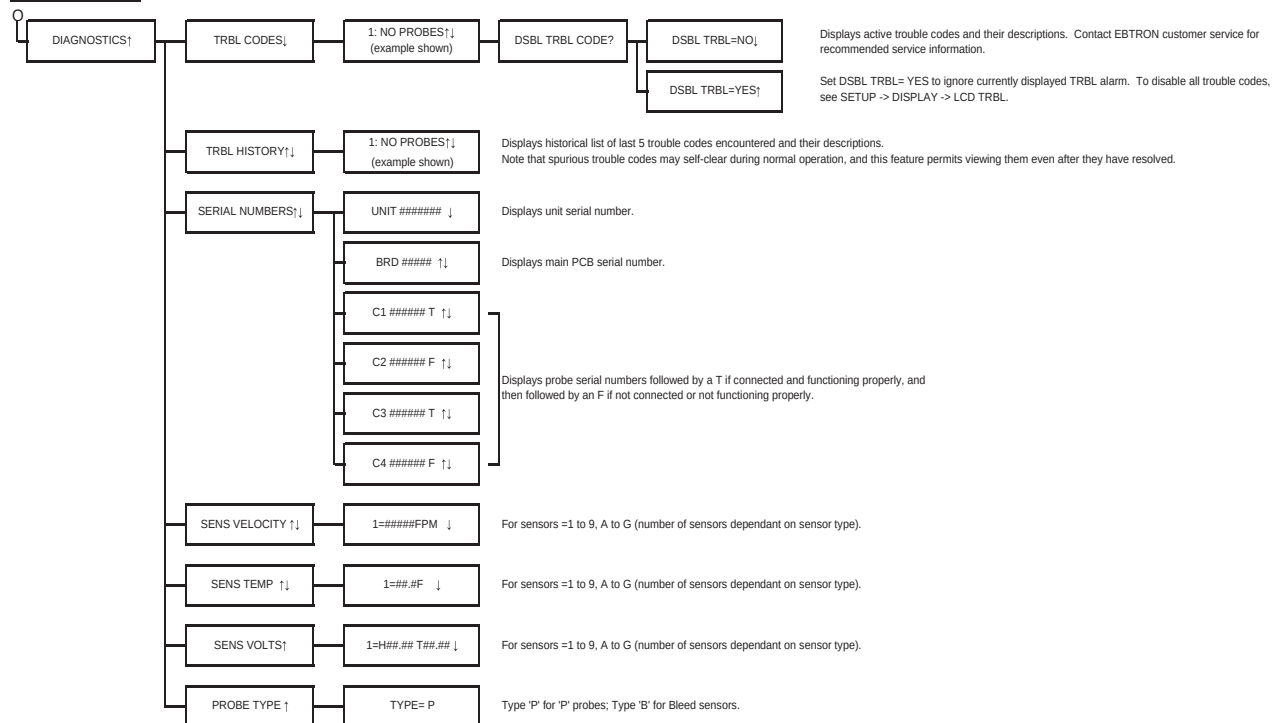
FROM PART 4

5B

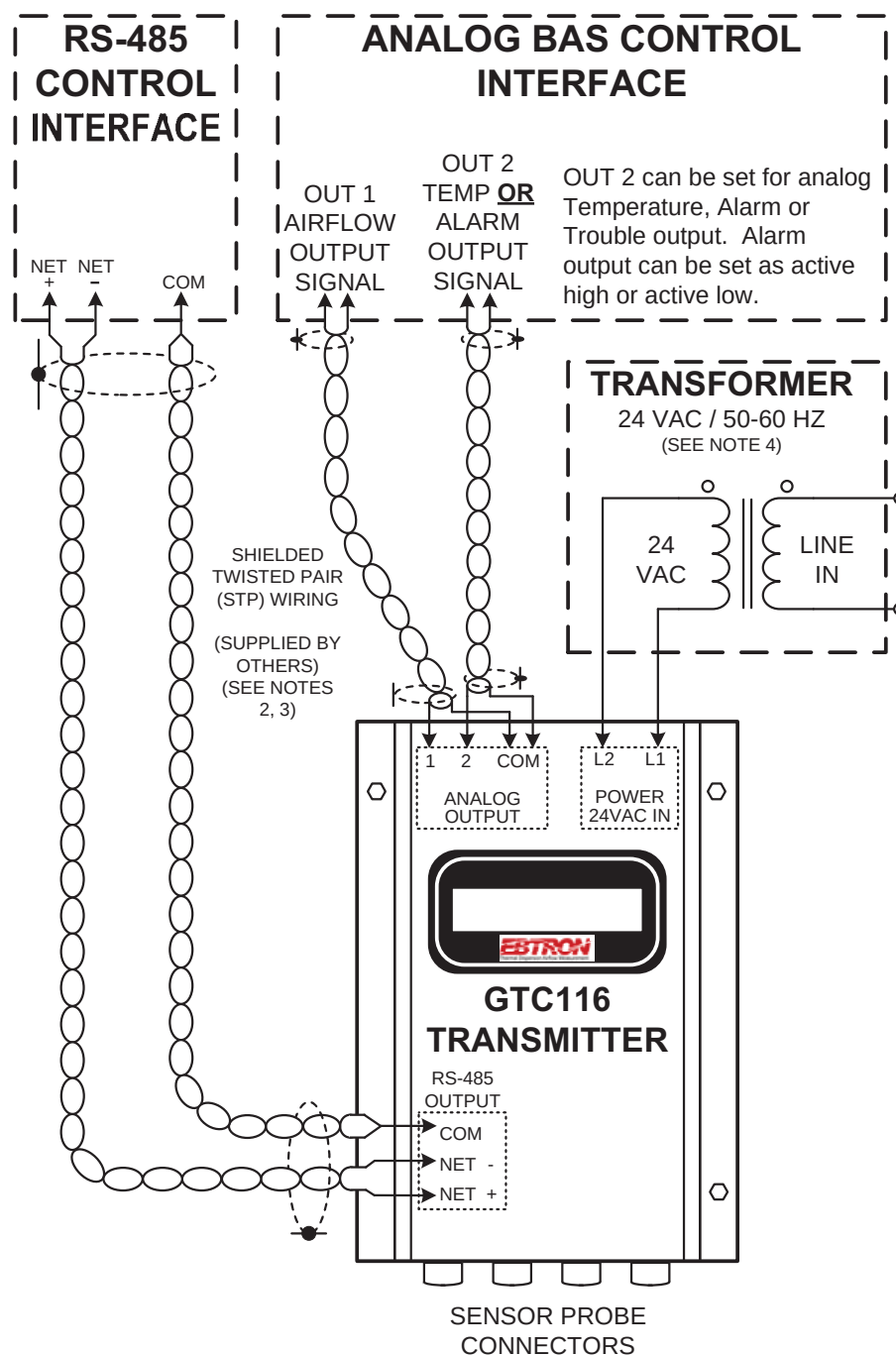


TO PART 6

FROM PART 5



APPENDIX B - GTC116 WIRING DIAGRAM



NOTES:

1. OUTPUT 2 CAN BE SET AS TEMPERATURE OR AS AN ALARM. ALARM CAN BE SET AS ACTIVE HIGH OR ACTIVE LOW.
2. CONNECT OUTPUT SIGNAL CABLE DRAINS TO EARTH GROUND AT ONE END OF EACH CABLE ONLY.
3. RS-485 COM CONNECTION MAY USE A SINGLE CONDUCTOR.
4. ON MULTIPLE TRANSMITTER INSTALLATIONS WITH A COMMON 24VAC SOURCE, WIRE 24 VAC POWER IN-PHASE TO THE SAME TERMINALS ON ALL TRANSMITTERS (e.g.: L1 to L1, L2 to L2).

Recommended Method for Cleaning EBTRON Sensor Elements

Sensor Cleaning Procedure

Use the tip of a dry, soft bristled brush to gently remove any accumulation on each sensor element. Do not apply excessive force that could break the glass sensor envelope. If cleaning with the soft brush tip does not remove the accumulation, or if a film residue remains on the glass sensor surface that is affecting performance, apply a small amount of clean acetone to the brush tip to gently remove the film residue. Clean the brush and if necessary, repeat this step to ensure complete removal of any film residue. Observe flow station output airflow measurements to confirm that indicated flow rate/volume has been restored. Recalibration of the flow station is NOT required. Use of other cleaning agents or solvents not compatible with probe and sensor materials is NOT recommended. Observe the following precautions when cleaning the sensors with acetone:

- Use protective eyewear, goggles or face shield, and latex gloves when handling acetone.
- Ensure good ventilation to prevent buildup of vapors.
- Use precautions necessary to prevent sparks and keep away from heat and flame.
- Keep container closed.

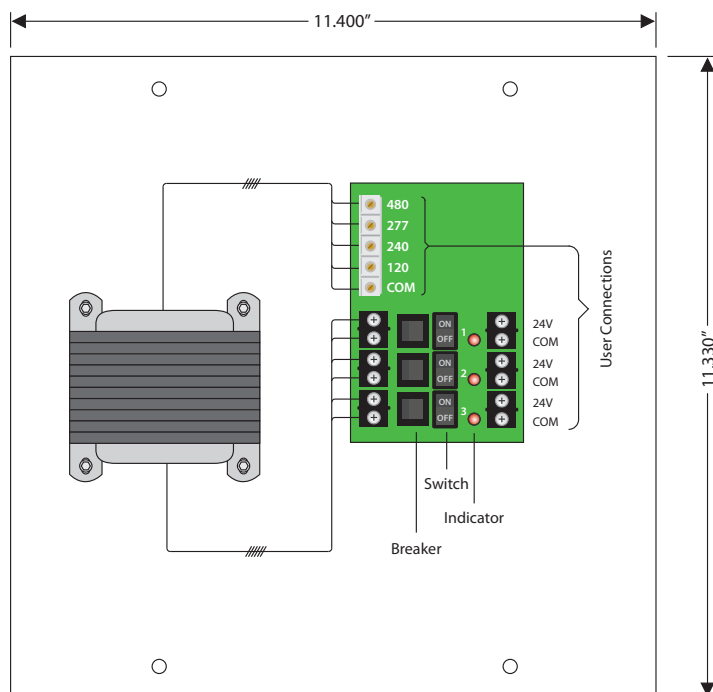
If this procedure does not result in the complete removal of all foreign material and/or film residue affecting performance, contact the EBTRON Customer Service team for additional assistance.

PSH300A

Enclosed 300VA Power Supply with Three 100VA Class 2 Outputs, 480/277/240/120 Vac to 24 Vac

PSMN300A

Open Style 300VA Power Supply with Three 100VA Class 2 Outputs, 480/277/240/120 Vac to 24 Vac



AC Power Supply

PSH300A
Shown
With
Cover



PSH300A
Shown
Without
Cover



PSMN300A



Specifications

Transformer: One (1) 300 VA
Over Current Protection: Circuit Breaker
Primary: 480/277/240/120 Vac
Frequency: 50/60 Hz
Dimensions: 12.125" x 12.125" x 6.000" (PSH300A)
 11.330" x 11.400" x 4.500" (PSMN300A)
Approvals: Class 2 (UL Approved UL5085-3),
 UL916, C-UL, CE, RoHS
Sub-Panel: Plenum Rated Polymetal
 Sub-Panel (PSMN300A)
Housing: NEMA1 Metal Enclosure (PSH300A)
Weight: 20.00 lbs. (PSH300A)
 11.00 lbs. (PSMN300A)

3 Secondaries:
 24 Vac, with LED Indicators

24 Vac ON/OFF:
 On / Off Switch & Breaker

Input:
 480/277/240/120 Vac **Finger-Safe Terminals**,
 8-18 AWG

Output:
 3 Isolated, Floating 100 VA Class 2 24 Vac Terminals,
 12-26 AWG

Ambient Temperature Derating:
 4A up to 40° C ; 3A up to 50° C ; 2A up to 55° C
 (When All 3 Outputs Operated Simultaneously)

Notes:
 • Open style is mounted to sub-panel SP3303 for
 shipping and may be remounted to suit application.

Standby Wattage:
 16.61 W @ 120 Vac
 17.70 W @ 240 Vac
 16.26 W @ 277 Vac
 19.20 W @ 480 Vac

Full Load Primary Current:
 2.66 A @ 120 Vac
 1.36 A @ 240 Vac
 1.18 A @ 277 Vac
 0.68 A @ 480 Vac

Secondary Output Voltage vs. Load:
 24.5 V @ 1 Amp
 23.5 V @ 2 Amp
 22.8 V @ 3 Amp
 22.3 V @ 4 Amp

• With 120 Vac primary input voltage
 • When all 3 outputs operated
 simultaneously, at room
 temperature

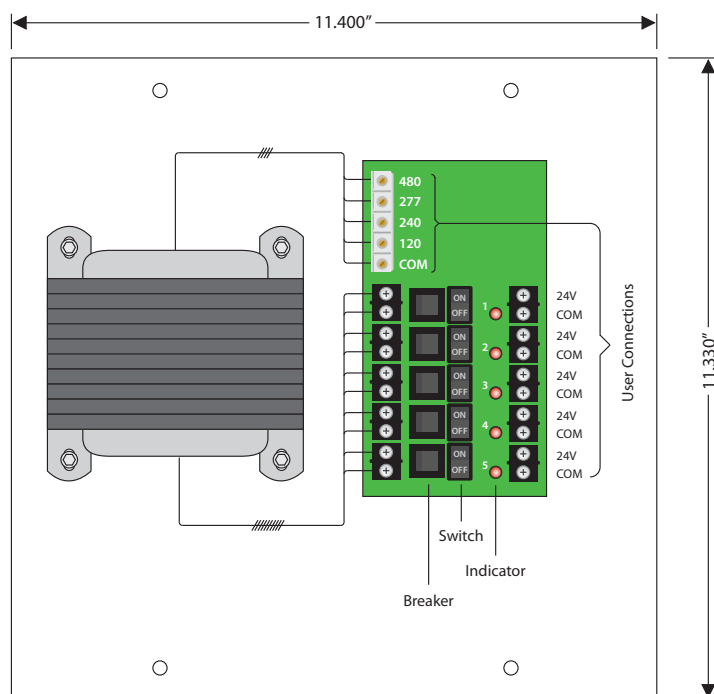
• **Great for VAV Applications**

PSH500A

Enclosed 500VA Power Supply with Five 100VA
Class 2 Outputs, 480/277/240/120 Vac to 24 Vac

PSMN500A

Open Style 500VA Power Supply with Five 100VA
Class 2 Outputs, 480/277/240/120 Vac to 24 Vac



AC Power Supply

PSH500A
Shown
With
Cover



PSH500A
Shown
Without
Cover



PSMN500A



Specifications

Transformer: One (1) 500 VA
Over Current Protection: Circuit Breaker
Primary: 480/277/240/120 Vac
Frequency: 50/60 Hz
Dimensions: 12.125" x 12.125" x 6.000" (PSH500A)
11.330" x 11.400" x 5.000" (PSMN500A)
Approvals: Class 2 (UL Approved UL5085-3),
UL916, C-UL, CE, RoHS
Sub-Panel: Plenum Rated Polymetal
Sub-Panel (PSMN500A)
Housing: NEMA1 Metal Enclosure (PSH500A)
Weight: 30.16 lbs. (PSH500A)
20.60 lbs. (PSMN500A)

5 Secondaries:
24 Vac, with LED Indicators

24 Vac ON/OFF:
On / Off Switch & Breaker

Input:
480/277/240/120 Vac **Finger-Safe Terminals**, 8-18 AWG

Output:
5 Isolated, Floating 100 VA Class 2 24 Vac Terminals,
12-26 AWG

Ambient Temperature Derating:
4A up to 40° C ; 3A up to 50° C ; 2A up to 55° C
(When All 5 Outputs Operated Simultaneously)

Notes:
• Open style is mounted to sub-panel SP3303 for
shipping and may be remounted to suit application.

Standby Wattage:
48.515 W @ 120 Vac
48.699 W @ 240 Vac
49.564 W @ 277 Vac
48.255 W @ 480 Vac

Full Load Primary Current:
4.66 A @ 120 Vac
2.41 A @ 240 Vac
2.06 A @ 277 Vac
1.17 A @ 480 Vac

Secondary Output Voltage vs. Load:
24.0 V @ 1 Amp
23.0 V @ 2 Amp
21.8 V @ 3 Amp
21.1 V @ 4 Amp

• With 240 Vac primary input voltage
• When all 5 outputs operated
simultaneously, at room
temperature

• **Great for VAV Applications**

PSB100AB10

AC POWER SUPPLY

Panel Mount 100 VA Power Supply, 120 to 24 Vac

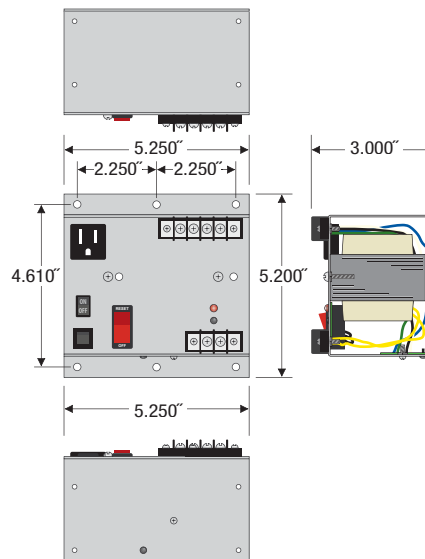
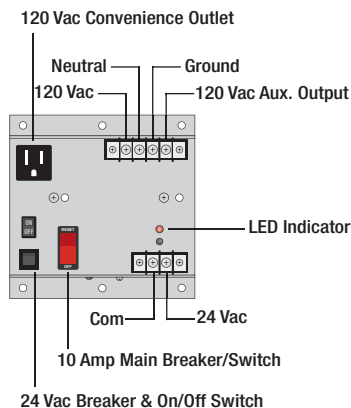


Now Available
with Terminal
Cover as Model
PSB100AB10-TC



SPECIFICATIONS

Transformer: One 100 VA Split-Bobbin
Primary: 120 Vac
Secondary: 24 Vac, w/ LED Indicator
Frequency: 50/60 Hz
Over Current Protection: Circuit Breaker
24 Vac ON/OFF: On / Off Switch & Breaker
Main Breaker ON/OFF: Switch / Breaker (10 Amp)
(Kills power to entire unit: Outlet, Aux.
Output, and Transformer)*
Total Combined Output 9A
Mounting: Panel mount
Approvals: Class II UL Listed, UL916, C-UL, CE
Dimensions: 5.200" x 5.250" x 3.000"
Weight: 3.58 lbs.



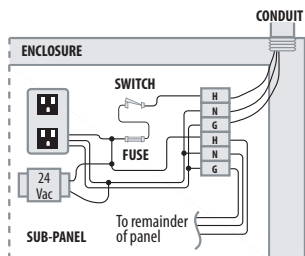
NOTES

CONDENSE WORK SPACE AND WIRING (POWER SUPPLIES)

The PSC, PSH, and PSB Series Power Supplies allow you to save large amounts of time, space, and wiring throughout your panel.

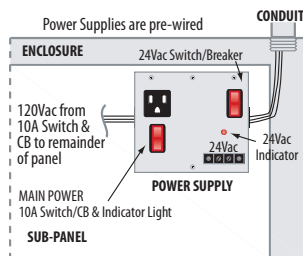
BEFORE

There is a lot of extra wiring in this enclosure which not only takes up space but also increases the difficulty and time associated with installation.



AFTER

By using one of Functional Devices' Power Supplies you will greatly reduce installation time, as well as save space in your enclosure.



POWER SUPPLIES

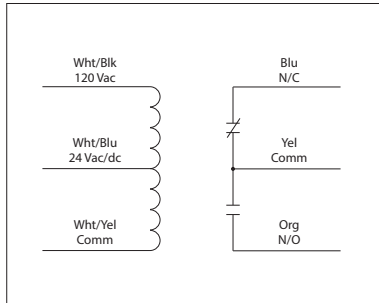
Any "B10" models in the PSC, PSH, or PSB Power Supply Series



20 AMP POWER CONTROL RELAYS

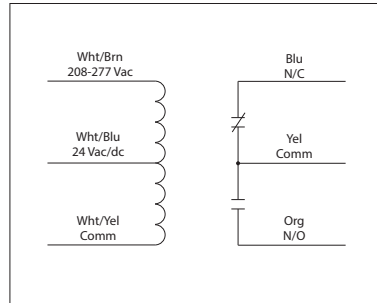
RIB2401B

Enclosed Relay 20 Amp SPDT with
24 Vac/dc/**120 Vac Coil**



RIB2402B

Enclosed Relay 20 Amp SPDT with
24 Vac/dc/**208-277 Vac Coil**



Made in USA
Meets
"Buy American"
of ARRA 2009

RELAYS

SPECIFICATIONS

Relays & Contact Type: One (1) SPDT Continuous Duty Coil
Expected Relay Life: 10 million cycles minimum mechanical
Operating Temperature: -30 to 140° F
Humidity Range: 5 to 95% (noncondensing)
Operate Time: 18ms
Relay Status: LED On = Activated
Dimensions: 2.30" x 3.20" x 1.80" with .50" NPT Nipple
Wires: 16", 600V Rated
Approvals: UL Listed, UL916, UL864, C-UL
 California State Fire Marshal, CE, RoHS
Housing Rating: UL Accepted for Use in Plenum, NEMA 1
Gold Flash: No
Override Switch: No

Contact Ratings:
 20 Amp Resistive @ 277 Vac
 5 Amp Resistive @ 480 Vac
 20 Amp Ballast @ 277 Vac
 16 Amp Electronic Ballast @ 277 Vac (N/O)
 10 Amp Tungsten @ 120 Vac (N/O)
 770 VA Pilot Duty @ 120 Vac
 1,110 VA Pilot Duty @ 277 Vac
 2 HP @ 277 Vac
 1 HP @ 120 Vac

Coil Current:
 50 mA @ 18 Vac 33 mA @ 22 Vdc
 83 mA @ 24 Vac 35 mA @ 24 Vdc
 47 mA @ 120 Vac (RIB2401B) 47 mA @ 30 Vdc
 69 mA @ 208-277 Vac (RIB2402B)

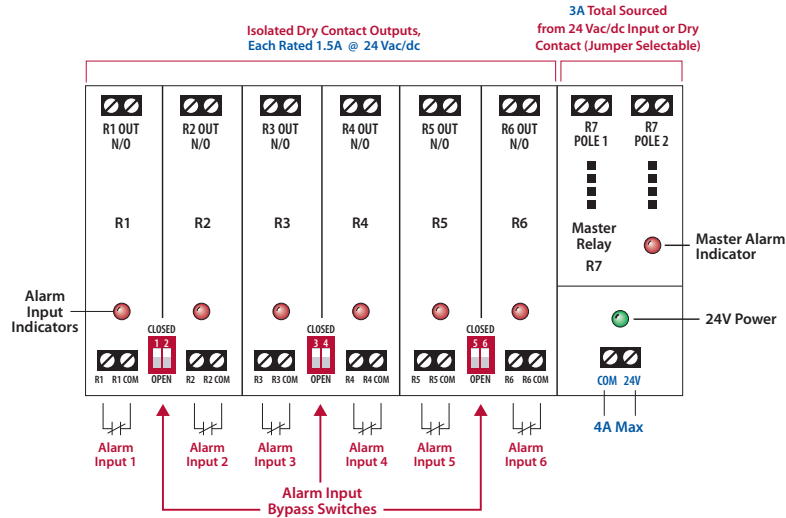
Coil Voltage Input:
 24 Vac/dc ; 120 Vac ; 50-60 Hz (RIB2401B)
 24 Vac/dc ; 208-277 Vac ; 50-60 Hz (RIB2402B)
 Drop Out = 2.1 Vac / 3.8 Vdc
 Pull In = 18 Vac / 22 Vdc



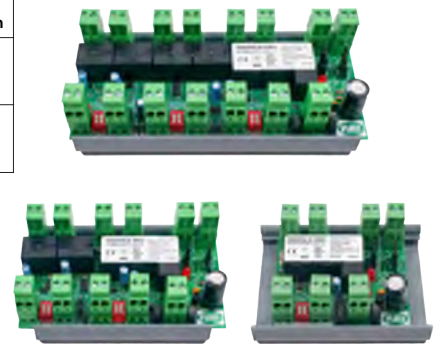
FAN SAFETY ALARM CIRCUITS

RIBMNLB-6NO/-4NO/-2NO

2.75" Track Mount AHU Fan Safety Alarm and General Purpose Logic Circuit, 24 Vac Power Input, 2/4/6 Alarm Inputs all with N/O Outputs



Meets "Buy American" of ARRA 2009



RELAYS

SPECIFICATIONS

- Expected Relay Life:** 10 million cycles minimum mechanical
- Operating Temperature:** -30 to 140° F
- Humidity Range:** 5 to 95% (noncondensing)
- Operate Time:** 8ms
- Power Input:** 4 Amp max. @ 24 Vac/dc ; 50-60 Hz
- Alarm Status:** LED On = Activated
- Dimensions:** 6.200" x 2.750" x 1.750" (RIBMNLB-6NO)
4.600" x 2.750" x 1.750" (RIBMNLB-4NO)
3.000" x 2.750" x 1.750" (RIBMNLB-2NO)
- Track Mount:** MT212-6 Mounting Track Provided (RIBMNLB-6NO)
MT212-4 Mounting Track Provided (RIBMNLB-4NO, RIBMNLB-2NO)
- Approvals:** UL Listed, UL916, UL864, C-UL, CE, RoHS
- Gold Flash:** No
- Override Switch:** No

Models RIBMNLB-6NO, RIBMNLB-4NO, and RIBMNLB-2NO are simply devices that combine a common relay-logic function into a small, easy-to-install, and less expensive form.

A master relay will open if any one of the normally-closed (N/C) inputs open. There are six, four, or two inputs depending on the model chosen. LED status of all inputs, the master relay, and power input is provided. Bypass of un-used inputs is also provided. The RIBMNLB series is provided with mounting track for mounting in user-provided electrical enclosures.

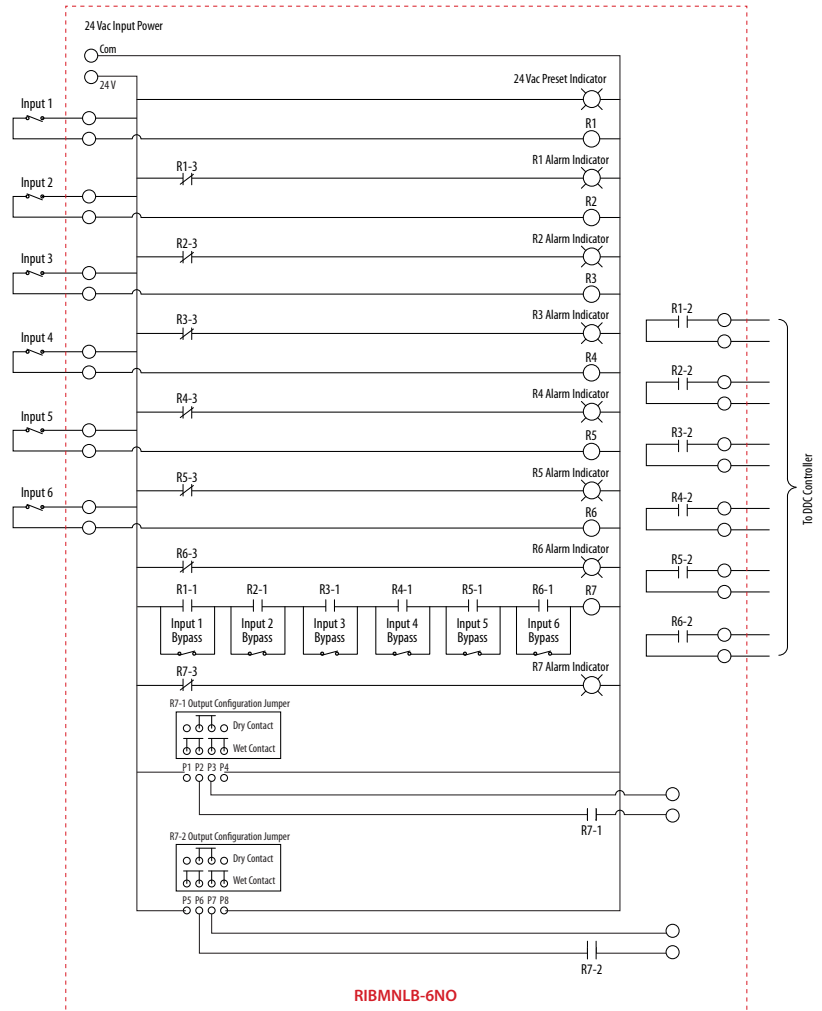
The master relay has two general-purpose outputs: both can be jumper selected at 24 V (sourced from input) or dry contact. The most common application is an Air Handling Unit (AHU) fan-safety-shutdown where the master relay is used to shutdown the fan. Contact closure outputs are provided so that a DDC controller can determine the cause of a shutdown.

Notes:

- RIBMNLB-6NO has six Alarm Inputs and one Master Alarm.
- RIBMNLB-4NO has four Alarm Inputs and one Master Alarm.
- RIBMNLB-2NO has two Alarm Inputs and one Master Alarm.
- This is a half wave device. When connecting 24 Vac to both this device and a full-wave device, damage to device can occur.

SELECTION GUIDE

Model#	Inputs	
RIBMNLB-6NO	6	MT212 Mounting Track
RIBMNLB-4NO	4	MT212 Mounting Track
RIBMNLB-2NO	2	MT212 Mounting Track



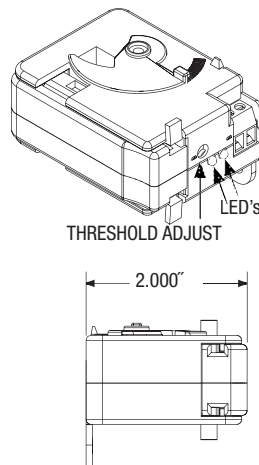
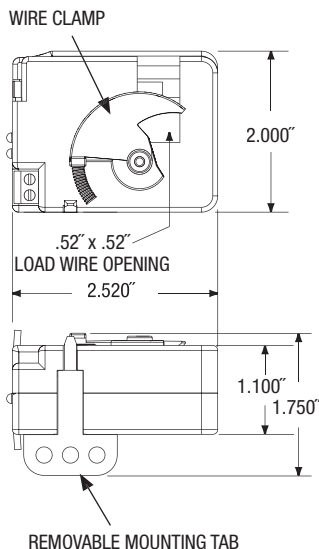
RIBXG SERIES

CURRENT SENSOR Enclosed Split Core Current Sensors



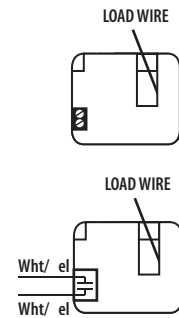
SPECIFICATIONS

Operating Temperature: -30 to 140° F
Max Sense Voltage: 600 Vac
Approvals: UL Listed, UL916, UL864, C-UL, CE, RoHS
Housing Rating: Plenum, NEMA 1
Mounting/Installation: Removable mounting tab provided. The wire clamp locks against the load wire, securing the unit in place.

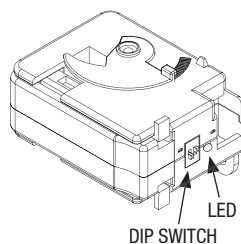
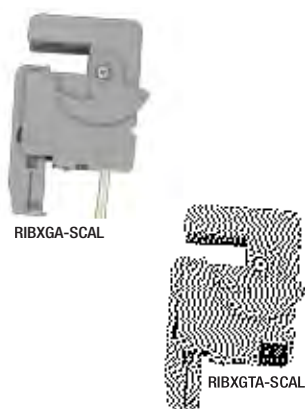


Solid State Contact
30 Vac/dc, .4 Amp Max.

When current sensor status is off (open), leakage <30 uA @ 30Vac/dc
When current sensor status is on (closed) voltage drop < .3 Vac/dc @ .1 Amp
< 1.6 Vac/dc @ .4 Amp



SELF-CALIBRATING CURRENT SENSOR (Models with -SCAL Suffix)



-SCAL LED Table

LED Off	No Current
Two Winks	Current Below Range
Three Winks	Current In Range
Four Winks	Current Above Range
Continuous Winks	Calibration in Progress

The SCAL unit begins the 30 second self-calibration process the first time current is applied in the operating range. The threshold is permanently set. Subsequent calibrations may be performed by moving SW1 to the position opposite of its current position with or without current applied (hands can be safely away from live voltage). Once current begins flowing, or if it already is, the calibration process will begin. At the end of the 30 seconds, amperage will be read and set as the threshold. SW2 in the ON position provides a 15% (+/-3%) differential, in the OFF position it provides a 25% (+/-3%) differential. SW2 can be selected at anytime and does not affect the threshold setting. Current in-range closes the status contacts. Current above or below range opens the status contacts. Ex. With a current of 10 amps set as the threshold and a 15% differential, status contacts will be closed between 8.5 amps and 11.5 amps and open outside of this range. A small amount of hysteresis is provided to prevent dithering near the differential limits.

RIBXG Series Selection Guide

MODEL #	RANGE	TYPE	THRESHOLD	OUTPUT	LED 1	LED 2
RIBXGF	.35-150 Amp	Split Core	Fixed, .35 Amp	Solid State Switch SPST ; 30 Vac/dc ; .4 Amps Max (Wht/Yel 16" 18 AWG Wire Leads)		
RIBXGFL	.75-150 Amp	Split Core	Fixed, .75 Amp	Solid State Switch SPST ; 30 Vac/dc ; .4 Amps Max (Wht/Yel 16" 18 AWG Wire Leads)	Over Trip Point	
RIBXGTF	.35-150 Amp	Split Core	Fixed, .35 Amp	Solid State Switch SPST ; 30 Vac/dc ; .4 Amps Max (Terminal Strip, Accepts #14-22 AWG Wire)		
RIBXGTFL	.75-150 Amp	Split Core	Fixed, .75 Amp	Solid State Switch SPST ; 30 Vac/dc ; .4 Amps Max (Terminal Strip, Accepts #14-22 AWG Wire)	Over Trip Point	
RIBXGA	.75-150 Amp	Split Core	Adjustable	Solid State Switch SPST ; 30 Vac/dc ; .4 Amps Max (Wht/Yel 16" 18 AWG Wire Leads)	Over Trip Point	Under Trip Point
RIBXGTA	.75-150 Amp	Split Core	Adjustable	Solid State Switch SPST ; 30 Vac/dc ; .4 Amps Max (Terminal Strip, Accepts #14-22 AWG Wire)	Over Trip Point	Under Trip Point
RIBXGA-SCAL	3-150 Amp	Split Core	Self-Cal.	Solid State Switch SPST ; 30 Vac/dc ; .4 Amps Max (Wht/Yel 16" 18 AWG Wire Leads)	See -SCAL Table	
RIBXGTA-SCAL	3-150 Amp	Split Core	Self-Cal.	Solid State Switch SPST ; 30 Vac/dc ; .4 Amps Max (Terminal Strip, Accepts #14-22 AWG Wire)	See -SCAL Table	

RIBXLS SERIES

RELAY & CURRENT SENSOR COMBO

Enclosed Relay/Current Sensor Combinations, SPST + Override with 10-30 Vac/dc Coil



SPECIFICATIONS

Relays & Contact Type: One (1) SPST Continuous Duty Coil
Expected Relay Life: 10 million cycles minimum mechanical
Operating Temperature: -30 to 140° F
Operate Time: 20ms
Relay Status: Red LED On = Activated
Dimensions: 4.00" x 4.00" x 1.80" with .50" NPT Nipple
Wire Length: 16", 600V Rated
Approvals: UL Listed, UL916, UL864, C-UL
 California State Fire Marshal, CE, RoHS
Housing Rating: Plenum, NEMA 1
Gold Flash: Yes
Override Switch: Yes

Coil Current:

30 mA @ 10 Vac
 32 mA @ 12 Vac
 42 mA @ 24 Vac
 50 mA @ 30 Vac
 12 mA @ 10 Vdc
 14 mA @ 12 Vdc
 16 mA @ 24 Vdc
 18 mA @ 30 Vdc

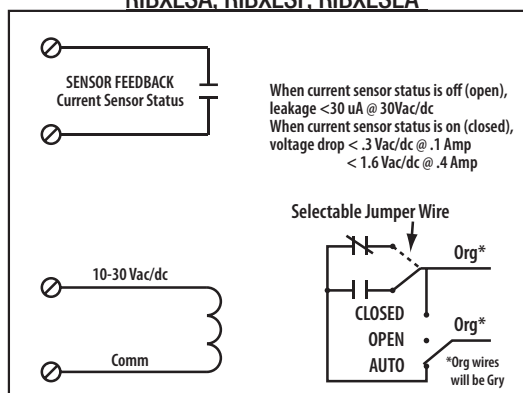
Coil Voltage Input:

10-30 Vac/dc ; 50-60 Hz
 Drop Out = 2.1 Vac / 2.8 Vdc
 Pull In = 9 Vac / 10 Vdc

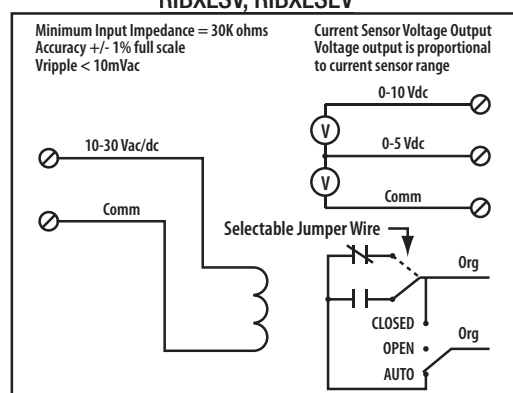
Notes:

- Normally Open or Normally Closed selected by yellow jumper wire
- Order with Momentary Override Switch by adding "-MNO" to end of model number

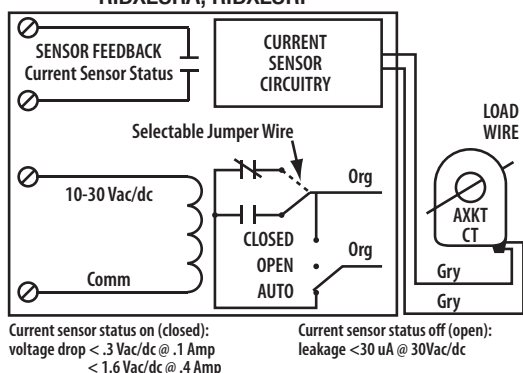
RIBXLSA, RIBXLSF, RIBXLSEA*



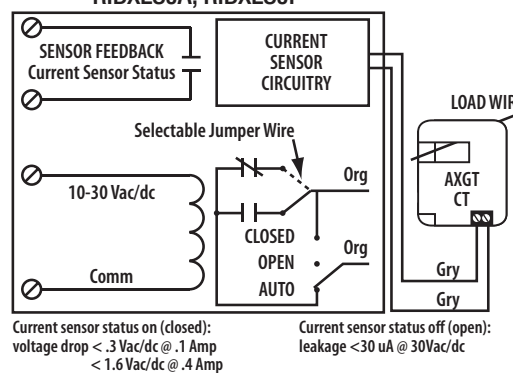
RIBXLSV, RIBXLSEV



RIBXLSRA, RIBXLSRF



RIBXLSJA, RIBXLSJF



Notes:

- Models AXKT and AXGT CT remotes do not have contact closure circuitry and only work in conjunction with RIBXLCR and RIBXLCJ models, respectively.

RIBXLS Series Selection Guide

MODEL #	RANGE	TYPE	THRESHOLD	OUTPUT	REMOTE STYLE	CURRENT SENSOR		RELAY	
						RESISTIVE	CONTACT RATINGS	RESISTIVE	CONTACT RATINGS
RIBXLSF	.50-10 Amps	Internal w/ contact status	Fixed, .50 Amp	Solid State Contact 30 Vac/dc, 0.4 Amp		10 Amp	10 Amp Resistive @ 277 Vac 480 VA Pilot Duty @ 277 Vac	10 Amp	10 Amp Resistive @ 277 Vac 480 VA Pilot Duty @ 277 Vac
RIBXLSA	.50-10 Amps	Internal w/ contact status	Adjustable	Solid State Contact 30 Vac/dc, 0.4 Amp		10 Amp	480 VA Ballast @ 277 Vac 600 Watt Tungsten @ 120 Vac N/O 240 Watt Tungsten @ 120 Vac N/C	10 Amp	480 VA Ballast @ 277 Vac 600 Watt Tungsten @ 120 Vac N/O 240 Watt Tungsten @ 120 Vac N/C
RIBXLSV	0-10 Amps	Internal w/ voltage output	Analog	0-5 Vdc 0-10 Vdc		10 Amp	1/3 HP for N/O @ 120-240 Vac 1/6 HP for N/C @ 120-240 Vac	10 Amp	1/3 HP for N/O @ 120-240 Vac 1/6 HP for N/C @ 120-240 Vac
RIBXLSRF	1.25-150 Amps	External w/ contact status	Fixed, 1.25 Amp	Solid State Contact 30 Vac/dc, 0.4 Amp	Model AXKT: (Solid Core Remote)	10 Amp	1/4 HP for N/O @ 277 Vac 1/8 HP for N/C @ 277 Vac	10 Amp	1/4 HP for N/O @ 277 Vac 1/8 HP for N/C @ 277 Vac
RIBXLSRA	1.25-150 Amps	External w/ contact status	Adjustable	Solid State Contact 30 Vac/dc, 0.4 Amp	Model AXKT: (Solid Core Remote)	10 Amp		10 Amp	
RIBXLSJF	3-150 Amps	External w/ contact status	Fixed, 3 Amp	Solid State Contact 30 Vac/dc, 0.4 Amp	Model AXGT: (Split Core Remote)	10 Amp		10 Amp	
RIBXLSJA	3-150 Amps	External w/ contact status	Adjustable	Solid State Contact 30 Vac/dc, 0.4 Amp	Model AXGT: (Split Core Remote)	10 Amp		10 Amp	
RIBXLSEA	.125-5 Amps	Internal w/ contact status	Adjustable	Solid State Contact 30 Vac/dc, 0.4 Amp		5 Amp	5 Amp Resistive @ 277 Vac 345 VA Pilot Duty @ 120/240 Vac N/O 268 VA Pilot Duty @ 277 Vac N/O 211 VA Pilot Duty @ 120/240 Vac N/C 175 VA Pilot Duty @ 277 Vac N/C	5 Amp	5 Amp Resistive @ 277 Vac 345 VA Pilot Duty @ 120/240 Vac N/O 268 VA Pilot Duty @ 277 Vac N/O 211 VA Pilot Duty @ 120/240 Vac N/C 175 VA Pilot Duty @ 277 Vac N/C
RIBXLSEV	0-5 Amps	Internal w/ voltage output	Analog	0-5 Vdc 0-10 Vdc		5 Amp	1/3 HP for N/O @ 120-240 Vac 1/6 HP for N/C @ 120-240 Vac 1/4 HP for N/O @ 277 Vac 1/8 HP for N/C @ 277 Vac	5 Amp	1/3 HP for N/O @ 120-240 Vac 1/6 HP for N/C @ 120-240 Vac 1/4 HP for N/O @ 277 Vac 1/8 HP for N/C @ 277 Vac



RELAYS & CONTACTORS

IDEC GENERAL-PURPOSE RELAYS

RH, RR, RJ SERIES

DESCRIPTION

IDEC **General-Purpose Relays** are available in the **RH Series Blade Style Relays**, **RR Series Pin Style Relays**, and **RJ Series Compact Relays**. The **RH Series** features a 10A switching capacity. They are available in SPDT, DPDT, 3PDT, and 4PDT contact configurations, driven by AC or DC coils, and they have blade terminals for socket mounting.

The **RR Series** has a 10A contact rating. The **RR Series** relays are available in SPDT, DPDT, and 3PDT configurations driven by AC or DC coils, and they have pin or blade terminals for socket mounting. The **RJ Series** is compact to reduce space requirements. They are available in a 12A SPDT version and an 8A DPDT version. They are driven by AC or DC coils and have blade terminals for socket mounting.



FEATURES

- **Blade style, pin style, and compact models**
- **Indicator light and/or check button available**
- **Surface or DIN rail mount**
- **UL recognized, CSA certified**



SPECIFICATIONS

COIL RATINGS

RH SERIES													
RATED VOLTAGE		RATED CURRENT (mA) ±15% @ 20°C								INRUSH CURRENT (mA)			
		60 Hz				50 Hz							
		SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT
AC	12	75	100	140	165	86	118	165	196	120	170	260	310
	24	37	50	70	83	42	59.7	81	98	56	85	130	165
	120	7.5	11	14.2	16.5	8.6	12.9	16.4	19.5	12	16	26	33
	240	3.2	5.5	7.1	8.3	3.7	6.5	8.2	9.8	7	8	12	16
DC		SPDT	DPDT			3PDT		4PDT		SPDT	DPDT	3PDT	4PDT
	12	64	75			120		125		—	—	—	—
	24	32	36.9			60		62		—	—	—	—

RR Series			
Rated Voltage	Rated Current (mA) ±15% @ 20°C		INRUSH CURRENT (mA)
	60 Hz	50 Hz	
AC	12	210	245
	24	105	121
	120	20.5	24
	240	10.5	12.1
DC	12	120	—
	24	60	—

RJ Series			
Coil Sensitivity	Nominal Voltage	Nominal Current	Coil Resistance
DC Coil	24V	25.7 mA	1080Ω
	24V	41.1 mA	243Ω
AC Coil (60 Hz)	120V	8.1 mA	5270Ω

Max continuous applied voltage

RH, RR 110% of rated voltage
RJ 140% of rated voltage

Pull-in voltage 80% of rated voltage,
70% for RJ DC coil

Drop-out voltage

AC 30% or more of rated voltage
DC 10% or more of rated voltage

Contact material

RH Silver cadmium oxide
RR Silver
RJ Silver nickel alloy

Contact resistance

RH 50 mΩ max
RR 30 mΩ max
RJ 50 mΩ max

CONTACT RATINGS

RH SERIES (UL ratings)												
VOLTAGE	RESISTIVE (A)				INDUCTIVE (A) $\cos\phi = 0.3$				MOTOR LOAD (hp)			
	SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT
240 AC	10	10	—	7.5	7	7	*	5	1/3	1/3	1/3	—
120 AC	10	10	10	10	7.5	—	—	7.5	1/6	1/6	1/6	—
30 DC	10	10	10	—	7	7	—	—	—	—	—	—
28 DC	10	10	10	10	7.5	—	—	7.5	—	—	—	—

* Note: 6.5 A / pole, 20 A Total

RR SERIES (UL ratings)			
VOLTAGE	RESISTIVE (A)	INDUCTIVE (A) $\cos\phi = 0.3$	MOTOR LOAD (hp)
240 AC	10	7	1/3
120 AC	10	7.5	1/4
30 DC	10	7	—

Resistive Load (Max)	CONTACT	RJ1S	RJ2S
	N.O.	12A @ 250 VAC/30 VDC	8A @ 250 VAC/30 VDC
Inductive Load (Max)	N.C.	12A @ 250 VAC; 6A @ 30 VDC	8A @ 250 VAC; 4A @ 30 VDC
	N.O.	7.5A @ 250 VAC; 6A @ 30 VDC	4A @ 250 VAC; 4A @ 30 VDC
	N.C.	7.5A @ 250 VAC; 3A @ 30 VDC	4A @ 250 VAC; 2A @ 30 VDC

Operate time

RH, RR 25 ms max
RJ 15 ms max

Release time

RH, RR 25 ms max
RJ 10 ms max

Min load

RH 24 VDC/30 mA, 5 VDC/100 mA
RR 24 VDC/10 mA, 5 VDC/20 mA
RJ 5 VDC/100 mA

Operating temp

-22° to 158°F (-30° to 70°C)
Agency approvals
(RH, RR): File #E67770, E59804,
(RJ): File #E55996
CSA certified, File #LR35144;
CE certified (not RR blade style)

Warranty

1 year

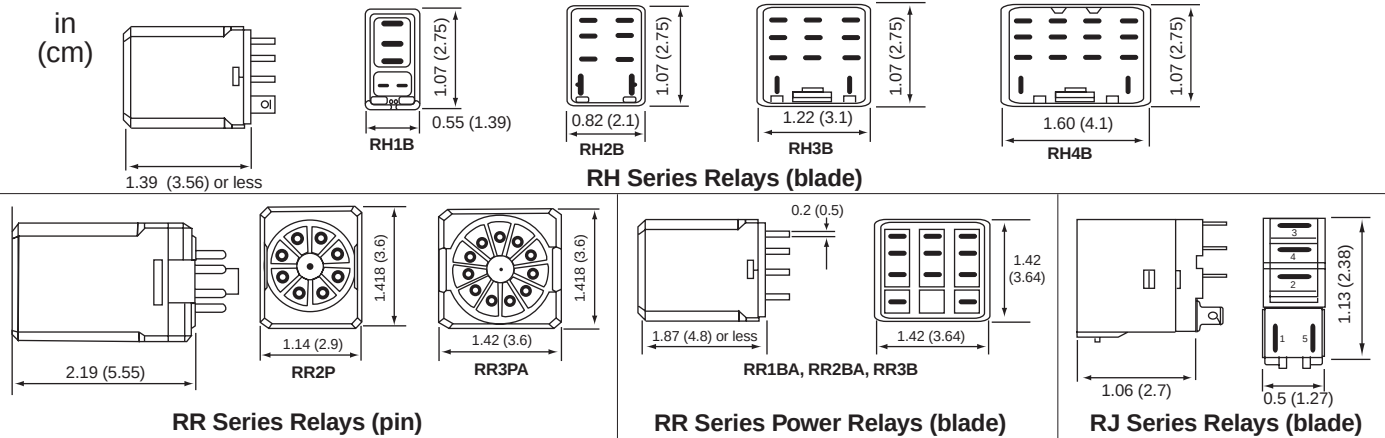


RELAYS & CONTACTORS

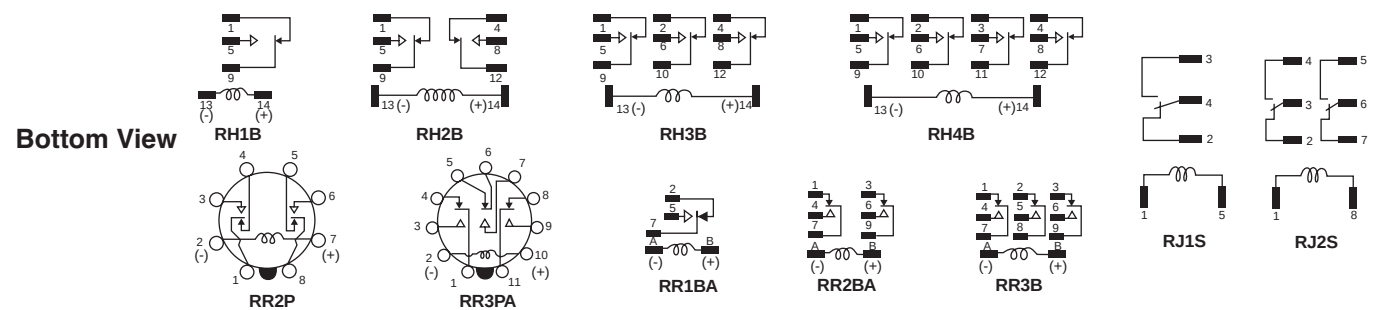
IDEC GENERAL-PURPOSE RELAYS

RH, RR, RJ SERIES

DIMENSIONS



WIRING



ORDERING INFORMATION

MODEL	DESCRIPTION
RH1B	Relay, SPDT, blade (use SH1B-05 socket)
RH2B	Relay, DPDT, blade (use SH2B-05 socket)
RH3B	Relay, 3PDT, blade (use SH3B-05 socket)
RH4B	Relay, 4PDT, blade (use SH4B-05 socket)
U	Standard relay
UL	Indicator light
ULC	Indicator light and check button
AC12V	12 VAC coil voltage
AC24V	24 VAC coil voltage
AC120V	120 VAC coil voltage
AC240V	240 VAC coil voltage
DC12V	12 VDC coil voltage
DC24V	24 VDC coil voltage

RH1B U AC24V

MODEL	DESCRIPTION
RJ1S	Relay, SPDT (use SJ1S-05B socket)
RJ2S	Relay, DPDT (use SJ2S-05B socket)
C	No options
CL	LED indicator
A24	24 VAC coil voltage
A120	120 VAC coil voltage
D24	24 VDC coil voltage

RJ1S C A24

MODEL	DESCRIPTION
RR2P	Relay, DPDT, 8 pin (use SR2P-05 or SR2P-06)
RR3PA	Relay, 3PDT, 11 pin (use SR3P-06 socket)
RR1BA	Relay, SPDT, 11 blade (use SR3B-05 socket)
RR2BA	Relay, DPDT, 11 blade (use SR3B-05 socket)
RR3B	Relay, 3PDT, 11 blade (use SR3B-05 socket)
U	Standard relay
UL	Indicator light
ULC	Indicator light and check button
AC12V	12 VAC coil voltage
AC24V	24 VAC coil voltage
AC120V	120 VAC coil voltage
AC240V	240 VAC coil voltage
DC12V	12 VDC coil voltage
DC24V	24 VDC coil voltage

RR2P U AC24V

Example: RR2PUAC24V DPDT relay 8 pin with 24VAC coil

SH, SR, SJ Series

Relay sockets

RELATED PRODUCTS

BAM-1000 or DIN-3F

Mounting DIN rail



DESCRIPTION

The **UCS-221E** is a solid-state device used for multistage control in HVAC systems, sequencing boilers or chillers, or floating/tri-state control of VAV boxes from a single analog signal. The **UCS-221E** can be used to obtain a digital output from a voltage or current producing sensor. Units may be daisy chained to provide additional stages of control, and a mounting track is supplied for easy installation.



FEATURES

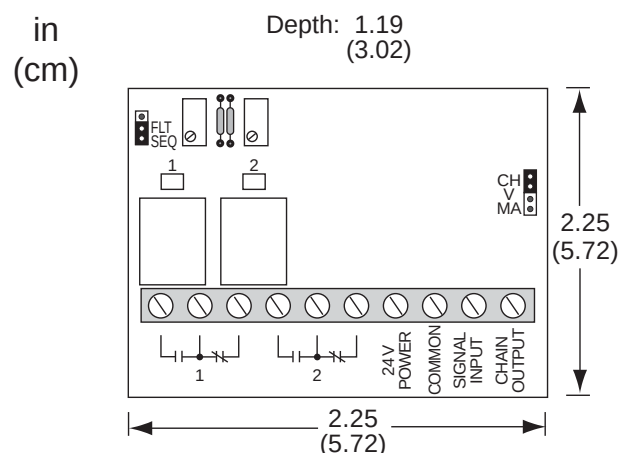
- **Two stages of relay control**
- **Voltage or current input**
- **LED indication of relay status**
- **Adjustable relay setpoints**
- **Adjustable relay differentials**
- **Snap-track mounted**

OPERATION

The **UCS-221E** accepts a 0-20 mA or 0-15V input signal to produce a two-stage relay output. Each relay has a multi-turn potentiometer adjustment to set the pull-in point. Relay 1 can be jumper-selected to pull in on either a rise or fall in signal. Relay 2 always pulls in on a signal rise. Individual relay differential is easily adjusted by using different value plug-in differential resistors. Multiple UCS models can be daisy chained to operate additional stages from one input signal. A maximum of eight slave units can be daisy chained.



DIMENSIONS



SPECIFICATIONS			
Supply Voltage	24 VAC $\pm 10\%$, half-wave; or 24 VDC $\pm 10\%$	Relay Differential	Factory set at 0.5 mA or 0.375V, adjustable using plug-in resistors
Supply Current	100 mA @ 24 VAC; 50 mA @ 24 VDC maximum	Relay Output Rating	10A @ 120 VAC
Input	0-20 mA or 0-15 VDC, jumper selectable	Operating Temperature	32° to 158°F (0° to 70°C)
Input Impedance	250 Ω (mA input); 49.7 k Ω (VDC input)	Operating Humidity	5% to 95% RH (non-condensing)
Wiring Terminations	Screw terminals	Weight	0.4 lb (.18 kg)
Accuracy	$\pm 1\%$	RoHS Statement	Yes
Output	Two SPDT relays, adjustable via setpoint potentiometers	Warranty	1 year



TRANSDUCERS

SEQUENCER CONTROL MODULE - TWO STAGE

UCS-221E

WIRING

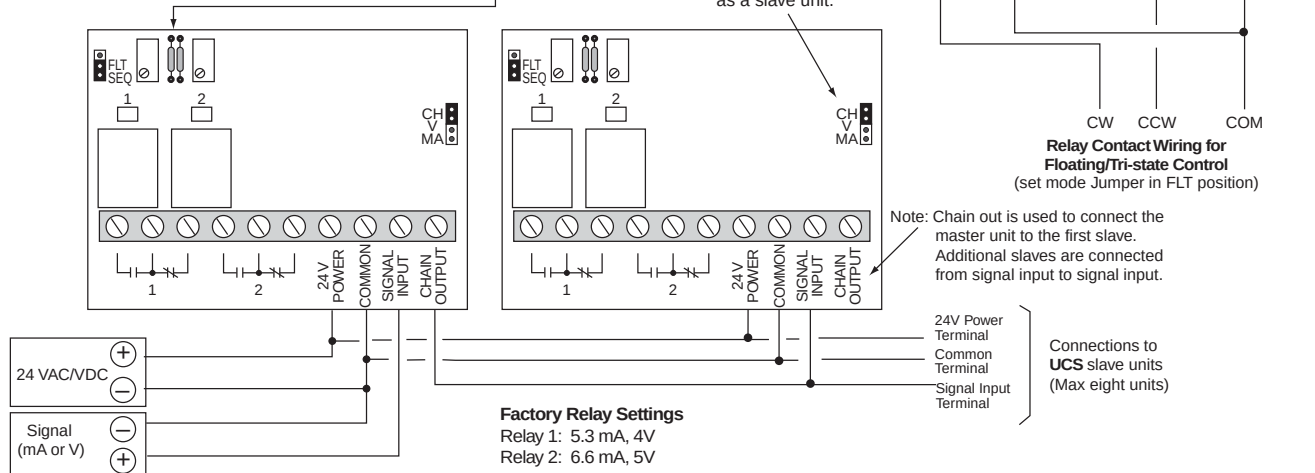
Make all connections according to the diagram below or as shown on the job diagrams and in compliance with national and local codes. Make all connections with power removed. Failure to do so could result in circuit board damage. Use shielded #18-gauge cable for connections from the **UCS-221E** to the controller, shield grounded at the controller.

TABLE 1. OTHER DIFFERENTIALS

Other Differential Resistors can be used (customer supplied)
9.1 k Ω = 0.25 mA or 0.1875V
36.5 k Ω = 1.0 mA or 0.75V
54.9 k Ω = 1.5 mA or 1.125V
73.2 k Ω = 2.0 mA or 1.5V

Plug-in Differential Resistors (1/4W, 1%)
18.2 k Ω = 0.5 mA or 0.375V (factory supplied)
See Table 1 for other differentials.

Jumper should be in chain (CH) position when using **UCS-221E** as a slave unit.



SETUP / CALIBRATION

1. Set jumpers to desired position as follows:

Mode jumper - In FLT position, Relay 1 energizes on a decrease in signal. In the SEQ position, Relay 1 energizes on an increase in signal. Relay 2 always energizes on an increase in signal.

Input jumpers - Select mA position for a 0-20 mA input, or V position for a 0-15 VDC input. If the **UCS-221E** is used as a slave control, place the bottle-plug jumper in the chain position.

2. Connect a meter in series with the SIGNAL INPUT terminal and the 0-20 mA (+) signal to read a current signal. To read a voltage input, connect across the COMMON (-) and SIGNAL INPUT (+) terminals.
3. Adjust the input signal to the desired pull-in current or voltage for Relay 1.
4. If Relay 1 LED is on, turn setpoint adjustment potentiometer clockwise (counterclockwise if Relay 1 has mode jumper in FLT position) until it de-energizes; otherwise, proceed to step 5.
5. Adjust Relay 1 pull-in point by turning the setpoint adjustment potentiometer counterclockwise (clockwise if Relay 1 has mode jumper in FLT position) until the relay energizes. (The potentiometers are 25-turn potentiometers.)
6. Repeat steps 3, 4, and 5 for Relay 2 using setpoint adjustment potentiometer.
7. When using a 0-20 mA input, the CHAIN OUTPUT produces a 0 to 12 VDC signal, which is proportional to the input signal. Connections should be made between CHAIN OUTPUT and COMMON. If a voltage input is used, the CHAIN OUTPUT is directly proportional to the input.

ORDERING INFORMATION

MODEL
UCS-221E
UCS-221E-C

DESCRIPTION

Sequencer control module, two relay outputs, field calibrated

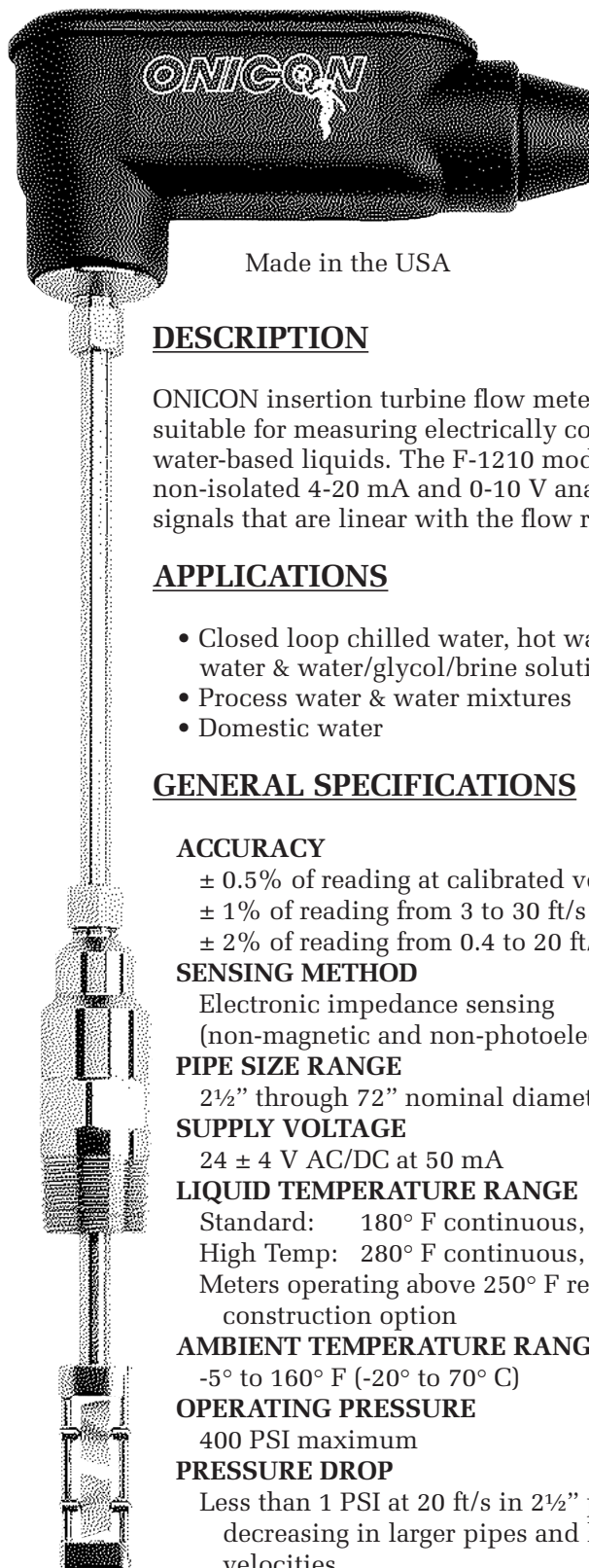
Sequencer control module, two relay outputs, pre-calibrated (specify settings when ordering)

RELATED PRODUCTS

B-5

5"x4"x3" two-piece aluminum box with two 1/2" conduit knockouts

PAGE
217



• **F-1210 DUAL TURBINE •**
INSERTION FLOW METER
ANALOG OUTPUT



Made in the USA

DESCRIPTION

ONICON insertion turbine flow meters are suitable for measuring electrically conductive water-based liquids. The F-1210 model provides non-isolated 4-20 mA and 0-10 V analog output signals that are linear with the flow rate.

APPLICATIONS

- Closed loop chilled water, hot water, condenser water & water/glycol/brine solutions for HVAC
- Process water & water mixtures
- Domestic water

GENERAL SPECIFICATIONS

ACCURACY

- ± 0.5% of reading at calibrated velocity
- ± 1% of reading from 3 to 30 ft/s (10:1 range)
- ± 2% of reading from 0.4 to 20 ft/s (50:1 range)

SENSING METHOD

Electronic impedance sensing
(non-magnetic and non-photoelectric)

PIPE SIZE RANGE

2½" through 72" nominal diameter

SUPPLY VOLTAGE

24 ± 4 V AC/DC at 50 mA

LIQUID TEMPERATURE RANGE

Standard: 180° F continuous, 200° F peak
High Temp: 280° F continuous, 300° F peak
Meters operating above 250° F require 316 SS construction option

AMBIENT TEMPERATURE RANGE

-5° to 160° F (-20° to 70° C)

OPERATING PRESSURE

400 PSI maximum

PRESSURE DROP

Less than 1 PSI at 20 ft/s in 2½" pipe,
decreasing in larger pipes and lower velocities

OUTPUT SIGNALS PROVIDED

Analog Output (non-isolated)
Voltage output: 0-10 V (0-5 V available)
Current output: 4-20 mA
Frequency Output
0 – 15 V peak pulse, typically less than 300 Hz

(continued on back)

CALIBRATION

Every ONICON flow meter is wet calibrated in our flow laboratory against primary volumetric standards that are directly traceable to N.I.S.T. A certificate of calibration accompanies every meter.

FEATURES

Unmatched Price vs. Performance - Custom calibrated, highly accurate instrumentation at very competitive prices.

Excellent Long-term Reliability - Patented electronic sensing is resistant to scale and particulate matter. Low mass turbines with engineered jewel bearing systems provide a mechanical system that virtually does not wear.

Industry Leading Two-year "No-fault" Warranty - Reduces start-up costs with extended coverage to include accidental installation damage (miswiring, etc.) Certain exclusions apply. See our complete warranty statement for details.

Simplified Hot Tap Insertion Design - Standard on every insertion flow meter. Allows for insertion and removal by hand without system shutdown.

OPERATING RANGE FOR COMMON PIPE SIZES 0.17 TO 20 ft/s

±2% accuracy begins at 0.4 ft/s

Pipe Size (Inches)	Flow Rate (GPM)
2 ½	2.5 - 230
3	4 - 460
4	8 - 800
6	15 - 1,800
8	26 - 3,100
10	42 - 4,900
12	60 - 7,050
14	72 - 8,600
16	98 - 11,400
18	120 - 14,600
20	150 - 18,100
24	230 - 26,500
30	360 - 41,900
36	510 - 60,900

F-1210 SPECIFICATIONS cont.

MATERIAL

Wetted metal components:

Standard: Electroless nickel plated brass

Optional: 316 stainless steel

ELECTRONICS ENCLOSURE

Standard: Weathertight aluminum enclosure

Optional: Submersible enclosure

ELECTRICAL CONNECTIONS

3-wire minimum for 4-20 mA or 0-10 V output

Second analog output and/or frequency output requires additional wires

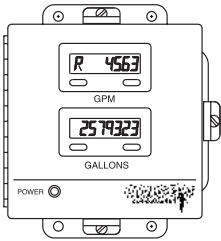
Standard: 10' of cable with ½" NPT conduit connection

Optional: Indoor DIN connector with 10' of plenum rated cable

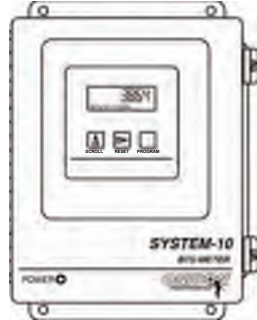
F-1210 Wiring Information

WIRE COLOR	DESCRIPTION	NOTES
RED	(+) 24 V AC/DC supply voltage, 50 mA	Connect to power supply positive
BLACK	(-) Common ground (Common with pipe ground)	Connect to power supply negative & analog input ground
GREEN	(+) Frequency output signal: 0-15 V peak pulse	Required when meter is connected to local display or Btu meter
BLUE	(+) Analog signal: 4-20 mA (non-isolated)	Both signals may be used independently
BROWN	(+) Analog signal: 0-10 V (non-isolated)	
DIAGNOSTIC SIGNALS		
ORANGE	Bottom turbine frequency	These signals are for diagnostic purposes - connect to local display or Btu meter
WHITE	Top turbine frequency	

ALSO AVAILABLE



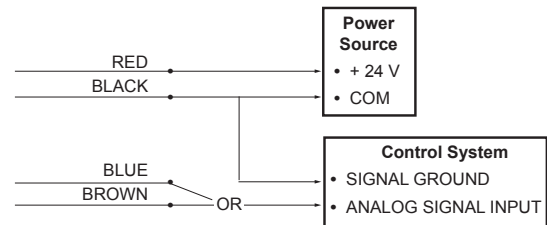
Display Modules



Btu Measurement Systems

F-1210 Wiring Diagram

Flow meter into control system (no display or Btu meter)



NOTE: 1. Black wire is common with the pipe ground (typically earth ground).

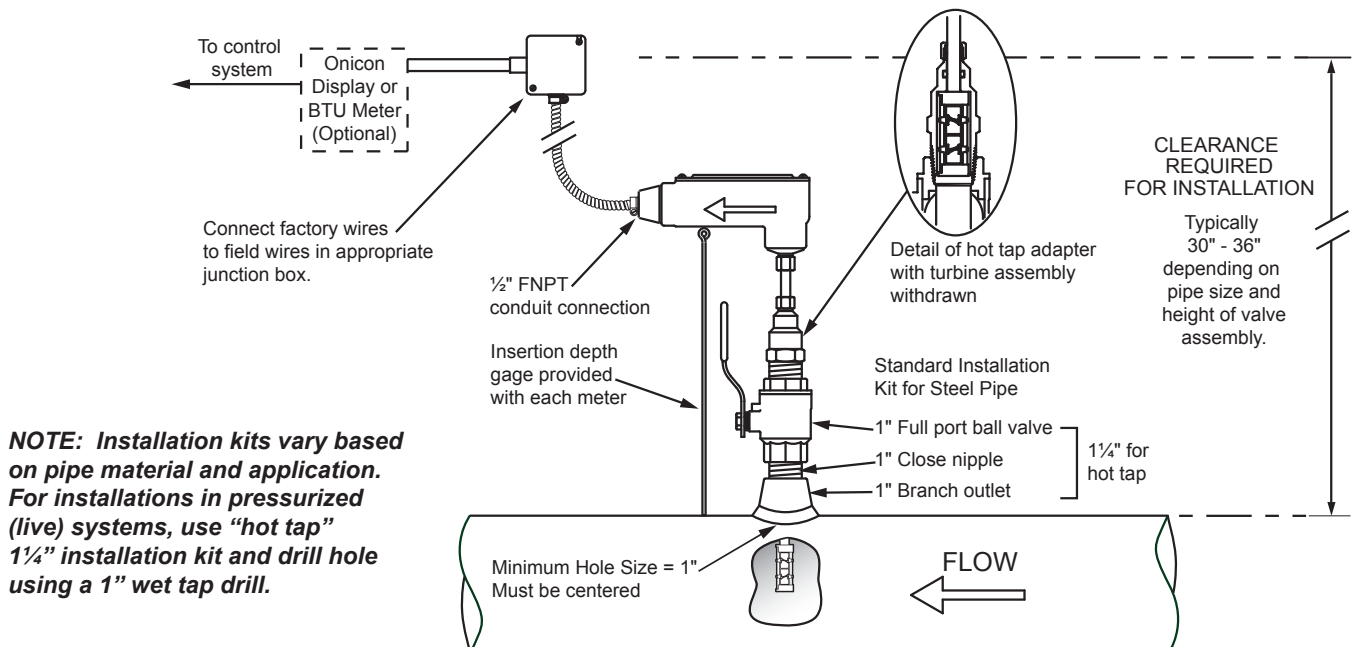
2. Frequency output required for ONICON display module or Btu meter, refer to wiring diagram for peripheral device.

Typical Meter Installation

(New construction or scheduled shutdown)

• Acceptable to install in vertical pipe

• Position meter anywhere in upper 240° for horizontal pipe



NOTE: Installation kits vary based on pipe material and application. For installations in pressurized (live) systems, use "hot tap" 1¼" installation kit and drill hole using a 1" wet tap drill.

General Purpose Type 1 Enclosures with Knockouts

Application-

Designed to house electrical controls, instruments and components in areas that do not require oil, water and dust tight protection. For installation information, consult our Installation Manual at www.saginawcontrol.com.

Construction -

- 0.048", 0.063" & 0.075" carbon steel depending on its size.
- Spot weld construction.
- Knockouts provided in the top, bottom, right and left side.
- Standoffs provided for mounting optional sub-panels.
- Butt hinge.
- Doors open 180 degrees.
- Keylocking quarter turn latch.
- Ground stud on door.
- Mounting holes in back of enclosure.
- Sub-panel with 2" x 2" mounting grid pattern included.

Options -

Optional mounting feet available.

Finish -

Precaution Blue, Safety Orange or Taupe Tan powder coat finish inside and out. Panels are powder coated white.

IS8 - Industry Standards -

NEMA Type 1
UL Listed Type 1
CSA Type 1
IEC 60529 IP30

GENERAL PURPOSE TYPE 1 ENCLOSURES WITH KNOCKOUTS

ENCLOSURE PRODUCT CODE N1					SUB-PANEL (N1)		
Catalog No.	Height (A)	Width (B)	Depth (C)	Industry Standard	Panel Height (D)	Panel Width (E)	List Price
SCE-18N1606NK-T	18.00	16.00	6.00	IS8	16.00	14.00	Included
SCE-18N1606NK-B	18.00	16.00	6.00	IS8	16.00	14.00	Included
SCE-18N1606NK-O	18.00	16.00	6.00	IS8	16.00	14.00	Included
SCE-24N2006NK-T	24.00	20.00	6.00	IS8	22.00	18.00	Included
SCE-24N2006NK-B	24.00	20.00	6.00	IS8	22.00	18.00	Included
SCE-24N2006NK-O	24.00	20.00	6.00	IS8	22.00	18.00	Included
SCE-36N2406NK-T	36.00	24.00	6.00	IS8	34.00	22.00	Included
SCE-36N2406NK-B	36.00	24.00	6.00	IS8	34.00	22.00	Included
SCE-36N2406NL-T*	36.00	24.00	6.00	IS17	34.00	22.00	Included
SCE-36N2406NL-B*	36.00	24.00	6.00	IS17	34.00	22.00	Included
SCE-36N2406NL-O*	36.00	24.00	6.00	IS17	34.00	22.00	Included

**UL-Non UL Listed 16 ga enclosures.*

Note: Part Numbers ending in the letter:

- (B) Precaution Blue
(O) RAL 8023 Orange
(T) Taupe Tan

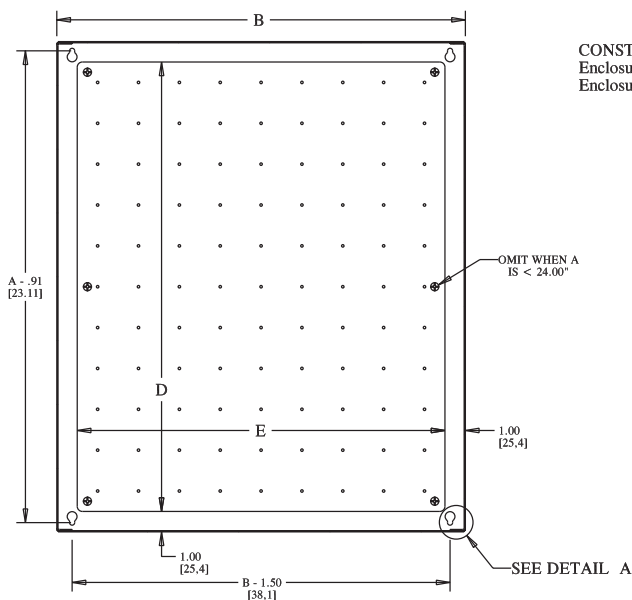
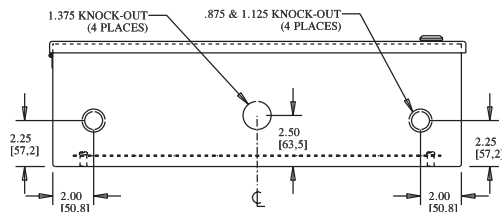
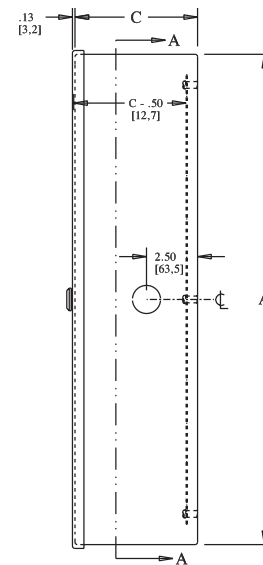
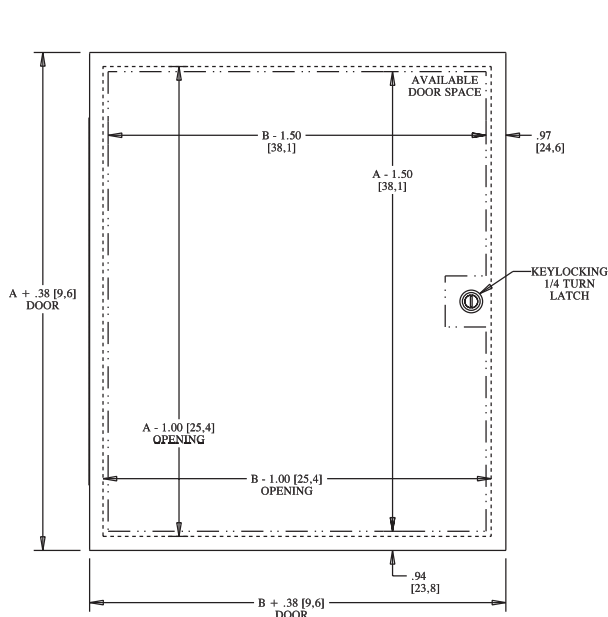


Phone (989) 799-6871
Fax (989) 799-4524

SCE SAGINAW
CONTROL &
ENGINEERING
Your Enclosure Source

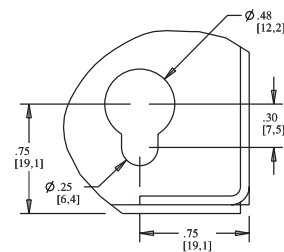
GENERAL PURPOSE TYPE 1 ENCLOSURES WITH KNOCKOUTS

TECHNICAL DATA



CONSTRUCTION NOTES:

Enclosures < 24.00" [609.6] wide are made of 0.060" [1.5] material.
Enclosures = > 24.00" [609.6] wide are made of 0.075" [1.9] material.

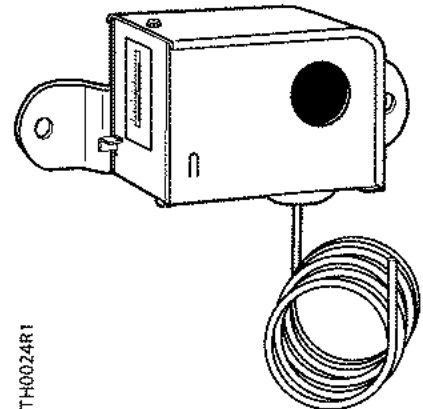


DETAIL A

SECTION A-A

Powers™ Controls

ET 134 Low Temperature Detection Thermostat



Description	The Electric Low Temperature Detection Thermostat is a remote bulb instrument with a Single-Pole Double-Throw (SPDT) switch which closes and opens a circuit in both directions.
Features	• Compact and sturdy • Adjustable range with fixed differential • Unaffected by ambient temperature at case • Manual or automatic reset available • The set point adjustment screw is accessible at the bottom of the control or at the top with the cover removed • Mounting bracket standard

Product Numbers

Description	Product Numbers
Low Temperature Detection Thermostat Automatic reset	134-1510
Manual reset	134-1511

Warning/Caution Notations

WARNING:		Personal injury/loss of life may occur if a procedure is not performed as specified.
CAUTION:		Equipment damage, or loss of data may occur if the user does not follow a procedure as specified

Application

The electric low temperature detection thermostats are especially suited for sensing low temperature conditions to avoid freeze-up of hydronic heating coils, cooling coils, liquid heating pipes and similar applications. Typically, the switch opens an electrical circuit to stop the supply fan motor when the temperature at the sensing element falls below the setting of the instrument.



WARNING:

The low temperature detection thermostat is designed for use only as an operating control. Where an operating control failure would result in personal injury and/or loss of property, it is the responsibility of the installer to add devices (safety, limit controls) or systems (alarm, supervisory systems) that protect against, or warn of control failure.

Specifications

Switch action	SPDT
Range	35 to 45°F (2 to 7°C)
Maximum bulb temperature	250°F (121°C)
Ambient temperature at thermostat	0 to 140°F (-18 to 60°C)
Differential	
134-1510	12°F (6.7°C)
134-1511	Temperature must be 12°F (6.7°C) above cutout point before control can be reset
Bulb	1/8-inch (3.2 mm) x 20 feet (6 m)
Capillary length	4 feet (1.2 m)
Sensing element	Vapor filled
Reset type	See <i>Product Number</i>
Electrical ratings	See <i>Table 1</i>
Material	
Case	0.62-inch (1.57 mm) cold rolled steel
Cover	0.32-inch (0.81 mm) cold rolled steel
Conduit opening	7/8-inch (22 mm) for 1/2-inch conduit
Finish	Gray enamel
Weight	1.8 lbs. (0.8 kg)
Dimensions	See <i>Figure 4</i>
Approvals	UL file SA3863 CSA File LR948

Operation

Any 1-foot length of the element subjected to temperatures below the temperature setting of the thermostat will actuate the thermostat switch mechanism regardless of the temperature being sensed by the remainder of the element. The sensing element is unaffected by the ambient temperature at the thermostat if it is warmer than the set point temperature.

The 134-1511 thermostat has a manual reset feature. (See *Figure 5*.)

NOTE: The reset lever must be pressed manually and released to resume normal fan system operation.

Operation, Continued

Table 1. Electrical Ratings.

Motor Ratings	120 V	208 V	240 V
A.C. Full Load Amps	16	9.2	8
A.C. Locked Rotor Amps	96	55.2	48
Non-inductive Amps	16	9.2	8
Pilot Duty -- 125 VA		24 to 277 Vac	

Mounting and Installation

General Guidelines

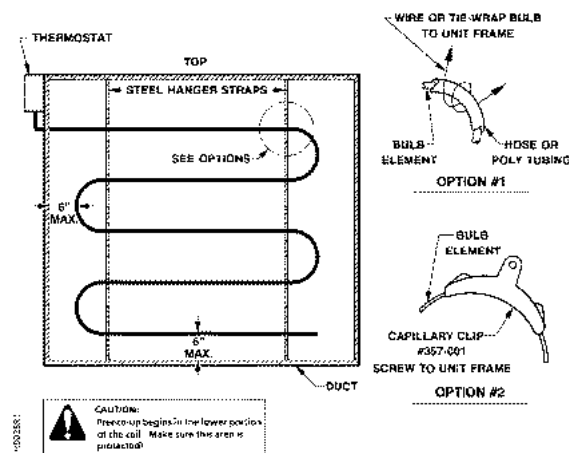
- Locate the sensing element in the downstream side of the coil.
- Locate the case and bellows where the ambient temperature is always warmer than the set point.
- Install the thermostat case so that the reset button is readily accessible and the element bellows point down.
- Avoid sharp bends or kinks in the sensing element.
- Install as much of the bulb as possible in a horizontal plane. If too much of the bulb is vertical, it will not operate properly.

Large Walk-in Ducts (Figure 1)

1. Attach the mounting bracket to the thermostat case with the two round head screws provided.
2. Mount the two perforated steel strap hangers inside the duct with the wide part of the hanger strap parallel to the air flow.
3. Drill a hole through the side of the duct. With the bulb still coiled, thread the bulb through the hole using a rotary movement.
4. Mount the thermostat case on the outside of the duct.
5. Carefully uncoil the bulb avoiding sharp bends or kinks in the sensing element.
6. Mount the bulb in a horizontal serpentine manner. Attaching the bulb to the strap as shown in the detail in *Figure 1*.

The installation is now complete.

For an alternate method of mounting, use coil clips (part number 356-115) in the fins to hold the bulb in a horizontal serpentine pattern.

**Figure 1. Typical Mounting in Walk-in Duct.**

Mounting and Installation, continued

Limited Access Ducts

(Figure 2)

1. Attach the mounting bracket to the thermostat case with the two round head screws provided.
2. Attach a mounting flange (part number 808-412) on the opposite side of the duct (near the bottom) from where the thermostat will be mounted.
3. Mount a second flange on a 8-inch by 4-inch sheet metal plate. Cut an access opening for the bulb on the duct diagonally across from the duct mounted flange. Drill mounting screw holes for the sheet metal plate.
4. Cut a length of copper tubing to fit diagonally across the duct. Stretch out the bulb and wrap it around the tubing.
5. Insert the tubing and bulb through the access hole and into the duct-mounted flange. Fasten the 8-inch by 4-inch sheet metal plate to the duct.
6. Mount the thermostat case on the outside of the duct.

The installation is now complete.

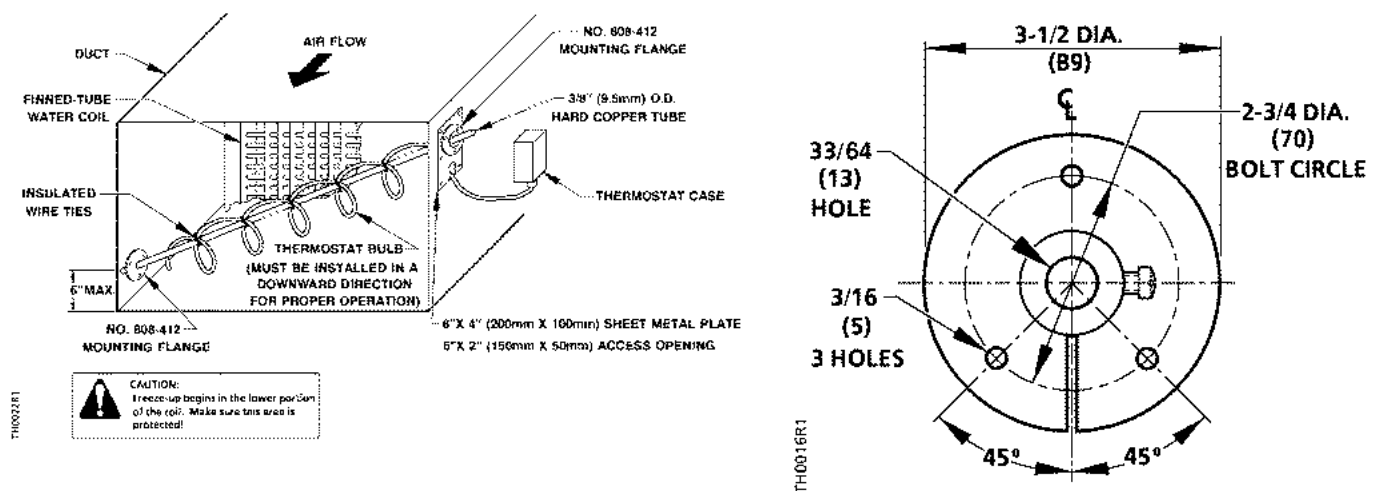


Figure 2. Bulb Mounting for Limited Access Ducts with Mounting Flange.

Wiring

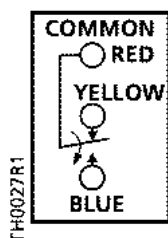


WARNING:

Disconnect the power supply before wiring connections are made to avoid possible electrical shock or damage to the equipment.

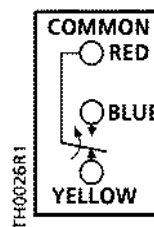
All wiring should conform to the National Electrical Code and local regulations. Loads exceeding the rating of the thermostat should be handled by means of a relay or motor starter.

Red is common. See *Figure 3* for terminal identification.



Red to Yellow opens on temp. decrease below set point.

Red to Blue closes on temp. decrease below set point.



Red to Blue closes on temp. decrease below set point.

Red to Yellow opens on temp. decrease below set point.

Figure 3. Terminal Identification.



CAUTION:

Use terminal screws furnished (#8-32 x 1/4-inch binder head screw). Substitution of other screws can cause problems in making proper connections.

Dimensions

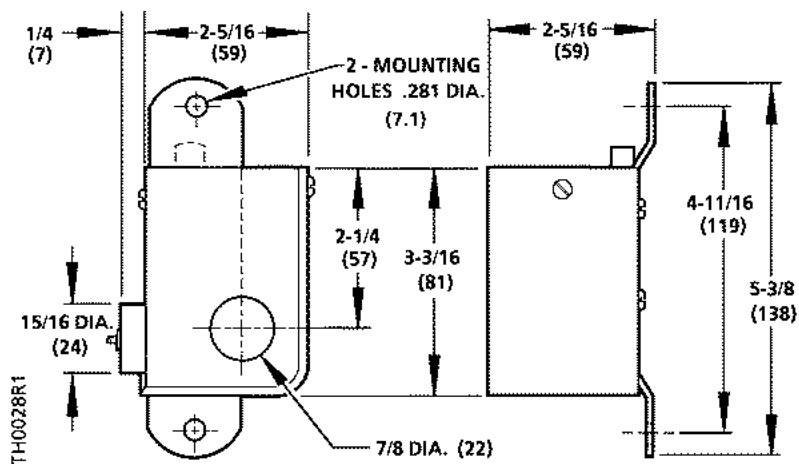


Figure 4. Dimensions of the 134-1510 and 134-1511 Thermostat.

Adjustment

Change the set point by turning the adjusting screw until the pointer is opposite the desired cutout point.

The adjusting screw is accessible at the bottom of the thermostat or at the top when the cover is removed. See *Figure 5* for the location of the adjusting screw.

The direct reading scale was calibrated at 800 feet (244 m) above sea level at 35°F (2°C). For critical installations in higher altitudes raise the set point by 1°F (0.56°C) for each 1,800 feet (549 m) of elevation.

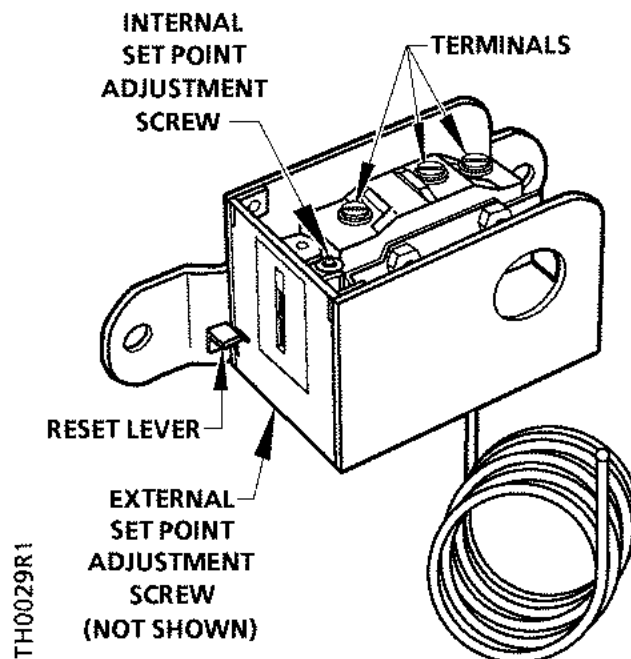


Figure 5. Internal View of Thermostat.

Troubleshooting

Observe a complete operating cycle to be sure that all components function correctly.

Service

There is no servicing of the thermostat. Replace if inoperative.

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Wet Media Differential Pressure Transducer

PW2 Series



PW2

4-20 mA, 2-Wire Device

FEATURES

- The jumper-selectable output switch for normal (4-20mA) or reverse (20-4mA) operation provides application flexibility
- Rugged, die-cast enclosure provides NEMA 4 sealing
- Selectable differential units: psid or bard
- Dual sensor design for improved overpressure tolerance... eliminates the requirement for a bypass valve assembly in most applications
- Jumper-controlled electronic surge dampening for high stability
- Pushbutton zero calibration – no trim pots to adjust... maintain accuracy and reduce callbacks with automatic zero calibration
- Jumper-selectable port swap feature eliminates costly replumbing the high and low ports are improperly plumbed... change the jumper position from normal to swap – problem solved!
- Switch-selectable pressure ranges... fewer models to order and stock
- LCD displays high pressure, low pressure, and differential pressure with easy readability

DESCRIPTION

The **PW2 Series** 2-wire, 4-20mA wet pressure transducers incorporate microprocessor profiled sensors for exceptional accuracy and reliability. Easy to use and designed to provide exceptional installation savings, the PW2 Series is ideal for measuring pressure across pumps, filters, heat exchangers, compressors, and other non-corrosive wet media applications

APPLICATIONS

- Monitoring and controlling pump differential pressure
- Chiller/boiler differential pressure drop
- CW/HW system differential pressure

SPECIFICATIONS

5 Year
Warranty

Input Power	Class 2; 12 to 24VDC, loop powered (polarity insensitive)
Maximum Current Draw	29mA
Output	2-wire transmitter; user selectable 4-20mA (clipped and capped)*
Accuracy @ 25°C**	Range A, B, C: $\pm 1\%$ F.S.; Range D: $\pm 2\%$ F.S.***
Surge Damping	Electronic; 5-second averaging
Fittings	1/8" NPT female thread, 17-4 PH stainless
PRESSURE RANGES (SELECTABLE)	
0-50 psi (0-3.45 barg) (Gauge)	0-5/10/25/50 psid (0-0.34/0.69/1.72/3.45 bard) (Differential)
0-100 psig (0-6.89 barg) (Gauge)	0-10/20/50/100 psid (Differential) (0-0.69/1.38/3.45/6.89 bard) (Differential)
0-250 psi (0-17.24 bar) (Gauge)	0-25/50/125/250 psid (Differential) (0-1.72/3.45/8.62/17.24 bard) (Differential)
Product Operating Environment	-10° to 55°C (14° to 130°F); 0 to 90%RH noncondensing
Long Term Stability	$\pm 0.25\%$ per year
Zero Adjust	Pushbutton auto-zero terminals
Housing Material	White powder-coated aluminum
SENSOR	
Media Compatibility	Media compatible with 17-4 PH stainless steel
Proof Pressure	Max. 2x F.S. range
Burst Pressure	Max. 5x F.S. range
Temperature Compensated Range	0° to 50°C (32° to 122°F); TC Zero $\leq \pm 1.5\%$ of product F.S. per sensor; TC Span $\leq \pm 1.5\%$ of product F.S. per sensor, (2 sensors per unit)
Media Temperature Limits	-20° to 85°C (-4° to 185°F); 0 to 90% RH non-condensing

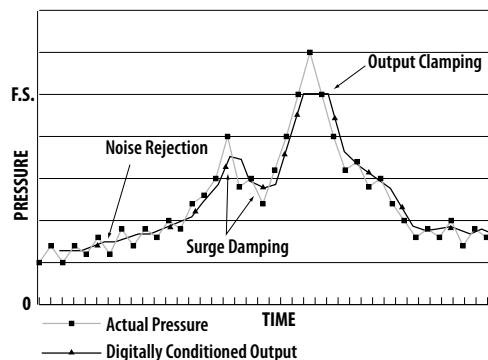
* Minimum input voltage: 250 Ω loop = 12VDC; 500 Ω loop = 17VDC

**Accuracy combines linearity, hysteresis, and repeatability.

***FS is defined as full span of selected range in bi-directional mode.

EMC Conformance - CE option: Low voltage directive 2006/95/EC; EMC directive 2004/108/EC.

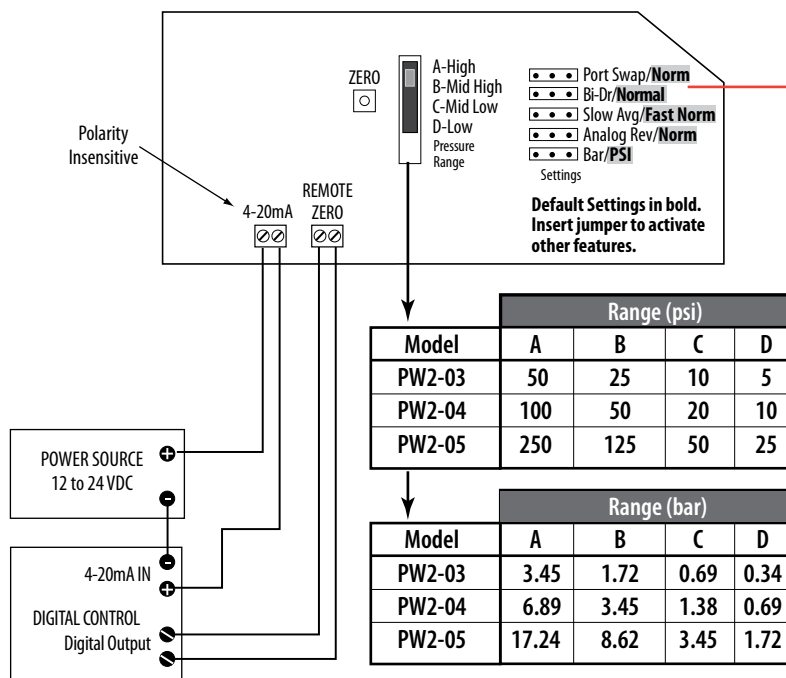
EMC Special Note: Connect this product to a DC distribution network or an AC/DC power adaptor with proper surge protection (EN 61000-6-1:2007 specification requirements).



Microprocessor provides digital signal conditioning

- Noise rejection reduces fluctuating readings due to noise or turbulence
- Surge damping prevents false alarms by averaging fast peaks

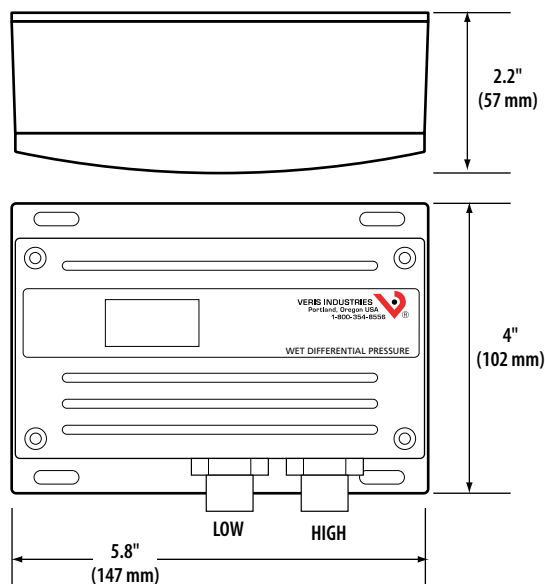
WIRING DIAGRAM



Bidirectional Operation

Input Conditions		Result	Outputs Read
HI PORT	LO PORT	DP	4-20mA
100 psi	0 psi	+100 psi	20mA
100 psi	50 psi	+50 psi	16mA
50 psi	50 psi	0 psi	12mA
50 psi	100 psi	-50 psi	8mA
0 psi	100 psi	-100 psi	4mA

DIMENSIONAL DRAWING



ORDERING INFORMATION



	Local Display	NIST	Operational Range*	US or EU
PW2	☐	☐	☐	☐
	L = LCD Display X = No Display	N = NIST X = None	03 = 0-50 psig/3.45 barg 04 = 0-100 psig/6.89 barg 05 = 0-250 psig/17.24 barg	S = Standard C = CE

Example:

PW2 ☐ L ☒ X ☐ 04 ☐ C

ACCESSORIES

Bypass valve assemblies (AA14A)
 PW installed on bypass valve manifold (AA16A)
 Snubbers, brass, 1/8" NPT (AA11)
 Snubbers, stainless steel, 1/8" NPT (AA12)
 Steam siphon (AA13)



AA11/AA12



AA13



AA14A

*Select operational range according to maximum gauge pressure, NOT differential pressure.

Example: High gauge pressure=90 psig, Select 100 psig model (04).

Current Switches: Fixed Trip Point



Split-Core & Solid-Core On/Off Status Current Switches



DESCRIPTION

Hawkeye x00 on/off current switches provide a cost-effective solution for monitoring status on unit vents, exhaust fans, recirculation pumps, and other fixed loads where belt loss is not a concern.

Veris has applied new technology to the H300, H600, and H800 models to achieve impressive improvement in turn-on levels. The Hawkeye H300 and H600 now have the lowest turn-on current in the industry at a mere 150mA!

APPLICATIONS

- Monitoring status of electrical loads
- Monitoring direct-drive units, exhaust fans, pumps, process motors, and other fixed loads
- Verifying lighting run times



FEATURES

- More reliable for status than relays across auxiliary contacts
- Ideal for direct-drive units, unit vents, fan coil units, exhaust fans, and other fixed loads
- Great for lighting status—less expensive than 277V relays
- Low 0.15 A turn-on (H300 and H600)...ideal for small exhaust fans (not intended to detect belt loss)
- Removable mounting bracket provides installation flexibility
- Bracket on H900 can be installed in three different configurations...installer convenience
- Split-core H300, H600, and H900 for fast retrofit installation
- Mini solid-core H800 and micro split-core H300 fit in tight enclosures...saves valuable panel space
- 100% solid-state, no moving parts to fail
- Polarity insensitive output
- 5-year warranty

SPECIFICATIONS



Sensor Power (N.O. Models)

Induced from monitored current

Insulation Class

600VAC RMS (UL), 300VAC RMS (CE)

Frequency Range

50/60 Hz

Temperature Range

H800, H800NC, H300, H900: -15° to 60°C (5° to 140°F)
H600: -15° to 40°C (5° to 104°F) (to 200A); -15° to 60°C (5° to 140°F) (to 150A)
H800HV: -40° to 50°C (-40° to 122°F) (to 200A); -40° to 75°C (-40° to 167°F) (to 100A, & 0.25A status output)

Humidity Range

10-90% RH non-condensing

Sensor Power (N.C. Models)

5-30VDC, permanently connected

Off State Leakage (N.C. Models)

34µA@5VDC, 200µA@30VDC

On State Voltage Drop (N.C. Models)

1.9VDC (max.) @0.1A

Terminal Block Maximum Wire Size

14 AWG (16 AWG for H300)

Terminal Block Torque (nominal)

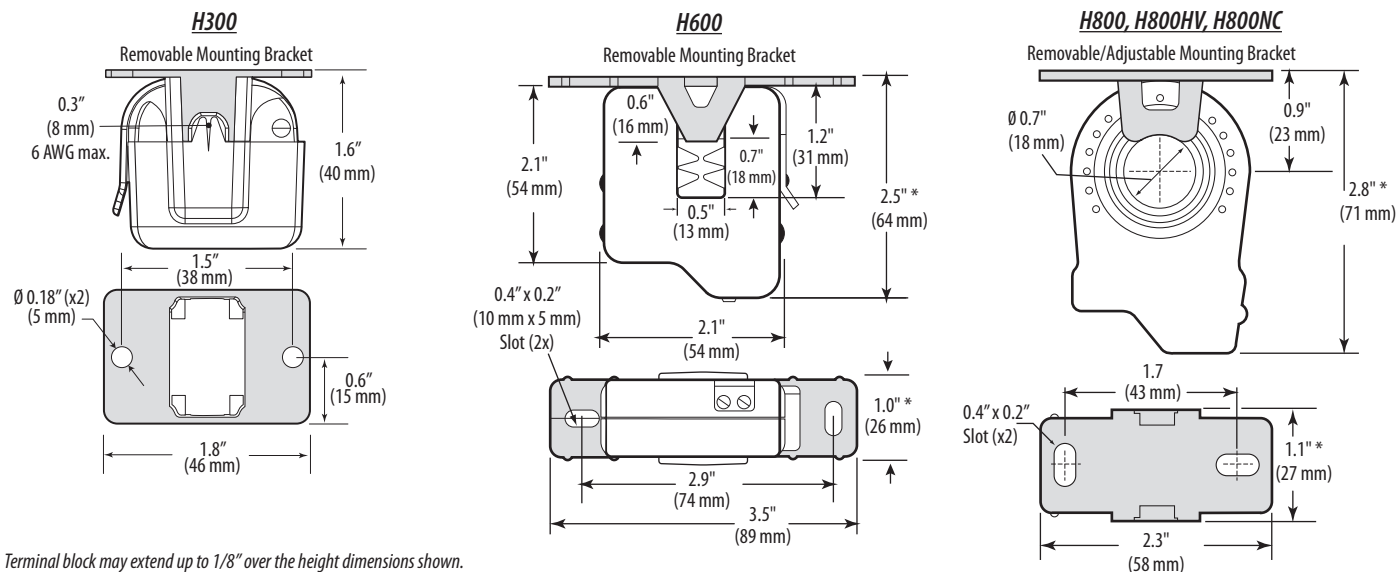
4 in-lbs (7 in-lbs for H300)

Agency Approvals

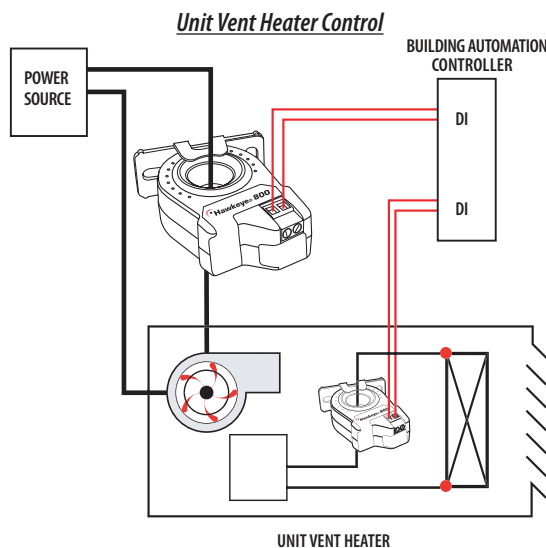
UL 508 open device listing; CE:EN61010-1:2001-02, CAT III, deg. 2, basic insulation

Do not use the LED status indicators as evidence of applied voltage.

DIMENSIONAL DRAWINGS



APPLICATION/WIRING DIAGRAM



ORDERING INFORMATION



MODEL	AMPERAGE RANGE	STATUS OUTPUT (max.)	TRIP POINT	HOUSING	UL	CE	RoHS
H300	0.15 - 60A	N.O. 1.0A@30VAC/DC	0.15A or less	Split-core	●	● ²	●
H600	0.15 - 200A	N.O. 1.0A@30VAC/DC	0.15A or less	Split-core	● ¹	●	●
H800	0.25 - 200A	N.O. 1.0A@30VAC/DC	0.25A or less	Solid-core	● ¹	●	●
H800NC	0.5 - 200A	N.C. 0.1A@30VDC	0.5A or less	Solid-core	● ¹		●
H800HV	0.75 - 200A	N.O. 0.5A@250VAC/DC	0.75A or less	Solid-core	● ³		
H900	1.5 - 200A	N.O. 1.0A@30VAC/DC	1.5A or less	Split-core	●	●	

¹ Listed for use on 75°C insulated conductors.

² Product provides functional insulation only.

³ Listed for use on 90°C insulated conductors.

ACCESSORIES

DIN Rail Clip Set (AH01, AH27)

DIN Rail (AV01) and DIN Stop Clip (AV02)



Gauge Pressure Sensors



Rugged Stainless Steel Construction

DESCRIPTION

The durable **PG/PV Series** pressure transducers are ideal for a wide variety of HVAC/R and industrial applications, such as refrigeration measurement, pneumatic pressure measurement, gas pressure measurement, pump inlet, and outlet fluid pressure. They are even compatible with extreme applications, such as aerospace and motor sports equipment.

APPLICATIONS

- Pump inlet/outlet and compressors
- Hydraulic/pneumatic systems
- Energy & water management
- Refrigeration equipment, fluids
- Gas pressure measurement

FEATURES

- Rugged stainless steel construction (PG and PV)
- No silicon oil, no internal O-rings, no welds...fewer parts to fail
- Sturdy construction...suitable for high shock and vibration applications
- A wide operating temperature range of -40° to 85°C (-40° to 185°F) for operation versatility

SPECIFICATIONS

5 Year
Warranty

Electrical:

Supply Voltage	10-28VDC
Output	Deluxe: 0-5/0-10VDC (3-wire) or 4-20mA (2-wire) ; Economy: 1-5VDC (3 wire) or 4-20mA (2-wire)
Load Impedance	>100 kΩ
Standard Connection	Cable gland 24" (600 mm) length
Pressure Port	1/4" NPT Male

Performance at 25°C (77°F):

Accuracy*	Deluxe: $\pm 0.25\%$ BFLS **; Economy: $\pm 0.50\%$ BFLS **
Media Compatibility	Fluids & gases compatible with 316L stainless steel
Pressure Cycles	>100 million cycles
Over Pressure	2x F.S. without change in calibration
Burst Pressure	5x rated pressure or 20,000 psi

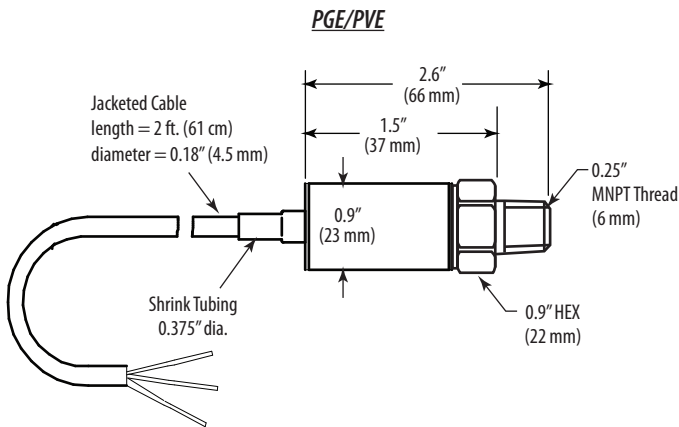
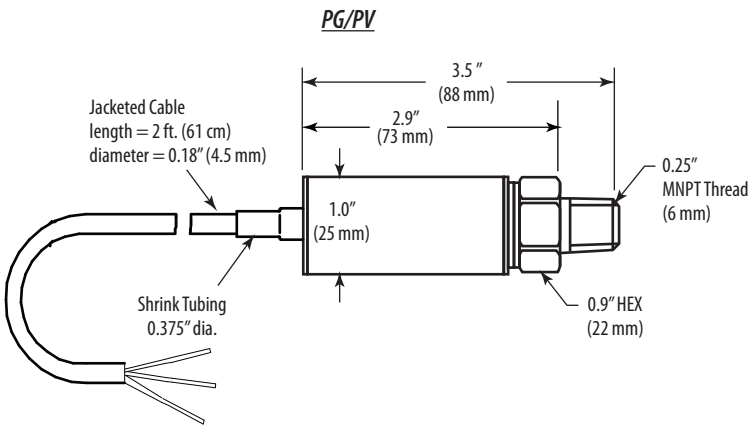
Environmental:

Shock	100G, 11 msec, 1/2 sine
Vibration	Deluxe: 20G peak, 20 to 2400 Hz; Economy: 10G peak, 20 to 2000 Hz
EMI/RFI Protection	Deluxe: yes; Economy: no
Rating	Deluxe: IP-66; Economy: IP-65
Operating Temperature Range	-40° to 85°C (-40° to 185°F)
Compensated Temperature Range	0° to 55°C (32° to 130°F)
Total Error Band Over Temperature	< $\pm 1\%$ of FS
Humidity	0-95% RH noncondensing

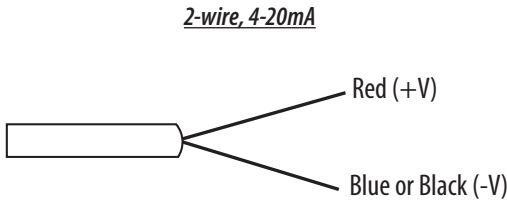
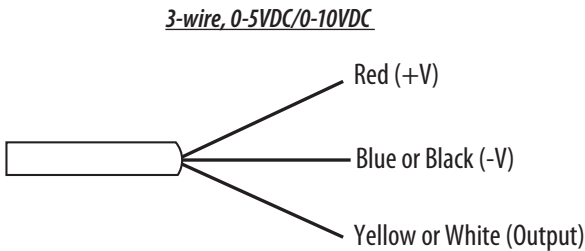
* Accuracy includes nonlinearity and hysteresis.

** BFLS = Best fit straight line

DIMENSIONAL DRAWINGS



WIRE COLOR CODING



ORDERING INFORMATION



Type	Range	Wetted Material	Output	Type	Range	Wetted Material	Output
PG		A		PV		A	
Blank = Deluxe E = Economy	03 = 0 to 15 psig (Deluxe only) 04 = 0 to 25 psig 05 = 0 to 50 psig 06 = 0 to 75 psig 07 = 0 to 100 psig 08 = 0 to 250 psig 09 = 0 to 500 psig 10 = 0 to 1000 psig 11 = 0 to 5000 psig 12 = 0 to 10000 psig	= 316L stainless steel	B = 1-5VDC (economy only) M = 4-20mA V = 0-10VDC (deluxe only) J = 0-5VDC (deluxe only)	Blank = Deluxe E = Economy	03 = -14.7 to 15 psig (Deluxe only) 04 = -14.7 to 25 psig 05 = -14.7 to 50 psig 06 = -14.7 to 75 psig 07 = -14.7 to 100 psig 08 = -14.7 to 250 psig 09 = -14.7 to 500 psig 10 = -14.7 to 1000 psig 11 = -14.7 to 5000 psig 12 = -14.7 to 10000 psig	= 316L stainless steel	B = 1-5VDC (economy only) M = 4-20mA V = 0-10VDC (deluxe only) J = 0-5VDC (deluxe only)
Example: PG 07 A V				Example: PV E 07 A M			
Call factory for ranges not shown.				Call factory for ranges not shown.			