

ZS Sensors

Technical Instructions

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





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Contents

What are ZS sensors?	1
Rnet configuration	6
Rnet wiring specifications	7
Power requirements	8
ZS zone sensors	9
Specifications for ZS zone sensors	9
CO2 sensor installation	11
Motion sensor installation	11
To address a ZS zone sensor	11
To wire and mount a ZS zone sensor	12
To communicate through a ZS zone sensor's local access port	13
To set up a Local Access connection in the WebCTRL® interface	14
Troubleshooting a ZS Pro or ZS Pro-F	15
ZS duct sensors	16
Specifications for ZS duct sensors	17
To address a ZS duct sensor	18
To mount a ZS duct temperature or temperature/humidity sensor	18
To mount a ZS duct averaging temperature sensor	20
To wire a ZS duct sensor	21
Humidity filter maintenance	23
ZS pipe clamp-on temperature sensor	23
Specifications for ZS pipe temperature sensor	23
To address a ZS pipe temperature sensor	24
To mount a ZS pipe temperature sensor	25
To wire a ZS pipe temperature sensor	26
ZS immersion temperature sensor	28
Specifications for ZS immersion temperature sensor	28
To address a ZS immersion temperature sensor	29
To mount a ZS immersion temperature sensor	29
To wire a ZS immersion temperature sensor	31
ZS outdoor air temperature sensors	32
Specifications for ZS outdoor air sensors	33
To address a ZS outdoor air temperature sensor	34
To mount a ZS outdoor air temperature sensor	34
To wire a ZS outdoor air sensor	36
Humidity filter maintenance	37
To format a ZS Sensor	37
Document revision history	38

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 *

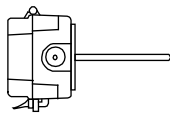


Temperature/Humidity Sensor

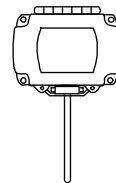
- Bottom probe *



* 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

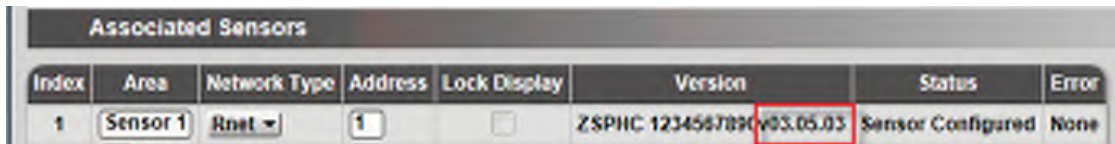
- You can have any combination of ZS and wireless sensors, but no more than 15 sensors total.
- You can have no more than 5 sensors per control program.

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.

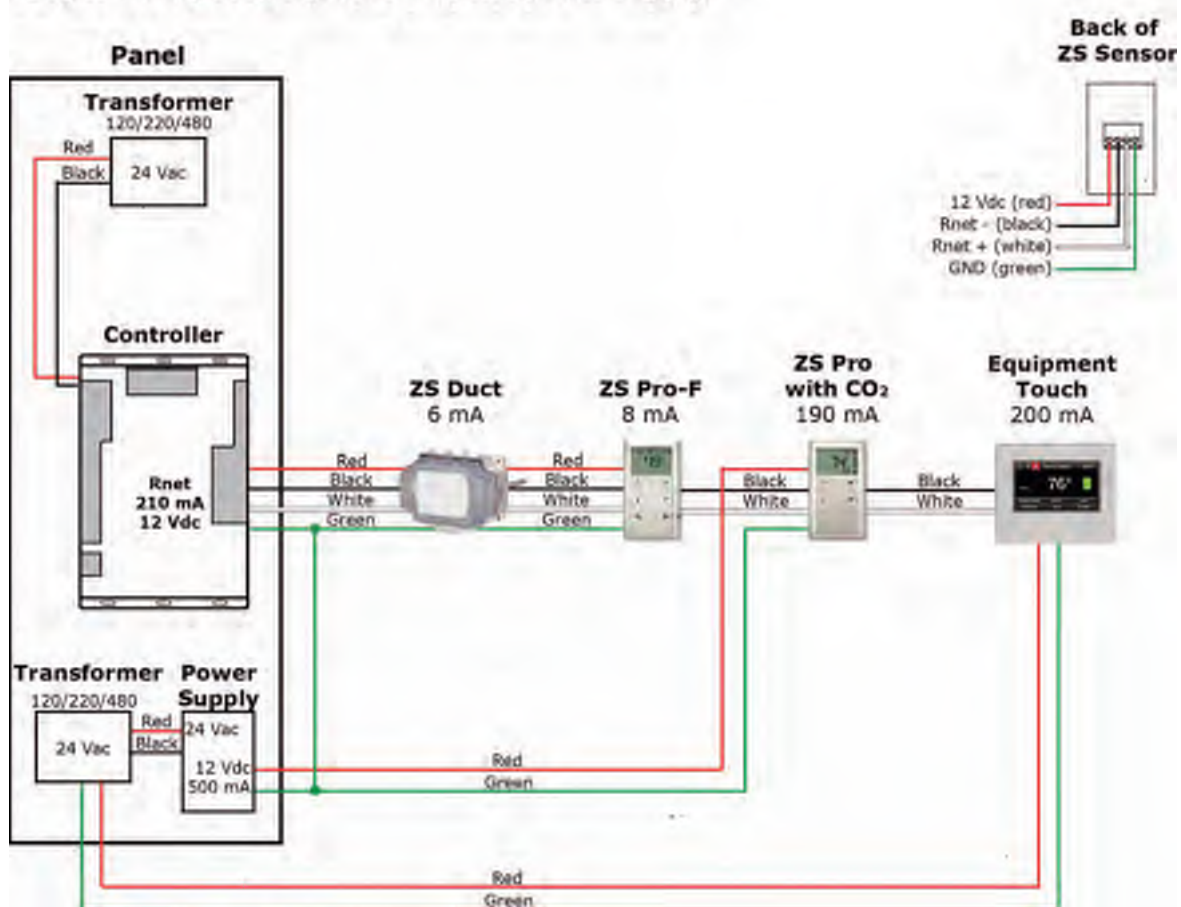
NOTE Use the specified type of wire and cable for maximum signal integrity.

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



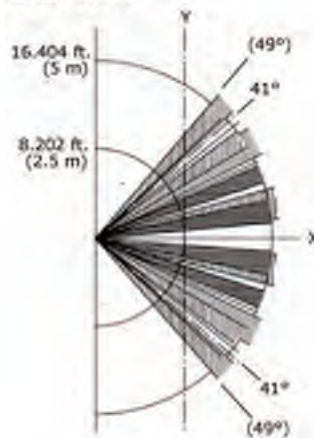
ZS Pro-F



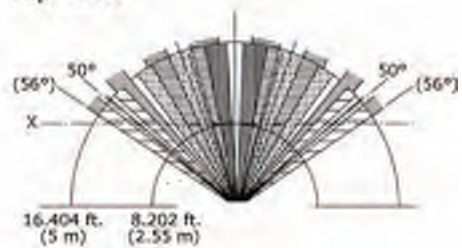
Specifications for ZS zone sensors

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.

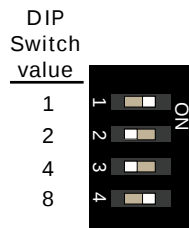
Avoid placing the sensor:

- 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.



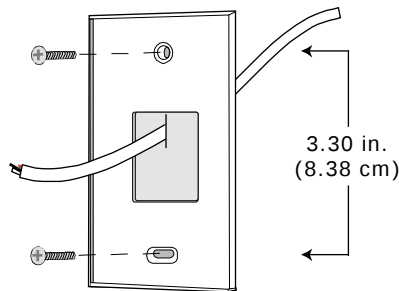
EXAMPLE DIP switches 1 and 4 above are on. Their values (1 + 8) total 9, so the sensor's address is 9.

To wire and mount a ZS zone sensor

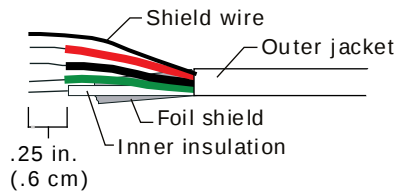
The Rnet communicates at a rate of 115 kbps and should be wired in a daisy-chain, star, or hybrid configuration.

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.

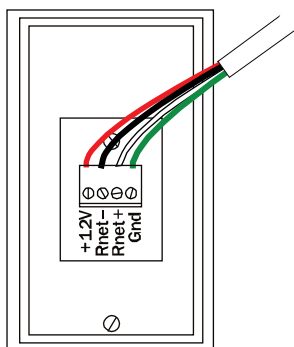
- 1 Turn off the controller's power.
- 2 Pull the backplate off the ZS Sensor. You may need to turn the setscrews in the bottom of the sensor clockwise until you can remove the backplate.
- 3 Pull the Rnet communication cable through the slit in the insulated backing material.



- 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.

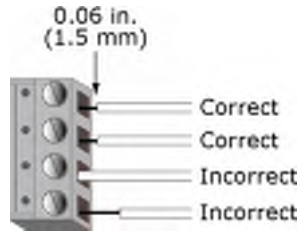


Automated Logic® recommends that you use the following Rnet wiring scheme:

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.

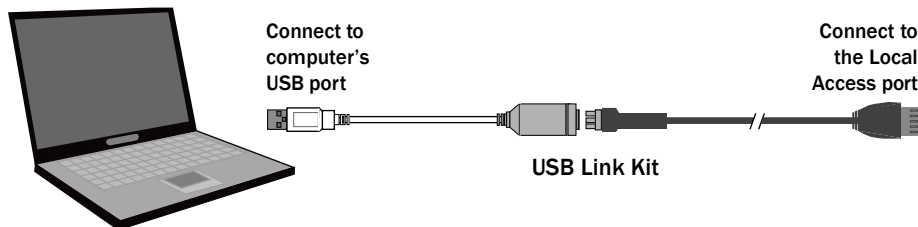
PREREQUISITES

- 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.



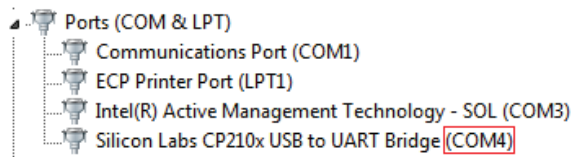
NOTE If using a USB isolator, plug the isolator into your computer's USB port, and then plug the USB Link Kit cable into the isolator.

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:

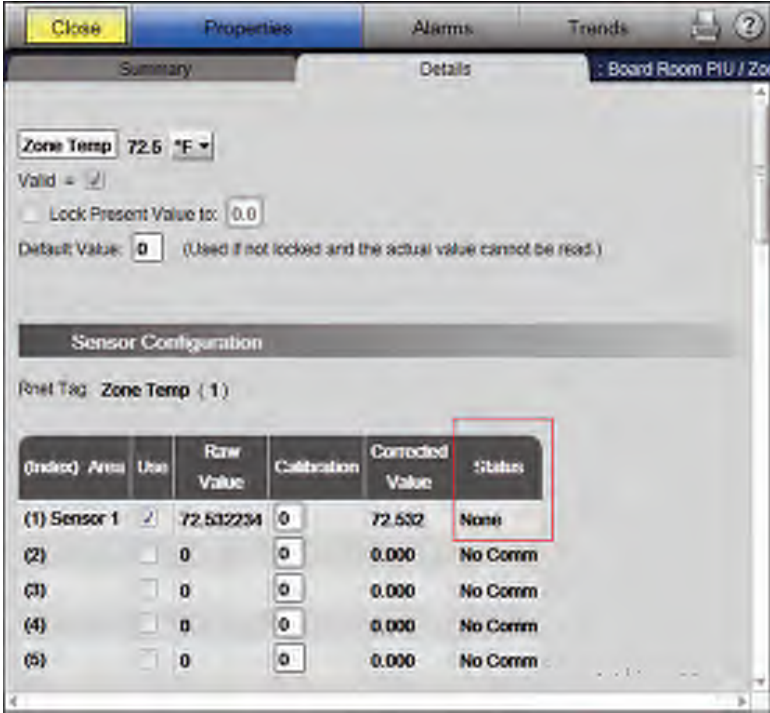
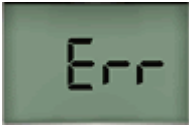
- 1 On the **System Configuration**  tree, select **Connections**.
- 2 On the **Configure** tab, click **Add**.
- 3 From the **Type** drop-down list, select **BACnet Local Access**.
- 4 Optional: Edit the **Description**.
- 5 Type the computer's **Port** number that the USB cable is connected to.

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. 
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 *

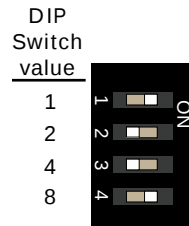
* Sensors with back probes (as shown) are to be mounted on the outside of ductwork. Sensors with bottom probes are to be mounted on the inside of ductwork.

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

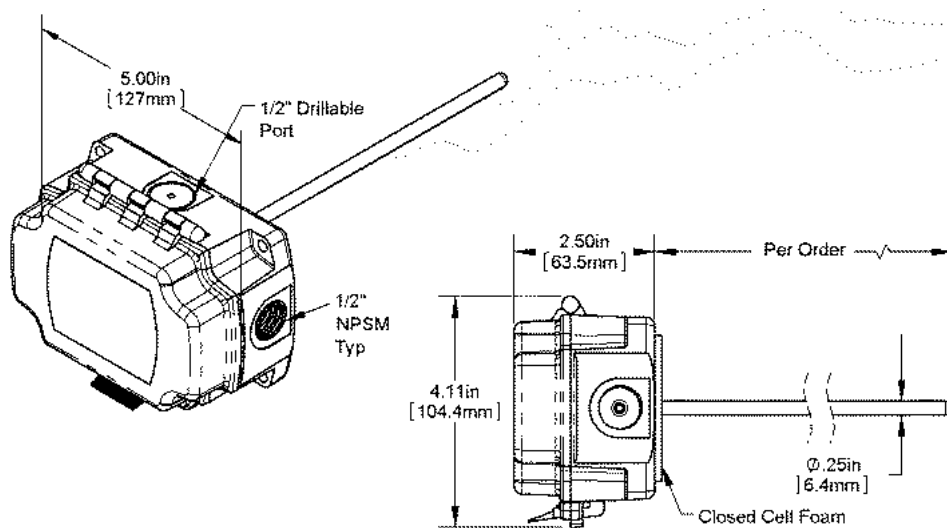
Each ZS Sensor on an Rnet must have a unique address, but addresses do not have to be sequential. Open the hinged cover on the sensor enclosure, and then use the DIP switches to set an address from 0 to 14. (0 is factory default.) Each DIP switch has the value shown in the figure below. Turn on as many DIP switches as you need so that their total value equals the address.



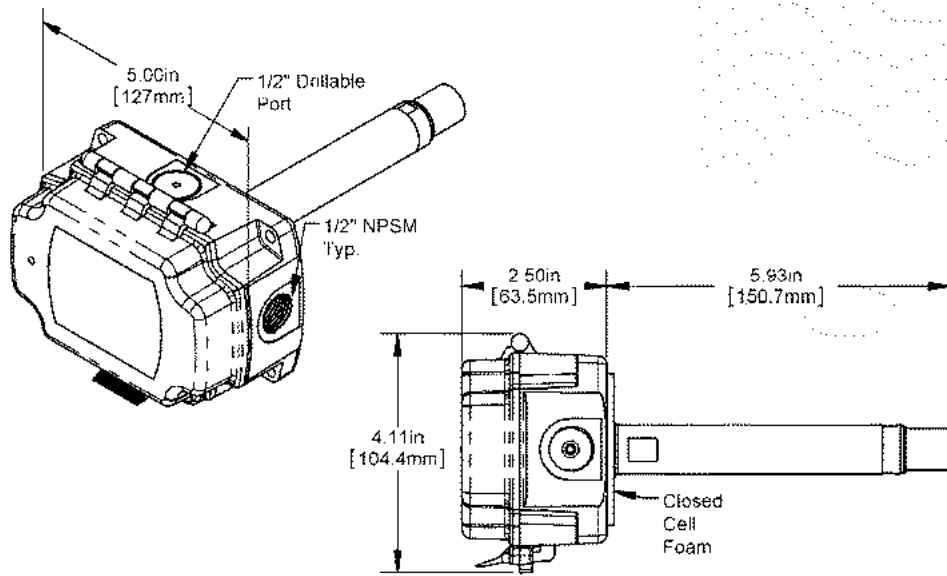
EXAMPLE DIP switches 1 and 4 above are on. Their values (1 + 8) total 9, so the sensor's address is 9.

To mount a ZS duct temperature or temperature/humidity sensor

Temperature sensor

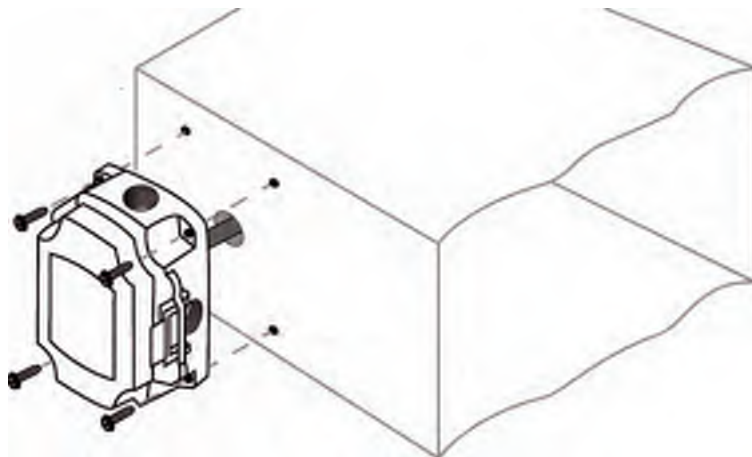


Temperature/Humidity sensor



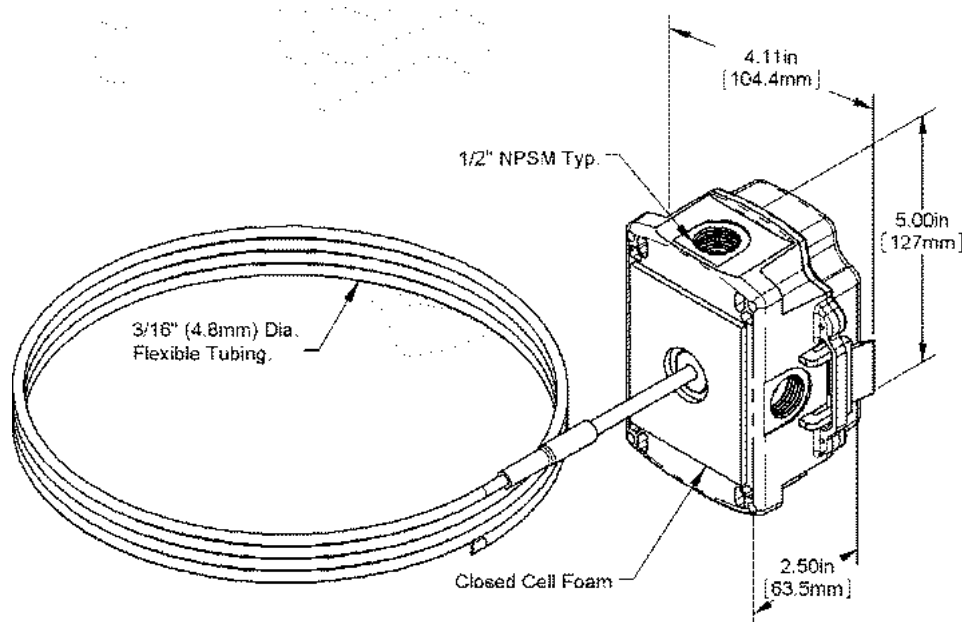
- 1 Determine the best location on the duct for the sensor. Mount the sensor:
 - In the middle of the duct away from temperature stratified air, coils, or humidifiers
 - At least 3 duct diameters away from humidifiers.
- 2 Unlatch and open the hinged door on the sensor's enclosure.
- 3 Remove the sensor's 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.



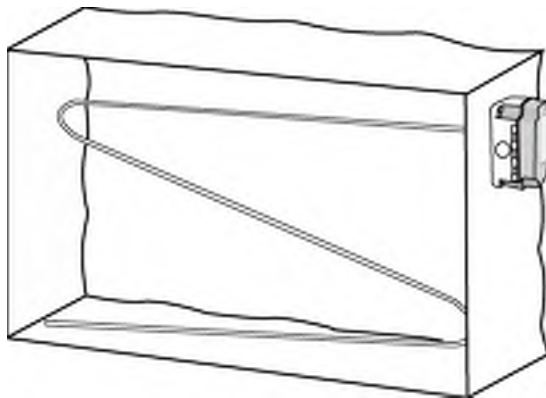
- 9 Tighten the screws so that the foam backing on the enclosure is depressed to prevent air leakage, but do not overtighten or strip the screw threads.

To mount a ZS duct averaging temperature sensor

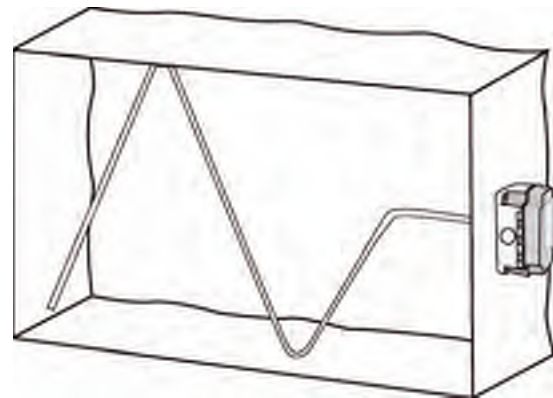


- 1 Determine the best location on the duct for the sensor. Mount the sensor in the middle or top of the duct as shown below so that the flexible probe can enter the duct in a convenient place.
- 2 Unlatch and open the hinged door on the sensor's enclosure.
- 3 Remove the sensor's knockout that is appropriate 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 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

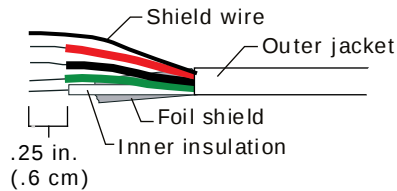
To wire a ZS duct sensor

NOTES

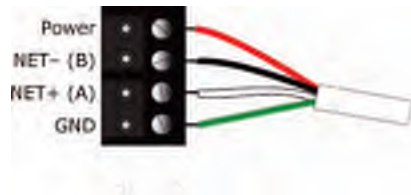
- Do not drill into the sensor's watertight enclosure which will violate the NEMA and/or IP rating.
- Use caulk or Teflon tape for your conduit entries to maintain the appropriate NEMA or IP rating for your application.
- For outdoor or wet applications, conduit entry should be from the bottom of the 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.

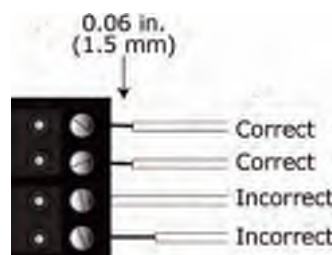


Automated Logic® recommends that you use the following Rnet wiring scheme:

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



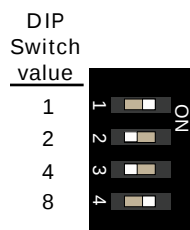
Specifications for ZS pipe temperature sensor

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

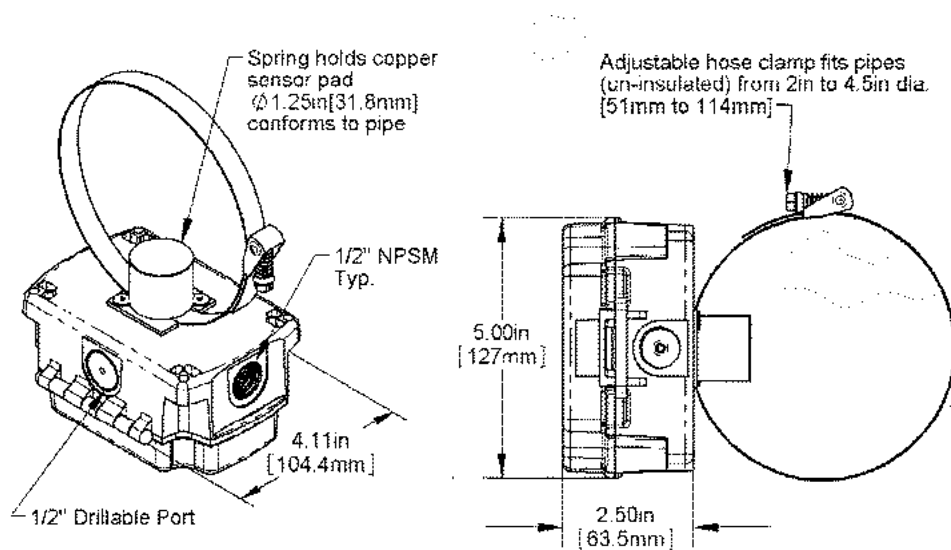
To address a ZS pipe temperature sensor

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.



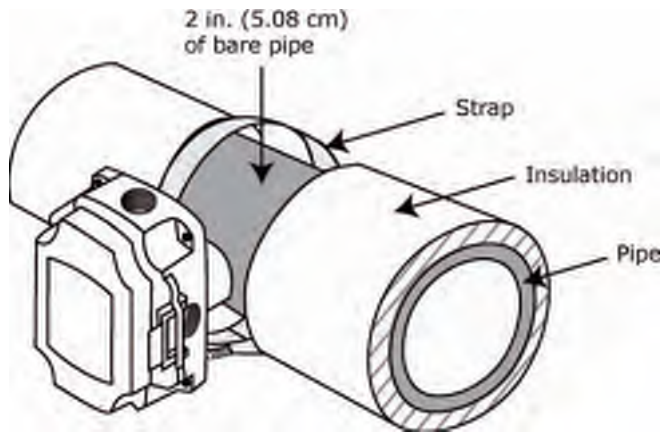
EXAMPLE DIP switches 1 and 4 above are on. Their values (1 + 8) total 9, so the sensor's address is 9.

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.



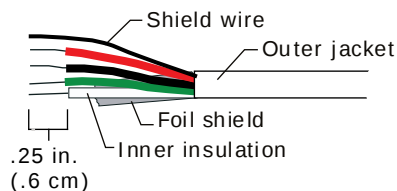
To wire a ZS pipe temperature sensor

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.

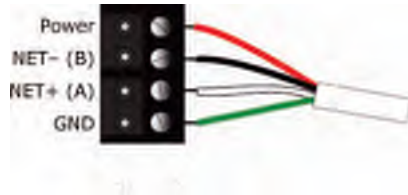
PREREQUISITE The Rnet cable is wired to the controller. The shield wire and the ground wire should be inserted into the controller's GND terminal.

- 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.

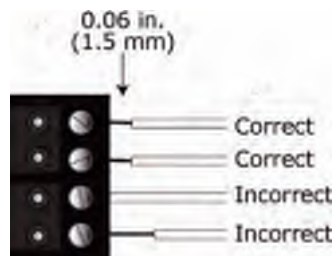
- 6 If wiring 1 cable to the sensor, cut the shield wire off at the outer jacket, then wrap the cable with tape at the outer jacket to cover the end of the shield wire.
If wiring 2 cables in a daisy-chain configuration, twist together the shield wires, then wrap the shield wires with tape.
- 7 Insert 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

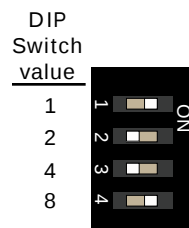
Specifications for ZS immersion temperature sensor

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

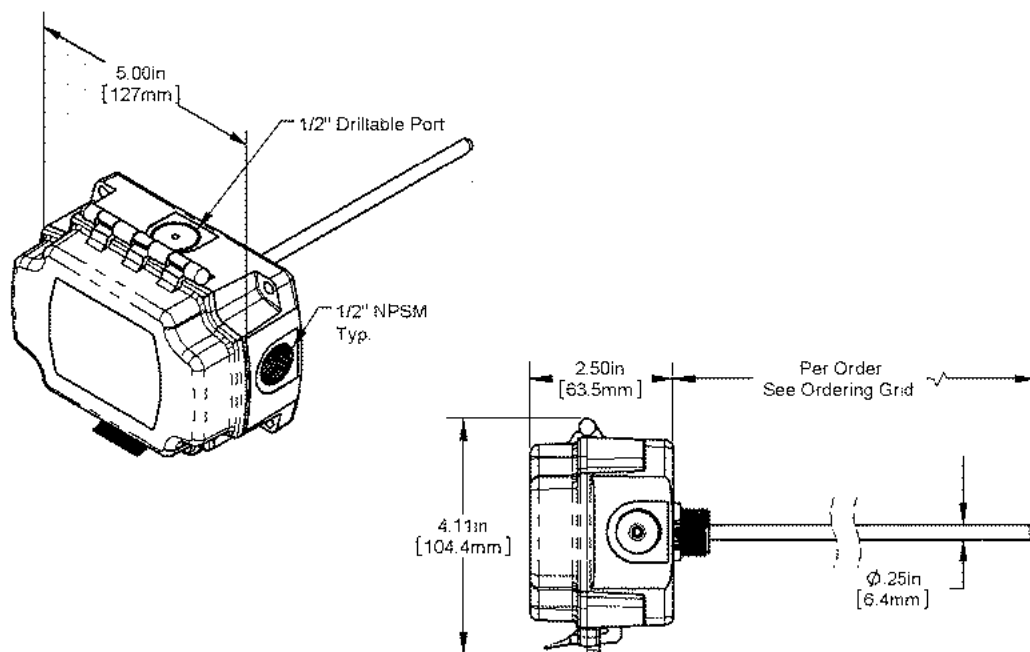
To address a ZS immersion temperature sensor

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.

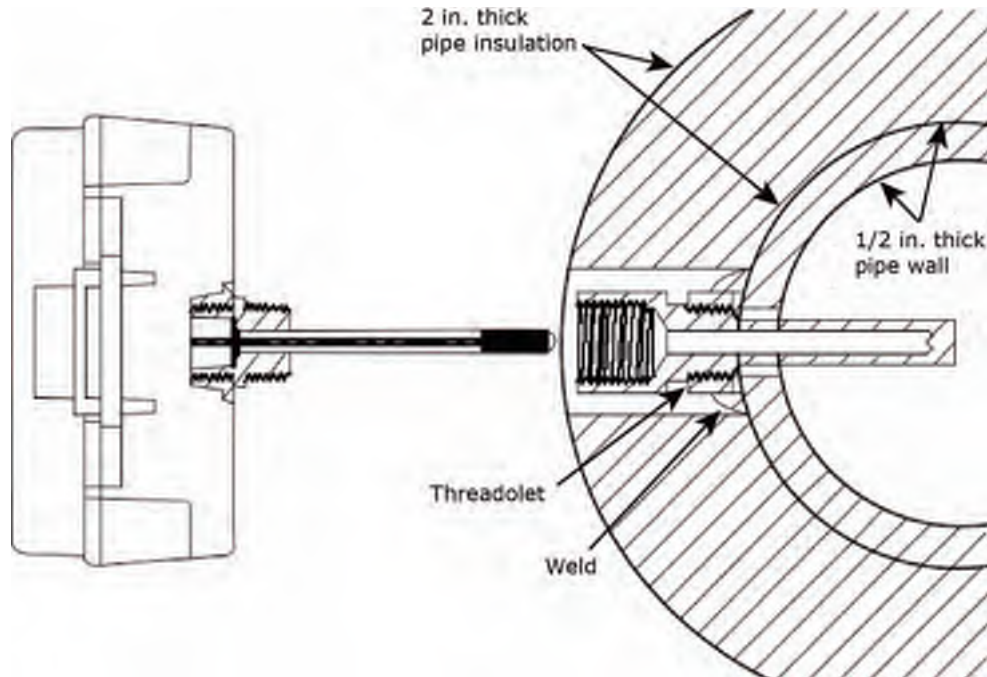


EXAMPLE DIP switches 1 and 4 above are on. Their values (1 + 8) total 9, so the sensor's address is 9.

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.

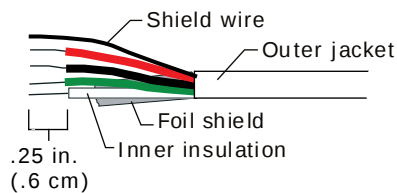
To wire a ZS immersion temperature sensor

NOTES

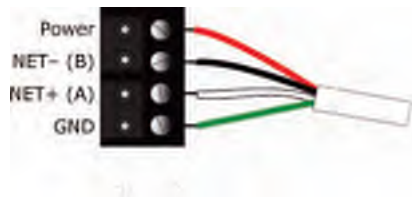
- Do not drill into the sensor's watertight enclosure which will violate the NEMA and/or IP rating.
- Use caulk or Teflon tape for your conduit entries to maintain the appropriate NEMA or IP rating for your application.
- For outdoor or wet applications, conduit entry should be from the bottom of the 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.

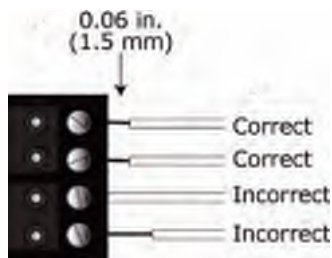


Automated Logic® recommends that you use the following Rnet wiring scheme:

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

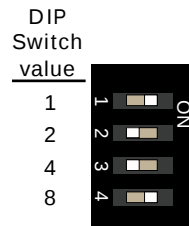


Specifications for ZS outdoor air sensors

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

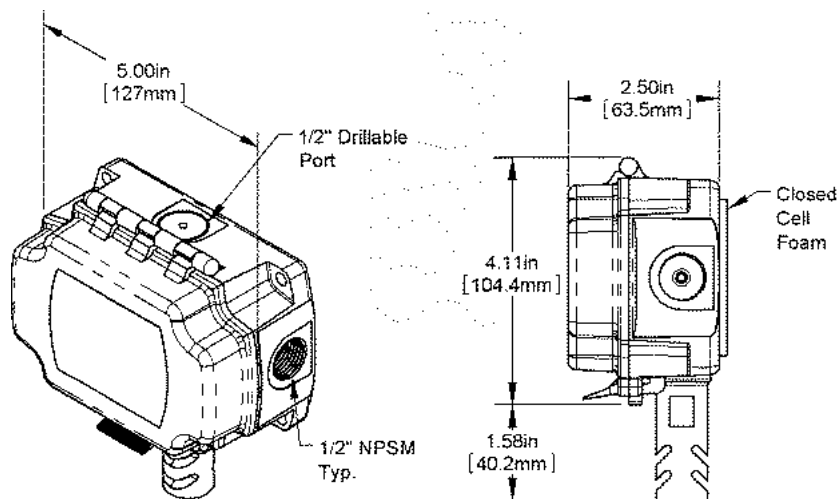
Each ZS Sensor on an Rnet must have a unique address, but addresses do not have to be sequential. Open the hinged cover on the sensor enclosure, and then use the DIP switches to set an address from 0 to 14. (0 is factory default.) Each DIP switch has the value shown in the figure below. Turn on as many DIP switches as you need so that their total value equals the address.



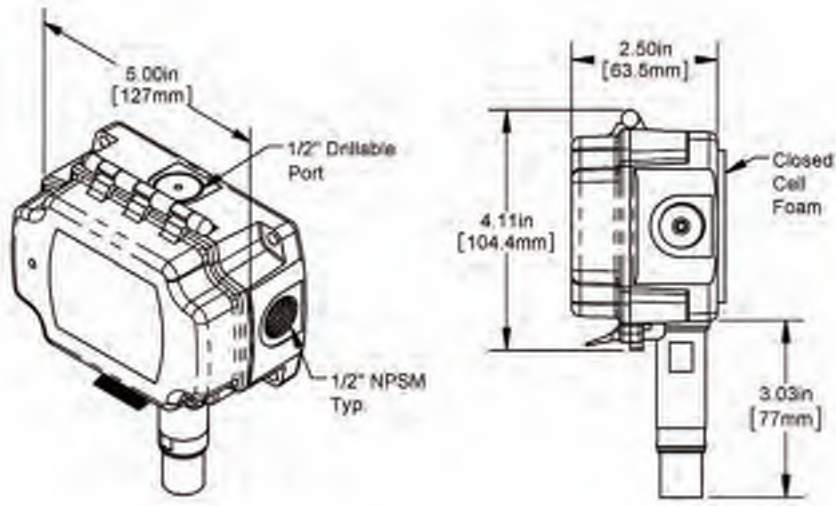
EXAMPLE DIP switches 1 and 4 above are on. Their values (1 + 8) total 9, so the sensor's address is 9.

To mount a ZS outdoor air temperature sensor

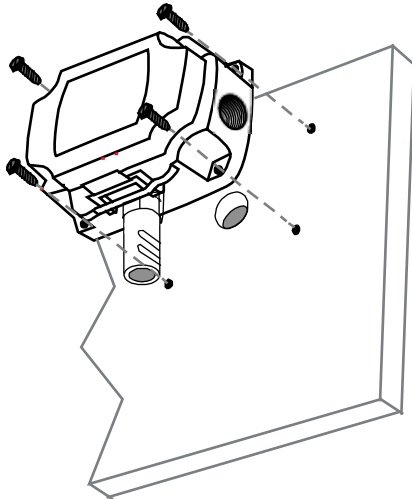
Outside Air Temperature sensor



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.

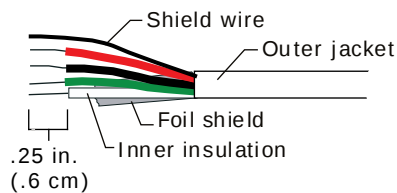
To wire a ZS outdoor air sensor

NOTES

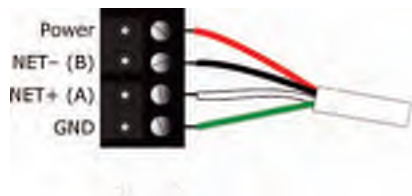
- Do not drill into the sensor's watertight enclosure which will violate the NEMA and/or IP rating.
- Use caulk or Teflon tape for your conduit entries to maintain the appropriate NEMA or IP rating for your application.

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.

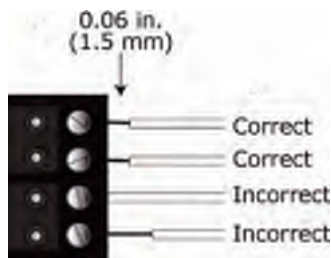


Automated Logic® recommends that you use the following Rnet wiring scheme:

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