A421 Series Standard Electronic Temperature Controls with and without Power Cords

Product Bulletin

A421ABC-x, A421ABG-x, A421ABJ-x, A421AEC-x,
A421AEJ-x, A421GBF-x, A421GEF-x

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Description

The A421 Series controls are single stage, electronic temperature controls with a single-pole, double-throw (SPDT) output relay. The controls feature an adjustable backlit LCD for viewing the temperature and status of other functions, and a three-button touchpad for setup and adjustment. An LED indicates the On/Off status of the output relay.

The A421 controls are available in low voltage 24 VAC and high voltage 120 or 240 VAC models, which provide options for most refrigeration and HVAC applications.

The A421 controls provide heating or cooling control, sensor offset, temperature setback, adjustable anti-short cycle delay, and a restricted user adjustment mode. The temperature units can be displayed in °F or °C. The temperature adjustment range is -40 to 212°F or -40 to 100°C.

The A421 controls are available in Type 1/IP20 high-impact plastic enclosures suitable for surface or DIN rail mounting and Type 4X/IP66 watertight, corrosion-resistant surface mount enclosures. See Figure 1 through Figure 3.

Figure 1: Standard Temperature Control with NEMA Type 1/IP20 Enclosure

Some A421 Series control models are equipped with factory-installed power cords. The power cords provide convenient plug-in connection and control of 120 VAC heating and cooling equipment.

Table 1: Features and Benefits (Part 1 of 2)

Features	Benefits
Control Front Panel LCD	Displays the temperature, parameters, and status and allows you to adjust the backlight intensity for ambient light conditions. Custom icons display the system and control status.
Basic and Advanced Programming Menu	Provides two levels of parameter adjustment and control setup, allowing you to set up advanced features in one menu and easily adjust basic parameters in the other menu.
On/Off Temperature Adjustment	Allows you to select the temperature values at which the relay turns On and Off, which automatically defines the Heating or Cooling mode of operation.
Switch-Activated Temperature Setback	Allows you to shift the On/Off temperature by an adjustable setback value. When a user-supplied switch closes the binary input control circuit, the control operates at the defined setback temperatures.
Adjustable Anti-Short Cycle Delay	Allows you to select the minimum time the output relay remains off before the next on cycle; avoiding short cycling, hard starts, and nuisance overload outages on compressors and other inductive applications.
Adjustable Sensor Offset	Allows you to adjust the displayed temperature to the actual sensed temperature.

Table 1: Features and Benefits (Part 2 of 2)

Features	Benefits
Optional Restricted Adjustment Mode	Allows you to restrict the On/Off adjustment to your defined temperature range.
Sensor Failure Mode	Allows you to select the relay On/Off state in the event of a sensor or sensor wire failure.
Backlight Brightness Level	Allows you to adjust the LCD backlight intensity.

Applications

IMPORTANT: Use this A421 Series Electronic Temperature Control only as an operating control. Where failure or malfunction of the A421 Series Control could lead to personal injury or property damage to the controlled equipment or other property, additional precautions must be designed into the control system. Incorporate and maintain other devices, such as supervisory or alarm systems or safety or limit controls, intended to warn of or protect against failure or malfunction of the A421 Series Control.

The A421 Electronic Temperature Control can be used to control a wide variety of single-stage refrigeration or HVAC equipment. See Table 2 for application information by control type.

Sample temperature control applications include:

- temperature monitoring and alarming

- on/off control of boilers and chillers

- boiler and chiller pump control

- heating or cooling control

- cooling tower fan control based on water temperature

- supply, makeup, and mixed air temperature control

- temperature actuated valve control

- supply and makeup air damper and fan control

- condenser fan control based on condenser temperature.

Figure 2: Standard Temperature Control with Type 4X/IP66 Enclosure

Figure 3: Corded Temperature Controls with Type 1/IP20 and Type 4X/IP66 Enclosures

Table 2: Applications by A421 Control Type

Control Type	Application Family	Wholesale	Agricultural	Beverage	Chillers	Data Center	Economizer	Food Service	HVAC	Ice Machines	Process	Refrigeration	Signage	Space Heating	Transportation	Ventilation
A421ABC	Standard	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
A421ABG	Power Cord[1]		X	X				X		X	X	X		X		X
A421ABJ	Power Cord[2]		X	X				X		X	X	X		X		X
A421AEC	Standard	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
A421AEJ	Power Cord[2]		X	X				X		X	X	X		X		X
A421GBF	Standard	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
A421GEF	Standard	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

1. This type features two power cords (male and female outlets on separate cords). Typical heating applications include salamander and torpedo heaters, and other portable, plug-in heating equipment in construction and agriculture applications. Typical cooling applications include controlling home freezers and refrigerators for home brewing, fermentation, and product storage applications.
2. This type features a single power cord (male and female outlets on the same cord).

Dimensions

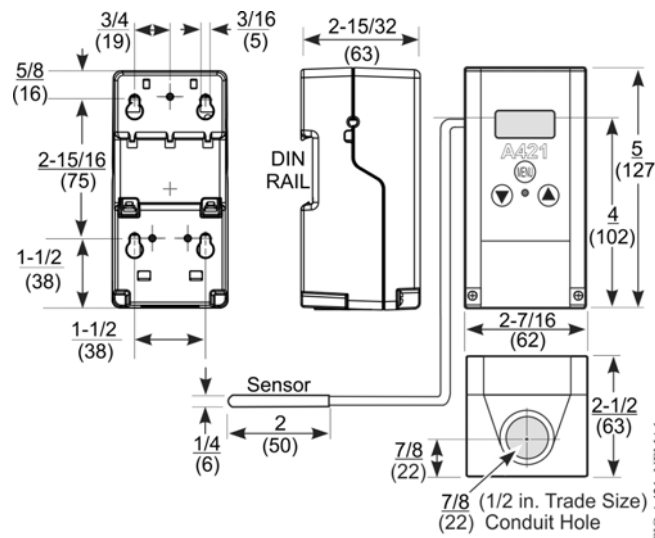### *Type 1/IP20 Enclosures*

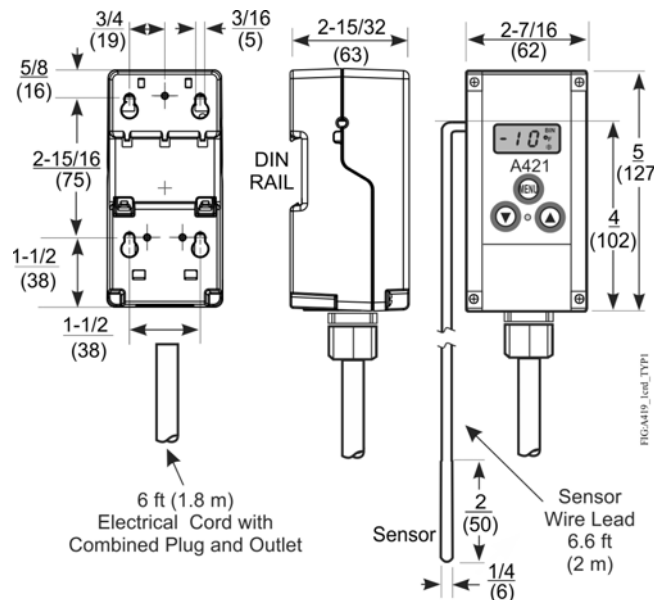**Figure 4: A421ABx and A421GBx Controls, Dimensions, in. (mm)**

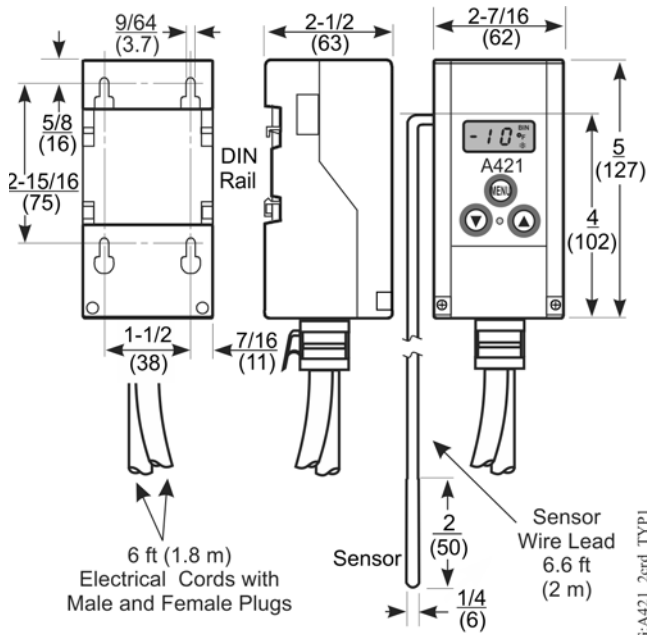**Figure 5: A421ABJ Control with One Power Cord, Dimensions, in. (mm)**

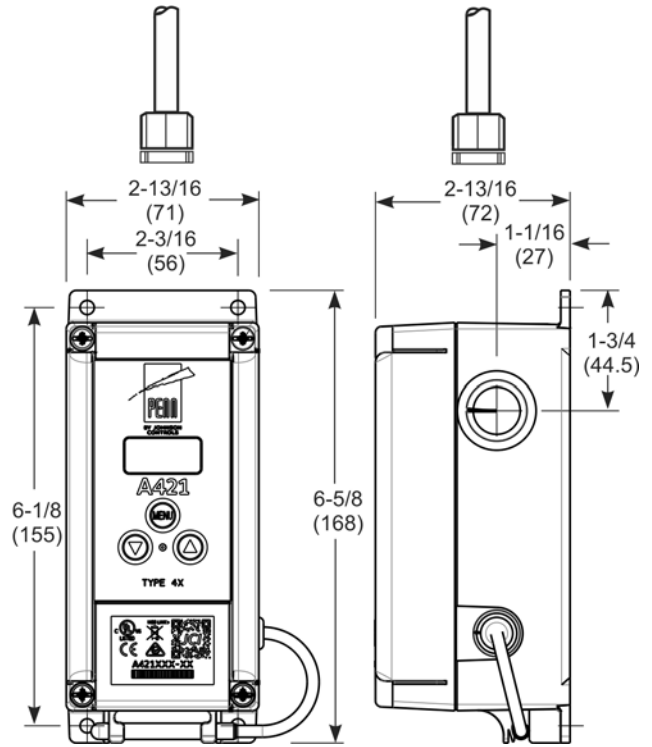**Figure 6: A421ABG Control with Two Power Cords, Dimensions, in. (mm)**

Type 4X/IP66 Watertight, Corrosion-Resistant Enclosures

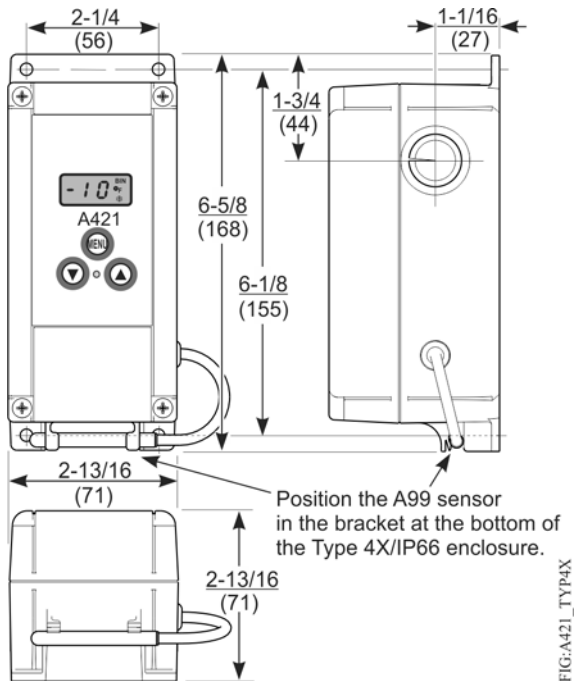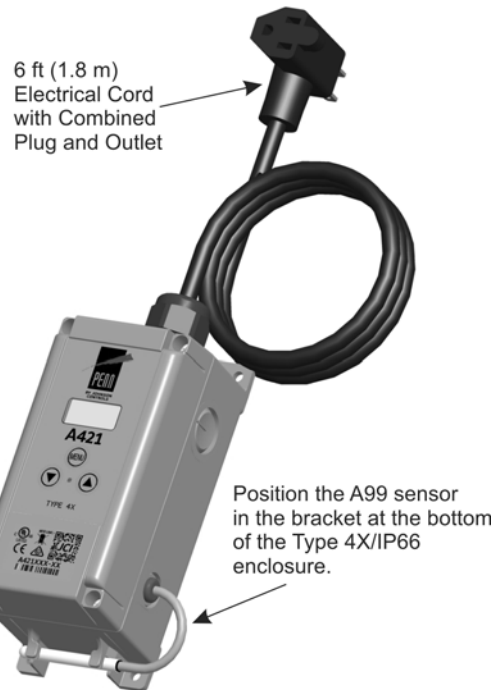**Figure 7: A421AEx and A421GEx Controls, Dimensions, in. (mm)**

Figure 8: A421ABJ Control A99 Sensor and Bracket with Power Cord, Dimensions, in. (mm)

Figure 9: A421ABJ Control A99 Sensor and Bracket with Power Cord

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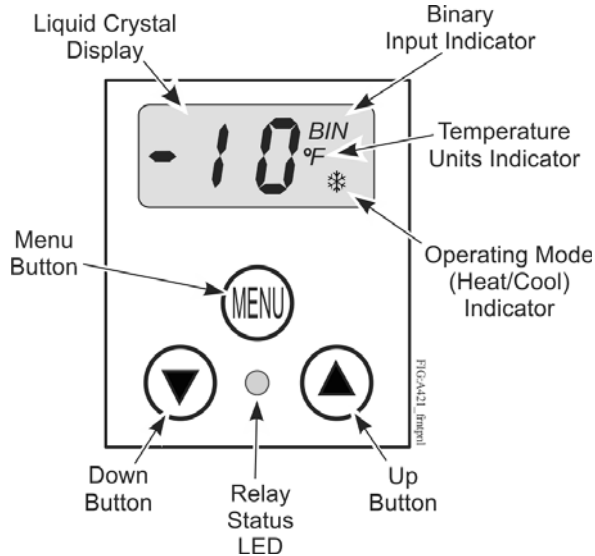
A421 Control User Interface

Figure 10: A421 Series Control Front Panel with LCD Display

Front Panel

The LCD allows you to view the status, parameters, temperature units, operating mode icons (flame = heating mode; snowflake = cooling mode), temperature, units, and binary input.

A three-button touchpad on the front panel allows you to set up the parameters and adjust the control. The menu button allows you to save the values and advance to the next parameter.

A green LED indicator reports the status of the output relay.

Backlight Brightness Level

The backlight brightness level feature allows you to adjust the LCD backlight intensity. At level 0 the backlight is off. Level 10 is the brightest backlight setting and the system default. The selected backlight brightness level is applied to the LCD during normal operation. When you enter the programming menus to set up the control or press any key, the LCD automatically goes to the brightest level. If no key is pressed for 30 seconds the main screen is displayed and the backlight setting reverts to the level you selected.

SPDT Relay Output

The terminals on the TB2 terminal block are connected to an SPDT dry-contact relay in the A421 control. The A421 Electronic Temperature Control can be wired to use the same power source to power the control and power the controlled load. The control can also be wired to control the relay based on the On/OFF temperature values.

Relay De-energized (Off) = LC open to LNO (as shown in Figure 11) and the relay status LED is off

Relay Energized (On) = LC closed to LNO and the relay status LED is on
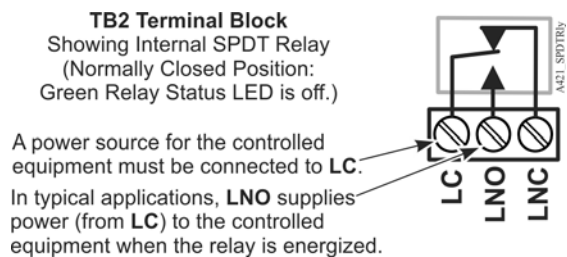
Figure 11: TB2 Terminal Block Showing Connections to the Internal SPDT Relay

Basic and Advanced Programming Menu

The A421 Series controls have a Basic adjustment and an Advanced setup and adjustment menu.

You use the Advanced menu for initial setup of control and adjustment of the advanced A421 control features.

The Basic menu allows you to set up simple applications, and quickly and easily adjust the temperature On and Off values and other basic features.

In Restricted Adjustment Mode, users cannot access either the Basic or Advanced menu, and can only adjust the temperature within the defined adjustment range. See _Restricted Adjustment Mode_ for more information.

Switch-Activated Temperature Setback

The Temperature Setback feature allows you to establish _setback_ temperature On and Off values. The A421 controls load to these effective setback values when the user-supplied switch closes the binary input control circuit, the LCD displays **BIN** in the upper-right corner. The temperature setback is enabled and the control uses the On/Off setback values to control the output relay.

Anti-Short Cycle Delay

The Anti-Short Cycle Delay feature allows you to select the minimum time the output relay remains Off de-energized) before the next on cycle can start (energize).

The delay interval overrides any Load Demand (On) and does not allow the output relay to start until the selected delay interval has elapsed (Figure 12).

This feature is typically used for refrigeration applications to allow the system pressure to equalize before restarting the compressor.
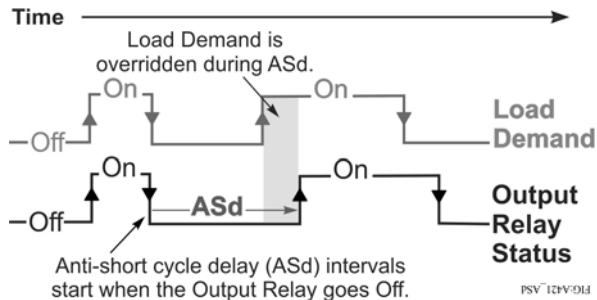

Figure 12: Anti-Short Cycle Delay

Adjustable Sensor Offset

The Sensor Temperature Offset feature allows you to offset the temperature displayed on the LCD from the temperature sensed at the A99 sensor. This feature is useful when the displayed temperature is different from the temperature measured at the sensor.

Restricted Adjustment Mode

The Restricted Adjustment Mode allows you to limit the temperature range over which end users can adjust the control and avoid over-adjustment of your heating or cooling application.

The adjustment range is limited by setting the high and low temperature stop values. See Figure 13.

You can also set the restricted adjustment range equal to the On and Off temperatures to eliminate any temperature adjustment on the control by end users, effectively locking the control adjustment features.
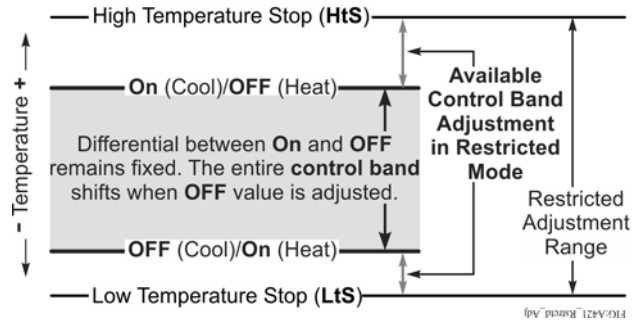

Figure 13: Restricted User Adjustment

Sensor Failure Mode

The Sensor Failure Mode establishes how the A421 control operates the equipment in the event of a sensor or sensor-wiring failure. The A421 control may be set to run the equipment continuously or to shut it down if the sensor or sensor wire fails. When a failure is detected, the LCD flashes *SF* alternately with *OP* if the sensor circuit is **open**, or *SF* and *SH* if the sensor circuit is **shorted**.

Repairs and Replacement

Do not attempt to repair or recalibrate the A421 Series Electronic Temperature Control. In case of a defective or improperly functioning control, contact your nearest Authorized Johnson Controls/PENN® Distributor or Sales Representative.

When contacting your Johnson Controls/PENN distributor, have the model number of the control available. This number can be found on the label inside the cover of the control.

Ordering Information

Table 3 provides ordering information for the A421 Standard and Standard Corded models available through most Johnson Controls/PENN authorized distributors. See Table 4 and Table 5 to order sensors, mounting hardware, and other accessories used to install A421 controls.

Contact your nearest Johnson Controls/PENN Distributor or Sales Representative to order these products.

Contact your local Johnson Controls/PENN representative for more information on options available for high-volume purchase models with specific application requirements.

Table 3: Standard A421 Electronic Temperature Control Selection Chart

Product Code	Description
A421ABC-02C	**Line-Voltage Type 1 Electronic Temperature Control:** Type 1 (NEMA), IP20 standard enclosure for DIN rail and surface-mount applications. Rated for 120/240 VAC. Includes an A99BB-200C temperature sensor with 6.6 ft (2.0 m) cable.
A421ABC-03C	**Line-Voltage Type 1 Electronic Temperature Control:** Type 1 (NEMA), IP20 standard enclosure for DIN rail and surface-mount applications. Rated for 120/240 VAC. Includes an A99BB-300C temperature sensor with 9.75 ft (3.0 m) cable.
A421ABC-04C	**Line-Voltage Type 1 Electronic Temperature Control:** Type 1 (NEMA), IP20 standard enclosure for DIN rail and surface-mount applications. Rated for 120/240 VAC. Includes an A99BB-400C temperature sensor with 13.1 ft (4.0 m) cable.
A421ABC-06C	**Line-Voltage Type 1 Electronic Temperature Control:** Type 1 (NEMA), IP20 standard enclosure for DIN rail and surface-mount applications. Rated for 120/240 VAC. Includes an A99BB-600C temperature sensor with 19.5 ft (6.0 m) cable.
A421ABG-02C	**120 VAC Type 1 Electronic Temperature Control with Dual Power Cords:** Type 1 (NEMA), IP20 enclosure for DIN rail and surface-mount applications, with 6 ft (1.8 m) cord with 120 VAC grounded male plug and 6 ft (1.8 m) cord with 120 VAC grounded female outlet. Rated for 120 VAC. Includes an A99BB-200C temperature sensor with 6.6 ft (2.0 m) cable.
A421AEC-01C	**Line-Voltage Type 4X Electronic Temperature Control:** Type 4X (NEMA), IP66 watertight enclosure for surface-mount applications. Rated for 120/240 VAC. Includes an A99BB-25C temperature sensor with 9-7/8 in. (0.25 m) cable.
A421AEC-02C	**Line-Voltage Type 4X Electronic Temperature Control:** Type 4X (NEMA), IP66 watertight enclosure for surface-mount applications. Rated for 120/240 VAC. Includes an A99BB-200C temperature sensor with 6.6 ft (2.0 m) cable.
A421AEJ-01C	**120 VAC Type 4X Electronic Temperature Control with Piggyback Power Cord:** Type 4X (NEMA), IP66 watertight enclosure for surface-mount applications, with 6 ft (1.8 m) single power cord with 120 VAC combination male/female grounded piggyback plug. Rated for 120 VAC. Includes an A99BB-25C temperature sensor with 9-7/8 in. (0.25 m) cable.
A421AEJ-02C	**120 VAC Type 4X Electronic Temperature Control with Piggyback Power Cord:** Type 4X (NEMA), IP66 watertight enclosure for surface-mount applications, with 6 ft (1.8 m) single power cord with 120 VAC combination male/female grounded piggyback plug. Rated for 120 VAC. Includes an A99BB-200C temperature sensor with 6.6 ft (2.0 m) cable.
A421GBF-02C	**Low-Voltage Type 1 Electronic Temperature Control:** Type 1 (NEMA), IP20 standard enclosure for DIN rail and surface-mount applications. Rated for 24 VAC Class 2, Safety Extra Low Voltage. Includes an A99BB-200C temperature sensor with 6.6 ft (2.0 m) cable.
A421GEF-01C	**Low-Voltage Type 4X Electronic Temperature Control:** Type 4X (NEMA), IP66 watertight enclosure for surface-mount applications. Rated for 24 VAC Class 2, Safety Extra Low Voltage. Includes an A99BB-25C temperature sensor with 9-7/8 in. (0.25 m) cable.
A421GEF-02C	**Low-Voltage Type 4X Electronic Temperature Control:** Type 4X (NEMA), IP66 watertight enclosure for surface-mount applications. Rated for 24 VAC Class 2, Safety Extra Low Voltage. Includes an A99BB-200C temperature sensor with 6.6 ft (2.0 m) cable.

Technical Specifications

Table 4:   A99 Temperature Sensors Selection Chart[1]

Product Code	Description
A99BA-200C	**PTC Temperature Sensor:** Standard probe 2 in. (5.1 cm) with 6.6 ft (2.0 m) shielded PVC cable; Ambient operating temperature range: -40 to 212ºF (-40 to 100ºC)
A99BB-25C	**PTC Temperature Sensor:** Standard probe 2 in. (5.1 cm) with 9-7/8 in. (0.25 m) PVC cable; Ambient operating temperature range: -40 to 212ºF (-40 to 100ºC)
A99BB-200C	**PTC Temperature Sensor:** Standard probe 2 in. (5.1 cm) with 6.6 ft (2.0 m) PVC cable; Ambient operating temperature range: -40 to 212ºF (-40 to 100ºC)
A99BB-300C	**PTC Temperature Sensor:** Standard probe 2 in. (5.1 cm) with 9.8 ft (3.0 m) PVC cable; Ambient operating temperature range: -40 to 212ºF (-40 to 100ºC)
A99BB-400C	**PTC Temperature Sensor:** Standard probe 2 in. (5.1 cm) with 13.1 ft (4.0 m) PVC cable; Ambient operating temperature range: -40 to 212ºF (-40 to 100ºC)
A99BB-600C	**PTC Temperature Sensor:** Standard probe 2 in. (5.1 cm) with 19.7 ft (6.0 m) PVC cable; Ambient operating temperature range: -40 to 212ºF (-40 to 100ºC)
A99BC-25C[1]	**PTC Temperature Sensor:** Standard probe 2 in. (5.1 cm) with 9-7/8 in. (0.25 m) high-temperature silicon cable; Ambient operating temperature range: -40 to 248ºF (-40 to 100ºC)
A99BC-100C[1]	**PTC Temperature Sensor:** Standard probe 2 in. (5.1 cm) with 3.3 ft (1.0 m) high-temperature silicon cable; Ambient operating temperature range: -40 to 248ºF (-40 to 120ºC)
A99BC-300C[1]	**PTC Temperature Sensor:** Standard probe 2 in. (5.1 cm) with 9.8 ft (3.0 m) high-temperature silicon cable; Ambient operating temperature range: -40 to 248ºF (-40 to 120ºC)
A99BC-500C[1]	**PTC Temperature Sensor:** Standard probe 2 in. (5.1 cm) with 16.4 ft (5.0 m) high-temperature silicon cable; Ambient operating temperature range: -40 to 248ºF (-40 to 120ºC)
A99BC-1500C[1]	**PTC Temperature Sensor:** Standard probe 2 in. (5.1 cm) with 49.2 ft (15.0 m) high-temperature silicon cable; Ambient operating temperature range: -40 to 248ºF (-40 to 120ºC)
A99CB-200C	**PTC Temperature Sensor:** Extended probe 6 in. (15.2 cm) with 6.6 ft (2.0 m) PVC cable; Ambient operating temperature range: -40 to 212ºF (-40 to 100ºC)
A99CB-600C	**PTC Temperature Sensor:** Extended probe 6 in. (15.2 cm) with 19.7 ft (6.0 m) PVC cable; Ambient operating temperature range: -40 to 212ºF (-40 to 100ºC)

1.   When any A99 Series Temperature Sensor is connected to a standard A421 control model, the range of displayed temperature values is -40 to 212ºF or -40 to 100ºC.

Table 5:   Accessories for the A421 Controls

Product Code	Description
BKT287-1R	12 in. (305 mm) long DIN rail section
BKT287-2R	36 in. (914 mm) long DIN rail section
PLT344-1R	Two End Clamps for DIN rail sections
A99-CLP-1	Surface Mounting Clip for A99B and A99C Series Temperature Sensors
SHL10-603R	Sun Shield for A99B and A99C Series Temperature Sensors
BOX10A-603R	PVC Enclosure for A99B and A99C Series Temperature Sensors
WEL11A-601R	Immersion well for applying sensor in fluid applications

Table 6: A421 Series Electronic Temperature Controls

Power Consumption	1.8 VA Maximum
Supply Power	24 VAC, 50/60 Hz, Class 2: 108/110/115/120 or 208/230/240 VAC, 50/60 Hz
Ambient Conditions	Type 1/IP20: Operating: -40 to 150°F (-40 to 66°C), 0 to 95% RH Non-condensing Shipping and Storage: -40 to 185°F (-40 to 85°C), 0 to 95% RH Non-condensing
	Type 4X/IP66: Operating: -40 to 140°F or (-40 to 60°C) Shipping and Storage: -40 to 140°F (-40 to 60°C)
Temperature Control Range	-40 to 212°F or (-40 to 100°C)
Sensor Type	A99 PTC temperature sensor, 1,035 ohm at 77°F (25°C)
Sensor Offset Range	±5ºF or ±3ºC
Enclosure Material	Type 1: IP20 High-Impact Thermoplastic or Type 4X: IP66 Watertight, Corrosion-Resistant, High-Impact Thermoplastic **Note:** The cover screws on the enclosures must be torqued to 10 to 12 in·lb (1.1 to 1.4 N·m) to achieve Type 1 or Type 4X rating.
Compliance C E	**North America:** cULus Listed; UL 60730, File E27734; FCC Compliant to CFR47, Part 15, Subpart B, Class B Industry Canada (IC) Compliant to Canadian ICES-003, Class B limits **Europe:** CE Mark – Johnson Controls, Inc. declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive; Low Voltage Directive. **Australia:** RCM Compliant

The performance specifications are nominal and conform to acceptable industry standards. Johnson Controls shall not be liable for damages resulting from misapplication or misuse of its products.

United States Emissions Compliance

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

 - Reorient or relocate the receiving antenna.

 - Increase the separation between the equipment and receiver.

 - Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

 - Consult the dealer or an experienced radio/TV technician for help.

Canadian Emissions Compliance

This Class (B) digital apparatus meets all the requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la Classe (B) respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

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