# A421 Series Electronic Temperature Controls with Off-Cycle Defrost

## Product Bulletin

A421ABD-x, A421AED-x

Refer to the QuickLIT website for the most up-to-date version of this document.

## 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 120 VAC and 240 VAC models.

The A421 Control with Defrost allows you to set up regular, passive defrost periods of 1 to 99 minutes. The defrost interval can range from 2 to 24 hours, or be set to 0 (no defrost interval). You can also start or stop a defrost cycle in two ways: using the three-button touchpad on the Advanced Menu or connect a momentary switch to the Binary Input (BIN).

This A421 Control with Defrost also provides 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 2.



**Figure 1: A421 Temperature Control with NEMA Type 1/IP20 Enclosure**

The control housing base on the Type 4X/IP66 models can be easily rotated 180º relative to the control housing cover and LCD, allowing you to bring the electrical connection to either the top or bottom of the mounted control. Do not twist the wiring harness between the housing base and cover more than 180º.

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

| Features | Benefits |
| --- | --- |
| **Off-Cycle Defrost** | Allows you to shut off the refrigeration system for defined defrost time interval and frequency. You can also start or stop a manual only defrost off-cycle. |
| **Control Front Panel LCD** | Displays the temperature, parameters, and status and allows you to adjust backlight brightness 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 set up, 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 mode of operation. |
| **Switch-Activated Temperature Setback** | Allows you to shift the On/Off temperature by an adjustable setback. When a user-supplied switch closes the binary input control circuit, temperature setback is enabled. |

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

| Features | Benefits |
|---|---|
| Adjustable Anti-Short Cycle Delay | Allows you to select the minimum time the output relay remains off before the next on-cycle. By selecting this minimal time, you can avoid 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. |
| Optional Restricted Adjustment Mode | Allows you to restrict On/Off adjustment to your defined temperature range. |
| Sensor Failure Mode | Allows you to run the control continuously in the event of a sensor or sensor wire failure or to shut it down. |
| Backlight Brightness Level | Allows you to adjust the brightness of the backlighting of the LCD screen. The backlight brightness level is applied during normal operation. When you set up or adjust the parameters, the LCD automatically goes to the brightest level. |



**Figure 2: A421 Temperature Control with Type 4X/IP66 Enclosure**

## 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 with Defrost Control is typically used to provide both temperature control and adjustable, timed, passive defrost cycles on medium temperature cooling applications such as reach-in boxes, display cases, and walk-in coolers. See Table 2 for application information by control type.

**Table 2: Applications by A421 Control Type**

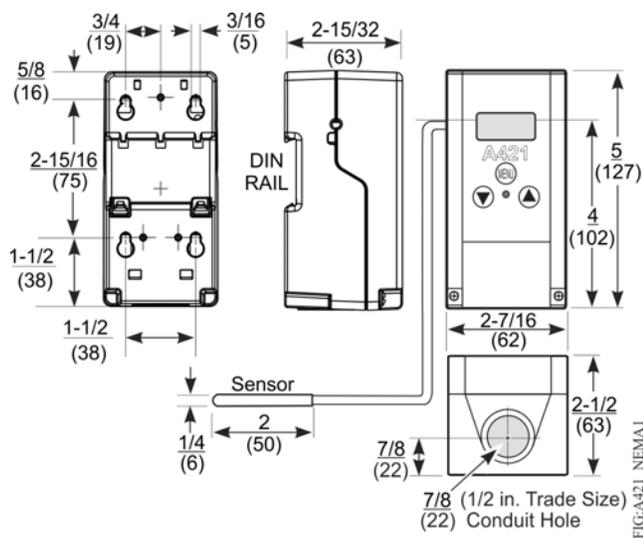| Control Type | Application Family | Wholesale | Agricultural | Chillers | Data Center | Economizer | Food Service | HVAC | Ice Machines | Process | Refrigeration | Ventilation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A421ABD | Off-Cycle Defrost | X | | X | X | | X | | | | X | |
| A421AED | Off-Cycle Defrost | X | | X | X | | X | | | | X | |

## Dimensions

### *Type 1/IP20 Enclosures*



**Figure 3: A421ABD Control, Dimensions, in. (mm)**

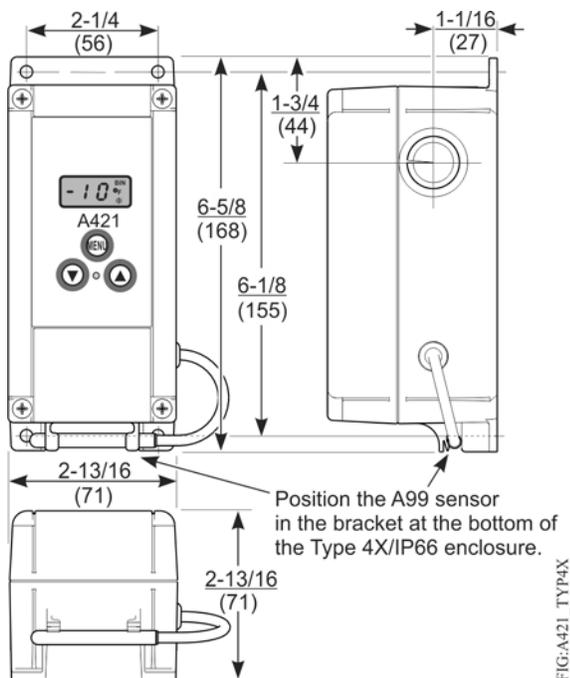### *Type 4X/IP66 Watertight, Corrosion-Resistant Enclosures*



**Figure 4: A421AED Control, Dimensions, in. (mm)**
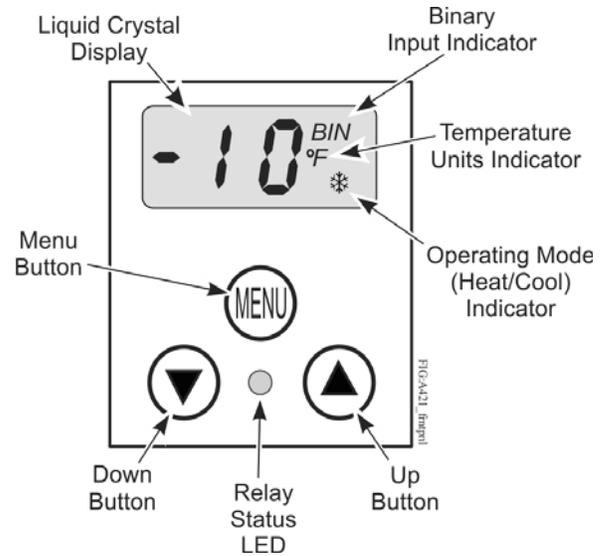
## A421 Control User Interface



**Figure 5: 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.

## 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. When the user-supplied switch (connected between the BIN and COM terminals) closes, the LCD displays **BIN** in the upper-right corner, and the A421 controls the output relay (load) to these effective setback values.

## 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 11).

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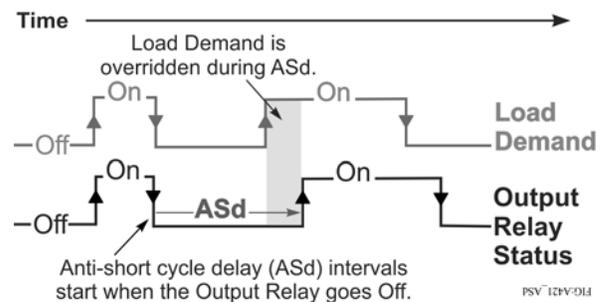


**Figure 6: Anti-Short Cycle Delay**

## 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 prevent over-adjustment of your heating or cooling application.

The adjustment range is limited by setting the high and low temperature stop values. See Figure 7.

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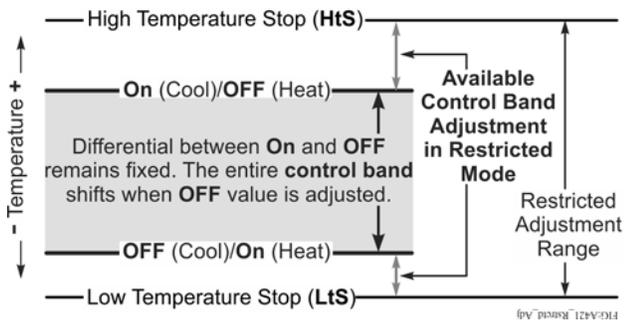


**Figure 7: Restricted User Adjustment**

## 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.

## Off-Cycle Defrost Control

The A421 Control with Off-Cycle Defrost allows you to set up regular, passive defrost periods of 1 to 99 minutes. The defrost interval can range from 2 to 24 hours, or be set to 0 (no defrost interval). You can also start or stop a defrost cycle in two ways: using the three-button touchpad on the Advanced Menu or connect a momentary switch to the Binary Input (BIN). See Figure 8 through Figure 10.

## 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 standard A421 Series Electronic Temperature Control models available through most Johnson Controls/PENN authorized distributors.

See Table 4 through 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.
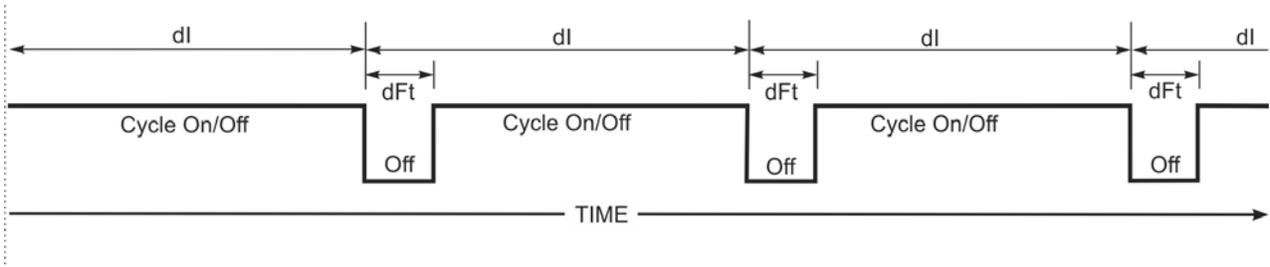
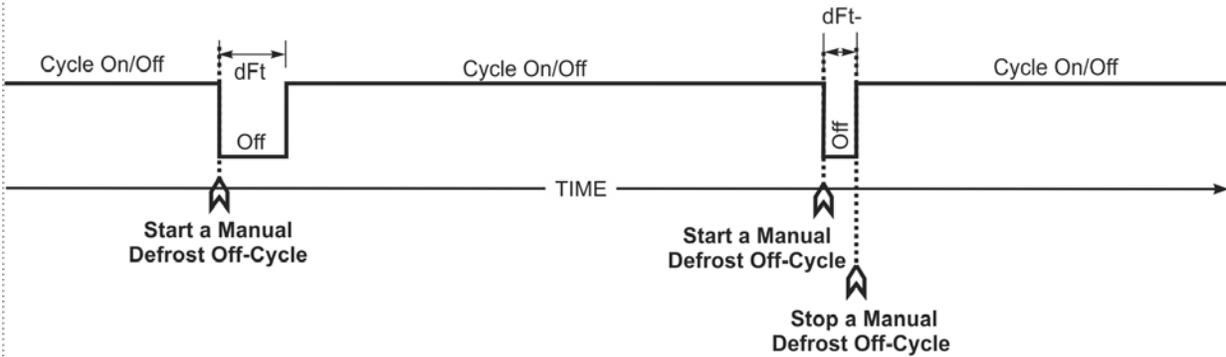**Figure 8: Typical Passive Defrost Cycle Behavior**

.



**Figure 9: Manual Defrost Only: Behavior When dI is Set to 0**
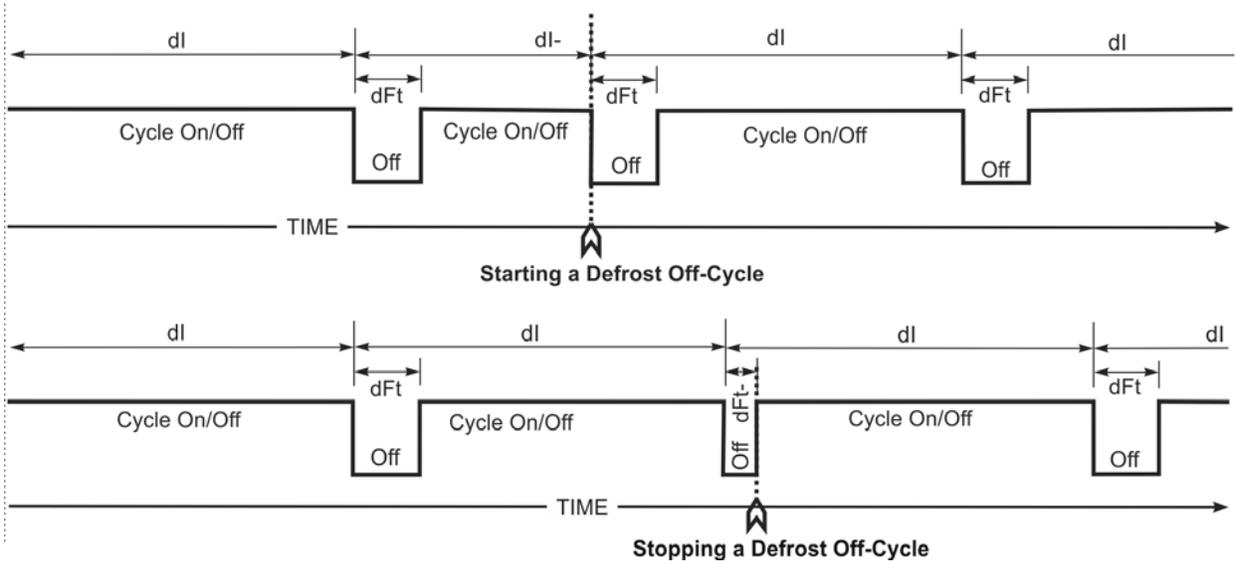


**Figure 10: Starting and Stopping a dFt: Behavior Using SdF Parameter and Momentary Contact Switch**

**Table 3:   A421 Electronic Temperature Control with Off-Cycle Defrost Selection Chart**

| Product Code | Description |
| --- | --- |
| A421ABD-02C | **Line -Voltage Type 1 Electronic Temperature Control with Off-Cycle Defrost Timer:** Type 1 (NEMA), IP20 standard enclosure for DIN rail and surface-mount applications. Rated for 120/240 VAC. Includes integral timer for On/Off defrost cycle control. Includes A99BB-200C temperature sensor with 6.6 ft (2.0 m) cable. |
| A421AED-01C | **Line -Voltage Type 4X Electronic Temperature Control with Off-Cycle Defrost Timer:** Type 4X (NEMA), IP66 standard enclosure for surface-mount applications. Rated for 120/240 VAC. Includes integral timer for On/Off defrost cycle control. Includes A99BB-25C temperature sensor with 9-7/8 in. (0.25 m) cable. |
| A421AED-02C | **Line -Voltage Type 4X Electronic Temperature Control with Off-Cycle Defrost Timer:** Type 4X (NEMA), IP66 standard enclosure for surface-mount applications. Rated for 120/240 VAC. Includes integral timer for On/Off defrost cycle control. Includes A99BB-200C temperature sensor with 6.6 ft (2.0 m) cable. |

**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 |

## Technical Specifications

**Table 6: Standard Models UL 60730 and EN 60730 Output Relay Contacts Electrical Ratings**

| Applied AC Voltage, 50/60 Hz | UL 60730 | | EN 60730 |
|---|---|---|---|
| | 120 VAC | 240 VAC | 230 VAC |
| Horsepower N.O. (N.C.) | 1 (0.25) | 1 (0.5) | 1 (0.5) |
| Full Load Amperes N.O. (N.C.) | 16 (5.8) | 8 (4.9) | 8 (4.9) |
| Locked Rotor Amperes N.O. (N.C.) | 96 (34.8) | 48 (29.4) | 48 (29.4) |
| Resistive Amperes N.O. (N.C.) | 15 (10) | 10 (10) | 10 (10) |
| Pilot Duty VA N.O. (N.C.) | 125 (125) | 125 (125) | 125 (125) |

**Table 7: A421 Series Electronic Temperature Controls**

| | |
|---|---|
| Power Consumption | 1.8 VA Maximum |
| Supply Power | Class 2: 108/110/115/120 or 208/230/240 VAC, 50/60 Hz |
| Ambient Conditions | **Type 1/IP20**<br>**Operating:** -40 to 150°F (-40 to 66°C), 0 to 95% RH Non-condensing<br>**Shipping and Storage:** -40 to 185°F (-40 to 85°C), 0 to 95% RH Non-condensing |
| | **Type 4X/IP66**<br>**Operating:** -40 to 140°F (-40 to 60°C)<br>**Shipping and Storage:** -40 to 140°F (-40 to 60°C) |
| Temperature Control Range | -40 to 212°F (-40 to 100°C) |
| Sensor Type | A99 PTC temperature sensor, 1,035 ohm at 77°F (25°C) |
| Sensor Offset Range | ±5°F or ±3°C |
| Enclosure Material | Type 1/IP20 High-Impact Thermoplastic or<br>Type 4X/IP66 Watertight, Corrosion-Resistant, High-Impact Thermoplastic |
| Compliance<br><br>CE | **North America:** cULus Listed; UL 60730, File E27734, Vol. 1; FCC Compliant to CFR47, Part 15, Subpart B, Class B<br>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:** Regulatory Compliant Mark (RCM) |

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

**Table 8: UL Conformity Declaration Information**

| Information | Description |
| --- | --- |
| Purpose of Control | Sensing Control / Operating Control |
| Construction of Control | Electronic Independently Mounted Control |
| Number of Cycles | 30,000 Cycles |
| Method of Mounting Control | Mounting Screws or DIN Rail |
| Type 1 or Type 2 Action | Type 1.B (Micro-disconnection) |
| External Pollution Situation | All Models: A421 [ ] B: Pollution Degree 3<br>All Models: A421 [ ] E: Pollution Degree 4 |
| Internal Pollution Situation | Pollution Degree 2 |
| Heat and Fire Resistance Category | D |
| Rated Impulse Voltage | 4000 V |
| Ball Pressure Temperature | 128 C |
| Cover Screw Torque Requirements Instruction | All Models: A421 [ ] E: To Maintain Type 4X / IP66 Rating, Tighten Enclosure Screws to: 10 to 12 in·lb |

*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.*

A421 Series Electronic Temperature Controls with Off-Cycle Defrost Product Bulletin