A52x Series Refrigeration Controller with Adaptive Defrost

Installation Instructions

A524/A525

Part No. 24-07664-03310 Rev. C
Issued April 2018

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

IMPORTANT: Use of this product is subject to and constitutes your agreement to the End User License Agreement set forth at www.johnsoncontrols.com/buildings/legal/digital Part No. 24-07664-03310

Application

IMPORTANT: Use this A52x Series Refrigeration Controller only as an operating control. Where failure or malfunction of the A52x Controller 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 A52x Controller.

IMPORTANT : Utiliser ce A52x Series Refrigeration Controller uniquement en tant que dispositif de contrôle de fonctionnement. Lorsqu'une défaillance ou un dysfonctionnement du A52x Régulateur risque de provoquer des blessures ou d'endommager l'équipement contrôlé ou un autre équipement, la conception du système de contrôle doit intégrer des dispositifs de protection supplémentaires. Veiller dans ce cas à intégrer de façon permanente d'autres dispositifs, tels que des systèmes de supervision ou d'alarme, ou des dispositifs de sécurité ou de limitation, ayant une fonction d'avertissement ou de protection en cas de défaillance ou de dysfonctionnement du A52x Régulateur.

The A52x Series Refrigeration Controller with Adaptive Defrost provides refrigerated space control and defrost control for medium and low temperature refrigeration applications.

The A525 Controller has five integral line-voltage, dry-contact relays to control the compressor, defrost heater or solenoid, evaporator fans, and user-provided alarm devices. The controller can control resistive heat, hot-gas bypass, or passive defrost. The controller can also control two-speed evaporator fans. The A524 Controller has four integral line-voltage relays and controls the same devices as the A525 Controller. The LO-SPD AUX relay is not available on the A524 Controller, which controls a single speed evaporator fan only.

The adaptive defrost feature allows the controller to adjust the defrost schedule to the minimum number of defrost intervals required to maintain peak efficiency, save energy, and maintain consistent space temperature. The A52x Controller has an IP65 enclosure with holes in the enclosure base for wall-surface mounting. An optional DIN rail mount kit (Part No. BKT524-1K) is also available.

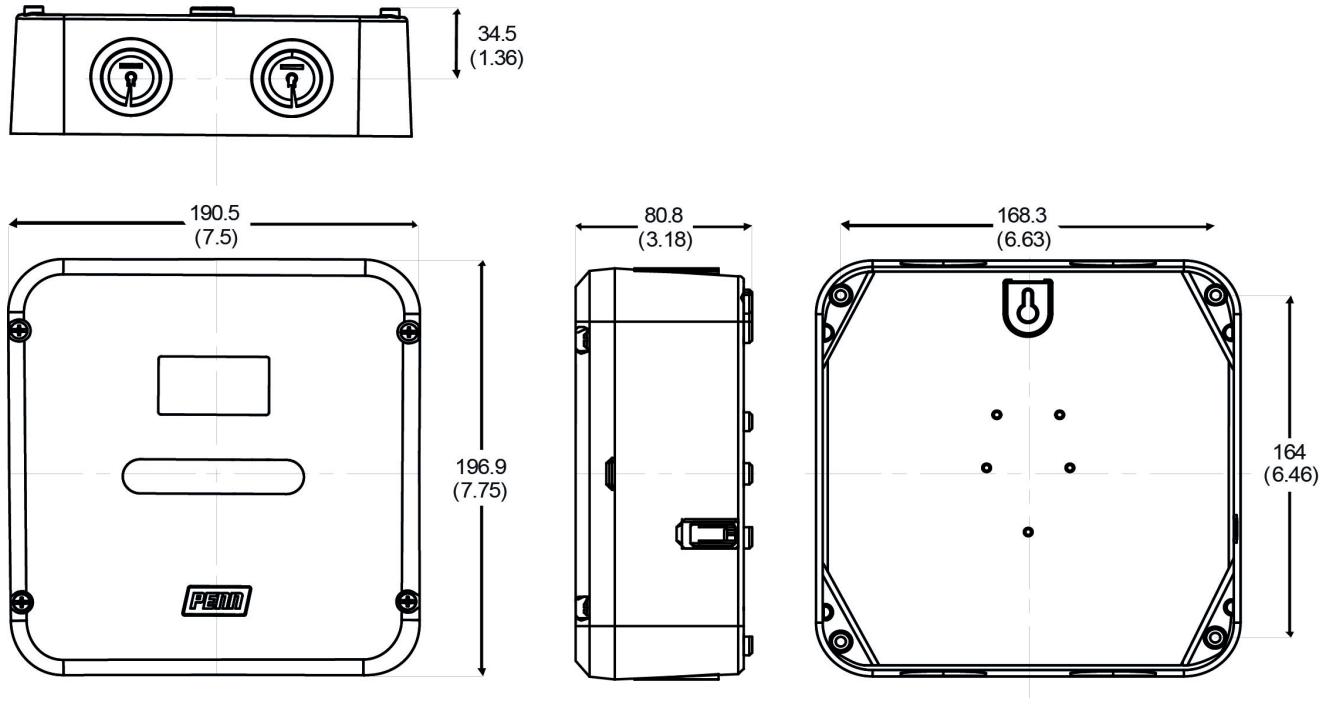
Refer to the *A52x Series Refrigeration Controller with Adaptive Defrost Technical Bulletin (LIT-12012405)* for more details on setting up, operating, and troubleshooting the A52x Controller. You can access and download the A52x Controller Technical Bulletin from QuickLIT.

Parts Included

Each A52x Series Controller includes two Johnson Controls/PENN® A99B Series Temperature Sensors. See *Sensor Wiring* on page 6, Table 12 on page 11, and refer to the *A99B Series Temperature Sensors Product/ Technical Bulletin (LIT-125186)* for more detailed installation procedures and technical specifications.

Dimensions

Figure 1: A52x Refrigeration Control with IP65 Enclosure Dimensions, mm (in.)



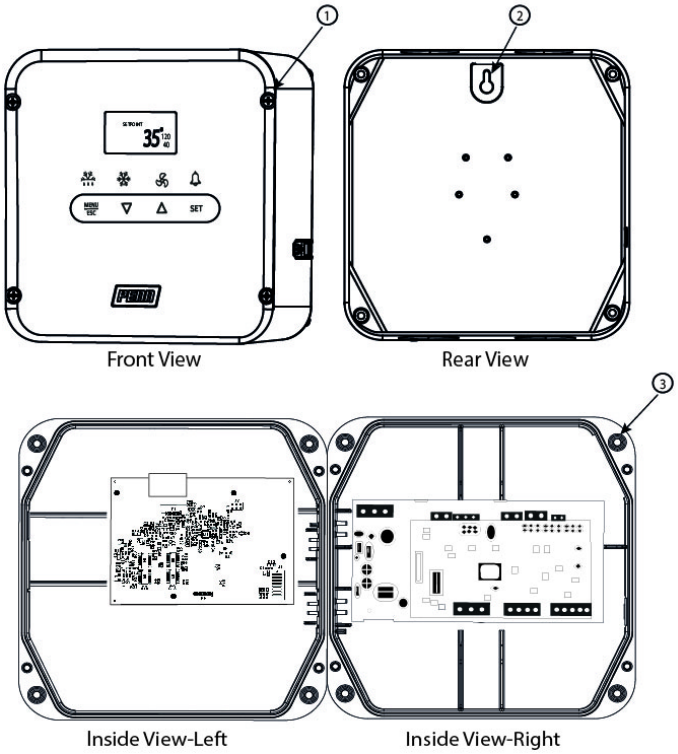
Mounting

Mounting Considerations

Observe the following A52x Controller location and mounting guidelines:

- Mount the controller on a flat surface.
- Ensure that the mounting surface can support the controller assembly, mounting hardware, and any user-supplied panel or enclosure.
- Ensure that the controller is in the proper orientation for easy wiring, setup, and viewing.
- Allow enough space to connect and route wires, view the LCD, and use the touchpad.
- Identify the appropriate mounting hardware.
- Mount the controller in locations free of corrosive vapors and observe the ambient operating conditions listed in the *Technical Specifications* on page 10 for both the A52x Controller and the A99B Sensors.
- Do not mount the controller on surfaces that are prone to vibration.
- Do not mount the controller in a location where high-voltage relays, motor starters, other sources of electromagnetic emissions, or strong radio frequency may cause Electro-Magnetic Interference (EMI).
- Do not install the controller in airtight enclosures.
- Do not install heat generating devices with the controller in an enclosure that may cause the ambient temperature to exceed 60°C (140°F).

Figure 2: A52x Refrigeration Control Wall-Surface Mounting



Wall Mounting

Table 1: A52x Refrigeration Control Wall-Surface Mounting

Callout	Description
1	Spring-loaded cover screw on the controller cover
2	Keyhole slot on the rear of the enclosure base
3	Mounting screw hole on the enclosure base

To mount the A52x Controller on a wall or other flat surface, complete the following steps:

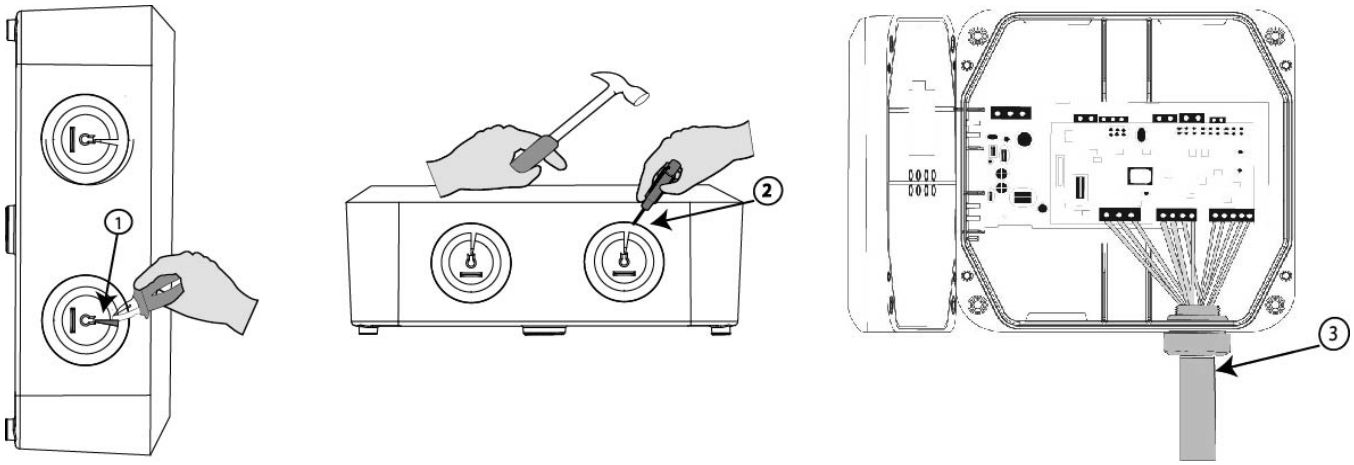
1. Loosen the four spring-loaded cover screws to open the controller cover. Be careful not to damage the controller's interior components.
2. Attach an appropriate fastener onto the wall or other flat surface.
3. Position the keyhole slot on the rear of the enclosure base over the fastener. Ensure that the controller hangs securely on the fastener.
4. Mark the location for the mounting screws using the four holes on the corners of the enclosure base, and remove the keyhole slot fastener from the wall surface.
5. Mount the controller using four screws (M4 [#8] panhead screw; 12 mm [0.5 in.] or longer).
6. Tighten the screws securely. Use shims to prevent warping the enclosure when mounting the controller on an uneven surface.
7. Close the front cover and tighten the spring-loaded cover screws to 0.9–1.1 N·m (8–10 in·lbs) to seal the cover.

DIN Rail Mounting

An optional DIN Rail mount kit *(*Product Code Number, BKT524-1K*)* is available for the A52x Controller. The DIN rail clip assembly attaches to the five holes on the back of the enclosure base. Refer to the installation instructions included with the DIN rail kit for DIN rail mounting procedures.

Conduit Fitting Section

Figure 3: Conduit Plug Removal and Liquid Tight Fitting Selection



Conduit Plug Removal and Fitting

To remove the conduit plug and insert the liquid tight fitting, complete the following steps:

1. Clip the conduit rib using a cutting pliers.
2. Place a flat blade screwdriver at the edge of the knockout. Gently tap with a hammer to carefully remove the conduit plug.
3. To maintain the IP65 moisture protection rating, select an appropriate water tight conduit connector.

Wiring

See Figure 4 on page 5 and Table 2 on page 6 for electrical termination locations, terminal labels, and wiring information for low-voltage terminations.

See Figure 5 on page 7 and Table on page 8 for electrical termination locations terminal labels, and wiring information for high-voltage terminations. See Table 5 on page 8 to Table 9 on page 9 for the electrical rating for the high-voltage relays.

⚠ WARNING

Risk of Electric Shock.
Disconnect or isolate all power supplies before making electrical connections. More than one disconnection or isolation may be required to completely de-energize equipment. Contact with components carrying hazardous voltage can cause electric shock and may result in severe personal injury or death.

⚠ WARNING

⚠ ADVERTISSEMENT

Risque de décharge électrique.
Débrancher ou isoler toute alimentation avant de réaliser un branchement électrique. Plusieurs isolations et débranchements sont peut-être nécessaires pour-couper entièrement l'alimentation de l'équipement. Tout contact avec des composants conducteurs de tensions dangereuses risque d'entraîner une décharge électrique et de provoquer des blessures graves, voire mortelles.

IMPORTANT: Use copper conductors only. Make all wiring in accordance with local, national, and regional regulations.

IMPORTANT: Do not exceed the A52x Controller electrical ratings. Exceeding controller electrical ratings can result in permanent damage to the controller and void any warranty.

IMPORTANT: Run all low-voltage wiring and cables separate from all high-voltage wiring and route wires per NEC or local electrical code requirements. Shielded cable is recommended for low-voltage cables that are exposed to high electromagnetic or radio frequency noise.

IMPORTANT: Electrostatic discharge can damage control components. Use proper electrostatic discharge precautions during installation, setup, and servicing to avoid damaging the controller.

IMPORTANT: Do not connect supply power to the controller before finishing wiring and checking all wiring connections. Short circuits or improperly connected wires can result in damage to the controller and void any warranty.

Low-Voltage Wiring

Figure 4 on page 5 and Table 2 on page 6 provide information about the low-voltage wiring terminal blocks, wiring terminal labels, and recommended wire sizes

Figure 4: A52x Controller Low-Voltage Terminal Block Connections

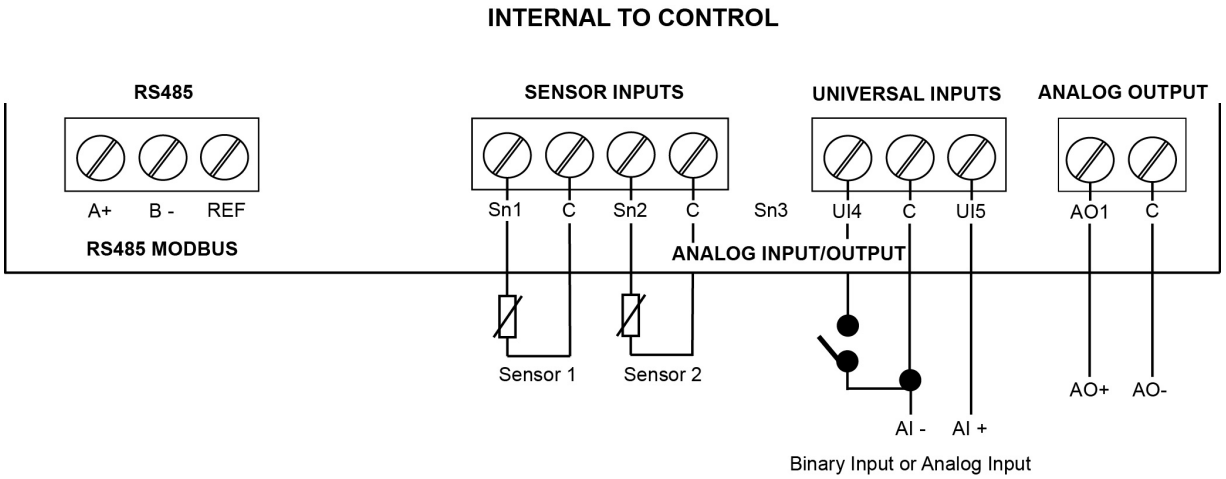


Table 2: A52x Controller Low-Voltage Terminal Blocks, Terminals, and Wire Sizes

Terminal Block Label	Terminal Label	Description, Function, and Requirements	Recommended Wire Sizes
RS485 MODBUS	A +	The RS485 Modbus communications terminal block provides a restricted connection to the Modbus connections on an optional Precision Superheat Controller (PSHC). Do not connect any other Modbus device to these terminals.	0.20 to 0.30 mm^2 (26 to 22 AWG) Stranded wires and twisted-leads cable
	B -		
	REF	RS485 Modbus signal common or reference	
ANALOG INPUT/OUTPUT	Sn1 	The main space temperature sensor. Connect either lead from the sensor to Sn1. Connect the other lead to a Common (C) terminal. **Note:** Sensors for A52x Controller are not polarity sensitive.	0.30 to 1.50 mm^2 (22 to 16 AWG) Stranded wires and twisted-leads cable
	Sn2 	Evaporator temperature sensor. Connect either lead from the sensor to Sn2. Connect the other lead to a C terminal. **Note:** Sensors for A52x Controller are not polarity sensitive.	
	Sn3	Not available	
	UI 4	Universal Input 4 can be configured as a 0–10 VDC analog input or dry contact binary input. Connect a 0 to 10 VDC input or binary input to the UI4 (+) terminal and a C (common/-) on the low voltage terminal block.	
	UI 5	Universal Input 5 can be configured as a 0–10 VDC analog input or dry contact binary input. Connect a 0 to 10 VDC input or binary input to the UI5 (+) terminal and a C (common/-) on the low voltage terminal block.	
	C	Three low-voltage common terminals All low-voltage C terminals are connected together.	
	AO1	**Note:** Analog Output 1 (AO1) is not supported in the A525. Make no connection to this terminal. The A524 Controller does not include an analog output and does not have an AO1 terminal block.	

Sensor Wiring

See Table 3 on page 7 for information about wire gauge and maximum sensor wire length. See Table 12 and Table 13 on page 11 for the sensor technical specifications.

Observe the following guidelines when you wire sensors to the A52x Controller:

- Sensor leads are not color coded or polarity-specific; you can connect either of the two sensor leads to the Sn1 or Sn2 terminal and a C terminal.
- Select only the sensor that is designed to operate in the ambient operating range that your A52x Controller is intended to monitor and control.
- Keep the sensor leads as short as possible in your application. The additional resistance in long sensor cables can create an offset between the actual temperature and the displayed temperature. Solder or butt splice connections are recommended.

Use 0.30 mm^2 (22 AWG), stranded-wires and twisted-leads cable with a cable shield for extending sensor cable runs.

Table 3: Maximum Recommended Sensor Cable Lengths and Wire Sizes

Wire Gauge	Maximum Sensor Cable Length [1]
1.3 mm^2 (16 AWG)	150 m (500 ft)
0.82 mm^2 (18 AWG)	100 m (300 ft)
0.52 mm^2 (20 AWG)	60 m (200 ft)
0.33 mm^2 (22 AWG)	40 m (125 ft)

1. At the listed cable lengths, there is less than 0.6°C (1°F) error between the temperature sensed at the A99B sensor and the temperature displayed on the LCD.

IMPORTANT: When connecting sensors with shielded cable to a control, connect the cable shield drain lead to one of the C (common) terminals on the input sensor terminal block. Do not connect the shield at any other point along the cable. Isolate and insulate the shield drain at the sensor end of the cable. Connecting a cable shield at more than one point can enable transient currents to flow through the sensor cable shield, which can cause erratic control operation.

High-Voltage Wiring

Figure 5 on page 7 and Table 4 on page 8 describe the high-voltage wiring terminal blocks, wiring terminal labels, and wire sizes. See Table 5 on page 8 to Table 9 on page 9 for relay electrical ratings.

Figure 5: A52x Controller High Voltage Terminal Block Connections

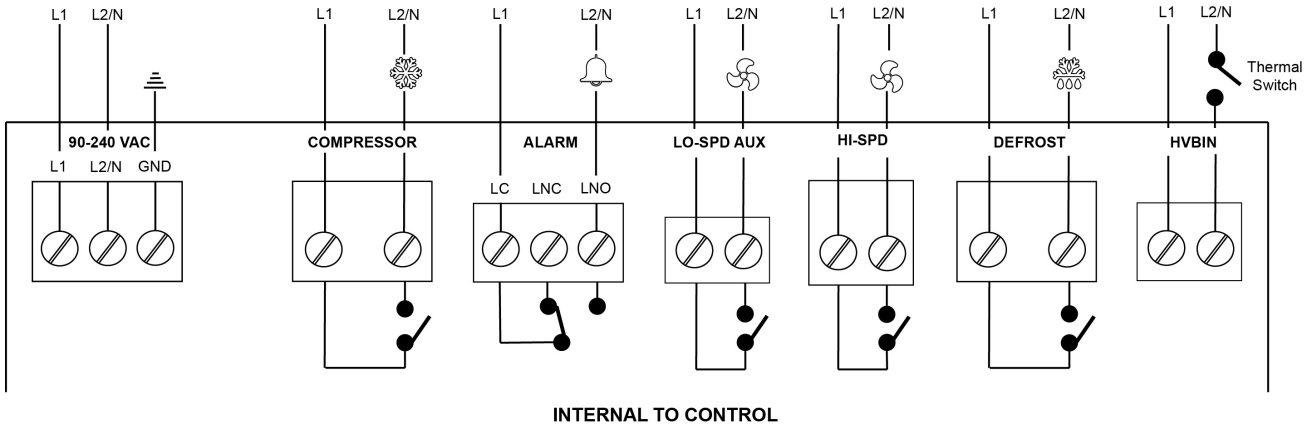


Table 4: A52x Controller High-Voltage Terminal Blocks, Terminals, and Wire Sizes

Terminal Block Label	Terminal Voltages	Description, Function, and Requirements	Recommended Wire Sizes
90-240 VAC	L1	Two terminals for supply power connection to the A525 Controller. Requires 90 to 240 VAC; 15 VA, (0.25 A maximum).	0.75 to 2.50 mm^2 (18 to 14 AWG)
	L2/N		
	GND	Earth ground connection terminal	
Compressor 		Two terminals for line-voltage, single-pole, single-throw (SPST), dry-contact relay to control compressor	1.50 to 6.0 mm^2 (16 to 10 AWG)
Alarm 	L1/LC	The common (LC), normally-open (LNO), normally-close (LNC) terminals for line-voltage, single-pole, double-throw (SPDT), dry-contact relay to control (user-supplied) alarm devices.	0.30 to 2.50 mm^2 (22 to 14 AWG)
	LNC		
	L2/N/LNO		
LO-SPD AUX		The A525 Controller includes two terminals for line-voltage, SPST, dry-contact relay to control an auxiliary device such as a user-provided alarm device or the low-speed on two-speed evaporator fans. The A524 Controller does not include this relay and terminal block.	0.30 to 2.50 mm^2 (22 to 14 AWG)
HI-SPD 		Two terminals for line-voltage, SPST, dry-contact relay to control single-speed evaporator fans or the high-speed on two-speed evaporator fans.	0.75 to 2.50 mm^2 (18 to 14 AWG)
Defrost 		Two terminals for line-voltage, SPST, dry-contact relay to control resistive defrost heater or bypass defrost solenoid.	1.5 to 6.0 mm^2 (16 to 10 AWG)
HVBIN		Two line-voltage binary input terminals for use with the line-voltage defrost temperature termination switch. These terminals require an external power source to provide 120 to 240 VAC, 50/60 Hz activation power when the external, user-supplied defrost termination switch closes.	0.30 to 1.50 mm^2 (22 to 16 AWG)

Relay Electrical Ratings

Table 5 on page 8 to Table 9 on page 9 provide the electrical ratings for the control relays in the A52x Controller. See Table 11 on page 11 for the relay's duty cycle ratings.

Table 5: SPST Compressor Relay Electrical Ratings

Agency and File	UL 60730			EN 60730
Applied AC Voltage at 50/60 Hz	24 VAC	120 VAC	240 VAC	240 VAC
Horsepower	--	1 HP	1 HP	1 HP
Full Load Amperes	--	16 A	8 A	8 A
Locked Rotor Amperes	--	96 A	48 A	48 A
Resistive Amperes	10 A	--	--	--
Pilot Duty VA	125 VA at 24 to 240 VAC			

Table 6: SPDT Alarm Relay Electrical Ratings

Agency and File	UL 60730			EN 60730
Applied AC Voltage at 50/60 Hz	24 VAC	120 VAC	240 VAC	240 VAC
Horsepower (LC/LNO and LC/LNC)	--	1/2 HP	1/2 HP	1/2 HP

Table 6: SPDT Alarm Relay Electrical Ratings

Agency and File	UL 60730			EN 60730
Full Load Amperes (LC/LNO and LC/LNC)	--	9.8 A	4.9 A	4.9 A
Locked Rotor Amperes (LC/LNO and LC/LNC)	--	58.8 A	29.4 A	29.4 A
Resistive Amperes (LC/LNO and LC/LNC)	10 A	10 A	10 A	10 A
Pilot Duty VA (LC/LNO and LC/LNC)	125 VA at 24 to 240 VAC			

Table 7: SPST Low Speed Fan or Auxiliary (LO-SPD AUX) Relay Electrical Ratings [1]

Agency and File	UL 60730			EN 60730
Applied AC Voltage at 50/60 Hz	24 VAC	120 VAC	240 VAC	240 VAC
Horsepower	--	1/2 HP	1/2 HP	1/2 HP
Full Load Amperes	--	9.8 A	4.9 A	4.9 A
Locked Rotor Amperes	--	58.8 A	29.4 A	29.4 A
Resistive Amperes	10 A	10 A	10 A	10 A
Pilot Duty VA	125 VA at 24 to 240 VAC			

1. Included on the A525 Controller but not on the A524 Controller.

Table 8: SPST High Speed Fan (HI-SPD) Relay Electrical Ratings

Agency and File	UL 60730			EN 60730
Applied AC Voltage at 50/60 Hz	24 VAC	120 VAC	240 VAC	240 VAC
Horsepower	--	1/2 HP	1/2 HP	1/2 HP
Full Load Amperes	--	9.8 A	4.9 A	4.9 A
Locked Rotor Amperes	--	58.8 A	29.4 A	29.4 A
Resistive Amperes	10 A	10 A	10 A	10 A
Pilot Duty VA	125 VA at 24 to 240 VAC			

Table 9: SPST Defrost Relay Electrical Ratings

Agency and File	UL 60730			EN 60730
Applied AC Voltage at 50/60 Hz	24 VAC	120 VAC	240 VAC	240 VAC[1]
Resistive Amperes	10 A	24 A[1]	24 A[1]	24 A[1]
Pilot Duty VA	125 VA at 24 to 240 VAC			

1. Rated for 24 A at temperatures up to 45°C (113°F). From 45C° to 60C° (113F° to 140F°), the Ampere rating decreases from 24 A to 15 A at a rate of 0.6 A per 1°C. The A525 Controller is not rated for use in ambient conditions above 60°C (140°F).

Repair Information

Do not attempt to repair the A52x Controller. In case of a defective or improperly functioning controller, contact your nearest authorized Johnson Controls/PENN Distributor or Sales Representative. When contacting your Johnson Controls/PENN Distributor, have the model number of the controller available. This number can be found on the label inside the cover of the controller.

Cleaning Information

Remove any loose debris from the controller. Use a soft cloth with a detergent solution to wipe the outside surface. Rinse the cloth with clean water and wipe the controller until clean. Dry the controller with a soft cloth.

Notes:

- Do not use abrasive cleaning powders
- Do not use abrasive cleaning pads or brushes.
- Do not use solvents or cleaning solutions that can damage plastic.

Ordering Information

Table 10 on page 10 contains information about the A52x Controller accessories. For more information about A99B Temperature Sensors, refer to the *A99B Series Temperature Sensors Product/Technical Bulletin (LIT-125186)* or contact your nearest Johnson Controls/PENN distributor or sales representative.

Table 10: A52x Controller Accessories

Product Code	Description
BKT287-1R	305 mm (12 in.) section of 35 mm DIN rail
BKT524-1K	Bracket for mounting A52x Controller to 35 mm DIN rail, includes five mounting screws

Technical Specifications

A52x Refrigeration Controller with Adaptive Defrost

Product	A524 / A525
Power Consumption	1.8 VA maximum
Supply Power	84 VAC to 260 VAC, 50/60 HZ, 10 VA maximum
Ambient Conditions	**Operating:** -30C° to 60C° (-22F° to 140F°), 0 to 95% RH non-condensing **Shipping and Storage:** -40C° to 85C° (-40F° to 185F°), 0 to 95% RH non-condensing
Temperature Sensing Range	-40C° to 50C° (-40F° to 122F°)
Input Signal (Sn1 and Sn2)	A99B PTC temperature sensors or TS-6340K-F00 NTC temperature sensor
Input Signal (UI4 and UI5)	0–10 VDC input for leak detector status or dry contact binary input with a switch wired between U14 or U15 and C
HVBIN Signal	120 VAC or 240 VAC
Sensor Offset Range	± 3ºC or ± 5ºF
RS485 MODBUS	Max. distance is 100 ft., 9.6k baud is the default but 19.2k is also supported
External USB	Use a standard USB flash drive to extract HACCP data or upgrade firmware revision for future upgrades
Enclosure	IP65 watertight, corrosion-resistant, high-impact thermoplastic
Dimensions (H x W x D)	196.8 mm (7.75 in.) x 190.5 mm (7.5 in.) x 82.6 cm (3.25 in.)
Weight	1.1 kg (2.4 lb)
Compliance CE	**United States:** cULus Listed; UL60730-1, UL60730-2-9, File SA516; FCC Compliant to CFR47, Part 15, Subpart B, Class B limits
	Canada: cULus Listed; CAN/CSA-E60730-1:15, CAN/CSA-E60730-2-9:15, File SA516; Industry Canada (IC) compliant to Canadian ICES-003, Class B limits
	Europe: CE Mark – Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive and Low Voltage Directive; RoHS Directive
	Australia and New Zealand: RCM Mark, Australia/NZ emissions compliant

Table 11: UL Conformity Declaration Information

Information	Description
Purpose of Control	Sensing control/operating control
Construction of Control	Electronic independently mounted control
Number of Cycles	Compressor relay: 100,000 cycles
	Defrost relay: 30,000 cycles
	Evaporator fan relays: 30,000 cycles
	Alarm relay: 8,000 cycles
Method of Mounting Control	Four mounting screws or optional DIN rail mounting kit
Type 1C or Type 2C Action	Micro-interruption
Heat and Fire Resistance Category	D
Rated Impulse Voltage	4000 V
Ball Pressure Temperature	125°C (257°F)
Cover Screw Torque Requirements Instruction	To maintain Type IP65 rating, tighten enclosure cover screws to 0.9–1.1 N·m (8–10 in·lb)

Table 12: A99B Type PTC Temperature Sensors

Ambient Sensing and Operating Conditions [1]	Type A99BA and A99BB: -40C° to 100C° (-40F° to 212F°) 0 to 100% RH, condensing Type A99BC: -40C° to 120C° (-40F° to 248F°) 0 to 100% RH, condensing
Reference Resistance	1,035 ohms at 25°C (77°F) and 855 ohms at 0°C (32°F)
Accuracy	0.5°C (0.9°F) between -15C° and 57C° (5F° and 167F°). Refer to the *A99B Series Temperature Sensors Product/Technical Bulletin (LIT-125186)* for accuracy rating outside of this temperature range.
Sensor Construction	Probe: stainless steel (50 mm x 6.0 mm); Cable length: A99Bx-200 (2 m); A99Bx-300 (3 m); A99Bx-500 (5 m)
Sensor Cable Sheath	Type A99BA: shielded PVC cable Type A99BB: PVC cable Type A99BC: high temperature silicon cable
Wire Gauge	22 AWG (0.33 mm^2)
Ambient Storage Conditions	Type A99BA and A99BB: -40C° to 105C° (-40F° to 221F°); 0 to 100% RH, condensing Type A99BC: -40C° to 130C° (-40F° to 266F°); 0 to 100% RH, condensing
Shipping Weight	41 g (1.4 oz) for A99B sensor with 2 m (6 1/2 ft) cable

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

Table 13: TS6340K-F00 NTC Temperature Sensor

Ambient Sensing and Operating Conditions [1]	-40C° to 100C° (-40F° to 212F°); 0 to 100% RH, condensing
Reference Resistance	10,000 ohms at 25°C (77°F)
Sensor Construction	Probe: stainless steel (50 mm x 6.0 mm); Cable length: 1.5 m
Sensor Cable Sheath	PVC cable

1. When any A99B Series Temperature Sensor or NTC Temperature Sensor is connected to the A52x Controller, the range of the displayed temperature values is restricted from -40°C to 60°C (-40°F to 140°F).

North American Emissions Compliance

United States

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.

Canada

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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