

Refrigeration Products Catalog





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Refrigeration Products Catalog

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Note: Page numbers in *italics* denote pages where the product code number appears, but not as the main part.



A11 Series Low Temperature Cutout Controls

Description

A11 Series Low Temperature Cutout Controls are available with single-pole, single-throw (SPST) or single-pole, double-throw (SPDT) contact action. Typical applications include the sensing of low temperature conditions to avoid over cooling or icing of hydronic coils, cooling coils, and liquid-handing pipes. The controls are compact and sturdy, and have an adjustable temperature setpoint range with a fixed differential. The range adjustment screw is accessible at the bottom of the control, and at the top of the control when the cover is removed.

The A11 Controls are compact and sturdy and feature an adjustable range with a fixed differential. The range adjustment screw is accessible at the bottom of the control or at the top, when the cover is removed. A factory-set low temperature stop is available when specified.

Refer to the *A11 Series Low Temperature Cutout Controls Product Bulletin (LIT-125010)* for important product application information.

Features

- precision repeat accuracy remains unaffected by ambient temperature at the control diaphragm cup and 4 ft (1.2 m) capillary (20 ft [6.1 m] sensing bulb must be in the controlled area)
- trip-free manual reset allows the lever to reset. You must press and release the lever before operation resumes.
- precision snap-acting contacts in a dust protected enclosure enables the A11 Control to operate to the fullest potential
- direct reading scale provides easy-to-adjust setpoint. Adjustments can be made from the top or bottom of the control.



A11 Series Low Temperature Cutout Control

Repair Information

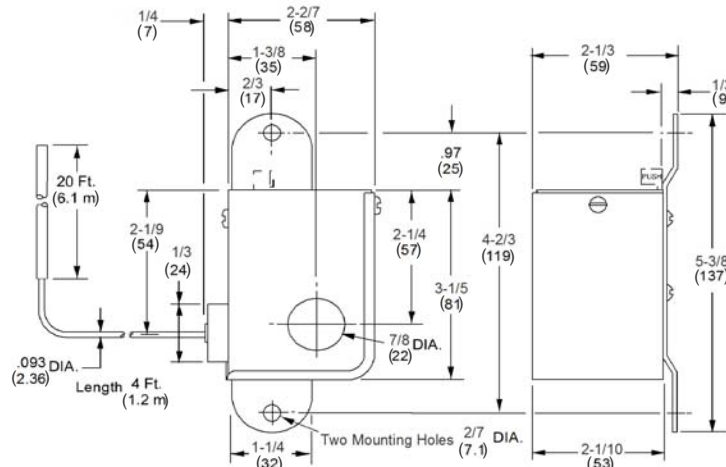
If the A11 Series Low Temperature Cutout Control fails to operate within its specifications, replace the unit. For a replacement control, contact the nearest Johnson Controls® representative.

Electrical Rating

Motor Rating	120 V	208 V	240 V
Motor Description			
AC Full Load Amperes	16.0	9.2	8.0
AC Locked Rotor Amperes	96.0	55.2	48.0
Non-Inductive Amperes	16.0	9.2	8.0
Pilot Duty	125 VA, 24 to 277 VAC		

Selection Chart

Model	Description
A11A	SPST, open low, manual reset
A11B	SPST, open low, automatic recycle
A11D	SPDT, manual reset
A11E	SPDT, automatic recycle



A11 Series Low Temperature Cutout Controls Dimensions, in. (mm)

The performance specifications are nominal and conform to acceptable industry standards. For applications at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products. © 2015 Johnson Controls, Inc. www.johnsoncontrols.com



Single-Stage Electromechanical Temperature Controls

A11 Series Low Temperature Cutout Controls (Continued)

Technical Specifications

A11 Low Temperature Cutout Controls		
Product Codes	A11A: SPST, open low, manual reset A11B: SPST, open low, automatic recycle A11D: SPDT, manual reset A11E: SPDT, automatic recycle	
Range Cutout	35 to 45°F (2 to 7°C)	
Differential	A11A and A11D: Temperature must be 12°F (6.7°C) above cutout point before control can be reset. A11B and A11E: 12°F (6.7°C)	
Ambient Temperature	Minimum: 0°F (-18°C) Maximum: 140°F (60°C)	
Maximum Temperature at Bulb	250°F (121°C)	
Sensing Element	1/8 in. x 20 ft (3 mm x 6.1 m) or 1/8 in. x 40 ft (3 mm x 12.2 m)	
Capillary Length	4 ft (1.2 m)	
Switch	Snap-acting contacts in dust-protected enclosure	
Material	Case: 0.6 (2 mm) cold rolled steel Cover: 0.3 in. (1 mm) cold rolled steel	
Finish	Galvanized steel	
Conduit Opening	22 mm (9/10 in.) hole for 13 mm (1/2 in.) conduit	
Mounting Bracket	Standard on all controls	
Shipping Weight	Individual pack: 1.8 lb (0.8 kg) Overpack of 20 units: 38 lb (17 kg)	
Electrical Rating	Pilot Duty: 125 VA, 24 to 277 VAC	
Motor Ratings	AC Full Load Ampere: 120 V = 16.0 A, 208 V = 9.2 A, 240 V = 8.0 A AC Locked Rotor Ampere: 120 V = 96.0 A, 208 V = 55.2 A, 240 V = 48.0 A Non-Inductive Ampere: 120 V = 16.0 A, 208 V = 9.2 A, 240 V = 8.0 A	
Compliance	United States	UL Listed, File SA516, SDFY
		FCC Compliant to CFR 47, Part 15 Subpart B, Class A
	Canada	UL Listed, CSA Class No. 1222 01, File LR948
		Industry Canada, ICES-003



A19 Series Remote Bulb Control

Description

The A19 Series Controls are single-stage temperature controls that incorporate environmentally friendly liquid-filled sensing elements.

Refer to the *A19 Series Hot Water Heating Controls Well Immersion Product Bulletin (LIT-125025)* for important product application information.

Features

- wide temperature ranges available
- constant differential throughout the entire range
- compact enclosure
- fixed or adjustable differential available
- variety of sensing element styles
- unaffected by cross-ambient conditions

Applications

The A19 is suitable for temperature control in HVAC/R applications.

Selection Charts

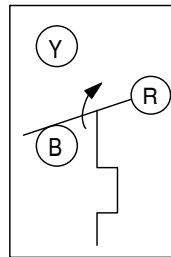
A19 Series Remote Bulb Control¹

Product Code Number	Switch Action	Range °F (°C)	Differential F° (C°)	Bulb and Capillary	Bulb Well No. (Order Separately)	Range Adjuster	Max. Bulb Temp. °F (°C)
Adjustable Differential (Wide Range)							
A19ABA-40C ²	Single-Pole, Single-Throw (SPST) Open low	-30 to 100 (-34 to 38)	3 to 12 (1.7 to 6.7)	3/8 in. x 4 in., 6 ft. capillary	WEL14A-602R	Screwdriver Slot	140 (60)
A19ABC-4C	SPDT	50 to 130 (10 to 55)	3-1/2 to 14 (1.9 to 8)	3/8 in. x 5 in., 8 ft. capillary	WEL14A-603R	Knob	170 (77)
A19ABC-24C ³	SPDT	-30 to 100 (-34 to 38)	3 to 12 (1.7 to 6.7)	3/8 in. x 4 in., 8 ft. capillary	WEL14A-602R	Convertible	140 (60)
A19ABC-36C	SPDT	-30 to 100 (-34 to 38)	3 to 12 (1.7 to 6.7)	3/8 in. x 4 in., 20 ft. capillary	WEL14A-602R	Convertible	140 (60)
A19ABC-37C	SPDT	-30 to 100 (-34 to 38)	3 to 12 (1.7 to 6.7)	3/8 in. x 4 in., 10 ft. capillary	WEL14A-602R	Screwdriver slot	140 (60)
A19ABC-74C	SPDT	-30 to 100 (-34 to 38)	3 to 12 (1.7 to 6.7)	3/8 in. x 4 in., 6 ft. capillary	WEL14A-602R	Screwdriver slot	140 (60)
Fixed Differential							
A19AAF-12C	SPDT	25 to 225 (-4 to 107)	3-1/2 (1.9)	3/8 in. x 3 in., 10 ft. capillary	WEL14A-602R	Screwdriver slot	275 (135)
Fixed Differential (Case Compensated)							
A19AAC-4C	SPDT	0 to 80 (-18 to 27)	5 (2.8)	3/8 in. x 4 in., 6 ft. capillary	WEL14A-602R	Screwdriver slot	140 (60)
A19AAD-12C	SPST Open low	-30 to 50 (-34 to 10)	2-1/2 (1.4)	3/8 in. x 4 in., 7 ft. capillary	WEL14A-602R	Screwdriver slot	140 (60)
Fixed Differential (Close)							
A19AAD-5C ⁴	SPST Open low	30 to 50 (-1 to 10) (Bulk Milk Cooler)	2-1/2 (1.4)	3/8 in. x 2-5/8 in., 6 ft. capillary	WEL16A-601R	Screwdriver slot	190 (88)
A19AAF-20C	SPDT	-30 to 100 (-34 to 38)	2-1/2 (1.4)	3/8 in. x 4 in., 6 ft. capillary	WEL14A-602R	Screwdriver slot	140 (60)
A19AAF-21C	SPDT	40 to 90 (4 to 32)	1-1/2 (0.8)	3/8 in. x 5-3/4 in., 6 ft. capillary	WEL14A-603R	Screwdriver slot	140 (60)
Manual Reset							
A19ACA-14C	SPST Open low	-30 to 100 (-34 to 38)	Manual reset	3/8 in. x 4 in. 6 ft capillary	WEL14A-602R	Screwdriver slot	140 (60)
A19ACA-15C	SPST Open low	-30 to 100 (-34 to 38)	Manual reset	3/8 in. x 4 in. 10 ft capillary	WEL14A-602R	Screwdriver slot	140 (60)
A19ADB-1C	SPST Open high	100 to 240 (38 to 116)	Manual reset	3/8 in. x 3-1/2 in. 6 ft capillary	WEL14A-602R	Knob	290 (143)
A19ADB-38C	SPST Open high	100 to 240 (38 to 116)	Manual reset	3/8 in. x 4 in. 6 ft capillary	WEL14A-602R	Screwdriver slot	290 (143)

1. Specify the control model code number, packing nut code number (if required), and bulb well code number (if required).
2. Replaces White-Rodgers® 1609-101
3. Replaces White-Rodgers 1609-12, -13; Ranco® 010-1408, -1409, -1410, -1490, 060-110; Honeywell® L6018C-1006, L6021A-1005, T675A-1011, -1508, -1516, -1821, T4301A-1008, T6031A-1011, T6031A-1029
4. Case-Compensated

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A19 Series



Action on Increase of Temperature

A19 Series Terminal Arrangement for Single-Pole, Double-Throw (SPDT)

a 19 eps



A19ABC-24 Remote Bulb Control



Single-Stage Electromechanical Temperature Controls

A19 Series Remote Bulb Control (Continued)

Replacement Parts

Product Code Number	Description
CVR28A-617R	Concealed adjustment cover
CVR28A-618R	Visible scale cover
KNB20A-602R	Replacement Knob Kit

Accessories

A packing nut is available for closed tank application.
Specify the code number **FTG13A-600R**.

Bulb wells (WEL14A Series) are available for liquid immersion applications.
See the selection chart or the *Bulb Wells Catalog Page (LIT-1922135)*.

Technical Specifications

Electrical Ratings

Motor Ratings VAC	120	208	240
Wide Range – Adjustable Differential			
AC Full Load A	16.0	9.2	8.0
AC Locked Rotor A	96.0	55.2	48.0
Non-Inductive A ¹	22 A, 120 to 277 VAC		
Pilot Duty	125 VA, 24 to 600 VAC		
Fixed Differential and Close Differential			
AC Full Load A	6.0	3.4	3.0
AC Locked Rotor A	36.0	20.4	18.0
Non-Inductive A	10 A, 24 to 277 VAC		
Pilot Duty	125 VA, 24 to 277 VAC		
Case Compensated – Fixed Differential A19AAC-4			
AC Full Load A	16.0	9.2	8.0
AC Locked Rotor A	96.0	55.2	48.0
Non-Inductive A ¹	22 A, 120 to 277 VAC		
Pilot Duty	125 VA, 24 to 600 VAC		
A19AAD-12			
AC Full Load A	6.0	3.4	3.0
AC Locked Rotor A	36.0	20.4	18.0
Non-Inductive A	10 A, 24 to 277 VAC		
Pilot Duty	125 VA, 24 to 277 VAC		
Manual Reset			
AC Full Load A	16.0	9.2	8.0
AC Locked Rotor A	96.0	55.2	48.0
Non-Inductive A	16.0	9.2	8.0
Pilot Duty	125 VA, 24 to 600 VAC		

1. SPST and N.O. contact of SPDT control;
SPDT N.C. contact- 16 amperes 120 to 277 VAC



A19 Series High Range Temperature Control

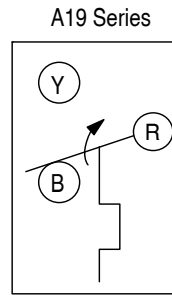
Description

The A19 Series Controls are single-stage temperature controls that incorporate liquid-filled sensing elements.

Refer to the *A19 Series Hot Water Heating Controls Well Immersion Product Bulletin (LIT-125025)* for important product application information.

Features

- wide temperature ranges available
- constant differential throughout the entire range
- single-pole, single-throw (SPST) or single-pole, double-throw (SPDT) snap-acting switches
- fixed or adjustable differential available
- unaffected by barometric pressure changes
- unaffected by cross-ambient conditions
- compact enclosure
- variety of sensing element styles



Action on Increase of Temperature

A19 Series Terminal Arrangement for SPDT



A19AAB Temperature Control

Applications

The A19s are suitable for temperature control in HVAC/R applications.

Selection Charts

A19 Series High Range Temperature Control

Product Code Number ¹	Switch Action	Range °F (°C)	Diff F° (C°) (Factory Set)	Bulb and Capillary	Bulb Well No. (Order Separately)	Range Adjuster	Max Bulb Temp °F (°C)
A19AAB-4C	SPST, open high Remote Bulb Thermostat	30 to 110 (-1 to 43)	3-1/2 (1.9)	3/8 in. x 5 in. copper 6 ft. capillary ²	WEL14A-602R	Screwdriver slot Visible scale	140 (60)
A19AAB-7C	SPST, open high Oven Thermostat	100 to 300 (38 to 149)	7 (3.9)	3/16 in. x 9-1/2 in. copper 6 ft. capillary	—	Knob Visible scale	350 (177)
A19AAB-10C	SPST, open high Oven Thermostat	200 to 550 (93 to 288)	10 (5.6)	3/16 in. x 6 in. copper 8 ft. capillary	—	Convertible	620 (327)
A19AAC-9C	SPDT	100 to 240 (38 to 116)	6 (3.3)	3/8 in. x 3-1/2 in. copper 6 ft. capillary ²	WEL14A-602R	Screwdriver slot Visible Scale	290 (143)
A19ABB-2C	SPST, open high Remote Bulb Thermostat	50 to 200 (10 to 93)	Adjustable 6 to 24 (3 to 13)	0.290 in. x 2-1/2 in. copper 10 ft. capillary	—	Knob Visible Scale	240 (116)
A19ABB-7C		50 to 201 (10 to 94)		7 x 64 mm copper 3m capillary			240 (116)

1. Specify code number, and closed tank fitting (Code Number **FTG13A-600R**), or bulb well, if required.
2. With 3-inch bulb support

Replacement Parts

Product Code Number	Description
CVR28A-617R	Concealed adjustment cover
CVR28A-618R	Visible scale cover
KNB20A-602R	Replacement knob kit

Technical Specifications

Electrical Ratings

Motor Ratings VAC	120	208	240
AC Full Load A	16.0	9.2	8.0
AC Locked Rotor A	96.0	55.2	48.0
Non-Inductive A ¹	22 A, 120 to 277 VAC		
Pilot Duty	125 VA, 24 to 600 VAC		

1. SPST and N.O. contact of SPDT control
SPDT N.C. contact - 16 A, 120 to 277 VAC



A19 Series Thermostat for Crop Drying

Description

The A19 Series are single-stage temperature controls that incorporate liquid-filled sensing elements.

Refer to the *A19 Series Utility Thermostats for Farm, Industrial, and Commercial Use Product Bulletin (LIT-125030)* for important product application information.

Technical Specifications

The maximum bulb temperature for the A19AAE-3 is 200°F (93°C) and for the A19ABB-2 is 240°F (116°C).

Electrical Rating 120 VAC

Motor Ratings VAC	120	208	240
A19AAE-3			
AC Full Load A	6.0	3.4	3.0
AC Locked Rotor A	36.0	20.4	18.0
Non-Inductive or Resistance Load A (Not Lamp Loads)	10 A 120 to 277 VAC		
Pilot Duty	125 VA, 24 to 277 VAC		
A19ABB-2			
AC Full Load A	10.0	–	6.0
AC Locked Rotor A	60.0	–	36.0
Pilot Duty	125 VA, 24 to 600 VAC		

Features

- designed for high temperature applications
- narrow (2F° fixed) or wide adjustable differentials

Applications

Crop drying thermostat energizes gas valve to maintain temperature.

Repair Information

If the A19 Series Thermostat for Crop Drying fails to operate within its specifications, replace the unit. For a replacement thermostat, contact the nearest Johnson Controls® representative.



A19AAE-3 Thermostat

Selection Chart

Product Code Number	Switch Action	Range °F (°C)	Differential F°(C°)	Bulb and Capillary	Range Adjuster	Max. Bulb Temperature °F (°C)
A19AAE-3C	Single-Pole, Single-Throw (SPST) open high	80 to 180 (27 to 82)	2 (1.1) fixed	1/8 in. x 1-1/4 in. copper-coiled 10 ft capillary	Knob Ext. scale	200 (93)
A19ABB-2C	SPST open high	50 to 200 (10 to 93)	6 to 24 (3 to 13) adjustable	0.290 in. x 2-1/2 in. 10 ft. capillary	Knob Ext. Scale	240 (116)



A19 Series Hot Water Temperature Control (Well Immersion)

Description

The A19 Series Temperature Controls are a universal replacement control for open high or single-pole, double-throw (SPDT) applications. The control is furnished with a well assembly for 1/2 in. tapping.

Refer to the *A19 Series Hot Water Heating Controls Well Immersion Product Bulletin (LIT-125025)* for important product application information.

Features

- liquid-filled element provides rapid response to temperature change
- adjustable differential
- universal replacement

Applications

This operating control is ideal for hot water boilers.



A19ABC-11
Temperature Control

A19ABC-12 Temperature Control

Selection Charts

A19 Series Hot Water Temperature Control (Well Immersion)

Product Code Number	Application	Switch Action	Range °F (°C)	Differential F° (C°)	Well Connector Size—NPT	Range Adjuster	Max. Bulb Temp. °F (°C)
A19ABC-11C	Open high (R-B)	Single-Pole, Double-Throw (SPDT)	100 to 240 (38 to 116)	6 to 24 (3 to 13)	1/2 in.	Convertible	250 (121)
A19ABC-12C	Open low (R-Y)						290 (143)
A19ADB-2C	High temperature lockout	Single-Pole, Single-Throw (SPST) Open high with lockout	100 to 240 (38 to 116)	Manual reset (locks out high)	1/2 in.	Knob	250 (121)

Replacement Parts

Product Code Number	Description
CVR28A-617R	Concealed adjustment cover
CVR28A-618R	Visible scale cover
KNB20A-602R	Knob kit

Technical Specifications

Electrical Ratings

Motor Ratings VAC	120	240
AC Full Load A	10.0	6.0
AC Locked Rotor A	60.0	36.0
Pilot Duty	125 VA, 24 to 600 VAC	



A19 Temperature Control Less Enclosure (SPDT, Close Differential)

Description

The A19 Temperature Control Less Enclosure is an open-type temperature control for mounting in cases or enclosures.

Refer to the *A19 Series Temperature Controls Less Enclosure Product Bulletin (LIT-125045)* for important product application information.

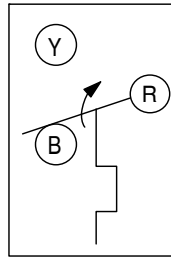
Features

This control is designed with single-pole, double-throw (SPDT) contacts for open high or open low applications.

Applications

Use for panel-mounted temperature control for a packaged terminal air conditioner or for self-contained HVAC equipment.

A19 Series



Action on Increase of Temperature

A19 Series Terminal Arrangement for SPDT

a19.eps



A19AGF-31 Temperature Control

Selection Charts

A19 Temperature Control Less Enclosure (SPDT, Close Differential)

Product Code Number	Switch Action	Range °F (°C)	Differential F° (C°)	Bulb and Capillary	Range Adjuster	Maximum Bulb Temp. °F (°C)
A19AGF-31C	Single-Pole, Double-Throw (SPDT)	40 to 90 (4 to 32)	1-1/2 (0.8)	3/8 x 5 in.; 5 ft. capillary	Shaft	140 (60)

Replacement Parts

Product Code Number	Description
CVR28A-617R	Concealed adjustment
CVR28A-618R	Visible scale
KNB20A-602R	Knob Kit

Technical Specifications

- back mounting
- knob supplied by the customer

Electrical Ratings

Motor Ratings VAC	120	208	240
AC Full Load A	6.0	3.4	3.0
AC Locked Rotor A	36.0	20.4	18
Non-Inductive	10 A, 120 to 277 VAC		
Pilot Duty	125 VA, 24 to 277 VAC		



A19 Series Thermostat for Hazardous Locations

Description

The A19 Series Thermostat provides remote bulb or coiled bulb sensing for hazardous environments.

Refer to the *Types A19AUC, A19BUC Fixed Differential Thermostat For Hazardous Location Product Bulletin (LIT-121035)* for important product application information.

Features

- precision enclosed switch and a liquid-filled sensing element provides repeat accuracy that is unaffected by barometric pressure and cross-ambient temperature fluctuations
- single-pole, double-throw (SPDT) switch provides open high or close high action for heating or cooling
- electrical rating permits direct control of most equipment

Applications

These thermostats are designed for use in grain elevators, chemical and powder plants, mines, oil refineries, and similar sites. For use in Class I, Group D and Class II, Groups E, F, and G hazardous locations.

Repair Information

If the A19 Series Thermostat for Hazardous Locations fails to operate within its specifications, replace the unit. For a replacement thermostat, contact the nearest Johnson Controls® representative.

Technical Specifications

Electrical Ratings

Motor Ratings VAC	120	208	240	277
Full Load Amperes	16.0	9.2	8.0	–
Locked Rotor Amperes	96.0	55.2	48.0	–
Non-Inductive Amperes	22.0	22.0	22.0	22.0
Pilot Duty	125 VA, 24 to 600 VAC			



A19AUC
Thermostat

A19BUC
Thermostat

Selection Chart

Product Code Number	Switch Action	Range °F (°C)	Differential F° (C°)	Bulb and Capillary	Bulb well (if required)	Range Adjuster	Maximum Bulb Temp. °F (°C)
A19AUC-1C	SPDT	-30 to 50 (-34 to 10)	5 (2.8)	3/8 in. x 4-1/16 in., 6 ft. capillary	WEL14A-602R	Knob	140 (60)
A19AUC-2C		20 to 80 (-7 to 27)	3-1/2 (1.9)	3/8 in. x 4-31/32 in., 6 ft. capillary	WEL14A-603R		140 (60)
A19AUC-3C		0 to 150 (-18 to 66)	6 (3)	3/10 x 2-1/2 in., 10 ft. capillary	WEL16A-600R		190 (88)
A19AUC-4C		100 to 250 (38 to 121)	6 (3)	3/10 x 2-3/8 in., 10 ft. capillary	WEL16A-600R		290 (143)
A19BUC-2C		20 to 80 (-7 to 27)	3-1/2 (1.9)	Coiled	–		140 (60)



A19 Series Coiled Bulb Space Thermostat

Description

The A19 Series Thermostat is a wide range temperature control with air coil sensing element.

Refer to the *A19 Series Utility Thermostats for Farm, Industrial, and Commercial Use Product Bulletin (LIT-125030)* for important product application information.

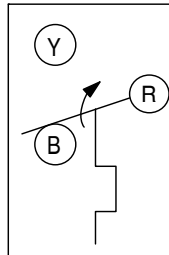
Features

- wide temperature range
- NEMA 1 enclosure

Applications

Use for return air or space temperature sensing.

A19 Series



Action on Increase of Temperature

a19.eps

A19 Series Terminal Arrangement for SPDT



A19BAC Thermostat

Selection Charts

A19 Series Coiled Bulb Space Thermostat

Product Code Number	Switch Action	Range °F (°C)	Differential F° (C°)	Bulb and Capillary	Range Adjuster	Maximum Bulb Temp °F (°C)
Ventilating, Heating						
A19BAB-3C	Single-Pole, Single-Throw (SPST), open high	35 to 95 (0 to 35)	3 (1.7) fixed	1-3/8 in. x 2-1/4 in. coiled	Knob	140 (60)
A19BAC-1C	Single-Pole, Double-Throw (SPDT)	30 to 110 (-1 to 43)	3-1/2 (1.9) fixed	1-3/8 in. x 2-1/4 in. coiled	Convertible	
A19BAF-1C	SPDT	30 to 110 (-1 to 43)	1-1/2 (0.9) fixed	1-3/8 in. x 2-1/4 in. coiled	Knob	
Cooling						
A19BBC-2C ¹	SPDT	-30 to 100 (-34 to 38)	3 to 12 (1.7 to 7)	1-3/8 in. x 2-1/4 in. coiled	Convertible	140 (60)

1. Replaces White-Rodgers® 201-16, -8, 2A37-1; Ranco® 010-1418, -1802, 016-594, C30-C1101; Honeywell® T631A, T696A, T6054 A1005.

Replacement Parts

Product Code Number	Description
CVR28A-617R	Concealed adjustment cover
CVR28A-618R	Visible scale cover
KNB20A-602R	Knob kit

Technical Specifications

Electrical Ratings

Motor Ratings VAC	120	208	240
A19BAB, A19BAC			
AC Full Load A	16.0	9.2	8.0
AC Locked Rotor A	96.0	55.2	48.0
Non-Inductive or Resistance Load A ¹ (Not Lamp Loads)	22 A, 120 to 277 VAC		
Pilot Duty	125 VA, 24 to 600 VAC		
A19BAF			
AC Full Load A	6.0	3.4	3.0
AC Locked Rotor A	36.0	20.4	18.0
Non-Inductive or Resistance Load A (Not Lamp Loads)	10 A, 120 to 277 VAC		
Pilot Duty	125 VA, 24 to 277 VAC		
Cooling - A19BBC			
AC Full Load A	16.0	9.2	8.0
AC Locked Rotor A	96.0	55.2	48.0
Non-Inductive or Resistance Load A ¹ (Not Lamp Loads)	22 A, 120 to 277 VAC		
Pilot Duty	125 VA, 24 to 600 VAC		

1. SPST and only one side of SPDT control; SPDT - 16 A 120 to 277 VAC



A19 Thermostat for Portable Heaters (Chain Mount and Drop Cord Electrical Connection)

Description

The A19 Series Thermostat is a sturdy compact thermostat designed especially for temporary installations.

Refer to the *Type A19BAG Thermostat for Portable Heaters with Thermostat Extension Cord and Beaded Chain Hanger Product Bulletin (LIT-121040)* for important product application information.

Features

- 6-foot extension cord with piggyback style plug
- NEMA 1 enclosure
- chain mount

Applications

- on/off control of portable space heaters
- agriculture

Repair Information

If the A19 Thermostat for Portable Heater fails to operate within its specifications, replace the unit. For a replacement thermostat, contact the nearest Johnson Controls® representative.

Technical Specifications

Electrical Ratings

Motor Ratings VAC	120
AC Full Load A	15
AC Locked Rotor A	90



A19BAG-1 Thermostat

Selection Chart

Product Code Number	Switch Action	Range °F (°C)	Differential F° (C°)	Maximum Bulb Temperature °F (°C)
A19BAG-1C	Single-Pole, Single-Throw (SPST) open high No-Heat position	35 to 95 (2 to 35)	3 (1.7) Non-adjustable	140 (60)



A19 Thermostat for Portable Cooling Applications (Chain Mount and Drop Cord Electrical Connection)

Description

The A19 Series Thermostat is a sturdy compact thermostat designed especially for temporary installations.

Refer to the *A19 Series Hot Water Heating Controls Well Immersion Product Bulletin (LIT-125025)* for important product application information.

Features

- 6-foot extension cord with piggyback style plug
- NEMA 1 enclosure
- chain mount
- remote sensing bulb with 6 ft (1.8 m) capillary tube

Applications

- on/off control of portable cooling applications
- home brewing

Repair Information

If the A19 Thermostat for Portable Cooling Applications (Chain Mount and Drop Cord Electrical Connections) fails to operate within its specifications, replace the unit. For a replacement thermostat, contact the nearest Johnson Controls® representative.

Technical Specifications

Electrical Ratings

Motor Ratings VAC	120
AC Full Load Amperes	15
AC Locked Rotor Amperes	90



A19AAT-2 Thermostat

Selection Chart

Product Code Number	Switch Action	Range °F (°C)	Differential F° (C°)	Maximum Bulb Temperature °F (°C)
A19AAT-2C	Single-Pole, Single-Throw (SPST) open low	20 to 80 (-7 to 27)	3-1/2 ± 2 (2 ± 1.11) Non-adjustable	140 (60)



A19 Series Automatic Changeover with Strap-On Mounting

Description

The A19 Series Changeover is a control for use with combination heating and cooling thermostats.

Refer to the *A19CAC Type Automatic Changeover Control Product Bulletin (LIT-125065)* for important product application information.

Features

This control automatically selects the correct thermostat function.

Applications

Recommended for convectors, fan coils, and blast coil units, and similar devices. The A19CAC-2 Control can be mounted directly on either a vertical or a horizontal pipe, using the can mounting strap supplied with control. The A19CAC-1 Control has a remote bulb for greater mounting convenience.

Selection Charts

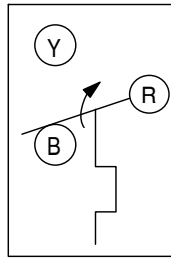
A19 Series Automatic Changeover with Strap-on Mounting

Product Code Number	Switch Action	Range °F (°C)	Differential F°(C°)	Mounting
A19CAC-1C	Single-Pole, Double-Throw (SPDT)	60 to 90 (16 to 32)	10 (5.6)	42 in. Capillary
A19CAC-2C	SPDT	60 to 90 (16 to 32)	10 (5.6)	Direct

Replacement Parts

Product Code Number	Description
CVR28A-617R	Concealed adjustment cover

A19 Series



Action on Increase of Temperature

A19 Series Terminal Arrangement for SPDT

a19.eps



A19CAC-1 Control (Remote Bulb Model)

Technical Specifications

- maximum case ambient temperature: 131°F (55°C)
- maximum bulb temperature: 250°F (121°C)

Electrical Ratings

Motor Ratings VAC	120	240
AC Full Load A	10.0	6.0
AC Locked Rotor A	60.0	36.0
AC Non-Inductive A	10.0	6.0
Pilot Duty	125 VA, 24 to 240 VAC	



A19D Series Surface Mounted Temperature Controls

Description

The A19D Series Surface Mounted Temperature Controls are reliable, durable On/Off temperature controls with line-voltage single-pole, double-throw (SPDT) switches. The A19D Series Controls are designed primarily for fluid piping applications and include two adjustable mounting straps for mounting the control directly to a pipe.

Refer to the *A19D Series Surface Mounted Temperature Controls Product Bulletin (LIT-125070)* for important product application information.

Features

- SPDT switch action provides either high or low temperature detection.
- sealed, dust-protected switch provides reliable and durable On/Off control for commercial and industrial applications.
- color-coded electrical terminals simplify wiring the controls.
- sensing element insulated from the control case minimizes the effects of ambient temperature on the control setpoint.

- convertible range adjuster kit provides knob, screwdriver, or concealed adjustment options.
- multi-position mounting capability allows you to mount the control in any position on horizontal, vertical, or angled pipes.
- NEMA 1 enclosure provides protection against contact with the control's electrical components and protects the switch and electrical terminals from incidental contact.

Applications

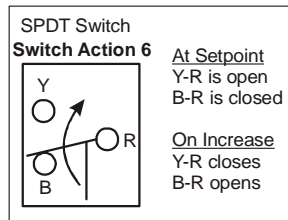
Typical A19D control applications include high temperature detection on boiler applications and low temperature detection on unit heaters coil applications.



A19D Series Temperature Control

Repair Information

If the A19D Series Surface Mounted Temperature Control fails to operate within its specifications, replace the unit. For a replacement control, contact the nearest Johnson Controls® representative.



A19D Series Control Switch Action

Selection Chart

Product Code Number	Description
A19DAC-1C	100 to 240°F Temperature Range and Scale, 10 F° (± 2.8 F°) Differential, Visible Range Scale
A19DAC-9C	40 to 120°C Temperature Range and Scale, 6 C° (± 1.0 C°) Differential, Visible Range Scale
A19DAC-10C	40 to 120°C Temperature Range and Scale, 6 C° (± 1.0 C°) Differential, Concealed Range Scale
A19DAC-12C	100 to 240°F Temperature Range and Scale, 10 F° (± 2.8 F°) Differential, Concealed Range Scale
A19DAF-2C	200 to 240°F Temperature Range and Scale, 3-1/2 F° (± 2.0 F°) Differential, Concealed Range Scale

Technical Specifications

A19D Series Surface Mount Temperature Controls					
Product Code Number	A19DAC: SPDT switch, standard differential A19DAF: SPDT switch, narrow differential				
Adjustable Temperature Range	A19DAC: 100 to 240°F or 40 to 120°C A19DAF: 200 to 240°F (95 to 120°C)				
Fixed Temperature Differential	A19DAC: 10 F° or 6.0 C° A19DAF: 3-1/2 F° (1.9 C°)				
Maximum Ambient Operating Temperature	Controller Housing: 140°F (60°C) Sensor Element: 250°F (121°C)				
Switch Contact Action	SPDT, Snap Acting, Enclosed Dust Protected Pennswitch Red to Yellow Terminal Contacts Close on Temperature Increase Red to Blue Terminal Contacts Open on Temperature Increase				
Terminal Screws	No. 8-32 x 1/4 in. Binder Head with Cup Washers				
Electrical Ratings	A19DAC: Standard Differential		A19DAF: Narrow Differential		
	Motor Rating VAC	120	240	120	240
	Full Load Amperes	10.0	6.0	6.0	3.4
	Locked Rotor Amperes	60.0	36.0	36.0	20.4
	Non-Inductive Amperes	10.0	6.0	6.0	3.4
	Pilot Duty	125 VA, 24 to 277 VAC		125 VA, 24 to 277 VAC	
Enclosure	NEMA Type 1 General Purpose; Cold Rolled Steel, Gray Baked Enamel				
Mounting	Clamp-On (Straps Included)				
Shipping Weight	1-1/5 lb (.54 kg)				
Compliance	UL Guide No. XAPX, File E6688 CSA Class No. 4813 02, File LR948 C-Tick				

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A19 Flange Mounted Duct Thermostat

Description

The A19 Flange Mounted Duct Thermostat is a wide-range temperature control with a special air coil sensing element and an adjustable mounting flange.

Refer to the *A19 Series Hot Water Heating Controls Well Immersion Product Bulletin (LIT-125025)* for important product application information.

Features

- single-pole, double-throw (SPDT) snap-action switch
- unaffected by barometric pressure or cross-ambient temperatures
- flat flange mounting with the coil element permits positioning the sensing bulb in the appropriate portion of the air stream

Selection Charts

A19 Flange Mounted Duct Thermostat

Product Code Number	Switch Action	Range °F (°C)	Differential F° (C°)	Maximum Bulb Temperature °F (°C)
A19EAF-1C	SPDT	60 to 130 (16 to 54)	2 (1.1)	200 (93)
A19EAF-2C	SPDT	30 to 110 (-1 to 43)	2 (1.1)	140 (60)

Replacement Parts

Product Code Number	Description
CVR28A-618R	Visible scale cover

Applications

These duct thermostats are used on rooftop units, make-up heaters, duct heaters, and air handling systems of all types.

Technical Specifications

Electrical Ratings

Motor Ratings VAC	120	208	240
AC Full Load A	6.0	3.4	3.0
AC Locked Rotor A	36.0	20.4	18.0
Non-Inductive	10 A, 120 to 277 VAC		
Pilot Duty	125 VA, 24 to 277 VAC		



A19EAF Thermostat



A19 Series Fan or Cutout Control (Liquid Expansion Bulb)

Description

The A19 Series Fan or Cutout Control is a wide range temperature control with adjustable dial stops and mounting flange.

Refer to the *A19E Series Warm Air Fan and Duct Controls Low or Line Voltage Product Bulletin (LIT-125075)* for important product application information.

Features

- liquid charged element for fast response
- may be mounted in any position

Applications

This control is designed for low or line voltage applications including warm air or furnace fan control.



**A19EBA, A19EBB, A19EBC
A19EDB Cutout Controls
(A19EDB not for use as cutout control)**

Selection Chart

A19 Series Fan or Cutout Control (Liquid Expansion Bulb)

Product Code Number	Application	Switch Action	Range °F (°C)	Differential F° (C°)		Adjustable Stop °F (°C)		Bulb Length	Maximum Bulb Temperature °F (°C)
				Min	Max	Min	Max		
A19EBA-1C	Furnace Fan Control	Close high Single-Pole, Single-Throw (SPST)	50 to 250 (10 to 121)	9 (5)	36 (20)	145 (63)	250 (121)	6 in.	290 (143)
A19EBB-1C	Warm Air	Open high SPST	100 to 350 (38 to 177)	9 (5)	36 (20)	240 (116)	350 (177)	6 in.	375 (191)
A19EBC-1C	Counter-Flow Warm Air Furnace	Single-Pole, Double-Throw (SPDT)	100 to 350 (38 to 177)	9 (5)	36 (20)	240 (116)	350 (177)	6 in.	375 (191)
A19EDB-1C ¹	Warm Air With Lock Out	Open high SPST	100 to 350 (38 to 177)	Manual Reset		240 (116)	350 (177)	6 in.	375 (191)

1. A19EDB-1 not for use as a limit control.

Replacement Parts

Product Code Number	Description
CVR28A-618R	Visible scale cover

Technical Specifications

Electrical Ratings

Motor Ratings VAC	120	208	240	277
A19EBA, A19EBB				
AC Full Load A	16.0	9.2	8.0	–
AC Locked Rotor A	96.0	55.2	48.0	–
AC Non-Inductive A	22.0	22.0	22.0	22.0
Pilot Duty	125 VA, 24 to 600 VAC			
A19EBC				
AC Full Load A	16.0	9.2	8.0	–
AC Locked Rotor A	96.0	55.2	48.0	–
AC Non-Inductive A	16.0	16.0	16.0	16.0
Pilot Duty	125 VA, 24 to 600 VAC			
A19EDB				
AC Full Load A	16.0	9.2	8.0	–
AC Locked Rotor A	96.0	55.2	48.0	–
AC Non-Inductive A	22.0	22.0	22.0	16.0
Pilot Duty	125 VA, 24 to 600 VAC			



A19 Temperature Control with Rainproof Enclosure

Description

The A19 Temperature Control is a remote bulb temperature control with a rainproof (NEMA Type 3R) enclosure.

Refer to the *A19 Series Hot Water Heating Controls Well Immersion Product Bulletin (LIT-125025)* for important product application information.

Features

This control has a rainproof gasketed enclosure.

Applications

Use for control of cooling tower sump heaters.

Repair Information

If the A19 Temperature Control with Rainproof Enclosure fails to operate within its specifications, replace the unit. For a replacement control, contact the nearest Johnson Controls® representative.



A19ANC-1 Temperature Control

Selection Chart

Product Code Number	Switch Action	Range °F (°C)	Diff. F° (C°)	Bulb and Capillary	Bulb Well No. (Order Separately)	Range Adjuster	Max. Bulb Temp. °F (°C)
A19ANC-1C	Single-Pole, Double-Throw (SPDT)	0 to 150 (-18 to 66)	5 (2.8) fixed	3/10 x 2-1/2 in. 10 ft. capillary	WEL11A-601R	Screwdriver slot	190 (88)

Technical Specifications

- maximum bulb temperature: 190°F (88°C)
- maximum ambient temperature: 140°F (60°C)

Electrical Ratings

Motor Ratings VAC	120	208	240	277	
AC Full Load A	16.0	9.2	8.0	—	
AC Locked Rotor A	96.0	55.2	48.0	—	
Non-Inductive A	When connected Single-Pole, Single-Throw (SPST)	22.0	22.0	22.0	22.0
	When connected SPDT	16.0	9.2	8.0	6.9
Pilot Duty	125 VA, 24 to 600 VAC				



A19 Agricultural/Industrial Thermostat with NEMA 4X Enclosure

Description

The A19PRC is a single-stage temperature control designed for heating and ventilation applications. It features a raintight enclosure for use in agricultural and industrial applications that require compliance with Article 547 of the National Electrical Code. The A19PRC Thermostat has a rugged thermoplastic enclosure that meets NEMA 4X specifications.

Refer to the *A19 Series Hot Water Heating Controls Well Immersion Product Bulletin (LIT-125025)* for important product application information.

Features

- an O-ring sealed setpoint adjustment knob
- exposed portion of the liquid filled sensing elements are plated and plastic coated to resist damage in corrosive atmospheres

Applications

Typical applications include controlling ventilation or heating equipment in animal confinement or industrial buildings.

Repair Information

If the A19 Agricultural/Industrial Thermostat with NEMA 4X Enclosure fails to operate within its specifications, replace the unit. For a replacement thermostat, contact the nearest Johnson Controls® representative.

Technical Specifications

Electrical Ratings

Motor Ratings VAC	120	208	240
AC Full Load A	16.0	9.2	8.0
AC Locked Rotor A	96.0	55.2	48.0
Non-Inductive or Resistance Load A (Not Lamp Loads) ¹	22 A, 120/277 VAC		
Pilot Duty	125 VA, 24 to 600 VAC		

1. Single-pole, single-throw (SPST) and only one side of single-pole, double-throw (SPDT) control; SPDT - 16 A, 120 to 277 VAC



A19PRC Thermostat

Selection Chart

Product Code Number	Switch Action	Range °F (°C)	Differential F° (C°)	Bulb and Capillary	Range Adjuster
A19PRC-1C	SPDT	30 to 110 (1 to 43)	3 to 12 (1.7 to 6.7)	1-3/8 in. x 2 -1/4 in. Coiled	Knob



A19 Industrial Thermostat (Watertight and Dusttight)

Description

The A19 Industrial Thermostat is a wide range temperature control with rainproof enclosure, single-pole, double-throw (SPDT) switch, and 5F° fixed differential.

Refer to the *A19 Series Hot Water Heating Controls Well Immersion Product Bulletin (LIT-125025)* for important product application information.

Features

- rugged steel enclosure
- liquid filled sensing element (provides uniform control)

Applications

Use for refrigeration, air conditioning, and heating applications that require a NEMA 4 watertight and dusttight enclosure.

Accessories

Order code number **WEL16A-600R** bulb well, if required.

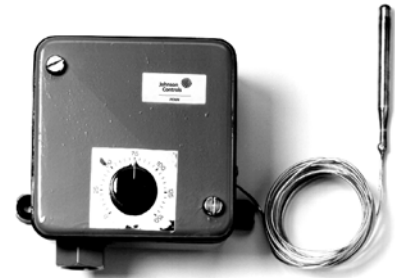
Repair Information

If the A19 Industrial Thermostat (Watertight and Dusttight) fails to operate within its specifications, replace the unit. For a replacement thermostat, contact the nearest Johnson Controls® representative.

Technical Specifications

Electrical Ratings

Motor Ratings VAC	120	208	240
AC Full Load A	16.0	9.2	8.0
AC Locked Rotor A	96.0	55.2	48.0
Non-Inductive or Resistance Load A (Not Lamp Loads)	16.0	9.2	8.0
Pilot Duty	125 VA, 24 to 600 VAC		



A19KNC-1 Thermostat

Selection Chart

Product Code Number	Switch Action	Range °F (°C)	Differential F° (C°)	Bulb and Capillary	Bulb Well No. (Order Separately)	Range Adjuster
A19KNC-1C	SPDT	0 to 150 (-15 to 65)	5 (2.8) fixed	3/10 x 2-1/2 in. 10 ft. capillary	WEL16A-600R	Knob



A19 Temperature Control with NEMA 4X Enclosure (Remote Bulb)

Description

The A19 Temperature Control is a remote bulb temperature control with a watertight NEMA 4X enclosure.

Refer to the *A19 Series Hot Water Heating Controls Well Immersion Product Bulletin (LIT-125025)* for important product application information.

Applications

- cooling tower sump heaters
- control of heating or ventilating equipment

Features

- watertight gasketed thermoplastic enclosure that meets NEMA 4X specifications
- concealed setpoint adjustment

Repair Information

If the A19 Temperature Control with NEMA 4X Enclosure (Remote Bulb) fails to operate within its specifications, replace the unit. For a replacement control, contact the nearest Johnson Controls® representative.



A19QSC Temperature Control

Technical Specifications

Maximum ambient temperature: 140°F (60°C).

Electrical Ratings

Motor Ratings VAC	120	208	240	277	
AC Full Load Amperes	16.0	9.2	8.0	—	
AC Locked Rotor Amperes	96.0	55.2	48.0	—	
Non-Inductive Amperes	When connected Single-Pole, Single-Throw (SPST)	22.0	22.0	22.0	22.0
	When connected Single-Pole, Double-Throw (SPDT)	16.0	9.2	8.0	6.9
Pilot Duty	125 VA, 24 to 600 VAC				

Selection Chart

Product Code Number	Switch Action	Range °F (°C)	Differential F° (C°)	Bulb and Capillary	Bulb Well No. (Order Separately)	Range Adjuster	Maximum Bulb Temperature °F (°C)
A19QSC-1C	SPDT	0 to 150 (-18 to 66)	5±2 (2.82 ±1.11) fixed	3/10 x 2-1/2 in.; 10 ft. capillary	WEL11A-601R	Concealed screwdriver slot	190 (88)
A19QSC-2C		100 to 250 (38 to 121)	6±2 (32 ±1.11) fixed	3/10 x 2-3/8 in.; 10 ft capillary	—		290 (143)
A19QSC-3C		200 to 350 (93 to 176)	5±2 (2.82 ±1.11) fixed	3/10 x 2-1/4 in.; 10 ft capillary	—	390 (199)	
A19QSC-4C		0 to 190 (-18 to 88)	5±2 (2.82 ±1.11) fixed	3/10 x 2-1/2 in.; 20 ft capillary	WEL11A-601R	190 (88)	



A19 Water Chiller Control with Locked Cut-Out/Adjustable Cut-In

Description

The A19 Water Chiller Control is a remote bulb temperature control with limited setpoint range, adjustable differential, and adjustable cut-out.

Refer to the *A19ZBA Type Temperature Control Product Bulletin (LIT-121065)* for important product application information.

Features

- adjustable cut-out (38 to 47°F)
- wide differential adjustment range

Accessories

- includes Code No. FTG13A-600R Packing Nut as standard
- replacement cover: CVR61A-600R

Applications

Use for water chillers.

Repair Information

If the A19 Water Chiller Control with Locked Cut-Out/Adjustable Cut-In fails to operate within its specifications, replace the unit. For a replacement control, contact the nearest Johnson Controls® representative.



A19ZBA Water Chiller Control

Technical Specifications

Maximum bulb temperature is 140°F (60°C).

Electrical Ratings

Motor Ratings VAC	120	208	240
AC Full Load A	16.0	9.2	8.0
AC Locked Rotor A	96.0	55.2	48.0
Non-Inductive or Resistance Load A (Not Lamp Loads)	16.0	9.2	8.0
Pilot Duty	125 VA, 24 to 277 VAC		

Selection Chart

Product Code Number	Switch Action	Range °F (°C)	Differential F° (C°)	Bulb and Capillary	Bulb Well No. (Order Separately)	Range Adjuster
A19ZBA-1C	Single-Pole, Single-Throw (SPST) Close high, open low	38 to 80 (3 to 27)	8 to 40 (4 to 22) Adjustable	3/8 in. x 3-7/16 in. 6 ft. capillary	WEL14A-602R	Knob



A19 Defrost Duration and Fan Delay Control

Description

The A19 Defrost Duration and Fan Delay Control is a remote bulb control with adjustable defrost termination temperature and preset fan delay temperature.

Refer to the *A19ZBC Type Temperature Control Product Bulletin (LIT-121071)* for important product application information.

Features

- sensing element unaffected by barometer pressure and cross ambient temperature problems
- limited adjustment range

Applications

Use for defrost termination control for refrigerated display cases.

Repair Information

If the A19 Defrost Duration and Fan Delay Control fails to operate within its specifications, replace the unit. For a replacement control, contact the nearest Johnson Controls® representative.

Technical Specifications

- maximum bulb temperature: 140°F (60°C)
- fan delay temperature: factory set at 25°F (-4°C)

Electrical Ratings

Motor Ratings VAC	120	208	240
AC Full Load A	16.0	9.2	8.0
AC Locked Rotor A	96.0	55.2	48.0
Non-Inductive or Resistance Load A (Not Lamp Loads)	16.0	9.2	8.0
Pilot Duty	125 VA, 24 to 277 VAC		



A19ZBC-2 Defrost Duration and Fan Delay Control

Selection Chart

Product Code Number	Switch Action	Defrost Termination °F (°C)	Bulb and Capillary	Range Adjuster
A19ZBC-2C	Single-Pole, Double-Throw (SPDT)	45 to 85 (7 to 29)	19/64 in. x 3-1/8 in.; 6 ft. capillary	Knob



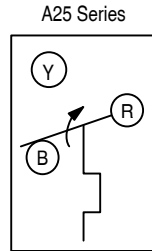
A25 Series Warm Air Limit Control with Manual Reset

Description

The A25 Warm Air Control Locks out on a temperature increase to the control setpoint. Manual reset is required before the electrical contacts can be reclosed.

The A25 Control is normally located in a return air duct and is wired to shut down air conditioning or ventilating fans when the temperature of the air becomes excessively hot.

Refer to the *A25 Series Warm Air Control with Manual Reset Product Bulletin (LIT-125118)* for important product application information.



Action on Increase of Temperature

A25 Series Action Diagram

a25.eps



A25AN-1 Warm Air Limit Control



A25AP-1 Warm Air Limit Control

Applications

Use for high temperature cut-out.

Features

- trip-free reset lever does not permit restarting until the reset lever is manually released
- the rod and tube type sensing element provides positive control action

Repair Information

If the A25 Series Warm Air Limit Control with Manual Reset fails to operate within its specifications, replace the unit. For a replacement control, contact the nearest Johnson Controls® representative.

Technical Specifications

The maximum element temperature is 300°F (149°C).

Electrical Ratings

Motor Ratings VAC	120	208	240	277
AC Full Load A	16.0	9.2	8.0	—
AC Locked Rotor A	96.0	55.2	48.0	—
Non-Inductive A	16.0 A at 120/277 VAC			
Pilot Duty	125 VA, 24 to 600 VAC			

Selection Chart

Product Code Number	Switch Action	Range °F (°C)	Range Adjuster	Dial Stop °F (°C)
A25AN-1C	Single-Pole, Single-Throw (SPST), Open high	25 to 215 (-4 to 102)	Knob	High limit set at 125 (52)
A25CN-1C	Single-Pole, Double-Throw (SPDT)	25 to 215 (-4 to 102)	Knob	High limit set at 125 (52)
Factory Mutual Approved Models				
A25AP-1C	SPST Open high	25 to 215 (-4 to 102)	Concealed screwdriver slot	High limit set at 125 (52)
A25CP-1C	SPDT	25 to 215 (-4 to 102)	Concealed screwdriver slot	High limit set at 125 (52)



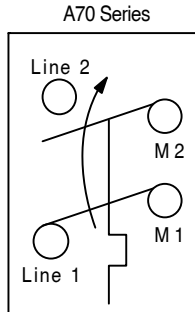
A70 Series Four-Wire, Two-Circuit Temperature Control

Description

The A70 Series Temperature Control incorporates a vapor-charged sensing element. The A70G, A70H, and A70K have a four-wire, two-circuit contact block that contains two isolated sets of contacts.

The contacts are designed so that when the main contact opens, the auxiliary contact closes.

Refer to the *A70, A72 Series Temperature Controls for Refrigeration and Heating Product Bulletin (LIT-125155)* for important product application information.



Action on Increase on Temperature

A70 Series Action Diagram



A70GA-1 Temperature Control

Features

- long-life, snap-acting contacts
- automatic or manual reset models

Applications

Typical applications include energizing an indicator light after a low temperature cutout on a ventilating system.

Selection Charts

A70 Series Four-Wire, Two-Circuit Temperature Control

Product Code Number	Switch Action		Range °F (°C)	Differential F° (C°)	Bulb and Capillary	Maximum Bulb Temperature °F (°C)	Range Adjuster	
	Main Contacts	Auxiliary Contacts						
A70GA-1C ¹	Open low	Close low	15 to 55 (-9.4 to 12.8)	5 (2.8)	20 ft of 1/8 in. O.D. tubing	400 (204.4)	Screwdriver slot	
A70GA-2C			35 to 80 (1.7 to 26.7)	3 to 30 (-16.1 to -1.1), factory set at 12 (-11.1)	3/8 in. x 3 in. 6 ft capillary	250 (121)		
A70HA-1C ¹			Manual reset	15 to 55 (-9.4 to 12.8)	20 ft of 1/8 in. O.D. tubing	400 (204.4)		
A70HA-2C				35 to 80 (1.7 to 26.7)		3/8 in. x 3 in. 6 ft capillary		250 (121)
A70HA-14C				15 to 55 (-9.4 to 12.8)		20 ft of 1/8 in. O.D. tubing		400 (204.4)
A70KA-1C			Open high	Close high	100 to 170 (37.8 to 76.7)			3/8 in. x 3 in. 6 ft capillary

1. On these models, the low cutout stop is set and sealed at 35°F (1.6°C). It cannot be set lower. The control responds only to the lowest temperature along any 14 to 16 in. section of the entire 20 ft element.

Replacement Covers

Product Code Number	Description
CVR17A-620R	Automatic reset cover
CVR17A-621R	Manual reset cover

Technical Specifications

Electrical Ratings

Pole Number	LINE-M2 (Main)						LINE-M1 (Auxiliary)			
	120	208	240	277	480 ¹	600 ¹	120	208	240	277
Motor Ratings VAC	16.0	9.2	8.0	—	5.0	4.8	6.0	3.4	3.0	—
AC Full Load A	96.0	55.2	48.0	—	30.0	28.8	36.0	20.4	18.0	—
AC Locked Rotor A	16.0	9.2	8.0	7.2	—	—	6.0	6.0	6.0	6.0
Pilot Duty – Both Poles	125 VA, 120 to 600 VAC and 57.5 VA, 120 to 300 VDC									

1. Not compressor motor loads.



A72 Series Two-Pole Heavy Duty Temperature Controls (Adjustable Differential)

Description

The A72 Series Temperature Controls incorporate a vapor charged sensing element and heavy duty contacts.

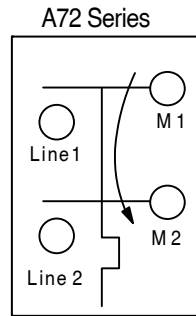
Refer to the *A70, A72 Series Temperature Controls for Refrigeration and Heating (LIT-125155)* for important product application information.

Features

The double-pole, single-throw (DPST) contact block contains two isolated sets of contacts that make or break simultaneously.

Applications

Use for automatic control of heavy electrical loads.



Action on Increase on Temperature

A72 Action Diagram



A72AA-3 Temperature Control

Selection Charts

Product Code Number	Switch Action	Range °F (°C)	Differential F° (C°)	Bulb and Capillary	Maximum Bulb Temperature °F (°C)	Range Adjuster
A72AA-1C	DPST Close high Open low	-30 to 30 (-34 to -1)	4 to 25 (2 to 14)	3/8 in. x 3 in. ¹ 6 ft capillary	200 (93)	Screwdriver slot
A72AA-2C	DPST Close high Open low	15 to 55 (-9 to 13)	3 to 30 (1.7 to 17)	3/8 in. x 3 in. ¹ 6 ft capillary	200 (93)	Screwdriver slot
A72AA-3C	DPST Close high Open low	50 to 90 (10 to 32)	3 to 30 (1.7 to 17)	11/16 in. x 6-3/4 in. Cross ambient 6 ft capillary	135 (57)	Screwdriver slot
A72AP-1C ²	DPST Close high Open low	-10 to 65 (-23 to 18)	4 to 40 (2 to 22)	11/16 in. x 6-3/4 in. Cross ambient 6 ft capillary	130 (54)	Screwdriver slot

1. Packing nut assembly available for direct immersion applications, Code No. FTG13A-600R.
2. Equipped with manual **PUSH TO START** button. Manual start feature is especially desirable on milk cooler jobs; permits manual start of the compressor when bulb temperature is between closing and opening setting of switch.

Replacement Covers

Product Code Number	Description
CVR17A-620R	Automatic reset cover
CVR17A-621R	Manual reset cover

Technical Specifications

Electrical Ratings

Motor Ratings VAC	120 Single-Phase	208 ¹ Single-Phase	240 ¹ Single-Phase	220 ¹ Two-Phase	208 Three-Phase	220 Three-Phase
Horsepower	2	3	3	5	5	5
AC Full Load A	24.0	24.0	24.0	15.0	15.9	15.0
AC Locked Rotor A	144.0	144.0	144.0	90.0	95.4	90.0
AC Non-Inductive A	24.0	24.0	24.0	-	-	-
DC Non-Inductive A ²	3.0	-	0.5	-	-	-
Pilot Duty	125 VA, 120 to 600 VAC; 57.5 VA, 120 to 300 VDC					

1. These full load and locked rotor ampere (not horsepower) ratings apply to hermetic compressors only.
2. This rating does not apply to the A72AP-1C Control.



A72 Series Cooling Tower or Evaporative Condenser Controls (Single-Stage Temperature Control with Outdoor Enclosure)

Description

The A72AE and A72CE are wide range temperature controls with heavy duty double-pole, single-throw (DPST) contacts and neoprene-coated sensing elements.

Refer to the *A72 Series Temperature Controls for Cooling Towers and Evaporated Condensers with Weather Resistant Enclosure Product Bulletin (LIT-125165)* for important product application information.

Features

Open high or close high models are available.

Applications

Use for control of cooling tower fans; motorized valves or solenoid operated valves.

Repair Information

If the A72 Series Cooling Tower or Evaporative Condenser Control fails to operate within its specifications, replace the unit. For a replacement control, contact the nearest Johnson Controls® representative.



A72 Series Temperature Control

Selection Chart

Product Code Number	Switch Action	Range °F (°C)	Differential F° (C°)	Bulb and Capillary	Range Adjuster
A72AE-1C	DPST; close high	25 to 90 (-5 to 30)	4 to 25 (2.2 to 14)	11/16 in. x 6-3/4 in. Neoprene-coated 6 ft cap.	Internal screwdriver slot
A72CE-1C	DPST; open high				

Technical Specifications

- ambient temperature limits: -65 to 150°F (-54 to 66°C)
- maximum bulb temperature: 170°F (77°C)

Electrical Ratings

Motor Ratings VAC	120 Single-Phase	208 ¹ Single-Phase	240 ¹ Single-Phase	220 ¹ Two-Phase	208 Three-Phase	220 Three-Phase
Horsepower	2	3	3	5	5	5
AC Full Load A	24.0	24.0	24.0	15.0	15.9	15.0
AC Locked Rotor A	144.0	144.0	144.0	90.0	95.4	90.0
AC Non-Inductive A	24.0	24.0	24.0	–	–	–
DC Non-Inductive A	3.0	–	0.5	–	–	–
Pilot Duty	125 VA, 120 to 600 VAC; 57.5 VA, 120 to 300 VDC					

1. These full load and locked rotor ampere (not horsepower) ratings apply to hermetic compressors only.



A72AA Coiled Bulb Space Thermostat (Cooling)

Description

The A72 is a space sensing temperature control with heavy-duty contacts.

Refer to the *A72 Series Temperature Controls for Cooling Towers and Evaporative Condensers with Weather Resistant Enclosure Product Bulletin (LIT-125165)* for important product application information.

Applications

Use for compressor cycling for walk-in coolers and freezers.

Accessories

For replacement cover, order code number **CVR17A-620R**.

Selection Chart

Product Code Number	Switch Action	Range °F (°C)	Differential F° (C°)	Bulb and Capillary	Range Adjuster
A72AA-4C	DPST Close high, open low	15 to 55 (-9 to 13)	3 to 30 (1.7 to 17)	Coiled copper bulb	Screwdriver slot

Technical Specifications

Maximum bulb temperature is 200°F (93°C).

Electrical Ratings

Motor Ratings VAC	120 Single-Phase	208 ¹ Single-Phase	240 ¹ Single-Phase	220 ¹ Two-Phase	208 Three-Phase	220 Three-Phase
Horsepower	2	3	3	5	5	5
AC Full Load Amperes	24.0	24.0	24.0	15.0	15.9	15.0
AC Locked Rotor Amperes	144.0	144.0	144.0	90.0	95.4	90.0
AC Non-Inductive Amperes	24.0	24.0	24.0	–	–	–
DC Non-Inductive Amperes	3.0	–	0.5	–	–	–
Pilot Duty	125 VA, 120 to 600 VAC; 57.5 VA, 120 to 300 VDC					

1. These full load and locked rotor ampere (not horsepower) ratings apply to hermetic compressors only.

Features

Double-pole, single-throw (DPST) contact block contains two isolated sets of contacts that make or break simultaneously.

Repair Information

If the A72AA Coiled Bulb Space Thermostat fails to operate within its specifications, replace the unit. For a replacement thermostat, contact the nearest Johnson Controls® representative.



A72AA-4 Thermostat



A421 Series Electronic Temperature Controls

Description

The A421 Series Electronic Temperature Controls are single-stage controls with a single-pole, double-throw (SPDT) output relay.

A421 Controls feature a bright backlit LCD with adjustable brightness and a three-button touchpad interface that can be set up to restrict user adjustments. An LED indicates the output relay's On/Off status. Standard A421 Series control modules have simple On and Off temperature settings for heating or cooling, an adjustable anti-short cycle delay, temperature setback, and sensor offset capability. The temperature control range is -40 to 212°F or -40 to 100°C.

The A421 controls are available either in Type 1 (NEMA), IP20 (CE), high-impact plastic enclosures suitable for surface or DIN rail mounting or in Type 4X (NEMA), IP67 (CE) watertight, corrosion resistant surface mount enclosures.

Refer to the *A421 Series Electronic Temperature Controls Product Bulletin (LIT-12011972)* for important product application information.

Applications

The A421 Electronic Temperature Control can be used to control a wide variety of single-stage refrigeration or HVAC equipment.

Sample temperature control applications include:

- temperature monitoring and alarming
- on/off control of boilers and chillers
- boiler and chiller pump control
- heating and cooling control
- floating temperature control of damper and valve actuators
- 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

Features

- easy-to-read, bright, adjustable backlit LCD screen displays the temperature, parameters, and status clearly and allows you to adjust LCD brightness for the ambient light conditions. Custom icons on the display provide visual cues on system and control status.
- basic and advanced programming menus allow you to easily set up your control application on the LCD using a simple three-button touchpad interface.
- adjustable On and Off temperature setpoints enable easy to set up cooling or heating control applications on the three-button touchpad, eliminating the need to remove the cover and reposition jumpers for reverse or direct control actions.
- high and low temperature setpoint adjustment stops allow you to set up your application for your desired range of adjustment and restrict user adjustment to just the desired temperature adjustment range.
- displayed temperature offset allows you to adjust the displayed temperature to the actual sensed temperature in applications where the resistance error in long sensor cable leads cause a deviation in the displayed temperature from the actual sensed temperature.
- adjustable anti-short cycle delay keeps the output relay Off after the Off setpoint is reached for a user-defined time delay, which helps avoid short cycling, hard starts, and nuisance overload outages on compressors and other inductive applications.
- temperature setback/offset control enables the control to shift the On and Off setpoint values by a user-defined offset when an external switch closes the binary input control circuit. Using a switching timer enables you to set up occupied/unoccupied temperature setback schedules for your applications.
- high-impact, thermoplastic Type 1/IP20 or Type 4X (NEMA)/IP66 watertight, corrosion-resistant enclosures increase application options, allowing surface and snap-fit DIN rail mount, or watertight surface mount.



A421 Series Electronic Temperature Control

- parameter adjustment restriction allows you to lock the control's setup parameters and restrict user adjustments to just the On and Off temperature setpoint values within your defined setpoint adjustment range.
- low- and line-voltage control models provide industry standard control voltage options for most refrigeration and HVAC control applications.

Repair Information

If the A421 Series Electronic Temperature Control fails to operate within its specifications, replace the unit. For a replacement A421 Control, contact the nearest Authorized Johnson Controls/PENN® Distributor or Sales Representative.



Single-Stage Electronic Temperature Controls

A421 Series Electronic Temperature Controls (Continued)

Selection Chart

A421 Electronic Temperature Control Selection Chart

Product Code Number	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 ft 7-1/5 in. (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 ft 9 in. (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 ft 1-1/5 in. (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-400C temperature sensor with 19 ft 6 in. (6.0 m) cable.
A421AEC-01C	Line-Voltage Type 4X Electronic Temperature Control: Type 4X (NEMA), IP67 weathertight 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), IP67 weathertight enclosure for surface-mount applications. Rated for 120/240 VAC. Includes an A99BB-200C temperature sensor with 6 ft 7-1/5 in. (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 ft 7-1/5 in. (2.0 m) cable.
A421GEF-01C	Low-Voltage Type 4X Electronic Temperature Control: Type 4X (NEMA), IP67 weathertight enclosure for surface-mount applications. Rated for 24 VAC Class 2, Safety Extra Low Voltage (SELV). 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), IP67 weathertight enclosure for surface-mount applications. Rated for 24 VAC Class 2 (SELV). Includes an A99BB-200C temperature sensor with 6 ft 7-1/5 in. (2.0 m) cable.

A99 Temperature Sensors Compatible with the A421 Control¹

Product Code Number	Description
A99BA-200C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 6 ft 7-1/5 in. (2.0 m) shielded PVC cable; Ambient operating temperature range: -40 to 212°F (-40 to 100°C)
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 212°F (-40 to 100°C)
A99BB-200C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 6 ft 7-1/5 in. (2.0 m) PVC cable; Ambient operating temperature range: -40 to 212°F (-40 to 100°C)
A99BB-300C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 9 ft 9-3/5 in. (3.0 m) PVC cable; Ambient operating temperature range: -40 to 212°F (-40 to 100°C)
A99BB-400C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 13 ft 1-1/5 in. (4.0 m) PVC cable; Ambient operating temperature range: -40 to 212°F (-40 to 100°C)
A99BB-600C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 19 ft 8-2/5 in. (6.0 m) PVC cable; Ambient operating temperature range: -40 to 212°F (-40 to 100°C)
A99BC-25C	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 248°F (-40 to 100°C)
A99BC-100C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 3 ft 3-3/5 in. (1.0 m) high-temperature silicon cable; Ambient operating temperature range: -40 to 248°F (-40 to 120°C)
A99BC-300C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 9 ft 9-3/5 in. (3.0 m) high-temperature silicon cable; Ambient operating temperature range: -40 to 248°F (-40 to 120°C)
A99BC-500C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 16 ft 4-4/5 in. (5.0 m) high-temperature silicon cable; Ambient operating temperature range: -40 to 248°F (-40 to 120°C)
A99BC-1500C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 49 ft 2-2/5 in. (15.0 m) high-temperature silicon cable; Ambient operating temperature range: -40 to 248°F (-40 to 120°C)
A99CB-200C	PTC Temperature Sensor: Extended probe 6 in. (15.2 cm) with 6 ft 7-1/5 in. (2.0 m) PVC cable; Ambient operating temperature range: -40 to 212°F (-40 to 100°C)
A99CB-600C	PTC Temperature Sensor: Extended probe 6 in. (15.2 cm) with 19 ft 8-2/5 in. (6.0 m) PVC cable; Ambient operating temperature range: -40 to 212°F (-40 to 100°C)

1. When any A99 Series Temperature Sensor is connected to a standard temperature A421 Control model, the range of usable values is -40 to 212°F (-40 to 100°C).



Single-Stage Electronic Temperature Controls

A421 Series Electronic Temperature Controls (Continued)

Accessories for the A421 Controls

Product Code Number	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

A421 Series Electronic Temperature Controls	
Power Consumption	1.8 VA maximum
Supply Power	Low Voltage Models: 24 VAC (20 to 30 VAC), 50/60 Hz, Class 2 or Safety Extra-Low Voltage Line Voltage Models: 110/120 or 208/230/240 VAC, 50/60 Hz
Ambient Conditions	Operating: Type 1 Models: -40 to 150°F (-40 to 66°C), 0 to 95% RH Noncondensing Type 4X Models: -40 to 140°F (-40 to 60°C), 0 to 95% RH Noncondensing Shipping and Storage: -40 to 185°F (-40 to 85°C), 0 to 95% RH Noncondensing
Temperature Control Range	-40 to 212°F (-40 to 100°C)
Input Signal	1,035 ohm at 77°F (25°C) for A99 PTC temperature sensors
Sensor Offset Range	±5°F or ±3°C
Output Relay Contacts Electrical Ratings	24 VAC models: 100 VA, 30 VAC maximum, Class 2 120/240 VAC models: Applied Voltage: 24 VAC 120 VAC 208 VAC 240 VAC Horsepower N.O. (N.C.): -- 1 (0.25) hp 1 (0.33) hp 1 (0.5) hp Full Load Amperes N.O. (N.C.): -- 16 (5.8) A 9.2 (4.0) A 8.0 (4.9) A Locked Rotor Amperes N.O. (N.C.): -- 96 (34.8) A 55.2 (24) A 48 (29.4) A Resistive Amperes N.O. (N.C.): 15 (10) A 15 (10) A 10 (10) A 10 (10) A Pilot Duty N.O. (N.C.): 125 (50) VA 125 (125) VA 125 (125) VA 125 (125) VA
Enclosure Material	Type 1/IP20 high-impact thermoplastic or Type 4X/IP66 watertight, corrosion-resistant, high-impact thermoplastic
Compliance	North America: cULus Listed; UL 60730, File E27734, Vol. 1; 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 2004/108/EC and the Low Voltage Directive 2006/95/EC. Australia: Regulatory Compliance Mark (RCM)



The performance specifications are nominal and conform to acceptable industry standards. For applications at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products. © 2015 Johnson Controls, Inc. www.johnsoncontrols.com



A421 Series Electronic Temperature Controls with Integral Power Cord

Description

The A421 Series Electronic Temperature Controls are single-stage controls with a single-pole, double-throw (SPDT) output relay, a bright backlit LCD, and a three-button touchpad interface that can be set up to restrict user adjustments. An LED indicates the output relay's On/Off status. The A421 Series Controls have simple On and Off temperature settings for heating or cooling, an adjustable anti-short cycle delay, and a temperature offset function.

The control range is -40 to 212°F (-40 to 100°C) for standard models. Models with a control range of -40 to 248°F (-40 to 120°C) are available in quantity orders. The controls feature remote sensing capability and interchangeable sensors. The A421 Controls are available in either Type 1 (NEMA)/IP20 high-impact plastic enclosure suitable for surface or DIN rail mounting or Type 4X (NEMA)/IP66 watertight, corrosion-resistant surface mount enclosures. The A421ABG Controls Type 1 (NEMA)/IP20 enclosure feature factory-installed power cords with plug and receptacle to provide easy plug-in connection and control of 120 VAC plug-in cooling and heating equipment.

Refer to the *A421 Series Electronic Temperature Controls Product Bulletin (LIT-12011972)* for important product application information.

Applications

The A421 Electronic Temperature Control can be used to control a wide variety of single-stage refrigeration or HVAC equipment.

Sample temperature control applications include:

- temperature monitoring and alarming
- on/off control of boilers and chillers
- boiler and chiller pump control
- heating and cooling control
- floating temperature control of damper and valve actuators
- 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

Features

- easy-to-read, bright, adjustable backlit LCD screen displays the temperature, parameters, and status clearly and allows you to adjust LCD brightness for the ambient light conditions. Custom icons on the display provide visual cues on system and control status.
- basic and advanced programming menus allow you to easily set up your control application on the LCD using a simple three-button touchpad interface.
- adjustable On and Off temperature setpoints enable easy to set up cooling or heating control applications on the three-button touchpad, eliminating the need to remove the cover and reposition jumpers for reverse or direct control actions.
- high and low temperature setpoint adjustment stops allow you to set up your application for your desired range of adjustment and restrict user adjustment to just the desired temperature adjustment range.
- displayed temperature offset allows you to adjust the displayed temperature to the actual sensed temperature in applications where the resistance error in long sensor cable leads cause a deviation in the displayed temperature from the actual sensed temperature.
- adjustable anti-short cycle delay keeps the output relay Off after the Off setpoint is reached for a user-defined time delay, which helps avoid short cycling, hard starts, and nuisance overload outages on compressors and other inductive applications.
- temperature setback/offset control enables the control to shift the On and Off setpoint values by a user-defined offset when an external switch closes the binary input control circuit. Using a switching timer enables you to set up occupied/unoccupied temperature setback schedules for your applications.
- high-impact, thermoplastic Type 1 (NEMA)/IP20 or Type 4X (NEMA)/IP66 watertight, corrosion-resistant enclosures increase application options, allowing surface and snap-fit DIN rail mount, or watertight surface mount.
- parameter adjustment restriction allows you to lock the control's setup parameters and restrict user adjustments to just the On and Off temperature setpoint values within your defined setpoint adjustment range.



A421 Series Electronic Temperature Controls with Integral Power Cord

- low- and line-voltage control models provide industry standard control voltage options for most refrigeration and HVAC control applications.

Repair Information

If the A421 Series Electronic Temperature Control with Integral Power Cord fails to operate within its specifications, replace the unit. For a replacement A421 Control, contact the nearest Authorized Johnson Controls/PENN® Distributer or Sales Representative.



Single-Stage Electronic Temperature Controls

A421 Series Electronic Temperature Controls with Integral Power Cord (Continued)

Selection Chart

A421 Electronic Temperature Control Selection Chart

Product Code Number	Description
A421ABG-02C	Line-Voltage Type 1 Electronic Temperature Control with Dual Power Cords: Type 1 (NEMA), IP20 standard enclosure for DIN rail and surface-mount applications. Rated for 120 VAC. Control is factory wired with a 6 ft (1.8 m) cord with 120 VAC grounded external plug and a 1 ft (0.30) cord with 120 VAC grounded internal receptacle. Includes an A99BB-200C temperature sensor with 6 ft 7-1/5 in. (2.0 m) cable.
A421ABJ-02C	Line-Voltage Type 1 Electronic Temperature Control with Single Power Cord and Piggyback Plug: Type 1 (NEMA), IP20 standard enclosure for DIN rail and surface-mount applications. Rated for 120 VAC. Control is factory wired with a 6 ft (1.8 m) cord with 120 VAC grounded piggyback plug. Includes an A99BB-200C temperature sensor with 6 ft 7-1/5 in. (2.0 m) cable.
A421AEJ-01C	Line-Voltage Type 4X Electronic Temperature Control with Single Power Cord and Piggyback Plug: Type 4X (NEMA), IP67 weathertight enclosure for surface-mount applications. Rated for 120 VAC. Control is factory wired with a 6 ft (1.8 m) cord with grounded piggyback plug. Includes an A99BB-25C temperature sensor with 9-7/8 in. (0.25 m) cable.
A421AEJ-02C	Line-Voltage Type 4X Electronic Temperature Control with Single Power Cord and Piggyback Plug: Type 4X (NEMA), IP67 weathertight enclosure for surface-mount applications. Rated for 120 VAC. Control is factory wired with a 6 ft (1.8 m) cord with grounded piggyback plug. Includes an A99BB-200C temperature sensor with 6.6 ft (2.0 m) cable.

A99 Temperature Sensors Compatible with the A421 Control¹

Product Code Number	Description
A99BA-200C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 6 ft 7-1/5 in. (2.0 m) shielded PVC cable; Ambient operating temperature range: -40 to 212°F (-40 to 100°C)
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 212°F (-40 to 100°C)
A99BB-200C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 6 ft 7-1/5 in. (2.0 m) PVC cable; Ambient operating temperature range: -40 to 212°F (-40 to 100°C)
A99BB-300C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 9 ft 9-3/5 in. (3.0 m) PVC cable; Ambient operating temperature range: -40 to 212°F (-40 to 100°C)
A99BB-400C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 13 ft 1-1/5 in. (4.0 m) PVC cable; Ambient operating temperature range: -40 to 212°F (-40 to 100°C)
A99BB-600C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 19 ft 8-2/5 in. (6.0 m) PVC cable; Ambient operating temperature range: -40 to 212°F (-40 to 100°C)
A99BC-25C	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 248°F (-40 to 120°C)
A99BC-100C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 3 ft 3-3/5 in. (1.0 m) high-temperature silicon cable; Ambient operating temperature range: -40 to 248°F (-40 to 120°C)
A99BC-300C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 9 ft 9-3/5 in. (3.0 m) high-temperature silicon cable; Ambient operating temperature range: -40 to 248°F (-40 to 120°C)
A99BC-500C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 16 ft 4-4/5 in. (5.0 m) high-temperature silicon cable; Ambient operating temperature range: -40 to 248°F (-40 to 120°C)
A99BC-1500C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 49 ft 2-2/5 in. (15.0 m) high-temperature silicon cable; Ambient operating temperature range: -40 to 248°F (-40 to 120°C)
A99CB-200C	PTC Temperature Sensor: Extended probe 6 in. (15.2 cm) with 6 ft 7-1/5 in. (2.0 m) PVC cable; Ambient operating temperature range: -40 to 212°F (-40 to 100°C)
A99CB-600C	PTC Temperature Sensor: Extended probe 6 in. (15.2 cm) with 19 ft 8-2/5 in. (6.0 m) PVC cable; Ambient operating temperature range: -40 to 212°F (-40 to 100°C)

1. When any A99 Series Temperature Sensor is connected to a standard temperature A421 control model, the range of usable values is -40 to 212°F (-40 to 100°C).

Accessories for the A421 Controls

Product Code Number	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



Single-Stage Electronic Temperature Controls

A421 Series Electronic Temperature Controls with Integral Power Cord (Continued)

Technical Specifications

A421 Series Electronic Temperature Controls	
Power Consumption	1.8 VA maximum
Supply Power	110/120 VAC, 50/60 Hz
Ambient Conditions	Operating: Type 1 Models: -40 to 150°F (-40 to 66°C), 0 to 95% RH noncondensing Type 4X Models: -40 to 140°F (-40 to 60°C), 0 to 95% RH noncondensing Shipping and Storage: All Models: -40 to 185°F (-40 to 85°C), 0 to 95% RH noncondensing
Temperature Control Range	-40 to 212°F (-40 to 100°C)
Input Signal	1,035 ohm at 77°F (25°C) for A99 PTC temperature sensors
Sensor Offset Range	±5°F or ±3°C
Output Relay Contacts Electrical Ratings	120 VAC Model with Integral Power Cord: Applied Voltage: 120 VAC Full Load Amperes N.O.: 12 A Locked Rotor Amperes N.O.: 72 A Resistive Amperes N.O.: 12 A Pilot Duty: 125 VA (N.O. contacts) at 24 to 120 VAC
Enclosure Material	NEMA 1/IP20 high-impact thermoplastic or NEMA 4X/IP66 watertight, corrosion-resistant, high-impact thermoplastic
Compliance	North America: cULus Listed; UL 60730, File E27734, Vol. 1; FCC Compliant to CFR47, Part 15, Subpart B, Class B Industry Canada (IC) Compliant to Canadian ICES-003, Class B limits



A421 Series Electronic Temperature Controls with Off-Cycle Defrost

Description

The A421 Series Electronic Temperature Controls are single-stage controls with a single-pole, double-throw (SPDT) output relay, a bright backlit LCD, and a three-button touchpad interface that can be set up to restrict user adjustments. An LED indicates the output relay's On/Off status. The A421 Series Controls have simple On and Off temperature settings for heating or cooling, an adjustable anti-short cycle delay, and a temperature offset function.

The control range is -40 to 212°F (-40 to 100°C) for standard models. Models with a control range of -40 to 248°F (-40 to 120°C) are available in quantity orders. The controls feature remote sensing capability and interchangeable sensors. The A421 Controls are available in either Type 1 (NEMA)/IP20 high-impact plastic enclosure suitable for surface or DIN rail mounting or Type 4X (NEMA)/IP66 watertight, corrosion-resistant surface mount enclosures.

A421 Controls with Off-Cycle Defrost (A421ABD and A421AED models) provide off-cycle defrost control with user-configurable defrost cycle duration and frequency.

Refer to the *A421 Series Electronic Temperature Controls Product Bulletin (LIT-12011972)* for important product application information.

Applications

The A421 Electronic Temperature Control can be used to control a wide variety of single-stage refrigeration or HVAC equipment.

Sample temperature control applications include:

- temperature monitoring and alarming
- on/off control of boilers and chillers
- boiler and chiller pump control
- heating and cooling control
- floating temperature control of damper and valve actuators
- 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

Features

- easy-to-read, bright, adjustable backlit LCD screen displays the temperature, parameters, and status clearly and allows you to adjust LCD brightness for the ambient light conditions. Custom icons on the display provide visual cues on system and control status.
- basic and advanced programming menus allow you to easily set up your control application on the LCD using a simple three-button touchpad interface.
- adjustable On and Off temperature setpoints enable easy to set up cooling or heating control applications on the three-button touchpad, eliminating the need to remove the cover and reposition jumpers for reverse or direct control actions.
- high and low temperature setpoint adjustment stops allow you to set up your application for your desired range of adjustment and restrict user adjustment to just the desired temperature adjustment range.
- displayed temperature offset allows you to adjust the displayed temperature to the actual sensed temperature in applications where the resistance error in long sensor cable leads cause a deviation in the displayed temperature from the actual sensed temperature.
- adjustable anti-short cycle delay keeps the output relay Off after the Off setpoint is reached for a user-defined time delay, which helps avoid short cycling, hard starts, and nuisance overload outages on compressors and other inductive applications.
- integrated off-cycle defrost timer (defrost control models only) shuts off the refrigeration system for a user-defined defrost time interval at a user-defined frequency. This eliminates the cost and time to install a separate defrost timer in many refrigeration applications.
- temperature setback/offset control enables the control to shift the On and Off setpoint values by a user-defined offset when an external switch closes the binary input control circuit. Using a switching timer enables you to set up occupied/unoccupied temperature setback schedules for your applications.
- high-impact, thermoplastic Type 1 (NEMA)/IP20 or Type 4X (NEMA)/IP66 watertight, corrosion-resistant enclosures increase application options, allowing surface and snap-fit DIN rail mount, or watertight surface mount.



A421 Series Electronic Temperature Control with Off-Cycle Defrost

- parameter adjustment restriction allows you to lock the control's setup parameters and restrict user adjustments to just the On and Off temperature setpoint values within your defined setpoint adjustment range.
- low- and line-voltage control models provide industry standard control voltage options for most refrigeration and HVAC control applications.

Repair Information

If the A421 Series Electronic Temperature Control with Off-Cycle Defrost fails to operate within its specifications, replace the unit. For a replacement A421 Control, contact the nearest Johnson Controls® representative.



Single-Stage Electronic Temperature Controls

A421 Series Electronic Temperature Controls with Off-Cycle Defrost (Continued)

Selection Charts

A421 Electronic Temperature Controls

Product Code Number	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 off-cycle defrost control. Includes an A99BB-200C temperature sensor with 6 ft 7-1/5 in. (2.0 m) cable.
A421AED-01C	Line-Voltage Type 4X Electronic Temperature Control with Off-Cycle Defrost Timer: Type 4X (NEMA), IP67 weathertight enclosure for surface-mount applications. Rated for 120/240 VAC. Includes integral timer for off-cycle defrost control. Includes an 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), IP67 weathertight enclosure for surface-mount applications. Rated for 120/240 VAC. Includes integral timer for off-cycle defrost control. Includes an A99BB-200C temperature sensor with 6 ft 6 in. (2 m) cable.

A99 Temperature Sensors Compatible with the A421 Control¹

Product Code Number	Description
A99BA-200C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 6 ft 7-1/5 in. (2.0 m) shielded PVC cable; Ambient operating temperature range: -40 to 212°F (-40 to 100°C)
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 212°F (-40 to 100°C)
A99BB-200C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 6 ft 7-1/5 in. (2.0 m) PVC cable; Ambient operating temperature range: -40 to 212°F (-40 to 100°C)
A99BB-300C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 9 ft 9-3/5 in. (3.0 m) PVC cable; Ambient operating temperature range: -40 to 212°F (-40 to 100°C)
A99BB-400C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 13 ft 1-1/5 in. (4.0 m) PVC cable; Ambient operating temperature range: -40 to 212°F (-40 to 100°C)
A99BB-600C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 19 ft 8-2/5 in. (6.0 m) PVC cable; Ambient operating temperature range: -40 to 212°F (-40 to 100°C)
A99BC-25C	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 248°F (-40 to 120°C)
A99BC-100C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 3 ft 3-3/5 in. (1.0 m) high-temperature silicon cable; Ambient operating temperature range: -40 to 248°F (-40 to 120°C)
A99BC-300C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 9 ft 9-3/5 in. (3.0 m) high-temperature silicon cable; Ambient operating temperature range: -40 to 248°F (-40 to 120°C)
A99BC-500C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 16 ft 4-4/5 in. (5.0 m) high-temperature silicon cable; Ambient operating temperature range: -40 to 248°F (-40 to 120°C)
A99BC-1500C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 49 ft 2-2/5 in. (15.0 m) high-temperature silicon cable; Ambient operating temperature range: -40 to 248°F (-40 to 120°C)
A99CB-200C	PTC Temperature Sensor: Extended probe 6 in. (15.2 cm) with 6 ft 7-1/5 in. (2.0 m) PVC cable; Ambient operating temperature range: -40 to 212°F (-40 to 100°C)
A99CB-600C	PTC Temperature Sensor: Extended probe 6 in. (15.2 cm) with 19 ft 8-2/5 in. (6.0 m) PVC cable; Ambient operating temperature range: -40 to 212°F (-40 to 100°C)

1. When any A99 Series Temperature Sensor is connected to a standard temperature A421 control model, the range of usable values is -40 to 212°F (-40 to 100°C).

Accessories for the A421 Controls

Product Code Number	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



Single-Stage Electronic Temperature Controls

A421 Series Electronic Temperature Controls with Off-Cycle Defrost (Continued)

Technical Specifications

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	Operating: -40 to 150°F (-40 to 66°C), 0 to 95% RH Noncondensing Shipping and Storage: -40 to 185°F (-40 to 85°C), 0 to 95% RH Noncondensing																				
Temperature Control Range	-40 to 212°F (-40 to 100°C) or -40 to 248°F (-40 to 120°C), depending on the model selected																				
Input Signal	1,035 ohm at 77°F (25°C) for A99 PTC temperature sensors																				
Sensor Offset Range	±5°F or ±3°C																				
Output Relay Contacts Electrical Ratings	<p>24 VAC Models: 100 VA, 30 VAC maximum, Class 2</p> <p>120 VAC Model with Integral Power Cord: Applied Voltage: 120 VAC Full Load Amperes N.O. and N.C.: 12 A Locked Rotor Amperes N.O. and N.C.: 72 A Non-inductive Amperes N.O. and N.C.: 12 A Pilot Duty: 125 VA (N.O. contacts) at 24 to 120 VAC</p> <p>120/240 VAC Models:</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Applied Voltage:</th> <th style="text-align: center;">120 VAC</th> <th style="text-align: center;">208 VAC</th> <th style="text-align: center;">240 VAC</th> </tr> </thead> <tbody> <tr> <td>Horsepower N.O. (N.C.):</td> <td style="text-align: center;">1 (0.25) hp</td> <td style="text-align: center;">1 (0.33) hp</td> <td style="text-align: center;">1 (0.5) hp</td> </tr> <tr> <td>Full Load Amperes N.O. (N.C.):</td> <td style="text-align: center;">16 (5.8) A</td> <td style="text-align: center;">9.2 (4.0) A</td> <td style="text-align: center;">8.0 (4.9) A</td> </tr> <tr> <td>Locked Rotor Amperes N.O. (N.C.):</td> <td style="text-align: center;">96 (34.8) A</td> <td style="text-align: center;">55.2 (24) A</td> <td style="text-align: center;">48 (29.4) A</td> </tr> <tr> <td>Non-inductive Amperes N.O. (N.C.):</td> <td style="text-align: center;">15 (10) A</td> <td style="text-align: center;">10 (10) A</td> <td style="text-align: center;">10 (10) A</td> </tr> </tbody> </table> <p>Pilot Duty: 125 VA (N.O. contacts) at 24 to 240 VAC 125 VA (N.C. contacts) at 24 to 240 VAC 50 VA (N.C. contacts) at 24 VAC</p>	Applied Voltage:	120 VAC	208 VAC	240 VAC	Horsepower N.O. (N.C.):	1 (0.25) hp	1 (0.33) hp	1 (0.5) hp	Full Load Amperes N.O. (N.C.):	16 (5.8) A	9.2 (4.0) A	8.0 (4.9) A	Locked Rotor Amperes N.O. (N.C.):	96 (34.8) A	55.2 (24) A	48 (29.4) A	Non-inductive Amperes N.O. (N.C.):	15 (10) A	10 (10) A	10 (10) A
Applied Voltage:	120 VAC	208 VAC	240 VAC																		
Horsepower N.O. (N.C.):	1 (0.25) hp	1 (0.33) hp	1 (0.5) hp																		
Full Load Amperes N.O. (N.C.):	16 (5.8) A	9.2 (4.0) A	8.0 (4.9) A																		
Locked Rotor Amperes N.O. (N.C.):	96 (34.8) A	55.2 (24) A	48 (29.4) A																		
Non-inductive Amperes N.O. (N.C.):	15 (10) A	10 (10) A	10 (10) A																		
Enclosure Material	NEMA 1/IP20 High-Impact Thermoplastic or NEMA 4X/IP66 Watertight, Corrosion-Resistant, High-Impact Thermoplastic																				
Compliance	<p>North America: cULus Listed; UL 60730, File E27734, Vol. 1; FCC Compliant to CFR47, Part 15, Subpart B, Class B Industry Canada (IC) Compliant to Canadian ICES-003, Class B limits</p> <p>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 2004/108/EC and the Low Voltage Directive 2006/95/EC.</p> <p>Australia: Mark: C-Tick Compliant (N1813)</p>																				



A421 Series Electronic Temperature Controls with Integral Cycle Timer

Description

The A421 Series Electronic Temperature Controls are single-stage controls with a single-pole, double-throw (SPDT) output relay, a bright backlit LCD, and a three-button touchpad interface that can be set up to restrict user adjustments. An LED indicates the output relay's On/Off status. The A421 Series Controls have simple On and Off temperature settings for heating or cooling, an adjustable anti-short cycle delay, and a temperature offset function.

The control range is -40 to 212°F (-40 to 100°C) for standard models. Models with a control range of -40 to 248°F (-40 to 120°C) are available in quantity orders. The controls feature remote sensing capability and interchangeable sensors. The A421 Controls are available in either Type 1 (NEMA)/IP20 high-impact plastic enclosure suitable for surface or DIN rail mounting or Type 4X (NEMA)/IP66 watertight, corrosion-resistant surface mount enclosures.

The A421 Controls with Integral Cycle Timer provide On/Off control of ventilation fans in agriculture applications, warehouse and storage facilities, and other ventilation application that require air-exchange based on temperature or a ventilation schedule with a user-defined On-time and Off-time cycle.

Refer to the *A421 Series Electronic Temperature Controls Product Bulletin (LIT-12011972)* for important product application information.

Applications

The A421 Electronic Temperature Control can be used to control a wide variety of single-stage refrigeration or HVAC equipment.

Sample temperature control applications include:

- temperature monitoring and alarming
- on/off control of boilers and chillers
- boiler and chiller pump control
- heating and cooling control
- floating temperature control of damper and valve actuators
- 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

Features

- easy-to-read, bright, adjustable backlit LCD screen displays the temperature, parameters, and status clearly and allows you to adjust LCD brightness for the ambient light conditions. Custom icons on the display provide visual cues on system and control status.
- basic and advanced programming menus allow you to easily set up your control application on the LCD using a simple three-button touchpad interface.
- adjustable On and Off temperature setpoints enable easy to set up cooling or heating control applications on the three-button touchpad, eliminating the need to remove the cover and reposition jumpers for reverse or direct control actions.
- high and low temperature setpoint adjustment stops allow you to set up your application for your desired range of adjustment and restrict user adjustment to just the desired temperature adjustment range.
- displayed temperature offset allows you to adjust the displayed temperature to the actual sensed temperature in applications where the resistance error in long sensor cable leads cause a deviation in the displayed temperature from the actual sensed temperature.
- adjustable anti-short cycle delay keeps the output relay Off after the Off setpoint is reached for a user-defined time delay, which helps avoid short cycling, hard starts, and nuisance overload outages on compressors and other inductive applications.
- temperature and timed ventilation control (integral cycle timer models only) enables you to set up timed ventilation or makeup air cycles independent from temperature controlled cycles. This eliminates the cost and time to install a separate interval timer in ventilation and makeup air applications.
- temperature setback/offset control enables the control to shift the On and Off setpoint values by a user-defined offset when an external switch closes the binary input control circuit. Using a switching timer enables you to set up occupied/unoccupied temperature setback schedules for your applications.
- high-impact, thermoplastic NEMA 1/IP20 or NEMA 4X/IP66 watertight, corrosion-resistant enclosures increase application options, allowing surface and snap-fit DIN rail mount, or watertight surface mount.



A421 Series Electronic Temperature Control with Integral Cycle Timer

- parameter adjustment restriction allows you to lock the control's setup parameters and restrict user adjustments to just the On and Off temperature setpoint values within your defined setpoint adjustment range.
- low- and line-voltage control models provide industry standard control voltage options for most refrigeration and HVAC control applications.

Repair Information

If the A421 Series Electronic Temperature Control with Integral Cycle Timer fails to operate within its specifications, replace the unit. For a replacement A421 Control, contact the nearest Johnson Controls® representative.



Single-Stage Electronic Temperature Controls

A421 Series Electronic Temperature Controls with Integral Cycle Timer (Continued)

Selection Charts

A421 Electronic Temperature Controls

Product Code Number	Description
A421ABT-02C	Line-Voltage Type 1 Electronic Temperature Control with Duty-Cycle 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 duty-cycle control. Includes an A99BB-200C temperature sensor with 6 ft 7-1/5 in. (2.0 m) cable.
A421AET-01C	Line-Voltage Type 4X Electronic Temperature Control with Duty-Cycle Timer: Type 4X (NEMA), IP67 weathertight enclosure for surface-mount applications. Rated for 120/240 VAC. Includes integral timer for On/Off duty-cycle control. Includes an A99BB-25C temperature sensor with 9-7/8 in. (0.25 m) cable.

A99 Temperature Sensors Compatible with the A421 Control¹

Product Code Number	Description
A99BA-200C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 6 ft 7-1/5 in. (2.0 m) shielded PVC cable; Ambient operating temperature range: -40 to 212°F (-40 to 100°C)
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 212°F (-40 to 100°C)
A99BB-200C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 6 ft 7-1/5 in. (2.0 m) PVC cable; Ambient operating temperature range: -40 to 212°F (-40 to 100°C)
A99BB-300C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 9 ft 9-3/5 in. (3.0 m) PVC cable; Ambient operating temperature range: -40 to 212°F (-40 to 100°C)
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 212°F (-40 to 100°C)
A99BB-600C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 19 ft 8-2/5 in. (6.0 m) PVC cable; Ambient operating temperature range: -40 to 212°F (-40 to 100°C)
A99BC-25C	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 248°F (-40 to 100°C)
A99BC-100C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 3 ft 3-3/5 in. (1.0 m) high-temperature silicon cable; Ambient operating temperature range: -40 to 248°F (-40 to 120°C)
A99BC-300C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 9 ft 9-3/5 in. (3.0 m) high-temperature silicon cable; Ambient operating temperature range: -40 to 248°F (-40 to 120°C)
A99BC-500C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 16 ft 4-4/5 in. (5.0 m) high-temperature silicon cable; Ambient operating temperature range: -40 to 248°F (-40 to 120°C)
A99BC-1500C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 49 ft 2-2/5 in. (15.0 m) high-temperature silicon cable; Ambient operating temperature range: -40 to 248°F (-40 to 120°C)
A99CB-200C	PTC Temperature Sensor: Extended probe 6 in. (15.2 cm) with 6 ft 7-1/5 in. (2.0 m) PVC cable; Ambient operating temperature range: -40 to 212°F (-40 to 100°C)
A99CB-600C	PTC Temperature Sensor: Extended probe 6 in. (15.2 cm) with 19 ft 8-2/5 in. (6.0 m) PVC cable; Ambient operating temperature range: -40 to 212°F (-40 to 100°C)

1. When any A99 Series Temperature Sensor is connected to a standard temperature A421 control model, the range of usable values is -40 to 212°F (-40 to 100°C).

Accessories for the A421 Controls

Product Code Number	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



Single-Stage Electronic Temperature Controls

A421 Series Electronic Temperature Controls with Integral Cycle Timer (Continued)

Technical Specifications

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	Operating: -40 to 150°F (-40 to 66°C), 0 to 95% RH noncondensing Shipping and Storage: -40 to 185°F (-40 to 85°C), 0 to 95% RH noncondensing
Temperature Control Range	-40 to 212°F (-40 to 100°C) or -40 to 248°F (-40 to 120°C), depending on the model selected
Input Signal	1,035 ohms at 77°F (25°C) for A99 PTC temperature sensors
Sensor Offset Range	±5°F or ±3°C
Output Relay Contacts Electrical Ratings	<p>24 VAC Models: 100 VA, 30 VAC maximum, Class 2</p> <p>120 VAC Model with Integral Power Cord: Applied Voltage: 120 VAC Full Load Amperes N.O. and N.C.: 12 A Locked Rotor Amperes N.O. and N.C.: 72 A Non-inductive Amperes N.O. and N.C.: 12 A Pilot Duty: 125 VA (N.O. contacts) at 24 to 120 VAC</p> <p>120/240 VAC Models: Applied Voltage: 120 VAC 208 VAC 240 VAC Horsepower N.O. (N.C.): 1 (0.25) hp 1 (0.33) hp 1 (0.5) hp Full Load Amperes N.O. (N.C.): 16 (5.8) A 9.2 (4.0) A 8.0 (4.9) A Locked Rotor Amperes N.O. (N.C.): 96 (34.8) A 55.2 (24) A 48 (29.4) A Non-inductive Amperes N.O. (N.C.): 15 (10) A 10 (10) A 10 (10) A Pilot Duty: 125 VA (N.O. contacts) at 24 to 240 VAC 125 VA (N.C. contacts) at 24 to 240 VAC 50 VA (N.C. contacts) at 24 VAC</p>
Enclosure Material	NEMA 1/IP20 high-impact thermoplastic or NEMA 4X/IP66 watertight, corrosion-resistant, high-impact thermoplastic
Compliance	<p>North America: cULus Listed; UL 60730, File E27734, Vol. 1; FCC Compliant to CFR47, Part 15, Subpart B, Class B Industry Canada (IC) Compliant to Canadian ICES-003, Class B limits</p> <p>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 2004/108/EC and the Low Voltage Directive 2006/95/EC.</p> <p>Australia: Mark: C-Tick Compliant (N1813)</p>





MR Series Defrost Control Modules

Description

The MR Series Controls are versatile, microprocessor-based, multifunction, programmable temperature controls. Depending on the model chosen, the MR Series Controls can also manage alarm, defrost cycle (active or passive defrost), and evaporator fan functions.

The MR Series Controls have large red LED displays. These compact controls are available in panel mount and DIN rail mount varieties. The MR Series Controls use the A99B temperature sensors, which allow remote mounting of the display unit.

All MR Series Controls perform temperature and alarm management. Some models have additional capabilities.

MR1 Series Controls

The MR1 Series provides temperature and alarm management functions. It can replace a temperature control and digital temperature readout.

MR2 Series Controls

The MR2 Series provides temperature, alarm, and defrost cycle management. The MR2 control performs defrost cycle management using time-based, passive, off cycle defrost. It can replace a temperature control, a digital temperature readout, and a defrost timer.

Refer to the *MR Series Refrigeration Temperature Controls Product Bulletin (LIT-125199)* for important product application information.

MR4 Series Controls

The MR4 Series provides temperature, alarm, defrost, and evaporator fan management. The MR4 Series provides defrost cycle management with hot gas or electric heat defrost and defrost termination based on time or temperature. The MR4 Series consolidates the functions of a temperature control, a digital temperature readout, a defrost cycle timer, and a defrost termination device.

Refer to the *MR Series Refrigeration Temperature Controls Product Bulletin (LIT-125199)* for important product application information.

Features

- programmable functions allow adjustment of control settings to meet application needs
- alarm management functions provide local alarm display and an alarm output relay that can be used to trigger a remote alarm or dial-out modem
- easily readable LED display displays temperature and other functions quickly and clearly
- programming button lockout allows user to disable programming buttons and deter accidental or unauthorized changes
- accurate, interchangeable temperature sensor provides accurate control performance with up to 300 feet of wiring (an adjustable temperature offset is provided for longer wiring)
- self-test procedure checks control operation by cycling all outputs and testing all LEDs



MR4 Series
DIN Rail and Panel Mount Modules

Repair Information

If the MR Series Defrost Control Modules fails to operate within its specifications, replace the unit. For a replacement control, contact the nearest Johnson Controls® representative.

Applications

Application	MR1	MR2	MR4
Cooling tower pump control	✓		
Space and return air temperature control	✓		
Convenience store coolers	✓	✓	✓
Convenience store freezers			✓
Supermarket display cases for produce		✓	✓
Reach-in coolers		✓	✓
Walk-in coolers		✓	✓
Freezers or coolers with passive defrost, time-based termination		✓	✓
Freezers with hot gas defrost (temperature or time-based termination)			✓
Freezers with electrical defrost (temperature or time-based termination)			✓

Selection Chart

Product Code Number	Description	Ship. Wt. lb (g)
MR1DR24-11C	MR1 Single-Stage, DIN Rail Mount Defrost Control, One A99BB-200C sensor included	0.75 lb (340 g)
MR2PM24-11C	MR2 Two-Stage, Panel Mount Defrost Control, One A99BB-200C sensor included	0.53 lb (240 g)
MR2DR24-11C	MR2 Two-Stage, DIN Rail Mount Defrost Control, One A99BB-200C sensor included	0.79 lb (360 g)
MR4PM24-12C	MR4 Four-Stage, Panel Mount Defrost Control, Two A99BB-200C sensors included	0.90 lb (410 g)
MR4DR24-12C	MR4 Four-Stage, DIN Rail Mount Defrost Control, Two A99BB-200C sensors included	1.17 lb (530 g)



Single-Stage Electronic Temperature Controls

MR Series Defrost Control Modules (Continued)

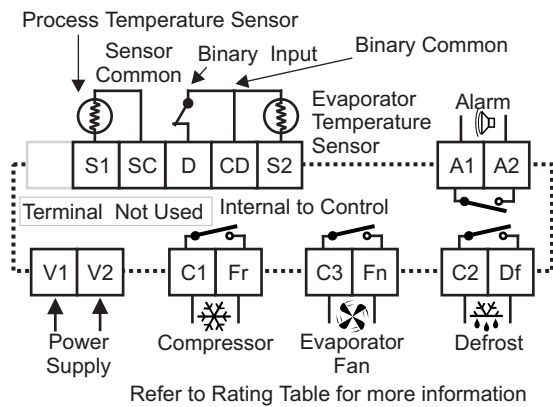
Technical Specifications

MR Series Defrost Control Modules		
Power Requirements	24 VAC, 50/60 Hz Class 2 (20 to 30 VAC)	
Power Consumption	3.7 VA at 24 VAC	
Accuracy	± 1.8F° (± 1°C)	
Ambient Conditions	Operating	+14 to +140°F (-10 to +60°C); 0 to 95% RH (noncondensing)
	Storage	-22 to +176°F (-30 to +80°C); 0 to 95% RH (noncondensing)
Dimensions (H x W x D)	Panel Mount	1.38 x 2.95 x 2.68 in. (35 x 75 x 68 mm)
	DIN Rail:	4.65 x 2.76 x 2.07 in. (118 x 70 x 53 mm)
Agency Listings	UL Recognized: File E194024, CCN XAPX2 Canadian UL Recognized: File E194024, CCN XAPX8	

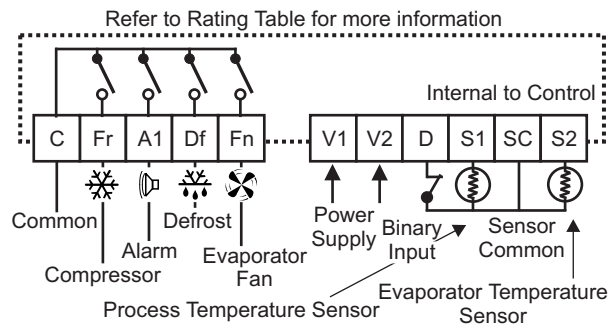
Electrical Ratings of Contacts

Rating Category	120 VAC	240 VAC	24 VDC
Horsepower	1/4	1/2	---
Full Load Amperes	5.8	4.9	---
Locked Rotor Amperes	34.8	29.4	---
Inductive (Non-Motor) Amperes	8	8	8
Pilot Duty VA	275	450	---

Note: Relay outputs must not exceed 20 Amperes total connected load. Open collector transistors on MR1 alarms have a maximum rating of 40 VDC 100 mA. Alarms require external power source.



MR4 DIN Rail Control



MR4 Panel Mount Control



MR4PMUHV Electronic Temperature/Defrost Control with Relay Pack

Description

The MR Series temperature controls are designed for use with hot gas or electric heat defrost in both refrigeration and freezer units. Either time or temperature based defrost termination may be selected.

The MR Series incorporates control functions such as compressor control, defrost management, fan management, and alarm management.

Refer to the *MR4PMUHV Electronic Temperature/Defrost Control with Relay Pack Product Bulletin (LIT-125190)* for important product application information.

- accurate, interchangeable temperature sensor provides reliable control performance with up to 300 ft. of wiring (an offset is provided for longer wiring)
- easily readable temperature display can show either evaporator or process temperature at the touch of a button
- heavy-duty relays allow direct control of compressors, fans, defrost heaters, and alarms
- alarm management functions provide both local alarm codes and a relay closure that can be used to trigger a remote alarm or a dial-out modem



MR4PMUHV Temperature Control

Features

- single package provides the functionality of multiple components at a cost-effective price
- mounting flexibility allows the control and relay pack to be mounted together or separately, facilitating multiple configurations

Applications

These relay pack mounted controls provide direct control of compressors up to 2 hp, electric heater loads of up to 20 amperes, and evaporator fan loads of up to 3/4 hp. The need for separate relays is eliminated in these applications.

In addition, the MR4PMUHV controls combine the functionality of an electromechanical thermostat, mechanical clock, defrost termination device, and temperature readout device with the accuracy of electronic technology.

Selection Charts

MR4PMUHV Electronic Temperature/Defrost Control with Relay Pack

Product Code Number	Description
MR4PMUHV-12C	Relay pack defrost control with two A99BB-200C sensors

Repair Parts

Product Code Number	Description
MR4PM12C-12C	Replacement control for use in relay pack
RP4MRUHV-1C	Relay pack without control
A99BB-200C	Sensor, cable length: 6.5 ft/1.98m

Technical Specifications

MR4PMUHV Electronic Temperature/Defrost Control with Relay Pack (Part 1 of 2)		
Frequency	60/50 Hz at 120/240 VAC	
Power consumption	10 VA at 240 VAC, 5 VA at 120 VAC	
Supply Level	120 and L1: 120 VAC +10%/-15% 240 and L1: 240 VAC +10%/-15%	
Accuracy	± 1.8F°/± 1C°	
A99 Sensor Cable	6.5 ft/1.98 m	
Ambient Operating Conditions	MR4PMUHV-12C	+14° to +111°F/-10° to +44°C; derating 6.25% per 1°C to 60° C; 0 to 95% RH (noncondensing)
	MR4PM12C-12C	+14° to +140°F/-10° to +60°C; 0 to 95% RH (noncondensing)
	RP4MRUHV-1C	-40° to +111°F/-40° to +44°C; derating 6.25% per 1°C to 60° C; 0 to 95% RH (noncondensing)
Ambient Storage Conditions	MR4PMUHV-12C	-22° to +176°F/-30° to +80°C 0 to 95% RH (noncondensing)
	MR4PM12C-12C	-22° to +176°F/-30° to +80°C 0 to 95% RH (noncondensing)
	RP4MRUHV-1C	-40° to +185°F/-40° to +85°C 0 to 95% RH (noncondensing)
Dimensions (H x W x D)	7.94 x 3.6 x 2.4 in./202 x 92 x 61 mm	

Technical Specifications (Continued)

MR4PMUHV Electronic Temperature/Defrost Control with Relay Pack (Part 2 of 2)	
Agency Listings	UL Listed (File SA516, UL Guide SDFY; cUL Guide SDFY7)
Shipping Weight	2.9 lb/1,320 g

Relay Electrical Ratings

	24	120	208	240
SPST Compressor Relay				
Horsepower Rating	—	1	1.5	2
AC Full Load Amperes	—	16	11	12
AC Locked Rotor Amperes	—	96	66	72
Pilot Duty (VA)	125	750	875	1,125
SPDT Fan Relay				
Horsepower Rating	—	1/3	1/2	3/4
AC Full Load Amperes	—	7.2	5.65	6.9
AC Locked Rotor Amperes	—	43.2	33.9	41.4
Pilot Duty (VA)	50	325	450	600
SPST Defrost Heater Relay				
Horsepower Rating	—	1	1.5	2
AC Full Load Ampere	—	16	11	12
AC Locked Rotor Amperes	—	96	66	72
Non-Inductive Load Amperes	—	20	20	20
Pilot Duty (VA)	125	750	825	1,125
SPST Alarm Relay				
Non-Inductive Load Ampere	5	5	5	5
Pilot Duty (VA)	—	125	250	325

Relay Electrical Ratings Note:

Ratings shown are for ambient operation at -40 to 44°C. Derate electrical ratings 6.25% per 1°C (1.8°F) between 44°C (111°F) and 60°C (140°F).

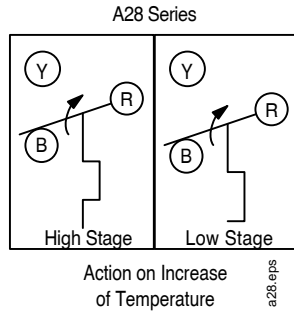


A28 Series Two-Stage Temperature Control

Description

The A28 Series are two-stage temperature controls that incorporate a liquid-filled sensing element.

Refer to the *A28 Series Two-Stage Temperature Controls with NEMA 1 Enclosure Product Bulletin Product Bulletin (LIT-125130)* for important product application information.



A28 Action Diagram



A28AA-4 Temperature Control



A28AB-29 Temperature Control

Features

- wide temperature ranges available
- constant differential throughout the entire range
- single-pole, double-throw (SPDT) snap-acting switches
- unaffected by changes in barometric pressure
- unaffected by cross ambient conditions
- compact enclosure
- variety of sensing element styles

Applications

Use for temperature sensing applications requiring two-stage control of HVAC/R equipment.

Accessories

- packing nut assembly available for direct immersion applications (Code No. **FTG13A-600R**)
- remote bulb models include 5/8 in. mounting clip

Selection Charts

Product Code Number	Switch Action	Range °F (°C)	Differential F° (C°)	Bulb and Capillary	Bulb Well No. (Order Separately)	Range Adjuster
Coiled Bulb-Fixed Differential						
A28AA-4C	Two-SPDT	30 to 110 (-1 to 43)	3-1/2 (1.9) each stage 3 (1.7) fixed between stages	1-3/8 in. x 2-1/4 in. coiled	—	Convertible
Case Compensated-Fixed Differential						
A28AA-9C	Two-SPDT	20 to 80 (-7 to 27)	3-1/2 (1.9) each stage 3 (1.7) fixed between stages	3/8 in. x 5 in. 6 ft capillary ¹	WEL14A-603R	Knob
Wide Range-Adjustable Interstage Differential						
A28AA-28C	Two-SPDT	30 to 110 (-1 to 43)	3-1/2 (1.9) each stage 2 to 7 adjustable between stages	12 ft averaging bulb 6 ft capillary	—	Screwdriver slot
A28AA-29C	Two-SPDT	-30 to 100 (-34 to 38)	5 (2.8) each stage 2 to 7 adjustable between stages	3/8 in. x 4 in. 8 ft capillary ¹	WEL14A-602R	Convertible
A28AA-36C	Two-SPDT	40 to 90 (4 to 32)	3 each stage 2 to 7 adjustable between stages	3/8 in. x 5-3/4 in. 6 ft capillary	—	Knob
A28AA-37C	Two-SPDT	60 to 140 (16 to 60)	5 each stage 2 to 7 adjustable between stages	3/8 in. x 4 in. 6 ft capillary	WEL14A-602R	Knob
A28AJ-4C	Two-SPDT	20 to 80 (-7 to 27)	2 each stage 2 to 7 adjustable between stages	3/16 in. x 22 in. 6 ft capillary	—	Knob
Changeover Control						
A28AB-1C	Two-SPDT ²	20 to 80 (-7 to 27)	3-1/2 (1.9)	3/8 in. x 5 in. 6 ft capillary	WEL14A-603R	Screwdriver slot

1. Packing nut assembly available for direct immersion applications (Code No. **FTG13A-600R**).

2. Switches within 1 F° (0.6 C°) of each other.



Multi-Stage Electromechanical Temperature Controls

A28 Series Two-Stage Temperature Control (Continued)

Replacement Parts

Product Code Number	Description
CVR28A-617R	Concealed adjustment
CVR28A-618R	Visible scale
KNB20A-602R	Knob kit

Technical Specifications

Maximum bulb temperature of A28AA-37 is 230°F (110°C). For all others, maximum bulb temperature is 140°F (60°C).

Electrical Ratings

Motor Ratings VAC	120	208	240	277
A28AA, A				
AC Full Load A	16.0	9.2	8.0	---
AC Locked Rotor A	96.0	55.2	48.0	---
Non-Inductive or Resistance Load A (Not Lamp Loads)	16.0	9.2	8.0	7.2
Pilot Duty	125 VA, 24 to 277 VAC ¹			
A28AJ				
AC Full Load A	6.0	3.4	3.0	---
AC Locked Rotor A	36.0	20.4	18.0	---
Non-Inductive or Resistance Load A (Not Lamp Loads)	15.0	9.2	8.0	7.2
Pilot Duty	125 VA, 24 to 277 VAC ¹			
A28AB				
AC Full Load A	16.0	9.2	8.0	---
AC Locked Rotor A	96.0	55.2	48.0	---
Non-Inductive or Resistance Load A (Not Lamp Loads)	16.0	9.2	8.0	7.2
Pilot Duty	125 VA, 24 to 277 VAC ¹			

1. When used as two-circuit control, the total connected load must not exceed 2,000 VA.



A28 Series Two-Stage Flange Mounted Duct Thermostat

Description

The A28AK is a two-stage temperature control with special air coil sensing element and adjustable mounting flange.

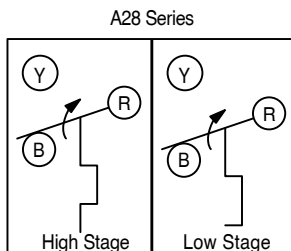
Refer to the *A28 Series Two-Stage Temperature Controls with NEMA 1 Enclosure Product Bulletin (LIT-125130)* for important product application information.

Features

- flat flange mounting with special coil sensing element permits positioning of sensing bulb in the appropriate portion of the air stream
- two single-pole, double-throw (SPDT) snap-acting switches
- unaffected by barometric pressure or cross ambient temperatures

Applications

These duct thermostats are used on roof top units, make-up heaters, duct heaters, and air handling systems of all types.



Action on Increase of Temperature

A28 Action Diagram



A28AK Thermostat

Repair Information

If the A28 Series Two-Stage Flange Mounted Duct Thermostat fails to operate within its specifications, replace the unit. For a replacement thermostat, contact the nearest Johnson Controls® representative.

Selection Chart

Product Code Number	Number of Stages	Switch Action	Range °F (°C)	Differential F° (C°) Fixed		Maximum Allowable Temperature at Bulb °F (°C)
				Each Stage	Between Stage	
A28AK-1C	Two	Two-SPDT switches	30 to 110 (-1 to 43)	2 (1.1)	3 (1.7)	140 (60)
A28AK-2C	Two	Two-SPDT switches	60 to 130 (16 to 54)	2 (1.1)	3 (1.7)	200 (93)

Technical Specifications

Electrical Ratings

Motor Ratings VAC	120	208	240	277
AC Full Load A	6.0	3.4	3.0	-
AC Locked Rotor A	36.0	20.4	18.0	-
Non-Inductive or Resistance Load A (Not Lamp Loads)	10.0	9.2	8.0	7.2
Pilot Duty	125 VA, 24 to 277 VAC			

Note: When used as a two-circuit control, the total connected load must not exceed 2,000 VA.



A28 Two-Stage Industrial Thermostat (Watertight and Dusttight)

Description

The A28KA is a wide range temperature control with gasketed enclosure and two single-pole, double-throw (SPDT) switches.

Refer to the A19A, A19K, A28K Series Industrial Controls Remote Bulb Product Bulletin (LIT-125105) for important product application information

Features

- rugged steel enclosure
- liquid-filled sensing element that provides uniform control

Applications

This control is for refrigeration, air conditioning, and heating applications. This model incorporates a gasketed enclosure that can be used in a wide range of industrial and general purpose applications.

Repair Information

If the A28 Two-Stage Industrial Thermostat fails to operate within its specifications, replace the unit. For a replacement thermostat, contact the nearest Johnson Controls® representative.

Technical Specifications

Electrical Ratings

Motor Ratings AC	120	208	240
AC Full Load A	16.0	9.2	8.0
AC Locked Rotor A	96.0	55.2	48.0
Non-Inductive or Resistance Load A (Not Lamp Loads)	16.0	9.2	8.0
Pilot Duty	125 VA, 24 to 277 VAC		

Note: When used as a two-circuit control, the total connected load must not exceed 2,000 VA.



A28KA Industrial Thermostat

Selection Chart

Product Code Number	Switch Action	Range °F (°C)	Differential F° (C°)	Bulb and Capillary	Bulb Well No. (Order Separately)	Range Adjuster
A28KA-1C	Two-SPDT	0 to 150 (-15 to 65)	5 (2.8) each stage 3 (1.7) fixed between stages	0.290 x 2-1/2 in. 10 ft capillary	WEL16A-600R	Knob



A28 Two-Stage Temperature Control with Weatherproof Enclosure

Description

The A28MA Controls are wide range temperature controls with rainproof NEMA 3R enclosure and two single-pole, double-throw (SPDT) switches.

Refer to the *A28MA Type Two-Stage Tower Fan Control Two-Stage Air Cooled Condenser Fan Control Product Bulletin (LIT-125135)* for important product application information

Technical Specifications

Electrical Ratings

Motor Ratings	120	208	240
AC Full Load A	16.0	9.2	8.0
AC Locked Rotor A	96.0	55.2	48.0
Non-Inductive or Resistance Load A (Not Lamp Loads)	16.0	9.2	8.0
Pilot Duty	125 VA, 24 to 277 VAC		

Note: When used as a two-circuit control, the total connected load must not exceed 2,000 VA.

Features

- rugged steel enclosure
- liquid-filled sensing element provides uniform control

Applications

- sump water temperature control for cooling towers and evaporative condensers
- fan cycling control for air-cooled condensers

Repair Information

If the A28 Two-Stage Temperature Control with Weatherproof Enclosure fails to operate within its specifications, replace the unit. For a replacement control, contact the nearest Johnson Controls® representative.

Selection Chart

Product Code Number	Switch Action	Range °F (°C)	Differential F° (C°)	Bulb and Capillary	Range Adjuster
A28MA-1C	Two-Stage Two-SPDT Switches	40 to 120 (4 to 49)	Factory set	3/8 in. x 4 in.; Neoprene-coated 6 ft capillary	Screwdriver slot
A28MA-2C			5 (2.8) each stage 8 (4.4) between stages		



A28MA Temperature Control



A28 Two-Stage Agricultural Thermostat with NEMA 4X Enclosure

Description

The A28PJ and A28PA are two-stage temperature controls with raintight and dusttight enclosures.

Refer to the *A28 Series Two-Stage Temperature Controls with NEMA 1 Enclosure Product Bulletin (LIT-125130)* for important product application information.

Features

- rugged thermoplastic gasketed enclosures that meet NEMA 4X specifications
- O-ring sealed setpoint adjustment knobs
- range scale with oversized white markings for easy readability in low light
- exposed portion of liquid-filled sensing elements are plated and plastic coated to resist damage in corrosive atmospheres

Applications

Designed for use in agricultural and industrial applications that require compliance with Article 547 of the National Electrical Code.

Repair Information

If the A28 Two-Stage Agricultural Thermostat with NEMA 4X Enclosure fails to operate within its specifications, replace the unit. For a replacement thermostat, contact the nearest Johnson Controls® representative.



A28PJ, A28PA Thermostat

Selection Chart

Product Code Number	Switch Action	Range °F (°C)	Differential F° (C°)	Bulb and Capillary	Range Adjuster
A28PJ-1C	Two-SPDT	30 to 110 (-1 to 43)	2 (1.1) each stage 2 to 7 (1.1 to 3.9) adjustable between stages	1-3/8 in. x 2-1/4 in. coiled	Knob
A28PA-2C	Two-SPDT	30 to 110 (-1 to 43)	2 (1.1) each stage 2 to 7 (1.1 to 3.9) adjustable between stages	1-3/8 in. x 2-1/4 in. coiled	Knob

Technical Specifications

Electrical Ratings

Motor Ratings VAC	120	208	240	277
A28PJ				
AC Full Load A	6.0	3.4	3.0	–
AC Locked Rotor A	36.0	20.4	18.0	–
Non-Inductive or Resistance Load A (Not Lamp Loads)	10.0	9.2	8.0	7.2
Pilot Duty	125 VA, 24 to 277 VAC ¹			
A28PA				
AC Full Load A	16.0	9.2	8.0	–
AC Locked Rotor A	96.0	55.2	48.0	–
Non-Inductive or Resistance Load A (Not Lamp Loads)	16.0	9.2	8.0	7.2
Pilot Duty	125 VA, 24 to 277 VAC ¹			

1. When used as a two-circuit control, the total connected load must not exceed 2,000 VA.



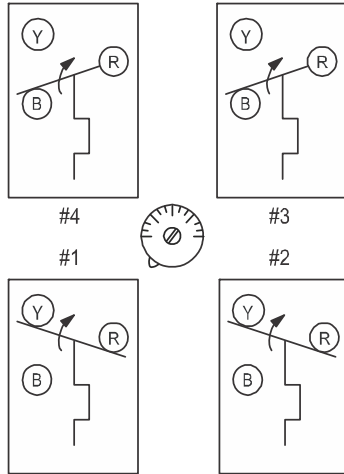
A36 Series Four-Stage Remote Bulb Thermostats

Description

The A36 series are four-stage thermostats with open construction for use in panel mounting.

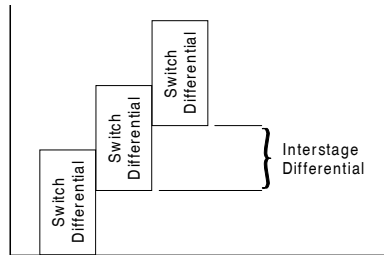
Refer to the *Type A36AHA 4-Stage Computer Environmental Temperature Control Product Bulletin (LIT-125145)* for important product application information.

A36 Series



Action on Increase on Temperature

A36 Series Action Diagram



A36 Series Differential Diagram

Features

Screwdriver slot adjustment with calibrated dial enables movement of entire staging band within the range.

Applications

Use for cycling control for multiple refrigeration compressors or unloading type compressors.

Accessories

Order Enclosure **CSE57A-600** separately, if required.



A36AHA-52 Remote Bulb Thermostat

Repair Information

If the A36 Series Four-Stage Remote Bulb Thermostat fails to operate within its specifications, replace the unit. For a replacement thermostat, contact the nearest Johnson Controls® representative.

Selection Chart

Product Code Number	Switch Action	Range °F (°C)	Differential F° (C°) Fixed	Bulb and Capillary	Bulb Well No. (Order Separately)	Range Adjuster
A36AHA-50C ¹	Four Single-Pole, Double-Throw (SPDT) switches	55 to 95 (13 to 35)	Two each stage	3/8 in. x 5-1/4 in. 18 in. capillary with 12 in. nylon armor	WEL14A-603R	Screwdriver slot with calibrated dial
A36AHA-52C ¹			1 1/2 (0.8) between stages			
A36AHA-58C ²		0 to 70 (-18 to 21)	Three each stage	3/8 in. x 4-3/4 in. 15 ft braid armor capillary	WEL14A-602R	
			Two each stage			
A36AHB-33C ¹			2-1/2 (1.4) between stages			

1. Calibrated at mid-switching point; computer room or comfort control.
2. Calibrated at low-switching point; special close control chiller applications.

Specifications

Maximum bulb temperature is 120°F (49°C) in operation and 140°F (60°C) when shipping.

Electrical Ratings (Per Switch)

Motor Ratings VAC	120	208	240	277
A36AHA				
AC Full Load A	10.0	6.9	5.0	—
AC Locked Rotor A	60.0	41.4	30.0	—
Non-Inductive A	16.0	9.2	8.0	7.2
Pilot Duty	125 VA, 120 to 227 VAC			
A36AHB				
AC Full Load A	6.0	3.4	3.0	—
AC Locked Rotor A	36.0	20.4	18.0	—
Non-Inductive A	10.0	5.7	5.0	4.3
Pilot Duty	125 VA, 120 to 227 VAC			

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S26 Series Switching Subbase

Description

The S26 Series is a switching subbase used in conjunction with T26A, T26J, and T26S thermostats to provide system and fan switching capability.

The variety of switching configurations available with the S26 Series adds application flexibility to the T26 Series thermostats.

Applications

S26 Series subbases are available with a variety of system switch configurations for manual control of system operation and fan speed for heating, cooling, and combination heating/cooling equipment.

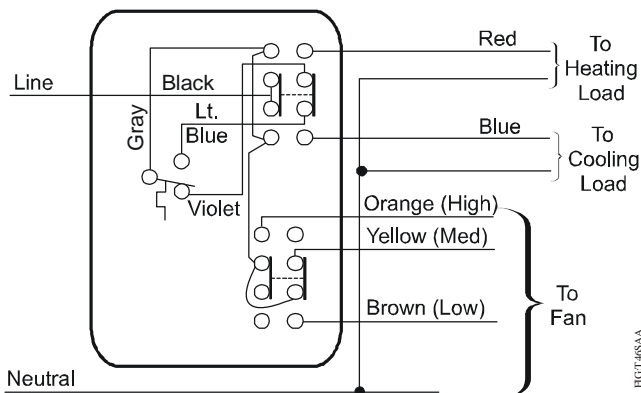
Selection Chart

Product Code Number	System Switch	Fan Switch
S26AA-1	Heat-off-cool	Low-med-high
S26AH-1	Heat-off-cool	None
S26DH-1	Off-auto	None

Technical Specifications

S26 Series System Switching Subbase		
Finish	Cover	Almond
	Faceplate	Gold metallic with dark brown border and lettering
Material	Base	0.050 in. (1 mm) cold rolled steel
	Cover	0.090 in. (2 mm) high impact PVC plastic
Mounting		Mounts to a 2-gang electrical box
Shipping Weight	Individual Pack	7 oz (0.20 kg)
	Overpack of 20 Units	10 lb, 4 oz (4.65 kg)
Wiring Connections		Color coded No. 16 AWG wires, 8 in. (203 mm) long

Electrical Ratings				
Motor Ratings	120V	208V	240V	277V
AC full load A	12.0	6.9	6.0	5.2
AC locked rotor A	72	41.4	36	31.2
AC non-inductive A	6.5	6.5	6.5	-
Pilot Duty	125 VA, 24 to 277 VAC			



T26S and S26AA (T46SAA) Heat-Off-Cool Selector Switch with Fan Speed Control (Heating and Cooling)

Refer to the *S26 Series Switching Subbase Product Bulletin (LIT-125610)* for important product application information.

Features

- mounts directly to a two-gang electrical box
- wiring connections enclosed and isolated from the user
- smooth action multi-position slide switches for dependable service
- can be added to existing T26 Series thermostats (new style with plastic cover)
- high-impact plastic enclosure

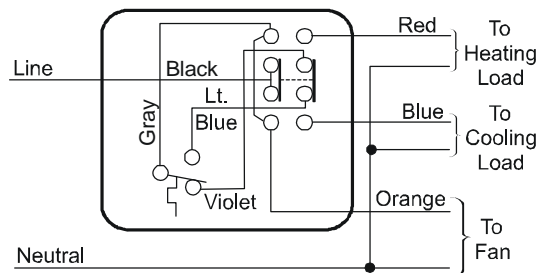
Repair Information

If the S26 Series Switching Subbase fails to operate within its specifications, replace the unit. For a replacement subbase, contact the nearest Johnson Controls® representative.



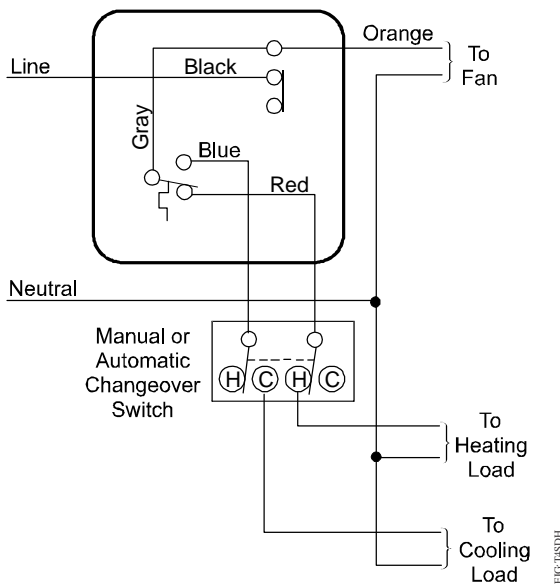
S26 Series Switching Subbase

Typical Wiring Configuration for Cooling S26



T26S and S26AH (T46SAH) Heat-Off-Cool Selector Switch with Continuous Fan (Heating and Cooling)

Typical Wiring Configurations for Combinations



T26S and S26DH (T46SDH) Off-Auto Selector Switch with Manual or Automatic Changeover Switch and Continuous Fan (Heating and Cooling)

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T22/T25/T26 Series Line Voltage Wall Thermostat (Heating, Cooling, or Heating and Cooling)

Description

For line voltage control of residential, commercial, or industrial heating or year-round air conditioning. Heat or cold anticipators are not required. The liquid-charged temperature sensing element and highly efficient diaphragm and leverage provide close temperature control.

Refer to the following documents for important product application information:

- *T22 Series Line Voltage Thermostats with Selector Switch Product Bulletin (LIT-125630)*
- *T25 Two-Stage Room Thermostat Product Bulletin (LIT-125640)*
- *T26 Series Line Voltage Thermostats Product Bulletin (LIT-125645)*



T22 Series Line Voltage Wall Thermostat



T25 Series Line Voltage Wall Thermostat



T26 Series Line Voltage Wall Thermostat

Features

- attractive beige colored, high-impact plastic enclosure (T26 Series)
- close differential without the need for anticipators
- bi-metal thermometer supplied as standard except where indicated
- equipped with adjustable dial stops (T26 Series)

Specifications

Temperature range is 40 to 90°F (5 to 30°C), except energy conservation models.

Accessories

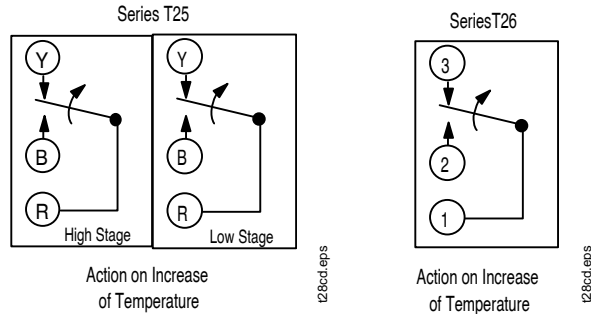
- replacement knobs and faceplates
- for double trim plate for mounting two T22s or T26s

Repair Information

If the T22/T25/T26 Series Line Voltage Wall Thermostat (Heating, Cooling, or Heating and Cooling) fails to operate within its specifications, replace the unit. For a replacement thermostat, contact the nearest Johnson Controls® representative.

Applications

Use for line voltage control of heating and cooling equipment.



T25, T26 Series Action Diagrams



Multi-Stage Electromechanical Temperature Controls

T22/T25/T26 Series Line Voltage Wall Thermostat (Heating, Cooling, or Heating and Cooling) (Continued)

Selection Chart

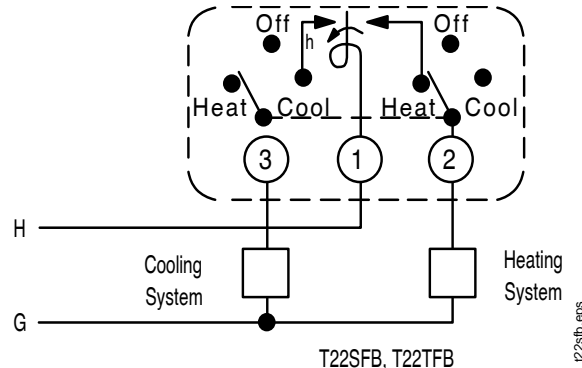
Product Code Number ¹	Type of Adjustment	Application	Selector Switch	Differential Approximately C° (F°)		Shipping Wt. (lb)
				Heating	Cooling	
Heating						
T22AAA-1C	Knob	Single-Pole, Single-Throw (SPST)	Off-Auto	1-3/4 (1)	-	1.3
T22ABC-1C			Auto-Off-Fan			
T22ABC-3C	Concealed	SPST, medium duty		3 (1.7)		
T22BBC-1C	Knob					
T22CBC-1C						
T22CBC-3C	Concealed					
T26A-14C (No Thermometer)	Knob	SPST, Energy Conservation Heating model, max. setting 75°F (24°C)	None	2 (1.1)		1.0
T26A-15C (No Thermometer)		SPST, Energy Conservation Heating model, max. setting 65°F (18°C)				
Cooling						
T22JAA-1C	Knob	SPST	Off-Auto	-	2-1/4 (1.3)	1.3
T22JCC-1C			Auto-Off-Fan			
T26J-7C (No Thermometer)		SPST, Energy Conservation Cooling model, min. setting 75°F (24°C)	None		2 (1.1)	1.0
T26J-9C (No Thermometer)		SPST, Energy Conservation Cooling model, min. setting 78°F (26°C)				
Heating and Cooling						
T22SDA-1C	Knob	Single-Pole, Double-Throw (SPDT), permits system shutdown at the thermostat	Off-Auto	1-3/4 (1)	2-1/4 (1.3)	1.3
T22SEB-1C		SPDT, used when the same device controls heating and cooling	Heat-Off-Cool			
T22SFB-1C ²		SPDT, used to control separate loads on heating and cooling				
T22TFB-1C ²		SPDT, heavy duty, used to control separate loads on heating and cooling		3 (1.7)	3 to 4 (1.7 to 2.2)	
T26S-18C ³		SPDT	None	1-3/4 (1)	2-1/4 (1.3)	1.0
T26T-3C ²		SPDT, heavy duty		3 (1.7)	3 to 4 (1.7 to 2.2)	
Two-Stage						
T25A-1C	Knob	Two SPDT switches	None	1-3/4 (1)	2-1/4 (1.3)	1.5
T25A-16C	Concealed	Two-stage heating, cooling or one-stage heating and one-stage cooling		3 (1.7) between stages		

- For the thermostat guard, refer to *G Series Thermostat and Humidistat Guards (LIT-1922145)*.
- Can also be used where one unit provides both heating and cooling by adding a jumper between terminals 2 and 3. Refer to *Typical Wiring Diagram and Electrical Ratings for Line Voltage Thermostats (LIT-1922600)*.
- Includes a faceplate for horizontal mounting. The plate is for on-the-job installation over a vertical plate. Can field-convert to other configurations.
The T26S-18 is a universal replacement for Honeywell T451A, -B, T651A; White-Rodgers 179-1, 180-1, 181-1, 182-101, -102; Robertshaw® TA500, TH71, -72, -79, -500, TX550.
T26T-3 replaces: Honeywell T4051A, -B, T6051A; White-Rodgers 151-6, 152-9, 159-3, -5.



Typical Wiring Diagram and Electrical Ratings for Line Voltage Thermostats

Technical Specifications



Typical Wiring Diagram for Line Voltage Thermostat

Electrical Ratings T22A, T22J, T22S, T25A, T26A, T26J, T26S

Motor Ratings VAC	120	208	240	277
AC Full Load A	6.0	3.4	3.0	-
AC Locked Rotor A	36.0	21	18.0	-
AC Non-Inductive A	(1)	(1)	(1)	(1)
Pilot Duty	125 VA, 24 to 277 VAC			

Note: T25A Non-Inductive Ratings are 10.0, 9.2, 8.0 and 7.2 A.
 T26A, T26S Non-Inductive Rating is 10.0 A,
 120 to 277 VAC.

Electrical Ratings T22BBC

Motor Ratings VAC	120	208	240
AC Full Load A	10.0	6.9	6.0
AC Locked Rotor A	60.0	41.4	36.0
Pilot Duty	125 VA, 24 to 277 VAC		

Electrical Ratings T22CBC¹, T26T²

Motor Ratings VAC	120		208		240	
	Heat	Cool	Heat	Cool	Heat	Cool
AC Full Load A	16.0	8.0	9.2	8.0	8.0	8.0
AC Locked Rotor A	96.0	48.0	55.2	48.0	48.0	48.0
Non-Inductive Rating	120		240		227	
AC Non-Inductive A	22.0		22.0		22.0	
Pilot Duty	125 VA, 120 to 240 VAC					

1. Heating rating only applies. Non-inductive ratings do not apply to Type T2CBC.
2. Non-inductive rating does not apply to the cooling side of T26T.

Electrical Ratings T22TFB

Motor Ratings VAC	120		208		240	
	Heat	Cool	Heat	Cool	Heat	Cool
AC Full Load A	16.0	8.0	9.2	8.0	8.0	8.0
AC Locked Rotor A	96.0	48.0	55.2	48.0	48.0	48.0
Pilot Duty	125 VA, 120 to 240 VAC					



T23 Series Fan Coil Thermostat (with Fan and System Selectors)

Description

This line voltage thermostat controls heating, cooling, or combination heating and cooling systems. It operates fan motors, relays, or valves on fan-coil units. All thermostats have a three-speed fan selector switch.

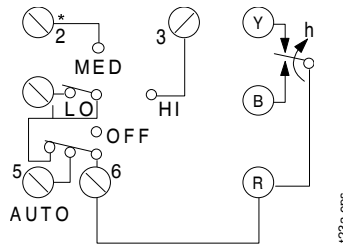
Refer to the *T23 Series Line Voltage Fan Coil Thermostat Product Bulletin (LIT-125635)* for important product application information.

Features

- dual voltage switching provided (120/240 VAC) without the need for anticipators to achieve close temperature control
- field-adjustable high and low dial stops
- mounts on a standard double outlet box
- attractive one-piece beige cover with inlaid two-tone panel

Applications

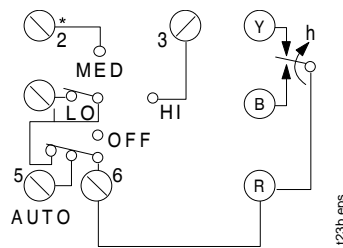
- line voltage control of fan motors, relays, or valves on fan-coil units



T23A Thermostat



T23A-1 Thermostat



T23B Thermostat

Repair Information

If the T23 Series Fan Coil Thermostat (with Fan and System Selectors) fails to operate within its specifications, replace the unit. For a replacement thermostat, contact the nearest Johnson Controls® representative.

Selection Chart

Product Code Number	Switches		Range °F (°C)	Differential F° (C°)		Shipping Weight (lb)
	Fan	System		Heating	Cooling	
T23A-1C	Low-Med-High	Heat-Off-Cool	50 to 90	1-3/4 (1)	2-1/4 (1.3)	1.5
T23B-1C	Low-Med-High	Auto-Off	(10 to 32)			

Technical Specifications

Mounts on a standard double outlet box.

Electrical Ratings

Motor Ratings VAC	120	240
AC Full Load Amperes	5.8	2.9
AC Locked Rotor Amperes	34.8	17.4
Pilot Duty	125 VA, 120 to 240 VAC	



T28 Series Fan Coil Thermostat (with or without Fan Selector Switches)

Description

This thermostat controls light duty line voltage fan coil or baseboard valves on heating, cooling, and heating-cooling systems. The thermostat can control one or two valves directly. These thermostats are rated for 120, 208, or 240 VAC at 50 to 60 Hz.

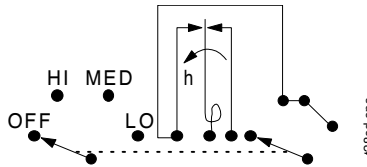
Refer to the *T28 Series Fan Coil Thermostats Product Bulletin (LIT-125650)* for important product application information.

Features

- precision, snap-acting contacts
- heating and cooling anticipation
- cooling and heating-cooling models have an interlocked fan off position

Applications

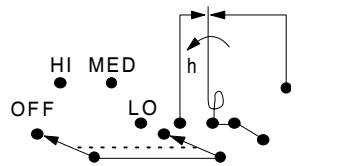
Use for line voltage control of heating and cooling equipment.



T28CD
Heating-Cooling Thermostat
with Off-Hi-Med-Lo Fan Switch



T28CD Thermostat



T28DG
Sequenced Heating-Cooling Thermostat
with Off-Hi-Med-Lo Fan Switch

Repair Information

If the T28 Series Fan Coil Thermostat (with or without Fan Selector Switches) fails to operate within its specifications, replace the unit. For a replacement thermostat, contact the nearest Johnson Controls® representative.

Selection Chart

Product Code Number	Fan Switch	Shipping Weight, lb (kg)
Cooling		
T28BD-1C	Off-Hi-Med-Lo	1.3 (0.59)
Heating-Cooling (Remote changeover, Single valve for heating and cooling)¹		
T28CD-1C	Off-Hi-Med-Lo	1.3 (0.59)
Heating-Cooling, Sequenced (Automatic changeover, Separate valves for heating and cooling)²		
T28DA-1C	None	1.0 (0.45)
T28DB-1C ¹	Off-On	1.3 (0.59)
T28DD-1C ¹	Off-Hi-Med-Lo	1.3 (0.59)
T28DG-1C ³	Off-Hi-Med-Lo	1.3 (0.59)

1. Off position of fan switch interlocks to turn off cooling.
2. For automatic changeover where one valve functions for heating or cooling, use A19CAC-2 Strap-On Changeover Control.
3. Off position of fan switch interlocks to turn off both heating and cooling.

Technical Specifications

The T28 mounts on a standard, double outlet box.

Nominal operating differential at 0.6°F (0.3 C°) heating, 1 F° (0.6 C°) cooling on standard 120 VAC fan coil valves. Sequenced models have 6 F° (3.3 C°) differential from heat on to cool on.

Electrical Ratings – Ampere

VAC	Thermostat				Fan Switch	
	Cooling		Heating		Full Load Amperes	Locked Rotor Amperes
	Normal	Inrush	Normal	Inrush		
120	0.32	1.0	0.12	0.36	5.8	34.8
208	0.18	0.57	0.07	0.21	3.3	19.8
240	0.16	0.50	0.06	0.18	2.9	17.4



T46 Series Fan Coil Thermostat

Description

The T46 Series Thermostat is used to control line voltage, fan coil, and heating zone valves on heating, cooling, and combination heating and cooling systems. Models are available with single-pole, single-throw (SPST) or single-pole, double-throw (SPDT) contact action for standard duty (nominal 1/4 hp, 6 A non-inductive) applications. Thermostats are available with or without fan speed control or built-in thermometers. Various system switch combinations are available, including fan speed selection.

Field-installable faceplate combinations of knob or concealed adjustment are possible. Also, the T46 is available with or without thermometer indication. These thermostats have plastic locking covers with an Allen-head screw to discourage unauthorized tampering. Standard models are supplied with the thermostat faceplate installed with knob adjustment and thermometer.

Refer to the *T46 Series Fan Coil Thermostats Product Bulletin (LIT-125655)* for important product application information.

Features

- knob or concealed setpoint adjustment
- low and high temperature dial stops that are concealed and adjustable throughout setpoint range
- can be set for a locked dial
- narrow differential without the need for anticipator
- standard internal dual Celsius and Fahrenheit scales
- switch mechanism and wiring connections go into the switch box to isolate electrical circuits from the sensing element
- mounts on a standard double outlet box
- separable mounting plate allows easy mounting and wiring without removing thermostat cover
- locking cover reduces unauthorized tampering
- high-impact plastic enclosure
- smooth action multi-position slide switches for dependable service



T46 Thermostat

Applications

These thermostats control fan coil and zone heating valves on a wide variety of heating and cooling combinations for conditioned space.

Selection Charts

T46 Series Fan Coil Thermostat

Product Code Number	System Switch	Fan Switch
Heating		
T46ABH-1C	Auto-off-fan	None
T46ADH-1C	Off-auto	None
Cooling		
T46JBH-1C	Auto-off-fan	None
T46JDH-1C	Off-auto	None
T46JEA-1C	On-off	Low-med-high
Heating and Cooling		
T46SAA-1C	Heat-off-cool	Low-med-high
T46SAH-1C	Heat-off-cool	None
T46SDA-1C	Off-auto	Low-med-high
T46SDH-1C	Off-auto	None

Replacement Parts

Product Code Number	Description
CVR88A-600R	Thermostat Cover Assembly for knob adjustment models with thermometer, °F scale, faceplate supplied unassembled
KNB26A-600R	Plastic push on knob for thermostat
BKT48A-600R	Mounting plate for T46

Accessories

Product Code Number	Faceplate Selection ¹			
	Mounting Position	Type of Adjustment	Thermometer Cutout	Temperature Scale
PLT333-1R ²	Vertical	Knob	Yes	Fahrenheit
PLT333-3R	Vertical	Concealed	Yes	Fahrenheit
PLT333-5R	Vertical	Knob	Yes	Celsius
PLT333-12R	Vertical	Concealed	No	—

1. Faceplates must be ordered in multiples of ten.
2. Supplied with standard wholesaler models.

Technical Specifications

T46 Series Fan Coil Thermostats		
Range	Thermostat	40 to 90°F (5 to 30°C)
	Thermometer	50 to 90°F (10 to 30°C)
Differential	Mechanical	Approximately 0.7°F (0.4°C)
	Operating	See next page
Finish	Cover	Almond
	Faceplate	Gold metallic with dark brown border and lettering
Mounting		Double gang box, separable mounting plate
Material	Base	0.050 in. (1 mm) cold rolled steel
	Cover	0.090 in. (2 mm) high-impact plastic
Sensing Element		Liquid-filled for positive trouble-free operation
Shipping Weight	Individual Pack	1 lb (0.45 kg)
	Overpack of 20 Units	20 lb (9.07 kg)
Thermometer		Bimetal type for accuracy and clarity, can be field-calibrated
Wiring Connections		Color coded No. 16 AWG wires, 8 in. (203 mm) long

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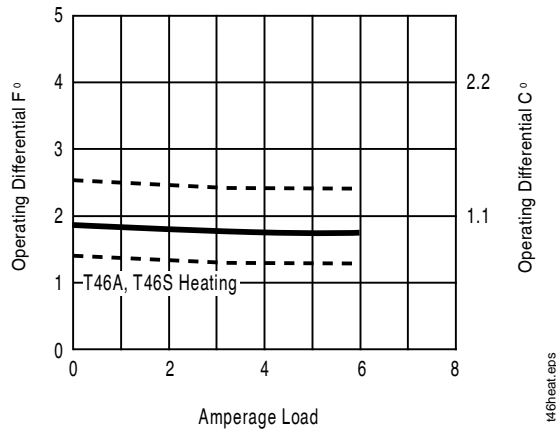
T46 Series Fan Coil Thermostat (Continued)

Technical Specifications (Continued)

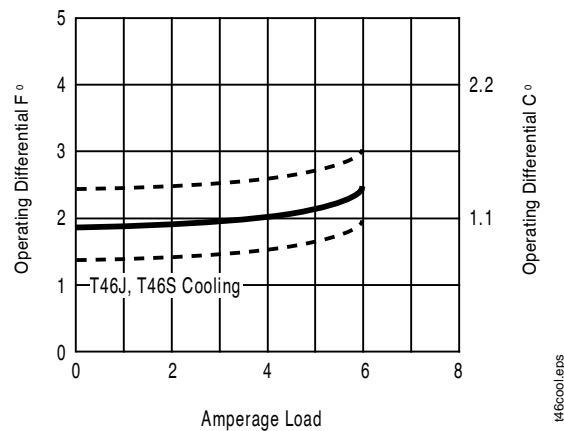
Electrical Ratings

Motor Ratings	120 V	208 V	240 V	277 V
T46 System and Fan Switches				
AC Full Load A	12.0	6.9	6.0	5.2
AC Locked Rotor A	34.8	19.1	17.4	14.4
AC Non-Inductive A	6.5	6.5	6.5	—
Pilot Duty	125 VA, 24 to 277 VAC			
T46 Thermostat Only				
AC Full Load A	6.0	3.5	3.0	—
AC Locked Rotor A	34.8	19.1	17.4	—
AC Non-Inductive A	6.5	6.5	6.5	—
Pilot Duty	125 VA, 24 to 277 VAC			

Operating Differentials



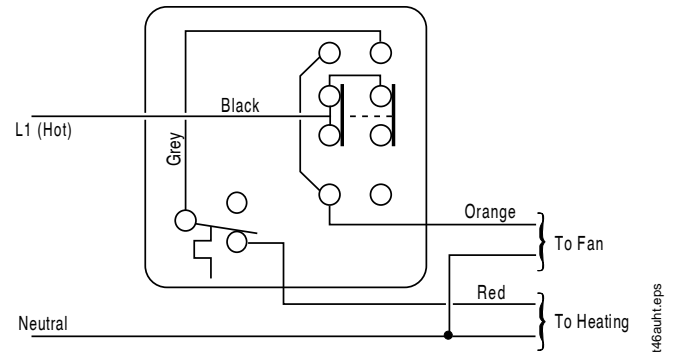
Operating Differential for T46A and Heating Side of T46S



Operating Differential for T46J and Cooling Side of T46S

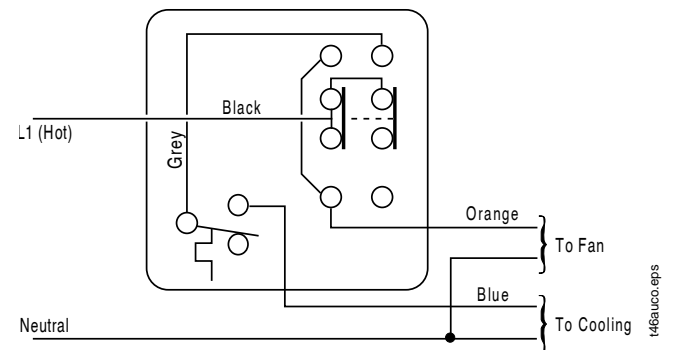
Note: The heavy line in each of the above figures is the nominal operating temperature differential. Production thermostats may vary from the norm, as indicated by the dotted line.

Typical Wiring Application for Heating



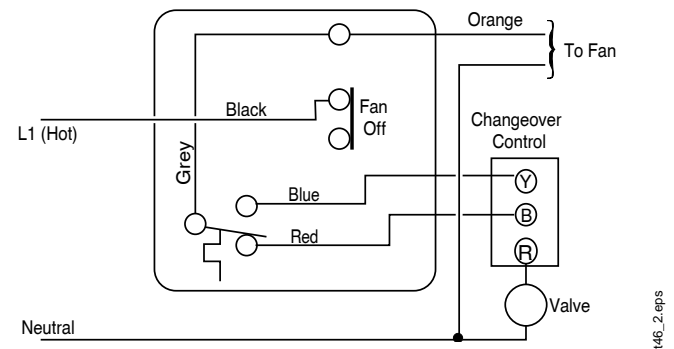
T46ABH Auto-Off-Fan Selector Switch with Continuous Fan (Heating Only)

Typical Wiring Application for Cooling



T46JBH Auto-Off-Fan Selector Switch with Continuous Fan (Cooling Only)

Typical Wiring Application for Combination



T46SDH Off-Auto Selector Switch. Used on Fan-Coil Unit with Cycling Valve and Continuous Fan. Terminal Markings Shown for A19CAC Changeover Control (Heating and Cooling)



MS Series Temperature Stage Control Modules

Description

The MS Series Temperature Controls are versatile, microprocessor-based, multifunction, programmable temperature controls. They are designed for single and multiple-stage temperature control applications.

Depending on the model selected, the MS Series Controls can operate in the following modes:

- Direct mode
- Reverse mode
- Deadband mode
- Independent Setpoint mode

The MS Series Controls have large, easy-to-read, red LED displays. These compact controls are available in panel mount and DIN rail mount models. MS Series Controls use the A99B temperature sensors, which allow remote mounting of the display unit.

Refer to the *MS Series Multi-Stage Electronic Temperature Controls Product Bulletin (LIT-125198)* for important product application information.

Features

- programmable functions allow adjustment of control settings to meet application needs
- alarm management functions provide visible alarm codes on the display
- easily readable LED display shows temperature and functions quickly and clearly
- programming button lockout allows user to disable programming buttons to deter accidental or unauthorized changes
- accurate temperature sensors provide precise control performance with up to 300 feet of wiring (An adjustable offset is provided for longer wiring)
- self-test procedure checks control operation by cycling all outputs and testing all LEDs



MS4 Series Panel and DIN Rail Mount, Multi-Stage, Electronic Temperature Controls

Repair Information

If the MS Series Temperature Stage Control Modules fails to operate within its specifications, replace the unit. For a replacement control, contact the nearest Johnson Controls® representative.

Applications

Application	MS1 Series Single-Stage	MS2 Series Two-Stage	MS4 Series Four-Stage
Rooftop heating or cooling units	✓	✓	✓
Boiler or pump control	✓	✓	✓
Convenience store coolers	✓	✓	✓
Space temperature control	✓	✓	
Cooling tower pump control	✓		
Compressor or chiller staging		✓	✓
Reach-in coolers		✓	✓
Supermarket display cases for produce		✓	✓
Restaurant and Convenience store walk-in coolers		✓	✓

Selection Chart

Product Code Number	Description	Shipping Weight, lb (g)
MS1DR24T-11C	MS1 Single-stage, DIN Rail Mount Temperature Control, A99BB-200C sensor included	0.75 (340)
MS2DR24T-11C	MS2 Two-stage, DIN Rail Mount Temperature Control, A99BB-200C sensor included	0.79 (360)
MS2PM24T-11C	MS2 Two-stage, Panel Mount Temperature Control, A99BB-200C sensor included	0.53 (240)
MS4DR24T-11C	MS4 Four-stage, DIN Rail Mount Temperature Control, 2 A99BB-200C sensors included	1.17 (530)
MS4PM24T-11C	MS4 Four-stage, Panel Mount Temperature Control, 2 A99BB-200C sensors included	0.90 (410)

Accessories

Product Code Number	Description
A99BB-200C	Temperature Sensor: Range: -40 to 212°F (-40 to 100°C) Cable length and type: 6-1/2 ft (2 m) PVC
A99BB-300C	Temperature Sensor: Range: -40 to 212°F (-40 to 100°C) Cable length and type: 9-3/4 ft (3 m) PVC
A99BB-500C	Temperature Sensor: Range: -40 to 212°F (-40 to 100°C) Cable length and type: 16-3/8 ft (5 m) PVC
A99BB-600C	Temperature Sensor: Range: -40 to 212°F (-40 to 100°C) Cable length and type: 19-1/2 ft (6 m) PVC
A99BA-200C	Temperature Sensor: Range: -40 to 212°F (-40 to 100°C) Cable length and type: 6-1/2 ft (2 m) Shielded



Multi-Stage Electronic Temperature Controls

MS Series Temperature Stage Control Modules (Continued)

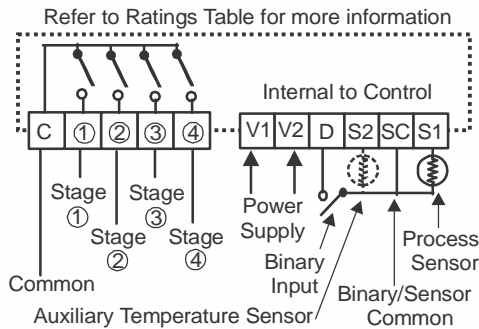
Technical Specifications

MS Series Temperature Stage Control Modules		
Power Requirements		24 VAC, 50/60 Hz, Class 2 (20 to 30 VAC)
Power Consumption		5 VA at 24 VAC
Accuracy		± 1.8°F (± 1°C)
Ambient Conditions	Operating	+14 to +140°F (-10 to +60°C); 0 to 95% RH (noncondensing)
	Storage	-22 to +176°F (-30 to +80°C); 0 to 95% RH (noncondensing)
Agency Listings		UL Recognized: File E194024, CCN XAPX2 Canadian UL Recognized: File E194024, CCN XAPX8
Dimensions (H x W x D)	Panel Mount	1.38 x 2.95 x 2.68 in. (35 x 75 x 68 mm)
	DIN Rail	4.65 x 2.76 x 2.07 in. (118 x 70 x 53 mm)

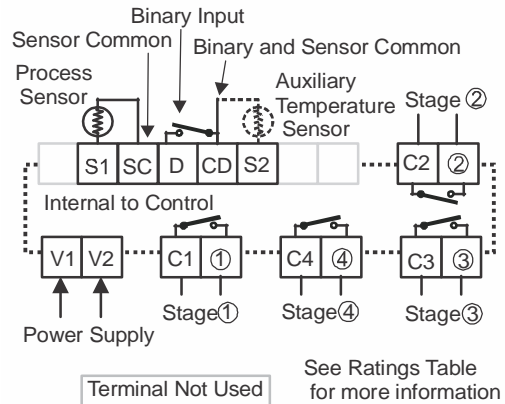
Electrical Ratings

	120 VAC	240 VAC	24 VDC
Horsepower	1/4	1/2	---
Full Load Amperes	5.8	4.9	---
Locked Rotor Amperes	34.8	29.4	---
Inductive (Non-Motor) Amperes	8	8	8
Pilot Duty VA	275	450	---

Note: Relay outputs must not exceed 20 Amperes total connected load. Open collector transistors on the MS1 Alarm Circuits have a maximum rating of 40 VDC 100 mA. Alarms require separate power source.



MS4PM24T Panel Mount Control Wiring



MS4DR24T Din Rail Mount Control Wiring



MS Series Single-Stage Control Modules with Voltage Input

Description

The MS Series Controls are versatile, microprocessor-based, multifunction, programmable controls for humidity, pressure, or other 0 to 10 VDC input. They are designed for single- and multiple-stage control applications.

Depending on the model selected, the MS Series Control can operate in one of several modes:

- Direct mode
- Reverse mode
- Deadband mode
- Independent Setpoint mode

The MS Series Controls have large, easy-to-read, red LED displays. These compact controls are available in panel mount and DIN rail mount models.

Refer to the *MS Series Multi-Stage Electronic Controls Product Bulletin (LIT-125502)* for important product application information.

Features

- programmable functions allow adjustment of control settings to meet application needs
- alarm management functions provide visible alarm codes on the display and alarm relay contacts that can be used to activate a remote alarm or dial-out modem
- easily readable LED display shows condition and functions quickly and clearly
- programming button lockout allows user to disable programming buttons to deter accidental or unauthorized changes
- provides accurate control performance with up to 300 feet of wiring (an adjustable offset is provided for longer wiring.)
- self-test procedure checks control operation by cycling all outputs and testing all LEDs



MS1 Series DIN Rail Mount, Single-Stage, Electronic Pressure, Temperature

Repair Information

If the MS Series Single-Stage Control Modules with Voltage Input fails to operate within its specifications, replace the unit. For a replacement control, contact the nearest Johnson Controls® representative.

Applications

Application	MS1 Series Single-Stage
Rooftop heating or cooling units	✓
Boiler or pump control	✓
Convenience store coolers	✓
Space temperature control	✓
Cooling tower pump control	✓

Selection Chart

Product Code Number	Description
MS1DR24T-11C	MS1 Single-Stage thermostat, DIN Rail Mount Control; A99 sensor included
MS1DR24V-11C	MS1 Single-Stage, DIN Rail Mount Control; 0 to 10 VDC input; no sensor included

Accessories

Product Code Number	Description
HE-6300-3	Humidity Sensor: 0 to 100% RH noncondensing 20 to 140°F (-29 to 60°C)
HE-6310-3	

Technical Specifications

MS Series Stage Control Modules with Voltage Input	
Power Requirements	24 VAC, 50/60 Hz, Class 2 (20 to 30 VAC)
Power Consumption	5 VA at 24 VAC
Accuracy	± 1.8°F (± 1°C)

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Multi-Stage Electronic Temperature Controls

MS Series Single-Stage Control Modules with Voltage Input (Continued)

MS Series Stage Control Modules with Voltage Input		
Ambient Conditions	Operating	+14 to +140°F (-10 to +60°C); 0 to 95% RH (noncondensing)
	Storage	-22 to +176°F (-30 to +80°C); 0 to 95% RH (noncondensing)
Agency Listings	UL Recognized: File E194024, CCN XAPX2 Canadian UL Recognized: File E194024, CCN XAPX8	
Dimensions (H x W x D)	Panel Mount	1.38 x 2.95 x 2.68 in. (35 x 75 x 68 mm)
	DIN Rail	4.65 x 2.76 x 2.07 in. (118 x 70 x 53 mm)

Electrical Ratings

	120 VAC	240 VAC	24 VDC
Horsepower	1/4	1/2	---
Full Load Amperes	5.8	4.9	---
Locked Rotor Amperes	34.8	29.4	---
Inductive (Non-Motor) Amperes	8	8	8
Pilot Duty VA	275	450	---

Note: Relay outputs must not exceed 20 Amperes total connected load. Open collector transistors on the MS1 Alarm Circuits have a maximum rating of 40 VDC 100 mA. Alarms require separate power source.



MS4PMUHVT Multi-Stage Electronic Temperature Control with Relay Pack

Description

The MS4PMUHVT Control is intended for multi-stage temperature control applications. This microprocessor based control offers innovative features and state-of-the-art technology to improve all your staged temperature control applications.

Refer to the *MS4PMUHVT Multi-Stage Electronic Temperature Control with Relay Pack Product Bulletin (LIT-125195)* for important product application information.

Features

- four enclosed, line voltage relays provide direct control of motor loads without additional relays
- 120/240 VAC power supply eliminates need for separate transformers
- one control provides single-sensor multi-stage control or dual-sensor reset control, which reduces need for warehouse or truck to stock multiple controls for similar applications
- accepts A99 sensor signal, which is suitable for a wide range of applications

- Surface Mounted Design (SMD) technology assures high quality, reliable components in a compact package
- keypad lock deters accidental changes to parameter settings
- listed for use on refrigeration equipment in accordance with Canadian and U.S. National standards

Applications

This control is specifically designed for the control of four-stage applications in the following configurations:

- four cooling stages with common setpoint
- four heating stages with common setpoint
- four stages with deadband (two heating stages and two cooling stages with common setpoint)
- two independent sets of two dependent stages (two heating stages and two cooling stages with independent setpoints)

Repair Information

If the MS4PMUHVT Multi-Stage Electronic Temperature Control with Relay Pack fails to operate within its specifications, replace the unit. For a replacement control, contact the nearest Johnson Controls® representative.



MS4PMUHVT Electronic Temperature Control

Selection Charts

MS4PMUHVT Multi-Stage Electronic Temperature Control with Relay Pack

Product Code Number	Description
MS4PMUHVT-11C	Multi-Stage Electronic Temperature Control with Relay Pack and One Temperature Sensor

Accessories and Maintenance Parts

Product Code Number	Description
A99BB-200C	Sensor with 6-1/2 ft/1.98 m Cable Length
MS4PM12CT-11C	Replacement Control (for use only with relay pack)
RP4MSUHV-1C	Replacement Relay Pack without Control

Electrical Ratings per Relay

	24 VAC	120 VAC	208 VAC	240 VAC
HP	—	1/3	3/4	1
FLA (Ampere)	—	7.2	7.6	8
LRA (Ampere)	—	43.2	45.6	48
Non-Inductive (Ampere)	—	8	8	8
Pilot Duty (VA)	50	325	625	750

Technical Specifications

MS4PMUHVT Multi-Stage Electronic Temperature Control with Relay Pack		
Power Requirements	120 VAC ±10% or 240 VAC ±10%	
Frequency	60/50 Hz	
Power Consumption	10 VA at 240 VAC, 10 VA at 120 VAC	
Sensor Range	-40 to 158°F (-40 to +70°C)	
Accuracy	±1 F°/±1 C°	
Ambient Operating Conditions	MS4PMUHVT-11C	+14 to +140°F (-10 to +60°C); 0 to 95% RH (noncondensing)
	MS4PM12CT-11C	+14 to +140°F (-10 to +60°C); 0 to 95% RH (noncondensing)
	RP4MSUHV-1C	-40 to +140°F (-40 to +60°C); 0 to 95% RH (noncondensing)
Ambient Storage Conditions	MS4PMUHVT-11C	-22 to +176°F (-30 to +80°C); 0 to 95% RH (noncondensing)
	MS4PM12CT-11C	-22 to +176°F (-30 to +80°C); 0 to 95% RH (noncondensing)
	RP4MSUHV-1C	-40 to +185°F (-40 to +85°C); 0 to 95% RH (noncondensing)
Agency Listings	UL File SA516, Guide SDFY cUL File SA516, Guide SDFY7	
Emissions Compliance	FCC (US), DOC (Canada)	
Dimensions (H x W x D)	7.94 x 3-3/5 x 2-2/5 in. (202 x 92 x 61 mm)	
Shipping Weight	2.9 lb (1,320 g)	



A99B Series Temperature Sensor

Description

The A99B Series Temperature Sensors are passive PTC (Positive Temperature Coefficient) sensors. The A99B sensors are splashproof and are designed to measure temperature in a variety of refrigeration applications. Several accessories allow easy tailoring of the temperature sensor to various mounting configurations.

Applications include temperature sensing for freezers and coolers, as well as in defrost termination sensing, space and return air temperature sensing, and condenser fan cycling.

Refer to the *A99B Series Temperature Sensors Product Bulletin (LIT-125186)* for important product application information.

Features

- variety of lead lengths available to encompass most application requirements and simplify wiring sensors
- an assortment of mounting hardware provides configurations for many applications
- exceptional accuracy of sensing element provides excellent performance in a wide variety of control applications
- stainless steel sensing bulb allows use in more applications than other types of bulbs without corrosion
- lead length may be extended up to 800 ft (244 m)



A99B Temperature Sensors

Repair Information

If the A99B Series Temperature Sensor fails to operate within its specifications, replace the unit. For a replacement sensor, contact the nearest Johnson Controls® representative.

Selection Chart

Product Code Number	Description
A99BA-200C	PTC Silicon Sensor with Shielded Cable; Cable length 6-1/2 ft (2 m); Range: -40 to 212°F (-40 to 100°C)
A99BB-25C	PTC Silicon Sensor with PVC Cable; Cable length 9-3/4 in. (0.25 m); Range: -40 to 212°F (-40 to 100°C)
A99BB-200C	PTC Silicon Sensor with PVC Cable; Cable length 6-1/2 ft (2 m); Range: -40 to 212°F (-40 to 100°C)
A99BB-300C	PTC Silicon Sensor with PVC Cable; Cable length 9-3/4 ft (3 m); Range: -40 to 212°F (-40 to 100°C)
A99BB-500C	PTC Silicon Sensor with PVC Cable; Cable length 16-3/8 ft (5 m); Range: -40 to 212°F (-40 to 100°C)
A99BB-600C	PTC Silicon Sensor with PVC Cable; Cable length 19-1/2 ft (6 m); Range: -40 to 212°F (-40 to 100°C)
A99BC-25C	PTC Silicon Sensor with High Temperature Silicon Cable; Cable length 9-3/4 in. (0.25 m); Range: -40 to 248°F (-40 to 120°C)
A99BC-300C	PTC Silicon Sensor with High Temperature Silicon Cable; Cable length 9-3/4 ft (3 m); Range: -40 to 248°F (-40 to 120°C)
A99BC-500C	PTC Silicon Sensor with High Temperature Silicon Cable; Cable length 16-3/8 ft (5 m); Range: -40 to 248°F (-40 to 120°C)
A99BC-1500C	PTC Silicon Sensor with High Temperature Silicon Cable; Cable length 49 ft (15 m); Range: -40 to 248°F (-40 to 120°C)

Accessories

Product Code Number	Description
A99-CLP-1	Surface Mounting Clip for the A99B Temperature Sensor
ADP11A-600R	1/2 in. diameter EMT Conduit Adaptor (box of 10) for use with BOX10A-600R
BOX10A-600R	PVC Enclosure
SHL10A-600R	Sun Shield for Single Sensor
SHL10A-603R	Sun Shield for Two Sensors
WEL11A-601R	Immersion Well

Applications

The A99B temperature sensor line offers an economical solution for a wide variety of temperature sensing needs in refrigeration and HVAC applications.

Typical temperature sensing applications and environments include:

- freezers
- display cases
- walk-in coolers
- reach-in coolers
- defrost termination temperature sensing
- condenser fan cycling
- space and return air temperature sensing
- outdoor air sensing
- process cooling and heating

Technical Specifications

A99B Series Temperature Sensor			
Sensing Range	A99BA A99BB	-40 to 212°F (-40 to 100°C)	
	A99BC	-40 to 248°F (-40 to 120°C)	
	Reference Resistance		1,035 ohms at 77°F (25°C)
Accuracy		0.9°F (0.5°C) between 5 and 167°F (-15 and 75°C)	
Sensor Construction			Stainless steel probe
Sensor Lead Wire Insulation	A99BA	Shielded PVC cable	
	A99BB	PVC cable	
	A99BC	High temperature silicon cable	
Lead Wire Gauge		22 AWG	
Maximum Allowable Bulb Temperature		257°F (125°C)	
Ambient Operating Conditions	A99BA A99BB	-40 to 212°F (-40 to 100°C); 0 to 100% RH, condensing	
	A99BC	-40 to 248°F (-40 to 120°C); 0 to 100% RH, condensing	
	Ambient Storage Conditions	A99BA A99BB	40 to 221°F (-40 to 105°C); 0 to 100% RH, condensing
A99BC		-40 to 266°F (-40 to 130°C); 0 to 100% RH, condensing	

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Bulb Wells

Description

Bulb Wells are used in conjunction with Remote Bulb Temperature Controls where bulb insertion into a vessel or container to sense temperature is required. These wells are used with TE-6000 and TE-6300 Series Sensors.

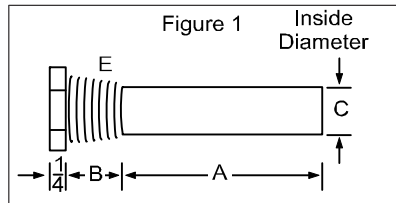
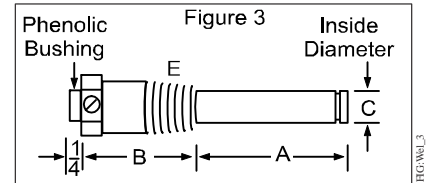
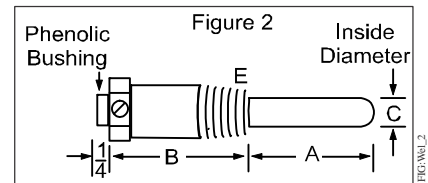
A variety of shapes, sizes, and materials are available for a wide range of applications. Refer to the appropriate temperature control for the exact bulb well required.

Accessories

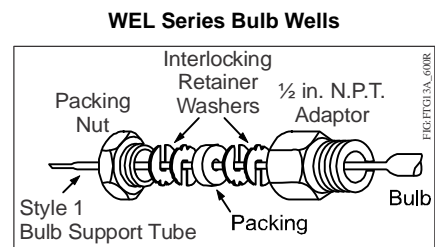
The Code No. FTG13A-600R Packing Nut Assembly is used in applications where the temperature does not fall below -35°F (-37°C). The maximum liquid pressure limit is 150 psig (1,034 kPa). Use with Style 1, 3/8 in. diameter bulb for direct immersion application. A19s require models with support tube; A70s and A72s do not need support tubes.

Repair Information

If the Bulb Wells fail to operate within their specifications, replace the unit. For a replacement Bulb Well, contact the nearest Johnson Controls® representative.



WEL Series Bulb Well



FTG13A-600R

Selection Charts

WEL Series Bulb Wells

Product Code Number	See Figure	Dimension, in.			Pipe Thread, in.		Material		Maximum Temp °F	Maximum Pressure psig	Type of Solder Joint	Plating
		A	B	C	Inside D	Outside E	Connector	Tube				
WEL11A-601R ¹	2	2-3/8	2-5/16	.299	-	1/2	Brass	Copper	250	300	Soft	-
WZ-1000-2 ²	1	5-1/4	1-1/4	.500	1/2	1/2	Stainless steel	Stainless steel	300	400	-	-
WZ-1000-4	1	5-1/4	1-1/4	.500	1/2	1/2	Stainless steel	Stainless steel	600	400	-	-
WZ-1000-5 ²	2	2-3/8	2-5/16	.299	-	1/2	Malleable	Brass	250	300	-	-
WEL14A-601R ³	3	7-9/16	1-13/16	.430	-	1/2	Brass	Copper	250	300	Silver	Brite-Dip
WEL14A-602R ³	3	4-15/16	1-13/16	.430	-	1/2	Brass	Copper	250	300	Silver	Brite-Dip
WEL14A-603R ³	3	5-13/16	1 13/16	.430	-	1/2	Brass	Copper	250	300	Silver	Brite-Dip
WEL16A-600R ¹	2	2-3/8	1-5/16	.299	-	1/2	Brass	Copper	250	300	Soft	-
WEL16A-601R	2	2-13/16	1-13/16	.375	-	1/2	Brass	Copper	250	300	Soft	-
WEL17A-600R ³	1	10-7/16	3/4	.763	1/2	3/4	Malleable	Copper	250	250	Silver	Tin
WEL17A-601R ³	1	8-11/16	3/4	.763	1/2	3/4	Malleable	Copper	250	250	Silver	Tin
WEL17A-602R ³	1	10-7/16	3/4	.753	1/2	3/4	Malleable	Steel	250	540	Silver	Tin
WEL17A-604R ³	1	14-13/32	3/4	.763	1/2	3/4	Malleable	Copper	250	250	Silver	Tin
WEL18A-600R ³	1	3-1/2	3/4	.773	1/2	3/4	Malleable	Steel	250	150	Silver	Tin
WEL18A-602R ³	1	3-1/2	3/4	.773	1/2	3/4	Malleable	Brass	250	150	Silver	Tin

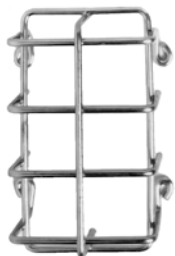
1. With phenolic bushing 0.093 in. slot
2. Includes thermal compound
3. For 11/16 in. diameter style 4 bulbs. Style 1 can be used, but is not fastened into well

T-800 Wells

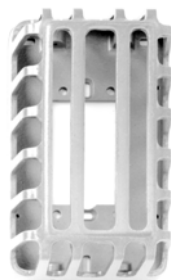
Product Code Number	Description
T-800-1605	Brass well, 6-1/2 inch
T-800-1606	Stainless steel well, 5-1/4 inch
T-800-1618	Brass well, 9-1/2 inch
T-800-1620	Brass well, 9-1/2 inch



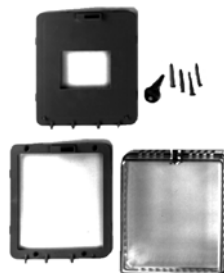
G Series Thermostat and Humidistat Guards



GRD10-1R
Wire Guard



GRD10A-601
Cast Aluminum Guard



GRD10A-608
Large Clear Plastic Guard



GRD10A-609
Rectangular Clear Plastic Guard

Description

The G Series Guards protect thermostats and humidistats from damage, vandalism, tampering, and unauthorized adjustment. They are available in plastic, cast aluminum, or wire construction.

Features

- clear plastic guards have tumbler-type key locks
- GRD10A-608 and -609 include a mounting ring for mounting to a wall or flat surface
- plastic baseplate and plastic mounting ring available
- the baseplate mounts to a flat surface or to a single or double outlet box
- the mounting ring permits mounting over a thermostat or humidistat already installed

Applications

Ideal for locations where locked protection is required, such as schools, warehouses, churches, hospitals, or offices.

Selection Chart

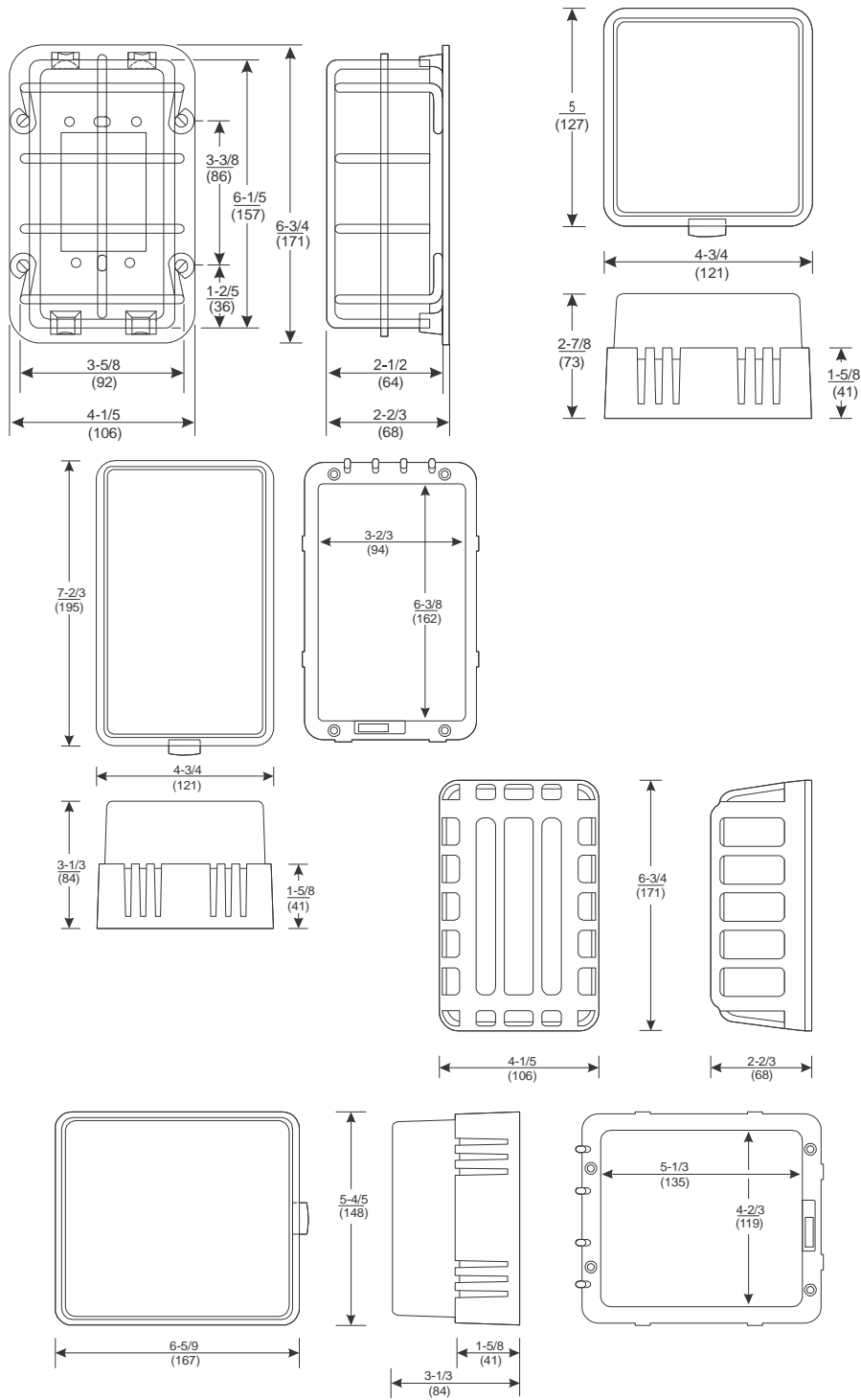
Product Code Number	Description	Thermostat or Humidistat Series Number				
		T22	T25	T26	T28 No Switches	T91
GRD10-1R	Wire guard only	✓	—	✓	—	✓
GRD10A-600	Wire guard and baseplate	✓	—	✓	—	✓
GRD10A-601	Aluminum guard and baseplate	✓	—	✓	✓	✓
GRD10A-606	Plastic guard with baseplate	✓	✓	—	✓	✓
GRD10A-608	Plastic guard with baseplate, mounting ring	✓	✓	✓	✓	✓
GRD10A-609	Plastic guard with baseplate, mounting ring	✓	✓	✓	✓	✓

Repair Parts

Replacement key **KEY12A-600** (set of two) is available.



G Series Thermostat and Humidistat Guards (Continued)



grc10a_dm.eps

grc10a_dm2.eps

G Series Dimensions, in. (mm)

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T22, T25, T26, T28, T46, and T91 Accessories

Description

Replacement Knob and Cover Kits

Replacement Knob Kit numbers KNB17A-600R, KNB20A-600R, and KNB26A-600R are designed as direct replacements for original equipment knobs.

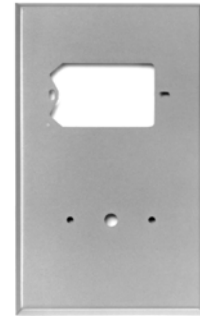
Faceplates

Faceplates are available with metal or plastic covers.

Thermostat Trim Plates

Trim plate PLT231-1R is for mounting two wall thermostats such as T22, T25, T26, T58, T91 or one thermostat and one humidistat on a three-gang electrical box. The PLT61A-600 is a similar three-gang plate but with one cutout and a 3/8 in. hole for mounting accessory switches.

These plates are finished in tawny silver to complement the design of the thermostat and humidistat.



PLT61A-600 Faceplate

Selection Charts

Replacement Knob and Cover Kits

Product Code Number	Description	Replacement Knob For
KNB17A-600R	Includes two plastic knobs	T91, T22, T25, and T26 with metal knob and metal cover
KNB20A-600R	Includes one plastic knob	T26 and W43 with plastic knob and metal cover
KNB26A-600R	Includes one plastic knob with trim disc	T26, T46, and W43 with plastic cover

Faceplates

Product Code Number	Mounting Position	Type of Adjustment	Cutout for Thermometer	Use With	Temperature Scale
Faceplates for T22, T25, T26, T80, T91, and W43 with Metal Cover					
PLT213-6R	Vertical	Concealed	No	T26, T91BA, W43 with metal cover	None
Faceplates for T26, W43 AND W45 with Plastic Cover					
PLT333-1R	Vertical	Knob	Yes	T26, T46	Fahrenheit
PLT333-2R	Horizontal	Knob	Yes	T26	Fahrenheit
PLT333-3R	Vertical	Concealed	Yes	T26, T46	Fahrenheit
PLT333-4R	Horizontal	Concealed	Yes	T26	Fahrenheit
PLT333-5R	Vertical	Knob	Yes	T26, T46	Celsius
PLT333-12R	Vertical	Concealed	No	T26, T46, and W43	None

Trim Plates

Product Code Number	Description	Replacement Trim Plate For
PLT231-1R	Tawny silver trim plate	T22, T25, T26, T28, T58, T91, W42, W43



T91 Series Room Temperature Sensor

Description

The T91 Series Temperature Sensor is a solid state thermistor sensor detects temperature changes in a room or similar space.

Series T91 Sensors may be used directly with Series M100Q Motor Actuators.

Refer to the *T91 Thermistor Room Temperature Sensor Product Bulletin (LIT-125675)* for important product application information.

Applications

Use for room or space temperature sensing to position sequencers or actuators for heating and/or cooling systems.

Features

- highly sensitive thermistor sensing element
- fast response
- integral Fan and System switch options
- vertical or horizontal mounting
- three types of adjusters: external knob, concealed knob, or provisions for remote setpoint
- easy to install and wire
- separable mounting plate with screws saves installation time



T91 Series Room Temperature Sensor

Repair Information

If the T91 Series Room Temperature Sensor fails to operate within its specifications, replace the unit. For a replacement sensor, contact the nearest Johnson Controls® representative.

Selection Chart

Product Code Number ¹	Range °F (°C)	Thermometer	Setpoint Adjustment	Switches	
				Fan	System
T91BAA-1C	40/90 (5/32)	No	Remote	—	—
T91BBA-1C	40/90 (5/32)	No	Concealed	—	—
T91BCA-1C	40/90 (5/32)	Yes	Knob	—	—

1. Supplied with vertical faceplate installed.

Technical Specifications

T91 Series Room Temperature Sensor	
Ambient Temperature	-40 to 140°F (-40 to 60°C)
Baseplate	0.050 in. (1 mm) cold rolled steel with dichromate dip finish
Cover	0.025 in. (1 mm) cold rolled steel. Baked on tawny silver finish. Faceplate is aluminum with dark brown and light brown finish. Letters and markings are bright aluminum surface.
Electrical Rating for Switches	5 A at 24 VAC
Wiring Connections	6 in. No. 18 color coded wire leads

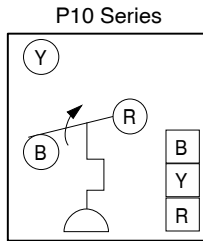


P10 Series Low Pressure Control

Description

The P10 Series Pressure Controls open or close electrical circuits from a change in operating air pressure. R to Y terminals make (cut-in) on pressure rise

Refer to the *P10 Series Low Range Pressure Controls Product Bulletin (LIT-125400)* for important product application information.



Action on Increase of Pressure

p10.eps

P10 Series Action Diagram

Features

- visible calibrated adjustable range scale
- snap-acting switch in a dust protected enclosure
- easily accessible wiring terminals

Applications

- pneumatic systems
- control of pumps or small air compressors

Accessories

- universal mounting bracket No. **BKT16A-600** as well as a barbed fitting supplied as standard
- model P10FC-4 has a jumper installed on the common terminals

Repair Information

If the P10 Series Low Pressure Control fails to operate within its specifications, replace the unit. For a replacement control, contact the nearest Johnson Controls® representative.



P10BC-7
with Bracket No. **BKT16A-600R**

Selection Chart

Product Code Number	No. of Stages	Contact Action	Range psi (kPa)	Factory Setting		Switch Diff psi (kPa)	Pressure Connector
				psig (kPa)			
P10BC-7C	1	Single-Pole, Double-Throw (SPDT)	3 to 20 (21 to 138)	12 (R to Y Cut-in)		2	Barbed Fitting
P10BG-3C	1	SPDT	2 to 20 (15 to 138)	12 (R to Y Cut-in)		0.2	1/8 in. Internal NPSF
P10BJ-1C	1	SPDT	3 to 20 (21 to 138)	12 (R to Y Cut-in)		2	1/8 in. Internal NPSF
P10FC-4C	2	SPDT	3 to 20 (21 to 138)	(R-Y Cutout) Low Stage 8 (55)	(R-Y Cut-in) High Stage 12 (82)	Low Stage 2 (14) High Stage 2 (14)	1/8 in. Barbed Fitting
P10PA-11C	3	SPST	3 to 20 (21 to 138)	Stage One Open High 6 (41)	Stages Two & Three Open High 18 (120)	Stage One 3 (21) Stages Two & Three 0.4 (3)	1/8 in. Barbed Fitting

Technical Specifications

- model P10BJ-1 is rated for 24 A non-inductive when used as a single-pole, single-throw (SPST) (R-Y). (See Electrical Ratings chart below.)
- maximum allowable pressure is 150 psig (1,034 kPa)
- maximum ambient temperature is 140°F (60°C)

Electrical Ratings (Part 1 of 2)

Motor Ratings VAC	120	208	240	277	600
P10BC-7					
AC Full Load A	16.0	9.2	8.0	7.0	—
AC Locked Rotor A	96.0	55.2	48.0	42.0	—
Non-Inductive A	16.0	9.2	8.0	7.2	—
Pilot Duty	125 VA, 24 to 277 VAC				
P10BG-3					
AC Full Load A	6.0	3.4	3.0	—	—
AC Locked Rotor A	36.0	20.4	18.0	—	—
Non-Inductive A	6.0	3.4	3.0	2.6	—
Pilot Duty	125 VA, 24 to 277 VAC				
P10BJ-1					
AC Full Load A	16.0	9.2	8.0	7	—

Electrical Ratings (Part 2 of 2)

Motor Ratings VAC		120	208	240	277	600
AC Locked Rotor A		96.0	55.2	48.0	42	—
Non-Inductive A	Double Throw	16.0	16.0	16.0	16.0	16.0
	Single Throw	24.0	24.0	24.0	24.0	24.0
Pilot Duty		125 VA, 24 to 600 VAC				
P10FC-4						
AC Full Load A		16.0	9.2	8.0	7.0	—
AC Locked Rotor A		96.0	55.2	48.0	42.0	—
Non-Inductive A		16.0	9.2	8.0	7.2	—
Pilot Duty		125 VA, 24 to 277 VAC On two- and three-stage models, maximum connected load shall not exceed 2,000 VA				
P10PA-11						
AC Full Load A		6.0	3.4	3.0	—	—
AC Locked Rotor A		36.0	20.4	18.0	—	—
Non-Inductive A		6.0	3.4	3.0	—	—
Pilot Duty		125 VA, 24 to 277 VAC On two- and three-stage models, maximum connected load shall not exceed 2,000 VA				

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P20 Series Air Conditioning/Pressure Cutout Control

Description

The P20 Series are field replacement high and low pressure controls for non-corrosive refrigerants. They include a dust-tight contact unit with quick connect connectors, and a 36 in. or 42 in. capillary with 1/4 in. sweat section. The setpoint is screwdriver adjustable.

Refer to the *P20, P21 Series Air Conditioning Limit Controls Product Bulletin (LIT-125415)* for important product application information.

Features

- accurate repeatability
- compact size
- trip-free manual reset

Applications

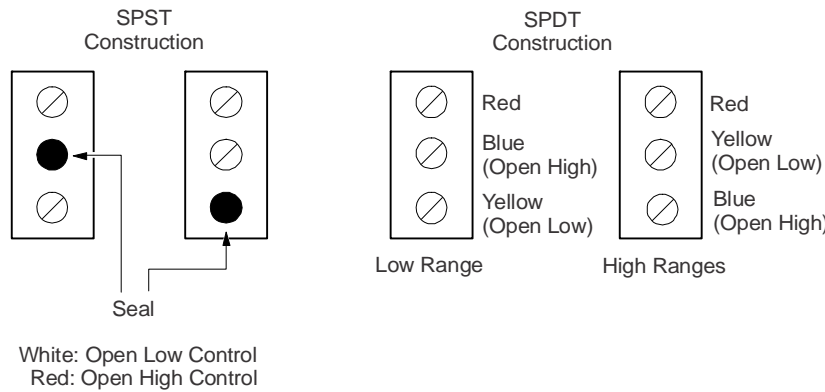
- air conditioning high/low pressure control
- refrigeration high/low pressure control
- head pressure control

Repair Information

If the P20 Series Air Conditioning/Pressure Cutout Control fails to operate within its specifications, replace the unit. For a replacement control, contact the nearest Johnson Controls® representative.



P20DB-1 Air Conditioning/Pressure Cutout Control



White: Open Low Control
Red: Open High Control

Control action is identified by colored sealing compound or terminal markings on switch.

Selection Chart

Product Code Number ¹	Pressure Connections	Switch Action	Range psi (kPa)	Differential psi (kPa)	Factory Setting, psig (kPa)		Max. Bellows Pressure psig (kPa)	Max. Temp.
					Opens	Closes		
P20BB-1C ²	36 in. capillary 1/4 in. sweat tube	Open on fall	7 to 150 (48 to 1,034)	Manual reset	40 (276)	Lockout	250 (1,724)	140°F
P20DB-1C ³		Open on rise	100 to 425 (690 to 2,930)	Manual reset	400 (2,758)	Lockout	450 (3,103)	
P20GB-1C	42 in. capillary 1/4 in. sweat tube	Single-Pole, Double-Throw (SPDT) Open on rise	100 to 425 (690 to 2,930)	Manual reset	360 (2,482)	Lockout	450 (3,103)	
P20EB-1C ⁴	36 in. capillary 1/4 in. sweat tube	SPDT	7 to 150 (48 to 1,034)	30 (172) fixed	40 (276)	70 (448)	250 (1,724)	
P20EB-18C	42 in. capillary 1/4 in. sweat tube	SPDT	7 to 150 (48 to 1,034)	22 (152) fixed	15 (103)	37 (255)	250 (1,724)	
P20EB-2C ⁵	36 in. capillary 1/4 in. sweat tube	SPDT	100 to 425 (690 to 2,930)	75 (483) fixed	400 (2,758)	324 (2,275)	450 (3,103)	

1. Mounting bracket supplied on all models.
2. Replaces Ranco® G20-4412; Robertshaw® 3126-216, 3160-212
3. Replaces Ranco G23-5253; Robertshaw 3127-220, 3161-205; Honeywell® P430X-1250, 1268, 1292, 1300
4. Replaces Ranco G20-4050; Robertshaw 3126-116, 3160-012, 3160-014; Honeywell P431X-1092, 1100
5. Replaces Ranco G23-5052; Robertshaw 3127-140, 3127-414, 3161-009; Honeywell P430X, 1235, 1243, 1276, 1284



Standard Electromechanical Pressure Controls

P20 Series Air Conditioning/Pressure Cutout Control

Accessories

Product Code Number	Description
210-604R	Black phenolic resin spring clip snap-on insulated terminal cover

Technical Specifications

Electrical Ratings

Motor Ratings VAC	120	208	240	277
AC Full Load A	16.0	9.2	8.0	7.0
AC Locked Rotor A	96.0	55.2	48.0	42.0
SPDT	16.0	16.0	16.0	-
Pilot Duty	125 VA at 24 VAC, 720 VA at 120 to 277 VAC			

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P29 Series Low Pressure Control with Time Delay

Description

P29NC is a low pressure control with time delay and lockout, which requires manual reset. A drop in pressure energizes the time delay relay and opens a contact after the time delay, shutting down the equipment. The time delay prevents nuisance shutdowns due to momentary fluctuations in system pressures.

Refer to the *P29 Series Low Pressure Control with Time Delay Relay Product Bulletin (LIT-125425)* for important product application information.

Features

- direct reading scale indication
- dust-protected snap action switch
- trip-free manual reset
- replacement timing relays available

Applications

- chiller low temperature
- industrial equipment, oil pressure lubrication
- low suction pressure

Technical Specifications

- pilot duty rating of 750 VA, 120/240 VAC
- external step down transformer for 440 and 550 VAC applications must be of sufficient capacity to supply 15 VA at 120 VAC or 30 VA at 240 VAC for time delay

Accessories

- universal mounting bracket (271-51)
- replacement timing relays (Refer to *Replacement Timing Relays for P28 and P29 Lube Oil Controls Catalog Page [LIT-1927395].*)



P29 Series Low Pressure Control

Repair Information

If the P29 Series Low Pressure Control with Time Delay fails to operate within its specifications, replace the unit. For a replacement control, contact the nearest Johnson Controls® representative.

Selection Chart

Product Code Number	Switch Action	Pressure Range	Differential psi (kPa)	Max Overpressure psig (kPa)	Max Working Pressure psig (kPa)	Pressure Connection	Time Delay Setting
P29NC-2C	Single-Pole, Single-Throw (SPST)	20 in. Hg Vacuum to 100 psig (-68 to 690 kPa)	2.2 ±1.5 (15.2 ±10.3)	325 (2,241)	250 (1,723)	1/4 in. external flare fitting	60 seconds (factory set)
P29NC-3C						36 in. copper capillary tube with 1/4 in. flare nut	120 seconds
P29NC-49C							90 seconds
P29NC-53C							120 seconds
P29NF-1C ¹							

1. With alarm contacts

Example: Setpoint at 10 psig. On a rise in pressure, the timing circuit opens at 10 psig and time out ends. On a fall in pressure, the timing circuit energizes at 6 to 9 psig and the time out begins. If the pressure fails to reach 10 psig within the 60 second time delay, the main contacts open, shutting down the controlled equipment.



P47 Series Steam Pressure Limit Control

Description

The P47 Controls are available with single-pole, single-throw (SPST), double-pole, single-throw (DPST), or four-wire, two-circuit contacts for line voltage or low voltage. The pressure connector is 1/4 in. external NPT (0 to 15 psi only) or 1/4 in. internal NPT (for all other ranges).

Refer to the *P47 Series Steam Pressure Controls Product Bulletin (LIT-125450)* for important product application information.

Features

- long-life contact structure with high contact force
- easy-to-adjust single sight set scales show both cut-in and cut-out settings

Applications

P47 steam pressure controls are designed for high limit or operating control applications. A typical use is as a limit control on steam heating systems. Models that close on a pressure increase are used on steam unit heaters to avoid blower operation when steam pressure is below the point required for adequate heating. The P47 can be used with steam, water, air, or noncombustible gases that do not harm iron or copper.

Accessories

The Part No. **TBG16A-600** Siphon is supplied with all controls except models with 0 to 15 psi range.



P47AA-1 Steam Pressure Limit Control

Selection Chart

Product Code Number	Switch Action	Range psi (kPa)	Diff psi (kPa)		Max. Over-pressure psig (kPa)
			Min.	Max.	
Contacts Open On Rise – Automatic Reset					
P47AA-1C	SPST	0 to 15 (0 to 103)	2 (14)	8 (55)	50 (345)
P47AA-4C		20 in. Hg to 50 (-68 to 345)	5 (34)	35 (241)	180 (1,241)
P47AA-13C		0 to 150 (0 to 1,034)	12 (83)	50 (345)	325 (2,241)
Contacts Close On Rise – Automatic Reset					
P47BA-1C	SPST	0 to 15 (0 to 103)	2 (14)	8 (55)	50 (345)
P47BA-6C		0 to 150 (0 to 1,034)	12 (83)	50 (345)	325 (2,241)
Four-Wire, Two Circuit¹ – Automatic Reset					
P47GA-9C ¹	Main open high; Auxiliary open low	0 to 150 (0 to 1,034)	12 (83)	50 (345)	325 (2,241)
P47AB-3C	SPST	50 to 240 (345 to 1,655)	Manual reset		300 (2,069)
P47EA-1C	SPDT	50 to 240 (345 to 1,655)	10 (69) Fixed		300 (2,069)

1. The main contacts (Line-M2) open on rise, as the auxiliary contacts (Line-M1) close.

Technical Specifications

Electrical Ratings for P47AA, P47AB, and P47BA

Motor Ratings VAC	120	208	240	277
AC Full Load A	16.0	9.2	8.0	–
AC Locked Rotor A	96.0	55.2	48.0	–
AC Non-Inductive A	16.0	16.0	16.0	16.0
Pilot Duty	125 VA, 120 to 600 VAC; 57.5 VA, 120 to 300 VDC			

Electrical Ratings for P47EA

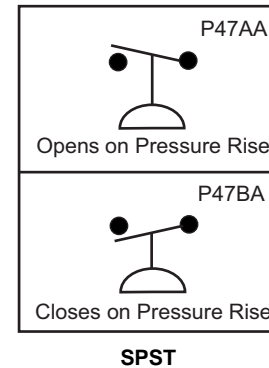
Motor Ratings VAC	120	208	240	277
AC Full Load A	16.0	9.2	8.0	–
AC Locked Rotor A	96.0	55.2	48.0	–
AC Non-Inductive A	16.0	10.0	10.0	10.0
Pilot Duty	125 VA, 120 to 227 VAC			

Electrical Ratings for P47GA

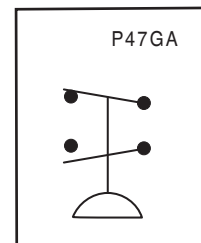
Pole Number	Line-M2 (Main)				Line-M1 (Auxiliary)			
	120	208	240	277	120	208	240	277
Motor Ratings VAC	120	208	240	277	120	208	240	277
AC Full Load A	16.0	9.2	8.0	–	6.0	3.3	3.0	–
AC Locked Rotor A	96.0	55.2	48.0	–	36.0	19.8	18.0	–
AC Non-Inductive A	16.0	9.2	8.0	7.2	6.0	6.0	6.0	6.0
Pilot Duty: Both Poles	125 VA, 120 to 600 VAC; 57.5 VA, 120 to 300 VDC							

Repair Information

If the P47 Series Steam Pressure Limit Control fails to operate within its specifications, replace the unit. For a replacement control, contact the nearest Johnson Controls® representative.



p47ga_1.eps



p47ga_2.eps



P67 Series Low Pressure Control

Description

P67 pressure controls are used to close or open an electrical circuit, based on a predetermined air pressure signal. The operating point of the control and the differential, are easy to adjust with the externally located adjustment screws on the top of the control enclosure. The pressure controls incorporate a non-metallic diaphragm that is positioned by air pressure changes. The diaphragm, in turn, actuates a heavy-duty electrical contact block using a lever mechanism.

Refer to the *P67 Series Low Range Pressure Control Product Bulletin (LIT-121445)* for important product application information.

Features

- long-life contact structure, high contact force
- easy-to-adjust settings: single sight-set scales show both cut-in and cut-out settings

Applications

Typical applications include the control of air compressors, fans, pilot lights, resistance heating elements, and other devices.



P67 Series Low Pressure Control with 271-350 Mounting Bracket

Selection Chart

Product Code Number	Control Action	Scale Range psi ¹ (kPa)	Temp. Range	Diff. psi (kPa)	Maximum Over-pressure psig (kPa)	Connector
P67AA-1C	Double-Pole, Single-Throw (DPST) opens on pressure drop	3 to 30 (21 to 207)	32 to 140°F 0 to 60°C	1-1/2-20 (10 to 138) Adjustable	50 (345)	Angle Barbed Fitting
P67CA-1C	DPST opens on pressure rise					1/8 in. External NPT
P67EA-5C	L-M2 contacts connect on pressure rise and simultaneously the L-M1 contacts break					

1. Range is minimum cut-out to maximum cut-in on Open Low controls. It is minimum cut-in to maximum cut-out on Open High controls.

Repair Information

If the P67 Series Low Pressure Control fails to operate within its specifications, replace the unit. For a replacement control, contact the nearest Johnson Controls® representative.

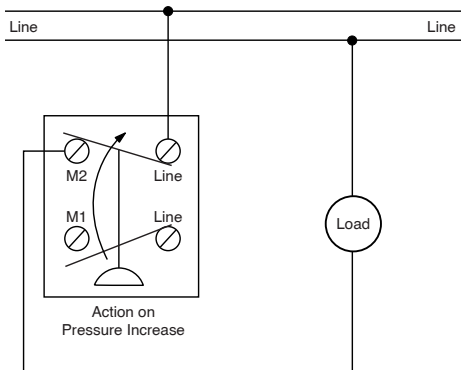
Technical Specifications

Electrical Ratings for P67AA and P67CA

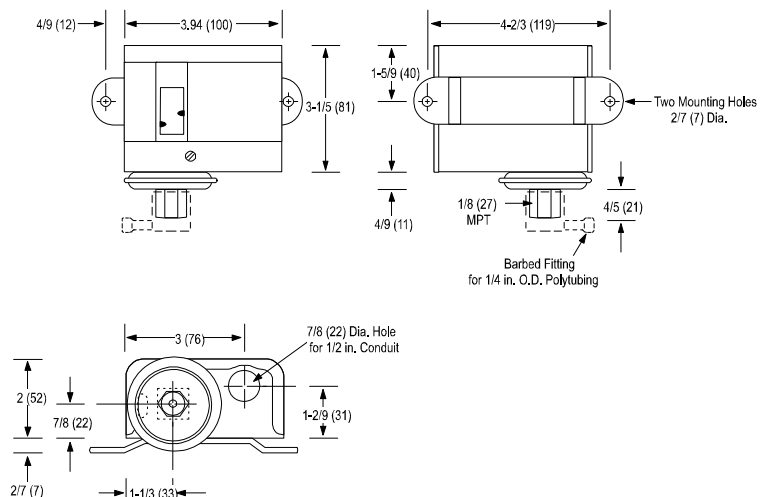
Motor Ratings VAC	1 Phase				2 - 3 Phase	
	120	208	240	277	208	240
AC Full Load A	12.0	12.0	12.0	—	12.0	12.0
AC Locked Rotor A	72.0	72.0	72.0	—	72.0	72.0
AC Non-Inductive A	12.0	12.0	12.0	12.0	—	—
DC Non-Inductive A	3.0	0.5	0.5	—	—	—
Pilot Duty	125 VA, 120 to 600 VAC; 57.5 VA, 120 to 300 VDC					

Electrical Ratings for P67EA and P67FA

Pole Number	LINE-M2 (Main)				LINE-M1 (Auxiliary)			
	120	208	240	277	120	208	240	277
Motor Rating VAC	120	208	240	277	120	208	240	277
AC Full Load A	16.0	9.2	8.0	—	6.0	3.3	3.0	—
AC Locked Rotor A	96.0	55.2	48.0	—	36.0	19.8	18.0	—
AC Non-Inductive A	16.0	9.2	8.0	7.2	6.0	6.0	6.0	6.0
Pilot Duty	125 VA, 120 to 600 VAC; 57.5 VA, 120 to 300 VDC							



P67 Wiring Diagram (no alarm)



P67 Dimensions, in. (mm)

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P70, P72 Approximate Low Pressure Settings for Typical Applications

Application	Approximate Temperature °F		Pressure - psig ¹									
			Refrigerant									
			R-12		R-22		R-502		R-717		R-134A	
Cut-Out	Cut-In	Cut-Out	Cut-In	Cut-Out	Cut-In	Cut-Out	Cut-In	Cut-Out	Cut-In	Cut-Out	Cut-In	
Ice Cube Maker - Dry Type Coil	-11	14	4	17	16	37	22	45	-	-	2	15
Sweet Water Bath - Soda Fountain	20	31	21	29	43	56	52	66	33	45	18	26
Beer, Water, Milk Cooler, Wet Type	17	31	19	29	40	56	48	66	-	-	16	26
Ice Cream Trucks, Hardening Rooms	-16	10	2	15	13	34	18	41	5	24	0	13
Eutectic Plates, Ice Cream Truck	-21	-11	1	4	11	16	16	22	4	8	1	2
Walk In, Defrost Cycle	9	37	14	34	32	64	40	75	23	55	12	32
Reach In, Defrost Cycle	20	39	19	36	40	68	48	78	30	57	16	36
Vegetable Display, Defrost Cycle	7	38	13	35	30	66	38	77	-	-	10	34
Vegetable Display Case - Open Type	12	45	16	42	35	77	44	89	-	-	14	40
Beverage Cooler, Blower Dry Type	11	37	15	34	34	64	42	75	24	55	12	32
Retail Florist - Blower Coil	29	45	28	42	55	77	65	89	44	67	26	40
Meat Display Case - Defrost Cycle	19	38	17	35	37	66	45	77	-	-	15	34
Meat Display Case - Open Type	4	28	11	27	27	53	35	63	-	-	8	25
Dairy Case - Open Type	2	38	10	35	26	66	33	77	-	-	16	34
Frozen Food - Open Type	-32	-9	7	5	4	17	8	24	-	-	10	3

1. Conversion factor: 1 psig = 6.9 kPa

Note: These settings represent approximate starting values. Actual values may vary widely, depending on application-specific guidelines.



P70, P72, and P170 Series Controls for Low Pressure Applications

Description

The P70, P72, and P170 Controls for low pressure applications are designed primarily for low pressure cut-out control, pump-down control, and capacity control on commercial refrigeration and air conditioning applications.

These controls are available in several pressure ranges and are compatible with most common refrigerants. They may also be used on other non-corrosive fluid applications. Ammonia-compatible models are also available.

Controls also are available in several different electrical ratings and switch configurations. The P72 models provide direct control of 208 to 240 volt single-phase motors up to 3 horsepower, and 208 to 220 volt three-phase motors up to 5 horsepower.

Refer to the *P70, P72, and P170 Series Controls for Low Pressure Applications Product Bulletin (Part No. 24-7664-2608)* for important product application information.

Features

- all-steel case and cover built to provide long lasting, rugged protection for internal components
- sight-set calibrated pressure adjustment displays a visible pressure scale, fully adjustable through the range without removing the cover (on NEMA 1 enclosure models)

- MICRO-SET™ differential option allows for precise control on critical low pressure applications
- manual reset lockout option provides trip-free low pressure lockout that cannot be overridden or reset until pressure returns to specified level
- limited knob adjustment option restricts control adjustment ranges and deters tampering and over-adjustment

Applications

NEMA 1 enclosures are standard on most models.

- **P70A and P170A models** with single-pole, single-throw (SPST) Open Low switch action are the most popular models, and are typically used for low pressure cut-out and pump-down control.
- **P70 and P170 models** are also available with SPST Open High switch action, and are typically used for capacity control. Models with single-pole, double-throw (SPDT) or four-wire, two-circuit switch action allow users to install alarm devices or other control circuits.
- **P72 models** have a double-pole, single-throw (DPST) switch with load-carrying contacts that can provide direct control of 208 to 240 V single-phase motors up to 3 horsepower, and 208 to 220 V 3-phase motors up to 5 horsepower. See the DPST Electrical Ratings (P72A, B, C, and D Models) that follow.



**P70AB-12 MICRO-SET
Low Pressure Control**

Repair Information

If the P70, P72, and P170 Series Controls for Low Pressure Applications fail to operate within their specifications, replace the units. For a replacement control, contact the nearest Johnson Controls® representative.



Standard Electromechanical Pressure Controls

P70, P72, and P170 Series Controls for Low Pressure Applications (Continued)

Selection Chart for Standard P70, P72, and P170 Controls for Low Pressure Applications

Product Code Number	Switch Action	Range psi (kPa)	Differential psi (kPa)	Pressure Connection	Max. Overpressure	Max. Working Pressure	Limited Knob Adjustment
MICRO-SET Controls (For Non-Corrosive Refrigerants)							
P70AB-12C	SPST open low	12 in. Hg to 80 (-41 to 551)	Minimum 5 (34) Maximum 35 (241)	36 in. capillary with 1/4 in. flare nut	525 psig (3,617 kPa)	80 psig (551 kPa)	Supplied, but not assembled
P170AB-12C				1/4 in. external flare connector			
P70EA-14C	SPDT 1 to 3 open low			36 in. capillary with 1/4 in. flare nut			
P170EA-14C	1 to 2 close low			1/4 in. external flare connector			
All-Range Controls (For Non-Corrosive Refrigerants)							
P70AB-1C	SPST open low	20 in. Hg to 100 (-68 to 690)	Minimum 7 (48) Maximum 50 (345)	1/4 in. external flare connector	325 psig (2,239 kPa)	100 psig (690 kPa)	Supplied, but not assembled
P70AB-2C				36 in. capillary with 1/4 in. flare nut			
P70BA-1C			Manual reset lockout	1/4 in. external flare connector			None
P70BA-10C							
P70EA-10C	SPDT 1 to 3 open low 1 to 2 close low		5 (34) fixed				
P72AA-1C	DPST open low		Minimum 7 (48) Maximum 50 (345)	36 in. capillary with 1/4 in. flare nut			Mounted on differential screw
P72AB-1C							
P170AB-2C	SPST open low		1/4 in. external flare connector	None			
P70CA-1C	SPST open high		36 in. capillary with 1/4 in. flare nut				
P170CA-1C			1/4 in. external flare connector				
All-Range Controls (Ammonia-Compatible)							
P70AA-5C	SPST open low	20 in. Hg to 100 (-68 to 690)	Minimum 7 (48) Maximum 50 (345)	1/4 in. SS Internal NPT	325 psig (2,239 kPa)	100 psig (690 kPa)	None
P70CA-4C	SPST open high						
P70GA-11C	Four-wire, Two-circuit						
P70HA-3C	Line M1 close low Line M2 open low						

Note: To order models not listed in the selection chart, please contact Johnson Controls/PENN® Refrigeration Application Engineering at 1-800-275-5676.

Technical Specifications

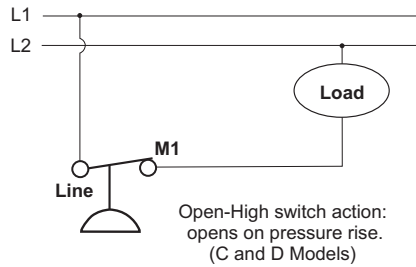
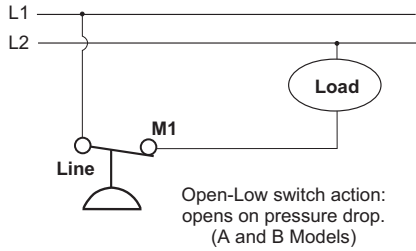
Single Pressure Controls Switch Action, Low Event, High Event, and Models

Switch and Action	Low Event	High Event	Models
SPST Open Low	Cut-Out (Opens Line to M1)	Cut-In (Closes Line to M1)	P70A, P70B, P170A
SPST Open High	Cut-In (Closes Line to M1)	Cut-Out (Opens Line to M1)	P70C, P70D, P170C, P170D
SPDT	Opens 1 to 2 and closes 1 to 3	Closes 1 to 2 and Opens 1 to 3	P70E, P70F
Four-Wire, Two-Circuits, 1 N.O., 1 N.C. Open Low	Cut-Out (Opens M2 to Line and Closes M1 to Line)	Cut-In (Closes M2 to Line and Opens M1 to Line)	P70G, P70H
Four-Wire, Two-Circuits, 1 N.O., 1 N.C. Open High	Cut-In (Closes M2 to Line and Opens M1 to Line)	Cut-Out (Opens M2 to Line and Closes M1 to Line)	P70J, P70K, P170K
DPST Open Low	Cut-Out (Opens M1 to Line and M2 to Line)	Cut-In (Closes M1 to Line and M2 to Line)	P72A, P72B
DPST Open High	Cut-In (Closes M1 to Line and M2 to Line)	Cut-Out (Opens M1 to Line and M2 to Line)	P72C, P72D

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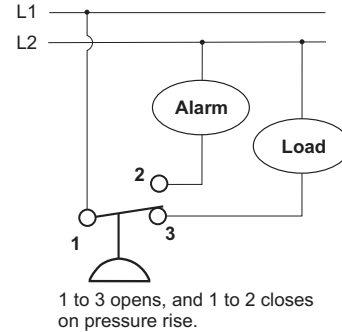


**P70, P72, and P170 Series Controls for Low Pressure Applications
(Continued)**



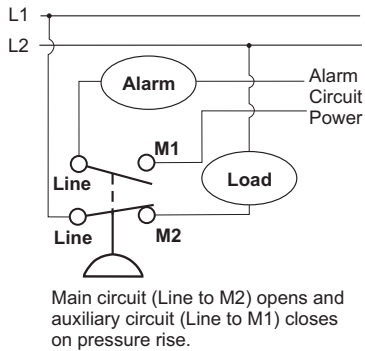
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**Typical Wiring for SPST Open Low Switch and Open High Switch
(P70A, B, C, D, and P170A, C, D, Models)**

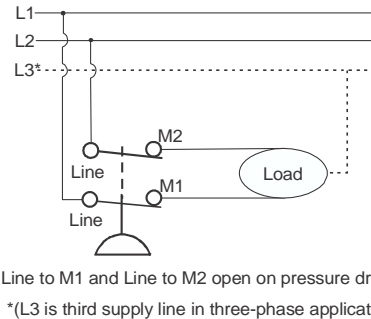


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Typical Wiring for SPDT Switch (P70E, F Models)



**Typical Wiring for Four-Wire Two-Circuit Switch
(P70G and H Models)**



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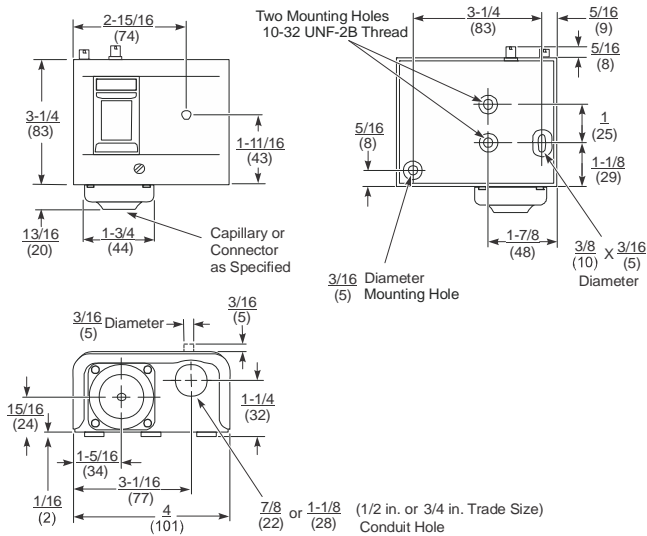
Typical Wiring for DPST Switch (P72A and B Models)



Standard Electromechanical Pressure Controls

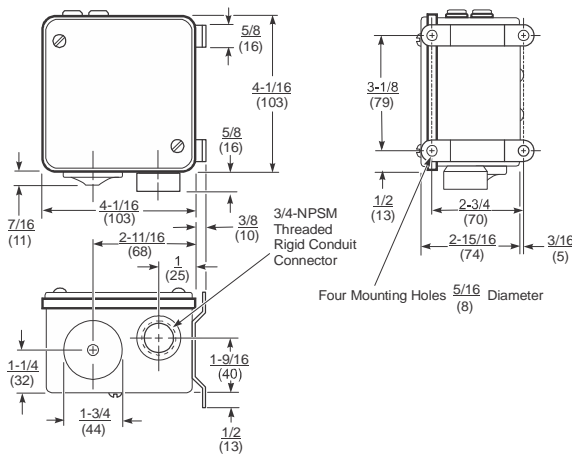
P70, P72, and P170 Series Controls for Low Pressure Applications (Continued)

Technical Specifications (Continued)



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Dimensions for Low Pressure Controls with NEMA 1 Enclosure, in. (mm)*



p70_low_NEMA3R_dims.eps

Dimensions for Low Pressure Controls with NEMA 3R Enclosure, in. (mm)*

* These dimensions are nominal and are subject to accepted manufacturing tolerances and application variables.

DPST Electrical Ratings (P72A, B, C, and D Models)

	Standard Ratings					Hermetic Compressor Ratings	
	120 VAC, Single-Phase	208 VAC, Single-Phase	240 VAC, Single-Phase	208 VAC, Three-Phase	220 VAC, Three-Phase	208 VAC, Single-Phase	240 VAC, Single-Phase
Motor Horsepower	2	3	3	5	5	--	--
Motor Full-Load A	24	18.7	17	15.9	15	24	24
Motor Locked-Rotor A	144	112.2	102	95.4	90	144	144
AC Non-Inductive A	24	24	24	24	24	--	--
DC Non-Inductive A	3	0.5	0.5	0.5	0.5	--	--
Pilot Duty	125 VA at 120 to 600 VAC; 57.5 VA at 120 to 300 VDC						

SPST Electrical Ratings

(P70A, B, C, and D, and P170A, C, and D Models)

	Single-Phase Ratings			
	Standard			Hermetic Compressor
	120 VAC	208 VAC	240 VAC	208/240 VAC
Motor Horsepower	2	3	3	--
Motor Full-Load A	24	18.7	17	20
Motor Locked-Rotor A	144	112.2	102	120
Non-Inductive A	22	22	22	--
Pilot Duty	125 VA, 120 to 600 VAC; 57.5 VA, 120 to 300 VDC			

SPDT Electrical Ratings 1hp Switch (P70E Models)

	Standard Single-Phase Ratings			
	120 VAC	208 VAC	240 VAC	277 VAC ¹
Motor Full Load A	16.0	9.2	8.0	7.0
Motor Locked Rotor A	96.0	55.2	48.0	42.0
Non-Inductive A	16.0	9.2	8.0	-
Pilot Duty	125 VA at 120 to 600 VAC		125 VA at 24 to 600 VAC	

1. Rating for P70EC models only

SPDT Electrical Ratings 1/4 hp Switch (P70F Models)

	Standard Single-Phase Ratings		
	120 VAC	208 VAC	240 VAC
Motor Full Load A	6.0	3.3	3.0
Motor Locked Rotor A	36.0	19.8	18.0
Non-Inductive A	6.0	6.0	6.0
Pilot Duty	125 VA at 24 to 240 VAC		

Four-Wire, Two-Circuit Electrical Ratings

(P70G, H, J, and K, and P170K Models)

	Standard Single-Phase Ratings							
	Line-M2 (Main Contacts)				Line-M1 (Auxiliary Contacts)			
	120 VAC	208 VAC	240 VAC	277 VAC	120 VAC	208 VAC	240 VAC	277 VAC
Motor Full Load A	16.0	9.2	8.0	--	6.0	3.3	3.0	--
Motor Locked Rotor A	96.0	55.2	48.0	--	36.0	19.8	18.0	--
Non-Inductive A	16.0	9.2	8.0	7.2	6.0	6.0	6.0	6.0
Pilot Duty for both sets of contacts	125 VA at 24 to 600 VAC; 57.5 VA at 120 to 300 VDC							

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P70, P72, and P170 Series Controls for High Pressure Applications

Description

The P70, P72, and P170 Controls for high pressure applications are designed primarily for high pressure cut-out control, head-pressure control, and condenser fan cycling control on commercial refrigeration and air conditioning applications.

Controls are available in several pressure ranges and are compatible with most common refrigerants. They may also be used on other non-corrosive fluid applications. Ammonia compatible models are also available.

Several different electrical ratings and switch configurations are available. The P72 models provide direct control of 208-240 volt single-phase motors up to 3 horsepower, and 208-220 volt 3-phase motors up to 5 horsepower.

Refer to the *P70, P72, and P170 Series Controls for High Pressure Applications Product/Technical Bulletin (LIT-125454)* for important product application information.

Features

- all-steel case and cover provides long lasting, rugged protection for internal components
- sight-set calibrated pressure adjustment displays a visible pressure scale, fully adjustable through the range without removing the cover (on NEMA 1 enclosure models)

- manual reset lockout option provides trip-free lockout that cannot be overridden or reset until pressure returns to specified level
- variety of available pressure connection styles allows greater flexibility when mounting control and adapting pressure connections to field application requirements

Applications

- **P70C, P70D P170C and P170D models** with single-pole, single-throw (SPST) Open High switch action are the most popular models, and are typically used for high-pressure cutout. The **C models** are automatic reset. The **D models** have a manual reset lockout mechanism. Some **P70C, P70D P170C and P170D models** are UL Listed as refrigeration pressure limiting controls.
- **P70A and P170A models** are available with SPST Open Low switch action, and typically are used for condenser fan cycling control.
- **P70 and P170 models** with single-pole, double-throw (SPDT), or four-wire, two-circuit switch action allow users to install alarm devices or other control circuits.



P70CA-3 High Pressure Cutout Control

- **P72 models** have a double-pole, single-throw (DPST) switch with load-carrying contacts that can provide direct control of 208-240 V single-phase motors up to 3 horsepower, and 208-220 V 3-phase motors up to 5 horsepower. See the DPST Electrical Ratings (P72A, B, C, and D Models) that follow.

NEMA 1 enclosures are standard on most models.

Repair Information

If the P70, P72, and P170 Series Controls for High Pressure Applications fail to operate within their specifications, replace the units. For a replacement control, contact the nearest Johnson Controls® representative.

Selection Chart (Part 1 of 2)

Product Code Number	Switch Action	Range psi (kPa)	Differential psi (kPa)	Pressure Connection	Max. Working Pressure
Condenser Fan Cycling Controls (for Non-Corrosive Refrigerants)					
P70AA-118C	SPST Open Low	100 to 400 (690 to 2,758)	Minimum 35 (241) Maximum 200 (1,379)	36 in. Capillary with 1/4 in. Flare Nut	475 psig (3,275 kPa)
P72AA-27C	DPST Open Low				
P170AA-118C	SPST Open Low				
All Range Controls (for Non-Corrosive Refrigerants)					
P70CA-2C ¹	SPST Open High	50 to 500 (345 to 3,448)	Minimum 60 (414); Maximum 150 (1,034)	1/4 in. External Flare Connector	525 psig (3,620 kPa)
P70CA-3C ¹				36 in. Capillary with 1/4 in. Flare Nut	
P70DA-1C ¹	Four-wire, Two-circuit Line-M1 Close High Line-M2 Open High		Manual Reset Lockout		
P70KA-1C					
P72CA-2C ¹	DPST Open-high		Minimum 60 (414); Maximum 150 (1,034)		
P72DA-1C ¹					
P170CA-3C ¹	SPST Open High		Minimum 60 (414); Maximum 150 (1,034)	1/4 in. External Flare Connector	
P170DA-1C					
P170KA-1C	Four-wire, Two-circuit Line-M1 Close High Line-M2 Open High				

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Standard Electromechanical Pressure Controls

P70, P72, and P170 Series Controls for High Pressure Applications (Continued)

Selection Chart (Part 2 of 2)

Product Code Number	Switch Action	Range psi (kPa)	Differential psi (kPa)	Pressure Connection	Max. Working Pressure
Models for High Pressure Non-Corrosive Refrigerants²					
P70AA-2C	SPST Open Low	0 to 150 (0 to 1,034)	Minimum 10 (69); Maximum 70 (483)	36 in. Cap. with 1/4 in. Flare Nut	325 psig (2,241 kPa)
P170AA-2C				1/4 in. External Flare Connector	
P70AA-400C	SPST Open High	100 to 470 (689 to 3,241)	Minimum 35 (241); Maximum 200 (1,379)	36 in. Cap. with 1/4 in. Flare Nut	690 psig (4,757 kPa)
P170AA-400C				1/4 in. External Flare Connector	
P70CA-400C ¹	SPST Open High	200 to 610 (1,379 to 4,206)	Minimum 60 (414); Maximum 150 (1,034)	36 in. Cap. with 1/4 in. Flare Nut	
P170CA-400C ¹				1/4 in. External Flare Connector	
P70DA-400C ¹			Manual Reset Lockout	36 in. Cap. with 1/4 in. Flare Nut	
P170DA-400C ¹					
Ammonia Compatible Models					
P70AA-119C	SPST Open Low	50 to 300 (345 to 2,068)	Minimum 20 (138); Maximum 120 (827)	1/4 in. SS Internal NPT	400 psig (2,758 kPa)
P70CA-5C ¹	SPST Open-High	50 to 500 (345 to 3,448)	Minimum 60 (414); Maximum 150 (1,034)		525 psig (3,620 kPa)
P70DA-2C ¹			Manual Reset Lockout		
P70KA-7C	Four-wire, Two-circuit Line-M1 Close-high Line-M2 Open High				

1. UL Listed as refrigeration pressure limiting controls
2. Compatible with R410A refrigerant.

Note: To order models not listed in the selection chart, please contact Johnson Controls/PENN Refrigeration Application Engineering at 1-800-275-5676.

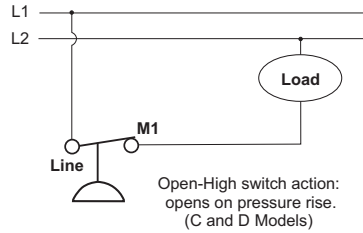
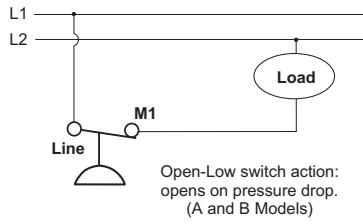
Technical Specifications

Single Pressure Controls Switch Action, Low Event, High Event, and Models

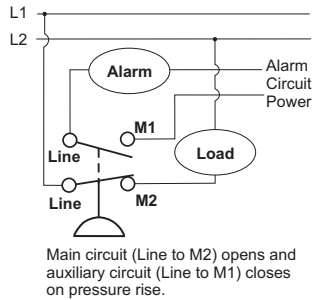
Switch and Action	Low Event	High Event	Models
SPST Open Low	Cut-Out (Opens Line to M1)	Cut-In (Closes Line to M1)	P70A, P70B, P170A
SPST Open High	Cut-In (Closes Line to M1)	Cut-Out (Opens Line to M1)	P70C, P70D, P170C, P170D
SPDT	Opens 1 to 2 and closes 1 to 3	Closes 1 to 2 and Opens 1 to 3	P70E, P70F
Four-wire, Two-circuits, 1 N.O., 1 N.C. Open Low	Cut-Out (Opens M2 to Line and Closes M1 to Line)	Cut-In (Closes M2 to Line and Opens M1 to Line)	P70G, P70H
Four-wire, Two-circuits, 1 N.O., 1 N.C. Open High	Cut-In (Closes M2 to Line and Opens M1 to Line)	Cut-Out (Opens M2 to Line and Closes M1 to Line)	P70J, P70K, P170K
DPST Open Low	Cut-Out (Opens M1 to Line and M2 to Line)	Cut-In (Closes M1 to Line and M2 to Line)	P72A, P72B
DPST Open High	Cut-In (Closes M1 to Line and M2 to Line)	Cut-Out (Opens M1 to Line and M2 to Line)	P72C, P72D



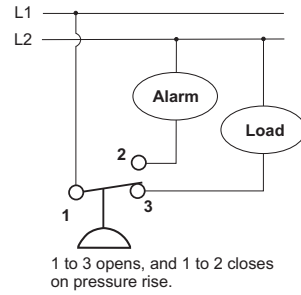
P70, P72, and P170 Series Controls for High Pressure Applications (Continued)



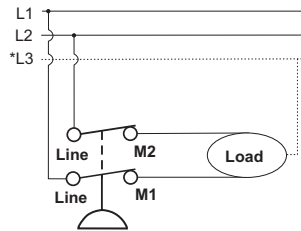
Typical Wiring for SPST (P70A, B, C, D, and P170A, C, D, Models)



Typical Wiring for Four-Wire Two-Circuit Switch used for a High Pressure Cutout Application with an Alarm Circuit (P70J, K, and P170K Models)



Typical Wiring for SPDT Switch (P70E, F Models)



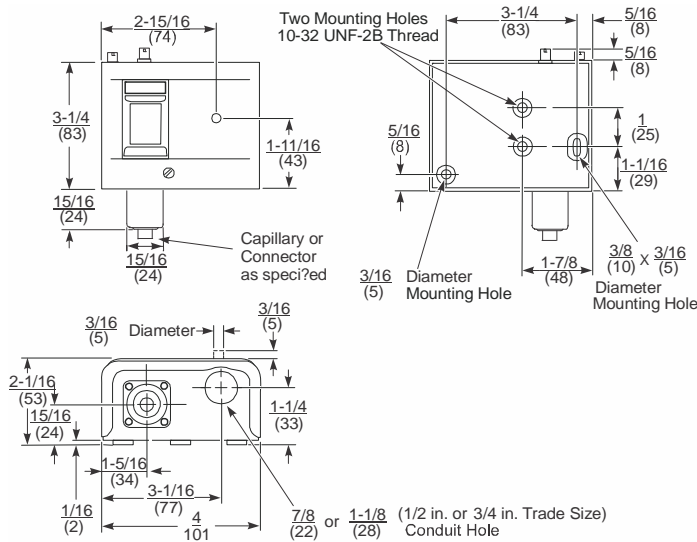
Typical Wiring for DPST Switch (P72C, and D Models)



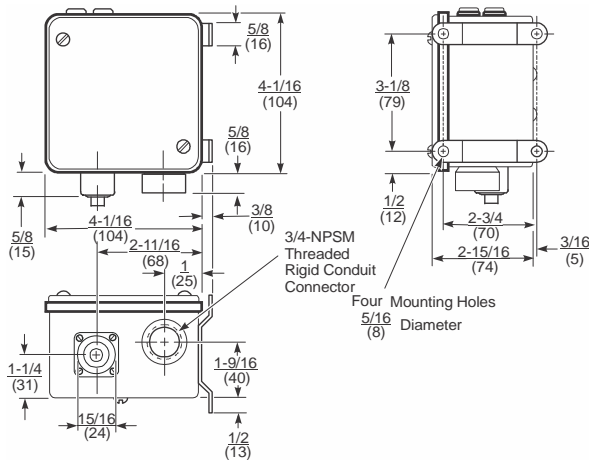
Standard Electromechanical Pressure Controls

P70, P72, and P170 Series Controls for High Pressure Applications (Continued)

Technical Specifications (Continued)



Dimensions for High Pressure Controls with NEMA 1 Enclosure, in. (mm)*



Dimensions for High Pressure Controls with NEMA 3R Enclosure, in. (mm)*

* These dimensions are nominal and are subject to accepted manufacturing tolerances and application variables.

SPST Electrical Ratings (P70A, B, C, and D, and P170A, C, and D Models)

	Single-Phase Ratings			
	Standard			Hermetic Compressor
	120 VAC	208 VAC	240 VAC	208/240 VAC
Motor Horsepower	2	3	3	--
Motor Full-Load A	24	18.7	17	24
Motor Locked-Rotor A	144	112.2	102	144
Non-Inductive A	22	22	22	--
Pilot Duty	125 VA at 120 to 600 VAC; 57.5 VA at 120 to 300 VDC			

SPDT Electrical Ratings 1hp Switch (P70E Models)

	Standard Single-Phase Ratings			
	120 VAC	208 VAC	240 VAC	277 VAC ¹
Motor Full Load A	16.0	9.2	8.0	7.0
Motor Locked Rotor A	96.0	55.2	48.0	42.0
Non-Inductive A	16.0	9.2	8.0	-
Pilot Duty	125 VA at 120 to 600 VAC		125 VA at 24 to 600 VAC	

1. Rating for P70EC models only

SPDT Electrical Ratings 1/4 hp Switch (P70F Models)

	Standard Single-Phase Ratings		
	120 VAC	208 VAC	240 VAC
Motor Full Load A	6.0	3.3	3.0
Motor Locked Rotor A	36.0	19.8	18.0
Non-Inductive A	6.0	6.0	6.0
Pilot Duty	125 VA at 24 to 240 VAC		

Four-wire, Two-circuit Electrical Ratings (P70G, H, J, and K, and P170K Models)

	Standard Single-Phase Ratings							
	Line-M2 (Main Contacts)				Line-M1 (Auxiliary Contacts)			
	120 VAC	208 VAC	240 VAC	277 VAC	120 VAC	208 VAC	240 VAC	277 VAC
Motor Full Load A	16.0	9.2	8.0	--	6.0	3.3	3.0	--
Motor Locked Rotor A	96.0	55.2	48.0	--	36.0	19.8	18.0	--
Non-Inductive A	16.0	9.2	8.0	7.2	6.0	6.0	6.0	6.0
Pilot Duty for both sets of contacts	125 VA at 24 to 600 VAC; 57.5 VA at 120 to 300 VDC							

DPST Electrical Ratings (P72A, B, C, and D Models)

	Standard Ratings					Hermetic Compressor Ratings	
	120 VAC, Single-Phase	208 VAC, Single-Phase	240 VAC, Single-Phase	208 VAC, Three-Phase	220 VAC, Three-Phase	208 VAC, Single-Phase	240 VAC, Single-Phase
Motor Horsepower	2	3	3	5	5	--	--
Motor Full-Load A	24	18.7	17	15.9	15	24	24
Motor Locked-Rotor A	144	112.2	102	95.4	90	144	144
AC Non-Inductive A	24	24	24	24	24	--	--
DC Non-Inductive A	3	0.5	0.5	0.5	0.5	--	--
Pilot Duty	125 VA at 120 to 600 VAC; 57.5 VA at 120 to 300 VDC						

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P70, P72, and P170 Series Controls for Dual Pressure Applications

Description

The P70, P72, and P170 Controls for Dual Pressure Applications are designed primarily for use as combination high and low pressure controls on commercial refrigeration and air conditioning applications.

These controls are available in several pressure ranges and are compatible with most common refrigerants. Ammonia compatible models are also available.

These controls respond directly to system pressure changes on both high and low sides, and can provide single-device control of the compressor.

Controls are available in several different electrical ratings and switch configurations, including independent high and low pressure switches (on P70S and P170S models). The P72 models provide direct control of 208 to 240 volt, single-phase motors up to three horsepower, and 208 to 220 volt, three-phase motors up to five horsepower.

Refer to the *P70, P72, and P170 Series Controls for Dual Pressure Applications Product Bulletin (LIT-125455)* for important product application information.

Features

- all-steel case and cover built to provide long lasting, rugged protection for internal components
- sight-set calibrated pressure adjustment displays a visible pressure scale, fully adjustable through the range without removing the cover (on NEMA 1 enclosure models)

- MICRO-SET™ differential option allows for precise control on low pressure applications
- independent high and low pressure switches (P70S and P170S Models) satisfies a variety of dual pressure application wiring requirements with a single versatile control
- convertible high pressure reset—auto reset or manual reset lockout (P70S and P170S Models) reduces inventory—one control can be adapted to several dual pressure applications in the field

Applications

- **P70S and P170S models** have independently operated high and low pressure single-pole, double-throw (SPDT) switches that can be wired to satisfy a variety of control requirements. These adaptable controls also come with a high pressure manual reset lockout mechanism that may be converted to automatic reset.
- **P70L, M, N, and P170L, M, N models** have a single-pole, single-throw (SPST) switch. Models are available with automatic or manual reset lockout options. Models with manual reset are available with either high-side-only manual reset, or low-side and high-side manual reset. Ammonia-compatible models are also available (P70L and P70M only).
- **P72 models** have a double-pole, single-throw (DPST) switch with load-carrying contacts that can provide direct control of 208 to 240 VAC, single-phase motors up to 3 hp, and 208 to 220 VAC, three-phase motors up to 5 hp. See the DPST Electrical Ratings (P72L, M, and N Types) that follow.



P70MA-1 Dual Pressure Control

Some models are available with **Limited Knob Adjustment**, which restricts adjustment of the pressure settings and deters over-adjustment or tampering.

NEMA 1 enclosures are standard on most models. **NEMA 3R enclosures** are also available.

Repair Information

If the P70, P72, and P170 Series Controls for Dual Pressure Applications fail to operate within its specifications, replace the unit. For a replacement control, contact the nearest Johnson Controls® representative.

Selection Chart (Part 1 of 2)

Product Code Number	Switch Action	Low Pressure Side psi (kPa)		High Pressure Side psi (kPa)		Pressure Connector	Limited Knob Adjustment
		Range	Differential	Range	Differential (Non-Adjustable)		
MICRO-SET Controls for Non-Corrosive Refrigerants							
P70LB-6C ¹	SPST	12 in.Hg to 80 (-41 to 552)	Minimum 5 (34) Maximum 35 (241)	100 to 500 (690 to 3,447)	Fixed approx. 65 (448)	36 in. capillary with 1/4 in. flare nut	Low cut-out
P70MA-1C ¹					Lockout requires manual reset		None
P70SA-1C ¹	Two independent SPDT				Fixed at 65 (448) or Lockout requires manual reset		
P170LB-6C ¹	SPST				Fixed approx. 65 (448)	1/4 in. external flare connector	Low cut-out
P170MA-18C ¹					Lockout requires manual reset		None
P170SA-1C ¹	Two independent SPDT				Fixed at 65 (448) or Lockout requires manual reset		
All Range Controls for Non-Corrosive Refrigerants							
P70LB-1C ¹	SPST	20 in.Hg to 100 (-68 to 690)	Minimum 6 (41) Maximum 50 (345)	100 to 500 (690 to 3,447)	Fixed Approx. 65 (448)	36 in. capillary with 1/4 in. flare nut	Low cut-out
P70MA-1C ¹					Lockout Requires Manual Reset		None
P70NA-1C			Fixed (manual reset)				
P72LA-1C ¹	DPST		Minimum 7 (48) Maximum 50 (345)		Fixed approx. 65 (448)		Low cut-out
P72LB-1C ¹					Lockout requires manual reset		None
P72MA-1C ¹							
P72NA-1C ¹					Fixed (manual reset)		

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P70, P72, and P170 Series Controls for Dual Pressure Applications (Continued)

Selection Chart (Part 2 of 2)

Product Code Number	Switch Action	Low Pressure Side psi (kPa)		High Pressure Side psi (kPa)		Pressure Connector	Limited Knob Adjustment
		Range	Differential	Range	Differential (Non-Adjustable)		
All Range Controls for Non-Corrosive Refrigerants							
P170LB-1C ¹	SPST	20 in. Hg to 100 (-68 to 690)	Minimum 7 (48)	100 to 500 (690 to 3,447)	Fixed approx. 65 (448)	1/4 in. External flare connector	Low cut-out
P170MA-1C ¹			Maximum 50 (345)		Lockout requires manual reset		None
P170NA-1C			Fixed (manual reset)				
All Range Ammonia Compatible Controls							
P70LA-2C ¹	SPST	20 in. Hg to 100 (-68 to 690)	Minimum 7 (48)	100 to 500 (690 to 3,447)	Fixed approx. 65 (448)	1/4 in. Internal NPT connector	None
P70MA-2C ¹			Maximum 50 (345)		Lockout requires manual reset		

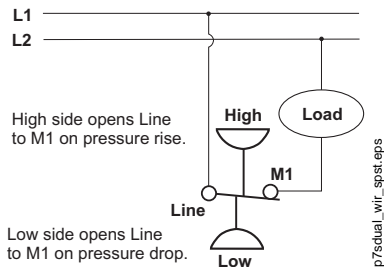
1. Control models with high pressure side (only) that are UL Listed as Refrigeration Pressure Limiting Controls.

Note: For information on models not listed, please contact Johnson Controls/PENN® Refrigeration Application Engineering at 1-800-275-5676.

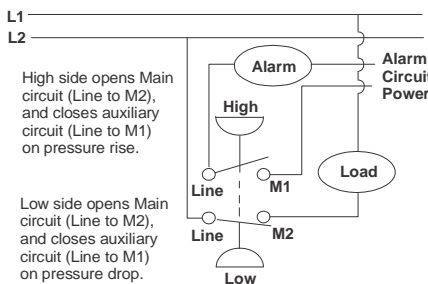
Technical Specifications

Maximum Pressures

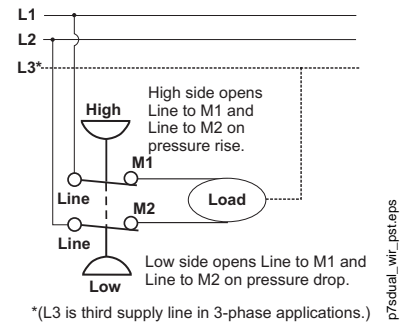
Pressure	Low Side		High Side
	All Range	MICRO-SET	
Maximum Working Pressure	100 psi (552 kPa)	80 psi (690 kPa)	500 psi (3,447 kPa)
Maximum Overpressure	325 psi (2,241 kPa)	525 psi (3,620 kPa)	525 psi (3,620 kPa)



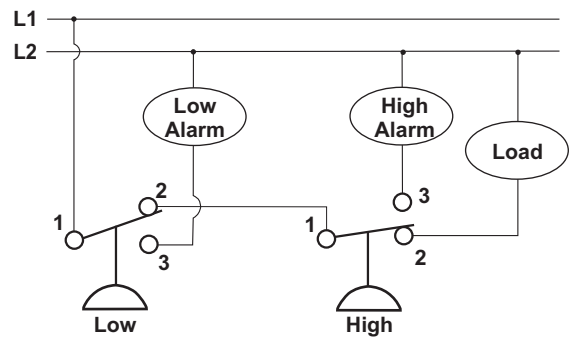
Typical Wiring for SPST Switch (P70L, M, and N, and P170L, M, and N Models)



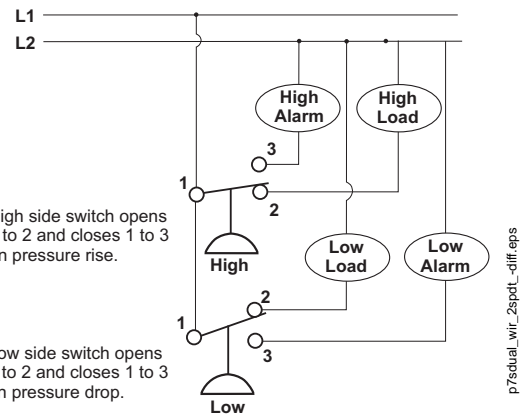
Typical Wiring for Four-Wire, Two-Circuit Switch (P70P, Q and R Models)



Typical Wiring for DPST Switch (P72L, M, and N Models)



Two SPDT Switches Wired as a Dual Pressure Control (Switching a Single Load with Optional High Side Alarm and Low Side Alarm) (P70S and P170S Models)



Two SPDT Switches Wired to Control Two Different Loads (Optional High Side Alarm and Low Side Alarm) (P70S and P170S Models)

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Standard Electromechanical Pressure Controls

P70, P72, and P170 Series Controls for Dual Pressure Applications (Continued)

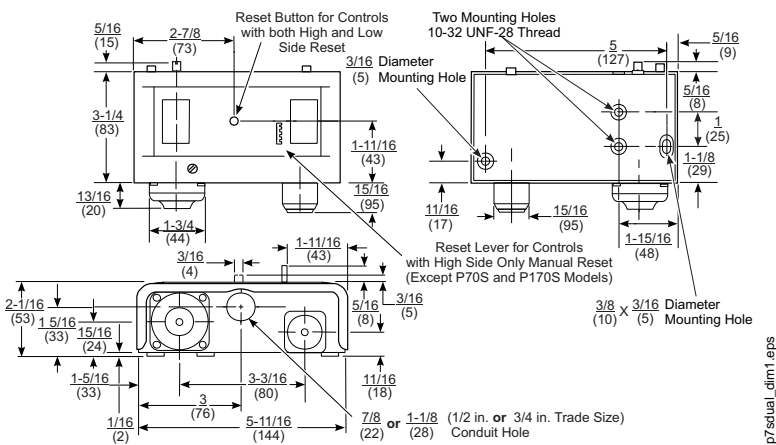
Technical Specifications (Continued)

DPST Electrical Ratings (P72L, M, and N Types)

	Standard Ratings					Hermetic Compressor Ratings	
	120 VAC, Single-Phase	208 VAC, Single-Phase	240 VAC, Single-Phase	208 VAC, Three-Phase	220 VAC, Three-Phase	208 VAC, Single-Phase	240 VAC, Single-Phase
Motor Horsepower	2	3	3	5	5	--	--
Motor Full-Load A	24	18.7	17	15.9	15	24	24
Motor Locked-Rotor A	144	112.2	102	95.4	90	144	144
AC Non-Inductive A	24	24	24	24	24	--	--
DC Non-Inductive A	3	0.5	0.5	0.5	0.5	--	--
Pilot Duty	125 VA at 120 to 600 VAC; 57.5 VA at 120 to 300 VDC						

SPST Electrical Ratings (P70L, M, and N, and P170L, M, and N Types)

	Single-Phase Ratings			
	Standard			Hermetic Compressor
	120 VAC	208 VAC	240 VAC	208/240 VAC
Motor Horsepower	2	3	3	--
Motor Full-Load A	24	18.7	17	24
Motor Locked-Rotor A	144	112.2	102	144
Non-Inductive A	22	22	22	--
Pilot Duty	125 VA at 120 to 600 VAC; 57.5 VA at 120 to 300 VDC			



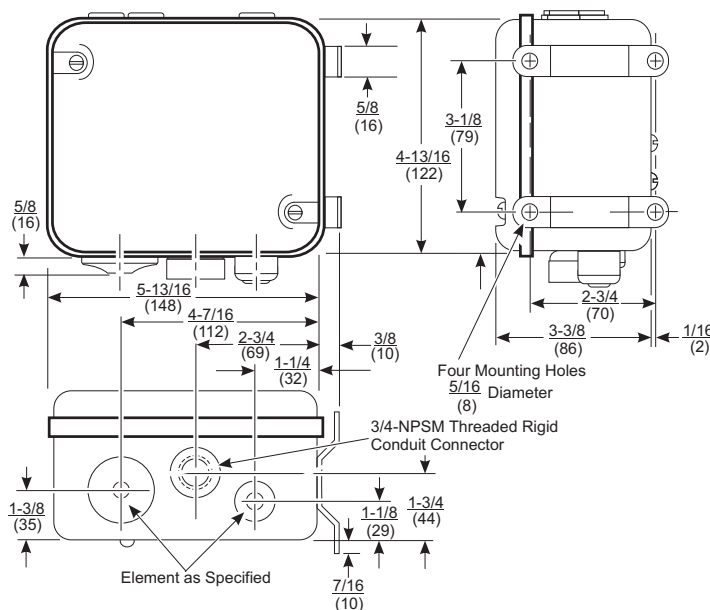
Dimensions for P70, P72, and P170 Dual Pressure Controls with NEMA 1 Enclosure, in. (mm)*

SPDT Electrical Ratings (P70S and P170S Types)

	Standard Single-Phase Ratings			
	120 VAC	208 VAC	240 VAC	277 VAC
Motor Full Load A	16.0	9.2	8.0	7.0
Motor Locked Rotor A	96.0	55.2	48.0	42.0
Non-Inductive A	16.0	9.2	8.0	-
Pilot Duty	125 VA at 24 VAC; 720 VA at 120 to 277 VAC			

Four-Wire, Two-Circuit Electrical Ratings (P70P, Q, and R Types)

	Standard Single-Phase Ratings							
	Line-M2 (Main Contacts)				Line-M1 (Auxiliary Contacts)			
	120 VAC	208 VAC	240 VAC	277 VAC	120 VAC	208 VAC	240 VAC	277 VAC
Motor Full Load A	16.0	9.2	8.0	--	6.0	3.3	3.0	--
Motor Locked Rotor A	96.0	55.2	48.0	--	36.0	19.8	18.0	--
Non-Inductive A	16.0	9.2	8.0	7.2	6.0	6.0	6.0	6.0
Pilot Duty for both sets of contacts	125 VA at 24 to 600 VAC; 57.5 VA at 120 to 300 VDC							



Dimensions for P70, P72, and P170 Dual Pressure Control with NEMA 3R Enclosure, in. (mm)*

*These dimensions are nominal and are subject to accepted manufacturing tolerances and application variables.

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P470 Electronic Pressure Control with Display

Description

The P470 Electronic Pressure Control with Display is a single-stage, On/Off, electronic pressure control with a single-pole, double-throw (SPDT) output relay. The control may be field set to operate in one of three pressure ranges (0 to 100 psi, 0 to 500 psi, or 50 to 750 psi), as either an open high or open low control.

The P470 Control features a large LCD that displays the sensed pressure and other system-status indicators, as well as the adjustable setpoints in the programming mode. The P470 Control has a lockable, three-button touchpad for adjusting setpoints, and a front-panel LED that indicates the output relay status.

The P470 Control uses a P499 Electronic Pressure Transducer in conjunction with a WHA-PDK3 Wiring Harness to sense system pressure. This arrangement virtually eliminates the chance of a refrigerant leak because there are no capillaries or bellows to break or fail.

Refer to the *P470 Electronic Pressure Control with Display Product Bulletin (LIT-125528)* for important product application information.

Features

- easy-to-read LCD
- three field-selectable pressure ranges between 0 to 750 psi
- 24 VAC, and 120 or 208/240 VAC models
- lockable, three-button, front-panel touchpad
- built-in, adjustable, anti-short cycle time-delay
- uses an economical and versatile transducer and wiring harness

Repair Information

The P470 pressure control and P499 transducer are not field repairable. Perform the following procedures, in the order they are presented, to determine the problem. If the problem is with the control or transducer, contact a Johnson Controls/PENN® sales representative for a replacement.



P470 Pressure Control with Transducer and Wiring Harness (Control, Transducer, and Harness Must be Purchased Separately)

Selection Chart

Item	Product Code Number	Description
P470 (Low-Voltage) Electronic Pressure Control with Display	P470FB-1C	Low Voltage (less than 30 VAC) Electronic Pressure Control with Display Supply Voltage: 24 VAC Class 2 Transformer (See <i>Technical Specifications</i> for complete Relay Electrical Ratings.)
P470 (Line-Voltage) Electronic Pressure Control with Display	P470EB-1C	Line Voltage Electronic Pressure Control with Display Supply Voltage: 120 or 208/240 VAC (See <i>Technical Specifications</i> for complete Relay Electrical Ratings.)
P499 Electronic Pressure Transducers	P499RAP-101C P499RAP-101K	0 to 100 psi Pressure Transducer with 1/8 in. NPT External Fitting
	P499RCP-101C P499RCP-101K	0 to 100 psi Pressure Transducer with 1/4 in. SAE (Schrader®) Internal Fitting with integral valve depressor
	P499RAP-105C P499RAP-105K	0 to 500 psi Pressure Transducer with 1/8 in. NPT External Fitting
	P499RCP-105C P499RCP-105K	0 to 500 psi Pressure Transducer with 1/4 in. SAE (Schrader) Internal Fitting with integral valve depressor
	P499RAP-107C P499RAP-107K	0 to 750 psi Pressure Transducer with 1/8 in. NPT External Fitting
	P499RCP-107C P499RCP-107K	0 to 750 psi Pressure Transducer with 1/4 in. SAE (Schrader) Internal Fitting with integral valve depressor
	Wiring Harnesses for P499 Transducers	WHA-PKD3-200C
WHA-PKD3-400C		13 ft 3 in. (4 m) 3-Wire Cable with Plug-in Connector for P499 Transducer
WHA-PKD3-600C		19 ft 8 in. (6 m) 3-Wire Cable with Plug-in Connector for P499 Transducer

Note: P470 Controls do not include a transducer or wiring harness. P499 Transducer and wiring harness must be purchased separately. Transducer must be matched to the selected pressure range.



Single-Stage Electronic Pressure Controls

P470 Electronic Pressure Control with Display (Continued)

Technical Specifications

Output Relay Contacts Electrical Ratings

	P470EB-1			P470 FB-1
	120 VAC	208 VAC	240 VAC	24 VAC
Horsepower N.O. (N.C.)	1 (1/4)	1 (1/3)	1 (1/2)	100 VA, 30 VAC maximum, Class 2
Full Load Ampere N.O. (N.C.)	16 (5.8)	9.2 (4.0)	8.0 (4.9)	
Locked Rotor Ampere N.O. (N.C.)	96 (34.8)	55.2 (24)	498 (29.4)	
Non-Inductive Ampere N.O. (N.C.)	15 (10)	10 (10)	10 (10)	
Pilot Duty	125 VA (N.O.) at 24 to 240 VAC 125 VA (N.C.) at 120 to 240 VAC 50 VA (N.C.) at 24 VAC			

P470 Electronic Pressure Control with Display			
Operating Pressure Ranges	0 to 100 psi	0 to 500 psi	50 to 750 psi
Minimum Differential Pressure	5 psig	20 psig	20 psig
Displayed Resolution	1 psig	3 psig	5 psig
Control Accuracy	± 1.5% of selected Operating Pressure Range plus transducer accuracy		
Supply Voltage	P470FB-1: 24 VAC, 50/60 Hz, Class 2 P470EB-1: 120 or 208/240 VAC, 50/60 Hz		
Power Consumption	1.8 VA maximum		
Transducer Type	P499 Electronic Pressure Transducer		
Ambient Temperature at Control	Operating: -30 to 140°F (-34 to 60°C) Shipping: -40 to 185°F (-40 to 85°C)		
Ambient Humidity at Operating Control	0 to 95% RH noncondensing; Maximum dew point: 85°F (29°C)		
Enclosure	Case and cover: NEMA 1 High-impact thermoplastic		
Agency Information	UL: File SA516; CCN SDFY Canadian UL: File SA516; CCN SDFY7 FCC/DOC Part 15, Class A		



P28 Series Lube Oil Pressure Cutout Control with Time Delay

Description

The P28 series provides dependable lube oil protection on pressure of lubricated refrigeration compressors by sensing low lube oil pressure. A built-in time delay switch, accurately compensated for ambient temperature, allows for pressure pick up on start and avoids nuisance shutdowns on pressure drops of short duration during the running cycle.

Refer to the *P28 and P128 Series Lube Oil Controls with Built-in Time Delay Relay Product Bulletin (LIT-125420)* for important product application information.

Features

- direct-reading scale indication
- adjustable setpoint
- trip-free manual reset
- replacement timing relays available
- dust-protected switch

Applications

- semi-hermetic compressors
- P28 Control measures pressure available to circulate oil through the lubrication system (Net oil pressure is the difference between oil gauge and crankcase pressure.)

Accessories

- all models listed on this page include a universal mounting bracket
- replacement timing relays— refer to *Replacement Timing Relays for P28 and P29 Lube Oil Controls Catalog Page (LIT-1927395)*

Repair Information

If the P28 Series Lube Oil Pressure Cutout Control with Time Delay fails to operate within its specifications, replace the unit. For a replacement control, contact the nearest Johnson Controls® representative.



P28AA Lube Oil Pressure Cutout Control

Selection Chart

Product Code Number	Time Delay	Time Delay Heater Circuit VAC	Type of Reset	Range ¹ psi (kPa)	Refrigerant (R)	Pressure Connection
P28AA-1C ²	90 seconds	120/240	Manual	8 to 70 (55 to 483)	Non-corrosive ³	36 in. capillary with 1/4 in. flare nut
P28AA-2C ⁴	60 seconds					
P28AA-17C ⁵	120 seconds					
P28AA-18C	45 seconds					
P28AN-1C	90 seconds	120/240	Manual	8 to 70 (55 to 483)	Ammonia	1/4 in. internal NPT
P28DN-1C	90 seconds	120/240	Manual	8 to 70 (55 to 483)	Non-corrosive ³	36 in. capillary with 1/4 in. flare nut
P28DA-1C	With Runlight and Alarm Terminals					
P28GA-2C	90 seconds					
P28NA-5C	120 seconds	24 VAC or VDC	Manual			

1. Switch differential approximately 5 psig (34 kPa). Time delay relay energizes at 9 psig (61 kPa) pressure difference, de-energized at 14 psig (97 kPa) difference
2. Replaces Ranco® P30-3701
3. Non-corrosive refrigerants include R-12, R-22, R-134A, R-500, R-502 (R)
4. Replaces Ranco P30-3601
5. Replaces Ranco P30-3801

Technical Specifications

The maximum bellows pressure is 180 psig (2,241 kPa).

Electrical Ratings - Pilot Duty

Time Delay Heater Circuit	Pilot Circuit	Alarm Circuit (must be same voltage as pilot circuit)	P28DA-1 Contact Rating 2 to 1: 2 to 3 (must be same voltage as time delay circuit)	
			Crankcase Heater: Term 2 to 1	Runlight: Term 2 to 3
120/240 VAC	750 VA, 120/240 VAC	125 VA, 120/240 VAC	10 A 120 VAC, 5 A 240 VAC	10 W
24 VAC or VDC	125 VA, 24 VAC 57.5 VA, 24 VDC	125 VA, 24 VAC 57.5 VA, 24 VDC	---	

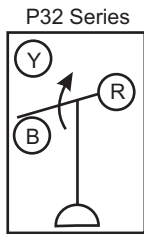


P32 Series Sensitive Pressure Switch

Description

This differential pressure switch is used to sense pressure/air flow in ducts.

Refer to the *P32 Series Sensitive Differential Pressure Switch Product Bulletin (LIT-125435)* for important product application information.



Action on Increase of Pressure

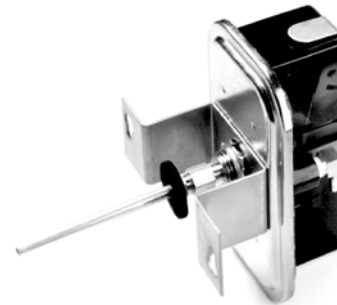
P28 Action Diagram

Features

- easy-to-read setpoint scale
- versatile mounting options

Applications

- pressure/air flow proving with electric duct heaters, humidifiers, and other equipment
- maximum pressure/air flow control for variable volume systems
- reheat duct powered systems
- clogged filter detection
- detection of icing of air conditioning coils and initiation of defrost cycle
- sensitive pressure settings
- dust-tight snap switch



P32 Sensitive Pressure Switch

Repair Information

If the P32 Series Sensitive Pressure Switch fails to operate within its specifications, replace the unit. For a replacement switch, contact the nearest Johnson Controls® representative.

Selection Chart

Product Code Number	Ambient Temperature Min./Max.	Connector	Maximum Over-pressure psig (kPa) ¹	Contact Action	Range in. WC (kPa)	Sensitivity at Min. Setpoint in. WC (kPa)	Setpoint	Scale Plate	Mounting Bracket (Included)
P32AC-1C	-40°F (-40°C) min. 167°F (75°C) max.	High Pressure connectors are metal 1/8 in. internal NPT inside, 1/2 in. NPSM outside for mounting Low pressure connectors are molded, 1/8 in. internal NPT	1 (6.895)	SPDT	0.15 to 12 (0.037 to 2.99)	0.07 (0.017)	Adjustable	Yes	L BKT182-1
P32AC-2C ²									U BKT229-1
P32AF-1C					L BKT182-1				
P32AF-2C ²					U BKT229-1				

1. Maximum overpressure at either connection
2. Supplied with 1/4 in. compression fitting, 4 in. extension tube, two mounting screws, and O-gasket (angle barbed fitting installed)

Accessories

The switch can be mounted directly or with the supplied mounting bracket.

Product Code Number	Description
FTG18A-600R	Remote Mounting Kit: 4 in. flanged sensing tube, two barbed fittings, two No. 10 screws, and a gasket

Technical Specifications

Electrical Ratings

Motor Ratings VAC	120	208	240
Type P32AC (Standard Differential, 1/2 hp)			
AC Full Load A	9.8	5.65	4.9
AC Locked Rotor A	58.8	33.9	29.4
Non-Inductive or Resistive Load	15 A, 24 to 277 VAC		
Pilot Duty	125 VA, 24 VAC; 360 VA, 120 to 277 VAC		
Type P32AF (Close Differential, 1/4 hp)			
AC Full Load A	5.8	3.3	2.9
AC Locked Rotor A	34.8	19.8	17.4
Non-Inductive or Resistive Load	10 A, 24 to 277 VAC		
Pilot Duty	125 VA, 24 VAC; 360 VA, 120 to 277 VAC		

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P45 Series Lube Oil Pressure Cutout Control with Time Delay

Description

The P45 Control provides dependable, low lube oil pressure protection for refrigeration compressors. The low-adjustable factory-set pressure setting provides operation to the compressor manufacturer's specification. A built-in time delay relay, compensated for ambient temperature, allows for pressure pick-up on start and avoids nuisance shutdowns on short duration pressure losses during the running cycle.

Refer to the *P45 Series Oil Pressure Cutout Controls with Built-in Time Delay Relay Product Bulletin (LIT-125445)* for important product application information.

Features

- universal mounting
- trip-free manual reset
- ambient compensated time delay

Accessories

These controls are supplied without mounting brackets. If brackets are required, order kit number **BKT38A-600R**, which contains five **271-51** Angle Mounting Brackets with screws.

Applications

The P45 control is used on semi-hermetic compressors. It measures net oil pressure available to circulate oil through the compressor's lubrication system. (Net oil pressure is the difference between oil pump pressure and the crank case pressure.)

Repair Information

If the P45 Series Lube Oil Pressure Cutout Control with Time Delay fails to operate within its specifications, replace the unit. For a replacement control, contact the nearest Johnson Controls® representative.



P45NCALube Oil Pressure Cutout Control

Technical Specifications

For all non-corrosive refrigerants.

Electrical Rating – Pilot Duty

Time Delay Heat Circuit	Pilot Duty
120/240 VAC	750 VA, 120/240 VAC
24 VAC	125 VA, 24 VAC

Selection Chart

Product Code Number	Time Delay ¹	Heater Circuit VAC	Type of Reset	Maximum Bellows Pressure, psig (kPa)	Factory Setting, psi (kPa) Fixed	Pressure Connection
Copeland® Compressors						
P45NAA-5C	120 seconds	24	Manual	425 (2,390)	9 (62) ²	36 in. capillary with 1/4 in. flare nut
P45NAA-10C	90 seconds					48 in. capillary with 1/4 in. flare nut
P45NCA-12C ³	120 seconds	120/240				36 in. capillary with 1/4 in. flare nut
P145NCA-12C ⁴						1/4 in. external flare (Style 5)
P145NCB-12C ⁵						
Carlyle® Compressors						
P45NCA-82C ⁶	45 seconds	120/240	Manual	425 (2,390)	6.5 (45) ⁷	36 in. capillary with 1/4 in. flare nut
P145NCA-82C ⁸						1/4 in. external flare (Style 5)
P145NCB-82C ⁹						

1. Relay is not field-replaceable
2. Switch differential is approximately 5 psi (34 kPa). Time delay relay energizes at 9 psi (61 kPa) pressure difference, de-energizes at 14 psi (97 kPa) difference.
3. Replaces Ranco® P30-5826
4. Replaces Ranco P30-5827
5. Replaces Ranco P30-5827 (Includes alarm wire)
6. Replaces Carlyle/Carrier® Code No. HKCA-500, 6342050
7. Switch differential is approximately 4.5 psi (34 kPa). Time delay relay energizes at 6.5 psi (45 kPa) pressure difference, de-energizes at 11 psi (76 kPa) difference.
8. Replaces Carlyle/Carrier Part No. HKCA-500, 6342050 with 36" SEC99A UltraCap®
9. Replaces Carlyle/Carrier Part No. HKCA-500, 6342050 with 36" SEC99A UltraCap (Includes alarm wire)



P74 Series Differential Pressure Control

Description

Series P74 measures the pressure difference between two sources: supply lines and return lines. A change in differential pressure will reposition the switching mechanism to cause corrective action of the supplementary control equipment.

Refer to the *P47 Series Steam Pressure Controls Product Bulletin (LIT-125450)* for important product application information.

Features

- field-proven Penn switch with a completely enclosed contact mechanism
- pressure differential setting is easily changed without removing the cover

Applications

- differential pressure sensing on chillers or water-cooled condensers
- lube oil failure cutout for refrigeration compressors (same as the P28, but does not incorporate time delay)
- positioning M100 Series motor-actuated valves (P74JA-2)
- to prove pump operation

Accessories

All models on this page include a universal mounting bracket.

Repair Information

If the P74 Series Differential Pressure Control fails to operate within its specifications, replace the unit. For a replacement control, contact the nearest Johnson Controls® representative.



P74EA-8 Differential Pressure Control

Selection Chart

Product Code Number	Switch Action	Range Pressure Differential psig (kPa) ¹	Switch Differential	Pressure Connections	Bellows Material	
For All Non-Corrosive Liquids						
P74AA-1C	Single-Pole, Single-Throw (SPST) closes on decreases in pressure difference	8 to 70 Adjustable (55 to 483)	8 to 30 Adjustable	36 in. capillary with 1/4 in. flare nut	Stainless steel	
P74BA-1C	SPST opens on decrease in pressure difference					
P74EA-8C	Single-Pole, Double-Throw (SPDT) (snap-acting)	2 to 26 Adjustable (14 to 207)	3.5 Fixed	36 in. capillary with 1/4 in. flare nut	Brass	
P74EA-10C				1/4 in. external flare		
P74FA-1C		8 to 60 Adjustable (55 to 414)	1.5 Fixed	1/4 in. FNPT		
P74FA-5C						
P74FA-10C		2 to 26 Adjustable (14 to 207)				36 in. capillary with 1/4 in. flare nut
P74JA-2C	SPDT (floating)	8 to 60 Adjustable (55 to 414)	2.5 Fixed	1/4 in. external flare		

1. Maximum continuous pressure to low pressure bellows - 180 psig (1,241 kPa)

Technical Specifications

Electrical Ratings

Motor Ratings	120 V	208 V	240 V	277 V
P74AA, P74BA - 1 Phase				
AC Full Load A	20.0	18.7	17.0	—
AC Locked Rotor A	120.0	112.2	102.0	—
AC Non-Inductive A	22.0	22.0	22.0	—
Pilot Duty	125 VA, 120 to 600 VAC; 57.5 VA, 120 to 300 VDC			
P74EA				
AC Full Load A	16.0	9.2	8.0	—
AC Locked Rotor A	96.0	55.2	48.0	—
AC Non-Inductive A	16.0	16.0	16.0	16.0
Pilot Duty	125 VA, 120 to 600 VAC			
P74FA				
AC Full Load A	6.0	3.4	3.0	—
AC Locked Rotor A	36.0	20.4	18.0	—
AC Non-Inductive A	10.0	10.0	10.0	10.0
Pilot Duty	125 VA, 120 to 277 VAC			
P74JA				
1 A; 24 VAC Class 2; 50/60 Hz				

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P128 and P145 Series Lube Oil Pressure Controls

Description

The P128 and P145 Series Controls provide dependable low pressure lube oil cut-out for pressure lubricated refrigeration compressors. The P128 Series offer adjustable range settings.

The P128 and P145 controls feature a 1/4 in. external flare pressure connection which may be used with a refrigerant hose or cap tube such as SEC99 UltraCap.

Refer to the *P28 and P128 Series Lube Oil Control with Built-in Time Delay Relay Product Bulletin (LIT-125420)* for important product application information.

Features

- ambient compensated time delay relay
- trip-free manual reset
- industry standard
- P128 is fully adjustable throughout its range
- P145 is factory set to compressor manufacturer's specifications

Applications

Use these controls for lube oil cutout on hermetic and semi-hermetic compressors used in commercial air-conditioning and commercial and industrial refrigeration systems.



P128AA Lube Oil Pressure Control



P145NCA Lube Oil Pressure Control

Technical Specifications

Pressure controls P128 and P145 are designed to be used with SEC99 UltraCap. Product specifications for P128 are the same as P28 model. Refer to *P28 Series Lube Oil Pressure Cutout Control (With Time Delay) (LIT-1927185)*. Product specifications for P145 are the same as P45 model. Refer to *P45 Series Lube Oil Pressure Cutout Control (With Time Delay) (LIT-1927185)*. Also note the selection chart below.

Accessories

Some controls are supplied less mounting brackets. If brackets are required, order kit number **BKT38A-600**, which contains five **271-51** angle mounting brackets with screws; or **BKT38A-601** which contains one mounting bracket with screws.

Repair Information

If the P128 and the P145 Series Lube Oil Pressure Control fails to operate within its specifications, replace the unit. For a replacement control, contact the nearest Johnson Controls® representative.

Selection Chart

Product Code Number	Time Delay	Heater Circuit VAC	Type of Reset	Range psig (kPa)		Refrigerant	Pressure Connection	
				Adjustable	Non-Adjustable			
P128AA-1C ¹	90 seconds	120/240	Manual	8 to 70 (55 to 483)	---	Non-corrosive	1/4 in. external flared connection	
P128AA-2C ²	60 seconds							
P128AA-17C ³	120 seconds							
P145NCA-12C ⁴	45 seconds			---	Factory Set 9 (62)	Non-corrosive		
P145NCA-82C ⁵								Factory Set 6.5 (45)
P145NCB-12C ⁶								Factory Set 9 (62)
P145NCB-82C ⁷								Factory Set 6.5 (45)

1. Replacement for P28AA-1*. Replaces Ranco® P30-3701.
2. Replacement for P28AA-2*. Replaces Ranco P30-3601.
3. Replacement for P28AA-17*. Replaces Ranco P30-3801.
4. Replacement for P45NCA-12*. (Copeland Model) Replaces Ranco P30-5826.
5. Replacement for P45NCA-82*. (Carlyle Model).
6. Copeland model with alarm circuit
7. Carlyle model with alarm circuit

* SEC99 UltraCap Hose must be ordered separately.



P12 Series Differential Pressure Controls

Description

The P12 Series Differential Pressure Controls are suitable for use with oil and/or non-corrosive refrigerants. The switch is actuated by a difference in pressure between the two sensing elements. The control is factory-set to open the switch (COM to 1) at a differential pressure of 18 psi (124 kPa) and close the switch (COM to 1) at a differential pressure of 12 psi (83 kPa). The control is not field-adjustable.

This control may be connected to a P28 Lube Oil Control, with time delay, to give complete monitoring of lubrication on two refrigeration compressors driven by one motor.

Refer to the *P12 Series Differential Pressure Control Product Bulletin (LIT-997452)* for important product application information.

Repair Information

If the P12 Series Differential Pressure Control fails to operate within its specifications, replace the unit. For a replacement control, contact the nearest Johnson Controls® representative.



P12AA
Differential Pressure Control

Selection Chart

Product Code Number	Differential Pressure		Maximum Overpressure, psi (kPa)	Enclosure	Fitting
	COM to 1 OPENS	COM to 1 CLOSES			
P12AA-3C	18 psi (124 kPa)	12 psi (83 kPa)	500 (3,447)	NEMA1 Enclosure	1/4 in. external SAE flare fitting



P545 Series Electronic Lube Oil Control

Description

The P545 Series Electronic Lube Oil Control is designed for use on refrigeration compressors equipped with an oil pump that accepts a single-point differential pressure switch. The P400 switch continuously monitors net lube oil pressure and the P545 control locks out the compressor if lube oil pressure falls below the manufacturer's recommended net pressure for longer than the recommended lube oil time delay. Front-mount LEDs indicate the status of the lubrication system, and a user-selectable, minimum-off time delay can be set to minimize compressor short cycling.

A Johnson Controls/PENN® R310AD Current Sensing Switch, sold separately, may be used to disable the P545 control lockout circuit during abnormal compressor shutdowns.

Refer to the *P545 Series Electronic Lube Oil Control Product Bulletin (LIT-12011012)* for important product application information.

Features

- single-pole, double-throw (SPDT) relay contacts for liquid line solenoid and alarm applications allow liquid line solenoid to be closed if the P545 control shuts off the compressor due to low oil pressure and provides alarm indication, including circuits that use neon lights

- relay contact output for compressor provides reliable, long-lasting operation
- built-in test circuit verifies proper control operation quickly, without additional tools or equipment
- improved noise immunity exceeds immunity requirements of UL 991 for transient overvoltage: IEC 61000-4-3 for radiated Radio Frequency (RF) and IEC 61000-4-6 for RF-induced conducted disturbances
- jumper-selectable anti-short cycle time delays provide for a wide range of anti-short cycle strategies that meet most equipment requirements—the anti-short cycle delay feature may allow for the elimination of an external short-cycle timer
- user-friendly display panel displays the status of the compressor lubrication system continuously
- backwards compatibility allows easy replacement of existing electronic lube oil controls



P545 Control with P400 Switch

Repair Information

If the P545 Series Electronic Lube Oil Control fails to operate within its specifications, replace the unit. For a replacement control, contact the nearest Johnson Controls® representative.

Selection Charts

P545 Series Electronic Lube Oil Control

Product Code Number	Lube Oil Delay (Seconds)	P400 Switch	Wiring Harness	Fits Compressors Manufactured by
P545NCB-22C ¹	120	P400AD-2	WHA-P400-100	Copeland
P545NCB-25C ¹	90	P400BD-1	WHA-P400-125	Bitzer
P545NCB-82C ¹	120	P400AD-1	WHA-P400-100	Carlyle

1. Switch and wiring harness included

Control and Sensor/Switch Compatibility

Test	P345 or P445 Control with P400 Switch	P545 Control and P400 Switch
Wiring Harness ¹	WHA-P400-xxx	WHA-P400-xxx
Test Switch	Does not function ²	Immediate

1. WHA-P400-xxx is the two-wire harness supplied with the P545 control and the P400 switch.
2. When the P445 Control is wired to a P400 Switch, the Test button may operate when first powered up; however, after a couple minutes of operation, the Test Switch function no longer works. All other control functions operate normally.



P545 Series Electronic Lube Oil Control (Continued)

Accessories

P400 Single-Point Differential Lube Oil Pressure Switch

Product Code Number ¹	Open Point (Differential Pressure)	Close Point (Differential Above Open Point)	Threads	Wiring Harness
P400AD-1C	7.0 ±1.0 psi	less than or equal to 2.0 psi	3/4-16 UNF	WHA-P400-100
P400AD-2C	12.75 ±0.75 psi	less than or equal to 1.5 psi		
P400BD-1C	10.0 ±1.5 psi	less than or equal to 3.0 psi	M20 x 1.5	WHA-P400-125

1. Wiring harness included

Wiring Harnesses and Other Accessories

Product Code Number	Description
KITP545-82C ¹	CST29A-600C Sensor Block; P545NCB-82 Control; P400AD-1C Switch; WHA-P400-100C Wiring Harness
WHA-P400-100C	3-1/3 ft (1 m) length wiring harness
WHA-P400-125C	4 ft (1-1/4 m) length wiring harness
WHA-P400-250C	8 ft (2-1/2 m) length wiring harness
WHA-P400-430C	14 ft (4-1/3 m) length wiring harness
R310AD-1C	Low-voltage Current Sensing Switch
271-51	Universal Mounting Bracket

1. Contact Carlyle Compressor Co. at 1-800-462-2759 to order Sensor Block Gasket 06DA680063.

Technical Specifications

P545NCB Electronic Lube Oil Control	
Power Requirements	120 or 240 VAC, 50/60 Hz +10%, -15%; power consumption: 3 VA
Open Point (Differential Pressure)	P545NCB-22/P400AD-2: 12.75 ± 0.75 psi (87.9 ± 5.17 kPa) P545NCB-25/P400BD-1: 10 ± 1.5 psi (68.9 ± 10.3 kPa) P545NCB-82 P400AD-1: 7 ± 1.0 psi (48.2 ± 6.9 kPa)
Lube Oil Time Delay (Factory Settings)	P545NCB-22: 120 ± 15 seconds P545NCB-25: 90 ± 12 seconds P545NCB-82: 120 ± 15 seconds
Anti-Short Cycle Timer	Four selectable positions: 0, 35, 65, and 100 seconds (nominal times)
Type of Refrigerant	Non-corrosive refrigerants only
Electrical Connections	Control: Screw type terminals on a barrier terminal strip Sensor: Snap-connect at sensor end, three-pin plug at control end
Maximum Electrical Rating	Isolated relay output to compressor contactor (M-1 and M-2) Pilot duty 375 VA at 120 VAC, 750 VA at 240 VAC
Alarm Circuit (Relay)	NOA contact: Pilot duty 125 VA at 120/240 VAC; 60 W tungsten at 120/240 VAC NCA contact: Pilot duty 125 VA at 120 VAC, 250 VA at 240 VAC
Backplate Material	0.062 in. (1 mm) cold rolled steel
Case and Cover Material	High impact thermoplastic
Ambient Operating Conditions	-40 to 131°F (-40 to 5°C)
Ambient Storage Conditions	-40 to 185°F (-40 to 85°C)
Approximate Shipping Weight	1.80 lb (0.82 kg)
Agency Listings	UL Listed, File SA516, CCN SDFY UL Listed for Canada, File SA516, CCN SDFY7

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CST29A Adaptor Block for Carlyle® Compressors

Description

The Johnson Controls/PENN® CST29A Adaptor Block is designed for use on Carlyle® compressors (models O6CC, O6D, and O6E) equipped with an oil pump. The adaptor block allows for the installation of the P400 single point differential pressure switch for use with the P545NCB-82 electronic lube oil control.

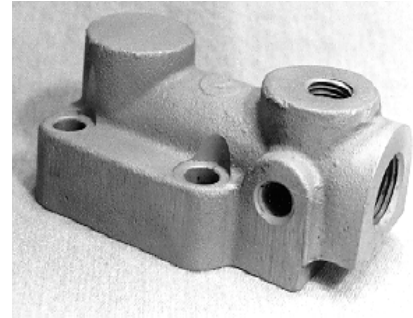
Refer to the *CST29A Adapter Block for Carlyle Compressors Product Bulletin (LIT-125730)* for important product application information.

Features

- simple installation— provides easy conversion of electromechanical lube oil control system to electronic equivalent
- designed specifically for Carlyle applications— applies to Carlyle compressor models O6CC, O6D, and O6E

Repair Information

If the CST29A Adaptor Block for Carlyle® Compressors fails to operate within its specifications, replace the unit. For a replacement adaptor, contact the nearest Johnson Controls® representative.



CST29A Adaptor Block

Selection Chart

Product Code Number	Description
CST29A-600C	Adaptor Block for Carlyle Compressor Series O6CC, O6D, and O6E; Includes Allen-head bolts.

Accessories

Product Code Number	Description
P545NCB-82C	Electronic Lube Oil Pressure Control, 120 second delay before lockout, with P400AD-1 switch and WHA-P400-100 switch cable
P400AD-1C	Replacement Differential Pressure Switch with WHA-P400-100 Wire Harness Open at 7 ±1.0 psi, Close Less than or Equal to 2.0 psig above Open Point
KITP545-82C	Single Pack P545 with Adaptor Block and Allen-head Bolts
WHA-P400-100C	3-1/3 ft (1 m) Length Wiring Harness
WHA-P400-125C	4 ft (1-1/4 m) Length Wiring Harness
WHA-P400-250C	8 ft (2-1/2 m) Length Wiring Harness
WHA-P400-400C	14 ft (4-1/3 m) Length Wiring Harness

Carlyle Supplied Parts

06DA680063 ¹	Adaptor Block Gasket for Carlyle Compressor Series O6CC, O6D, and O6E
-------------------------	---

1. Order this part from a Carlyle distributor. For information on the nearest Carlyle distributor, contact Carlyle at 1-800-462-2759.

**Replacement Timing Relays for P28 and P29 Lube Oil Controls****Selection Chart**

Product Code Number	Voltage	Reset	Alarm Circuit	Timing (Seconds)
RLY13A-616R	120/240 VAC	Manual	No	120
RLY13A-613R	12 VAC	Manual	No	120
RLY13A-609R	24 VAC or DC	Manual	No	120
RLY13A-608R	120/240 VAC	Automatic	No	90
RLY13A-602R	120/240 VAC	Manual	No	90
RLY13A-600R	120/240 VAC	Manual	No	60
RLY13A-617R	120/240 VAC	Manual	No	45
RLY13A-610R	120/240 VAC	Manual	No	30



P100 Series Encapsulated Pressure Switches

Description

P100 Series switches are encapsulated, nonadjustable, single-pole, single-throw (SPST), direct-mount switches for use with non-corrosive refrigerants. The switches are available with automatic reset in both open low and open high configurations and manual reset with open high action.

Refer to the *P100 Series Encapsulated Pressure Controls Product Bulletin (LIT-121485)* for important product application information.

Features

- compact size and light weight allow for direct mounting
- trip-free manual reset (manual reset models); contacts cannot be overridden by continued depression of the reset button

- use with all non-corrosive refrigerants
- encapsulated switch, dust tight
- 1/4 in. internal flare fitting with built-in Schrader type depressor is standard
- electrical connections are made to 48 in. leads

Applications

- low limit, high limit, and fan cycling control in commercial refrigeration
- ice machines
- food service equipment

Repair Information

If the P100 Series Encapsulated Pressure Switches fails to operate within its specifications, replace the unit. For a replacement switch, contact the nearest Johnson Controls® representative.



P100 Series Encapsulated Pressure Switch

Technical Specifications

Standard Duty Electrical Contact Ratings

Switch Action-Model Numbers	SPST-P100AA, AC, AG, AJ, CA, CC, CG, CJ, DA, and DC		SPST-P100AP, CP	
	120V	240V	120V	240V
Motor Ratings				
AC Full Load Ampere	5.8	2.9	6.0	6.0
AC Locked Rotor Ampere	34.8	15.0	36.0	36.0
Non-Inductive Ampere	-	-	-	-
Inductive Ampere	-	-	-	-
Pilot Duty	375 VA		375 VA	

Heavy Duty Electrical Contact Ratings

Switch Action-Model Numbers	SPST-P100AE and CE				SPDT-P100EE			
	120V		240V		120V		240V	
Motor Ratings								
Contact Type	N.O.	N.C.	N.O.	N.C.	N.O.	N.C.	N.O.	N.C.
AC Full Load Ampere	13.0	13.0	10.0	10.0	5.8	13.0	2.9	10.0
AC Locked Rotor Ampere	65.0	60.0	45.0	45.0	34.8	60.0	17.4	45.0
Non-Inductive Ampere	13.0	25.0	10.0	25.0	10.0	25.0	5.0	25.0
Inductive Ampere	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
Pilot Duty	278 VA	125 VA	278 VA	125 VA	278 VA	125 VA	278 VA	125 VA

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P100 Series Encapsulated Pressure Switches (Continued)

Product Code Number	Setpoints - psig (kPa)		Replaces:								
	Opens	Closes	Ranco®	Robertshaw®	Saginomiya	Danfoss®	Klixon®	Supco	Wilspec	International Refrigeration Products	Gemline
P100AC-1C ²	5 (34)	20 (138)	MPL-7001	-	ACB-2UA318W	-	PS80-K2-F0305-020-005	SLP0520	HR201A020005D	SLP0520	-
P100AP-354C	5 (34)	30 (207)	-	3100-002	-	-	-	SLP0530	-	-	-
P100AP-15C	10 (69)	25 (172)	HR00011A1R702	3100-050	ACB-2UA97W	061F7523	PS80-K2-F0307-025-005	SLP1025	HR201A025010D	SLP1025	-
P100AP-201C	10 (69)	32 (221)	MPL-7011	3100-050	ACB-2UA101	-	-	SLP1032	-	SLP1032	-
P100AC-2C ²	15 (103)	30 (207)	MPL-7002	-	-	-	-	-	-	-	-
P100AP-356C	20 (138)	45 (310)	-	3100-003	ACB-2UA40W	-	-	SLP2045	-	-	-
P100AP-12C	25 (172)	50 (345)	-	-	ACB-2UA143	-	PS80-K2-F0316-050-005	SLP2550	HR201A050025D	SLP2550	-
P100AP-9C	25 (172)	80 (551)	MPL-7003	3101-003	-	-	PS80-K2-F0325-080-005	SLP2580	HR201A080025D	SLP2580	-
P100AP-105C	30 (207)	60 (413)	-	3100-004	ACB-2UA94	-	-	-	-	SLP3560	-
P100AP-2C	35 (241)	60 (414)	MPL-7004	3100-004	-	-	-	SLP3560	-	SLP3560	-
P100AP-10C	40 (276)	60 (413)	HR00011A1R704	-	-	-	-	-	-	-	-
P100AP-357C	40 (276)	80 (551)	-	3100-052	ACB-2UA354W	-	PS80-K2-F0326-080-005	SLP4080	HR201A080040D	SLP4080	-
P100AP-361C	50 (345)	90 (620)	-	-	-	-	PS80-KS-F0328-090-005	SLP5090	HR201A090050D	SLP5090	-
P100AP-358C	75 (517)	100 (689)	-	-	ACB-2UA441W	-	-	-	-	SLP75100	-
P100AP-351C ¹	75 (517)	120 (827)	-	-	-	-	-	SFC75120	-	-	-
P100AP-352C ¹	110 (758)	170 (1,171)	-	-	-	-	-	SFC110170	-	-	-
P100AP-353C ¹	126 (868)	264 (1,819)	-	-	-	-	-	SFC125265	-	-	-
P100AP-3C ¹	150 (1,034)	225 (1,551)	MPF-7008	-	ACB-2UA685W	-	-	SFC150225	-	-	-
P100AP-359C ¹	165 (1,137)	215 (1,481)	-	3100-215	ACB-2UA48W	-	-	-	-	-	-
P100AP-4C ¹	170 (1,172)	250 (1,724)	-	-	ACB-2UA631W	-	-	SFC170250	-	-	-
P100AP-362C ¹	195 (1,344)	240 (1,654)	-	3100-080	-	-	-	-	-	-	-
P100AP-200C ¹	195 (1,344)	275 (1,895)	-	-	-	-	-	-	-	-	-

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P100 Series Encapsulated Pressure Switches (Continued)

Replaces:													
Product Code Number	Switch Action	Setpoints - psig (kPa)		Ranco®	Robertshaw®	Saginomiya	Danfoss®	Klixon®	Supco	Wilspec	International Refrigeration Products	Gemline	
		Opens	Closes										
P100AP-354C ¹	Open on Pressure Drop	210 (1,447)	275 (1,895)	-	-	ACB-2UA319W	-	-	SFC210275	-	SFC210275	-	
P100EE-79C		300 (2,068)	370 (2,551)	-	-	-	-	-	-	-	-	-	
P100AP-332C ¹	Open on Pressure Rise	300 (2,068)	400 (2,758)	MPF7010	-	ACB-2UA627W	061F7514	-	SFC300400	-	-	-	
P100CP-157C		225 (1,550)	150 (1,034)	-	-	-	-	-	-	-	-	-	
P100CP-158C		250 (1,723)	150 (1,034)	-	-	-	-	PS80-K1-0336-250-150	SHP250150	HR202A250150D	SHP250150	-	
P100CP-159C		270 (1,860)	200 (1,378)	-	-	-	-	-	-	-	-	-	
P100CC-9C ²		275 (1,896)	175 (1,207)	-	3100-112	ACB-2UB724W	-	-	-	-	-	-	
P100CP-91C		300 (2,067)	200 (1,378)	-	-	ACB-2UB723W	-	-	PS80-K1-0341-300-200	-	HR202A300200D	SHP300200	-
P100CP-166C		325 (2,239)	225 (1,550)	-	-	-	061F6080	-	PS80-K1-0346-320-230	SHP325225	HR202A325230D	-	-
P100CP-140C		350 (2,412)	245 (1,688)	-	3100-150	ACB-2UB273W	061F3212	-	PS80-K1-0348-350-245	-	HR202A350245D	SHP350250	-
P100CP-160C		375 (2,584)	275 (1,895)	-	-	ACB-2UB191	061F7509	-	-	-	-	SHP375265	-
P100CP-161C		400 (2,756)	200 (1,378)	-	3100-152	-	-	-	PS80-K1-0357-400-200	SHP400200	HR202A400200D	SHP400200	-
P100CP-162C	400 (2,756)	280 (1,929)	-	-	-	-	-	PS80-K1-0358-400-280	SHP400280	HR202A400280D	SHP400280	-	
P100EE-78C	400 (2,756)	300 (2,068)	-	-	-	-	-	-	-	-	-	-	
P100CP-1C	400 (2,758)	300 (2,068)	MPH-7107	3100-151	ACB-2UB35	061FS14	-	PS80-K1-0359-400-300	SHP400300	HR202A400300D	SHP400300	PC 151	
P100CP-156C	410 (2,825)	290 (1,998)	-	-	-	-	-	-	-	-	-	-	
P100CP-163C	425 (2,928)	300 (2,067)	-	-	-	-	-	PS80-K1-0360-425-300	SHP425300	HR202A425300D	SHP425300	-	
P100CP-2C	425 (2,930)	325 (2,241)	MPH-7106	3100-100	ACB-2UB282W	-	-	-	SHP425325	-	-	PC 100	
P100CP-164C	450 (3,101)	250 (1,723)	-	-	-	-	-	PS80-K1-0363-450-250	SHP450250	HR202A450250D	SHP450250	-	
P100CP-38C	500 (3,447)	325 (2,241)	-	-	-	-	-	-	-	-	-	-	
P100CP-165C	600 (4,134)	475 (3,273)	HR000011B1R704	-	-	-	061F7517	-	SHP600475	-	-	-	
P100CP-85C	665 (4,585)	565 (3,895)	-	-	-	-	-	-	SHP665565	-	-	-	

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P100 Series Encapsulated Pressure Switches (Continued)

Selection Chart (Part 3 of 3)

Product Code Number	Switch Action	Setpoints - psig (kPa)		Replaces:									
		Opens	Closes	Ranco®	Robertshaw®	Saginomiya	Danfoss®	Klixon®	Supco	Wilspec	International Refrigeration Products	Gemline	
P100DA-35C	Open on Pressure Rise	350 (2,413)	Lockout Manual Reset	-	-	ACBPC45M	-	-	-	-	-	-	-
P100DC-3C ³		375 (2,586)	Lockout Manual Reset	-	-	-	-	-	-	-	SMR375	-	-
P100DA-1C		410 (2,827)	Lockout Manual Reset	-	-	ACBPC115M	-	29PSL012-24	SMR410	HM202A410000D	SMR410	PC 103	-
P100DA-100C		415 (2,859)	Lockout Manual Reset	-	-	-	-	29PSL004-1	-	-	HM202A415000D	SMR410	-
P100DA-101C		440 (3,032)	Lockout Manual Reset	-	-	-	-	-	SMR440	-	-	SMR440	-
P100DA-2C		475 (3,275)	Lockout Manual Reset	-	-	-	-	-	-	-	HM202A475000D	-	-
P100DA-86C		575 (3,964)	Lockout Manual Reset	-	-	-	-	-	SMR575	-	-	-	-
P100DA-81C		630 (4,343)	Lockout Manual Reset	-	-	-	-	-	SMR630	-	-	-	-

1. Models are designed for condenser fan cycling.
2. Includes conduit clamp for 3/8 in. flexible metal conduit.
3. Includes conduit box with opening for 1/2 in. conduit connector.

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P499 Series Electronic Pressure Transducers

Description

The P499 Series Electronic Pressure Transducers are compact, economical, rugged, direct-mount pressure transducers designed for use in commercial refrigeration and air conditioning applications. These transducers produce an analog signal based on the sensed pressure.

The P499 Series transducers feature environmentally protected electronics with stainless steel construction. The digitally compensated P499 transducers are highly accurate over a broad temperature range, resisting the effects of wide ambient temperature swings, high humidity, condensation, and icing.

The pressure port is machined from a solid piece of 17-4PH stainless steel. No O-rings, organic materials, or welds are exposed to the pressure media, allowing for a leak-proof, all-metal, sealed pressure system.

The P499 Series transducers operate with any corrosive or non-corrosive pressure medium that is compatible with 17-4PH stainless steel, including water, condensate, carbon dioxide, glycol, most refrigerants (including ammonia), and many other compatible fluids and gases.

The P499 Series provides transducers in a variety of pressure ranges, covering most common refrigeration and air conditioning applications.

Features

- single-piece machined 17-4PH stainless steel pressure port provides a durable assembly that eliminates refrigerant loss due to O-ring or weld failures; resists damage due to physical shock, vibration, and pressure pulsations; enables use with non-corrosive or corrosive pressure media that is compatible with 17-4PH stainless steel.
- environmentally protected electronics withstand the effects of adverse conditions associated with typical HVAC/R applications, including freeze/thaw applications on suction lines.
- reliable, repeatable performance and long operating life minimizes service and replacement costs.
- many available pressure ranges provide a single line of transducers for all refrigeration and air conditioning application needs.
- 1% total error band provides high-accuracy performance.
- slender body design facilitates use of deep-socket wrenches for ease of installation; requires zero turning radius.
- CE and UL agency listings allow for global applications.



P499 Electronic Pressure Transducers; Style 47 Fitting Shown on the Left and Style 49 Fitting Shown on the Right

Refer to the *P449 Series Electronic Pressure Transducer Product/Technical Bulletin (LIT-12011190)* for important product application information.

Repair Information

If the P499 Series Electronic Pressure Transducer fails to operate within its specifications, replace the unit. For a replacement transducer, contact the nearest Johnson Controls® representative.

Accessories

P499 transducers require wire harnesses for all models that do not have an integral cable.

Wire Harnesses with Packard Electrical Connectors

Product Code Number ¹	Length
WHA-PKD3-200C	6-1/2 ft (2.0 m)
WHA-PKD3-400C	13 ft (4.0 m)
WHA-PKD3-600C	19-5/8 ft (6.0 m)

1. Wire harnesses for P399 transducers and P499 transducers are interchangeable.

Selection Chart

0.5 to 4.5 VDC Ratiometric P499 Transducer Models with Packard Electrical Connections, psis

Product Code Number	Pressure Connection	Pressure Range ¹		Individual or Kit ²
		Minimum Pressure (Pmin)	Maximum Pressure (Pmax)	
P499RAPS100C	1/8 in. 27 NPT External Thread (Style 49)	-10 psis (-0.7 bar)	100 psis (6.9 bar)	Individual
P499RAPS100K		[20 in. Hg]		Kit
P499RAPS102C		0 psis (0 bar)	200 psis (13.8 bar)	Individual
P499RAPS102K				Kit
P499RCPS100C	1/4 in. SAE 45° Flare Internal Thread (7/16-20 UNF) with Depressor (Style 47)	-10 psis (-0.7 bar)	100 psis (6.9 bar)	Individual
P499RCPS100K		[20 in. Hg]		Kit
P499RAPS102C		0 psis (0 bar)	200 psis (13.8 bar)	Individual
P499RAPS102K				Kit

1. Transducer sealed and rated for IP67 harsh environments.

2. The **Individual** pack comes with a transducer only - you must order the wire harness separately. The **Kit** is packaged with a transducer, 6-1/2 ft (2 m) wire harness, and technical documentation.



P499 Series Electronic Pressure Transducers (Continued)

0.5 to 4.5 VDC Ratiometric P499 Transducer Models with Integral 2 m (6-1/2 ft) Shielded Cable, psis

Product Code Number	Pressure Connection	Pressure Range ¹	
		Minimum Pressure (Pmin)	Maximum Pressure (Pmax)
P499RCSS101C	1/4 in. SAE 45° Flare Internal Thread (7/16-20 UNF) with Depressor (Style 47)	0 psis (0 bar)	100 psis (6.9 bar)

1. Transducer sealed and rated for IP67 harsh environments.

0.5 to 4.5 VDC Ratiometric P499 Transducer Models with Packard Electrical Connections, psi

Product Code Number	Pressure Connection	Pressure Range		Individual or Kit ¹
		Minimum Pressure (Pmin)	Maximum Pressure (Pmax)	
P499RAP-101C	1/8 in. 27 NPT External Thread (Style 49)	0 psi (0 bar)	100 psi (6.9 bar)	Individual
P499RAP-101K				Kit
P499RAP-102C		0 psi (0 bar)	200 psi (13.8 bar)	Individual
P499RAP-105C		0 psi (0 bar)	500 psi (34.5 bar)	Individual
P499RAP-105K				Kit
P499RAP-107C		0 psi (0 bar)	750 psi (51.7 bar)	Individual
P499RAP-107K				Kit
P499RCP-101C	1/4 in. SAE 45° Flare Internal Thread (7/16-20 UNF) with Depressor (Style 47)	0 psi (0 bar)	100 psi (6.9 bar)	Individual
P499RCP-101K				Kit
P499RCP-105C		0 psi (0 bar)	500 psi (34.5 bar)	Individual
P499RCP-105K				Kit
P499RCP-107C		0 psi (0 bar)	750 psi (51.7 bar)	Individual
P499RCP-107K				Kit

1. The **Individual** pack comes with a transducer only - you must order the wire harness separately. The **Kit** is packaged with a transducer, 6-1/2 ft (2 m) wire harness, and technical documentation.

0 to 10 VDC P499 Transducer Models with Packard Electrical Connections, psi

Product Code Number	Pressure Connection	Pressure Range		Individual or Kit ¹
		Minimum Pressure (Pmin)	Maximum Pressure (Pmax)	
P499VAP-101C	1/8 in. 27 NPT External Thread (Style 49)	0 psi (0 bar)	100 psi (6.9 bar)	Individual
P499VAP-101K				Kit
P499VAP-105C		0 psi (0 bar)	500 psi (34.5 bar)	Individual
P499VAP-105K				Kit
P499VAP-107C		0 psi (0 bar)	750 psi (51.7 bar)	Individual
P499VAP-107K				Kit
P499VCP-101C		1/4 in. SAE 45° Flare Internal Thread (7/16-20 UNF) with Depressor (Style 47)	0 psi (0 bar)	100 psi (6.9 bar)
P499VCP-101K				Kit
P499VCP-105C	0 psi (0 bar)		500 psi (34.5 bar)	Individual
P499VCP-105K				Kit
P499VCP-107C	0 psi (0 bar)		750 psi (51.7 bar)	Individual
P499VCP-107K				Kit

1. The **Individual** pack comes with a transducer only, you must order the wire harness separately. The **Kit** is packaged with a transducer, 6-1/2 ft (2 m) wire harness, and technical documentation.

4 to 20 mA P499 Transducer Models with Packard Electrical Connections, psi (Part 1 of 2)

Product Code Number	Pressure Connection	Pressure Range		Individual or Kit ¹
		Minimum Pressure (Pmin)	Maximum Pressure (Pmax)	
P499AAP-101C	1/8 in. 27 NPT External Thread (Style 49)	0 psi (0 bar)	100 psi (6.9 bar)	Individual
P499AAP-101K				Kit
P499AAP-105C		0 psi (0 bar)	500 psi (34.5 bar)	Individual
P499AAP-105K				Kit
P499AAP-107C		0 psi (0 bar)	750 psi (51.7 bar)	Individual
P499AAP-107K				Kit



P499 Series Electronic Pressure Transducers (Continued)

4 to 20 mA P499 Transducer Models with Packard Electrical Connections, psi (Part 2 of 2)

Product Code Number	Pressure Connection	Pressure Range		Individual or Kit ¹
		Minimum Pressure (Pmin)	Maximum Pressure (Pmax)	
P499ACP-101C	1/4 in. SAE 45° Flare Internal Thread (7/16-20 UNF) with Depressor (Style 47)	0 psi (0 bar)	100 psi (6.9 bar)	Individual
P499ACP-101K				Kit
P499ACP-105C		0 psi (0 bar)	500 psi (34.5 bar)	Individual
P499ACP-105K				Kit
P499ACP-107C		0 psi (0 bar)	750 psi (51.7 bar)	Individual
P499ACP-107K				Kit

1. The **Individual** pack comes with a transducer only, you must order the wire harness separately. The **Kit** is packaged with a transducer, 6-1/2 ft (2 m) wire harness, and technical documentation.

Technical Specifications

P499 Series Electronic Pressure Transducers		
Pressure Ranges		-10 to 100 psis, 0 to 100 psi, 0 to 200 psi, 0 to 500 psi, 0 to 750 psi
Maximum Working Pressure		2x Pressure Range; short duration; infrequent, abnormal condition
Burst Pressure		5x Pressure Range
Vacuum		30 microns (0.03 mm Hg); short term
Media Compatibility		All media compatible with 17-4PH stainless steel, including ammonia
Output Signal		0.5 to 4.5 VDC, 0 to 10 VDC, or 4 to 20 mA
Supply Voltage	0.5 to 4.5 VDC Ratiometric Output	5.0 ±0.25 VDC, Safety Extra-Low Voltage (SELV) or Class 2
	4 to 20 mA Output	9 to 30 VDC, SELV or Class 2
	0 to 10 VDC Output	12 to 30 VDC, SELV or Class 2
Direct-Mount Pressure Connections		1/8 in. 27 NPT External Thread (Style 49), 1/4 in. SAE 45° Flare Internal Thread (7/16-20 UNF) with Depressor (Style 47)
Temperature and Humidity	Storage	-40 to 257°F (-40 to 125°C)
	Operating	-40 to 185°F (-40 to 85°C)
	Compensated Range	-4 to 185°F (-20 to 85°C)
	Humidity	0 to 100% RH
Linearity		±0.25% Full Span best fit straight line
Accuracy		±1% Full Span (maximum) over compensated temperature range
Materials	Pressure Port	17-4PH stainless steel construction
	Packard Connector	40% glass-filled Polyetherimide (PEI)
Vibration		20G, 20 to 200 Hz
Shock		200G/11 ms
Compliance	United States	UL Listed, File E29374, CCN NKPZ UL Recognized for Use in Class I, Division 2 Hazardous Locations, File E322274
	Canada	UL Listed, File E29374, CCN NKPZ7 UL Recognized for Use in Class I, Division 2 Hazardous Locations, File E322274
	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 2004/108/EC.
	Australia/ New Zealand	C-Tick Mark, Emissions Compliant

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R310A Series Current Sensing Switch

Description

The R310A Series Current Sensing Switch detects alternating current (AC) flow in a single circuit without being connected to that circuit. It may be used in any application where current detection is required.

The R310A replaces the R10A used with Johnson Controls/PENN® time delay oil failure cutout controls such as the P28, P45, and P445. These applications incorporate internal line breaking overload protection, where lockout due to overload cycling is unacceptable or undesirable. The R310A switch is not intended to detect breakage of belts.

The R310A is molded in a high dielectric material, which permits mounting inside a starter or contactor.

Refer to the *R310A Series Current Sensing Switch Product Bulletin (LIT-121536)* for important product application information.

Features

- small size allows mounting in small enclosure
- solid-state switching contains no moving parts to fail
- low 0.5 ampere activation allows monitoring of most small equipment circuit loads
- high 200 ampere monitoring capacity allows monitoring of heavy duty equipment
- large 0.70 in. (18 mm) diameter sensor hole accepts large diameter wire sizes and multiple coilings of smaller diameter wire sizes

Applications

The R310A Current Sensing Switch is designed to sense alternating current in a conductor that passes through its opening. The R310A sensor closes an electronic switch if the alternating current in the conductor exceeds 0.5 amperes. Thus, the R310A switch may be used for several purposes:

- switch a pilot circuit
- energize a run signal on a device such as a fan, motor, or pump
- monitor motors and electrical loads for proper operation
- monitor on/off status of process motors

The R310A Series Current Sensing Switch is available in two models. The R310AD-1 switch is for use in low-voltage applications, such as with the P445 Electronic Lube Oil Control. The R310AE-2 switch is for use in high-voltage applications, such as with the P28 and P45 Electromechanical Lube Oil Controls.

The R310A switch avoids nuisance lockouts by sensing the lack of current flow to the motor. Regardless of the reason for motor shutdown, the lube oil control time delay circuit is de-energized when the current flow in the motor supply line drops below 0.5 amperes.

In a typical application, the lube oil control does not lock out when the control circuit shuts off the compressor. However, if the compressor overheats and the internal thermal overload circuits open, the compressor shuts itself down, which causes the oil pressure to drop. This drop in oil pressure will energize the lube oil control heater (P28, P45) or timer (P445), causing a



R310A Series Current Sensing Switch

nuisance lockout. In this situation, the R310 switch senses the lack of current to the motor, and is used to de-energize the time delay heater (P28, P45) or electronic timer (P445) before a nuisance lockout occurs.

Repair Information

If the R310A Series Current Sensing Switch fails to operate within its specifications, replace the unit. For a replacement switch, contact the nearest Johnson Controls® representative.

Selection Chart

Product Code Number	Description
R310AD-1C	Current Sensing Switch Voltage switching capacity: 0 to 30 VAC Used with: P445 Electronic Lube Oil Control
R310AE-2C	Current Sensing Switch Voltage switching capacity: 120 to 240 VAC Used with: P28 and P45 Electromechanical Lube Oil Controls

Technical Specifications

R310A Series Current Sensing Switch		
Switch Action	SPST, normally open	
Current Sensing Range	R310AD-1C	0.5 to 200 Amperes
	R310AE-2C	0.75 to 200 Amperes
Switch Threshold	R310AD-1C	0.5 Amperes
	R310AE-2C	0.75 Amperes
Sensor Supply Voltage	Induced from monitored conductor, isolation 600 VAC RMS	
Switching Capacity (General Purpose)	R310AD-1C	0.1A at 30 VAC/DC
	R310AE-2C	0.5 at 250 VAC/DC
Output Polarity	Non-polarity sensitive output	
Enclosure	NEMA 1	
Ambient Operating Conditions	5 to 140°F (-15 to 60°C); 0 to 95% RH, noncondensing	
Ambient Storage Conditions	-40 to 158°F (-40 to 70°C); 0 to 95% RH	
Dimensions (H x W x D)	2.34 x 1.85 x 0.875 in. (59 x 46 x 22 mm)	
Sensor Hole Size	7/10 in. (17 mm) Diameter	
Agency Listings	UL Guide NRNT cUL Guide NRNT7	



Universal Mounting Brackets

Description

The 271-51 is the universal mounting bracket used with many Johnson Controls/PENN® products. BKT38A-601R contains one mounting bracket with screws. BKT38A-600R contains five 271-51 angle mounting brackets with screws.

Selection Chart

Product Code Number	Description
271-51	Universal Mounting Bracket
BKT38A-600R	Five Universal Mounting Brackets with ten screws



271-51
Universal Mounting Bracket



SEC99A UltraCap Armored Capillary

Description

The SEC99A UltraCap Armored Capillary is designed for use as a pressure connection in refrigeration and air conditioning applications. This small-orifice capillary minimizes pressure pulsation, and the brass armor sleeve improves resistance to abrasion caused by vibration. The copper capillary inside the armored sleeve allows no effusion of refrigerant to the environment.

UltraCap is designed for use with 1/4 in. SAE external flare fitting connectors, such as those found on the Johnson Controls/PENN® lines of pressure-actuated controls. Integral Schrader valve depressors are available.

UltraCap Armored Capillary is compatible with all common non-corrosive refrigerants. The UltraCap capillary is available in a variety of lengths, and in models with two straight fittings or with one straight fitting and one 90° elbow fitting.



SEC99AB and SEC99AA UltraCap Armored Capillaries

Selection Chart

Product Code Number	Description
Schrader Depressor in One End	
SEC99AA-18C	Two straight fittings Length: 18 in. (457 mm)
SEC99AA-24C	Two straight fittings Length: 24 in. (610 mm)
SEC99AA-36C	Two straight fittings Length: 36 in. (914 mm)
SEC99AA-48C	Two straight fittings Length: 48 in. (1,219 mm)
SEC99AA-60C	Two straight fittings Length: 60 in. (1,524 mm)
Schrader Depressor in Both Ends	
SEC99AB-18C	One straight and one 90° fitting Length: 18 in. (457 mm)
SEC99AB-24C	One straight and one 90° fitting Length: 24 in. (610 mm)
SEC99AB-36C	One straight and one 90° fitting Length: 36 in. (914 mm)
SEC99AB-48C	One straight and one 90° fitting Length: 48 in. (1,219 mm)
SEC99AB-60C	One straight and one 90° fitting Length: 60 in. (1,524 mm)

Repair Information

If the SEC99A UltraCap Armored Capillary fails to operate within its specifications, replace the unit. For a replacement capillary, contact the nearest Johnson Controls® representative.

Technical Specifications

SEC99A UltraCap Armored Capillary	
Capillary Diameters	Inside: 0.062 in. (1 mm); Outside: 0.125 in. (3 mm)
Temperature Range	-50 to 350°F (-46 to 177°C)
Burst Pressure	3,000 psig (20,685 kPa)
Maximum Working Pressure	600 psig (4,137 kPa)
Suggested Torque to Seal	8 to 10 lb-ft (10.9 to 13.6 N-m)
Fittings: Straight	1/4 in. Internal Flare Connector with Schrader Depressor
90° Elbow	1/4 in. Internal Flare Connector with Schrader Depressor
Material	Forged Brass Nut with Copper Stem
Agency Listings	UL Recognized: File SA9457, CCN SFCS2 UL Recognized for Canada: SA9457, CCN SFCS8



RLD-H10PRO Refrigerant Leak Detector

Description

The RLD-H10PRO is a professional-grade leak detector for use by refrigeration and air conditioning technicians. This detector senses all CFC, HCFC, and HFC refrigerants and blends, such as R12, R22, R134a, R404a, R410a, R502, and R507 among others. The RLD-H10PRO is self-powered with a rechargeable battery and provides both manual and automatic compensation for background levels of refrigerant. A full line of accessories and maintenance kits are also available, including replacement sensors, tuneup kits, probe extensions, battery chargers, and leak vial bottles.

Refer to the *RLD-H10PRO Refrigerant Leak Detector Product Bulletin (LIT-12012073)* for important product application information.

Features

- positive ion emission heated diode sensor provides the most sensitivity available today, while still detecting all halogenated refrigerant gases

- rechargeable battery with low and full charge LEDs enhances portability—no external power required
- high quality air pump supplies constant airflow to the sensor so it responds quickly to leaks; also helps the sensor recover quickly after exposure to a refrigerant so the leak can be verified
- switchable adjustment for manual or automatic balance allows users to choose their preferred method of compensation for background refrigerant levels
- visual and audible signal facilitates sensing in noisy equipment rooms with 360° visibility and a piercing tone. Frequency of noise and light indicates the magnitude of the leak.
- headset jack allows users to hear the leak detector response in noisy environments
- external calibration source and calibration indicators indicate when the sensor is working properly and serves as a reference point to judge leak size



RLD-H10PRO Refrigerant Leak Detector

Repair Information

If the RLD-H10PRO Refrigerant Leak Detector fails to operate within its specifications, contact Johnson Controls@ application engineering at (414) 524-5535.

Selection Chart

Product Code Number	Description
RLD-H10PRO-1	Refrigerant leak detector and charger

Accessories

Product Code Number	Description
RLD-H10-100	14 inch flexible probe extension
RLD-H10-101	120 VAC power supply adaptor
RLD-H10-102	Cigarette lighter adaptor
RLD-H10-103	Replacement battery charger
RLD-H10-105	Belt pack battery
RLD-H10-600R	Tuneup kit: includes sensor, 100 filters, three airflow balls, three rubber probe tips, and leak vial
RLD-H10-601R	Replacement sensor
RLD-H10-602R	Maintenance kit: includes 100 filters, three airflow balls, three rubber probe tips, and leak vial
RLD-H10-603R	Replacement leak vial
RLD-H10-604R	Replacement for RLD-H10PRO internal battery
RLD-H10-606R	Clear plastic probe tip
RLD-H10-607R	Probe replacement assembly

Technical Specifications

RLD-H10PRO Refrigerant Leak Detector		
Power Requirements	12 VDC internal battery, or 100 to 240 VAC input/18 V output wall adaptor (included) (RLD-H10-101).	
Sensing Element Type	Positive ion emission heated diode	
Approximate Sensitivity¹	Stationary	0.006 oz./yr
	Moving (Per SAE J2791)	0.1 oz./yr
Automatic Background Adjustment	Mode selection for automatic or manual background zeroing Manual background zeroing provides the best sensitivity.	
Leak Alarm	Audible alarm (through internal beeper or stereo headphone jack), visible red LED	
Response Time	Approximately 1 second	
Warmup Time	Approximately 2 minutes	
Probe Length	Approximately 4-1/2 ft (1.4 m)	
Ambient Operating Conditions	32 to 104°F (0 to 40°C); 5-90% RH, noncondensing	
Ambient Storage Conditions	14 to 140°F (-10 to 60°C); 5-90% RH, noncondensing	
Case	Rugged high-density polyethylene	
Dimensions (H x W x D)	5-2/5 x 10-1/2 x 8-3/10 in. (137 x 267 x 211 mm)	
Compliance	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 2004/108/EC.	
Shipping Weight	5.1 lb (2.3 kg)	

1. Sensitivity for R12, R22, R134a, R410a, R404a, and R507 when unit is set to small leak setting, manual mode.










RLD Refrigerant Leak Detector Accessories and Replacement Parts

Description

These parts are used on the RLD-H10G-1 and on the RLD-H10PRO-1.

Selection Chart

Product Code Number	Description	Figure
RLD-H10-100	14 in. Flexible Probe Extension	
RLD-H10-600R	Tune-up Kit; Includes: One Sensor, 100 Filters, Three Airflow Indicator Balls, Three Probe Tips, One Leak Vial	
RLD-H10-601R	Replacement Sensor	
RLD-H10-602R	Maintenance Kit; Includes: 100 Replacement Filters, Three Airflow Indicator Balls, Three Probe Tips	
RLD-H10-603R	Replacement Leak Vial	
RLD-H10-606R	Replacement Clear Plastic Probe Tip	
RLD-H10-607R	Replacement Probe Assembly	

The performance specifications are nominal and conform to acceptable industry standards. For applications at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products. © 2015 Johnson Controls, Inc. www.johnsoncontrols.com



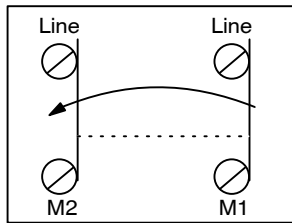
F59 Series Sump Pump Switch

Description

The F59 Series Controls are designed to start an electric motor on liquid level rise and stop the motor on liquid level drop. The control cuts in when upper weight is submerged approximately halfway, and cuts out when lower weight is approximately half-exposed. Each switch includes 36 in. cable and two weights.

Refer to the *F59 Series Liquid Level Switch for Sump Operations Product Bulletin (LIT-125215)* for important product application information.

Type F59A, F59H



Action on Rise in Liquid Level

F59 Series Action Diagram

f59.eps



F59A-2 Sump Pump Switch

F59H-1 Sump Pump Switch

Selection Charts

Product Code Number	Contact Action	Mounting	Range Adjuster
F59A-1C	Double-Pole, Single-Throw (DPST)	External mounting bracket	Drop cord wiring
F59A-2C	DPST	External mounting – includes universal mounting bracket and 24 in. strap for quick, easy mounting on the motor, on the pedestal or on the discharge pipe.	Drop cord wiring
F59H-1C	DPST	External mounting bracket	Conduit wiring –7/8 in. conduit openings in case

Features

F59D-5 is equipped with a power cord and a piggyback style plug. The external prongs plug into the wall outlet, and the sump pump cord plugs into the internal end of the plug.

Applications

Use for On/Off control of sump pumps.

Technical Specifications

Electrical Ratings

Volts	Horsepower
F59A-1	
120 VAC	1 hp
240 VAC	1 hp
32 VDC	1/4 hp
F59A-2	
120 VAC	1 hp
240 VAC	1 hp
32 VDC	1/4 hp
F59D-5	
120 VAC	1/2 hp
F59H-1	
120 VAC	1 hp
240 VAC	1 hp
32 VDC	1/4 hp

Replacement Parts

Product Code Number	Replacement Weight Kit for F59 Series
WGT11A-600R	Two Weights (Floats), 40 in. Plastic Cable, Weights with 3 in. Polyethylene Cable
WGT11A-604R	Two Weights (Floats), 36 in. Monel Wire, Two Float Support Plates, Weights with 3 in. Monel Cable



F261 Series Fluid Flow Switches

Description

The F261 Series Flow Switches respond to fluid flow in lines carrying water, ethylene glycol, or other nonhazardous fluids. These models also work in applications with swimming pool water and lubricating oils.

F261 Series Standard Flow Switches use a variety of paddle sizes to respond to fluid flow rates in applications with pipe sizes greater than 1 inch trade size.

Refer to the *F261 Series Fluid Flow Switches Product Bulletin (LIT-12011987)* for important product application information.

Features

- Type 3R (NEMA) or Type 4 (NEMA) enclosure allows use in indoor or outdoor applications.
- Viton® diaphragms allow use in fluid lines carrying chlorinated water, treated water, or other nonhazardous fluids.
- low-flow operation on low-flow models actuates switch with less than 1.0 GPM (3.8 L/min) flow for water applications or 9.0 GPM (34.1 L/min) flow for steam applications.
- maximum fluid pressure of 290 psig (20 bar) permits use in a wide range of pressure flow conditions.



F261 Flow Switch

Repair Information

If the F261 Series Flow Switch fails to operate within its specifications, replace the unit. For a replacement F261 Series Flow Switch, contact the nearest Johnson Controls® representative.

Selection Chart

F261 Series Standard Model Flow Switches

Product Code Number	Description
F261KAH-V01C	Standard model flow switch with Type 3R (NEMA) enclosure; 1 in., 2 in., 3 in., and 6 in. stainless steel paddles, lock-tooth washer, and stainless steel paddle screw supplied uninstalled
F261MAH-V01C	Standard model flow switch with Type 4 (NEMA) enclosure; 1 in., 2 in., 3 in., and 6 in. stainless steel paddles, lock-tooth washer, and stainless steel paddle screw supplied uninstalled
F261MAL-V01C	Standard model flow switch with Type 4 (NEMA) enclosure; 1 in., 2 in., 3 in., and 6 in. stainless steel paddles, lock-tooth washer, and stainless steel paddle supplied uninstalled.

F261 Series Low-Flow Model Flow Switches

Product Code Number	Description
F261KEH-V01C	Low-flow model flow switch with Type 3R (NEMA) enclosure; 1/2 in. x 1/2 in. External NPTF inlet and outlet
F261KFH-V01C	Low-flow model flow switch with Type 3R (NEMA) enclosure; 3/4 in. x 3/4 in. External NPTF inlet and outlet
F261KFH-V02C	Low-flow model flow switch with Type 3R (NEMA) enclosure; 3/4 in. x 3/4 in. External NPTF inlet and outlet
F261MEH-V01C	Low-flow model flow switch with Type 4 (NEMA) enclosure; 1/2 in. x 1/2 in. External NPTF inlet and outlet
F261MFH-V01C	Low-flow model flow switch with Type 4 (NEMA) enclosure; 3/4 in x 3/4 in. External NPTF inlet and outlet

Replacement Paddle Parts

Product Code Number	Description
KIT21A-600	Stainless steel three-piece paddle (3 in., 2 in., and 1 in. segments)
KIT21A-601	Stainless steel 6 in. paddle
PLT52A-600R	Stainless steel three-piece paddle (3 in., 2 in., and 1 in. segments) and Stainless steel 6 in. paddle

Technical Specifications

F261xxH Series Standard Controls Electrical Ratings

Volts, 50/60 Hz	UL60730/UL1059				EN60730	
	24	120	208	240	24	230
Horsepower	–	1	1	1	–	–
Full Load Amperes	–	16	10	10	–	8
Locked Rotor Amperes	–	96	60	60	–	48
Resistive Amperes	16	16	10	10	16	16
Pilot Duty VA	125	720	720	720	77	720



F261 Series Fluid Flow Switches (Continued)

UL Conformity Declaration Information

Information	Description
Purpose of Control	F261 Fluid Flow Switch
Construction of Control	Electronic independently mounted control
Number of Cycles	100,000 cycles
Method of Mounting Control	Mounting to sensed media vessel/orientation
Type 1 or Type 2 Action	Type 1.C (Microinterruption)
External Pollution Situation	Pollution degree 4
Internal Pollution Situation	Pollution degree 2
Rated Impulse Voltage	4,000 VAC
Ball Pressure Temperature	Enclosure: 266°F (130°C) Switch Component: 252°F (122°C)
Control Adjustment Instruction	-
Field Wiring Rating	Wire/Cord Temperature Ratings: 140°F (60°C) only permitted when ambient air and media are less than 113°F (45°C) 167°F (75°C) only permitted when ambient air and media are less than 140°F (60°C) 194°F (90°C) only permitted when ambient air is less than 140°F (60°C) and media is less than 167°F (75°C) 302°F (150°C) permitted when ambient air is less than 140°F (60°C) and media is less than 249°F (121°C)
Vessel Pressure	F261 Fluid Flow Switch: 290 psi (20 Bar)

F261 Series Fluid Flow Switches	
Switch	Single-Pole, Double-Throw (SPDT)
Enclosure	UL: Type 3R or Type 4 CE: IP43 (IP23 with drain hole plug removed) or IP67
Wiring Connections	Three color-coded screw terminals and one ground terminal
Conduit Connection	One 7/8 in. (22 mm) hole for 1/2 in. trade size (or PG16) conduit
Pipe Connector	Standard: 1 in. 11-1/2 NPT Threads
Maximum Fluid Pressure	290 psi (20 bar)
Minimum Fluid Temperature ¹	-20°F (-29°C)
Maximum Fluid Temperature ²	250°F (121°C)
Ambient Conditions	-40 to 140°F (-40 to 60°C)
Compliance	<p>North America: cULus Listed; UL 60730, File E6688; FCC Compliant to CFR47, Part 15, Subpart B, Class B Industry Canada (IC) Compliant to Canadian ICES-003, Class B limits</p> <p>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 and the Low Voltage Directive.</p> <p>Australia/New Zealand Mark: RCM Compliant</p>



1. Ensure that the low liquid temperature combined with the low ambient temperature does not lead to the freezing the liquid inside the body (or bellows, where appropriate). Please observe the liquid freezing point.
2. At higher ambient temperatures, the maximum allowed liquid temperature becomes lower. The temperature of the electrical switch inside should not exceed 158°F (70°C).



F262 Airflow Switch

Description

The F262 Airflow Switch detects airflow or the absence of airflow by responding only to the velocity of air movement within a duct. The single-pole, double-throw (SPDT) control can be wired to open one circuit and close a second circuit for either signaling or interlock purposes.

Airflow failure during the normal operation of air handling systems may cause overheating, coil icing, or other conditions that may be detrimental to the equipment.

Refer to the *F262 Airflow Switch Product Bulletin (LIT-12011988)* for important product application information.

Application

The F262 switch detects airflow or the absence of airflow by responding only to the velocity of air movement within a duct. The SPDT control can be wired to open one circuit and close a second circuit for either signaling or interlock purposes.

Failure of airflow during the normal operation of air handling systems may cause overheating, coil icing, and other conditions that may be detrimental to the equipment.

Typical applications include:

- Make-up air systems
- Air cooling or heating processes
- Exhaust systems

The control has a Type 3R (NEMA) enclosure with an integral mounting plate. A mounting plate gasket is supplied with each switch.

Features

- Type 3R (NEMA) Polycarbonate enclosure allows use in indoor applications and provides dust protection and is approved for use in a plenum according to NEC
- dependable dust-protected SPDT snap-acting PENN switch detects the presence or absence of airflow
- large wiring space makes wiring convenient and easily accessible
- easily accessible range adjustment screw allows easy field adjustment



F262 Airflow Control

Repair Information

If the F262 Airflow Switch fails to operate within its specifications, replace the unit. For a replacement F262 Airflow Switch, contact the nearest Johnson Controls® representative.

Selection Charts

F262 Airflow Switch

Product Code Number	Description
F262KDH-01C	Airflow switch with a 2-1/8 in. wide x 6-7/8 in. long (54 mm x 175 mm) paddle installed and a 3-1/8 in. wide x 6-7/8 in. long (79 mm x 175 mm) paddle supplied with the control

Replacement Paddle Kits for F262 Switch

Product Code Number	Description
PLT112-1R	2-1/8 in. wide x 6-7/8 in. long (54 mm x 175 mm) paddle
PLT112-2R	3-1/8 in. wide x 6-7/8 in. long (79 mm x 175 mm) paddle


Technical Specifications

F262 Switch Electrical Ratings

Volts 50/60 Hz	UL60730				EN60730	
	24	120	208	240	24	230
Horsepower	–	1	1	1	–	–
Full Load Amperes	–	16	10	10	–	8
Locked Rotor Amperes	–	96	60	60	–	48
Resistive Amperes	16	16	10	10	16	16
Plot Duty VA	125	720	720	720	125	720



F262 Airflow Switch (Continued)

F262 Series Airflow Switch	
Switch	SPDT
Enclosure	UL: Type 3R CE: IP43
Wiring Connections	Three color-coded screw terminals and one ground terminal
Conduit Connection	One 7/8 in. (22 mm) hole for 1/2 in. trade size (or PG16) conduit
Paddle Material	0.006 in. (0.15 mm) stainless spring steel
Maximum Air Velocity	2,000 FPM (10.16 m/s)
Maximum Duct Air Temperature	176°F (80°C)
Ambient Conditions	32 to 104°F (0 to 40°C)
Compliance 	North America: cULus Listed; UL 60730, File E6688; 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 and the Low Voltage Directive.
	Australia/New Zealand Mark: RCM Compliant



F263 Series Liquid Level Float Switches

Description

The F263 Series Liquid Level Float Switches are designed to maintain a liquid level in indoor or outdoor closed tanks that hold water or other nonhazardous liquids. When the liquid level in the tank rises above or falls below the required level, the single-pole, double-throw (SPDT) switch closes one circuit and opens a second circuit.

Refer to the *F263 Series Liquid Level Float Switches Product Bulletin (LIT-12011989)* for important product application information.

Application

Use F263 Series Float Switches in closed tanks where a liquid level is to be maintained. A change in the liquid level opens or closes an electrical circuit.

Use F263MAP switches on indoor or outdoor tanks that hold water or other nonhazardous liquids at temperatures greater than the liquid's freezing point and between -20°F (-29°C) and 212°F (100°C). The maximum allowable liquid pressure is 150 psig (1,035 kpa).

Use F263MAC switches on indoor or outdoor tanks that hold water or other nonhazardous liquids at temperatures greater than the liquid's freezing point and between -20°F (-29°C) and 250°F (121°C). The maximum allowable liquid pressure is 100 psig (690 kpa).

Note: Do not use these float switches with liquids that are lighter than water.

Features

- Viton® diaphragm allows use in fluid lines carrying chlorinated water, treated water, or other nonhazardous liquids.
- single-pole, double-throw switch provides control where liquid levels rise and fall
- sturdy Type 4 (NEMA) enclosure allows for use in indoor or outdoor applications; inhibits the formation of moisture in low temperature applications.
- solid polycarbonate float (F263MAP models) provides greater resistance to corrosion



F263 Liquid Level Float Switch

Repair Information

If the F263 Series Liquid Level Float Switch fails to operate within its specifications, replace the unit. For a replacement F263 Switch, contact the nearest Johnson Controls® representative.

Selection Chart

Product Code Number	Description
F263MAC-V01C	SPDT float switch with Type 4 (NEMA) enclosure and copper float for liquid temperatures -20 to 250°F (-29 to 121°C); maximum liquid pressure 100 psig (690 kPa)
F263MAP-V01C	SPDT float switch with Type 4 (NEMA) enclosure and polycarbonate float for liquid temperatures -20 to 212°F (-29 to 100°C); maximum liquid pressure 150 psig (1,035 kPa)

Technical Specifications


F263 Switch Electrical Ratings

Volts 50/60 Hz	UL60730				EN60730	
	24	120	208	240	24	230
Horsepower	–	1	1	1	–	–
Full Load Amperes	–	16	10	10	–	8
Locked Rotor Amperes	–	96	60	60	–	48
Resistive Amperes	16	16	10	10	16	16
Plot Duty VA	125	720	720	720	125	720



Liquid Level and Flow Controls

F263 Series Liquid Level Float Switches (Continued)

F263 Series Liquid Level Float Switches	
Switch	SPDT
Enclosure	UL: Type 4 (NEMA) CE: IP67
Wiring Connections	Three color-coded screw terminals and one ground terminal
Conduit Connection	One 7/8 in. (22 mm) hole for 1/2 in. trade size (or PG16) conduit
Pipe Connector	1 in. 11-1/2 NPT threads
Minimum Tank Diameter	9 in. (229 mm)
Maximum Liquid Pressure	100 psig (690 kPa) for copper float 150 psig (1,035 kPa) for polycarbonate float
Liquid Temperature Range	Minimum: -20°F (-29°C) or liquid freezing point Maximum: 212°F (100°C) polycarbonate, 250°F (121°C) copper
Ambient Conditions	Minimum: -40°F (-40°C) Maximum: 140°F (60°C)
Compliance 	North America: cULus Listed; UL 60730, File E6688; 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 and the Low Voltage Directive.
	Australia/New Zealand Mark: RCM Compliant



F61 and F62 Series Replacement Paddles

Selection Chart

Replacement Kit Number	Description
KIT21A-600	3-in-1 stainless steel paddle kit for F61 Series
KIT21A-601	6 in. stainless steel paddle kit for F61 Series
PLT112-1	Replacement paddle for F62AA-8
PLT112-2	Replacement paddle for F62AA-9



F92 Series Air Volume Controls for Shallow Wells

Description

The F92 Series Air Volume Controls for Shallow Wells control the amount of air in the residential water storage tanks of shallow well water systems. Shallow wells are less than 25 ft. (7.6 m) deep.

F92 Series Controls automatically maintain air volume in the storage tanks of shallow well water systems by allowing room air to enter into the air charging section of the pump when the water level in the tank rises (loss of air volume).

F92 Controls open the air valve on a rise in tank water level to permit charging air into the storage tank with pressures up to 80 psig (552 kPa).

Refer to the *F92 Series Air Volume Controls for Shallow Wells Product Bulletin (Part No. 24-7664-2993)* for important product application information.

Features

- sturdy Noryl (high performance thermoplastic) body resists mechanical damage and corrosion.
- brass internal operating parts minimize corrosion.
- pressure tested plastic float provides long operating life.
- optional pressure gauge tapping allows mounting of a pressure gauge.



F92 Series Air Volume Control for Shallow Wells

Application

Water storage tanks in residential water systems rely on a volume of air in the tank to provide system pressure, making it important to control the amount of air in the tank:

- Too little air in the tank results in rapid pump cycling — a problem common in shallow well systems (less than 25 ft [7.6 m] deep).
- Too much air in the tank results in air entering the distribution system — a problem common in deep well systems (more than 25 ft [7.6 m] deep).

Repair Information

If the F92 Series Air Volume Controls for Shallow Wells fails to operate within its specifications, replace the unit. For a replacement F92 Series control, contact the nearest Johnson Controls® representative.

Selection Chart

Product Code Number	Description
F92A-4C	Air Volume Control for Shallow Wells, opens on pressure rise, barbed fitting on charger valve
F92B-1C	Air Volume Control for Shallow Wells, opens on pressure rise, 1/4-18 PTF SAE short gage tap, 0.016 in. (0.5 mm) valve orifice. Use this model in applications where excessive airflow may reduce water pumping capacity.
F92B-2C	Air Volume Control for Shallow Wells, opens on pressure rise, 1/4-18 PTF SAE short gage tap

Technical Specifications

F92 Series Air Volume Control for Shallow Wells	
Body Material	30% glass-filled Noryl thermoplastic
Float Material	Plastic with brass rod
Maximum Tank Pressure	80 psig (552 kPa)
Shipping Weight	Individual: 0.25 lb (0.11 kg) Bulk pack (30): 30.9 lb (4.08 kg)
Tank Connector Size	1-1/4 in. external NPT
Air Flow Restrictor Orifice	F92B-1C Model: 0.016 in. (0.5 mm)
Snifter Line Connection	Flare fitting for 3/16 in. (5 mm) tubing



F93 Series Air Volume Controls for Deep Wells

Description

The F93 Series Air Volume Controls for Deep Wells control the amount of air in the residential water storage tanks of deep well water systems. Deep wells are more than 25 ft (7.6 m) deep.

F93 Series Controls automatically maintain air volume in the storage tanks of deep well water systems by allowing air to escape from the tank and into the surrounding room when the water level in the tank drops (increase of air volume).

F93 deep well controls open the air valve on a fall in tank water level to bleed excess air from the tank at pressures up to 100 psig (690 kPa).

The F93H has a minimum pressure release valve to avoid lowering tank pressure below 25 psig (172 kPa). Use this model on applications where water may be rapidly drained.

Refer to the *F93 Series Air Volume Controls for Deep Wells Product Bulletin (Part No. 24-7664-3000)* for important product application information.

Features

- sturdy Noryl (high performance thermoplastic) body resists mechanical damage and corrosion.
- brass internal operating parts minimize corrosion.
- pressure tested plastic float provides long operating life.
- optional pressure gauge tapping allows mounting of a pressure gauge.
- certification for Federal Safe Drinking Water Act (SDWA) meets the US Federal standards of the Reduction of Lead in Drinking Water Act.



F93 Series Air Volume Control for Deep Wells

Application

Water storage tanks in residential water systems rely on a volume of air in the tank to provide system pressure, making it important to control the amount of air in the tank:

- Too little air in the tank results in rapid pump cycling - a problem common in shallow well systems (less than 7.6 m [25 ft] deep).
- Too much air in the tank results in air entering the distribution system — a problem common in deep well systems (more than 7.6 m [25 ft] deep).

Repair Information

If the F93 Series Air Volume Controls for Deep Wells fails to operate within its specifications, replace the unit. For a replacement F93 Series control, contact the nearest Johnson Controls® representative.

Selection Chart

Product Code Number	Description
F93A-1C	Air Volume Control for Deep Wells, opens on pressure drop, no gage tap, no pressure release valve
F93B-1C	Air Volume Control for Deep Wells, opens on pressure drop, 1/4-18 PTF SAE short gage tap, no pressure release valve
F93H-1C	Air Volume Control for Deep Wells, opens on pressure drop, 1/4-18 PTF SAE short gage tap, with 25 psig (172 kPa) minimum air pressure release valve. Use this model in applications where water may be rapidly drawn from the system.

Technical Specifications

F93 Series Air Volume Control for Deep Wells	
Body Material	30% glass-filled Noryl thermoplastic
Float Material	Plastic with brass rod
Maximum Tank Pressure	100 psig (690 kPa)
Shipping Weight	Individual: 0.25 lb (0.11 kg) Bulk pack (30): 30.9 lb (4.08 kg)
Tank Connector Size	1-1/4 in. external NPT
Compliance	United States Federal Safe Drinking Water Act (SDWA) Compliant, Underwriters Laboratories Classified in Accordance with NSF/ANSI 372 (File MH59894)



P266 Series Single-Phase Condenser Fan Speed Control

Description

The P266 Series Single-Phase Condenser Fan Speed Control is a cost-effective, weather-resistant, durable motor speed control. The P266 Series Controls are designed for approved single-phase, Permanent Split-Capacitor (PSC) motors commonly used in a wide variety of refrigeration and air conditioning condenser fan applications.

The P266 Series Controls are designed to replace the Johnson Controls® P66 Series and P215 Series fan speed controls, providing additional features and flexibility, greater energy efficiency, and longer motor life in a compact, rugged, weather-resistant package.

P266 Series Controls are available for 208 through 575 VAC 50/60 Hz range applications. P266 Series controls have current ratings from 4 to 12 A, depending on the voltage and model.

Some P266 Series Controls provide optional control of up to three auxiliary (fixed-speed) fans or fan stages. In addition, some models provide two additional high-voltage triacs that allow you to split the source power to the main and auxiliary windings, and connect a low-speed capacitor to increase efficiency at low-speed operation.

Refer to the *P266 Series Single-Phase Condenser Fan Speed Control Product Bulletin (LIT-12011534)* for important product application information.

Features

- one or two durable, accurate, stainless steel, remote-mount pressure transducers
- available in 208/240 VAC (8 or 12 A), 380/460 VAC (4 A), or 460/575 VAC (4 A)
- wide, adjustable pressure throttling range
- optional auxiliary fan control
- optional low-speed capacitor mode
- NEMA 3R, (IP54) enclosure with integral metal heat-sink and stand-off mounting feet

Application

The P266 Series Single-Phase Condenser Fan Speed Control, in conjunction with a P266 Series Electronic Pressure Transducer, is a pressure-actuated, digital electronic motor speed control designed for approved single-phase, PSC motors used in a wide variety of HVAC/R applications.

The P266 Series Fan Speed Control regulates supply voltage to the fan motor in response to the condenser refrigerant pressure and maintains the appropriate fan speed (air movement) through the condenser regardless of the ambient temperature or air delivery variations.

The P266 Series control is housed in a NEMA 3R (IP54) rainproof enclosure for outdoor applications.

The P266 Series control is an energy efficient and effective alternative to On/Off fan-cycling controls, multiple-speed motors, temperature fan-speed controls, modulating air-damper systems, condenser flood-back systems, and other condenser pressure control methods.



P266 Series Single-Phase Condenser Fan Speed Control

P266 Series Fan Speed Control applications include:

- computer room air conditioning
- commercial refrigeration
- commercial air conditioning

Repair Information

If a P266 Series Single-Phase Condenser Fan Speed Control fails to operate within its specifications, replace the unit. For a replacement P266 Series control, contact the nearest Johnson Controls® representative.

Selection Charts

P266 Series Fan Speed Control Model and Kit Product Code Numbers, Descriptions, and Details (Part 1 of 2)

Product Code Number	Description	Transducer Model Included in Kit	Voltage (VAC)	Maximum Output Amperes	High VAC Triacs	Available Auxiliary Fan Control Circuits ¹
P266AAA-100C ²	P266 Fan Speed Control (only)	N/A	208/240	8	3	0
P266ABA-100C ²	P266 Fan Speed Control (only)	N/A	208/240	8	3	3
P266ACA-100C ²	P266 Fan Speed Control (only)	N/A	208/240	8	1	0
P266ADA-100C ²	P266 Fan Speed Control (only)	N/A	208/240	8	1	3
P266BGA-100C ²	P266 Fan Speed Control (only)	N/A	460/575	4	2	0
P266BHA-100C ²	P266 Fan Speed Control (only)	N/A	460/575	4	2	3
P266BCA-100C ²	P266 Fan Speed Control (only)	N/A	460/575	4	1	0
P266BDA-100C ²	P266 Fan Speed Control (only)	N/A	460/575	4	1	3
P266CHA-100C ²	P266 Fan Speed Control (only)	N/A	380/460	4	2	3
P266ABA-1K ²	P266 Fan Speed Control with one P266 Pressure Transducer and one 2 m (6.6 ft) cable	P266SNR-1C, 0 to 35 bar (0 to 508 psig)	208/240	8	3	3
P266ABA-3K ²	P266 Fan Speed Control with one P266 Pressure Transducer and one 2 m (6.6 ft) cable	P266SNR-2C, 0 to 52 bar (0 to 754 psig)	208/240	8	3	3

The performance specifications are nominal and conform to acceptable industry standards. For applications at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products. © 2015 Johnson Controls, Inc. www.johnsoncontrols.com



Motor Speed Controls

P266 Series Single-Phase Condenser Fan Speed Control (Continued)

P266 Series Fan Speed Control Model and Kit Product Code Numbers, Descriptions, and Details (Part 2 of 2)

Product Code Number	Description	Transducer Model Included in Kit	Voltage (VAC)	Maximum Output Amperes	High VAC Triacs	Available Auxiliary Fan Control Circuits ¹
P266ABA-2K ²	P266 Fan Speed Control with two P266 Pressure Transducers and two 2 m (6 ft 7-1/5 in.) cables	P266SNR-1C, 0 to 35 bar (0 to 508 psi)	208/240	8	3	3
P266ABA-4K ²	P266 Fan Speed Control with two P266 Pressure Transducers and two 2 m (6 ft 7-1/5 in.) cables	P266SNR-2C, 0 to 52 bar (0 to 754 psi)	208/240	8	3	3
P266BHA-1K ²	P266 Fan Speed Control with one P266 Pressure Transducer and one 2 m (6 ft 7-1/5 in.) cable	P266SNR-1C, 0 to 35 bar (0 to 508 psi)	460/575	4	2	3
P266BHA-3K ²	P266 Fan Speed Control with one P266 Pressure Transducer and one 2 m (6 ft 7-1/5 in.) cable	P266SNR-2C, 0 to 52 bar (0 to 754 psi)	460/575	4	2	3
P266BHA-2K ²	P266 Fan Speed Control with two P266 Pressure Transducers and two 2 m (6 ft 7-1/5 in.) cables	P266SNR-1C, 0 to 35 bar (0 to 508 psi)	460/575	4	2	3
P266BHA-4K ²	P266 Fan Speed Control with two P266 Pressure Transducers and two 2 m (6 ft 7-1/5 in.) cables	P266SNR-2C, 0 to 52 bar (0 to 754 psi)	460/575	4	2	3
P266EAA-1K ²	P266 Fan Speed Control with Internal Transformer and one P266 Pressure Transducer and one 2 m (6 ft 7-1/5 in.) cable	P266SNR-1C, 0 to 35 bar (0 to 508 psi)	208/240	8	3	0
P266EAA-3K ²	P266 Fan Speed Control with Internal Transformer and one P266 Pressure Transducer and one 2 m (6 ft 7-1/5 in.) cable	P266SNR-2C, 0 to 52 bar (0 to 754 psi)	208/240	8	3	0
P266EBA-1K ²	P266 Fan Speed Control with Internal Transformer and one P266 Pressure Transducer and one 2 m (6 ft 7-1/5 in.) cable	P266SNR-1C, 0 to 35 bar (0 to 508 psi)	208/240	8	3	3
P266EBA-3K ²	P266 Fan Speed Control with Internal Transformer and one P266 Pressure Transducer and one 2 m (6 ft 7-1/5 in.) cable	P266SNR-2C, 0 to 52 bar (0 to 754 psi)	208/240	8	3	3
P266ECA-1K ²	P266 Fan Speed Control with Internal Transformer and one P266 Pressure Transducer and one 2 m (6 ft 7-1/5 in.) cable	P266SNR-1C, 0 to 35 bar (0 to 508 psi)	208/240	8	1	0
P266ECA-3K	P266 Fan Speed Control with Internal Transformer and one P266 Pressure Transducer and one 2 m (6 ft 7-1/5 in.) cable	P266SNR-2C, 0 to 52 bar (0 to 754 psi)	208/240	8	1	0
P266EDA-1K ²	P266 Fan Speed Control with Internal Transformer and one P266 Pressure Transducer and one 2 m (6 ft 7-1/5 in.) cable	P266SNR-1C, 0 to 35 bar (0 to 508 psi)	208/240	8	1	3
P266EDA-3K ²	P266 Fan Speed Control with Internal Transformer and one P266 Pressure Transducer and one 2 m (6 ft 7-1/5 in.) cable	P266SNR-2C, 0 to 52 bar (0 to 754 psi)	208/240	8	1	3
P266EEA-1K ²	P266 Fan Speed Control with Internal Transformer and one P266 Pressure Transducer and one 2 m (6 ft 7-1/5 in.) cable	P266SNR-1C, 0 to 35 bar (0 to 508 psi)	208/240	12	1	0
P266EEA-3K ²	P266 Fan Speed Control with Internal Transformer and one P266 Pressure Transducer and one 2 m (6 ft 7-1/5 in.) cable	P266SNR-2C, 0 to 52 bar (0 to 754 psi)	208/240	12	1	0
P266EFA-1K ²	P266 Fan Speed Control with Internal Transformer and one P266 Pressure Transducer and one 2 m (6 ft 7-1/5 in.) cable	P266SNR-1C, 0 to 35 bar (0 to 508 psi)	208/240	12	1	3

1. 24 VAC Class 2 at 1/4 A.
2. Factory default settings: Start Voltage is set to 40% of the supply line-voltage. End Voltage is set to 95% of the supply line-voltage. Start Pressure is set to 44% of the P266 Transducer's total pressure range. End Pressure is set to 51% of the P266 Transducer's total pressure range.

P266 Series SNR Electronic Pressure Transducers

Product Code Number	Description
P266SNR-1C	Electronic Pressure Transducer: 0 to 35 bar (0 to 508 psi) total range with a 1/4 in. SAE Internal Flare connection and a 2 meter (6 ft 7-1/5 in.) cable.
P266SNR-2C	Electronic Pressure Transducer: 0 to 52 bar (0 to 754 psi) total range with a 1/4 in. SAE Internal Flare connection and a 2 meter (6 ft 7-1/5 in.) cable.



P266 Series Single-Phase Condenser Fan Speed Control (Continued)

Technical Specifications

P266xxx-x Series Single Phase Condenser Fan Speed Controls	
Input Supply Power	208/240 VAC 50/60 Hz, 380/460 VAC 50/60 Hz, or 460/575 VAC 50/60 Hz, depending on model (Refer to the label inside the P266 Series control housing cover for rated voltage range and model-specific wiring diagram.)
Short Circuit Current Rating	Suitable for use on a circuit capable of delivering not more than 5,000 rms symmetrical amperes, 600 Volts maximum when protected by Class H Fuses.
Low-Voltage Power Supply	P266A, P266B, and P266C Types: External 24 VAC Class 2, 20 VA Supply Transformer P266E Types: Low-voltage power for P266 control is provided by an onboard transformer. Note: When auxiliary fan starters are connected to P266E type controls, you must provide an external Safety Extra-Low Voltage (SELV) AC supply to power the fan starters.
Ambient Operating Conditions	Temperature: -40 to 60°C (-40 to 140°F) Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)
Ambient Shipping and Storage Conditions	Temperature: -40 to 85°C (-40 to 185°F) Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)
Low-Voltage Connections	1/4 in. Quick-Connect terminals, 30 m (100 ft) maximum wiring runs
Input Transducer	P266SNR-x Pressure Transducer: 5 VDC for 0.5 to 4.5 VDC ratiometric analog signal
Enclosure Type	NEMA 3R, IP54
Case Construction	Aluminum die casting
Cover Construction	UV Stabilized Polycarbonate
Dimensions (HxWxD)	159 x 177 x 70 mm (6-1/4 x 7 x 2-3/4 in.)
Weight	Heaviest model weight: 1.0 kg (2.2 lb) Approximate shipping weight: 1.2 kg (2.6 lb)
Compliance	<p>North America: cULus, File E244421; FCC Compliant to CFR47, Part 15, Subpart B, Class A Industry Canada (IC) Compliant to Canadian ICES-003, Class A limits</p> <p>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 2004/108/EC and the Low Voltage Directive 2006/95/EC.</p> <p>Australia: C-Tick Compliant (N1813)</p>





P66/S66 Series Controls to P266 Series Controls Replacement Guide

**P66/S66 to P266 Series Controls
Cross-Reference (Part 1 of 4)**

Product Code Number	Operating Range (psig)	ETR (psig)	Start Voltage (%)	Replacement Control ¹ (see notes)	Transducer Sold Separately (see notes)
P66AAB-1	190/250	60	10	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66AAB-2	190/250	60	10	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66AAB-3	180/240	60	16	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66AAB-4	135/165	30	10	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66AAB-5	90/120	30	16	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66AAB-6	170/230	60	16	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66AAB-7	85/115	30	16	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66AAB-8	190/250	60	16	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66AAB-9	170/230	60	40	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66AAB-10	190/250	60	16	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66AAB-11	140/200	60	16	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66AAB-12	220/280	60	16	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66AAB-13	60/90	30	16	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66AAB-14	220/280	60	40	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66AAB-15	190/250	60	40	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66AAB-16	140/170	30	40	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66AAB-17	160/190	30	40	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66AAB-18	180/240	60	10	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66AAB-19	115/145	30	40	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66AAB-20	220/280	60	16	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66AAB-21	220/280	60	16	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66AAB-22	140/170	30	40	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66AAB-23	160/190	30	40	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66AAB-24	160/190	30	10	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴

**P66/S66 to P266 Series Controls
Cross-Reference (Part 2 of 4)**

Product Code Number	Operating Range (psig)	ETR (psig)	Start Voltage (%)	Replacement Control ¹ (see notes)	Transducer Sold Separately (see notes)
P66AAB-25	180/240	60	10	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66AAB-26	220/280	60	40	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66AAB-27	85/115	30	40	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66AAB-28	135/165	30	10	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66AAB-29	190/250	60	10	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66AAB-30	170/230	60	16	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66AAB-31	115/145	30	40	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66AAB-32	140/200	60	40	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66AAB-33	115/215	60	40	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66AAB-34	320/410	90	40	P266ACA-100C ² P266BCA-100C ³	P266SNR-2C ⁴
P66AAB-35	230/320	90	40	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66AAB-36	190/250	60	10	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66AAB-37	320/410	90	10	P266ACA-100C ² P266BCA-100C ³	P266SNR-2C ⁴
P66AAB-38	360/450	90	40	P266ACA-100C ² P266BCA-100C ³	P266SNR-2C ⁴
P66AAD-1	160/220	60	25	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66AAD-2	190/250	60	10	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66AAD-3	190/250	60	10	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66AAD-4	180/240	60	10	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66AAD-5	160/190	30	10	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66ABB-20	220/280	60	16	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66ABB-21	220/280	60	16	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66ABB-22	140/170	30	40	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66ABB-23	160/190	30	40	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66ABB-24	190/250	60	16	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴

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**P66/S66 Series Controls to P266 Series Controls Replacement Guide
(Continued)**

**P66/S66 to P266 Series Controls
Cross-Reference (Part 3 of 4)**

Product Code Number	Operating Range (psig)	ETR (psig)	Start Voltage (%)	Replacement Control ¹ (see notes)	Transducer Sold Separately (see notes)
P66ABB-25	190/250	60	16	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66ABB-26	170/230	60	40	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66ABB-27	190/250	60	40	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁴
P66ABB-28	320/410	60	16	P266ACA-100C ² P266BCA-100C ³	P266SNR-2C ⁴
P66BAB-1	190/250	60	10	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁵
P66BAB-2	190/250	60	10	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁵
P66BAB-3	170/230	60	16	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁵
P66BAB-4	190/250	60	16	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁵
P66BAB-5	190/250	60	40	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁵
P66BAB-6	220/280	60	40	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁵
P66BAB-7	190/250	60	10	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁵

**P66/S66 to P266 Series Controls
Cross-Reference (Part 4 of 4)**

Product Code Number	Operating Range (psig)	ETR (psig)	Start Voltage (%)	Replacement Control ¹ (see notes)	Transducer Sold Separately (see notes)
P66BAB-8	170/230	60	16	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁵
P66BAB-9	320/410	90	40	P266ACA-100C ² P266BCA-100C ³	P266SNR-2C ⁵
P66BAB-10	360/450	90	40	P266ACA-100C ² P266BCA-100C ³	P266SNR-2C ⁵
P66BBB-1	190/250	60	16	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁵
P66BAD-1	160/220	60	25	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁵
P66BAD-2	190/250	60	10	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁵
P66BAD-3	190/250	60	10	P266ACA-100C ² P266BCA-100C ³	P266SNR-1C ⁵
S66AA-1	NA	NA	50	P266ACA-100C ⁶	NA
S66DC-1	NA	NA	40	NR	NA
S66FA-1	NA	NA	50	P266ACA-100C ^{6,7}	NA

1. Factory default start voltage is 40%.
2. For 208/240 Volt applications
3. For 460/480 Volt applications
4. Use one transducer.
5. Use two transducers.
6. 0 to 5 VDC input, not 0 to 10 VDC
7. Hard start not available.

NA = Not applicable

NR = No replacement available



VFD68 Variable Frequency Drives

Description

The VFD68 Variable Frequency Drive provides three-phase motor speed control in a variety of HVAC/R applications. The VFD68 drive is designed primarily for condenser fan speed control on HVAC and refrigeration condensing units, but can also be set up to control a variety of pumps, blowers, and fans.

The VFD68 drive accepts an input signal from P499 Electronic Pressure Transducer, or other devices that provide a 0 to 5 VDC, 0 to 10 VDC, or 4 to 20 mA signal.

The application-specific design of the VFD68 drive provides a simple interface, which makes the drive easy to understand and operate.

You can quickly and easily reconfigure the VFD68 drive to control variable speed pumps in cooling and heating applications, or to control variable speed supply fans in VAV applications.

The VFD68 drive is an RS485, RTU-compliant ModBus® slave device and can be integrated into a ModBus network.

Refer to the *VFD68 Variable Frequency Drives Product Bulletin (LIT-12012068)* for important product application information.

Features

- Selectable input types allows use with 0 to 5 VDC (ratiometric), 0 to 10 VDC, or 4 to 20 mA input signals from transducers, sensors, and controllers.
- High input signal selection of two similar inputs (230 or 460 volt models only) provides fan speed control of dual circuit condensing units, based on the highest pressure circuit.
- Compact design provides for easy and flexible installation.
- Three-phase, 230, 460, or 575 VAC models can control a wide variety of three-phase motors ranging up to 10hp.
- Simple and advanced end-user settings provide quick and simple application setup and operation, as well as advanced setup parameters for custom applications.

Applications

The VFD68 drive accepts input signals from a variety of pressure transducers, temperature sensors, and low-voltage controllers to provide continuous response to changing condenser load conditions.

The VFD68 drive allows the system to:

- maintain optimum condenser head pressure
- operate in low ambient temperature conditions down to -40°C (-40°F)
- reduce short-cycling, which occurs when using
- use On/Off fan controls
- maintain a more stable evaporator temperature
- operate more efficiently, reducing electricity cost.

The VFD68 drive can also:

- help optimize compressor operation, reduce wear, and extend compressor life by stabilizing the condenser head pressures
- reduce motor repair and replacement costs by eliminating the condenser fan short-cycling
- extend refrigerated product life and provide more consistent comfort cooling by stabilizing evaporator temperatures

Selecting a Motor

IMPORTANT: When selecting the motor, do not exceed the maximum output current rating of the VFD68 drive

Motors used with the VFD68 drive must:

- be AC induction three-phase motors that are UL Recognized and CSA Certified, or equivalent
- be rated for: 230 VAC at 50/60 Hz; 460 VAC at 50/60 Hz; or 575 VAC at 60 Hz
- have an Inverter Rating (460 VAC motors)
- have Insulation Class F or better

The VFD68 drive is intended for use with variable speed motors that are rated for 40:1 operation.



VFD68BBB Variable Frequency Drive

A VFD68 drive can control multiple motors wired in parallel; however, the sum of the Full Load Amperes (FLA) ratings for the motors must not exceed the maximum output current rating of the VFD68 drive, including any de-rating due to altitude, temperature, or a combination of both.

IMPORTANT: Do not control both single-phase and three-phase motors with the same VFD68 drive.

Repair Information

If the VFD68 Variable Frequency Drive fails to operate within its specifications, replace the unit. For a replacement VFD68 Drive, contact the nearest Johnson Controls® representative.



VFD68 Variable Frequency Drives (Continued)

Selection Charts

230 VAC ±10% Production Models

Product Code Number	Description
VFD68BBB-2C	VFD68 Drive; 0.1 kw (1/8 hp); 128 x 68 x 81 mm (5 x 2-11/16 x 3-3/16 in.)
VFD68BCB-2C	VFD68 Drive; 0.2 kw (1/4 hp); 128 x 68 x 81 mm (5 x 2-11/16 x 3-3/16 in.)
VFD68BDC-2C	VFD68 Drive; 0.4 kw (1/2 hp); 128 x 68 x 113 mm (5 x 2-11/16 x 4-7/16 in.)
VFD68BFD-2C	VFD68 Drive; 0.75 kw (1 hp); 128 x 68 x 133 mm (5 x 2-11/16 x 5-1/4 in.)
VFD68BGG-2C	VFD68 Drive; 0.5 kw (2 hp); 128 x 108 x 136 mm (5 x 4-1/4 x 5-5/16 in.)
VFD68BHG-2C	VFD68 Drive; 2.2 kw (3 hp); 128 x 108 x 136 mm (5 x 4-1/4 x 5-5/16 in.)
VFD68BJK-2C	VFD68 Drive; 3.7 kw (5 hp); 128 x 170 x 142 mm (5 x 6-11/16 x 5-5/8 in.)
VFD68BKL-2C	VFD68 Drive; 5.5 kw (7-1/2 hp); 150 x 220 x 155 mm (5-15/16 x 8-11/16 x 6-1/8 in.)
VFD68BLL-2C	VFD68 Drive; 7.5 kw (10 hp); 150 x 220 x 155 mm (5-15/16 x 8-11/16 x 6-1/8 in.)
VFD68BMP-2C	VFD68 Drive; 11 kw (15 hp); 260 x 220 x 190 (10-1/4 x 8-11/16 x 7-1/2)
VFD68BNP-2C	VFD68 Drive; 15 kw (20 hp); 260 x 220 x 190 (10-1/4 x 8-11/16 x 7-1/2)

460 VAC ±10% Production Models

Product Code Number	Description
VFD68CDF-2C	VFD68 Drive; 0.4 kw (1/2 hp); 128 x 108 x 130 mm (5 x 4-1/4 x 5-1/8 in.)
VFD68CFF-2C	VFD68 Drive; 0.75 kw (1 hp); 128 x 108 x 130 mm (5 x 4-1/4 x 5-1/8 in.)
VFD68CGG-2C	VFD68 Drive; 1.5 kw (2 hp); 128 x 108 x 136 mm (5 x 4-1/4 x 5-5/16 in.)
VFD68CHH-2C	VFD68 Drive; 2.2 kw (3 hp); 128 x 108 x 156 mm (5 x 4-1/4 x 6-1/8 in.)
VFD68CJJ-2C	VFD68 Drive; 3.7 kw (5 hp); 128 x 108 x 166 mm (5 x 4-1/4 x 6-1/2 in.)
VFD68CKL-2C	VFD68 Drive; 5.5 kw (7-1/2 hp); 150 x 220 x 155 mm (5-15/16 x 8-11/16 x 6-1/8 in.)
VFD68CLL-2C	VFD68 Drive; 7.5 kw (10 hp); 150 x 220 x 155 mm (5-15/16 x 8-11/16 x 6-1/8 in.)
VFD68CMP-2C	VFD68 Drive; 11 kw (15 hp); 260 x 220 x 190 (10-1/4 x 8-11/16 x 7-1/2)
VFD68CNP-2C	VFD68 Drive; 15 kw (20 hp); 260 x 220 x 190 (10-1/4 x 8-11/16 x 7-1/2)

575 VAC +5/-10% Production Models

Product Code Number	Description
VFD68DFM-2C	VFD68 Drive; 0.75 kw (1 hp); 150 x 140 x 136 mm (5-15/16 x 5-1/2 x 5-5/16 in.)
VFD68DGM-2C	VFD68 Drive; 1.5 kw (2 hp); 150 x 140 x 136 mm (5-15/16 x 5-1/2 x 5-5/16 in.)
VFD68DHM-2C	VFD68 Drive; 2.2 kw (3 hp); 150 x 140 x 136 mm (5-15/16 x 5-1/2 x 5-5/16 in.)
VFD68DJN-2C	VFD68 Drive; 3.7 kw (5 hp); 150 x 220 x 148 mm (5-15/16 x 8-11/16 x 5-13/16 in.)
VFD68DKN-2C	VFD68 Drive; 5.5 kw (7-1/2 hp); 150 x 220 x 148 mm (5-15/16 x 8-11/16 x 5-13/16 in.)
VFD68DLN-2C	VFD68 Drive; 7.5 kw (10 hp); 150 x 220 x 148 mm (5-15/16 x 8-11/16 x 5-13/16 in.)

Accessories

Product Code Number	Description	Accessory Information
P499RAPS100K P499RCPS100K	Electronic Pressure Transducer (-10 to 100 psis [sealed for wet and freeze/thaw applications] Range) and WHA-PKD3-200C Wire Harness	<ul style="list-style-type: none"> Product code numbers ending in K are P499 kit models that include one P499 Pressure Transducer model and a WHA-PKD3-200C (6-1/2 ft [2 m]) Wire Harness. To order a single P499 Pressure Transducer model (without a WHA-PKD3-200C Wire Harness), replace the K with a C at the end of the P499 product code number. P499RxP type models are 0.5 to 4.5 VDC ratiometric pressure transducers with Packard style electrical connections. P499RAP type models have a 1/8 in. 27 NPT external thread (Style 49) pressure connection. P499RCP type models have a 1/4 in. SAE 45° flare internal thread (7/16-20 UNF) with depressor (Style 47) pressure connection. Refer to the <i>P499 Series Electronic Pressure Transducers Product/Technical Bulletin (LIT-12011190)</i> for more information on P499 Pressure Transducer models and the associated wire harnesses.
P499RAPS102K P499RCPS102K	Electronic Pressure Transducer (0 to 200 psis [sealed for wet and freeze/thaw applications] Range) and one WHA-PKD3-200C Wire Harness	
P499RAP-101K P499RCP-101K	Electronic Pressure Transducer (0 to 100 psig Range) and WHA-PKD3-200C Wire Harness	
P499RAP-102C	Electronic Pressure Transducer (0 to 200 psig Range)	
P499RAP-105K P499RCP-105K	Electronic Pressure Transducer (0 to 500 psig Range) and WHA-PKD3-200C Wire Harness	
P499RAP-107K P499RCP-107K	Electronic Pressure Transducer (0 to 750 psig Range) and WHA-PKD3-200C Wire Harness	
WHA-PKD3-200C	Wire Harness with Pigtail Leads, 6-1/2 ft (2 m)	
WHA-PKD3-400C	Wire Harness with Pigtail Leads, 13 ft (4 m)	
WHA-PKD3-400C	Wire Harness with Pigtail Leads, 19-5/8 ft (6 m)	

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VFD68 Variable Frequency Drives (Continued)

Technical Specifications

VFD68 Variable Frequency Drive	
Input Power Voltage/Frequency	230 VAC, 50 HZ (208/230 VAC, 60 Hz); 400 VAC, 50 Hz (460 VAC, 60 Hz); 575 VAC, 50 Hz; Continuous Duty
Output Voltage/Frequency	230 VAC, 50 HZ (208/230 VAC, 60 Hz); 400 VAC, 50 Hz (460 VAC, 60 Hz); 575 VAC, 50 Hz; Continuous Duty
Input Devices	Johnson Controls/PENN® P499 Electronic Pressure Transducers
PWM Carrier Frequency	Adjustable 0.7 to 15 kHz
Motor Requirements	Three-phase NEMA Design B motors required; Inverter-rated motors recommended
Overload Capacity	150% of ampere rating for 1 minute
Start/Stop	Use STF input to start or stop the motor
Ambient Conditions	Storage: -40 to 65°C (-40 to 149°F), 0 to 95% RH noncondensing Operating: -40 to 50°C (-40 to 122°F), 0 to 95% RH noncondensing Altitude: 1,000 m (3,300 ft) maximum without derating
Enclosures	UL Type 1 (NEMA) fan cooled (230 VAC 1 hp and lower models do not have a fan)
Maximum High Voltage Wire Length	Up to 100 m (328 ft) between the VFD68 drive and the motor (using the appropriate wire gauge)
Compliance	North America: cULus Listed, UL 508C, CSA-C22.2 No. 14, File E244421; 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 and the Low Voltage Directive. Australia: Regulatory Compliance Mark (RCM)
Dimensions (H x W x D)	Minimum: 128 x 68 x 81 mm (5 x 2-11/16 x 3-3/16 in.) Maximum: 260 x 220 x 190 mm (10-1/4 x 8-11/16 x 7-1/2 in.)
Shipping Weight	0.5 to 3.8 kg (1.1 to 8.38 lb)

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V43/V243 Series Pressure-Actuated Water-Regulating Valves

Description

The V43/V243 Pressure Actuated Water Regulating Valves are designed to regulate water flow through the condenser of large refrigerated cooling systems. These pilot-operated valves open on an increase in refrigerant head pressure and provide modulating operation.

The V43/V243 water regulating valves are available for commercial and maritime applications.

V43 valves are available for non-corrosive low- and medium-pressure refrigerants such as R-134A, R-404A, R-502, and R-507. Specially designed V43 valves are also available for ammonia service (R-717).

V243 valves are available for non-corrosive high-pressure refrigerants such as R410A.

Commercial V43/V243 valves are constructed with a cast iron body, brass internal parts, and bronze seat material.

To resist the corrosive action of sea water, the V43/V243 maritime and navy models are constructed with a red brass body, bronze and monel interior parts, and monel seat material.

Refer to the *V43/V243 Pressure Actuated Water Regulating Valves Product/Technical Bulletin (LIT-125683)* for important product information.

Features

- built-in pilot valve allows more precise throttling
- easy adjustment allows service and adjustment without breaking line connections
- drain plug allows water to be drained during shutdown to reduce the possibility of freeze-up
- mesh monel screen protects pilot valve from items such as dirt and scale and is easily removed for cleaning and servicing without breaking any line connections



V43 Pressure Actuated Valve

Selection Charts

When ordering V43 valves, specify the complete product code number including an optional companion flange and gasket kit. A companion flange and gasket kit is required to mount the water lines to commercial type V43/V243 water-regulating valves.

Valve Construction and Pressure Type

Designator	Construction and Pressure Type
A	Commercial Service with Iron Body, Open on Pressure Increase, V43
B	Maritime Service with Brass Body, Open on Pressure Increase, V43
C	Navy Service with Brass Body, Open on Pressure Increase, V43
G	Commercial Service with Iron Body, Open on Pressure Increase, V243
H	Maritime Service with Brass Body, Open on Pressure Increase, V243

Flange Size

Designator	Flange Size
S	2 in.
T	2-1/2 in.
V	3 in.
W	4 in.

V43 Series Pressure Actuated Water Valves (except NAVSEA valves)

Product Code Number	Pipe Size (in.)	Inlet and Outlet	Opening Point Adjustment Range psig (kPa)	Shipping Wt. lb (kg)
Commercial Type – Non-Corrosive Refrigerants (R)				
V43AS-1C	2	Four Hole ASME Flanged	70 to 150 (483 to 1,034)	59 (26.76)
V43AS-2C	2-1/2		160 to 260 (1,103 to 1,793)	
V43AT-1C			70 to 150 (483 to 1,034)	65 (29.48)
V43AT-2C	140 to 260 (1,103 to 1,793)			
V43AV-1C	3		70 to 150 (483 to 1,034)	90 (40.82)
V43AV-2C	4		160 to 260 (1,103 to 1,793)	90 (40.82)
V43AW-2C		Eight Hole ASME Flanged	142 (64.41)	
Commercial Type - Ammonia (R)				
V43AV-5C	3		160 to 260 (1,103 to 1,793)	90 (40.82)
Maritime Type – Non-Corrosive Refrigerants (R)				
V43BS-6C	2	Four Hole ASME Flanged	70 to 150 (483 to 1,034)	59 (26.76)
V43BS-7C	2-1/2		160 to 260 (1,103 to 1,793)	
V43BT-6C			70 to 150 (483 to 1,034)	65 (29.48)
V43BT-7C	140 to 260 (1,103 to 1,793)			
V43BV-10C	3		70 to 150 (483 to 1,034)	90 (40.82)
V43BV-7C	4		140 to 260 (1,103 to 1,793)	

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V43/V243 Series Pressure-Actuated Water-Regulating Valves (Continued)

Selection Charts (Continued)

V43 Series Pressure Actuated Water valves, Navy NAVSEA Certified

Product Code Number	Pipe Size (in.)	Inlet and Outlet	Pressure Connector	Opening Point Adjustment Range – psig (kPa)	Shipping Wt, lb (kg)
Navy NAVSEA Certified – Non-Corrosive Refrigerants (R)					
V43BS-3C	2	Four Hole ASME Flange	1/4 in. External Flared Connector	70 to 150 (483 to 1,034)	59 (26.76)
V43CS-1C		Six Hole Navy Flange	Internal Sweat Connector		
V43CS-2C					
V43BT-3C	2-1/2	Four Hole ASME Flange	1/4 in. External Flared Connector	65 (29.48)	
V43CT-2C		Six Hole Navy Flange			
V43BV-4C	3	Four Hole ASME Flange	Internal Sweat Connector	90 (40.82)	
V43CV-1C		Eight Hole Navy Flange	1/4 in. External Flared Connector		
V43CV-2C			Internal Sweat Connector		
V43BW-7C	4	Eight Hole ASME Flange	1/4 in. External Flared Connector	140 to 260 (1,103 to 1,793)	142 (64.41)
V43BW-2C					

V243 Series Pressurized Actuated Water Valves

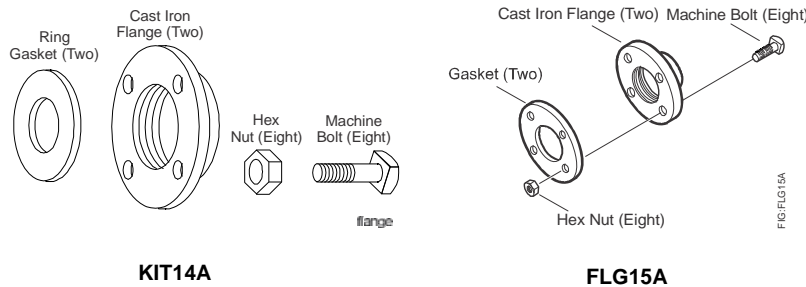
Product Code Number	Pipe Size (in.)	Inlet and Outlet	Opening Point Adjustment Range – psig (kPa)	Shipping Weight, lb (kg)
Commercial Type – High Pressure Refrigerants				
V243GS-1C	2	Four Hole ASME Flange	200 to 400 (1,379 to 2,758)	59 (26.76)
V243GT-1C	2-1/2			65 (29.48)
V243GV-1C	3	Eight Hole ASME Flange		90 (40.82)
V243GW-1C	4			142 (64.41)
Maritime Type – High Pressure Refrigerants				
V243HS-1C	2	Four Hole ASME Flange	200 to 400 (1,379 to 2,758)	59 (26.76)
V243HT-1C	2-1/2			65 (29.48)
V243HV-1C	3	Eight Hole ASME Flange		90 (40.82)
V243HW-1C	4			142 (64.41)

Accessories

Kit Code Number	Water Valve Size (in.)	Shipping Weight, lb (kg)
KIT14A-613 ^{1, 2}	2	11.8 (5.4)
KIT14A-614 ^{1, 2}	2-1/2	16.5 (7.5)
FLG15A-600 ^{1, 3}	3	20 (9.1)
FLG15A-601 ^{1, 3}	4	34 (15.4)

- Commercial valves only.
- These are the parts included in the flange and gasket kit for the 2-inch and 2-1/2 inch valves.
- These are the parts included in the flange and gasket kit for the 3-inch and 4-inch valves.

A companion flange and gasket kit is required to mount the water lines to commercial type V43/V243 water-regulating valves.





V43/V243 Series Pressure-Actuated Water-Regulating Valves (Continued)

Repair and Replacement Information

If a V43/V243 Pressure-Actuated Water-Regulating Valve fails to operate within its specifications, replacement sensing elements, internal parts, and diaphragms are available for valve repair.

To obtain replacement parts, kits, instructions, and details, contact your nearest Johnson Controls® distributor at http://cgproducts.johnsoncontrols.com/dist_locate/locateDIST.asp.

For replacement parts, see Repair Parts and Parts Kits.

Repair Parts (Part 1 of 2)

Model	Diaphragm Kit	Seat Disc and Diaphragm Kit	Seat Repair Kit	Screen Repair Kit	Push Rod Kit ¹	Sensing Element Kit	Disc Body Kit
V43AS-1C	DPM18A-600R	DSC16A-600R	STT19A-602R	SCN10A-600R	ROD18A-600R	SEP88A-600R	DBK11A-600R
V43AS-2C	DPM18A-600R	DSC16A-600R	STT19A-602R	SCN10A-600R	ROD18A-600R	SEP88A-601R	DBK11A-600R
V43AS-5C	DPM18A-600R	DSC16A-600R	STT19A-602R	SCN10A-600R	ROD18A-600R	SEP87A-600R	DBK11A-600R
V43AT-1C	DPM18A-601R	DSC16A-601R	STT19A-603R	SCN10A-600R	ROD18A-601R	SEP88A-600R	DBK11A-601R
V43AT-2C	DPM18A-601R	DSC16A-601R	STT19A-603R	SCN10A-600R	ROD18A-601R	SEP88A-601R	DBK11A-601R
V43AT-5C	DPM18A-601R	DSC16A-601R	STT19A-603R	SCN10A-600R	ROD18A-601R	SEP87A-600R	DBK11A-601R
V43AV-1C	DPM18A-602R	DSC16A-602R	STT19A-606R	SCN10A-600R	ROD18A-601R	SEP88A-600R	DBK11A-602R
V43AV-2C	DPM18A-602R	DSC16A-602R	STT19A-606R	SCN10A-600R	ROD18A-601R	SEP88A-601R	DBK11A-602R
V43AV-5C	DPM18A-602R	DSC16A-602R	STT19A-606R	SCN10A-600R	ROD18A-601R	SEP87A-600R	DBK11A-602R
V43AW-1C	DPM18A-603R	DSC16A-603R	STT19A-608R	SCN10A-600R	ROD18A-602R	SEP88A-600R	DBK11A-603R
V43AW-2C	DPM18A-603R	DSC16A-603R	STT19A-608R	SCN10A-600R	ROD18A-602R	SEP88A-601R	DBK11A-603R
V43AW-5C	DPM18A-603R	DSC16A-603R	STT19A-608R	SCN10A-600R	ROD18A-602R	SEP87A-600R	DBK11A-603R
V43BS-1C ¹	DPM18A-600R	DSC16A-600R	STT19A-602R	SCN10A-601R	ROD18A-602R	SEP88A-600R	DBK11A-600R
V43BS-2C ¹	DPM18A-600R	DSC16A-600R	STT19A-602R	SCN10A-601R	ROD18A-602R	SEP88A-601R	DBK11A-600R
V43BS-3C	DPM18A-600R	DSC16A-600R	STT19A-600R	SCN10A-601R	ROD18A-602R	SEP88A-600R	DBK10A-600R
V43BS-6C	DPM18A-600R	DSC16A-600R	STT19A-600R	SCN10A-601R	ROD18A-602R	SEP88A-600R	DBK10A-600R
V43BS-7C	DPM18A-600R	DSC16A-600R	STT19A-600R	SCN10A-601R	ROD18A-602R	SEP88A-601R	DBK10A-600R
V43BT-1C ¹	DPM18A-601R	DSC16A-601R	STT19A-603R	SCN10A-601R	ROD18A-603R	SEP88A-600R	DBK11A-601R
V43BT-2C ¹	DPM18A-601R	DSC16A-601R	STT19A-603R	SCN10A-601R	ROD18A-603R	SEP88A-601R	DBK11A-601R
V43BT-3C	DPM18A-601R	DSC16A-601R	STT19A-605R	SCN10A-601R	ROD18A-603R	SEP88A-600R	DBK10A-602R
V43BT-6C	DPM18A-601R	DSC16A-601R	STT19A-605R	SCN10A-601R	ROD18A-603R	SEP88A-600R	DBK10A-602R
V43BT-7C	DPM18A-601R	DSC16A-601R	STT19A-605R	SCN10A-601R	ROD18A-603R	SEP88A-601R	DBK10A-602R
V43BV-1C ¹	DPM18A-602R	DSC16A-602R	STT19A-606R	SCN10A-601R	ROD18A-603R	SEP88A-600R	DBK11A-602R
V43BV-2C ¹	DPM18A-602R	DSC16A-602R	STT19A-606R	SCN10A-601R	ROD18A-603R	SEP88A-601R	DBK11A-602R
V43BV-4C	DPM18A-602R	DSC16A-602R	STT19A-607R	SCN10A-601R	ROD18A-603R	SEP88A-600R	DBK10A-601R
V43BV-5C ¹	DPM18A-602R	DSC16A-602R	STT19A-606R	SCN10A-601R	ROD18A-603R	SEP88A-600R	DBK11A-602R
V43BV-6C ¹	DPM18A-602R	DSC16A-602R	STT19A-606R	SCN10A-601R	ROD18A-603R	SEP88A-601R	DBK11A-602R
V43BV-7C	DPM18A-602R	DSC16A-602R	STT19A-607R	SCN10A-601R	ROD18A-603R	SEP88A-601R	DBK10A-601R
V43BV-8C	DPM18A-602R	DSC16A-602R	STT19A-607R	SCN10A-601R	ROD18A-603R	SEP88A-600R	DBK10A-601R
V43BV-9C	DPM18A-602R	DSC16A-602R	STT19A-607R	SCN10A-601R	ROD18A-603R	SEP88A-601R	DBK10A-601R
V43BV-10C	DPM18A-602R	DSC16A-602R	STT19A-607R	SCN10A-601R	ROD18A-603R	SEP88A-600R	DBK10A-601R
V43BW-1C	DPM18A-603R	DSC16A-603R	STT19A-609R	SCN10A-601R	ROD18A-602R	SEP88A-600R	DBK10A-603R
V43BW-2C	DPM18A-603R	DSC16A-603R	STT19A-609R	SCN10A-601R	ROD18A-602R	SEP88A-601R	DBK10A-603R
V43BW-5C	DPM18A-603R	DSC16A-603R	STT19A-609R	SCN10A-601R	ROD18A-602R	SEP88A-600R	DBK10A-603R
V43BW-6C	DPM18A-603R	DSC16A-603R	STT19A-609R	SCN10A-601R	ROD18A-602R	SEP88A-601R	DBK10A-603R
V43BW-7C	DPM18A-603R	DSC16A-603R	STT19A-609R	SCN10A-601R	ROD18A-602R	SEP88A-600R	DBK10A-603R
V43CS-1C	DPM18A-600R	DSC16A-600R	STT19A-600R	SCN10A-601R	ROD18A-602R	SEP88A-600R	DBK10A-600R
V43CS-2C	DPM18A-600R	DSC16A-600R	STT19A-600R	SCN10A-601R	ROD18A-602R	SEP88A-600R	DBK10A-600R
V43CS-3C	DPM18A-600R	DSC16A-600R	STT19A-600R	SCN10A-601R	ROD18A-604R	SEP88A-600R	DBK10A-600R
V43CT-1C	DPM18A-601R	DSC16A-601R	STT19A-605R	SCN10A-601R	ROD18A-603R	SEP88A-600R	DBK10A-602R
V43CT-2C	DPM18A-601R	DSC16A-601R	STT19A-605R	SCN10A-601R	ROD18A-603R	SEP86A-600R	DBK10A-602R
V43CV-1C	DPM18A-602R	DSC16A-602R	STT19A-607R	SCN10A-601R	ROD18A-603R	SEP86A-600R	DBK10A-601R
V43CV-2C	DPM18A-602R	DSC16A-602R	STT19A-607R	SCN10A-601R	ROD18A-603R	SEP88A-600R	DBK10A-601R

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V43/V243 Series Pressure-Actuated Water-Regulating Valves (Continued)

Repair Parts (Part 2 of 2)

Model	Diaphragm Kit	Seat Disc and Diaphragm Kit	Seat Repair Kit	Screen Repair Kit	Push Rod Kit ¹	Sensing Element Kit	Disc Body Kit
V243GS-1C	DPM18A-600R	DSC16A-600R	STT19A-602R	SCN10A-600R	ROD18A-600R	SEP90A-600R	DBK11A-600R
V243GT-1C	DPM18A-601R	DSC16A-601R	STT19A-603R	SCN10A-600R	ROD18A-601R	SEP90A-600R	DBK11A-601R
V243GV-1C	DPM18A-602R	DSC16A-602R	STT19A-606R	SCN10A-600R	ROD18A-601R	SEP90A-600R	DBK11A-602R
V243GW-1C	DPM18A-603R	DSC16A-603R	STT19A-608R	SCN10A-600R	ROD18A-600R	SEP90A-600R	DBK11A-603R
V243HS-1C	DPM18A-600R	DSC16A-600R	STT19A-600R	SCN10A-601R	ROD18A-602R	SEP90A-600R	DBK10A-600R
V243HT-1C	DPM18A-601R	DSC16A-601R	STT19A-605R	SCN10A-601R	ROD18A-603R	SEP90A-600R	DBK10A-601R
V243HV-1C	DPM18A-602R	DSC16A-602R	STT19A-607R	SCN10A-601R	ROD18A-603R	SEP90A-600R	DBK10A-602R
V243HW-1C	DPM18A-603R	DSC16A-603R	STT19A-609R	SCN10A-601R	ROD18A-602R	SEP90A-600R	DPK10A-603R

1. Replacement push rod kit requires a seat repair kit and/or a diaphragm kit when replaced.

Parts Kits

The following valves, manufactured after date code 8702, contain monel interior trim. Order replacement kits as listed in Repair Parts or V43xx and V243xx Series Repair Parts Kits Technical Bulletin (LIT-121690).

Parts Kits

Valve Model	Order Parts Kits for:
V43BS-1C	V43BS-6C
V43BS-2C	V43BS-7C
V43BT-1C	V43BT-6C
V43BT-2C	V43BT-7C
V43BV-1C	V43BV-10C
V43BV-2C	V43BV-7C
V43BV-5C	V43BV-10C
V43BV-6C	V43BV-9C

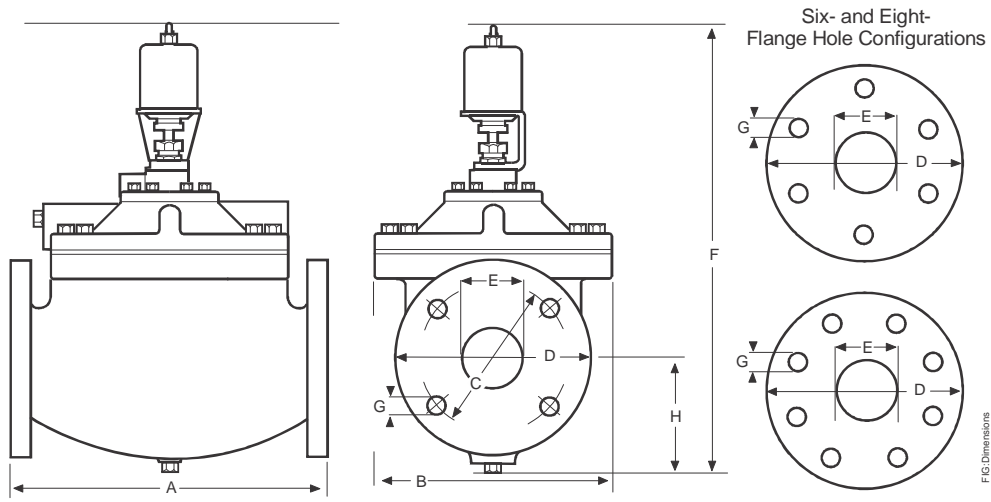
Dimensions

Symbol	2 Inch	2-1/2 Inch	3 Inch	4 Inch
A ¹	9-1/2 in. (241 mm)	10-3/4 in.(273 mm)	11-3/4 in. (298 mm)	14 in. (356 mm)
B	7-1/2 in. (191 mm)	8 in. (203 mm)	9 in. (229 mm)	10-3/4 in. (273 mm)
C	4-3/4 in. (121 mm)	5-1/2 in. (140 mm)	6 in. (152 mm)	7-1/2 in. (191 mm)
D	6 in. (152 mm)	7 in. (178 mm)	7-1/2 in. (191 mm)	9 in. (229 mm)
E	2-1/8 in. (54 mm)	2-5/8 in. (67 mm)	3-1/8 in. (80 mm)	4-1/8 in. (105 mm)
F ²	15-1/4 in. (387 mm)	15-9/16 in. (395 mm)	16-9/16 in. (421 mm)	18-7/32 in. (462 mm)
F ³	15-29/32 in. (404 mm)	16-7/32 in. (412 mm)	17-7/32 in. (437 mm)	18-7/8 in. (479 mm)
G	3/4 in. (19 mm) Diameter (Four)	3/4 in. (19 mm) Diameter (Four)	3/4 in. (19 mm) Diameter (Four)	3/4 in. (19 mm) Diameter (Eight)
H	3-5/8 in. (92 mm)	3-15/16 in. (100 mm)	4-1/4 in. (108 mm)	5-1/16 in. (128 mm)

1. Flange face to flange face.
2. These are the measurements for the V43 valves.
3. These are the measurements for the V243 valves.



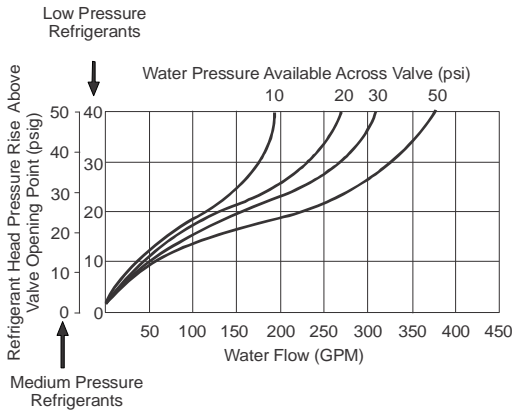
V43/V243 Series Pressure-Actuated Water-Regulating Valves (Continued)



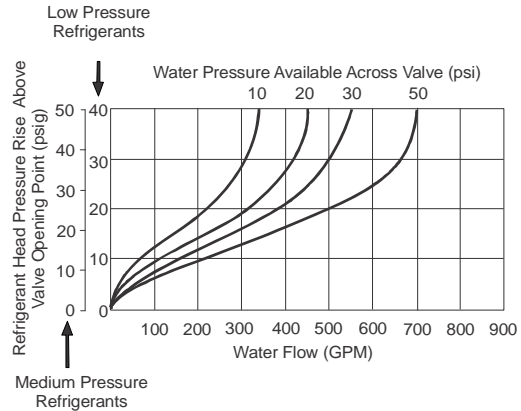
V43/V243 Pressure Actuated Water Regulating Valves Dimensions

V43 Capacity Flow Charts

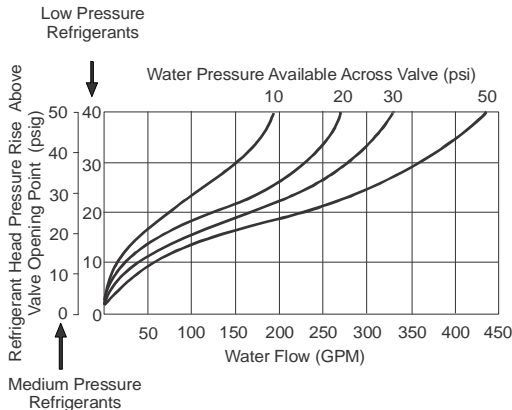
CAPACITY CHART FOR 2 in. VALVE



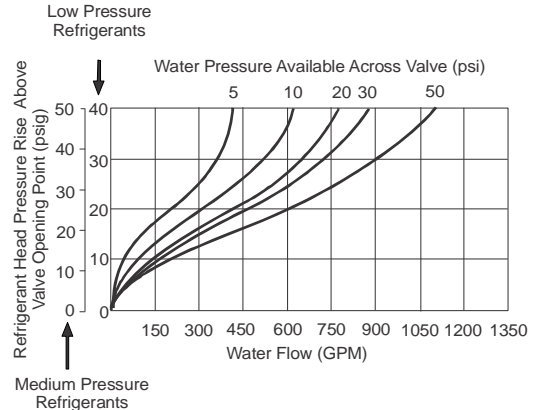
CAPACITY CHART FOR 3 in. VALVE



CAPACITY CHART FOR 2-1/2 in. VALVE



CAPACITY CHART FOR 4 in. VALVE



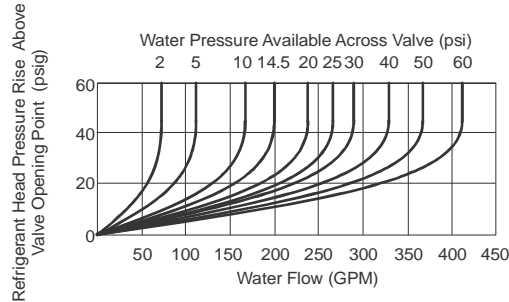
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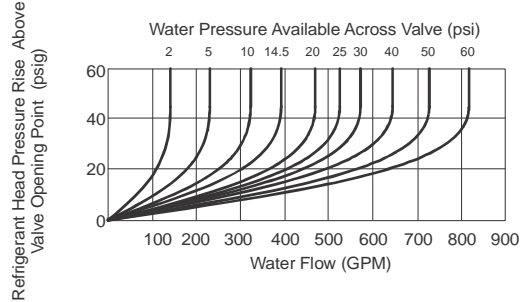
V43/V243 Series Pressure-Actuated Water-Regulating Valves (Continued)

V243 Capacity Flow Charts

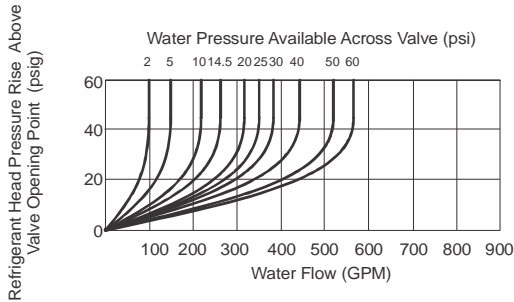
CAPACITY CHART FOR 2 in. VALVE



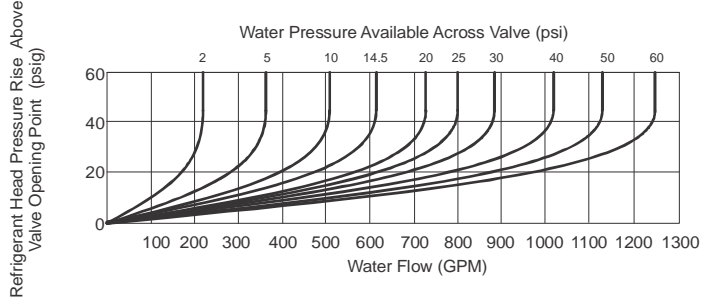
CAPACITY CHART FOR 3 in. VALVE



CAPACITY CHART FOR 2-1/2 in. VALVE



CAPACITY CHART FOR 4 in. VALVE



Technical Specifications

V43/V243 Pressure-Actuated Water-Regulating Valves			
Maximum Water Supply Pressure		150 psig (1,034 kPa)	
V43 Maximum Head Pressure		300 psig (2,068 kPa)	
V243 Maximum Head Pressure		630 psig (4,344 kPa)	
Head Pressure Range (Opening Points)	V43	Low Pressure Refrigerants	R-134A – 70 to 150 psig (482 to 1,034 kPa)
		Medium Pressure Refrigerants	R-22, R-502, R404A – 160 to 260 psig (1,103 to 1,793 kPa)
		Ammonia	160 to 260 psig (1,103 to 1,793 kPa)
	V243	High Pressure	200 to 400 psig (1,379 to 2,758 kPa)
Factory Settings ¹	V43	Low Pressure Refrigerants	90 psig (621 kPa)
		Medium Pressure Refrigerants	180 psig (1,241 kPa)
		Ammonia	180 psig (1,241 kPa)
	V243	High Pressure	200 psig (1,379 kPa)
Maximum Water Supply Temperature		160°F (71°C)	
Valve Body Material	Commercial	Cast iron	
	Maritime	Red brass	
Internal Parts Material	Commercial	Brass	
	Maritime	Bronze, Monel	
Seat Material	Pilot	Monel	
	Main Valve	Commercial – Bronze, Maritime – Monel	
Seat Disc Material		Buna N™	
Packing – Bellows Assembly		Brass stem, stainless steel spring, synthetic rubber boot	
Pressure Connection Refrigerant Side	Non-Corrosive	1/4 in. SAE External Flare	
	Ammonia	1/4 in. FNPT	

1. Factory opening setpoint for the valve is adjustable.



V46 Series Pressure Actuated Water Regulating Valve

Description

The V46 is a pressure actuated modulating valve that is suitable for use either on closed or open systems. Direct acting valves open on pressure increase. This type of valve is primarily used to regulate the flow of water or glycol to a water cooled condenser on a refrigeration system.

Refer to the *V46 Pressure-Actuated Water-Regulating Valve Product Bulletin (LIT-125687)* for important product application information.

Features

- no close fitting or sliding parts in water passages
- minimizes chatter or water hammer
- free movement of all parts provides smooth pressure modulation
- refrigerant adjustment is not affected by water pressure
- withstands high hydraulic shock without damage
- range spring does not come in contact with cooling water
- easy manual flushing, if required
- 3/8, 1/2, and 3/4 in. valves may be disassembled and reassembled without detaching from the refrigeration system or without pumping down

Applications

This valve is designed to modulate flow of water or glycol to a water cooled condenser on a refrigeration system.

- ice machines
- ice cream machines
- computer room air conditioning units
- refrigeration cases



V46AA-1 Water Regulating Valve



V46AT-1 Water Regulating Valve

Repair Information

If the V46 Series Pressure Actuated Water Regulating Valve fails to operate within its specifications, replace the unit. For a replacement valve, contact the nearest Johnson Controls® representative.

Selection Chart

Product Code Number ¹	Pipe Size (In.)	Inlet and Outlet	Opening Point Range – psig (kPa)	Pressure Element Style ²	Seat Repair Kit	Replacement Power Elements
Commercial Type, Standard Flow - Non-Corrosive Refrigerant						
V46AA-1C	3/8 NPT	Threaded	70 to 260 (483 to 1,793)	30 in Capillary; 1/4 in. Flare Nut (Style 45)	STT14A-600R	SEP91A-600R and SEC99AA-36C ³
V46AA-50C	1/2 NPT			1/4 in. External Flare Fitting (Style 5)		
V46AB-1C				30 in Capillary; 1/4 in. Flare Nut (Style 45)	STT16A-601R	SEP91A-601R and SEC99AA-36C ³
V46AB-25C	1/4 in. External Flare Fitting (Style 5)			STT17A-609R		
V46AC-1C	3/4 NPT				30 in Capillary; 1/4 in. Flare Nut (Style 45)	STT17A-610R
V46AC-26C	1 NPT			1/4 in. External Flare Fitting (Style 5)	STT17A-610R	
V46AD-1C				30 in Capillary; 1/4 in. Flare Nut (Style 45)		STT17A-610R
V46AD-13C	1 1/4 NPT			1/4 in. External Flare Fitting (Style 5)	STT17A-610R	
V46AE-1C				30 in Capillary; 1/4 in. Flare Nut (Style 45)		STT17A-610R
V46AE-17C	1/4 in. External Flare Fitting (Style 5)			STT17A-610R	SEP91A-603R	
V46AJ-2C	1/2	Union	48 in Capillary; 1/4 in. Flare Nut (Style 46)			STT15A-602R
V46EK-2C	3/4			STT16A-601R	SEP127A-600R	
V46AL-2C	1					STT17A-609R
V46AM-2C	1-1/4			STT17A-610R	SEP91A-603R and SEC99AA-36C ³	
V46AR-1C	1 1/2					Four Hole ASME Flange
V46AR-10C	2	1/4 in. External Flare Fitting (Style 5)	STT18A-601R	SEP81A-601R		
V46AS-1C					70 to 170 (483 to 1,172)	
V46AS-2C	160 to 260 (1,103 to 1,793)	STT18A-601R	SEP81A-601R			
V46AT-1C	2-1/2			70 to 170 (483 to 1,172)	STT18A-601R	
V46AT-2C	2-1/2	160 to 260 (1,103 to 1,793)	STT18A-601R			

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V46 Series Pressure Actuated Water Regulating Valve (Continued)

Product Code Number ¹	Pipe Size (In.)	Inlet and Outlet	Opening Point Range – psig (kPa)	Pressure Element Style ²	Seat Repair Kit	Replacement Power Elements	
Commercial Type, Low Flow - Non-Corrosive Refrigerants⁴							
V46DA-2C	3/8 NPT	Threaded	70 to 260 (483 to 1,793)	30 in. Capillary; 1/4 in. Flare Nut (Style 45)	STT14A-603R	SEP91A-600R and SEC99AA-36C ⁵	
Commercial Type - Ammonia							
V46AC-8C	3/4 NPT	Threaded	100 to 200 (690 to 1,379)	1/4 in. Internal NPT (Style 15)	STT16A-601R	SEP70A-601R	
V46AD-4C	1 NPT				STT17A-609R	SEP70A-604R	
V46AE-4C	1-1/4 NPT				STT17A-610R		
V46AR-2C	1-1/2	Four Hole ASME Flange			STT18A-600R	SEP70A-605R	
V46AS-3C	2				STT18A-601R		
V46AT-3C	2 1/2						
Maritime Type - Non-Corrosive Refrigerants							
V46BA-2C	3/8 NPT	Threaded	70 to 260 (483 to 1,793)	30 in. Capillary with Sweat Connection (Style 34)	STT14A-601R	SEP13A-602R	
V46BB-2C	1/2 NPT				STT15A-603R	SEP13A-600R	
V46BC-2C	3/4 NPT				STT17A-613R	SEP13A-603R	
V46BD-2C	1 NPT				STT17A-611R	SEP50A-600R	
V46BE-2C	1-1/4 NPT				STT17A-612R		
V46BS-4C	2				STT18A-602R	SEP50A-601R	
V46BT-4C	2-1/2	Four Hole ASME Flange	160 to 260 (1,103 to 1,793)				
NAVSEA Certified – Non-Corrosive Refrigerants							
V46CG-1C	3/8	Threaded	70 to 260 (483 to 1,793)	30 in. Capillary with Sweat Connection (Style 34)	STT14A-601R	SEP13A-602R	
V46CH-2C	3/8	Sweat Connector					
V46CH-4C	3/8						
V46CH-5C	3/8						
V46CJ-2C	1/2	Sweat Connector			STT15A-603R	SEP13A-600R	
V46CN-2C	3/4	Four Hole Navy Flange			STT17A-613R	SEP13A-603R	
V46CP-2C	1				STT17A-611R	SEP50A-600R	
V46CQ-2C	1-1/4				STT17A-612R		
V46BR-2C	1-1/2	Four Hole ASME Flange					
V46CR-2C	1-1/2	Six Hole Navy Flange					
V46BS-3C	2	Four Hole ASME Flange			70 to 170 (483 to 1,172)	STT18A-602R	SEP50A-601R
V46CS-3C	2	Six Hole Navy Flange					
V46CS-4C	2				160 to 260 (1,103 to 1,793)		
V46BT-3C	2-1/2	Four Hole ASME Flange			70 to 170 (483 to 1,172)		
V46CT-3C	2-1/2	Six Hole Navy Flange					
V46CT-4C	2-1/2		160 to 260 (1,103 to 1,793)				

1. Refer to *V46 Series Valve Sizing Information — 90% Open Method (LIT-1927400)*. Then specify the code number from this chart. Refer to the *Accessories* chart on the following page for companion flange kit code numbers.
2. Standard capillary length on Style 45 and Style 34 elements is 30 inches
3. Replacement element supplied with 1/4 in. external SAE connector. Order SEC99AA Capillary Kit with 2 flare nuts separately, if needed.
4. Low water flow valve - 2.5 GPM max.
5. Replacement element supplied with 1/4 in. external SAE connector. Order SEC99AA Capillary Kit with 2 flare nuts separately, if needed.

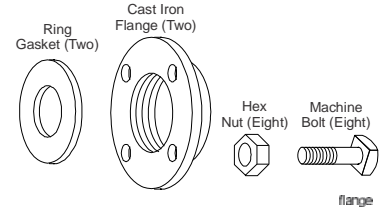
Note: Use only on valves specified.



V46 Series Pressure Actuated Water Regulating Valve (Continued)

Accessories (Companion Flanges and Gaskets)

Product Code Number	Companion Flange Kit (See Diagram)	Water Valve Size (in.)
246-423	KIT14A-612 ¹	1-1/2 in.
246-424	KIT14A-613 ¹	2 in.
246-425	KIT14A-614 ¹	2-1/2 in.



Companion Flange Kit

1. For commercial valves only

Note: Flange has NPT (National Pipe Thread)

Technical Specifications

V46 Series Pressure Actuated Water Regulating Valves		
Maximum Water Temperature	170°F (77°C)	
Valve Body	Commercial	3/8 to 3/4 in. cast brass, 1 in. and larger cast iron with a special finish
	Navy and Maritime	Cast naval bronze with Monel® interior parts

Pressure Range Specification

Refrigerant	Opening Point Range ¹ - psig (kPa) V46A B, C, D	Maximum Permissible Pressure psig (kPa)		Refrigerant
		Water		
		Static	ΔP Across Valve	
Non-Corrosive Refrigerants (R12, R22, R134a, R502, R404a, R507)				
All Range Valve	70 to 260 (483 to 1,793)	150 (1,034)	60 PST	320 (2,206)
All Range with High Overpressure				370 (2,551)
3/8 in. Extended All Range	70 to 300 (483 to 2,068)			440 (3,034)
Valves 2 in. or Larger				
R12, R134a - 2 and 2-1/2 in. Low Range	70 to 170 (483 to 1,172)	150 (1,034)	60 PST	230 (1,586)
R22, R502, R404a, R507 - 2 and 2-1/2 in. High Range	160 to 260 (1,103 to 1,793)			320 (2,206)
Other Refrigerants				
Ammonia R717	100 to 200 (690 to 1,379)	150 (1,034)	60 PST	320 (2,206)

1. Direct acting valve ranges indicate the valve opening point.



V46N Series Reverse Acting Valve

Description

The V46N Series are reverse acting pressure actuated modulating valves used on either open or closed loop coolant systems. Reverse acting valves open on a refrigerant pressure decrease. They are generally used in parallel with a direct acting valve for heat pump applications or for bypass operation.

Refer to the *V46 Pressure-Actuated Water-Regulating Product Bulletin (LIT-125687)* for important product application information.

Applications

- bypass systems
- water cooled heat pumps in parallel with direct acting valve

Repair Information

If the V46N Series Reverse Acting Valve fails to operate within its specifications, replace the unit. For a replacement valve, contact the nearest Johnson Controls® representative.



V46 Series Reverse Acting Valve

Selection Chart

Product Code Number ¹	Pipe Size In.	Inlet and Outlet	Opening Point Range psig (kPa)	Pressure Element Style	Seat Repair Kit	Replacement Power Elements
Commercial Type – Non-Corrosive Refrigerants (R)						
V46NA-1C	3/8 NPT	Threaded	90 to 280 (621 to 1,931)	30 in. capillary with 1/4 in. flare nut	STT14A-600R	SEP91A-600R & SEC99AA-36C ²
V46NA-4C			40 to 100 ³ (276 to 690)			
V46NB-1C	1/2 NPT		90 to 280 (621 to 1,931)	+ Schrader Valve depressor (Style 45)	STT15A-602R	SEP91A-602R & SEC99AA-36C ²
V46NB-2C			40 to 100 ³ (276 to 690)			
V46NC-1C	3/4 NPT		90 to 280 (621 to 1,931)		STT16A-601R	SEP91A-601R & SEC99AA-36C ²
V46NC-2C			40 to 100 ³ (276 to 690)			
V46ND-1C	1 NPT		90 to 280 (621 to 1,931)		STT17A-609R	SEP91A-603R & SEC99AA-36C ²
V46ND-2C			40 to 100 ³ (276 to 690)			
V46NE-1C	1-1/4 NPT	90 to 280 (621 to 1,931)	STT17A-610R			
V46NE-2C		40 to 100 ³ (276 to 690)				

1. Refer to *V46 Series Valve Sizing Information — 90% Open Method (LIT-1927400)*, and then specify the code number from this chart.
2. Maximum bellows overpressure is 320 psig (2,206 kPa). Replacement element provided with 1/4 in. external SAE connector. Order SEC37A capillary kit with two flare nuts, separately if needed. Use only on valves specified.
3. For heat pump application.



V46 Series Valve Sizing Information—90% Open Method

To Select Water Valve Size:

See the Flow Chart for selection of water valves. Carefully follow the steps as outlined below.

- 1 Determine maximum water flow required. The manufacturer of the condensing unit will usually provide tables, or calculations can be made from the following:
 - a Maximum Btu per hour to be removed. (Be sure to add heat gains in refrigeration equipment and heat of compression. If figures are not available, it is customary to add 25% to the load for these heat gains.)
 - b Incoming water temperature at time of maximum load.
 - c Outlet water temperature; this must be lower than condensing temperature of the refrigerant - use condensing unit manufacturer's data, or assume 10° difference.
 - d Flow (gallons/min) =

$$\frac{(\text{Tons of Refrigeration} \times 15,000 \text{ Btu/h})}{500 \times (\text{Outlet Temperature} - \text{Inlet Temperature})}$$

- 2 Draw horizontal line across upper half of flow chart through flow required as determined by Step 1 d above.

- 3 Determine the available system pressure for use with the valve by the following appropriate method:

Open System:

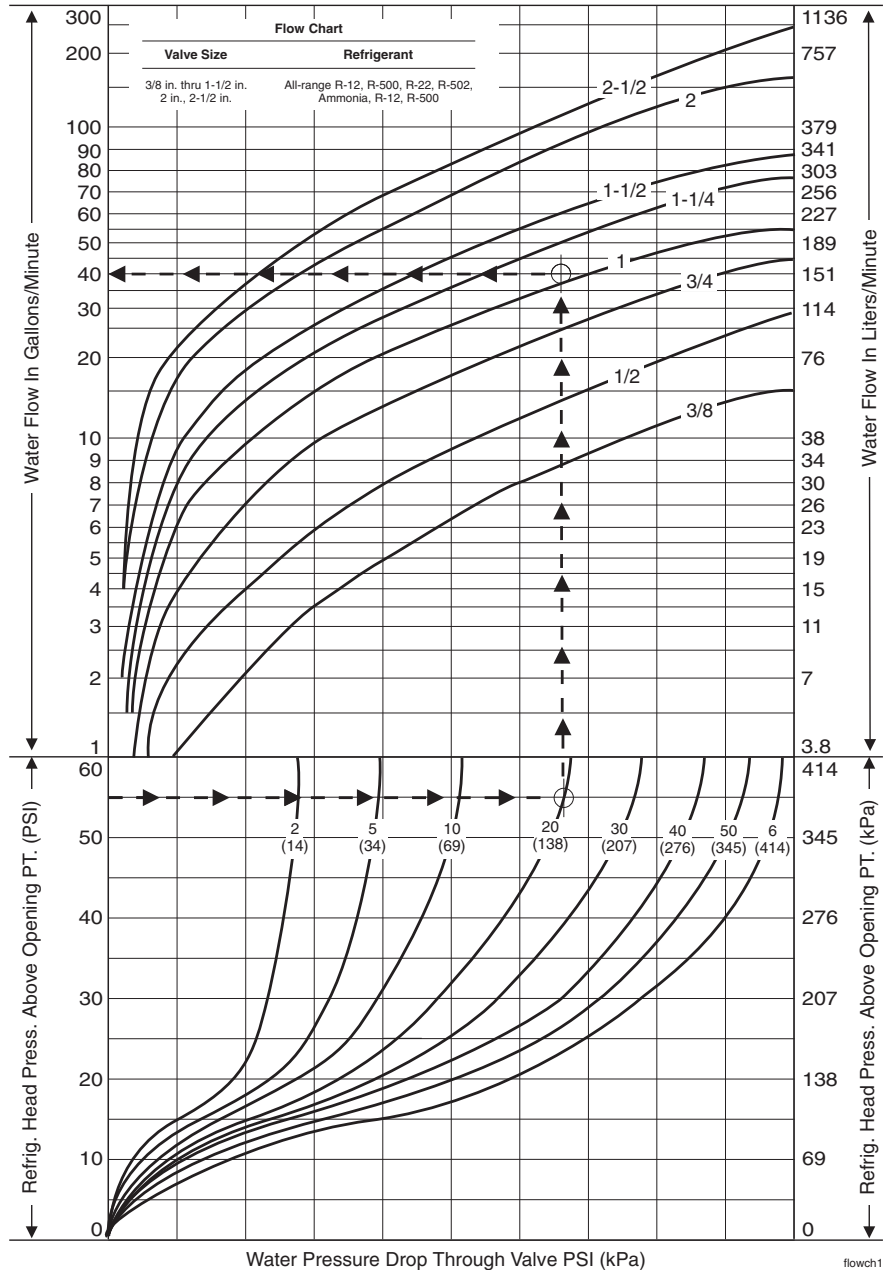
Available System Pressure = Inlet Pressure - condenser pressure drop - friction losses in piping.

Closed System:

Available System Pressure = Inlet Pressure - static head - condenser pressure drop - friction losses in piping.

The available system pressure is represented by the curve in the lower half of the flow chart.

- 4 Draw a horizontal line from 55 psi head pressure rise above opening point (valve approximately 90% open) to the available system pressure. If the point falls between two curves, use the curve to the left (this gives an automatic safety factor).
- 5 From the point where the horizontal line intersects the available system pressure curve, draw a vertical line upwards until it intersects with the horizontal line from Step 2.
- 6 If the intersection falls on a valve size curve, this is the valve size.
- 7 If the intersection falls between two curves, use the curve to the left for the required valve size.



Flow Chart, V46 Valve

Example:

- 1 The required flow of an R404A system is found to be 40 GPM (151 l/m). City water pressure is 40 psig (276 kPa) and manufacturer's table gives drop through condenser and accompanying piping and valves at 15 psi (103 kPa) drop through installed piping approximately 5 psi (35 kPa), leaving a net pressure drop available of 20 psi.
- 2 Draw a line through 40 GPM (151 l/m) - see dotted line, upper half of flow chart.
- 3 Size valves at 55 psi head pressure rise above opening point (valve is approximately 90% open).
- 4 Draw a line through 55 psi (375 kPa) - see dotted line, lower half of flow chart.
- 5 Available water pressure drop through valve = 40 - 20 = 20 psi (276 - 137 = 137 kPa).
- 6 Draw vertical line upward from this point to flow line - circle on flow chart marks this intersection.
- 7 Since the intersection falls between curves for 1 in. and 1-1/4 in. valves, choose the larger size. A 1-1/4 in. valve is required.



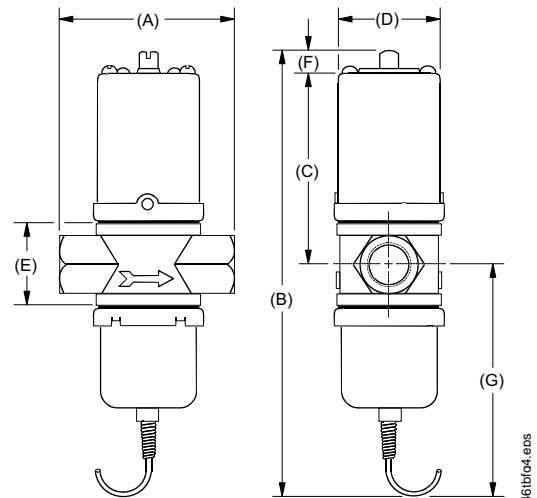
V46 Series Valve Dimensions

Roughing-in Dimensions

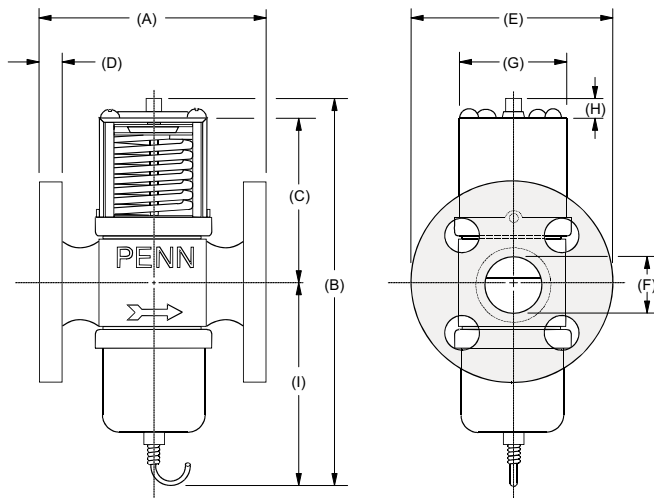
Commercial Service: V46 Threaded Connection Dimensions

Valve Size	Dimensions in Inches						
	A	B	C	D	E	F	G
3/8 in.	2-5/8	6-3/4	3-1/8	1-1/2	1-1/4	13/32	3-7/32
1/2 in.	3-1/8 (3-1/4) ¹	7-13/32	3-3/8	1-27/32	1-1/2	13/32	3-5/8
3/4 in.	3-3/8 (3-5/8) ¹	7-7/8	3-7/8	2-1/32	1-3/4	13/32	3-21/32
1 in.	4-1/2 (4-7/8) ¹	10-3/4	5-1/2	2-25/32	2	1/2	4-3/4
1-1/4 in.	4-7/8	11-1/8	5-3/4	2-5/8	2-3/8	1/2	4-29/32

1. Values in parenthesis are for maritime valves. All other dimensions remain the same.



V46 Series Threaded Type Valves



Flange Type Valves

Commercial Service: V46 Flange Connection Dimensions

Valve Size	Dimensions in Inches									V46 Flange Specifications		
	A	B	C	D	E	F	G	H	I	No. of Holes	Hole Size	Bolt Circle
1-1/2 in.	5-5/16	11-1/8	5-3/4	9/16	5	1-7/8	2-5/8	1/2	4-29/32	4	5/8	3-7/8
2 in.	6-5/8	13	6-15/32	5/8	6	2-1/4	3-1/2	1/2	6-1/8	4	3/4	4-3/4
2-1/2 in.	6-3/4	13-1/2	6-3/8	3/4	7	2-23/32	3-1/2	1-1/32	6-3/32	4	3/4	5-1/2

Maritime Service: ASME Flange Connection Dimensions

Valve Size	Dimensions in Inches									ASME Flange Specifications		
	A	B	C	D	E	F	G	H	I	No. of Holes	Hole Size	Bolt Circle
1-1/2 in.	5-5/16	10-1/2	5-5/8	9/16	5	1-7/8	2-5/8	1/2	5	4	5/8	3-7/8
2 in.	6-3/8	13-1/8	6-1/2	1/2	6	2-3/4	3-1/2	5/8	6	4	3/4	4-3/4
2-1/2 in.	6-3/4	13-1/8	6-1/2	11/16	7	2-3/4	3-1/2	5/8	6	4	3/4	5-1/2

Navy BuShips Service: Navy Flange Connection Dimensions

Valve Size	Dimensions in Inches									Navy Flange Specifications		
	A	B	C	D	E	F	G	H	I	No. of Holes	Hole Size	Bolt Circle
3/4 in.	4-3/16	7-3/4	4	7/16	3-13/16	1-1/8	2-1/32	1/2	3-5/16	4	9/16	2-11/16
1 in.	5-5/16	9	4-1/2	1/2	4-1/4	1-1/4	2-5/8	1/2	4	4	9/16	3-1/8
1-1/4 in.	5-5/16	9-11/32	4-11/16	1/2	4-1/2	1-5/8	2-5/8	1/2	4-5/32	4	9/16	3-3/8
1-1/2 in.	5-5/16	10-7/32	5-3/4	1/2	5-1/16	1-7/8	2-5/8	1/2	4	6	9/16	3-15/16
2 in.	6-3/8	14-1/8	6-13/32	1/2	5-9/16	2-3/4	3-1/2	7/16	7-9/32	6	9/16	4-7/16
2-1/2 in.	6-3/8	14-5/16	6-1/2	1/2	6-1/8	2-3/4	3-1/2	5/8	7-3/16	6	9/16	5

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V47 Series Temperature Actuated Modulating Valve

Description

The V47 is a temperature actuated modulating valve that regulates the flow of water or glycol to maintain a desired temperature. Three temperature ranges for each valve size are available.

Many valves come with a removable bypass plug that can be replaced by the bypass orifice provided separately with each valve.

Valve action is open on temperature increase. For open on temperature decrease models, contact Application Engineering.

Refer to the *V47 Series Temperature Actuated Modulating Water Valves Product Bulletin (LIT-125690)* for important product application information.

Features

- no close fitting sliding parts in water passages
- range spring does not come in contact with the cooling water
- easy manual flushing, if required
- valve design minimizes chatter and water hammer

Repair Information

If the V47 Series Temperature Actuated Modulating Valve fails to operate within its specifications, replace the unit. For a replacement valve, contact the nearest Johnson Controls® representative.



V47 Series Valve

Selection Chart

Product Code Number ¹	Pipe Size, in.	Range (Opening Point) °F	Bulb Size, in. (Dia. length)	Std Bypass Orifice Dia., in.	Seat Repair Kit	Replacement Sensing Element	Bulb Well Number Order Separately
V47AA-1C	3/8	115 to 180 Heating	11/16 x 3-1/4	0.062	STT14A-600R	SET29A-622R	WEL18A-602R
V47AA-2C	3/8	160 to 230 Heating	11/16 x 3-1/4	0.062	STT14A-600R	SET29A-623R	WEL18A-602R
V47AA-3C	3/8	75 to 135 Cross Ambient	11/16 x 6	0.062	STT14A-600R	SET29A-601R	WEL17A-601R
V47AA-26C ²	3/8	20 to 65 Cross Ambient	11/16 x 6 ³	–	STT14A-600R	–	WEL17A-601R
V47AB-2C	1/2	75 to 135 Cross Ambient	11/16 x 10 ³	–	STT15A-602R	SET29A-602R	WEL17A-600R
V47AB-3C	1/2	115 to 180 Heating	11/16 x 3-1/4	0.062	STT15A-602R	SET29A-624R	WEL18A-602R
V47AB-4C	1/2	160 to 230 Heating	11/16 x 3-1/4	0.062	STT15A-602R	SET29A-625R	WEL18A-602R
V47AB-5C	1/2	75 to 135 Cross Ambient	11/16 x 10	0.062	STT15A-602R	SET29A-602R	WEL17A-600R
V47AB-27C ⁴	1/2	40 to 85 Cross Ambient	11/16 x 10 ³	Yes ⁵	STT15A-602R	–	WEL17A-600R
V47AC-3C	3/4	115 to 180 Heating	11/16 x 3-1/4	0.062	STT16A-601R	SET29A-626R	WEL18A-602R
V47AC-4C	3/4	160 to 230 Heating	11/16 x 3-1/4	0.062	STT16A-601R	SET29A-627R	WEL18A-602R
V47AC-6C	3/4	75 to 135 Cross Ambient	11/16 x 10	0.062	STT16A-601R	SET29A-604R	WEL17A-600R
V47AC-8C	3/4	75 to 135 Heating	11/16 x 3-1/4	–	STT16A-601R	SET98A-621R	WEL18A-602R
V47AC-40C	3/4	40 to 85 Cross Ambient	11/16 x 10	Yes ⁵	STT16A-601R	–	WEL17A-600R
V47AD-1C	1	75 to 135 Cross Ambient	11/16 x 16-1/4	0.093	STT17A-609R	SET29A-605R	–
V47AD-2C	1	115 to 180 Heating	11/16 x 6	0.093	STT17A-609R	SET29A-629R	WEL17A-601R
V47AD-3C	1	160 to 230 Heating	11/16 x 6	0.093	STT17A-609R	SET29A-630R	WEL17A-601R
V47AD-19C	1	40 to 85 Cross Ambient	11/16 x 16-1/4	0.093	STT17A-609R	–	–
V47AE-1C	1-1/4	75 to 135 Cross Ambient	11/16 x 16-1/4	0.093	STT17A-610R	SET29A-605R	–
V47AE-2C	1-1/4	115 to 180 Heating	11/16 x 6	0.093	STT17A-610R	SET29A-629R	WEL17A-601R
V47AE-3C	1-1/4	160 to 230 Heating	11/16 x 6	0.093	STT17A-610R	SET29A-630R	WEL17A-601R
V47AE-13C	1-1/4	40 to 85 Cross Ambient	11/16 x 16-1/4	Yes ⁵	STT17A-610R	–	–
V47AR-1	1-1/2 ⁶	75 to 135 Cross Ambient	11/16 x 16-1/4	0.093	STT17A-610R	SET29A-605R	–
V47AR-2	1-1/2 ⁶	115 to 180 Heating	11/16 x 6	0.093	STT17A-610R	SET29A-629R	WEL17A-601R
V47AR-3	1-1/2 ⁶	160 to 230 Heating	11/16 x 6	0.093	STT17A-610R	SET29A-630R	WEL17A-601R
V47AS-1	2 ⁶	115 to 160 Heating	11/16 x 10	0.125	STT18A-600R	SET29A-632R	WEL17A-600R
V47AS-2	2 ⁶	160 to 205 Heating	11/16 x 10	0.125	STT18A-600R	SET29A-633R	WEL17A-600R
V47AS-3	2 ⁶	75 to 115 Cross Ambient	11/16 x 43	0.125	STT18A-600R	SET29A-606R	–
V47AS-13C	2 ⁶	40 to 85 Cross Ambient	11/16 x 43	Yes ⁵	STT18A-600R	–	–
V47AT-1	2-1/2 ⁶	115 to 160 Heating	11/6 x 10	0.125	STT18A-601R	SET29A-632R	WEL17A-600R
V47AT-2	2-1/2 ⁶	160 to 205 Heating	11/6 x 10	0.125	STT18A-601R	SET29A-633R	WEL17A-600R
V47AT-3	2-1/2 ⁶	75 to 115 Cross Ambient	11/16 x 43	0.125	STT18A-601R	SET29A-606R	–

1. Standard capillary is 6 ft (Style 4)

2. 2 ft capillary

3. Style 1 bulb (does not include 1/2 in. external NPT fitting)

4. 4 ft capillary

5. Solid plug installed, orifice available separately

6. ASME Flange

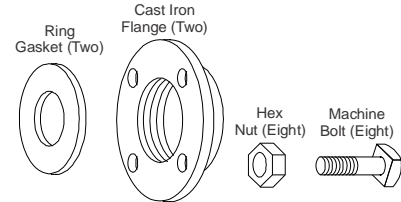
Note: For more information on Bulb Wells, refer to *Bulb Wells (LIT-1922135)*.



V47 Series Temperature Actuated Modulating Valve (Continued)

Accessories (Companion Flanges and Gaskets)

Product Code Number		Water Valve Size (in.)
Flange Gasket (One Gasket per Package)	Companion Flange Kit (See Diagram)	
246-423	KIT14A-612	1-1/2 in.
246-424	KIT14A-613	2 in.
246-425	KIT14A-614	2-1/2 in.



Note: Flanges have NPT (National Pipe Thread).

Companion Flange Kit

Technical Specifications

V47 Series Temperature Actuated Modulating Valves	
Maximum Bulb Temperature	20F° (-6.7 C°) above temperature range
Maximum Water Temperature	170°F (77°C)
Maximum Supply Water Pressure	150 psig (1,034 kPa)
Capillary	Nylon Armor ¹
Temperature Bulb Style 4 ² (pictured)	(1/2 in. NPT closed tank immersion)

- For capillary length, refer to the selection chart on the previous page.
- V47AA-26, V47AB-2, V47AB-27 — Temperature Bulb Style 1 (no 1/2 in. NPT external fitting)

Metric Conversion

°F	°C
20 to 65	-6 to 18
40 to 85	4 to 29
75 to 115	24 to 46
75 to 135	24 to 57
115 to 160	46 to 71
115 to 180	46 to 82
160 to 205	71 to 96
160 to 230	71 to 110

V47 Valve Sizing Information

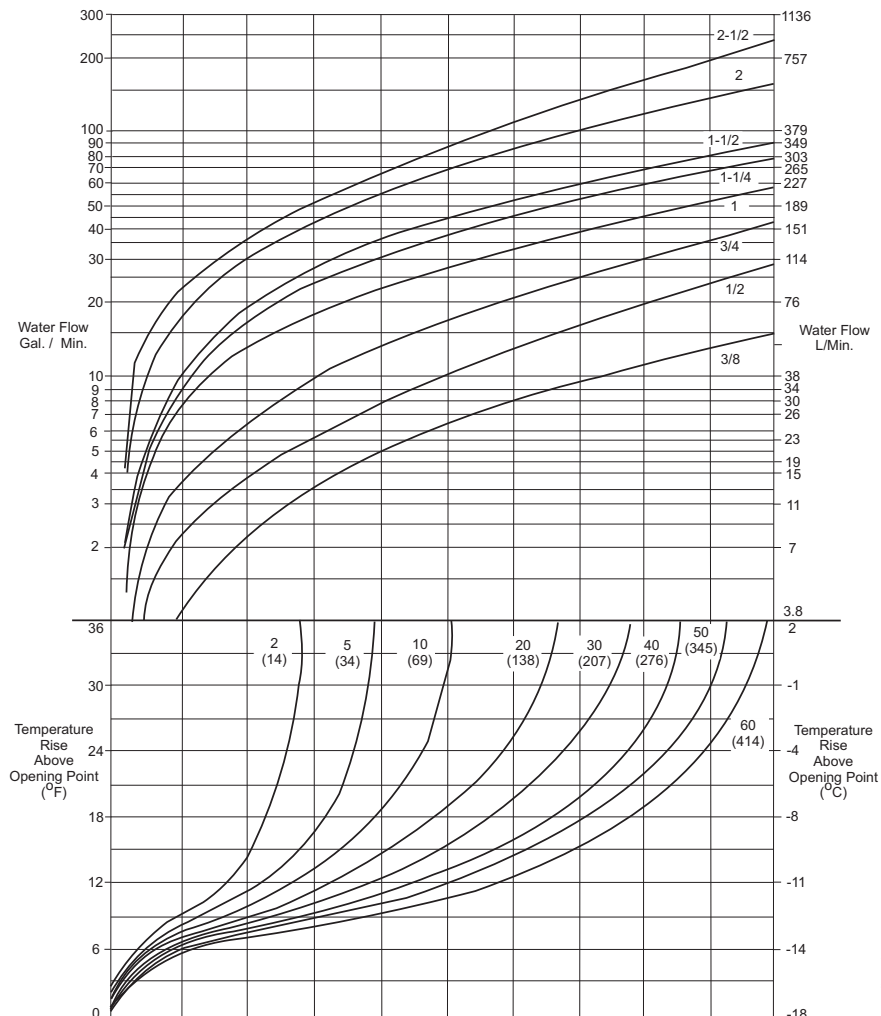
To Select Water Valve Size, see the flow chart for selection of water valves. Carefully follow the steps as outlined below.

- Determine the maximum water flow required.
Draw a horizontal line through this flow across the upper half of the flow chart.
- Use the following method to determine the temperature rise above the opening point.
 - Valve closing point is the highest temperature at which it is desired to have no flow through the valve.
 - Valve opening point is about 5F° above the closing point.
 - Determine the temperature the valve is to maintain, this is the operating temperature.
 - Subtract the opening temperature from the operating temperature. This is the temperature rise above the opening point.
- Determine the available system pressure for use with the valve by the following appropriate method:

Open System:
Available System Pressure = Inlet Pressure - condenser pressure drop - friction losses in piping.

Closed System:
Available System Pressure = Inlet Pressure - static head - condenser pressure drop - friction losses in piping.

The available system pressure is represented by the curve in the lower half of the flow chart.
- In the lower half of the flow curve, draw a horizontal line from the temperature above the opening point (Step 2d) to the available system pressure (Step 3). If the point falls between two pressure drop curves, use the curve to the left (this gives an automatic factor of safety).
- From this point, draw a vertical line until it intersects the flow line from Step 1.
- If the intersection falls on a valve size curve, this is the valve size.
- If the intersection falls between two curves, use the curve to the left for the required valve size.



Flow Chart, V47 Valve

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V47N Series Reverse Acting Valve

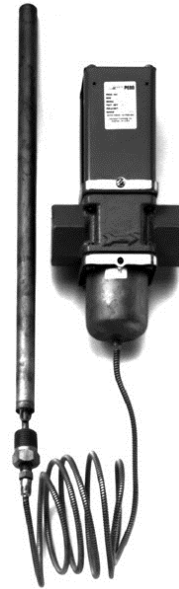
Description

The V47N Series are reverse-acting, temperature-actuated, modulating valves that regulate the flow of water or glycol to maintain a desired temperature. Reverse-acting valves open on a drop in temperature. They are generally used in parallel with direct-acting valves for hand pump applications or for bypass operation.

Refer to the *V47 Series Temperature Actuated Modulating Water Valves Product Bulletin (LIT-125690)* for important product application information.

Applications

- bypass systems
- water-cooled heat pumps in parallel with a direct-acting valve



V47N Series Reverse Acting Valve

Selection Charts

V47N Series Reverse Acting Valve

Product Code Number ¹	Pipe Size & Connector	Opening Point Range	Factory-set Opening Point	Bulb Size, In.	Standard Bypass Orifice
V47NB-1C	1/2 in. Screw	85 to 155°F	105°F	11/16 x 3-1/4	—
V47NC-1C	3/4 in. Screw				
V47NR-1C	1-1/2 in. Flange	45 to 85°F	55°F	11/16 x 16-1/4	

1. Refer to sizing information in *V47 Series Temperature Actuated Modulating Valve (LIT-1927330)*, then specify the code number from this chart.

Repair Parts and Accessories

Parts For:	Product Code Number		
	Seat Repair Kit	Replacement Sensing Element	Bulb Well Number (Order Separately)
V47NB-1C	STT15A-602R	—	WEL18A-602R (Brass)
V47NC-1C	STT16A-601R		
V47NR-1C	STT17A-610R	SET29A-605R	—



V48 Series Three-Way Water Regulating Valve

Description

V48 Series valves are designed specifically for condensing units cooled either by atmospheric or forced draft cooling towers.

Refer to the *V48 Series 3-Way Water Regulating Valves for Cooling Tower Systems Product Bulletin (LIT-121705)* for important product application information.

Applications

V48 Series valves are used on single or multiple condenser hook-ups to the tower to provide the most economical and efficient use of the tower.

Repair Information

If the V48 Series Three-Way Water Regulating Valve fails to operate within its specifications, replace the unit. For a replacement valve, contact the nearest Johnson Controls® representative.



V48 Series Three-Way Water Regulating Valve

Selection Chart (Non-Corrosive Refrigerants)

Product Code Number	Pipe Size, In.	Range Opening Point of Normally Closed Side psi (kPa)	Pressure Element Style	Water Supply Pressure	Inlet and Outlet Ports	Max Bellows Overpressure	Seat Repair Kit	Replacement Sensing Element	
V48AB-1C	1/2	85 to 110 (586 to 758)	30 in. capillary with 1/4 in. flare nut (Style 45) ¹	150 psig (1,034 kPa)	Threaded	230 psig (1,586 kPa)	STT15A-605R	SEP91A-602R SEC99AA-36C ²	
V48AB-2C	1/2	145 to 190 (1,000 to 1,310)				320 psig (2,206 kPa)			
V48AC-1C	3/4	85 to 110 (586 to 758)				230 psig (1,586 kPa)	STT16A-604R		SEP91A-601R SEC99AA-36C ²
V48AC-2C	3/4	145 to 190 (1,000 to 1,310)				320 psig (2,206 kPa)			
V48AD-1C	1	85 to 110 (586 to 758)			230 psig (1,586 kPa)	STT17A-616R	SEP91A-603R SEC99AA-36C ²		
V48AD-2C	1	145 to 190 (1,000 to 1,310)			320 psig (2,206 kPa)				
V48AE-1C	1-1/4	85 to 110 (586 to 758)			230 psig (1,586 kPa)	STT17A-617R			
V48AE-2C	1-1/4	145 to 190 (1,000 to 1,310)			320 psig (2,206 kPa)				
V48AF-1C	1-1/2	85 to 110 (586 to 758)	1/4 in. External Flare Fitting (Style 5)			230 psig (1,586 kPa)	STT17A-604R	SEP81A-602R	
V48AF-2C	1-1/2	145 to 190 (1,000 to 1,310)				320 psig (2,206 kPa)		SEP81A-601R	
V48AJ-2C	1/2		30 in. capillary with 1/4 in. flare nut (Style 45)		Union	320 psig (2,206 kPa)	STT15A-605R	SEP77A-605R	
V48EK-2C	3/4		30 in. capillary with 1/4 in. flare nut (Style 46)			370 psig (2,551 kPa)	STT16A-604R	SEP127A-600R	
V48AL-2C	1					320 psig (2,206 kPa)	STT17A-616R	SEP107A-602R	
V48AM-2C	1-1/4					320 psig (2,206 kPa)	STT17A-617R		

- Standard capillary length on Style 45 elements is 30 inches
- Replacement element supplied with 1/4 in. external SAE connector. Order SEC99AA capillary kit with two flare nuts separately if needed. Use only on valves specified.

Technical Specifications

V48 Series Factory Settings

Refrigerant (R)	Factory Settings psig (kPa)	
	Opening Press. Port 1 to Port 2	Closing Press. Port 1 to Port 3
Low Pressure (R-12, R134a, etc.)	95 (655)	120 (896)
Medium Pressure (R-22, R404A, etc.)	165 (1,138)	215 (1,482)

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V146 Series Two-Way Pressure-Actuated Water-Regulating Valves

Description

The V146 Series Two-Way Pressure-Actuated Water-Regulating Valves regulate water flow to control refrigerant head pressure in systems with water-cooled condensers. The V146 valves are ideal for applications with system water pressures of up to 350 psig (24.1 bar), such as high-rise buildings.

V146EK and V146AL valves have an adjustable opening point in a refrigerant pressure range of 70 to 260 psi (4.8 to 17.9 bar). V146EK and V146AL valves are available in a 3/4 in. and 1 in. size. Use these valves with standard, non-corrosive refrigerants.

V146GK1 and V146GL1 valves have an adjustable opening point in a refrigerant pressure range of 200 to 400 psi (13.8 to 27.6 bar). The V146GK1 and V146GL1 valves are available in 3/4 in. and 1 in. size for use with standard, non-corrosive, high-pressure refrigerants.

Refer to the *V146 Series 2-Way Pressure-Actuated Water-Regulating Valves Product Bulletin (LIT-121709)* for important product application information.

Features

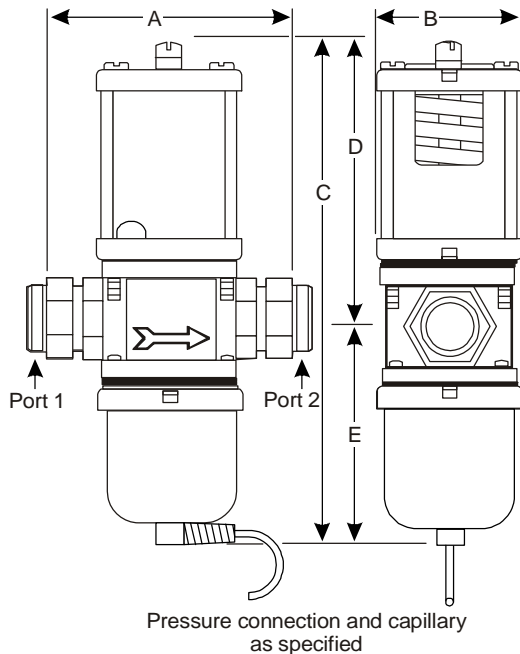
- no close-fitting or sliding parts in water passages
- high-pressure design
- pressure-balanced design
- corrosion-resistant material for internal parts
- accessible range spring
- take-apart construction

Applications

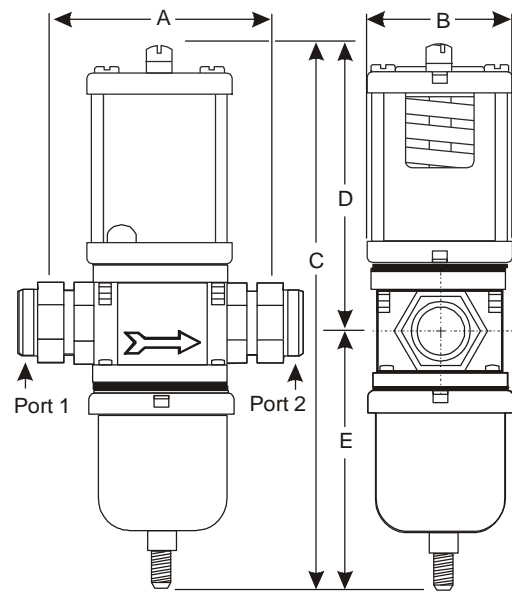
Each application is unique and requires specific engineering data to properly size and design a system to fulfill the appropriate requirements. Typically, a valve is replaced with another valve of the same size in a properly sized and engineered system.



V146 Series Valve



3/4 in. V146EK Valves



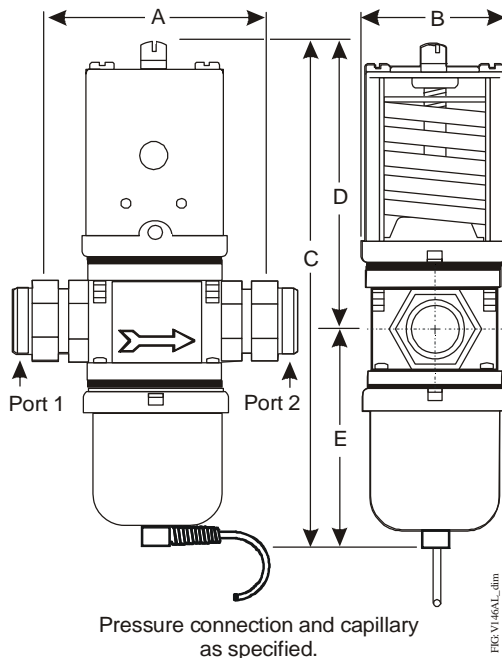
High Refrigerant Pressure 3/4 in. V146GK1 Valves



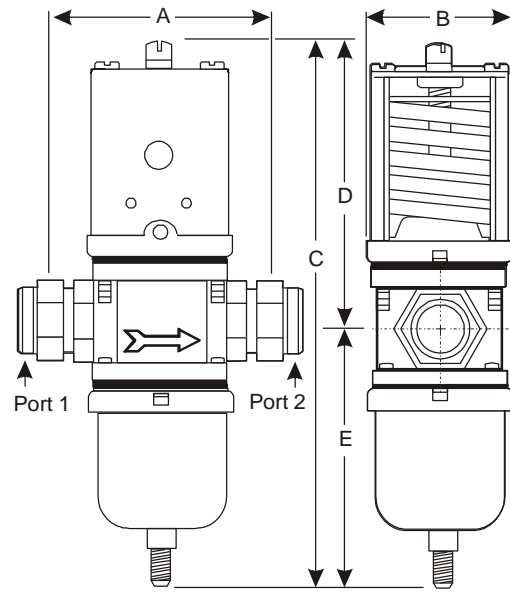
V146 Series Two-Way Pressure-Actuated Water-Regulating Valves (Continued)

Valve Dimensions, Inches (Millimeters)

Product Code Number	Nominal Valve Size	A	B	C	D	E
V146EK-1C	3/4 in.	3-3/8 (86)	2-3/16 (55)	7-3/16 (183)	4-3/16 (106)	3 (76)
V146GK1-001C	3/4 in.	3-3/8 (86)	2-3/16 (55)	8 (204)	4-3/16 (106)	3-13/16 (98)
V146AL-1C	1 in.	4-3/4 (121)	2-13/16 (72)	10 (254)	5-15/16 (151)	4-1/16 (103)
V146GL1-001C	1 in.	4-3/4 (121)	2-13/16 (72)	10-1/2 (267)	5-15/16 (151)	4-9/16 (116)



1 in. V146AL Valves



High Refrigerant Pressure 1 in. V146GL1 Valves

Selection

To make a rough field estimate of the size of valve for an application, find the valve size by locating a point on a flow chart that satisfies these requirements:

- water flow required by the condenser (**Flow**)
- refrigerant head pressure rise (**P_{RISE}**)
- available water pressure (**P_{AVAIL}**)

Follow these steps, and use the information obtained to locate a point on one of the flowcharts that satisfies all three steps.

1. Take the water flow required by the condenser (**Flow**) from information provided by the manufacturer of the condensing unit. If the manufacturer's information is unavailable, use the following information to make a rough approximation of maximum water flow in gallons per minute (gpm) (cubic meters per hour [m³/hr]):
 - System Capacity (**Tons of Refrigeration**)
 - Outlet Water Temperature (**Temp. _{Outlet}**)
 - Inlet Water Temperature (**Temp. _{Inlet}**)

Calculate the flow using the following formula:

$$\text{Flow} = \frac{\text{Tons of Refrigeration} \times 30}{(\text{Temp.}_{\text{Outlet}} - \text{Temp.}_{\text{Inlet}})}$$

Flow Required

- Note: If the outlet temperature is unknown, assume it to be 10F° (5.6C°) above the inlet temperature.
2. Determine refrigerant head pressure rise above the valve opening point (**P_{RISE}**) using the following steps:
 - a. The **Valve Closing Pressure (P_{CLOSE})** is equal to the refrigerant pressure at the highest ambient temperature the refrigeration equipment experiences in the Off cycle. Use a Pressure-Temperature Chart for the refrigerant selected to find this pressure.
 - b. To approximate the **Valve Opening Pressure (P_{OPEN})**, add about 7 psi (0.5 bar) for EK and AL models or 10 psi (0.7 bar) for GL1 or GK1 models to the Valve Closing Pressure.

V146 Series Two-Way Pressure-Actuated Water-Regulating Valves (Continued)

$$P_{OPEN} = P_{CLOSE} + 7 \text{ psi (0.5 bar)}$$

$$P_{OPEN} = P_{CLOSE} + 10 \text{ psi (0.7 bar)}$$

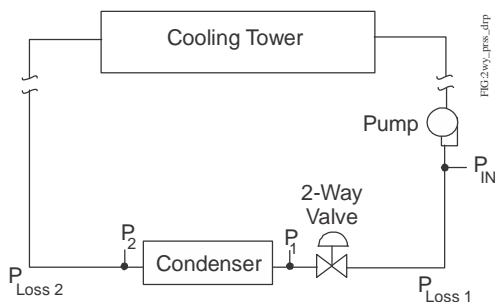
Valve Opening Pressure, EK and AL Models (Top) or GK1 and GL1 Models (Bottom)

- c. From the Pressure-Temperature Chart for the refrigerant selected, read the **Refrigerant Condensing Pressure (P_{COND})** (operating head pressure) corresponding to the selected condensing temperature.
- d. Subtract the Valve Opening Pressure from the Refrigerant Condensing Pressure. This gives the head pressure rise.

$$P_{RISE} = P_{COND} - P_{OPEN}$$

Figure 1: Refrigerant Head Pressure Rise

3. Determine the available water pressure to the valve (P_{AVAIL}) using the following steps. This is the actual water pressure available to force water through the valve.
 - a. Determine the minimum inlet pressure (P_{IN}). This is the water pressure from city water mains, pumps, or other sources.
 - b. Pressure drop through condenser (ΔP_{COND}) is the difference in water pressure between the condenser inlet and the condenser outlet. Obtain this information from the condenser manufacturer.
 - c. Estimate or calculate the pressure drop through all associated piping (P_{LOSS}).
 - d. Subtract the ΔP_{COND} and P_{LOSS} from P_{IN} . The result is P_{AVAIL} .



$$\Delta P_{COND} = P_1 - P_2$$

$$P_{LOSS} = P_{Loss 1} + P_{Loss 2} + \dots$$

$$P_{AVAIL} = P_{IN} - (\Delta P_{COND} + P_{LOSS})$$

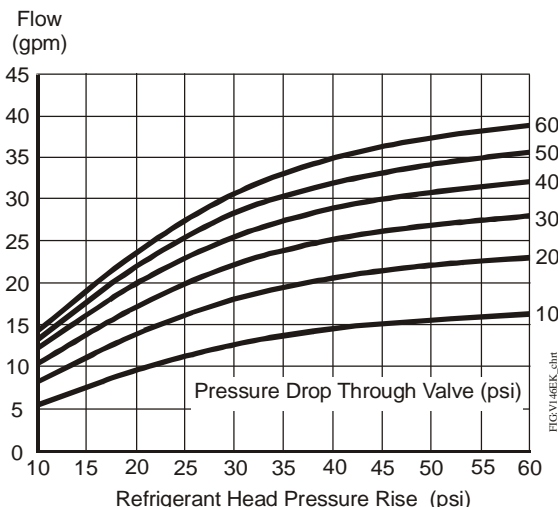
Available Water Pressure

4. Select the proper valve size from the flowcharts by locating a point on a chart that satisfies the flow, the head pressure rise above opening point, and the pressure drop across the valve.

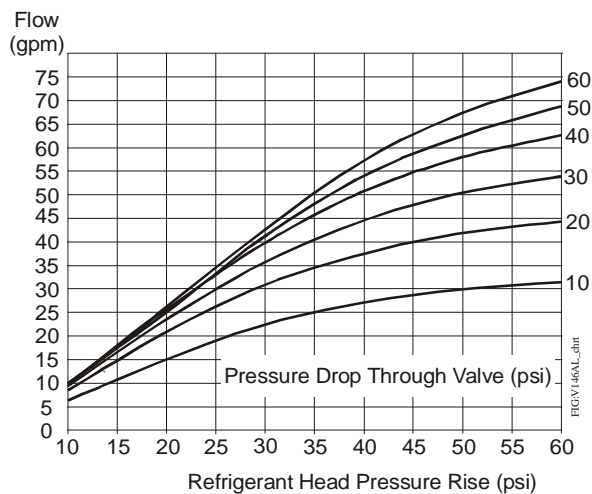
Use these equations to convert between U.S. and S.I. units.

- $1 \text{ dm}^3/\text{s} = 3.6 \text{ m}^3/\text{h} = 15.9 \text{ U.S. gal. /min.} = 13.2 \text{ U.K. gal. /min.}$
- $1 \text{ bar} = 100 \text{ kPa} = 0.1 \text{ MPa} = 1.02 \text{ kg/cm}^2 = 0.987 \text{ atm} = 14.5 \text{ psi}$

The maximum recommended differential water pressure across a valve is 60 psi (4.1 bar).



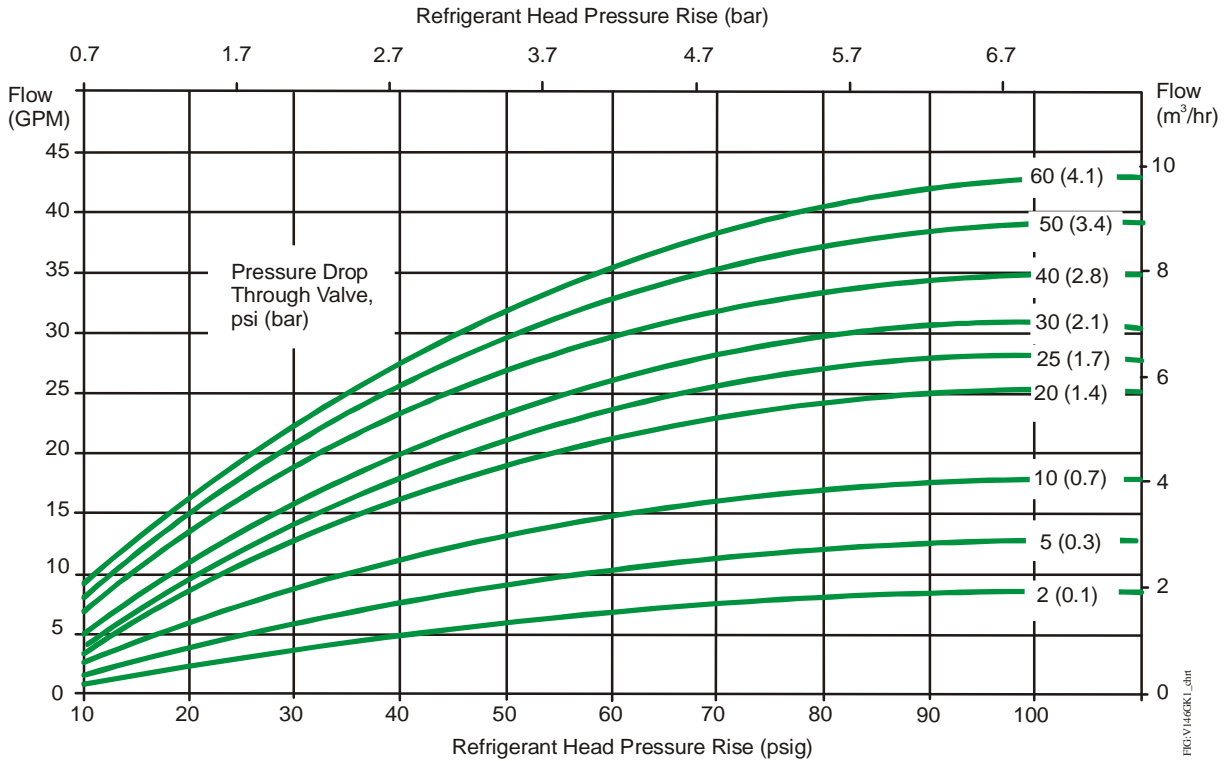
3/4 in. V146EK Valve



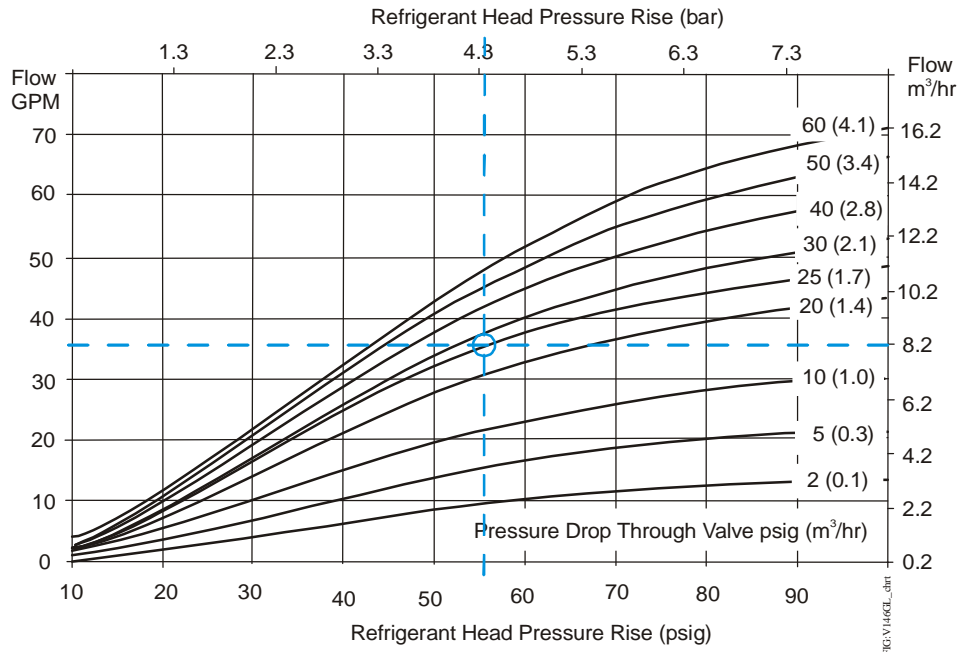
1 in. V146AL Valve



**V146 Series Two-Way Pressure-Actuated Water-Regulating Valves
(Continued)**



High Refrigerant Pressure 3/4 in. V146GK1 Valves



High Refrigerant Pressure 1 in. V146GL1 Valves

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**V146 Series Two-Way Pressure-Actuated Water-Regulating Valves
(Continued)**

Style 5



1/4-in. SAE External Flare Connector

Style 46



Copper Capillary with
1/4-in. SAE Internal Flare Connector
(Includes Valve Stem Depressor)

11G.valve_ctr_01.pdf

Pressure Connection Styles

Selection Chart

Product Code Number	Nominal Valve Size	Inlet and Outlet Ports	Pressure Connection Style	Shipping Weight, lb (kg)
V146EK-1C	3/4 in.	Union (Sweat)	46	4.3 (2.0)
V146GK1-001C	3/4 in.	Union (Sweat)	5	4.3 (2.0)
V146AL-1C	1 in.	Union (Sweat)	46	9.3 (4.0)
V146GL1-001C	1 in.	Union (Sweat)	5	9.3 (4.0)

Repair Information

If the V146 Series Two-Way Pressure-Actuated Water-Regulating Valve fails to operate within its specifications, refer to the *V146 Series Two-Way Pressure-Actuated Water-Regulating Valves Product Bulletin (LIT-1201709)* for a list of repair parts available.

Technical Specifications

V146 Series 2-Way Pressure-Actuated Water-Regulating Valves	
Maximum Refrigerant Pressure	V146EK: 370 psi (25.5 bar) V146AL: 320 psi (22.1 bar)
Maximum Working Pressure	V146GK1, V146GL1: 630 psi (43.4 bar)
Opening Point Adjustment Range	V146EK, V146AL: 70 to 260 psi (4.8 to 17.9 bar) V146GK1, V146GL1: 200 to 400 psi (13.8 to 27.6 bar)
Factory-Set Opening Point	V146EK, V146AL: 165 psi (11.4 bar) V146GK1, V146GL1: 275 psi (19.0 bar)
Media	350 psi (24.1 bar) maximum, -4°F to 170°F (-20°C to 77°C) glycol/water or liquids with low freezing points that are compatible with valve materials



V148 Series Three-Way Pressure-Actuated Water-Regulating Valves

Description

The V148 Series Three-Way Pressure-Actuated Water-Regulating Valves regulate water flow to control refrigerant head pressure in systems with single or multiple water-cooled condensers. The V148 valves are designed for applications with system water pressures of up to 350 psi (24.1 bar), such as high-rise buildings.

V148EK and V148AL valves have an adjustable opening point in a refrigerant pressure range of 145 to 190 psi (10.0 to 13.1 bar). V148EK and V148AL valves are available in 3/4 in. and 1 in. sizes. Use these valves with standard, non-corrosive refrigerants.

V148GK1 and V148GL1 valves have an adjustable opening point in a refrigerant pressure range of 200 to 400 psi (13.8 to 27.6 bar). The V148GK1 and V148GL1 Valves are available in 3/4 in. and 1 in. sizes for use with standard, non-corrosive, high-pressure refrigerants.

Refer to the *V148 Series 3-Way Pressure-Actuated Water-Regulating Valves Product Bulletin (LIT-121712)* for important product application information.

Features

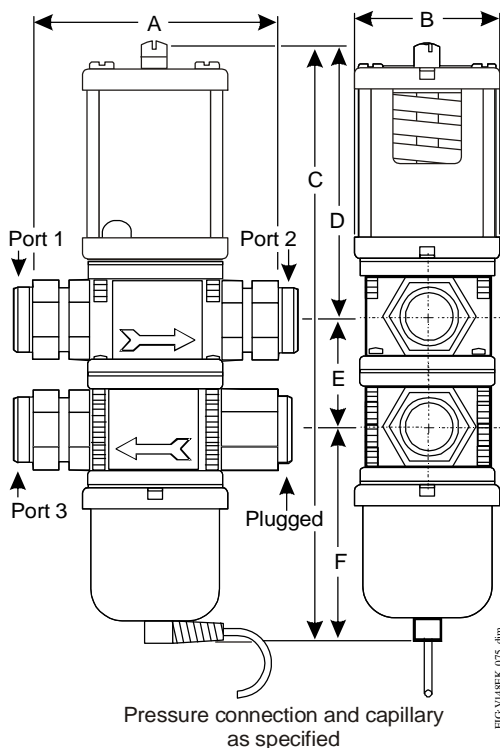
- no close-fitting or sliding parts in water passages
- high water pressure design
- pressure-balanced design
- corrosion-resistant material for internal parts
- accessible range spring
- take-apart construction

Applications

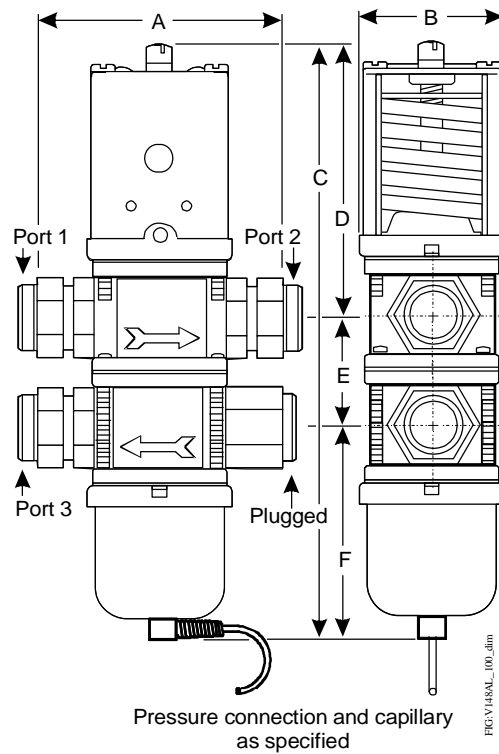
Each application is unique and requires specific engineering data to properly size and design a system to fulfill the appropriate requirements. Typically, a valve is replaced with another valve of the same size in a properly sized and engineered system.



V148 Series Valve



3/4 in. V148EK Valve



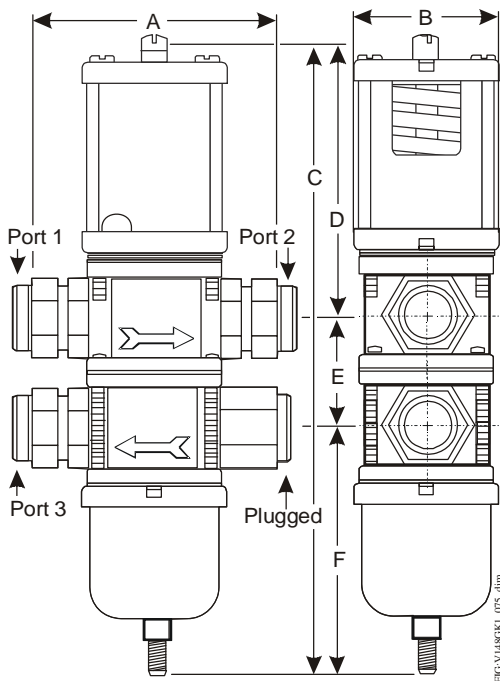
1 in. V148AL Valve



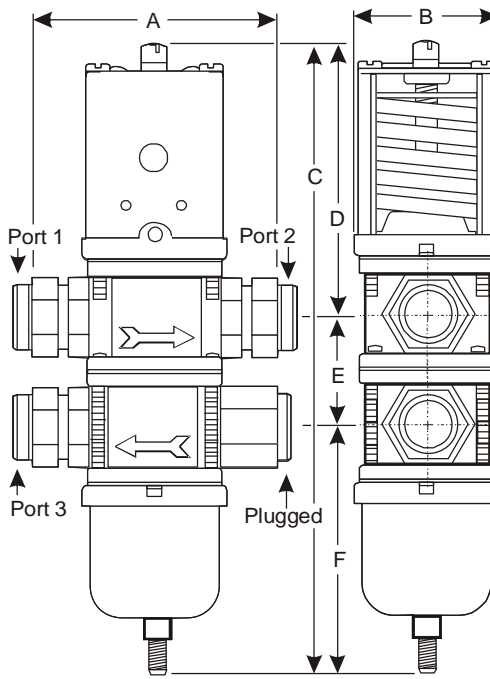
V148 Series Three-Way Pressure-Actuated Water-Regulating Valves (Continued)

Valve Dimensions, Inches (Millimeters)

Model	Nominal Valve Size	A	B	C	D	E	F
V148EK-1C	3/4 in.	3-3/8 (86)	2-3/16 (56)	9 (229)	4-3/16 (106)	1-3/4 (44)	3 (76)
V148GK1-001C	3/4 in.	3-3/8 (86)	2-3/16 (56)	9-13/16 (249)	4-3/16 (106)	1-3/4 (44)	3-13/16 (97)
V148AL-1C	1 in.	4-3/4 (121)	2-3/4 (71)	12 (305)	5-15/16 (151)	2 (51)	4 (102)
V148GL1-001C	1 in.	4-3/4 (121)	2-3/4 (71)	12-1/2 (318)	5-15/16 (151)	2 (51)	4-1/2 (115)



3/4 in. High Refrigerant Pressure V148GK1 Valves



1 in. High Refrigerant Pressure V148GL1 Valves

Selection

To make a rough field estimate of the size of valve for an application, find the valve size by locating a point on a flow chart that satisfies these requirements:

- water flow required by the condenser (**Flow**)
- refrigerant head pressure rise (**P_{RISE}**)
- available water pressure (**P_{AVAIL}**)

Follow these steps, and use the information obtained to locate a point on one of the flowcharts that satisfies all three steps.

1. Take the water flow required by the condenser (**Flow**) from information provided by the manufacturer of the condensing unit. If the manufacturer's information is unavailable, use the following information to make a rough approximation of maximum water flow in gallons per minute (gpm) (cubic meters per hour [m³/hr]):
 - System Capacity (**Tons of Refrigeration**)
 - Outlet Water Temperature (**Temp. _{Outlet}**)
 - Inlet Water Temperature (**Temp. _{Inlet}**)

Calculate the flow using the following formula:

$$\text{Flow} = \frac{\text{Tons of Refrigeration} \times 30}{(\text{Temp.}_{\text{Outlet}} - \text{Temp.}_{\text{Inlet}})}$$

Flow Required

- Note: If the outlet temperature is unknown, assume it to be 10F° (5.6C°) above the inlet temperature.
2. Determine refrigerant head pressure rise above the valve opening point (**P_{RISE}**) using the following steps:
 - a. The **Valve Closing Pressure (P_{CLOSE})** is equal to the refrigerant pressure at the highest ambient temperature the refrigeration equipment experiences in the Off cycle. Use a Pressure-Temperature Chart for the refrigerant selected to find this pressure.
 - b. To approximate the **Valve Opening Pressure (P_{OPEN})**, add about 7 psi (0.5 bar) for EK and AL models or 10 psi (0.7 bar) for GK1 and GL1 models to the Valve Closing Pressure.



V148 Series Three-Way Pressure-Actuated Water-Regulating Valves (Continued)

$$P_{OPEN} = P_{CLOSE} + 7 \text{ psi (0.5 bar)}$$

$$P_{OPEN} = P_{CLOSE} + 10 \text{ psi (0.7 bar)}$$

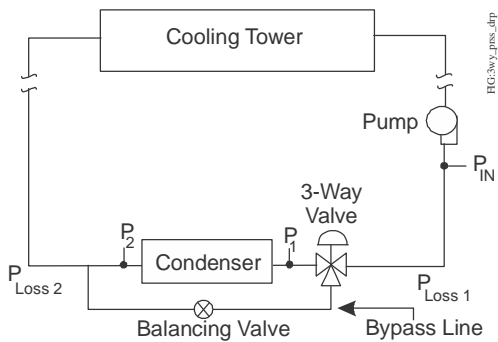
Valve Opening Pressure, EK and AL Models (Top) or GK1 and GL1 Models (Bottom)

- c. From the Pressure-Temperature Chart for the refrigerant selected, read the **Refrigerant Condensing Pressure (P_{COND})** (operating head pressure) corresponding to the selected condensing temperature.
- d. Subtract the Valve Opening Pressure from the Refrigerant Condensing Pressure. This gives the head pressure rise.

$$P_{RISE} = P_{COND} - P_{OPEN}$$

Refrigerant Head Pressure Rise

- 3. Determine the available water pressure to the valve (P_{AVAIL}) using the following steps. This is the actual water pressure available to force water through the valve.
 - a. Determine the minimum inlet pressure (P_{IN}). This is the water pressure from city water mains, pumps, or other sources.
 - b. Pressure drop through condenser (ΔP_{COND}) is the difference in water pressure between the condenser inlet and the condenser outlet. Obtain this information from the condenser manufacturer.
 - c. Estimate or calculate the pressure drop through all associated piping (P_{LOSS}).
 - d. Subtract the ΔP_{COND} and P_{LOSS} from P_{IN} . The result is P_{AVAIL} .



$$\Delta P_{COND} = P_1 - P_2$$

$$P_{LOSS} = P_{LOSS 1} + P_{LOSS 2} + \dots$$

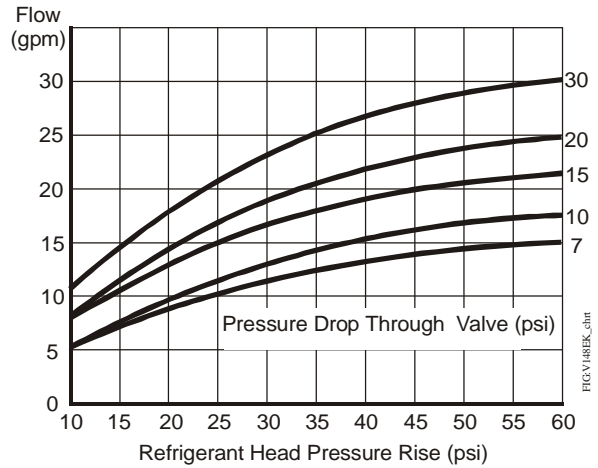
$$P_{AVAIL} = P_{IN} - (\Delta P_{COND} + P_{LOSS})$$

Available Water Pressure

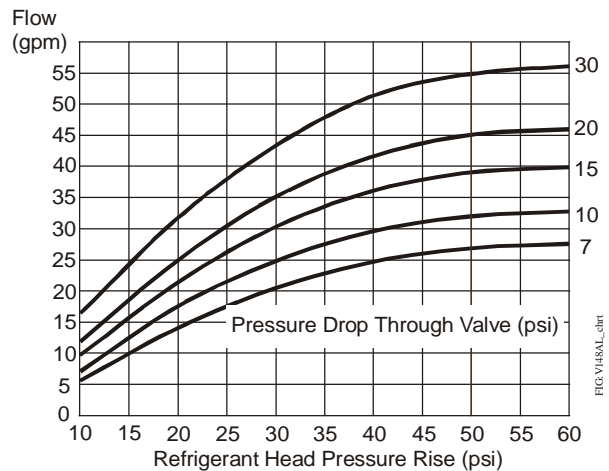
- 4. Select the proper valve size from the flowcharts by locating a point on a chart that satisfies the flow, the head pressure rise above opening point, and the pressure drop across the valve.

Use these equations to convert between U.S. and S.I. units.

- 1 dm³/s = 3.6 m³/h = 15.9 U.S. gal. /min. = 13.2 U.K. gal. /min.
- 1 bar = 100 kPa = 0.1 MPa = 1.02 kg/cm² = 0.987 atm = 14.5 psi



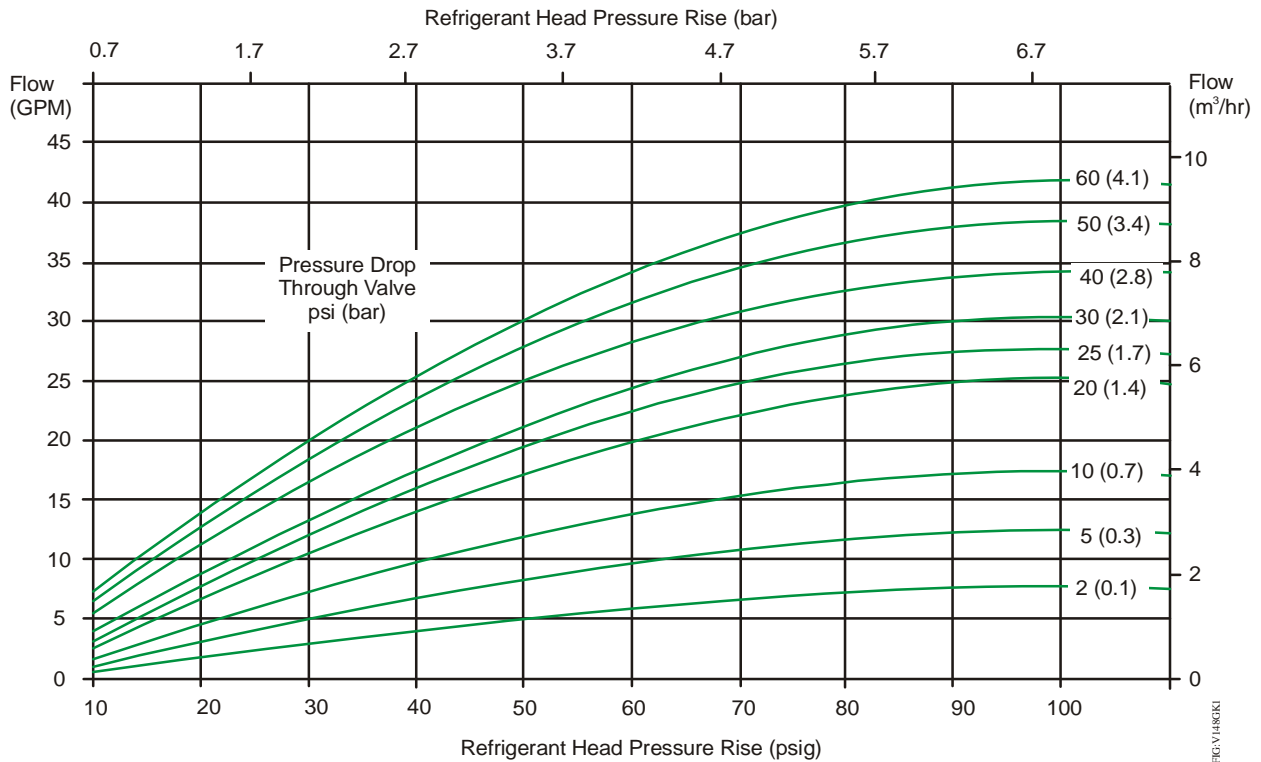
3/4 in. V148EK Valve



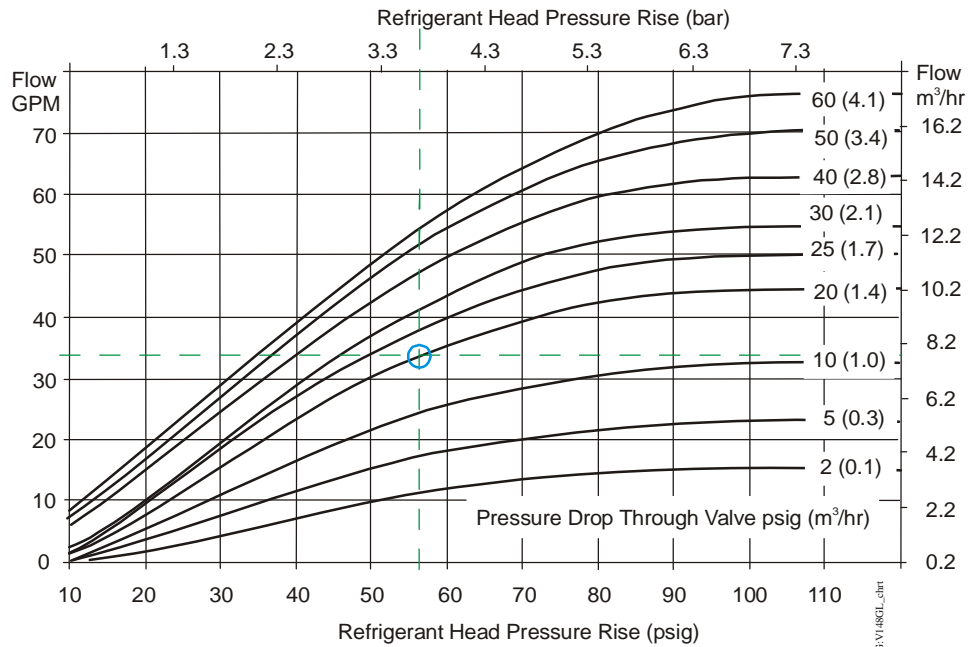
1 in. V148AL Valve



**V148 Series Three-Way Pressure-Actuated Water-Regulating Valves
(Continued)**



High Refrigerant Pressure 3/4 in. V148GK1 Valve



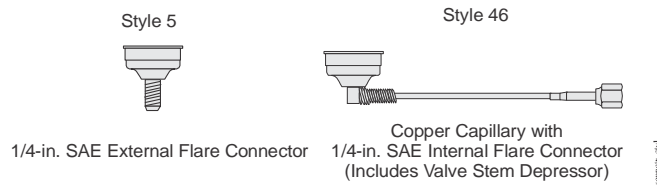
High Refrigerant Pressure 1 in. V148GL1 Valve

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Valves and Valve Accessories

V148 Series Three-Way Pressure-Actuated Water-Regulating Valves (Continued)



Pressure Connection Styles

Selection Chart

Product Code Number	Nominal Valve Size	Inlet and Outlet Ports	Pressure Connection Style	Shipping Weight, lb (kg)
V148EK-1C	3/4 in.	Union (Sweat)	46	7 (3.2)
V148GK1-001C	3/4 in.	Union (Sweat)	5	7 (3.2)
V148AL-1C	1 in.	Union (Sweat)	46	12 (5.4)
V148GL1-001C	1 in.	Union (Sweat)	5	12 (5.4)

Repair Information

If the V148 Series Three-Way Pressure-Actuated Water-Regulating Valve fails to operate within its specifications, refer to the *V148 Series Three-Way Pressure-Actuated Water-Regulating Valves Product Bulletin (LIT-121712)* for a list of repair parts available.

Technical Specifications

V148 Series 3-Way Pressure-Actuated Water-Regulating Valves	
Maximum Refrigerant Pressure	V148EK: 370 psig (25.5 bar) V148AL: 320 psig (22.1 bar)
Maximum Working Pressure	V148GK1, V148GL1: 630 psig (43.4 bar)
Factory-Set Opening Point (Port 1 to Port 2)	V148EK, V148AL: 165 psig (11.4 bar) V148GK1, V148GL1: 275 psig (19.0 bar)
Opening Point Adjustment Range (Port 1 to Port 2)	V148EK, V148AL: 145 to 190 psi (10.0 to 13.1 bar) V148GK1, V148GL1: 200 to 400 psi (13.8 to 27.6 bar)
Throttling Range	V148EK, V148AL: 70 psig (4.8 bar) V148GK1, V148GL1: 100 psig (6.9 bar)
Media	350 psi (24.1 bar) maximum, -4°F to 170°F (-20°C to 77°C) glycol/water or liquids with low freezing points that are compatible with valve materials



V246 Series Two-Way Pressure-Actuated Water-Regulating Valves for High-Pressure Refrigerants

Description

The V246 Series Two-Way Pressure-Actuated Water-Regulating Valves for High-Pressure Refrigerants come in two types of control action: direct acting and reverse acting. V246 valves regulate water flow to control refrigerant head pressure in systems with water-cooled condensers.

The V246 Series Valves are available in 3/8 in. through 2 in. sizes and have a maximum allowable water pressure of 150 psig (10.3 bar). Direct acting V246 valves have an adjustable opening point in a refrigerant pressure range of 200 to 400 psi (13.8 to 27.6 bar), and reverse acting valves have a range of 135 to 300 psi (9.3 to 20.7 bar). V246 valves may be used with standard non-corrosive refrigerants.

Maritime models, which have nickel copper (MoneI®) internal parts, are available for applications where the media may be corrosive to the internal parts.

Refer to the *V246 Series 2-Way Pressure-Actuated Water-Regulating Valves for High-Pressure Refrigerants Product Bulletin (LIT-12011514)* for important product application information.

Features

- no close fitting or sliding parts in water passages
- accessible range spring
- take-apart construction
- pressure-balanced design
- corrosion-resistant material for internal parts

Repair Information

If the V246 Series Two-Way Pressure-Actuated Water-Regulating Valve for High Pressure Refrigerants fails to operate within its specifications, refer to the *V246 Series Two-Way Pressure-Actuated Water-Regulating Valves for High Pressure Refrigerants Product Bulletin (LIT-12011514)* for a list of repair parts available.



V246 Series Water-Regulating Valve

Selection Charts

North American Standard Production Models

Product Code Number	Construction	Valve Size and Connection	Element Style	Shipping Weight, lb (kg)
V246GA1-001C	Direct Acting ¹ , Commercial	3/8 in. NPT Screw	Style 5	1.8 (0.8)
V246GB1-001C	Direct Acting ¹ , Commercial	1/2 in. NPT Screw	Style 5	3.0 (1.4)
V246GC1-001C	Direct Acting ¹ , Commercial	3/4 in. NPT Screw	Style 5	3.7 (1.7)
V246GD1-001C	Direct Acting ¹ , Commercial	1 in. NPT Screw	Style 5	9.3 (4.2)
V246GE1-001C	Direct Acting ¹ , Commercial	1-1/4 in. NPT Screw	Style 5	10 (4.5)
V246GM1-001C	Direct Acting ¹ , Commercial	1-1/4 in. Union Sweat	Style 5	10 (4.5)
V246GR1-001C	Direct Acting ¹ , Commercial	1-1/2 in. Flange	Style 5	13.6 (6.2)
V246GS1-001C	Direct Acting ¹ , Commercial	2 in. Flange	Style 5	27 (12.3)
V246HA1-001C	Direct Acting ¹ , Maritime	3/8 in. NPT Screw	Style 5	1.8 (0.8)
V246HB1-001C	Direct Acting ¹ , Maritime	1/2 in. NPT Screw	Style 5	3.0 (1.4)
V246HC1-001C	Direct Acting ¹ , Maritime	3/4 in. NPT Screw	Style 5	4.3 (2.0)
V246HD1-001C	Direct Acting ¹ , Maritime	1 in. NPT Screw	Style 5	9.5 (4.3)
V246HE1-001C	Direct Acting ¹ , Maritime	1-1/4 in. NPT Screw	Style 5	10.3 (4.7)
V246HR1-001C	Direct Acting ¹ , Maritime	1-1/2 in. ASME Flange	Style 5	13.6 (6.2)
V246HS1-001C	Direct Acting ¹ , Maritime	2 in. ASME Flange	Style 5	27 (12.3)
V246KA1-001C	Direct Acting ¹ , Commercial, Low Flow	3/8 in. NPT Screw	Style 5	1.8 (0.8)
V246NA1-001C	Reverse Acting ² , Commercial	3/8 in. NPT Screw	Style 5	1.8 (0.8)
V246NB1-001C	Reverse Acting ² , Commercial	1/2 in. NPT Screw	Style 5	3.0 (1.4)
V246NC1-001C	Reverse Acting ² , Commercial	3/4 in. NPT Screw	Style 5	3.7 (1.7)
V246ND1-001C	Reverse Acting ² , Commercial	1 in. NPT Screw	Style 5	9.3 (4.2)

1. The range is 200 to 400 psi (13.8 to 27.6 bar).
 2. The range is 135 to 300 psi (9.3 to 20.7 bar).

European Standard Production Models (Part 1 of 2)

Product Code Number	Construction	Valve Size and Connection	Element Style	Shipping Weight, kg (lb)
V246GA1A001C	Direct Acting, Commercial	3/8 in. BSPP Screw, ISO 228	Style 5	0.8 (1.8)
V246GB1A001C	Direct Acting, Commercial	1/2 in. BSPP Screw, ISO 228	Style 5	1.4 (3.0)
V246GC1A001C	Direct Acting, Commercial	3/4 in. BSPP Screw, ISO 228	Style 5	1.7 (3.7)
V246GD1B001C	Direct Acting, Commercial	1 in. BSPT Screw, ISO 7	Style 5	4.2 (9.3)
V246GE1B001C	Direct Acting, Commercial	1-1/4 in. BSPT Screw, ISO 7	Style 5	4.5 (10)

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V246 Series Two-Way Pressure-Actuated Water-Regulating Valves for High-Pressure Refrigerants (Continued)

European Standard Production Models (Part 2 of 2)

Product Code Number	Construction	Valve Size and Connection	Element Style	Shipping Weight, kg (lb)
V246GR1B001C	Direct Acting, Commercial	1-1/2 in. Flange, DIN2533	Style 5	6.2 (13.6)
V246GS1B001C	Direct Acting, Commercial	2 in. Flange, DIN2533	Style 5	12.3 (27)
V246HA1B001C	Direct Acting, Maritime	3/8 in. BSPP Screw, ISO 228	Style 5	0.8 (1.8)
V246HB1B001C	Direct Acting, Maritime	1/2 in. BSPP Screw, ISO 228	Style 5	1.4 (3.0)
V246HC1B001C	Direct Acting, Maritime	3/4 in. BSPP Screw, ISO 228	Style 5	2.0 (4.3)
V246HD1B001C	Direct Acting, Maritime	1 in. BSPP Screw, ISO 228	Style 5	4.3 (9.5)
V246HE1B001C	Direct Acting, Maritime	1-1/4 in. BSPP Screw, ISO 228	Style 5	4.7 (10.3)
V246HR1B001C	Direct Acting, Maritime	1-1/2 in. Flange, DIN86021	Style 5	6.2 (13.6)
V246HS1B001C	Direct Acting, Maritime	2 in. Flange, DIN86021	Style 5	12.3 (27)

Valve Sizing Information

Each application is unique and requires specific engineering data to properly size and design a system to fulfill the appropriate requirements. Typically, a valve is replaced with another valve of the same size in a properly sized and engineered system. In North America, contact Johnson Controls/PENN® Refrigeration Application Engineering at 1-800-275-5676 to obtain specific engineering data. In other areas, contact the local Johnson Controls® sales office to obtain specific engineering data.

To make a rough field estimate of the size of valve for an application, find the valve size needed by locating a point on a flow chart that satisfies these requirements:

- water flow required by the condenser (**Flow**)
- refrigerant head pressure rise (**P_{RISE}**)
- available water pressure (**P_{AVAIL}**)

Follow these steps, and use the information obtained to locate a point on one of the flowcharts that satisfies all three steps.

1. Take the water flow required by the condenser (**Flow**) from information provided by the manufacturer of the condensing unit. If the manufacturer's information is unavailable, use the following information to make a rough approximation of water flow in gallons per minute (gpm) [cubic meters per hour (m³/hr)]:
 - System Capacity (**Tons of Refrigeration**)
 - Outlet Water Temperature (**Temp. _{Outlet}**)
 - Inlet Water Temperature (**Temp. _{Inlet}**)

Calculate the flow using the following formula:

$$\text{Flow} = \frac{\text{Tons of Refrigeration} \times 30}{(\text{Temp.}_{\text{Outlet}} - \text{Temp.}_{\text{Inlet}})}$$

Flow Required

Note: If the outlet temperature is unknown, assume it to be 10F° (6C°) above the inlet temperature.

2. Determine refrigerant head pressure rise above the valve opening point (**P_{RISE}**) using the Refrigerant Head Pressure Rise figure and the following steps:
 - a. The **Valve Closing Pressure (P_{CLOSE})** is equal to the refrigerant pressure at the highest ambient temperature the refrigeration equipment experiences in the Off cycle. Use a Pressure-Temperature Chart for the refrigerant selected to find this pressure.
 - b. To approximate the **Valve Opening Pressure (P_{OPEN})**, add about 10 psi (0.7 bar) to the Valve Closing Pressure.

Note: Add about 20 psi (1.4 bar) for 3/8 in. valves.

$$P_{\text{OPEN}} = P_{\text{CLOSE}} + 10 \text{ psi (0.7 bar)}$$

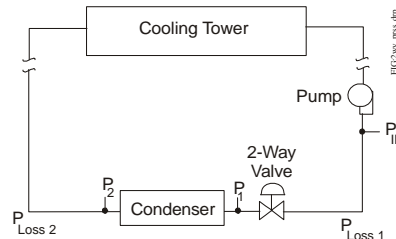
Valve Opening Pressure

- c. From the Pressure-Temperature Chart for the refrigerant selected, read the **Refrigerant Condensing Pressure (P_{COND})** (operating head pressure) corresponding to the selected condensing temperature.
- d. Subtract the Valve Opening Pressure from the Refrigerant Condensing Pressure. This gives the head pressure rise.

$$P_{\text{RISE}} = P_{\text{COND}} - P_{\text{OPEN}}$$

Refrigerant Head Pressure Rise

3. Determine the available water pressure to the valve (**P_{AVAIL}**) using the following steps. This is the actual water pressure available to force water through the valve.
 - a. Determine the inlet pressure (**P_{IN}**). This is the water pressure from city water mains, pumps, or other sources.
 - b. Pressure drop through condenser (**ΔP_{COND}**) is the difference in water pressure between the condenser inlet and the condenser outlet. Obtain this information from the condenser manufacturer.
 - c. Estimate or calculate the pressure drop through all associated piping (**P_{LOSS}**).
 - d. Subtract the **ΔP_{COND}** and **P_{LOSS}** from **P_{IN}**. The result is **P_{AVAIL}**.



$$\Delta P_{\text{COND}} = P_1 - P_2 \quad P_{\text{LOSS}} = P_{\text{Loss 1}} + P_{\text{Loss 2}} + \dots$$

$$P_{\text{AVAIL}} = P_{\text{IN}} - (\Delta P_{\text{COND}} + P_{\text{LOSS}})$$

Available Water Pressure

4. Select the proper valve size from the flowcharts by locating a point on a chart that satisfies the flow, the head pressure rise above opening point, and the pressure drop across the valve.

Metric Conversions

Use these equations to convert between U.S. and S.I. units.

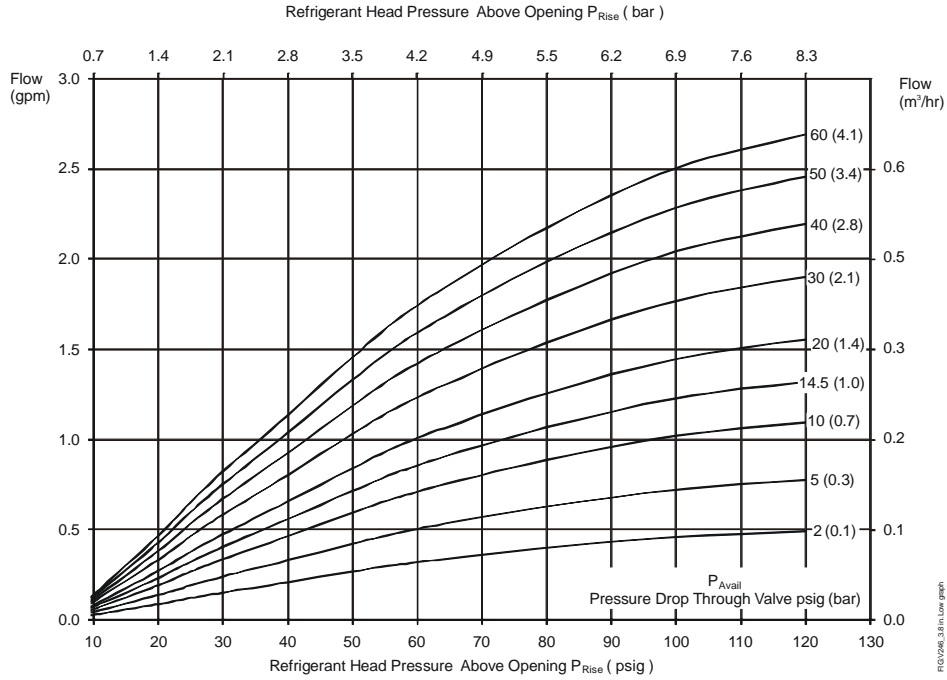
- 1 dm³/s = 3.6 m³/h = 15.9 U.S. gal. /min. = 13.2 U.K. gal. /min.
- 1 bar = 100 kPa = 0.1 MPa = 1.02 kg/cm² = 0.987 atm = 14.5 psi



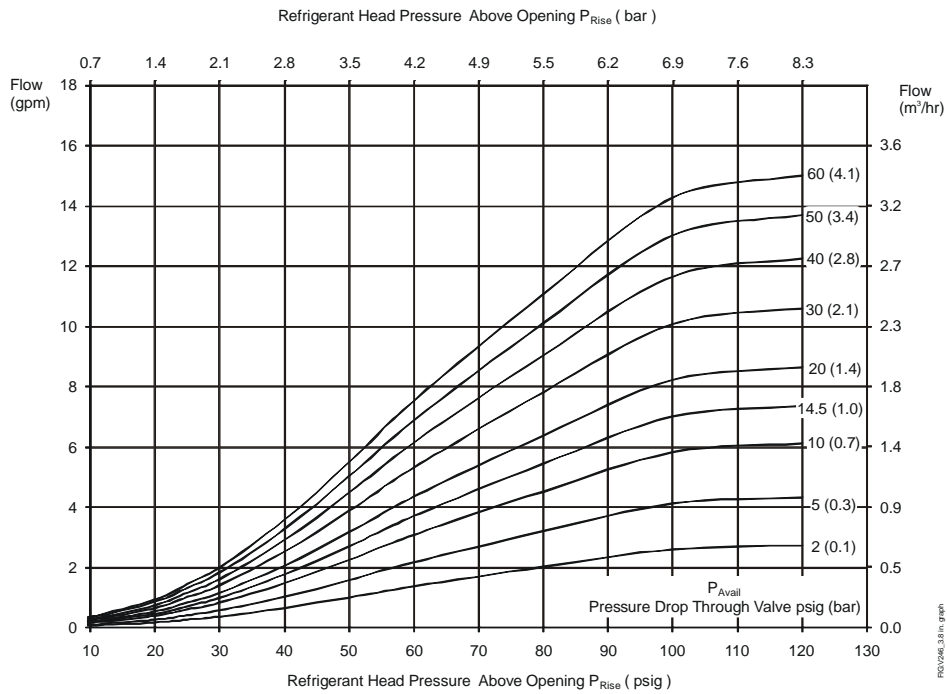
V246 Series Two-Way Pressure-Actuated Water-Regulating Valves for High-Pressure Refrigerants (Continued)

V246 Flowcharts

The maximum recommended differential water pressure across a valve is 60 psig (4.1 bar).



3/8 in. Direct Acting Low-Flow Valve Flowchart



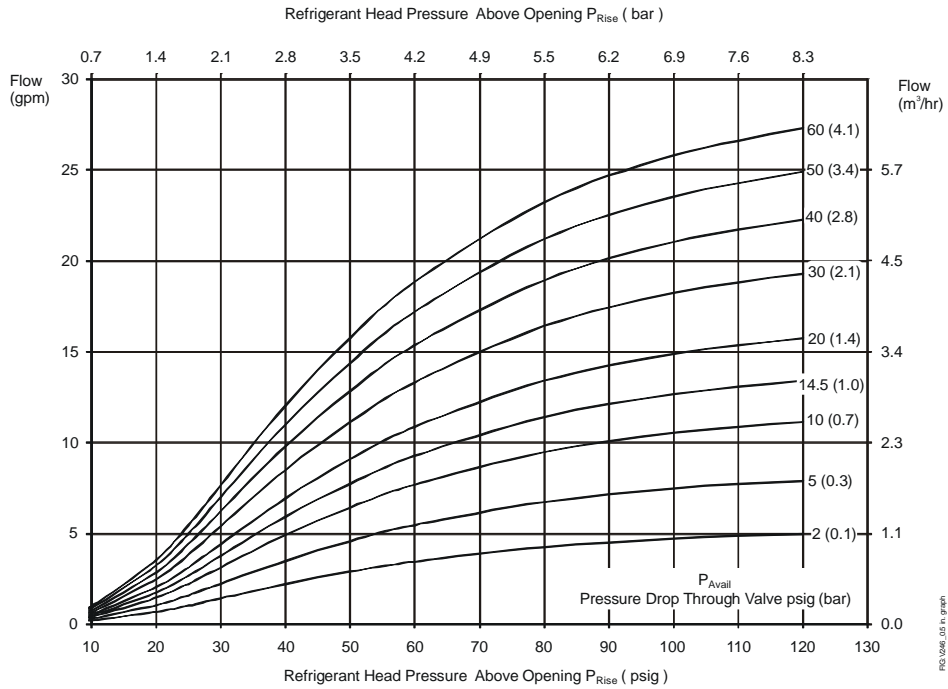
3/8 in. Direct Acting Valve Flowchart

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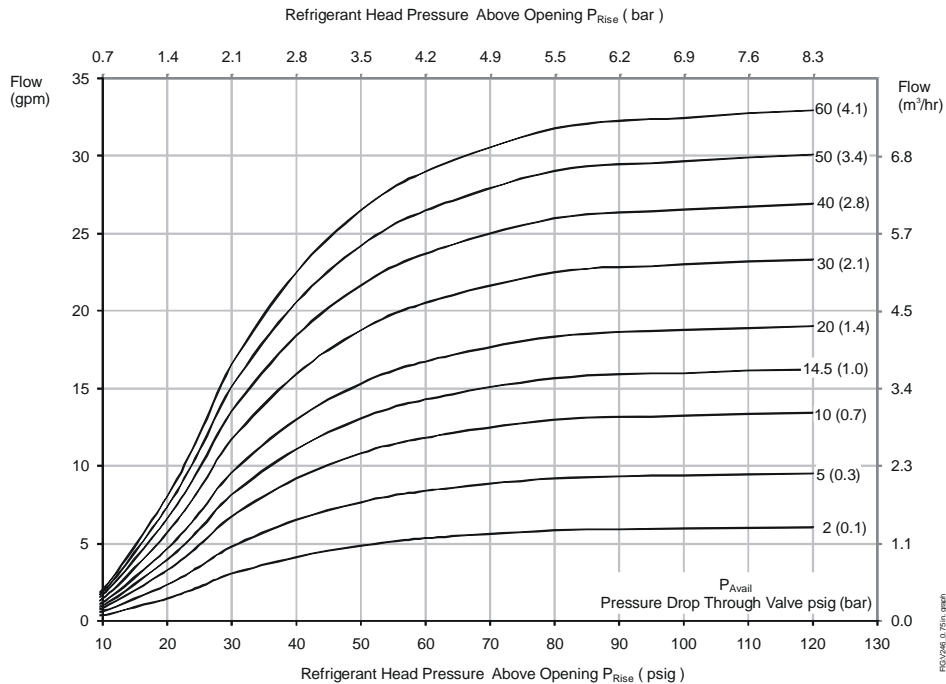


Valves and Valve Accessories

V246 Series Two-Way Pressure-Actuated Water-Regulating Valves for High-Pressure Refrigerants (Continued)



1/2 in. Direct Acting Valve Flowchart



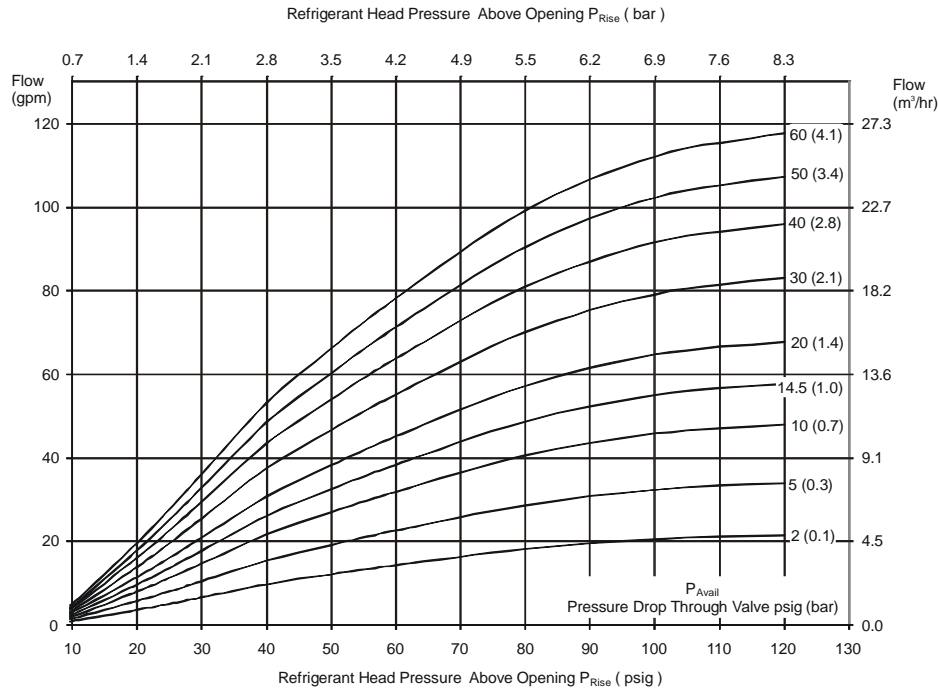
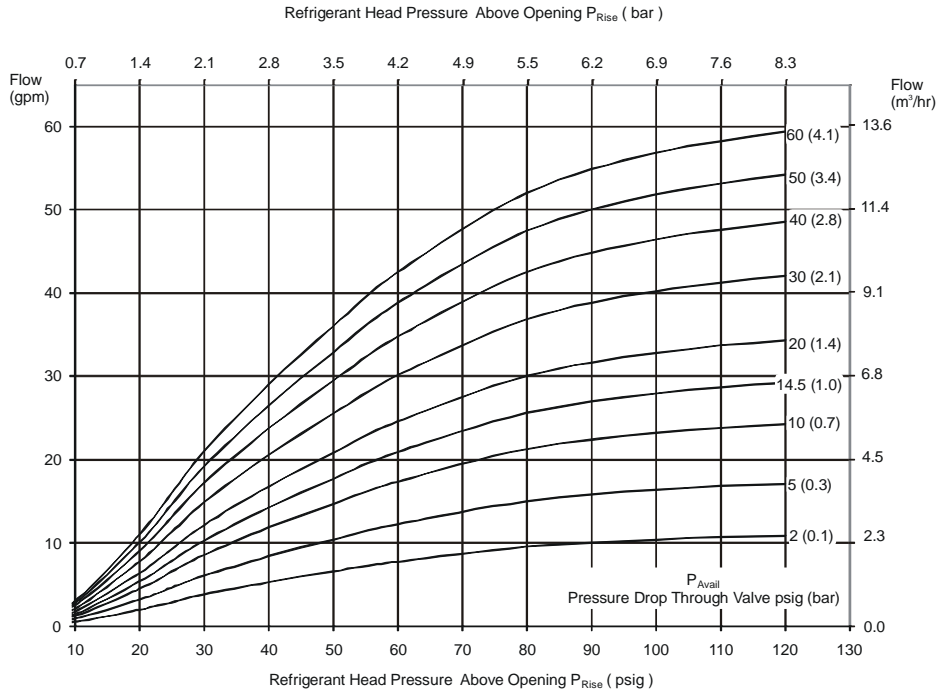
3/4 in. Direct Acting Valve Flowchart

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Valves and Valve Accessories

V246 Series Two-Way Pressure-Actuated Water-Regulating Valves for High-Pressure Refrigerants (Continued)

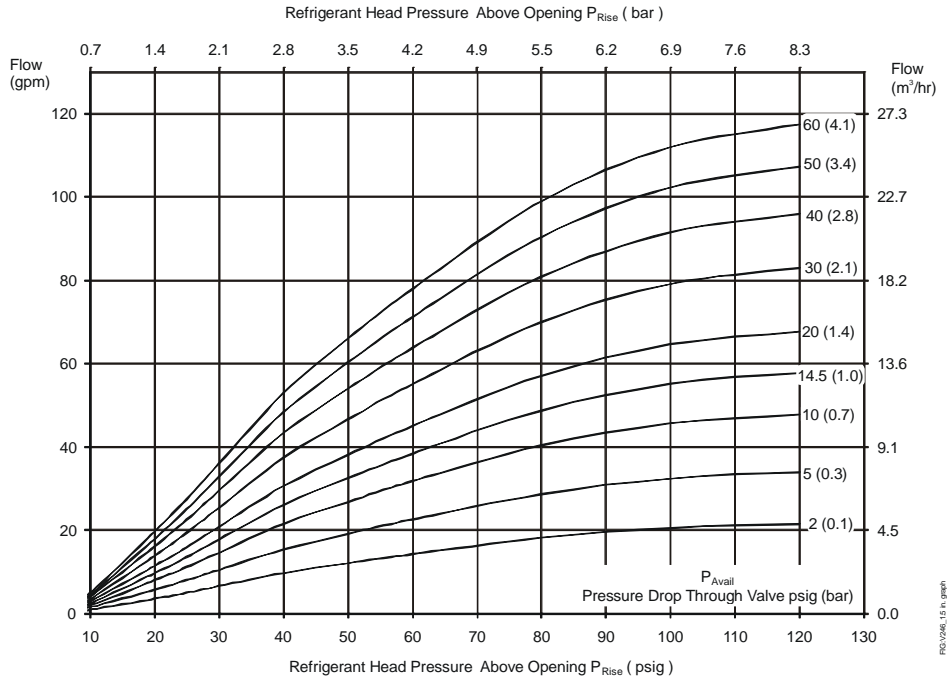


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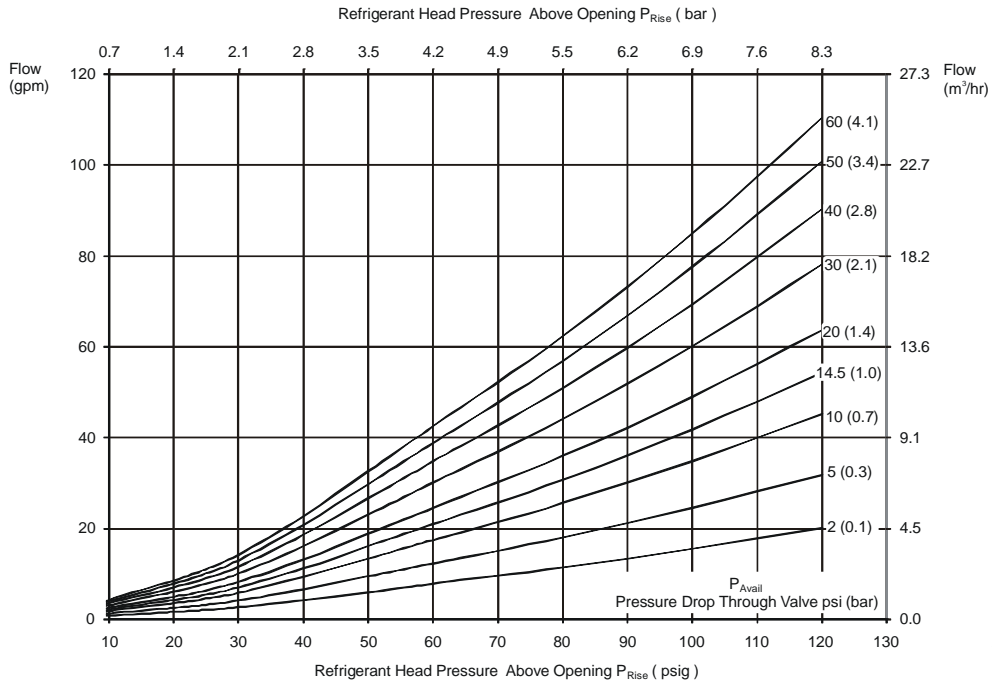


Valves and Valve Accessories

V246 Series Two-Way Pressure-Actuated Water-Regulating Valves for High-Pressure Refrigerants (Continued)



1-1/2 in. Direct Acting Valve Flowchart



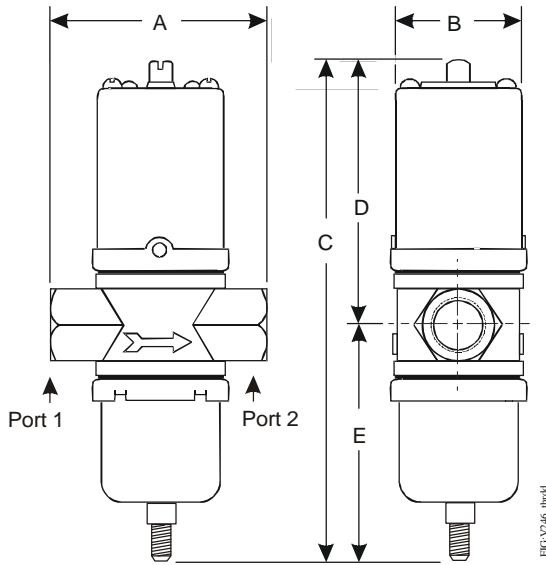
2 in. Direct Acting Valve Flowchart

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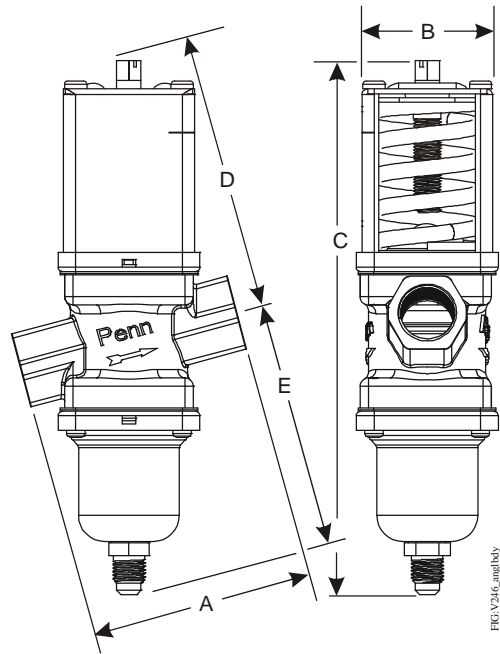


V246 Series Two-Way Pressure-Actuated Water-Regulating Valves for High-Pressure Refrigerants (Continued)

Dimensions



V246 Screw Connection Valves Dimensions



V246 Angle-Body Screw Connection Valves Dimensions

V246 Screw Connection Valves Dimensions

Valve Size	Dimensions in Inches (Millimeters)				
	A	B	C	D	E
3/8 in.	2-5/8 (67)	1-5/8 (41)	6-1/2 (166)	3-1/2 (89)	3 (77)
1/2 in.	3-1/16 (78)	2 (51)	7-3/16 (182)	3-13/16 (96)	3-3/8 (86)
3/4 in.	3-3/8 (86)	2-3/16 (55)	8 (203)	4-3/16 (106)	3-13/16 (98)
1 in.	4-3/4 (121)	2-13/16 (71)	10-1/2 (267)	5-15/16 (151)	4-9/16 (116)
1-1/4 in.	4-3/4 (121)	2-13/16 (71)	10-7/8 (276)	6-1/8 (156)	4-3/4 (121)

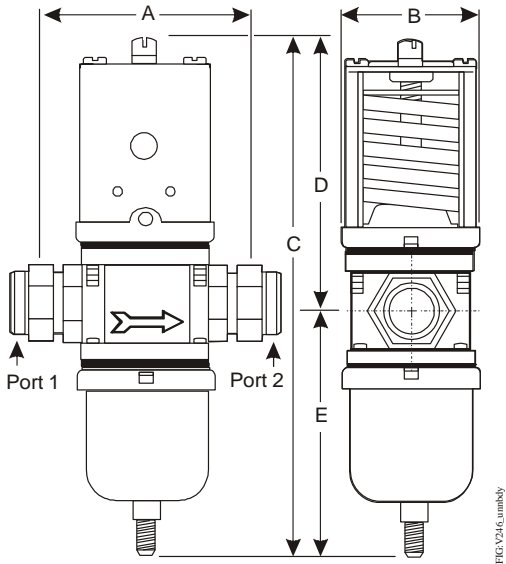
V246 Angle-Body Screw Connection Valves Dimensions

Valve Size	Dimensions in Inches (Millimeters)				
	A	B	C	D	E
3/8 in.	2-3/4 (70)	1-5/8 (41)	6-15/16 (176)	3-5/8 (92)	3-1/8 (80)
1/2 in.	3-1/8 (80)	2 (51)	7-1/2 (191)	3-7/8 (98)	3-1/2 (88)
3/4 in.	3-9/16 (90)	2-1/8 (55)	8-9/16 (217)	4-5/16 (110)	4 (101)

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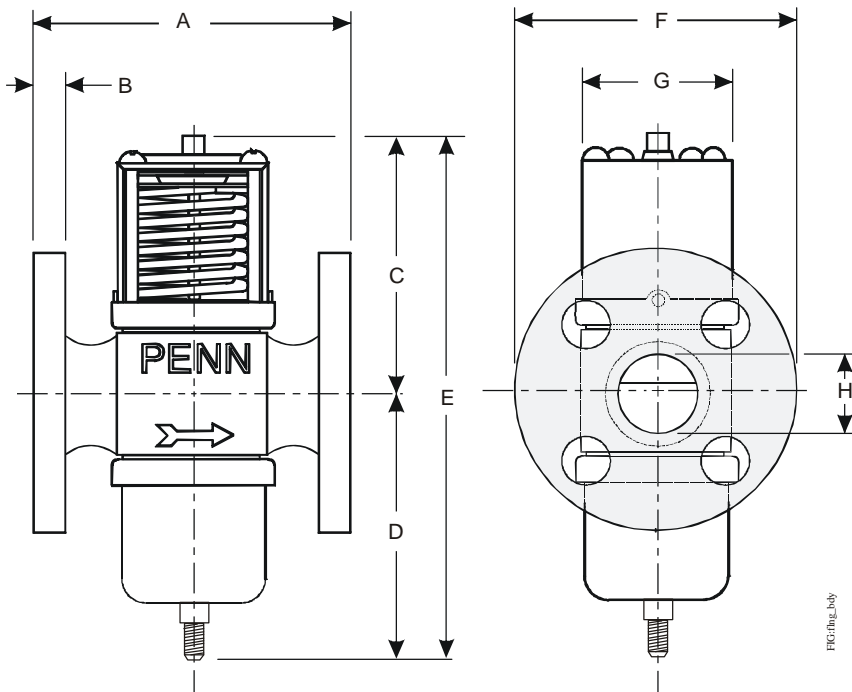
V246 Series Two-Way Pressure-Actuated Water-Regulating Valves for High-Pressure Refrigerants (Continued)



V246 Union Sweat Connection Valves Dimensions

V246 Union Sweat Connection Valves Dimensions

Valve Size	Dimensions in Inches (Millimeters)				
	A	B	C	D	E
1-1/4 in.	4-3/4 (121)	2-13/16 (71)	10-7/8 (276)	6-1/8 (156)	4-3/4 (121)



V246 Flange Valve Dimensions

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Valves and Valve Accessories

V246 Series Two-Way Pressure-Actuated Water-Regulating Valves for High-Pressure Refrigerants (Continued)

V246 Flange Valve, Commercial Service - Dimensions

Valve Size	Dimensions in Inches (Millimeters)							
	A	B	C	D	E	F	G	H
1-1/2 in.	5-5/16 (135)	9/16 (14)	6-1/8 (156)	4-3/4 (121)	10-7/8 (276)	5-1/4 (133) ¹	2-5/8 (67)	1-7/8 (48)
2 in.	6-5/8 (168)	5/8 (16)	7-1/8 (181)	6-1/8 (156)	13-1/4 (336)	6-3/16 (157) ²	3-1/2 (89)	2-1/4 (57)

1. The dimensions on the European versions are 5-29/32 in. (150 mm).
2. The dimensions on the European versions are 6-1/2 in. (165 mm).

V246 Flange Valve, Commercial Service - Flange Specifications

Valve Size	Regional Version	Number of Holes	Hole Size	Bolt Circle
1-1/2 in.	North American	4	5/8 in. (16 mm)	3-7/8 in. (98 mm)
2 in.			3/4 in. (19 mm)	4-3/4 in. (121 mm)
1-1/2 in.	European, DIN2533 Flanges	4	18 mm	110 mm
2 in.				125 mm

V246 Flange Valve, Maritime Service - Dimensions

Valve Size	Dimensions in Inches (Millimeters)							
	A	B	C	D	E	F	G	H
1-1/2 in.	5-5/16 (135)	9/16 (14)	6-1/8 (156)	4-3/4 (121)	10-7/8 (276)	5-1/4 (133) ¹	2-5/8 (67)	1-7/8 (48)
2 in.	6-3/8 (162)	5/8 (16)	7-1/8 (181)	6-1/8 (156)	13-1/4 (337)	6 (152) ²	3-1/2 (89)	2-3/4 (70)

1. The dimensions on the European versions are 5-29/32 in. (150 mm).
2. The dimensions on the European versions are 6-1/2 in. (165 mm).

V246 Flange Valve, Maritime Service - Flange Specifications

Valve Size	Regional Version	Number of Holes	Hole Size	Bolt Circle
1-1/2 in.	North American	4	5/8 in. (16 mm)	3-7/8 in. (98 mm)
2 in.			3/4 in. (19 mm)	4-3/4 in. (121 mm)
1-1/2 in.	European, DIN86021 Flanges	4	18 mm	110 mm
2 in.				125 mm

Materials

North American V246 Materials

Nominal Valve Size:	3/8 in. to 3/4 in. (Commercial)	1 in. to 2 in. (Commercial)	Maritime (All Sizes)
Material			
Body	Cast brass	Cast iron/rust resisting finish	Cast bronze
Seat	Aluminum Bronze	Aluminum bronze	Monel
Disc	BUNA-N	BUNA-N	BUNA-N
Disc Cup	Brass	Brass	Monel
Disc Stud	Brass	Brass	Monel
Stem/Extension Sleeve	Brass	Brass	Monel
Diaphragms	Nylon reinforced BUNA-N	Nylon reinforced BUNA-N	Nylon reinforced BUNA-N
Refrigerant Contact			
Pressure Element	Cup	300 Series stainless steel	300 Series stainless steel
	Bellows	300 Series stainless steel	300 Series stainless steel
	Bellows Ring	Steel/nickel plated	Steel/nickel plated



Valves and Valve Accessories

V246 Series Two-Way Pressure-Actuated Water-Regulating Valves for High-Pressure Refrigerants (Continued)

European V246 Materials

Nominal Valve Size:	3/8 in. to 3/4 in. (Commercial)	1 in. to 2 in. (Commercial)	Maritime (All sizes)	
Material				
Body	Hot forged brass	Cast iron/rust resisting finish	Cast bronze	
Seat	Aluminum bronze	Aluminum bronze	Monel	
Disc	BUNA-N	BUNA-N	BUNA-N	
Disc Cup	Brass	Brass	Monel	
Disc Stud	Brass	Brass	Monel	
Stem/Extension Sleeve	Brass	Brass	Monel	
Diaphragms	Nylon reinforced BUNA-N	Nylon reinforced BUNA-N	Nylon reinforced BUNA-N	
Refrigerant Contact				
Pressure Element	Cup	300 Series stainless steel	300 Series stainless steel	300 Series stainless steel
	Bellows	300 Series stainless steel	300 Series stainless steel	300 Series stainless steel
	Bellows Ring	Steel/nickel plated	Steel/nickel plated	Steel/nickel plated

Technical Specifications

V246 Series 2-Way Pressure-Actuated Water-Regulating Valves for High-Pressure Refrigerants	
Factory-Set Opening Point	Direct Acting 200 psig (13.8 bar), Reverse Acting 165 psig (11.4 bar)
Maximum Working Pressure	630 psig (43.4 bar)
Opening Point Adjustment Range	Direct Acting 200 to 400 psi (13.8 to 27.6 bar), Reverse Acting 135 to 300 psi (9.3 to 20.7 bar)
Media	150 psig (10.3 bar) Maximum, -4°F to 170°F (-20°C to 77°C) glycol/water or liquids with low freezing points that are compatible with valve materials



V248 Series Three-Way Pressure-Actuated Water-Regulating Valves for High-Pressure Refrigerants

Description

The V248 Series Three-Way Pressure-Actuated Water-Regulating Valves for High-Pressure Refrigerants regulate water flow and control refrigerant head pressure in systems with single or multiple water-cooled condensers.

V248 valves have an adjustable opening point in a refrigerant pressure range of 200 to 400 psi (13.8 to 27.6 bar). V248 valves are available in 1/2 in. through 1-1/2 in. size for use with standard, non-corrosive, high-pressure refrigerants.

Maritime models, which have nickel copper (Monel®) internal parts, are available for applications where the media may be corrosive to the internal parts.

Refer to the *V248 Series 3-Way Pressure-Actuated Water-Regulating Valves for High-Pressure Refrigerants Product Bulletin (LIT-12011515)* for important product application information.

Features

- no close fitting or sliding parts in water passages
- accessible range spring
- take-apart construction
- pressure-balanced design
- corrosion-resistant material for internal parts

Repair Information

If the V248 Series Three-Way Pressure-Actuated Water-Regulating Valves for High-Pressure Refrigerants fails to operate within its specifications, refer to the *V248 Series 3-Way Pressure-Actuated Water-Regulating Valves for High-Pressure Refrigerants Product Bulletin (LIT-12011515)* for a list of repair parts available.



V248 Screw Connection Valve

Selection Charts

North American Standard Production Models - Range 200 to 400 psi

Product Code Number	Construction	Valve Size and Connection	Element Style	Shipping Weight, lb (kg)
V248GB1-001C	Direct Acting, Commercial	1/2 in. NPT Screw	Style 5	5.0 (2.3)
V248GC1-001C	Direct Acting, Commercial	3/4 in. NPT Screw	Style 5	6.5 (3.0)
V248GD1-001C	Direct Acting, Commercial	1 in. NPT Screw	Style 5	12.0 (5.4)
V248GE1-001C	Direct Acting, Commercial	1-1/4 in. NPT Screw	Style 5	16.0 (7.2)
V248GF1-001C	Direct Acting, Commercial	1-1/2 in. NPT Screw	Style 5	25.0 (11.3)
V248GK1-001C	Direct Acting, Commercial	3/4 in. Union Sweat	Style 5	7.0 (3.2)
V248GL1-001C	Direct Acting, Commercial	1 in. Union Sweat	Style 5	12.0 (5.4)
V248GM1-001C	Direct Acting, Commercial	1-1/4 in. Union Sweat	Style 5	13.7 (6.2)

European Standard Production Models - Range 13.8 to 27.8 bar

Product Code Number	Construction	Valve Size and Connection	Element Style	Shipping Weight, lb (kg)
V248GB1B001C	Direct Acting, Commercial	1/2 in. BSPT Screw, ISO 7	Style 5	5.0 (2.3)
V248GC1B001C	Direct Acting, Commercial	3/4 in. BSPT Screw, ISO 7	Style 5	6.5 (3.0)
V248GD1B001C	Direct Acting, Commercial	1 in. BSPT Screw, ISO 7	Style 5	12.1 (5.5)
V248GE1B001C	Direct Acting, Commercial	1-1/4 in. BSPT Screw, ISO 7	Style 5	16.0 (7.2)
V248GF1B001C	Direct Acting, Commercial	1-1/2 in. BSPT Screw, ISO 7	Style 5	25.0 (11.3)
V248HC1B001C	Direct Acting, Maritime	3/4 in. BSPP Screw, ISO 228	Style 5	6.5 (3.0)



V248 Series Three-Way Pressure-Actuated Water-Regulating Valves for High-Pressure Refrigerants (Continued)

Applications

Each application is unique and requires specific engineering data to properly size and design a system to fulfill the appropriate requirements. Typically, a valve is replaced with another valve of the same size in a properly sized and engineered system. In North America, contact Johnson Controls/PENN® Refrigeration Application Engineering at 1-800-275-5676 to obtain specific engineering data. In other areas, contact the local Johnson Controls® sales office to obtain specific engineering data.

To make a rough field estimate of the size of valve for an application, find the valve size needed by locating a point on a flow chart that satisfies these requirements:

- water flow required by the condenser (**Flow**)
- refrigerant head pressure rise (**P_{RISE}**)
- available water pressure (**P_{AVAIL}**)

Follow these steps, and use the information obtained to locate a point on one of the flowcharts that satisfies all three steps.

1. Take the water flow required by the condenser (**Flow**) from information provided by the manufacturer of the condensing unit. If the manufacturer's information is unavailable, use the following information to make a rough approximation of water flow in gallons per minute (gpm) [cubic meters per hour (m³/hr)]:
 - System Capacity (**Tons of Refrigeration**)
 - Outlet Water Temperature (**Temp. _{Outlet}**)
 - Inlet Water Temperature (**Temp. _{Inlet}**)

Calculate the flow using the following formula:

$$\text{Flow} = \frac{\text{Tons of Refrigeration} \times 30}{(\text{Temp.}_{\text{Outlet}} - \text{Temp.}_{\text{Inlet}})}$$

Flow Required

Note: If the outlet temperature is unknown, assume it to be 10F° (6C°) above the inlet temperature.

2. Determine refrigerant head pressure rise above the valve opening point (**P_{RISE}**) using the following steps:
 - a. The **Valve Closing Pressure (P_{CLOSE})** is equal to the refrigerant pressure at the highest ambient temperature the refrigeration equipment experiences in the Off cycle. Use a Pressure-Temperature Chart for the refrigerant selected to find this pressure.
 - b. To approximate the **Valve Opening Pressure (P_{OPEN})**, add about 10 psig (0.7 bar) to the Valve Closing Pressure.

$$P_{\text{OPEN}} = P_{\text{CLOSE}} + 10 \text{ psi (0.7 bar)}$$

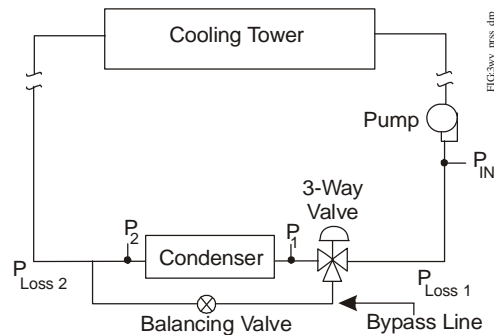
Valve Opening Pressure

- c. From the Pressure-Temperature Chart for the refrigerant selected, read the **Refrigerant Condensing Pressure (P_{COND})** (operating head pressure) corresponding to the selected condensing temperature.
- d. Subtract the Valve Opening Pressure from the Refrigerant Condensing Pressure. This gives the head pressure rise.

$$P_{\text{RISE}} = P_{\text{COND}} - P_{\text{OPEN}}$$

Refrigerant Head Pressure Rise

3. Determine the available water pressure to the valve (**P_{AVAIL}**) using the following steps. This is the actual water pressure available to force water through the valve.
 - a. Determine the minimum inlet pressure (**P_{IN}**). This is the water pressure from city water mains, pumps, or other sources.
 - b. Pressure drop through condenser (**ΔP_{COND}**) is the difference in water pressure between the condenser inlet and the condenser outlet. Obtain this information from the condenser manufacturer.
 - c. Estimate or calculate the pressure drop through all associated piping (**P_{LOSS}**).
 - d. Subtract the **ΔP_{COND}** and **P_{LOSS}** from **P_{IN}**. The result is **P_{AVAIL}**.



$$\Delta P_{\text{COND}} = P_1 - P_2$$

$$P_{\text{LOSS}} = P_{\text{Loss 1}} + P_{\text{Loss 2}} + \dots$$

$$P_{\text{AVAIL}} = P_{\text{IN}} - (\Delta P_{\text{COND}} + P_{\text{LOSS}})$$

Available Water Pressure

4. Select the proper valve size from the flowcharts by locating a point on a chart that satisfies the flow, the head pressure rise above opening point, and the pressure drop across the valve.

Metric Conversions

Use these equations to convert between U.S. and S.I. units.

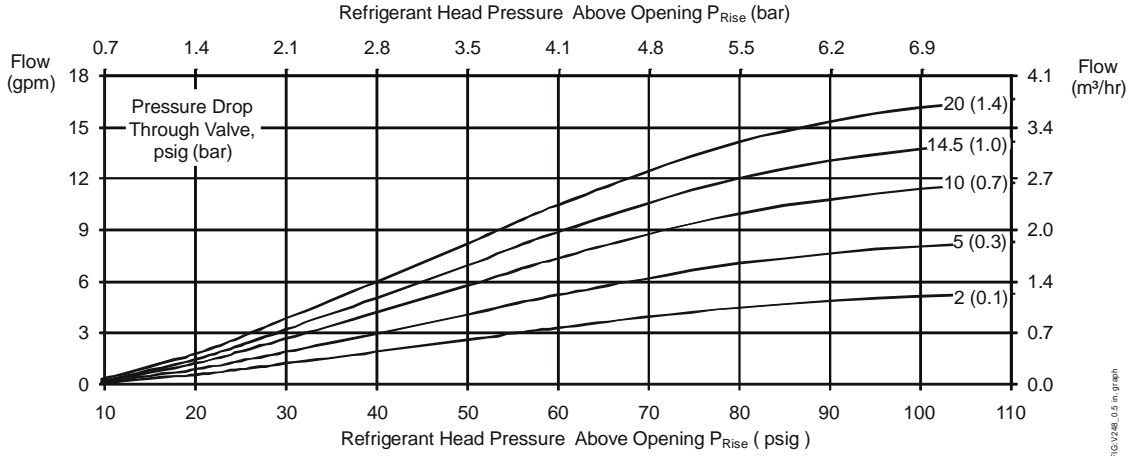
- 1 dm³/s = 3.6 m³/h = 15.9 U.S. gal. /min. = 13.2 U.K. gal. /min.
- 1 bar = 100 kPa = 0.1 MPa = 1.02 kg/cm² = 0.987 atm = 14.5 psig



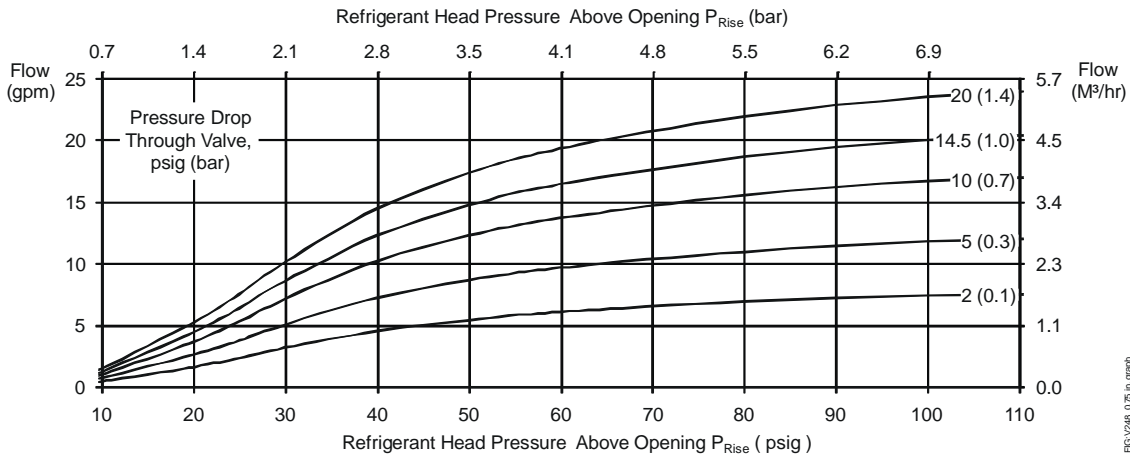
V248 Series Three-Way Pressure-Actuated Water-Regulating Valves for High-Pressure Refrigerants (Continued)

V248 Flowcharts

The maximum recommended differential water pressure across a valve is 20 psig (1.4 bar).



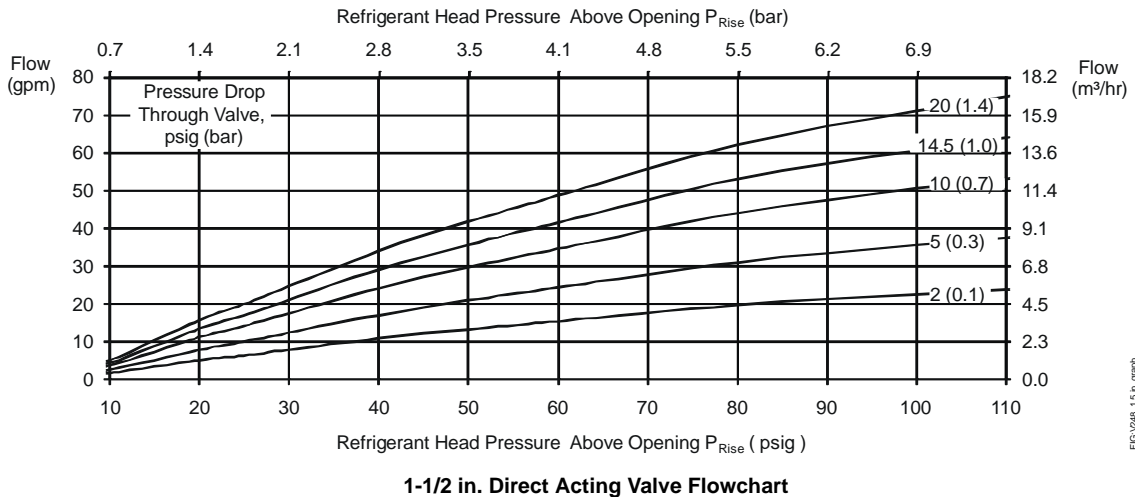
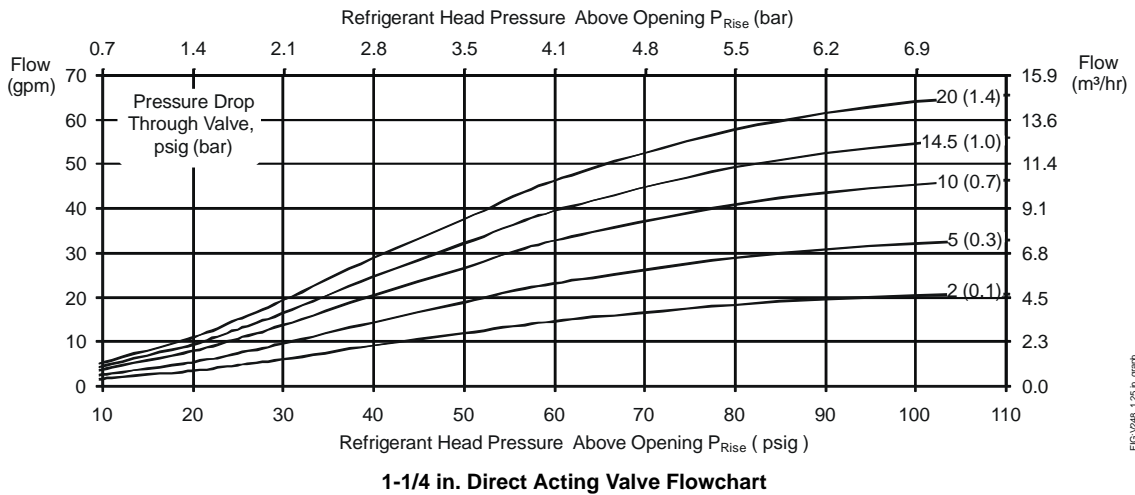
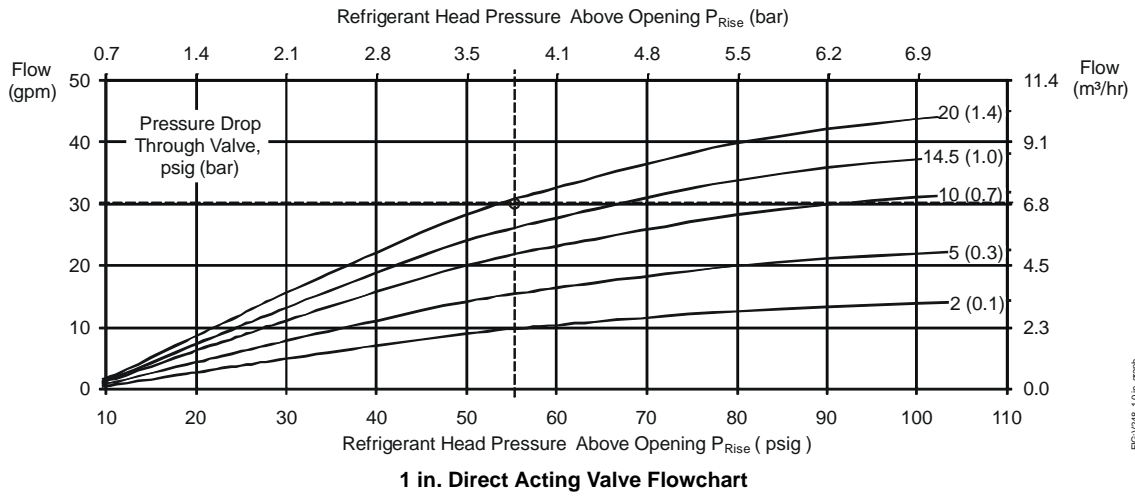
1/2 in. Direct Acting Valve Flowchart



3/4 in. Direct Acting Valve Flowchart

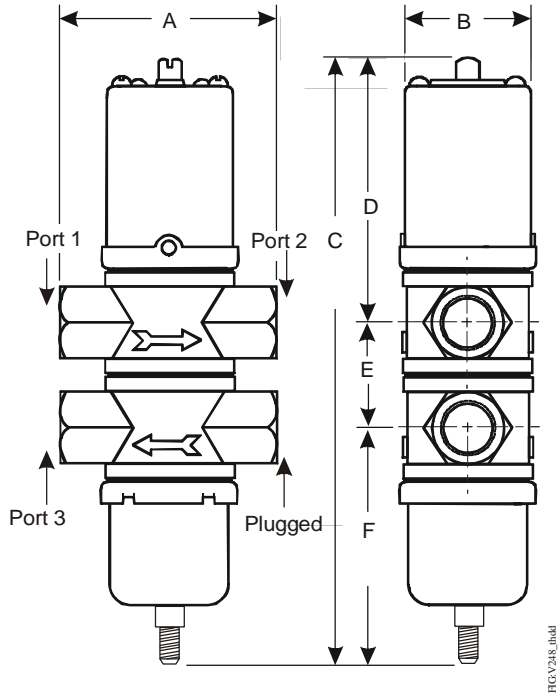


V248 Series Three-Way Pressure-Actuated Water-Regulating Valves for High-Pressure Refrigerants (Continued)

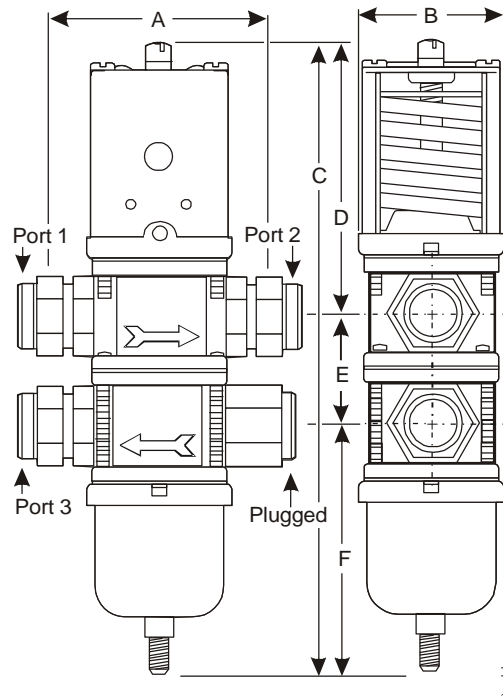


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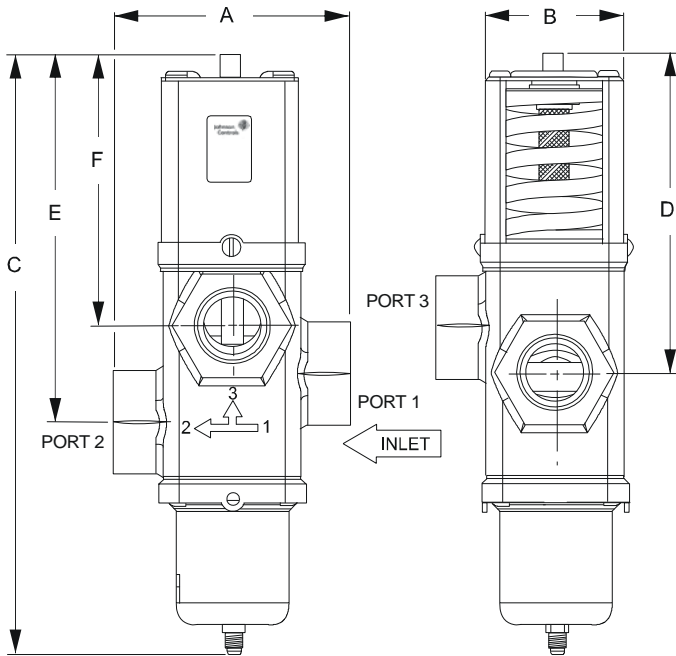
V248 Series Three-Way Pressure-Actuated Water-Regulating Valves for High-Pressure Refrigerants (Continued)



V248 1/2 in. Through 1-1/4 in. Screw Connection Valves Dimensions



V248 Union Sweat Connection Valves Dimensions



V248 1-1/2 in. Screw Connection Valves Dimensions



Valves and Valve Accessories

V248 Series Three-Way Pressure-Actuated Water-Regulating Valves for High-Pressure Refrigerants (Continued)

V248 1/2 in. Through 1-1/4 in. Screw Connection Valves Dimensions

Valve Size	Dimensions in Inches (Millimeters)					
	A	B	C	D	E	F
1/2 in.	3-1/16 (78)	2 (51)	8-11/16 (220)	3-13/16 (96)	1-1/2 (38)	3-3/8 (86)
3/4 in.	3-3/8 (86)	2-3/16 (55)	9-3/4 (248)	4-3/16 (106)	1-3/4 (44)	3-13/16 (98)
1 in.	4-3/4 (121)	2-13/16 (71)	12-1/2 (318)	5-15/16 (151)	2-1/16 (52)	4-1/2 (114)
1-1/4 in.	4-3/4 (121)	2-13/16 (71)	13-1/4 (336)	6-1/8 (156)	2-3/8 (60)	4-3/4 (121)

V248 Union Sweat Connection Valves Dimensions

Valve Size	Dimensions in Inches (Millimeters)					
	A	B	C	D	E	F
3/4 in.	3-3/8 (86)	2-3/16 (55)	9-3/4 (248)	4-3/16 (106)	1-3/4 (44)	3-13/16 (98)
1 in.	4-3/4 (121)	2-13/16 (71)	12-1/2 (318)	5-15/16 (151)	2-1/16 (52)	4-1/2 (114)
1-1/4 in.	4-3/4 (121)	2-13/16 (71)	13-1/4 (336)	6-1/8 (156)	2-3/8 (60)	4-3/4 (121)

V248 1-1/2 in. Screw Connection Valves Dimensions

Valve Size	Dimensions in Inches (Millimeters)					
	A	B	C	D	E	F
1-1/2 in.	6 (152)	3-1/2 (89)	15-1/4 (382)	8 (203)	9-5/16 (237)	6-7/8 (175)



V248 Series Three-Way Pressure-Actuated Water-Regulating Valves for High-Pressure Refrigerants (Continued)

Materials

North American V248 Materials

Nominal Valve Size:		3/8 in. to 3/4 in. (Commercial)	1 in. to 1-1/2 in. (Commercial)	Maritime (All Sizes)
Material				
Body		Cast brass	Cast iron/rust resisting finish	Cast bronze
Seat		Aluminum bronze	Aluminum bronze	Monel
Disc		BUNA-N	BUNA-N	BUNA-N
Disc Cup		Brass	Brass	Monel
Disc Stud		Brass	Brass	Monel
Stem/Extension Sleeve		Brass	Brass	Monel
Diaphragms		Nylon reinforced BUNA-N	Nylon reinforced BUNA-N	Nylon reinforced BUNA-N
Refrigerant Contact				
Pressure Element	Cup	300 Series stainless steel	300 Series stainless steel	300 Series stainless steel
	Bellows	300 Series stainless steel	300 Series stainless steel	300 Series stainless steel
	Bellows Ring	Steel/nickel plated	Steel/nickel plated	Steel/nickel plated

European V248 Materials

Nominal Valve Size:		3/8 in. to 3/4 in. (Commercial)	1 in. to 1-1/2 in. (Commercial)	Maritime (All Sizes)
Material				
Body		Hot forged brass	Cast iron/rust resisting finish	Cast bronze
Seat		Aluminum bronze	Aluminum bronze	Monel
Disc		BUNA-N	BUNA-N	BUNA-N
Disc Cup		Brass	Brass	Monel
Disc Stud		Brass	Brass	Monel
Stem/Extension Sleeve		Brass	Brass	Monel
Diaphragms		Nylon reinforced BUNA-N	Nylon reinforced BUNA-N	Nylon reinforced BUNA-N
Refrigerant Contact				
Pressure Element	Cup	300 Series stainless steel	300 Series stainless steel	300 Series stainless steel
	Bellows	300 Series stainless steel	300 Series stainless steel	300 Series stainless steel
	Bellows Ring	Steel/nickel plated	Steel/nickel plated	Steel/nickel plated

Technical Specifications

V248 Series Pressure-Actuated Water-Regulating Valves for High-Pressure Refrigerants	
Maximum Working Pressure	630 psig (43.4 bar)
Factory-Set Opening Point (Port 1 to Port 2)	275 psig (19.0 bar)
Opening Point Adjustment Range (Port 1 to Port 2)	200 to 400 psi (13.8 to 27.6 bar)
Throttling Range	120 psi (8.3 bar) for 1/2 in. size 100 psi (6.9 bar) for 3/4 in., 1 in., and 1-1/4 in. sizes 140 psi (9.6 bar) for 1-1/2 in. size
Media	150 psig (10.3 bar) maximum, -4°F to 170°F (-20°C to 77°C) glycol/water or liquids with low freezing points that are compatible with valve materials

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STT Water Valve Renewal Kit for V46, V47, and V48 Series Valves

Description

These renewal kits include a seat, disc, diaphragms, and all additional internal parts required to recondition the valves.

Selection Chart

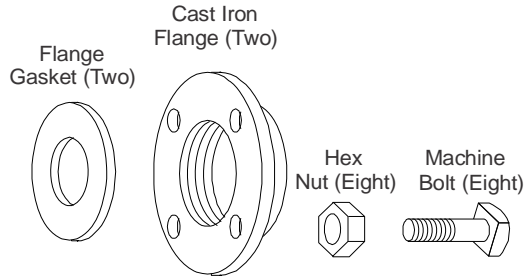
Valve Size (in.)	Commercial Kit		Monel Kit	Diaphragm Kits Only for All Types
	For Series V46A, V46N, V47A, V47N Product Code Numbers	For Series V48 Product Code Numbers	For Series V46B, V46C, V47B, V47C Product Code Number	
3/8	STT14A-600R	–	STT14A-601R	–
1/2	STT15A-602R	STT15A-605R	STT15A-603R	–
3/4	STT16A-601R	STT16A-604R	STT17A-613R	–
1	STT17A-609R	STT17A-616R	STT17A-611R	DPM17A-600R
1-1/4	STT17A-610R	STT17A-617R	STT17A-612R	
1-1/2		STT17A-604R		
2	STT18A-600R	–	STT18A-602R	DPM17A-601R
2-1/2	STT18A-601R	–		



Companion Flanges and Gaskets for V43, V46, and V47 Series Valves

Description

Companion flanges and gaskets are sold individually or in kits. The kits contain two flange gaskets, two cast iron flanges with NPT (National Pipe Thread), eight hex nuts, and eight machine bolts.



Companion Flange Kit

Selection Chart

Valve Size	Valve Series		
	V43 Series	V46 Series	V47 Series
Flange Gaskets (One gasket per package)			
1-1/2 in.	—	246-423	
2 in.		246-424	
2-1/2 in.		246-425	
Companion Flange Kits (See diagram)			
1-1/2 in.	—	KIT14A-612 ¹	KIT14A-612
2 in.	KIT14A-613 ¹	KIT14A-613 ¹	KIT14A-613
2-1/2 in.	KIT14A-614 ¹	KIT14A-614 ¹	KIT14A-614
3 in.	FLG15A-600 ¹	—	—
4 in.	FLG15A-601 ¹	—	—

1. Commercial valves only

Repair Information

If the Companion Flanges and Gaskets for V43, V46, and V47 Series Valves fail to operate within its specifications, replace the unit. For a replacement flange or gasket, contact the nearest Johnson Controls® representative.



Y63, Y64, Y65, Y66, and Y69 Series Transformers

Description

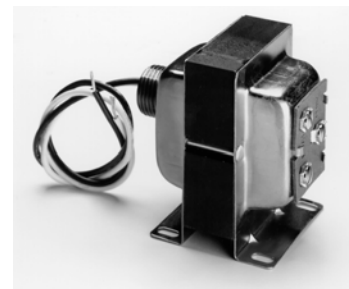
The Y63, Y64, Y65, Y66, and Y69 Series Transformers provide 24 VAC power for loads of 40 VA through 300 VA. These transformers are designed for use on digital controllers, gas controls, ignition systems, motor actuators, staging controls, and most other 24 VAC HVAC/R control systems.

The Y6x Series meets the requirements of UL 1585, UL 506, and CSA C22.2 No. 66, providing compliance in both the United States and Canada. The Y63, Y64, Y65, and Y66 transformers are listed as Class 2 transformers (UL 1585, CSA C22.2 No. 66). The Y69 is listed as a general purpose transformer (UL 506, CSA C22.2 No. 66).

Refer to the *Series Y63, Y64, Y65, Y66, and Y69 Transformers Product Bulletin (LIT-125755)* for important product application information.

Features

- split-bobbin design provides best primary/secondary isolation
- multi-tap primaries reduce stocking requirements and offer application flexibility
- choice of foot, plate, or conduit hub mounting provides mounting flexibility
- choice of primary voltages meets a wide range of power requirements from 24 VAC through 480 VAC
- color-coded lead wires provide simplicity and standardization
- cULus listed or cURus recognized meets US and Canadian requirements for Class 2 transformers (Y63, Y64, Y65, and Y66) and general purpose transformers (Y69)
- built-in, easy-reset circuit breakers eliminate replacement time and cost caused by burn-out (Y63, Y64, Y66, and Y69)
- open frame Y65 models serve as ideal models when end bells are not required



Y65 Series Transformer

Repair Information

Do not make any field repairs to transformers. For a replacement transformer, contact the nearest Johnson Controls® distributor or sales representative.

Selection Chart

Y63, Y64, Y65, Y66, and Y69 Series Transformers (Part 1 of 2)

Product Code Number	Primary Voltage VAC	Secondary Voltage VAC	Primary Connection	Secondary Connection	Mounting	Agency Requirement
40 VA Capacity Transformers with Energy Limiting Type Overload Protection						
Y65G13-0	24	24	External Fitting 8 in. primary leads	External Fitting 30 in. secondary leads	Foot	cULus Class 2
Y65A13-0	120	24	External Fitting 8 in. primary leads	External Fitting 30 in. secondary leads	Foot	cULus Class 2
Y65A21-0	120	24	End bell holes 8 in. primary leads	Three screw terminals (one is blind)	4 in. x 4 in. plate	cULus Class 2
Y65T31-0	120/208/240	24	External Fitting 8 in. primary leads	Three screw terminals (one is blind)	Foot 4 in. x 4 in. plate ¹	cULus Class 2
Y65T42-0	120/208/240	24	Common External Fitting 8 in. primary leads	Common External Fitting 8 in. secondary leads	Hub 4 in. x 4 in. plate ¹	cURus Class 2
Y65T54-0	120/208/240	24	8 in. primary leads	8 in. secondary leads	Foot-skeleton	cURus Class 2
Y65S13-0	208/240	24	External Fitting 8 in. primary leads	External Fittings 30 in. secondary leads	Foot	cULus Class 2
Y65F13-0	277/480	24	External Fitting 8 in. primary leads	External Fitting 30 in. secondary leads	Foot	cULus Class 2
Y65F42-0	277/480	24	Common External Fitting 8 in. primary leads	Common External Fitting 8 in. secondary leads	Hub 4 in. x 4 in. plate ¹	cURus Class 2
50 VA Capacity Transformers with Circuit Breakers						
Y63T22-0	120/208/240	24	End bell Hole 8 in. primary leads	End bell Hole 8 in. secondary leads	4 in. x 4 in. plate	cURus Class 2
Y63T31-0	120/208/240	24	External Fitting 8 in. primary leads	Three screw terminals (one is blind)	Foot 4 in. x 4 in. plate ¹	cULus Class 2
Y63F22-0	277/480	24	End bell Hole 8 in. primary leads	End bell Hole 8 in. secondary leads	4 in. x 4 in. plate	cURus Class 2

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Relays and Transformers

Y63, Y64, Y65, Y66, and Y69 Series Transformers (Continued)

Y63, Y64, Y65, Y66, and Y69 Series Transformers (Part 2 of 2)

Product Code Number	Primary Voltage VAC	Secondary Voltage VAC	Primary Connection	Secondary Connection	Mounting	Agency Requirement
75 VA Capacity Transformers with Circuit Breakers						
Y66T12-0	120/208/240	24	Common External Fitting 8 in. primary leads	Common External Fitting 8 in. secondary leads	Foot	cURus Class 2
Y66T13-0	120/208/240	24	External Fitting 8 in. primary leads	External Fitting 30 in. secondary leads	Foot	cULus Class 2
Y66F12-0	277/480	24	Common External Fitting 8 in. primary leads	Common External Fitting 8 in. secondary leads	Foot	cURus Class 2
Y66F13-0	277/480	24	External Fitting 8 in. primary leads	External Fitting 30 in. secondary leads	Foot	cULus Class 2
92 VA Capacity Transformers with Circuit Breakers						
Y64T15-0	120/208/240	24	External Fitting 8 in. primary leads	Internal Fitting 30 in. secondary leads	Foot	cULus Class 2
Y64T21-0	120/208/240	24	End bell holes 8 in. primary leads	Three screw terminals (one is blind)	Plate	cULus Class 2
Y64T22-0	120/208/240	24	End bell Hole 8 in. primary leads	End bell Hole 8 in. secondary leads	Plate	cURus Class 2
300 VA Capacity Transformers with Circuit Breakers						
Y69T15-0	120/208/240	24	External Fitting 8 in. primary leads	Internal Fitting 30 in. secondary leads	Foot	cULus Power Transformer

1. 4 in. x 4 in. plate and nut packed with transformer.

Technical Specifications

Series Y63, Y64, Y65, Y66, Y69 Transformers													
Input Power Requirements	24 to 480 VAC at 60 Hz												
Full Load Secondary Voltage	23.5 VAC (Nominal)												
Open Circuit Secondary Voltage (No Load)	27.0 VAC (Nominal)												
Full Load Secondary VA Rating	<table border="1" style="width: 100%;"> <thead> <tr> <th>Series</th> <th>Volt-Amperes</th> </tr> </thead> <tbody> <tr> <td>Y63</td> <td>50 VA</td> </tr> <tr> <td>Y64</td> <td>92 VA</td> </tr> <tr> <td>Y65</td> <td>40 VA</td> </tr> <tr> <td>Y66</td> <td>75 VA</td> </tr> <tr> <td>Y69</td> <td>300 VA</td> </tr> </tbody> </table>	Series	Volt-Amperes	Y63	50 VA	Y64	92 VA	Y65	40 VA	Y66	75 VA	Y69	300 VA
Series	Volt-Amperes												
Y63	50 VA												
Y64	92 VA												
Y65	40 VA												
Y66	75 VA												
Y69	300 VA												
Finish	End bells, frame, feet, and mounting plates are corrosion resistant												
Ambient Operating Temperature	-40 to 104°F (-40 to 40°C)												
Ambient Storage Temperature	-40 to 140°F (-40 to 60°C)												
Shipping Weight	<table border="1" style="width: 100%;"> <tbody> <tr> <td>Y63</td> <td>3.0 lb/1.4 kg</td> </tr> <tr> <td>Y64</td> <td>4.0 lb/1.8 kg</td> </tr> <tr> <td>Y65</td> <td>2.0 lb/0.9 kg</td> </tr> <tr> <td>Y66</td> <td>3.0 lb/1.4 kg</td> </tr> <tr> <td>Y69</td> <td>11.0 lb/5.0 kg</td> </tr> </tbody> </table>	Y63	3.0 lb/1.4 kg	Y64	4.0 lb/1.8 kg	Y65	2.0 lb/0.9 kg	Y66	3.0 lb/1.4 kg	Y69	11.0 lb/5.0 kg		
Y63	3.0 lb/1.4 kg												
Y64	4.0 lb/1.8 kg												
Y65	2.0 lb/0.9 kg												
Y66	3.0 lb/1.4 kg												
Y69	11.0 lb/5.0 kg												
Agency Compliance	UL Listed Y63, Y64, Y65, Y66; File E95575, CCN's XOKV (US) and XOKV7 (Canada) UL Recognized Y63, Y64, Y65, Y66; File E95575, CCN's XOKV2 (US) and XOKV8 (Canada) UL Listed Y69; File E95138, CCN's XPTQ (US) and XPTQ7 (Canada) All transformers are Class 2 except the Y69 (300 VA), which is listed as a power transformer.												

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System 450™ Series Modular Controls

Description

System 450™ is a family of modular, digital electronic controls that is easily assembled and set up to provide reliable temperature, pressure, and humidity control for a wide variety of HVAC/R applications, commercial process applications, and industrial process applications.

The System 450 control system is designed to replace System 350™ and System 27 control systems, and to provide many additional features and benefits with fewer than twenty model variations.

System 450 control modules provide a field-configurable out-of-the-box solution. Most System 450 control modules can control temperature, pressure, and humidity systems simultaneously.

System 450 Control Modules with Communications enable you to connect System 450 control systems to Modbus® or Ethernet networks for remote monitoring and setup. The Modbus communications control module is an RS485, RTU-compliant slave device. The Ethernet communications control module has an integral web server that can deliver web pages by means of a direct connection, on your LAN, or across the Internet.

System 450 Reset Control Modules provide many of the features of the standard models for temperature and humidity control. In addition, these modules provide setpoint reset, real-time setback scheduling, and run-time balancing (equal run time) capability.

The System 450 Control Module with Hybrid Analog Output has a single self-selecting analog output to optimize and extend the controlled speed range of variable speed electronically commutated (EC) motors.

Refer to the following documents for important product application information.

- *System 450™ Series Modular Controls Product Bulletin (LIT-12011458)*
- *System 450™ Series Modular Control Systems with Standard Control Modules Technical Bulletin (LIT-12011459)*
- *System 450™ Series Modular Control Systems with Reset Control Modules Technical Bulletin (LIT-12011842)*
- *System 450™ Series Modular Control Systems with Communications Control Modules Technical Bulletin (LIT-12011826)*

Features

- durable, compact, interchangeable modular components with plug-together connectors and DIN rail or direct wall mount capability eliminate field wiring between modules and allow you to quickly and easily design, assemble, install, and upgrade your control systems.
- versatile, multipurpose, field-configurable control modules and expansion modules designed for global use allow you to create a wide variety of application-specific control systems capable of controlling temperature, pressure, or humidity, or all three conditions simultaneously, with only a small suite of module models.
- up to three hard-wired input sensors and up to ten relay or analog outputs (in any combination) per control system allow you to build complex custom control systems while reducing your control system cost to only the cost of the required components.
- control Modules with bright backlit LCDs and four-button touch pad user interfaces provide quick, clear, visual status of your System 450 control system inputs and outputs with the touch of a button and enable you to quickly and easily set up and adjust your control system.



System 450 Control System with a Control, Power, and Expansion Module

- multipurpose, all-in-one control modules enable simple stand-alone, single-module control systems that are temperature, pressure, and humidity capable out of the box and easy to set up in the field to replace a wide variety of OEM HVAC/R and process controls.
- an extensive suite of compatible temperature and humidity sensors, and pressure transducers allows you to monitor and control a wide range of HVAC/R and process conditions in a variety of standard and global units of measurement.
- high input signal selection enables your control system to monitor a temperature, pressure, or humidity condition with two or three sensors (of the same type) and control your system outputs based on the highest condition value sensed by the referenced sensors.
- differential control enables your control system to monitor and maintain a temperature, pressure, or humidity differential between two sensor points within a system, process, or space.

The Reset Control modules have additional features:

- adjustable minimum and maximum setpoint temperatures (reset control modules only) enable compliance with the manufacturer's specifications for your controlled HVAC/R and process equipment.
- selectable shutdown-high and shutdown-low temperature settings (reset control modules only) saves you energy by shutting down controlled equipment when the ambient temperature either rises or drops to a point where heating or cooling is no longer required.
- real time clock and adjustable setback temperature (reset control modules only) save you energy by setting back heating, cooling, or humidity setpoints during scheduled unoccupied periods (24-hour day, 7-day week schedule).
- user-defined reset control capability (reset control modules only) saves you energy in a wide variety of temperature and humidity reset control applications by adjusting the temperature or humidity control loop, based on changes in ambient outdoor temperature or other uncontrolled condition.



System 450™ Series Modular Controls (Continued)

The Control Modules with Communications have additional features:

- Ethernet communication capability through a built-in web server (Ethernet Control Modules only) allows you to monitor your control system status and set up or change the parameters by means of a direct Ethernet cable connection, through a LAN connection, or over the Internet. The built in web server delivers user-friendly web pages to client browsers on a desktop, laptop, tablet, or smart device.
- The Web page server on Ethernet communication modules provides a simple, intuitive web interface for easy remote monitoring, setup, adjustment and remote monitoring of your control systems across Ethernet networks.
- RS485, RTU-compliant Modbus® network communication capability (Modbus control modules only) enables a head-end RS485 Modbus master controller to read and write control system status and setup parameters to the System 450 Modbus communication control module.
- Password protection for local access (Ethernet and Modbus control modules only) and password protection for remote access (Ethernet control module only) deters unauthorized changes to the control system settings, but allows local and remote monitoring of your control system status.
- Analog output signal limiting features (communication control modules only) allow you to select the rate and condition range at which the control updates the analog output signal, potentially reducing wear on the controlled equipment.
- Binary input with time delay (communication control modules only) allows you to use an external set of dry contacts and selectable time delays to control relay outputs.

Applications

You can create a wide variety of custom, application-specific control systems with System 450 modules. The following are some common control application examples:

- Temperature control
- Pressure control
- Humidity control
- Multipurpose control
- Reset and setback control
- High input-signal selection
- Differential control

Temperature Control

- Temperature monitoring and alarming
- On/Off staged control of boilers and chillers
- Proportional stage control of boilers and chillers
- Boiler and chiller pump control
- Heating and cooling control with deadband
- Floating temperature control of damper and valve actuators
- Cooling tower fan speed/stage control based on water temperature
- Supply, make-up, and mixed air temperature control
- Temperature actuated valve control
- Supply and make-up air damper and fan control
- Condenser fan staging or speed control based on condenser temperature

Refrigerant Pressure Control

- Condenser fan cycling and stage control
- Multispeed condenser fan control
- Floating pressure control of damper and valve actuators
- Condenser fan speed and damper control
- High and low pressure cutout control
- Staged compressor control
- Cooling tower fan speed control based on high-side pressure
- Direct speed control of electronically commutated (EC) condenser fan motors (C450CPW-100 model)

Other Pressure Control

- Relief damper and fan control for building pressurization
- Constant static pressure control

Humidity Control

- On/Off humidification and dehumidification control
- Proportional humidification and dehumidification control
- Multistage humidification and dehumidification control
- Humidity monitoring and alarming

Multipurpose Control

- Temperature and pressure based refrigeration rack control
- Temperature and humidity control of wine cellars and greenhouses
- Temperature, humidity, and static pressure control of clean rooms and greenhouses
- Dehumidification with reheat control

Reset Control

- Boiler supply water temperature reset control based on outside air temperature
- Chiller supply water temperature reset control based on outside air temperature
- VAV zone temperature control based on outside air temperature
- Humidity reset based on outside air temperature
- Staged applications with runtime balancing
- Real-time Occupied/Unoccupied Setback

High Input Signal Selection

- Pressure-based fan speed or fan cycling control on multi-circuit condensers
- Temperature-based fan speed or fan cycling control on multi-circuit condensers

Differential Control

- Air and fluid pump-flow monitoring and alarming
- Air and fluid filter status monitoring and alarming
- Chiller barrel flow monitoring, control, and alarming
- Solar air and water heating applications

Note: Communications modules add network communication to any application of your choosing, except those requiring reset, setback, or EC motor control.

Repair Information

If a System 450 module fails to operate within its specifications, replace the module. For a replacement module, contact your Johnson Controls® representative.



System 450™ Series Modular Controls (Continued)

System 450 Control Module Capabilities

Control by _____	System 450 Control Modules			
	Standard	Communications	Reset	Hybrid
	C450CPN-3C C450CQN-3C C450CBN-3C C450CCN-3C	C450CEN-1C C450CRN-1C	C450RBN-3C C450RCN-3C	C450CPW-100C
Controlled Condition				
Temperature	✓	✓	✓	✓
Pressure	✓	✓	-	✓
Humidity	✓	✓	✓	✓
Combination of Conditions	✓	✓	✓	✓
Control Capabilities				
On/Off Relay Control	✓	✓	✓	✓
Analog Proportional Control (Direct and Reverse Action)	✓	✓	✓	✓
Analog Proportional Plus Integral Control (Direct and Reverse Action)	✓	✓	✓	✓
Combination of On/Off Relay and Analog Output Control	✓	✓	✓	✓
Stand-Alone Control	✓	-	✓	✓
Multi-Stage Control (Relay or Analog)	✓	✓	✓	✓
Network Communications	-	✓	-	-
High Input Signal Selection	✓	✓	-	✓
Differential Control	✓	✓	-	✓
Output Signal Limiting Output Signal Update Rate Output Signal Deadband	-	✓	-	-
Binary Input Control for Relay Outputs	-	✓	-	-
On/Off Duration Time Control	-	✓	-	-
Temperature and Humidity Reset Control	-	-	✓	-
Scheduling and Temperature Setback Control	-	-	✓	-
Reset Setpoint Control	-	-	✓	-
Setback Scheduling	-	-	✓	-
Run-Time Balancing	-	-	✓	-
Hybrid Analog Output Control	-	-	-	✓ ¹

1. Only on output OUTA1.



System 450™ Series Modular Controls (Continued)

Selection Charts

System 450 Modules and Accessories Ordering Information

Product Code Number	Product Description
C450CBN-3C	Standard Control Module with LCD, Four-Button Touchpad UI, and Relay Output; provides one relay output (SPDT line-voltage relay) for SPDT control.
C450CCN-3C	Standard Control Module with LCD, Four-Button Touchpad UI, and Relay Output; provides two relay outputs (SPDT line-voltage relays) for SPDT control.
C450CEN-1C	Control Module with Ethernet Communications, LCD, and Four-Button Touchpad UI. (No onboard outputs available on control modules with network communications capabilities.)
C450CPN-3C	Standard Control Module with LCD, Four-Button Touchpad UI, and Analog Output; provides one analog output (0 to 10 VDC or 4 to 20 mA self-selecting signal) for proportional control.
C450CPW-100C	Hybrid Analog Output Control Module with LCD, Four-Button Touchpad UI, Hybrid Analog Output and Optional High Input Signal Select; provides one hybrid analog output and optional high input signal select primarily used for variable-speed EC motor speed control. Only Analog Output 1 (OUTA1) can be configured as a hybrid analog output and/or use the High Input Signal Selection feature. These features are not available for any of the other outputs in a System 450 control system that uses the C450CPW-100C as the control module.
C450CQN-3C	Standard Control Module with LCD and Four-Button Touchpad UI, and Analog Output; provides two analog outputs (0 to 10 VDC or 4 to 20 mA self-selecting signals) for proportional control.
C450CRN-1C	Control Module with RS485 Modbus Communications, LCD, and Four-Button Touchpad UI. (No onboard outputs available on control modules with network communications capabilities.)
C450RBN-3C	Reset Control Module with LCD, Four-Button Touchpad UI, and SPDT relay output; provides one SPDT output relay. One A99BC-25C temperature sensor with 0.25 m (9-1/4 in.) silicon leads and one A99BC-300C temperature sensor with 3 m (9 ft 10 in.) silicon leads are included in the box with the Reset Control Module.
C450RCN-3C	Reset Control Module with LCD, Four-Button Touchpad UI, and SPDT relay output; provides two SPDT output relays. One A99BC-25C temperature sensor with 0.25 m (9-1/4 in.) silicon leads and one A99BC-300C temperature sensor with 3 m (9 ft 10 in.) silicon leads are included in the box with the Reset Control Module.
C450SBN-3C	Relay Output Expansion Module; provides one SPDT line-voltage relay output.
C450SCN-3C	Relay Output Expansion Module; provides two SPDT line-voltage relay outputs.
C450SPN-1C	Analog Output Expansion Module; provides one analog output (0 to 10 VDC or 4 to 20 mA self-selecting signal) for proportional control.
C450SQN-1C	Analog Output Expansion Module; provides two analog outputs (0 to 10 VDC or 4 to 20 mA self-selecting signals) for proportional control.
C450YNN-1C	Power Module; provides 24 V to System 450 Module Assembly; 120 VAC or 240 VAC supply power input terminals.
BKT287-1R	DIN Rail; 0.30 m (12 in.) long
BKT287-2R	DIN Rail; 1 m (39-1/3 in.) long
BKT287-3R	DIN Rail; 0.61 m (24 in.) long
BKT287-4R	DIN Rail; 0.36 m (14 in.) long
PLT344-1R	DIN Rail End Clamps (2 clamps)
WHA-C450-100C	System 450 module connection extension cable, 100 cm (3.3 ft) long

System 450 Compatible A99B Temperature Sensors and Accessories Ordering Information¹ (Part 1 of 2)

Product Code Number	Product Description
A99BA-200C	PTC Silicon Sensor with Shielded Cable; Cable Length 2 m (6-1/2 ft); Sensor Temperature Range: -40 to 120°C (-40 to 250°F) Cable Jacket Temperature Range: -40 to 100°C (-40 to 212°F)
A99BB-25C	PTC Silicon Sensor with PVC Cable; Cable Length 0.25 m (9-3/4 in.); Sensor Temperature Range: -40 to 120°C (-40 to 250°F) Cable Jacket Temperature Range: -40 to 100°C (-40 to 212°F)
A99BB-200C	PTC Silicon Sensor with PVC Cable; Cable Length 2 m (6-1/2 ft); Sensor Temperature Range: -40 to 120°C (-40 to 250°F) Cable Jacket Temperature Range: -40 to 100°C (-40 to 212°F)
A99BB-300C	PTC Silicon Sensor with PVC Cable; Cable Length 3 m (9-3/4 ft); Sensor Temperature Range: -40 to 120°C (-40 to 250°F) Cable Jacket Temperature Range: -40 to 100°C (-40 to 212°F)
A99BB-500C	PTC Silicon Sensor with PVC Cable; Cable Length 5 m (16-3/8 ft); Sensor Temperature Range: -40 to 120°C (-40 to 250°F) Cable Jacket Temperature Range: -40 to 100°C (-40 to 212°F)
A99BB-600C	PTC Silicon Sensor with PVC Cable; Cable Length 6 m (19-1/2 ft); Sensor Temperature Range: -40 to 120°C (-40 to 250°F) Cable Jacket Temperature Range: -40 to 100°C (-40 to 212°F)
A99BC-25C	PTC Silicon Sensor with High Temperature Silicon Cable; Cable Length 0.25 m (9-3/4 in.); Sensor Temperature Range: -40 to 120°C (-40 to 250°F) Cable Jacket Rated for Full Sensor Temperature Range.
A99BC-300C	PTC Silicon Sensor with High Temperature Silicon Cable; Cable Length 3 m (9-3/4 ft) Sensor Temperature Range: -40 to 120°C (-40 to 250°F) Cable Jacket Rated for Full Sensor Temperature Range.
A99BC-1500C	PTC Silicon Sensor with High Temperature Silicon Cable; Cable Length 15 m (49 ft) Sensor Temperature Range: -40 to 120°C (-40 to 250°F) Cable Jacket Rated for Full Sensor Temperature Range.
BOX10A-600R	PVC Enclosure for A99 Sensor; Includes Wire Nuts and Conduit Connector (for Outdoor Sensor)

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System 450™ Series Modular Controls (Continued)

System 450 Compatible A99B Temperature Sensors and Accessories Ordering Information¹ (Part 2 of 2)

Product Code Number	Product Description
WEL11A-601R	Immersion Well for A99 Sensor Liquid Sensing Applications
A99-CLP-1	Mounting Clip for A99 Temperature Sensor
ADP11A-600R	Conduit Adaptor, 1/2 in. Snap-Fit EMT Conduit Adaptor (box of 10)
TE-6001-1	Duct Mounting Hardware with Handy Box for A99 Sensor
TE-6001-11	Duct Mounting Hardware without Handy Box for A99 Sensor
SHL10A-603R	Sun Shield (for Use with Outside A99 Sensors in Sunny Locations)

1. Refer to the *A99B Series Temperature Sensors Product/Technical Bulletin (LIT-125186)* on the Johnson Controls® Product Literature website for more information.

System 450 Compatible TE-6000 Series 1,000 Ohm Nickel Temperature Sensors and Accessories Ordering Information

Product Code Number	Product Description
TE-6000-x	TE6000 Series 1,000 ohm at 70°F nickel temperature sensors (only). Only the TE-6000-6 sensor can be used for the entire HI°C and HI°F temperature range. Different sensing element packages are available for various applications. For a complete list of compatible 1,000 ohm nickel sensors, including sensor descriptions, technical specifications, and mounting accessories, refer to the <i>TE-6000 Series Temperature Sensing Elements Product Bulletin (LIT-216288)</i> . (System 450 Sensor Types HI°C and HI°F)

System 450 Compatible TE-6300 Series 1,000 Ohm Nickel Temperature Sensors and Accessories Ordering Information

Product Code Number	Product Description
TE-631xx-x	TE6300 Series 1,000 ohm at 70°F nickel averaging and 1,000 ohm thin-film nickel temperature sensors (only). For a complete list of compatible 1,000 ohm nickel averaging and thin-film nickel sensors, including sensor descriptions, technical specifications, and mounting accessories, refer to the <i>TE-6300 Series Temperature Sensors Product Bulletin (LIT-216320)</i> . (System 450 Sensor Types HI°C and HI°F)

System 450 Compatible TE-68NT-0N00S 1,000 Ohm Nickel Temperature Sensor Ordering Information

Product Code Number	Product Description
TE-68NT-0N00S	TE6800 Series 1,000 ohm nickel temperature sensor for wall-mount applications. For more information, including sensor description, technical specifications, and mounting accessories, refer to the <i>TE-6800 Series Temperature Sensors Product Bulletin (LIT-12011542)</i> . (System 450 Sensor Types HI°C and HI°F)

System 450 Compatible HE67S3 Type Humidity Sensors with Integral A99B Temperature Sensor Ordering Information¹

Product Code Number	Product Description
HE-67S3-0N0BT	Wall Mount Humidity Sensor with A99B Type Temperature Sensor: 10 to 90% RH; 0 to 60°C (32 to 140°F)
HE-67S3-0N00P	Duct Mount Humidity Sensor with A99B Type Temperature Sensor: 10 to 90% RH; 0 to 60°C (32 to 140°F)

1. The HE-67S3 sensors require 24 VAC input and must use the 0–5 VDC output. Refer to the *TrueRH Series HE-67xx Humidity Element with Temperature Sensors Product Bulletin (LIT-216245)* on the Johnson Controls Product Literature website for more information, including technical specifications and mounting accessories.

System 450 Compatible HE6800 Series Humidity Transmitters with Temperature Sensor Ordering Information¹

Product Code Number	Product Description
HE-68N2-0N00WS	Wall Mount Humidity Transmitter with Nickel Temperature Sensor: 10 to 90 ±2% RH; 0 to 55°C (32 to 131°F)
HE-68N3-0N00WS	Wall Mount Humidity Transmitter with Nickel Temperature Sensor: 10 to 90 ±3% RH; 0 to 55°C (32 to 131°F)

1. The HE-6800 transmitters require 24 VAC input and must use the 0–5 VDC output. Refer to the *HE-6800 Series Humidity Transmitters with Temperature Sensor Product Bulletin (LIT-12011625)* on the Johnson Controls Product Literature website for more information, including technical specifications and mounting accessories.

System 450 Compatible Low Pressure Differential Transducer Ordering Information^{1 2}

Product Code Number	Product Description
DPT2650-R25B-AB	Low Pressure Differential Transducer: -0.25 to 0.25 in. W.C. (System 450 Sensor Type: P 0.25) ³
DPT2650-0R5D-AB	Low Pressure Differential Transducer: 0 to 0.5 in. W.C. (System 450 Sensor Type: P 0.5)
DPT2650-2R5D-AB	Low Pressure Differential Transducer: 0 to 2.5 in. W.C. (System 450 Sensor Type: P 2.5)
DPT2650-005D-AB	Low Pressure Differential Transducer: 0 to 5.0 in. W.C. (System 450 Sensor Type: P 5)
DPT2650-10D-AB	Low Pressure Differential Transducer: 0 to 10 in. W.C. (System 450 Sensor Type: P 10)

1. Refer to the *Setra Systems Model DPT265 Very Low Differential Pressure Transducer Catalog Page* on the Johnson Controls Product Literature website for more information.
2. The DPT265 sensors require 24 VAC input and must use the 0–5 VDC output. Refer to the *Setra Systems Model DPT265 Very Low Differential Pressure Transducer Catalog Page* on the Johnson Controls Product Literature website for more information.
3. Used only with Communications Control Modules.



System 450™ Series Modular Controls (Continued)

System 450 Compatible P499 Series Transducers with 1/4 in. SAE 45 Flare Internal Thread with Depressor (Style 47) Ordering Information¹

Product Code Number	Product Description
P499RCP-401C	-1 to 8 bar; order WHA-PKD3 type wire harness separately
P499RCP-402C	-1 to 15 bar; order WH A-PKD3 type wire harness separately
P499RCP-404C	0 to 30 bar; order WHA-PKD3 type wire harness separately
P499RCP-405C	0 to 50 bar; order WHA-PKD3 type wire harness separately
P499RCPS100C	-10 to 100 psis (sealed for wet and freeze/thaw applications); order WHA-PKD3 type wire harness separately
P499RCPS100K	-10 to 100 psis (sealed for wet and freeze/thaw applications); WHA-PKD3-200C wire harness included
P499RCPS102C	0 to 200 psis (sealed for wet and freeze/thaw applications); order WHA-PKD3 type wire harness separately
P499RCPS102K	0 to 200 psis (sealed for wet and freeze/thaw applications); WHA-PKD3-200C wire harness included
P499RCP-101C	0 to 100 psi; order WHA-PKD3 type wire harness separately
P499RCP-101K	0 to 100 psi; WHA-PKD3-200C wire harness included
P499RCP-105C	0 to 500 psi; order WHA-PKD3 type wire harness separately
P499RCP-105K	0 to 500 psi; WHA-PKD3-200C wire harness included
P499RCP-107C	0 to 750 psi; order WHA-PKD3 type wire harness separately
P499RCP-107K	0 to 750 psi; WHA-PKD3-200C wire harness included

1. The P499 sensors must be powered with the +5 VDC and C terminals and the output is 0.5 to 4.5 VDC. Refer to the *P499 Series Electronic Pressure Transducers Product/Technical Bulletin (LIT-12011190)* on the Johnson Controls Product Literature website for more information.

System 450 Compatible P499 Series Transducers with 1/8 in. 27 NPT External Thread (Style 49) Ordering Information¹

Product Code Number	Product Description
P499RAPS100C	-10 to 100 psis (sealed for wet and freeze/thaw applications); order WHA-PKD3 type wire harness separately
P499RAPS100K	-10 to 100 psis (sealed for wet and freeze/thaw applications); WHA-PKD3-200C wire harness included
P499RAPS102C	0 to 200 psis (sealed for wet and freeze/thaw applications); order WHA-PKD3 type wire harness separately
P499RAPS102K	0 to 200 psis (sealed for wet and freeze/thaw applications); WHA-PKD3-200C wire harness included
P499RAP-101C	0 to 100 psi; order WHA-PKD3 type wire harness separately
P499RAP-101K	0 to 100 psi; WHA-PKD3-200C wire harness included
P499RAP-102C	0 to 200 psi; order WHA-PKD3 type wire harness separately
P499RAP-105C	0 to 500 psi; order WHA-PKD3 type wire harness separately
P499RAP-105K	0 to 500 psi; WHA-PKD3-200C wire harness included
P499RAP-107C	0 to 750 psi; order WHA-PKD3 type wire harness separately
P499RAP-107K	0 to 750 psi; WHA-PKD3-200C wire harness included

1. The P499 sensors must be powered with the +5 VDC and C terminals and the output is 0.5 to 4.5 VDC. Refer to the *P499 Series Electronic Pressure Transducers Product/Technical Bulletin (LIT-12011190)* on the Johnson Controls Product Literature website for more information.

WHA-PKD3 Wire Harnesses Ordering Information¹

Product Code Number	Product Description
WHA-PKD3-200C	Plug and Three-Wire Harness for P499 Electronic Pressure Transducers: 2.0 m (6-1/2 ft) cable
WHA-PKD3-400C	Plug and Three-Wire Harness for P499 Electronic Pressure Transducers: 4.0 m (13 ft) cable
WHA-PKD3-600C	Plug and Three-Wire Harness for P499 Electronic Pressure Transducers: 6.0 m (19-5/8 ft) cable

1. Refer to the *P499 Series Electronic Pressure Transducers Product/Technical Bulletin (LIT-12011190)* on the Johnson Controls Product Literature website for more information.



Technical Specifications

C450CPN-3C and C450CQN-3C Control Modules with Analog Output (Part 1 of 2)	
Product	C450CPN-3C and C450CQN-3C: System 450 Control Module models are sensing controls and operating controls with LCD, four-button touchpad, and SPDT analog output C450CPN-3C: Control Module with one analog output C450CQN-3C: Control Module with two analog outputs
Power Consumption	C450CPN-3C: 1.3 VA maximum using 0 to 10 V out; 1.5 VA maximum using 4 to 20 mA out C450CQN-3C: 2.0 VA maximum using 0 to 10 V out; 2.4 VA maximum using 4 to 20 mA out
Supply Power	Internal Supply Power: C450YNN-1C Power Supply Module External Supply Power: 24 VAC (20 to 30 VAC) Safety Extra-Low Voltage (SELV) (Europe), Class 2 (North America), 50/60 Hz, 10 VA minimum Note: A System 450 control module or module assembly can use an internal or an external supply power source, but must not be connected to both simultaneously.



System 450 Control Series

System 450™ Series Modular Controls (Continued)

C450CPN-3C and C450CQN-3C Control Modules with Analog Output (Part 2 of 2)	
Ambient Operating Conditions	Temperature: -40 to 66°C (-40 to 150°F) when using 0–10 VDC outputs; -40 to 40°C (-40 to 104°F) when using 4–20 mA outputs Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)
Ambient Shipping and Storage Conditions	Temperature: -40 to 80°C (-40 to 176°F) Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)
Input Signal	0 to 5 VDC for humidity sensors and static pressure transducers 0.5 to 4.5 VDC for ratiometric pressure transducers 1,035 ohms at 25°C (77°F) for A99 PTC temperature sensors 1,000 ohms at 21.1°C (70°F) for TE-6xxx Nickel temperature sensors
Analog Output	Voltage Mode (0–10 VDC): 10 VDC maximum output voltage 10 mA maximum output current Requires an external load of 1,000 ohms or more The AO operates in Voltage Mode when connected to devices with impedance greater than 1,000 ohms. Devices that fall below 1,000 ohms may not operate as intended with Voltage Mode applications. Current Mode (4–20 mA): Requires an external load between 0 to 300 ohms The AO operates in Current Mode when connected to devices with impedance less than 300 ohms. Devices that rise above 300 ohms may not operate as intended with Current Mode applications.
Analog Input Accuracy	Resolution: 14 bits
Control Construction	Independently mounted control, surface mounted with Lexan® 950 enclosure suitable for DIN rail mounting or direct mounting to a hard, even surface.
Dimensions (H x W x D)	127 x 61 x 61 mm (5 x 2-3/8 x 2-3/8 in.)
Weight	C450CPN-3C: 195 g (0.43 lb) C450CQN-3C: 195 g (0.43 lb)
Compliance	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 and the Low Voltage Directive. Australia: Mark: C-Tick Compliant (N1813)
	
C450CEN-1C Control Module with Ethernet Communications	
Product	C450CEN: System 450 control modules are sensing controls and operating controls with LCD and four-button touchpad UI, Ethernet communications capability, and no outputs. C450CEN-1C: Control module with Ethernet communications capability
Supply Power	Internal Supply Power: C450YNN-1C Power Supply Module External Supply Power: 24 VAC (20 to 30 VAC) Safety Extra-Low Voltage (SELV) (Europe), Class 2 (North America), 50/60 Hz, 10 VA minimum Note: A System 450 control module or module assembly can use an internal or an external supply power source, but must not be connected to both simultaneously.
Ambient Operating Conditions	Temperature: -40 to 66°C (-40 to 150°F) Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)
Ambient Shipping and Storage Conditions	Temperature: -40 to 80°C (-40 to 176°F) Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)
Input Signal	0 to 5 VDC; 1,035 ohms at 25°C (77°F) for an A99 PTC Temperature Sensor
Analog Input Accuracy	Resolution: 16 bits
Control Construction	Independently mounted control, surface mounted with Lexan® 950 enclosure suitable for DIN rail mounting or direct mounting to a hard, even surface.
Dimensions (H x W x D)	127 x 63 x 63 mm (5 x 2-3/8 x 2-3/8 in.)
Weight	C450CEN-1C: 207 g (0.46 lb)
Compliance	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; CISPR22, class B. Australia: Mark: C-Tick Compliant (N1813)
	




System 450 Control Series


System 450™ Series Modular Controls (Continued)

C450CRN-1C Control Module with RS485 Modbus Communications	
Product	C450CRN-1C: System 450 control modules are sensing controls and operating controls with LCD and four-button touchpad UI and no outputs. This control module is an RS485, RTU compliant Modbus slave device.
Supply Power	Internal Supply Power: C450YNN-1C Power Supply Module External Supply Power: 24 VAC (20 to 30 VAC) Safety Extra-Low Voltage (SELV) (Europe), Class 2 (North America), 50/60 Hz, 10 VA minimum Note: A System 450 control module or module assembly can use an internal or an external supply power source, but must not be connected to both simultaneously.
Ambient Operating Conditions	Temperature: -40 to 66°C (-40 to 150°F) Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)
Ambient Shipping and Storage Conditions	Temperature: -40 to 80°C (-40 to 176°F) Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)
Input Signal	0 to 5 VDC; 1,035 ohms at 25°C (77°F) for an A99 PTC Temperature Sensor
Analog Input Accuracy	Resolution: 16 bits
Control Construction	Independently mounted control, surface mounted with Lexan® 950 enclosure suitable for DIN rail mounting or direct mounting to a hard, even surface.
Dimensions (H x W x D)	127 x 63 x 63 mm (5 x 2-3/8 x 2-3/8 in.)
Weight	C450CRN-1C: 207 g (0.46 lb)
Compliance	<div style="display: flex; align-items: center;"> <div> <p>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</p> <p>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; CISPR22, class B</p> <p>Australia: Mark: C-Tick Compliant (N1813)</p> </div> </div>
C450CPW-100C Control Module with Hybrid Analog Output (Part 1 of 2)	
Product	C450CPW-100C System 450 control module is a sensing control and operating control with LCD, four-button touchpad, and analog output with pulse-width modulation capability.
Power Consumption	C450CPW-100C: 1.3 VA maximum using 0 to 10 V out; 1.5 VA maximum using 4 to 20 mA out
Supply Power	Internal Supply Power: C450YNN-1C Power Supply Module External Supply Power: 24 VAC (20 to 30 VAC) Safety Extra-Low Voltage (SELV) (Europe), Class 2 (North America), 50/60 Hz, 10 VA minimum Note: A System 450 control module or module assembly can use an internal or an external supply power source, but must not be connected to both simultaneously.
Ambient Operating Conditions	Temperature: -40 to 66°C (-40 to 150°F) when using 0 to 10 VDC outputs; -40 to 40°C (-40 to 104°F) when using 4 to 20 mA outputs Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)
Ambient Shipping and Storage Conditions	Temperature: -40 to 80°C (-40 to 176°F) Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)
Input Signal	0 to 5 VDC for humidity sensors and static pressure transducers 0.5 to 4.5 VDC for ratiometric pressure transducers 1,035 ohms at 25°C (77°F) for A99 PTC temperature sensors 1,000 ohms at 21.1°C (70°F) for TE-6xxx Nickel temperature sensors
Analog Output	<p>Voltage Mode (0–10 VDC): 10 VDC maximum output voltage 10 mA maximum output current Requires an external load of 1,000 ohms or more The AO operates in Voltage Mode when connected to devices with impedance greater than 1,000 ohms. Devices that fall below 1,000 ohms may not operate as intended with Voltage Mode applications.</p> <p>Current Mode (4–20 mA): Requires an external load between 0 to 300 ohms The AO operates in Current Mode when connected to devices with impedance less than 300 ohms. Devices that rise above 300 ohms may not operate as intended with Current Mode applications.</p>
Analog Input Accuracy	Resolution: 14 bits
Control Construction	Independently mounted control, surface mounted with Lexan® 950 enclosure suitable for DIN rail mounting or direct mounting to a hard, even surface.
Dimensions (H x W x D)	127 x 61 x 61 mm (5 x 2-3/8 x 2-3/8 in.)
Weight	C450CPW-100C: 195 g (0.43 lb)



System 450™ Series Modular Controls (Continued)

C450CPW-100C Control Module with Hybrid Analog Output (Part 2 of 2)	
	<p>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</p> <p>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 and the Low Voltage Directive.</p> <p>Australia: Mark: C-Tick Compliant (N1813)</p>

C450CBN-3C and C450CCN-3C Control Modules with Relay Output										
Product	C450CBN-3C and C450CCN-3C: System 450 Control Module models are sensing controls and operating controls with LCD, four-button touchpad, and SPDT relay output C450CBN-3C: Control Module with one SPDT output relay C450CCN-3C: Control Module with two SPDT output relays									
Power Consumption	C450CBN-3C: 0.9 VA maximum C450CCN-3C: 1.3 VA maximum									
Supply Power	Internal Supply Power: C450YNN-1C Power Supply Module External Supply Power: 24 VAC (20 to 30 VAC) Safety Extra-Low Voltage (SELV) (Europe), Class 2 (North America), 50/60 Hz, 10 VA minimum Note: A System 450 control module or module assembly can use an internal or an external supply power source, but must not be connected to both simultaneously.									
Ambient Operating Conditions	Temperature: -40 to 66°C (-40 to 150°F) Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)									
Ambient Shipping and Storage Conditions	Temperature: -40 to 80°C (-40 to 176°F) Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)									
Input Signal	0 to 5 VDC for humidity sensors and static pressure transducers 0.5 to 4.5 VDC for ratiometric pressure transducers 1,035 ohms at 25°C (77°F) for A99 PTC temperature sensors 1,000 ohms at 21.1°C (70°F) for TE-6xxx Nickel temperature sensors									
Output Relay Contacts	General: 1/2 HP at 120/240 VAC, SPDT Specific: <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>AC Motor Ratings</th> <th>120 VAC</th> <th>208/240 VAC</th> </tr> </thead> <tbody> <tr> <td>AC Full-load Amperes:</td> <td>9.8 A</td> <td>4.9 A</td> </tr> <tr> <td>Locked-Rotor Amperes:</td> <td>58.8 A</td> <td>29.4 A</td> </tr> </tbody> </table> 10 Amperes AC Non-inductive at 24/240 VAC Pilot Duty: 125 VA at 24/240 VAC	AC Motor Ratings	120 VAC	208/240 VAC	AC Full-load Amperes:	9.8 A	4.9 A	Locked-Rotor Amperes:	58.8 A	29.4 A
AC Motor Ratings	120 VAC	208/240 VAC								
AC Full-load Amperes:	9.8 A	4.9 A								
Locked-Rotor Amperes:	58.8 A	29.4 A								
Analog Input Accuracy	Resolution: 14 bits									
Control Construction	Independently mounted control, surface mounted with Lexan® 950 enclosure suitable for DIN rail mounting or direct mounting to a hard, even surface.									
Dimensions (H x W x D)	127 x 61 x 61 mm (5 x 2-3/8 x 2-3/8 in.)									
Weight	C450CBN-3C: 209 g (0.46 lb) C450CCN-3C: 222 g (0.49 lb)									
	<p>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</p> <p>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 and the Low Voltage Directive.</p> <p>Australia: Mark: C-Tick Compliant (N1813)</p>									

C450RBN-3C and C450RCN-3C Reset Control Modules with Real-Time Clock and Relay Output (Part 1 of 2)	
Product	C450RBN-3C and C450RCN-3C: System 450 Reset Control Module models are sensing controls and operating controls with LCD, four-button touchpad, and SPDT relay output C450RBN-3C: Control Module with one SPDT output relay C450RCN-3C: Control Module with two SPDT output relays
Power Consumption	C450RBN-3C: 0.9 VA maximum C450RCN-3C: 1.3 VA maximum
Supply Power	Internal Supply Power: C450YNN-1C Power Supply Module External Supply Power: 24 VAC (20 to 30 VAC) Safety Extra-Low Voltage (SELV) (Europe), Class 2 (North America), 50/60 Hz, 10 VA minimum Note: A System 450 control module or module assembly can use an internal or an external supply power source, but must not be connected to both simultaneously.
Ambient Operating Conditions	Temperature: -40 to 66°C (-40 to 150°F) Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)
Ambient Shipping and Storage Conditions	Temperature: -40 to 80°C (-40 to 176°F) Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)

The performance specifications are nominal and conform to acceptable industry standards. For applications at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products. © 2015 Johnson Controls, Inc. www.johnsoncontrols.com



System 450 Control Series

System 450™ Series Modular Controls (Continued)

C450RBN-3C and C450RCN-3C Reset Control Modules with Real-Time Clock and Relay Output (Part 2 of 2)										
Input Signal	0 to 5 VDC for humidity sensors 1,035 ohms at 25°C (77°F) for A99 PTC temperature sensors									
Output Relay Contacts	General: 1/2 HP at 120/240 VAC, SPDT Specific: <table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="text-align: left;">AC Motor Ratings</td> <td style="text-align: center;">120 VAC</td> <td style="text-align: center;">208/240 VAC</td> </tr> <tr> <td style="text-align: left;">AC Full-load Amperes:</td> <td style="text-align: center;">9.8 A</td> <td style="text-align: center;">4.9 A</td> </tr> <tr> <td style="text-align: left;">AC Locked-Rotor Amperes:</td> <td style="text-align: center;">58.8 A</td> <td style="text-align: center;">29.4 A</td> </tr> </table> 10 Amperes AC Non-inductive at 24/240 VAC Pilot Duty: 125 VA at 24/240 VAC	AC Motor Ratings	120 VAC	208/240 VAC	AC Full-load Amperes:	9.8 A	4.9 A	AC Locked-Rotor Amperes:	58.8 A	29.4 A
AC Motor Ratings	120 VAC	208/240 VAC								
AC Full-load Amperes:	9.8 A	4.9 A								
AC Locked-Rotor Amperes:	58.8 A	29.4 A								
Clock Accuracy	±4 minutes per year									
Clock Backup Power	12 hours (capacitor reserve)									
Setback Events	One occupied and one unoccupied event per day; 7 day schedule									
Analog Input Accuracy	Resolution: 14 bits									
Control Construction	Independently mounted control, surface mounted with Lexan® 950 enclosure suitable for DIN rail mounting or direct mounting to a hard, even surface.									
Dimensions (H x W x D)	127 x 61 x 61 mm (5 x 2-3/8 x 2-3/8 in.)									
Weight	C450RBN-3C: 209 g (0.46 lb) C450RCN-3C: 222 g (0.49 lb)									
Compliance	<div style="display: flex; align-items: center;"> <div> <p>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</p> <p>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 and the Low Voltage Directive.</p> <p>Australia: Mark: C-Tick Compliant (N1813)</p> </div> </div>									
C450SPN-1C and C450SQN-1C Expansion Modules with Analog Output										
Product	C450SPN-1C: System 450 Expansion Module with one Analog output C450SQN-1C: System 450 Expansion Module with two Analog outputs									
Power Consumption	C450SPN-1C: 1.1 VA max using 0 to 10 V out; 1.3 VA maximum using 4 to 20 mA out C450SQN-1C: 1.8 VA max using 0 to 10 V out; 2.2 VA maximum using 4 to 20 mA out									
Supply Power	Internal Supply Power: C450YNN-1C Power Supply Module External Supply Power: 24 VAC (20 to 30 VAC) Safety Extra-Low Voltage (SELV) (Europe), Class 2 (North America), 50/60 Hz, 10 VA minimum Note: A System 450 control module or module assembly can use an internal or an external supply power source, but must not be connected to both simultaneously.									
Ambient Operating Conditions	Temperature: -40 to 66°C (-40 to 150°F) when using 0 to 10 VDC outputs; -40 to 40°C (-40 to 104°F) when using 4 to 20 mA outputs Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)									
Ambient Shipping and Storage Conditions	Temperature: -40 to 80°C (-40 to 176°F) Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)									
Analog Output	<p>Voltage Mode (0 to 10 VDC): 10 VDC maximum output voltage 10 mA maximum output current Requires an external load of 1,000 ohms or more The AO operates in Voltage Mode when connected to devices with impedance greater than 1,000 ohms. Devices that drop below 1,000 ohms may not operate as intended with Voltage Mode applications.</p> <p>Current Mode (4 to 20 mA): Requires an external load between 0 to 300 ohms The AO operates in Current Mode when connected to devices with impedances less than 300 ohms. Devices that exceed 300 ohms may not operate as intended with Current Mode applications.</p>									
Control Construction	Independently mounted control, surface mounted with Lexan® 950 enclosure suitable for DIN rail mounting or direct mounting to a hard, even surface.									
Dimensions (H x W x D)	127 x 61 x 61 mm (5 x 2-3/8 x 2-3/8 in.)									
Weight	C450SPN-1C: 150 g (0.33 lb) C450SQN-1C: 150 g (0.33 lb)									
Compliance	<div style="display: flex; align-items: center;"> <div> <p>North America: cULus Listed; UL 60730, File E27734, Vol. 1; FCC Compliant to CFR47, Part 15, Subpart B, Class B Industry Canada (IC) Compliant to Canadian ICES-003, Class B limits</p> <p>Europe: CE Mark - Johnson Controls, Inc., declares that this product is in compliance with the essential requirements and other relevant provisions of the Low Voltage Directive and the EMC Directive.</p> <p>Australia: Mark: C-Tick Compliant (N1813)</p> </div> </div>									



System 450 Control Series

System 450™ Series Modular Controls (Continued)

C450SBN-3C and C450SCN-3C Expansion Modules with Relay Output										
Product	C450SBN-3C: System 450 Expansion Module with one SPDT output relay C450SCN-3C: System 450 Expansion Module with two SPDT output relays									
Power Consumption	C450SBN-3C: 0.8 VA maximum C450SCN-3C: 1.2 VA maximum									
Supply Power	Internal Supply Power: C450YNN-1C Power Supply Module External Supply Power: 24 VAC (20 to 30 VAC) Safety Extra-Low Voltage (SELV) (Europe), Class 2 (North America), 50/60 Hz, 10 VA minimum Note: A System 450 control module or module assembly can use an internal or an external supply power source, but must not be connected to both simultaneously.									
Ambient Operating Conditions	Temperature: -40 to 66°C (-40 to 150°F) Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)									
Ambient Shipping and Storage Conditions	Temperature: -40 to 80°C (-40 to 176°F) Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)									
Output Relay Contacts	General: 1/2 HP at 120/240 VAC, SPDT Specific: <table border="1" style="margin-left: 20px;"> <thead> <tr> <th style="text-align: left;">AC Motor Ratings</th> <th style="text-align: center;">120 VAC</th> <th style="text-align: center;">208/240 VAC</th> </tr> </thead> <tbody> <tr> <td>AC Full-Load Amperes:</td> <td style="text-align: center;">9.8 A</td> <td style="text-align: center;">4.9 A</td> </tr> <tr> <td>AC Locked-Rotor Amperes:</td> <td style="text-align: center;">58.8 A</td> <td style="text-align: center;">29.4 A</td> </tr> </tbody> </table> 10 Amperes AC Noninductive at 24/240 VAC Pilot Duty: 125 VA at 24/240 VAC	AC Motor Ratings	120 VAC	208/240 VAC	AC Full-Load Amperes:	9.8 A	4.9 A	AC Locked-Rotor Amperes:	58.8 A	29.4 A
AC Motor Ratings	120 VAC	208/240 VAC								
AC Full-Load Amperes:	9.8 A	4.9 A								
AC Locked-Rotor Amperes:	58.8 A	29.4 A								
Control Construction	Independently mounted control, surface mounted with Lexan® 950 enclosure suitable for DIN rail mounting or direct mounting to a hard, even surface.									
Dimensions (H x W x D)	127 x 61 x 61 mm (5 x 2-3/8 x 2-3/8 in.)									
Weight	C450SBN-3C: 172 g (0.38 lb) C450SCN-3C: 186 g (0.41 lb)									
Compliance	<div style="display: flex; align-items: center;"> <div style="font-size: 2em; margin-right: 10px;">CE</div> <div> <p>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</p> <p>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 and the Low Voltage Directive.</p> <p>Australia: Mark: C-Tick Compliant (N1813)</p> </div> </div>									

C450YNN-1C Power Supply Module	
Product	C450YNN-1C: System 450 Power Supply Module; 120 or 240 VAC stepdown to 24 VAC Class 2 (North America) or SELV (Europe)
Supply Power	110/120 VAC or 220/240 VAC at 50/60 Hz (100 mA maximum)
Secondary Power	24 VAC, 10 VA
Ambient Operating Conditions	Temperature: -40 to 66°C (-40 to 150°F) Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)
Ambient Shipping and Storage Conditions	Temperature: -40 to 80°C (-40 to 176°F) Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)
Control Construction	Independently mounted control, surface mounted with Lexan® 950 enclosure suitable for DIN rail mounting or direct mounting to a hard, even surface.
Dimensions (H x W x D)	127 x 61 x 61 mm (5 x 2-3/8 x 2-3/8 in.)
Weight	C450YNN-1C: 390 gm (0.86 lb)
Compliance	<div style="display: flex; align-items: center;"> <div style="font-size: 2em; margin-right: 10px;">CE</div> <div> <p>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</p> <p>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 and the Low Voltage Directive.</p> <p>Australia: Mark: C-Tick Compliant (N1813)</p> </div> </div>



System 450™ Series Control Module with Network Communications

Description

System 450™ is a family of modular, digital electronic controls that is easily assembled and set up to provide reliable temperature, pressure, and humidity control for a wide variety of HVAC/R applications, commercial process applications, and industrial process applications.

The System 450 control system is designed to replace System 350™ and System 27 control systems and to provide many additional features and benefits with fewer than twenty model variations.

System 450 control modules provide a field-configurable out-of-the-box solution. Most System 450 control modules can control temperature, pressure, and humidity systems simultaneously.

A single C450 control module can be set up as a stand-alone control or connected to expansion modules to control up to ten On/Off relay and proportional analog outputs, based on any of the three available inputs.

System 450 Control Modules with Communications enable you to connect System 450 control systems to Modbus® or Ethernet networks for remote monitoring and setup. The Modbus communications control module is an RS485, RTU-compliant slave device. The Ethernet communications control module has an integral web server that can deliver web pages through a direct connection, on your LAN, or across the Internet.

Refer to the following documents for important product application information, as well as detailed information on designing, installing, setting up, and troubleshooting:

- *System 450™ Series Modular Controls Product Bulletin (LIT-12011458)*
- *System 450™ Series Modular Control Systems with Communications Control Modules Technical Bulletin (LIT-12011826)*
- *System 450™ Series Control Module with RS485 Modbus® Communications Installation Instructions (Part No. 24-7664-2926)*
- *System 450™ Series Control Module with Ethernet Communications Installation Instructions (Part No. 24-7664-2934)*

Features

- Durable, compact, interchangeable modular components with plug-together connectors and DIN rail or direct wall mount capability eliminate field wiring between modules and allow you to quickly and easily design, assemble, install, and upgrade your control systems.
- Versatile, multipurpose, field-configurable control modules and expansion modules designed for global use allow you to create a wide variety of application-specific control systems capable of controlling temperature, pressure, or humidity, or all three conditions simultaneously, with only a small suite of module models.
- Up to three hard-wired input sensors and up to ten relay or analog outputs (in any combination) per control system allow you to build complex custom control systems while reducing your control system cost to only the cost of the required components.
- Control modules with bright backlit LCDs and four-button touch pad user interfaces provide quick, clear, visual status of your System 450 control system inputs and outputs with the touch of a button and enable you to quickly and easily set up and adjust your control system.
- An extensive suite of compatible temperature and humidity sensors, and pressure transducers allows you to monitor and control a wide range of HVAC/R and process conditions in a variety of standard and global units of measurement.
- High input signal selection enables your control system to monitor a temperature, pressure, or humidity condition with two or three sensors (of the same type) and control your system outputs based on the highest condition value sensed by the referenced sensors.



C450CEN Control Module with Communication

- Differential control enables your control system to monitor and maintain a temperature, pressure, or humidity differential between two sensor points within a system, process, or space.
- Ethernet communication capability through a built-in web server (Ethernet control modules only) allows you to monitor your control system status and set up or change the parameters by means of a direct Ethernet cable connection, through a LAN connection, or over the Internet. The built in web server delivers user-friendly web pages to client browsers on a desktop, laptop, tablet, or smart device.
- The web page server on Ethernet communication modules provides a simple, intuitive web interface for easy remote monitoring, setup, adjustment and remote monitoring of your control systems across Ethernet networks.
- RS485, RTU-compliant Modbus® network communication capability (Modbus control modules only) enables a head-end RS485 Modbus master controller to read and write control system status and setup parameters to the System 450 Modbus communication control module.
- Password protection for local access (Ethernet and Modbus control modules only) and password protection for remote access (Ethernet control module only) deters unauthorized changes to the control system settings, but allows local and remote monitoring of your control system status.
- Analog output signal limiting features (communication control modules only) allow you to select the rate and condition range at which the control updates the analog output signal, potentially reducing wear on the controlled equipment.
- Binary input with time delay (communication control modules only) allows you to use an external set of dry contacts and selectable time delays to control relay outputs.



**System 450™ Series Control Module with Network Communications
(Continued)**

Selection Chart

Refer to the *System 450 Compatible Sensors, Transducers, and Accessories Catalog Page (LIT-1900662)* for temperature sensors, humidity sensors, and pressure transducers compatible with the System 450 Control Modules.

Communications System 450 Modules and Accessories Ordering Information

Product Code Number	Product Description
C450CEN-1C	Control Module with Ethernet Communications, LCD, and Four-Button Touchpad UI. (No onboard outputs available on control modules with network communications capabilities.)
C450CRN-1C	Control Module with RS485 Modbus Communications, LCD, and Four-Button Touchpad UI. (No onboard outputs available on control modules with network communications capabilities.)
BKT287-1R	DIN Rail; 0.30 m (12 in.) long
BKT287-2R	DIN Rail; 1 m (39-1/3 in.) long
BKT287-3R	DIN Rail; 0.61 m (24 in.) long
BKT287-4R	DIN Rail; 0.36 m (14 in.) long
PLT344-1R	DIN Rail End Clamps (Two clamps)
WHA-C450-100C	System 450 module connection extension cable, 100 cm (3.3 ft) long

Repair Information

If the System 450™ Control Module with Ethernet or RS485 Modbus Communication fails to operate within its specifications, replace the unit. For a replacement System 450™ Control Module, contact a Johnson Controls® representative.

Technical Specifications

C450CEN-1C Control Module with Ethernet Communications	
Product	C450CEN: System 450 control modules are sensing controls and operating controls with LCD and four-button touchpad UI, Ethernet communications capability, and no outputs. C450CEN-1C: Control module with Ethernet communications capability
Supply Power	Internal Supply Power: C450YNN-1C Power Supply Module External Supply Power: 24 VAC (20 to 30 VAC) Safety Extra-Low Voltage (SELV) (Europe), Class 2 (North America), 50/60 Hz, 10 VA minimum Note: A System 450 control module or module assembly can use an internal or an external supply power source, but must not be connected to both simultaneously.
Ambient Operating Conditions	Temperature: -40 to 66°C (-40 to 150°F) Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)
Ambient Shipping and Storage Conditions	Temperature: -40 to 80°C (-40 to 176°F) Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)
Input Signal	0 to 5 VDC; 1,035 ohms at 25°C (77°F) for an A99 PTC Temperature Sensor
Analog Input Accuracy	Resolution: 16 bits
Control Construction	Independently mounted control, surface mounted with Lexan® 950 enclosure suitable for DIN rail mounting or direct mounting to a hard, even surface.
Dimensions (H x W x D)	127 x 63 x 63 mm (5 x 2-3/8 x 2-3/8 in.)
Weight	C450CEN-1C: 207 g (0.46 lb)
Compliance	<div style="display: flex; align-items: center;"> <div> <p>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</p> <p>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; CISPR22, class B.</p> <p>Australia: Mark: C-Tick Compliant (N1813)</p> </div> </div>

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System 450 Control Series

System 450™ Series Control Module with Network Communications (Continued)

C450CRN-1C Control Module with RS485 Modbus Communications	
Product	C450CRN-1C: System 450 control modules are sensing controls and operating controls with LCD and four-button touchpad UI and no outputs. This control module is an RS485, RTU compliant Modbus slave device.
Supply Power	Internal Supply Power: C450YNN-1C Power Supply Module External Supply Power: 24 VAC (20 to 30 VAC) Safety Extra-Low Voltage (SELV) (Europe), Class 2 (North America), 50/60 Hz, 10 VA minimum Note: A System 450 control module or module assembly can use an internal or an external supply power source, but must not be connected to both simultaneously.
Ambient Operating Conditions	Temperature: -40 to 66°C (-40 to 150°F) Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)
Ambient Shipping and Storage Conditions	Temperature: -40 to 80°C (-40 to 176°F) Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)
Input Signal	0 to 5 VDC; 1,035 ohm at 25°C (77°F) for an A99 PTC Temperature Sensor
Analog Input Accuracy	Resolution: 16 bit
Control Construction	Independently mounted control, surface mounted with Lexan® 950 enclosure suitable for DIN rail mounting or direct mounting to a hard, even surface.
Dimensions (H x W x D)	127 x 63 x 63 mm (5 x 2-3/8 x 2-3/8 in.)
Weight	C450CRN-1C: 207 g (0.46 lb)
Compliance	<div style="display: flex; align-items: center;"> <div> <p>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</p> <p>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; CISPR22, class B</p> <p>Australia: Mark: C-Tick Compliant (N1813)</p> </div> </div>



System 450™ Reset Control Modules with Real-Time Clock and Relay Output

Description

System 450™ is a family of modular, digital electronic controls that is easily assembled and set up to provide reliable temperature, pressure, and humidity control for a wide variety of HVAC/R applications, commercial process applications, and industrial process applications.

System 450 Reset Control Modules provide many of the features of the standard models for temperature and humidity control. In addition, these modules provide setpoint reset, real-time setback scheduling, and run-time balancing (equal run time) capability.

The System 450 control system is designed to replace System 350™ and System 27 control systems, and to provide many additional features and benefits with fewer than twenty model variations.

System 450 control modules provide a field-configurable out-of-the-box solution. Most System 450 control modules can control temperature, pressure, and humidity systems simultaneously.

A single C450 control module can be set up as a stand-alone control or connected to expansion modules to control up to ten On/Off relay and proportional analog outputs, based on any of the three available inputs.

Refer to the following documents for important product application information:

- *System 450™ Series Modular Controls Product Bulletin (LIT-12011458)*
- *System 450™ Series Modular Control Systems with Reset Control Modules Technical Bulletin (LIT-12011842)*
- *System 450™ Series Reset Control Modules with Real-Time Clock and Relay Output Installation Instructions (Part No. 24-7664-2888)*

Features

- Durable, compact, interchangeable modular components with plug-together connectors and DIN rail or direct wall mount capability eliminate field wiring between modules and allow you to quickly and easily design, assemble, install, and upgrade your control systems.
- Versatile, multipurpose, field-configurable control modules and expansion modules designed for global use allow you to create a wide variety of application-specific control systems capable of controlling temperature, pressure, or humidity, or all three conditions simultaneously, with only a small suite of module models.
- Up to three hard-wired input sensors and up to ten relay or analog outputs (in any combination) per control system allow you to build complex custom control systems while reducing your control system cost to only the cost of the required components.
- Control Modules with bright backlit LCDs and four-button touch pad user interfaces provide quick, clear, visual status of your System 450 control system inputs and outputs with the touch of a button and enable you to quickly and easily set up and adjust your control system.
- Multipurpose, all-in-one control modules enable simple stand-alone, single-module control systems that are temperature, pressure, and humidity capable out of the box and easy to set up in the field to replace a wide variety of OEM HVAC/R and process controls.
- An extensive suite of compatible temperature and humidity sensors, and pressure transducers allows you to monitor and control a wide range of HVAC/R and process conditions in a variety of standard and global units of measurement.
- High input signal selection enables your control system to monitor a temperature, pressure, or humidity condition with two or three sensors (of the same type) and control your system outputs based on the highest condition value sensed by the referenced sensors.



C450RCN-3 Reset Control Module with Real-Time Clock and Relay Output

- Differential control enables your control system to monitor and maintain a temperature, pressure, or humidity differential between two sensor points within a system, process, or space.

Reset Control Features

- Adjustable minimum and maximum setpoint temperatures (reset control modules only) enable compliance with the manufacturer's specifications for your controlled HVAC/R and process equipment.
- Selectable shutdown-high and shutdown-low temperature settings (reset control modules only) saves you energy by shutting down controlled equipment when the ambient temperature either rises or drops to a point where heating or cooling is no longer required.
- Real time clock and adjustable setback temperature (reset control modules only) save you energy by setting back heating, cooling, or humidity setpoints during scheduled unoccupied periods (24-hour day, 7-day week schedule).
- User-defined reset control capability (reset control modules only) saves you energy in a wide variety of temperature and humidity reset control applications by adjusting the temperature or humidity control loop, based on changes in ambient outdoor temperature or other uncontrolled condition.

Repair Information

If the System 450 Reset Control Module fails to operate within its specifications, replace the unit. For a replacement System 450 Reset Control Module, contact the nearest Johnson Controls® representative.



System 450™ Reset Control Modules with Real-Time Clock and Relay Output (Continued)

Selection Chart

Refer to the *System 450 Compatible Sensors, Transducers, and Accessories Catalog Page (LIT-1900662)* for temperature sensors and humidity sensors compatible with the System 450 Reset Control Modules. Reset Control Modules control temperature and humidity, but not pressure.

Reset System 450 Modules and Accessories Ordering Information

Product Code Number	Product Description
C450RBN-3C	Reset Control Module with LCD, Four-Button Touchpad UI, and SPDT relay output; provides one SPDT output relay. One A99BC-25C temperature sensor with 0.25 m (9-1/4 in.) silicon leads and one A99BC-300C temperature sensor with 3 m (9 ft 10 in.) silicon leads are included in the box with the Reset Control Module.
C450RCN-3C	Reset Control Module with LCD, Four-Button Touchpad UI, and SPDT relay output; provides two SPDT output relays. One A99BC-25C temperature sensor with 0.25 m (9-1/4 in.) silicon leads and one A99BC-300C temperature sensor with 3 m (9 ft 10 in.) silicon leads are included in the box with the Reset Control Module.
BKT287-1R	DIN Rail; 0.30 m (12 in.) long
BKT287-2R	DIN Rail; 1 m (39-1/3 in.) long
BKT287-3R	DIN Rail; 0.61 m (24 in.) long
BKT287-4R	DIN Rail; 0.36 m (14 in.) long
PLT344-1R	DIN Rail End Clamps (Two clamps)
WHA-C450-100C	System 450 module connection extension cable, 100 cm (3.3 ft) long

Technical Specifications

C450RBN-3C and C450RCN-3C Reset Control Modules with Real-Time Clock and Relay Output										
Product	C450RBN-3C and C450RCN-3C: System 450 Reset Control Module models are sensing controls and operating controls with LCD, four-button touchpad, and SPDT relay output C450RBN-3C: Control Module with one SPDT output relay C450RCN-3C: Control Module with two SPDT output relays									
Power Consumption	C450RBN-3C: 0.9 VA maximum C450RCN-3C: 1.3 VA maximum									
Supply Power	Internal Supply Power: C450YNN-1C Power Supply Module External Supply Power: 24 VAC (20 to 30 VAC) Safety Extra-Low Voltage (SELV) (Europe), Class 2 (North America), 50/60 Hz, 10 VA minimum Note: A System 450 control module or module assembly can use an internal or an external supply power source, but must not be connected to both simultaneously.									
Ambient Operating Conditions	Temperature: -40 to 66°C (-40 to 150°F) Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)									
Ambient Shipping and Storage Conditions	Temperature: -40 to 80°C (-40 to 176°F) Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)									
Input Signal	0 to 5 VDC for humidity sensors 1,035 ohms at 25°C (77°F) for A99 PTC temperature sensors									
Output Relay Contacts	General: 1/2 HP at 120/240 VAC, SPDT Specific: <table border="1" style="display: inline-table; margin-left: 20px;"> <thead> <tr> <th>AC Motor Ratings</th> <th>120 VAC</th> <th>208/240 VAC</th> </tr> </thead> <tbody> <tr> <td>AC Full-load Amperes:</td> <td>9.8 A</td> <td>4.9 A</td> </tr> <tr> <td>AC Locked-Rotor Amperes:</td> <td>58.8 A</td> <td>29.4 A</td> </tr> </tbody> </table> 10 Amperes AC Non-inductive at 24/240 VAC Pilot Duty: 125 VA at 24/240 VAC	AC Motor Ratings	120 VAC	208/240 VAC	AC Full-load Amperes:	9.8 A	4.9 A	AC Locked-Rotor Amperes:	58.8 A	29.4 A
AC Motor Ratings	120 VAC	208/240 VAC								
AC Full-load Amperes:	9.8 A	4.9 A								
AC Locked-Rotor Amperes:	58.8 A	29.4 A								
Clock Accuracy	±4 minutes per year									
Clock Backup Power	12 hours (capacitor reserve)									
Setback Events	One occupied and one unoccupied event per day; 7 day schedule									
Analog Input Accuracy	Resolution: 14 bits									
Control Construction	Independently mounted control, surface mounted with Lexan® 950 enclosure suitable for DIN rail mounting or direct mounting to a hard, even surface.									
Dimensions (H x W x D)	127 x 61 x 61 mm (5 x 2-3/8 x 2-3/8 in.)									
Weight	C450RBN-3C: 209 g (0.46 lb) C450RCN-3C: 222 g (0.49 lb)									
Compliance	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 and the Low Voltage Directive. Australia: Mark: C-Tick Compliant (N1813)									



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System 450™ Control Modules with Analog Output

Description

System 450™ is a family of modular, digital electronic controls that is easily assembled and set up to provide reliable temperature, pressure, and humidity control for a wide variety of HVAC/R applications, commercial process applications, and industrial process applications.

The System 450 control system is designed to replace System 350™ and System 27 control systems, and to provide many additional features and benefits with fewer than twenty model variations.

System 450 control modules provide a field-configurable out-of-the-box solution. Most System 450 control modules can control temperature, pressure, and humidity systems simultaneously.

A single C450 control module can be set up as a stand-alone control or connected to expansion modules to control up to ten On/Off relay and proportional analog outputs, based on any of the three available inputs.

Refer to the following documents for important product application information:

- *System 450™ Series Modular Controls Product Bulletin (LIT-12011458)*
- *System 450™ Series Modular Control Systems with Standard Control Modules Technical Bulletin (LIT-12011459)*
- *System 450™ Series Control Modules with Analog Outputs Installation Instructions (Part No. 24-7664-2853)*

Features

- Durable, compact, interchangeable modular components with plug-together connectors and DIN rail or direct wall mount capability eliminate field wiring between modules and allow you to quickly and easily design, assemble, install, and upgrade your control systems.
- Versatile, multipurpose, field-configurable control modules and expansion modules designed for global use allow you to create a wide variety of application-specific control systems capable of controlling temperature, pressure, or humidity, or all three conditions simultaneously, with only a small suite of module models.
- Up to three hard-wired input sensors and up to ten relay or analog outputs (in any combination) per control system allow you to build complex custom control systems while reducing your control system cost to only the cost of the required components.
- Control Modules with bright backlit LCDs and four-button touch pad user interfaces provide quick, clear, visual status of your System 450 control system inputs and outputs with the touch of a button and enable you to quickly and easily set up and adjust your control system.



C450CPN-3C Control Module with Analog Output

- Multipurpose, all-in-one control modules enable simple stand-alone, single-module control systems that are temperature, pressure, and humidity capable out of the box and easy to set up in the field to replace a wide variety of OEM HVAC/R and process controls.
- An extensive suite of compatible temperature and humidity sensors, and pressure transducers allows you to monitor and control a wide range of HVAC/R and process conditions in a variety of standard and global units of measurement.
- High input signal selection enables your control system to monitor a temperature, pressure, or humidity condition with two or three sensors (of the same type) and control your system outputs based on the highest condition value sensed by the referenced sensors.
- Differential control enables your control system to monitor and maintain a temperature, pressure, or humidity differential between two sensor points within a system, process, or space.

Repair Information

If the System 450™ Control Module with Analog Outputs fails to operate within its specifications, replace the unit. For a replacement System 450™ Control Module with Analog Outputs, contact your Johnson Controls® representative.

Selection Chart

Refer to the *System 450 Compatible Sensors, Transducers, and Accessories Catalog Page (LIT-1900662)* for temperature sensors, humidity sensors, and pressure transducers compatible with the System 450 Control Modules with Analog Outputs.

Standard System 450 Modules and Accessories Ordering Information

Product Code Number	Product Description
C450CPN-3C	Standard Control Module with LCD, Four-Button Touchpad UI, and Analog Output; provides one analog output (0 to 10 VDC or 4 to 20 mA self-selecting signal) for proportional control.
C450CQN-3C	Standard Control Module with LCD and Four-Button Touchpad UI, and Analog Output; provides two analog outputs (0 to 10 VDC or 4 to 20 mA self-selecting signals) for proportional control.
BKT287-1R	DIN Rail; 0.30 m (12 in.) long
BKT287-2R	DIN Rail; 1 m (39-1/3 in.) long
BKT287-3R	DIN Rail; 0.61 m (24 in.) long
BKT287-4R	DIN Rail; 0.36 m (14 in.) long
PLT344-1R	DIN Rail End Clamps (Two clamps)
WHA-C450-100C	System 450 module connection extension cable, 100 cm (3.3 ft) long

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System 450™ Control Modules with Analog Output (Continued)

Technical Specifications

C450CPN-3C and C450CQN-3C Control Modules with Analog Output	
Product	C450CPN-3C and C450CQN-3C: System 450 Control Module models are sensing controls and operating controls with LCD, four-button touchpad, and SPDT analog output C450CPN-3C: Control Module with one analog output C450CQN-3C: Control Module with two analog outputs
Power Consumption	C450CPN-3C: 1.3 VA maximum using 0 to 10 V out; 1.5 VA maximum using 4 to 20 mA out C450CQN-3C: 2.0 VA maximum using 0 to 10 V out; 2.4 VA maximum using 4 to 20 mA out
Supply Power	Internal Supply Power: C450YNN-1C Power Supply Module External Supply Power: 24 VAC (20 to 30 VAC) Safety Extra-Low Voltage (SELV) (Europe), Class 2 (North America), 50/60 Hz, 10 VA minimum Note: A System 450 control module or module assembly can use an internal or an external supply power source, but must not be connected to both simultaneously.
Ambient Operating Conditions	Temperature: -40 to 66°C (-40 to 150°F) when using 0 to 10 VDC outputs; -40 to 40°C (-40 to 104°F) when using 4 to 20 mA outputs Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)
Ambient Shipping and Storage Conditions	Temperature: -40 to 80°C (-40 to 176°F) Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)
Input Signal	0 to 5 VDC for humidity sensors and static pressure transducers 0.5 to 4.5 VDC for ratiometric pressure transducers 1,035 ohms at 25°C (77°F) for A99 PTC temperature sensors 1,000 ohms at 21.1°C (70°F) for TE-6xxx Nickel temperature sensors
Analog Output	Voltage Mode (0–10 VDC): 10 VDC maximum output voltage 10 mA maximum output current Requires an external load of 1,000 ohms or more The AO operates in Voltage Mode when connected to devices with impedance greater than 1,000 ohms. Devices that fall below 1,000 ohms may not operate as intended with Voltage Mode applications. Current Mode (4–20 mA): Requires an external load between 0 to 300 ohms The AO operates in Current Mode when connected to devices with impedance less than 300 ohms. Devices that rise above 300 ohms may not operate as intended with Current Mode applications.
Analog Input Accuracy	Resolution: 14 bits
Control Construction	Independently mounted control, surface mounted with Lexan® 950 enclosure suitable for DIN rail mounting or direct mounting to a hard, even surface.
Dimensions (H x W x D)	127 x 61 x 61 mm (5 x 2-3/8 x 2-3/8 in.)
Weight	C450CPN-3C: 195 g (0.43 lb) C450CQN-3C: 195 g (0.43 lb)
Compliance	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 and the Low Voltage Directive. Australia: Mark: C-Tick Compliant (N1813)





System 450™ Control Modules with Relay Output

Description

System 450™ is a family of modular, digital electronic controls that is easily assembled and set up to provide reliable temperature, pressure, and humidity control for a wide variety of HVAC/R applications, commercial process applications, and industrial process applications.

The System 450 control system is designed to replace System 350™ and System 27 control systems, and to provide many additional features and benefits with fewer than twenty model variations.

System 450 control modules provide a field-configurable out-of-the-box solution. Most System 450 control modules can control temperature, pressure, and humidity systems simultaneously.

A single C450 control module can be set up as a stand-alone control or connected to expansion modules to control up to ten On/Off relay and proportional analog outputs, based on any of the three available inputs.

Refer to the following documents for important product application information:

- *System 450™ Series Modular Controls Product Bulletin (LIT-12011458)*
- *System 450™ Series Modular Control Systems with Standard Control Modules Technical Bulletin (LIT-12011459)*
- *System 450™ Series Control Modules with Relay Outputs Installation Instructions (Part No. 24-7664-2896)*

Features

- Durable, compact, interchangeable modular components with plug-together connectors and DIN rail or direct wall mount capability eliminate field wiring between modules and allow you to quickly and easily design, assemble, install, and upgrade your control systems.
- Versatile, multipurpose, field-configurable control modules and expansion modules designed for global use allow you to create a wide variety of application-specific control systems capable of controlling temperature, pressure, or humidity, or all three conditions simultaneously, with only a small suite of module models.
- Up to three hard-wired input sensors and up to ten relay or analog outputs (in any combination) per control system allow you to build complex custom control systems while reducing your control system cost to only the cost of the required components.
- Control Modules with bright backlit LCDs and four-button touch pad user interfaces provide quick, clear, visual status of your System 450 control system inputs and outputs with the touch of a button and enable you to quickly and easily set up and adjust your control system.



C450CCN-3C Control Module with Relay Output

- Multipurpose, all-in-one control modules enable simple stand-alone, single-module control systems that are temperature, pressure, and humidity capable out of the box and are easy to set up in the field to replace a wide variety of OEM HVAC/R and process controls.
- An extensive suite of compatible temperature and humidity sensors and pressure transducers allows you to monitor and control a wide range of HVAC/R and process conditions in a variety of standard and global units of measurement.
- High input signal selection enables your control system to monitor a temperature, pressure, or humidity condition with two or three sensors (of the same type) and control your system outputs based on the highest condition value sensed by the referenced sensors.
- Differential control enables your control system to monitor and maintain a temperature, pressure, or humidity differential between two sensor points within a system, process, or space.

Repair Information

If the System 450™ Control Module with Relay Outputs fails to operate within its specifications, replace the unit. For a replacement System 450™ Control Module with Relay Outputs, contact a Johnson Controls® representative.

Selection Chart

Refer to the *System 450 Compatible Sensors, Transducers, and Accessories Catalog Page (LIT-1900662)* for temperature sensors, humidity sensors, and pressure transducers compatible with the System 450 Control Modules with Relay Outputs.

Standard System 450 Modules and Accessories Ordering Information


Product Code Number	Product Description
C450CBN-3C	Standard Control Module with LCD, Four-Button Touchpad UI, and Relay Output; provides one relay output (SPDT line-voltage relay) for SPDT control.
C450CCN-3C	Standard Control Module with LCD, Four-Button Touchpad UI, and Relay Output; provides two relay outputs (SPDT line-voltage relays) for SPDT control.
BKT287-1R	DIN Rail; 0.30 m (12 in.) long
BKT287-2R	DIN Rail; 1 m (39-1/3 in.) long
BKT287-3R	DIN Rail; 0.61 m (24 in.) long
BKT287-4R	DIN Rail; 0.36 m (14 in.) long
PLT344-1R	DIN Rail End Clamps (Two clamps)
WHA-C450-100C	System 450 module connection extension cable, 100 cm (3.3 ft) long

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System 450™ Control Modules with Relay Output (Continued)

Technical Specifications

C450CBN-3C and C450CCN-3C Control Modules with Relay Output										
Product	C450CBN-3C and C450CCN-3C: System 450 Control Module models are sensing controls and operating controls with LCD, four-button touchpad, and SPDT relay output C450CBN-3C: Control Module with one SPDT output relay C450CCN-3C: Control Module with two SPDT output relays									
Power Consumption	C450CBN-3C: 0.9 VA maximum C450CCN-3C: 1.3 VA maximum									
Supply Power	Internal Supply Power: C450YNN-1C Power Supply Module External Supply Power: 24 VAC (20 to 30 VAC) Safety Extra-Low Voltage (SELV) (Europe), Class 2 (North America), 50/60 Hz, 10 VA minimum Note: A System 450 control module or module assembly can use an internal or an external supply power source, but must not be connected to both simultaneously.									
Ambient Operating Conditions	Temperature: -40 to 66°C (-40 to 150°F) Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)									
Ambient Shipping and Storage Conditions	Temperature: -40 to 80°C (-40 to 176°F) Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)									
Input Signal	0 to 5 VDC for humidity sensors and static pressure transducers 0.5 to 4.5 VDC for ratiometric pressure transducers 1,035 ohms at 25°C (77°F) for A99 PTC temperature sensors 1,000 ohms at 21.1°C (70°F) for TE-6xxx Nickel temperature sensors									
Output Relay Contacts	General: 1/2 HP at 120/240 VAC, SPDT Specific: <table border="1"> <thead> <tr> <th>AC Motor Ratings</th> <th>120 VAC</th> <th>208/240 VAC</th> </tr> </thead> <tbody> <tr> <td>AC Full-load Amperes:</td> <td>9.8 A</td> <td>4.9 A</td> </tr> <tr> <td>Locked-Rotor Amperes:</td> <td>58.8 A</td> <td>29.4 A</td> </tr> </tbody> </table> 10 Amperes AC Non-inductive at 24/240 VAC Pilot Duty: 125 VA at 24/240 VAC	AC Motor Ratings	120 VAC	208/240 VAC	AC Full-load Amperes:	9.8 A	4.9 A	Locked-Rotor Amperes:	58.8 A	29.4 A
AC Motor Ratings	120 VAC	208/240 VAC								
AC Full-load Amperes:	9.8 A	4.9 A								
Locked-Rotor Amperes:	58.8 A	29.4 A								
Analog Input Accuracy	Resolution: 14 bits									
Control Construction	Independently mounted control, surface mounted with Lexan® 950 enclosure suitable for DIN rail mounting or direct mounting to a hard, even surface.									
Dimensions (H x W x D)	127 x 61 x 61 mm (5 x 2-3/8 x 2-3/8 in.)									
Weight	C450CBN-3C: 209 g (0.46 lb) C450CCN-3C: 222 g (0.49 lb)									
Compliance	 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 and the Low Voltage Directive. Australia: Mark: C-Tick Compliant (N1813)									



System 450™ Control Module with Hybrid Analog Output

Description

System 450™ is a family of modular, digital electronic controls that is easily assembled and set up to provide reliable temperature, pressure, and humidity control for a wide variety of HVAC/R applications, commercial process applications, and industrial process applications.

System 450 control modules provide a field-configurable out-of-the-box solution. Most System 450 control modules can control temperature, pressure, and humidity systems simultaneously.

A single C450 control module can be set up as a stand-alone control or connected to expansion modules to control up to ten On/Off relay and proportional analog outputs, based on any of the three available inputs.

The System 450 Control Module with Hybrid Analog Output has a single self-selecting analog output to optimize and extend the controlled speed range of variable speed electronically commutated (EC) motors.

Refer to the following documents for important product application information:

- *System 450™ Series Modular Controls Product Bulletin (LIT-12011458)*
- *System 450™ Series Modular Control Systems with Standard Control Modules Technical Bulletin (LIT-12011459)*
- *System 450™ Series Control Module with Hybrid Analog Output and High Input Signal Selection Installation Instructions (Part No. 24-7664-2802)*

Features

- Durable, compact, interchangeable modular components with plug-together connectors and DIN rail or direct wall mount capability eliminate field wiring between modules and allow you to quickly and easily design, assemble, install, and upgrade your control systems.
- Versatile, multipurpose, field-configurable control modules and expansion modules designed for global use allow you to create a wide variety of application-specific control systems capable of controlling temperature, pressure, or humidity, or all three conditions simultaneously, with only a small suite of module models.
- Up to three hard-wired input sensors and up to ten relay or analog outputs (in any combination) per control system allow you to build complex custom control systems while reducing your control system cost to only the cost of the required components.
- Control Modules with bright backlit LCDs and four-button touch pad user interfaces provide quick, clear, visual status of your System 450 control system inputs and outputs with the touch of a button and enable you to quickly and easily set up and adjust your control system.
- Multipurpose, all-in-one control modules enable simple stand-alone, single-module control systems that are temperature, pressure, and humidity capable out of the box and easy to set up in the field to replace a wide variety of OEM HVAC/R and process controls.



C450CPW-100 Control Module with Hybrid Analog Output

- An extensive suite of compatible temperature and humidity sensors, and pressure transducers allows you to monitor and control a wide range of HVAC/R and process conditions in a variety of standard and global units of measurement.
- High input signal selection enables your control system to monitor a temperature, pressure, or humidity condition with two or three sensors (of the same type) and control your system outputs based on the highest condition value sensed by the referenced sensors.
- Differential control enables your control system to monitor and maintain a temperature, pressure, or humidity differential between two sensor points within a system, process, or space.

Repair Information

If the System 450™ Control Module with Hybrid Analog Output fails to operate within its specifications, replace the unit. For a replacement System 450™ Control Module with Hybrid Analog Output, contact a Johnson Controls® representative.



System 450™ Control Module with Hybrid Analog Output (Continued)

Selection Chart

Refer to the *System 450 Compatible Sensors, Transducers, and Accessories Catalog Page (LIT-1900662)* for temperature sensors, humidity sensors, and pressure transducers compatible with the System 450 Control Modules.

Hybrid System 450 Modules and Accessories Ordering Information

Product Code Number	Product Description
C450CPW-100C	Hybrid Analog Output Control Module with LCD, Four-Button Touchpad UI, Hybrid Analog Output and Optional High Input Signal Select; provides one hybrid analog output and optional high input signal select primarily used for variable-speed EC motor speed control. Only Analog Output 1 (OUTA1) can be configured as a hybrid analog output and/or use the High Input Signal Selection feature. These features are not available for any of the other outputs in a System 450 control system that uses the C450CPW-100C as the control module.
BKT287-1R	DIN Rail; 0.30 m (12 in.) long
BKT287-2R	DIN Rail; 1 m (39-1/3 in.) long
BKT287-3R	DIN Rail; 0.61 m (24 in.) long
BKT287-4R	DIN Rail; 0.36 m (14 in.) long
PLT344-1R	DIN Rail End Clamps (Two clamps)
WHA-C450-100C	System 450 module connection extension cable, 100 cm (3.3 ft) long

Technical Specifications

C450CPW-100C Control Module with Hybrid Analog Output	
Product	C450CPW-100C System 450 control module is a sensing control and operating control with LCD, four-button touchpad, and analog output with pulse-width modulation capability.
Power Consumption	C450CPW-100C: 1.3 VA maximum using 0 to 10 V out; 1.5 VA maximum using 4 to 20 mA out
Supply Power	Internal Supply Power: C450YNN-1C Power Supply Module External Supply Power: 24 VAC (20–30 VAC) Safety Extra-Low Voltage (SELV) (Europe), Class 2 (North America), 50/60 Hz, 10 VA minimum Note: A System 450 control module or module assembly can use an internal or an external supply power source, but must not be connected to both simultaneously.
Ambient Operating Conditions	Temperature: -40 to 66°C (-40 to 150°F) when using 0 to 10 VDC outputs; -40 to 40°C (-40 to 104°F) when using 4 to 20 mA outputs Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)
Ambient Shipping and Storage Conditions	Temperature: -40 to 80°C (-40 to 176°F) Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)
Input Signal	0 to 5 VDC for humidity sensors and static pressure transducers 0.5 to 4.5 VDC for ratiometric pressure transducers 1,035 ohms at 25°C (77°F) for A99 PTC temperature sensors 1,000 ohms at 21.1°C (70°F) for TE-6xxx Nickel temperature sensors
Analog Output	Voltage Mode (0–10 VDC): 10 VDC maximum output voltage 10 mA maximum output current Requires an external load of 1,000 ohms or more The AO operates in Voltage Mode when connected to devices with impedance greater than 1,000 ohms. Devices that fall below 1,000 ohms may not operate as intended with Voltage Mode applications. Current Mode (4–20 mA): Requires an external load between 0 to 300 ohms The AO operates in Current Mode when connected to devices with impedance less than 300 ohms. Devices that rise above 300 ohms may not operate as intended with Current Mode applications.
Analog Input Accuracy	Resolution: 14 bits
Control Construction	Independently mounted control, surface mounted with Lexan® 950 enclosure suitable for DIN rail mounting or direct mounting to a hard, even surface.
Dimensions (H x W x D)	127 x 61 x 61 mm (5 x 2-3/8 x 2-3/8 in.)
Weight	C450CPW-100C: 195 g (0.43 lb)
Compliance	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 and the Low Voltage Directive. Australia: Mark: C-Tick Compliant (N1813)





System 450™ Expansion Modules with Analog Output

Description

System 450 expansion modules allow you to increase the number of outputs in your control system to meet your application requirements. The following models are available:

- C450SPN-1C: Analog Expansion Module with one analog output (each 0 to 10 VDC or 4 to 20 mA)
- C450SQN-1C: Analog Expansion Module with two analog outputs (each 0 to 10 VDC or 4 to 20 mA)

Refer to the following documents for important product application information:

- *System 450™ Series Modular Controls Product Bulletin (LIT-12011458)*
- *System 450™ Series Expansion Modules with Analog Outputs Installation Instructions (Part No. 24-7664-2799)*

Features

- Durable, compact, interchangeable modular components with plug-together connectors and DIN rail or direct wall mount capability eliminate field wiring between modules and allow you to quickly and easily design, assemble, install, and upgrade your control systems.
- Versatile, multipurpose, field-configurable control modules and expansion modules designed for global use allow you to create a wide variety of application-specific control systems capable of controlling temperature, pressure, or humidity, or all three conditions simultaneously, with only a small suite of module models.
- Up to three hard-wired input sensors and up to ten relay or analog outputs (in any combination) per control system allow you to build complex custom control systems while reducing your control system cost to only the cost of the required components.



C450SQN-1C Expansion Module with Analog Output

Repair Information

If the System 450™ Expansion Module with Analog Output fails to operate within its specifications, replace the unit. For a replacement System 450™ Expansion Module with Analog Output, contact a Johnson Controls® representative.

Selection Chart

Product Code Number	Product Description
C450SPN-1C	Analog Output Expansion Module; provides one analog output (0 to 10 VDC or 4 to 20 mA self-selecting signal) for proportional control.
C450SQN-1C	Analog Output Expansion Module; provides two analog outputs (0 to 10 VDC or 4 to 20 mA self-selecting signals) for proportional control.
BKT287-1R	DIN Rail; 0.30 m (12 in.) long
BKT287-2R	DIN Rail; 1 m (39-1/3 in.) long
BKT287-3R	DIN Rail; 0.61 m (24 in.) long
BKT287-4R	DIN Rail; 0.36 m (14 in.) long
PLT344-1R	DIN Rail End Clamps (Two clamps)
WHA-C450-100C	System 450 module connection extension cable, 100 cm (3.3 ft) long



System 450™ Expansion Modules with Analog Output (Continued)

Technical Specifications

C450SPN-1C and C450SQN-1C Expansion Modules with Analog Output	
Product	C450SPN-1C: System 450 Expansion Module with one analog output C450SQN-1C: System 450 Expansion Module with two analog outputs
Power Consumption	C450SPN-1C: 1.1 VA maximum using 0 to 10 V out; 1.3 VA maximum using 4 to 20 mA out C450SQN-1C: 1.8 VA maximum using 0 to 10 V out; 2.2 VA maximum using 4 to 20 mA out
Supply Power	Internal Supply Power: C450YNN-1C Power Supply Module External Supply Power: 24 VAC (20 to 30 VAC) Safety Extra-Low Voltage (SELV) (Europe), Class 2 (North America), 50/60 Hz, 10 VA minimum Note: A System 450 control module or module assembly can use an internal or an external supply power source, but must not be connected to both simultaneously.
Ambient Operating Conditions	Temperature: -40 to 66°C (-40 to 150°F) when using 0 to 10 VDC outputs; -40 to 40°C (-40 to 104°F) when using 4 to 20 mA outputs Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)
Ambient Shipping and Storage Conditions	Temperature: -40 to 80°C (-40 to 176°F) Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)
Analog Output	Voltage Mode (0 to 10 VDC): 10 VDC maximum output voltage 10 mA maximum output current Requires an external load of 1,000 ohms or more The AO operates in Voltage Mode when connected to devices with impedance greater than 1,000 ohms. Devices that drop below 1,000 ohms may not operate as intended with Voltage Mode applications. Current Mode (4 to 20 mA): Requires an external load between 0 to 300 ohms The AO operates in Current Mode when connected to devices with impedances less than 300 ohm. Devices that exceed 300 ohms may not operate as intended with Current Mode applications.
Control Construction	Independently mounted control, surface mounted with Lexan® 950 enclosure suitable for DIN rail mounting or direct mounting to a hard, even surface.
Dimensions (H x W x D)	127 x 61 x 61 mm (5 x 2-3/8 x 2-3/8 in.)
Weight	C450SPN-1C: 150 g (0.33 lb) C450SQN-1C: 150 g (0.33 lb)
Compliance	North America: cULus Listed; UL 60730, File E27734, Vol. 1; 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 Low Voltage Directive and the EMC Directive. Australia: Mark: C-Tick Compliant (N1813)





System 450™ Expansion Modules with Relay Output

Description

System 450 expansion modules allow you to increase the number of outputs in your control system to meet your application requirements. The following models are available:

- C450SBN-3C: Relay Expansion Module with one relay output
- C450SCN-3C: Relay Expansion Module with two relay outputs

Refer to the following documents for important product application information:

- *System 450™ Series Modular Controls Product Bulletin (LIT-12011458)*
- *System 450™ Series Expansion Modules with Relay Outputs Installation Instructions (Part No. 24-7664-2896)*

Features

- Durable, compact, interchangeable modular components with plug-together connectors and DIN rail or direct wall mount capability eliminate field wiring between modules and allow you to quickly and easily design, assemble, install, and upgrade your control systems.
- Versatile, multipurpose, field-configurable control modules and expansion modules designed for global use allow you to create a wide variety of application-specific control systems capable of controlling temperature, pressure, or humidity, or all three conditions simultaneously, with only a small suite of module models.
- Up to three hard-wired input sensors and up to ten relay or analog outputs (in any combination) per control system allow you to build complex custom control systems while reducing your control system cost to only the cost of the required components.



C450SCN-3C Expansion Module with Relay Output

Repair Information

If the System 450™ Expansion Module with Relay Output fails to operate within its specifications, replace the unit. For a replacement System 450™ Expansion Module with Relay Output, contact a Johnson Controls® representative.

Selection Chart

Product Code Number	Product Description
C450SBN-3C	Reset Control Module with LCD, Four-Button Touchpad UI, and SPDT relay output; provides one SPDT output relay. One A99BC-25C temperature sensor with 0.25 m (9-1/4 in.) silicon leads and one A99BC-300C temperature sensor with 3 m (9 ft 10 in.) silicon leads are included in the box with the Reset Control Module.
C450SCN-3C	Reset Control Module with LCD, Four-Button Touchpad UI, and SPDT relay output; provides two SPDT output relays. One A99BC-25C temperature sensor with 0.25 m (9-1/4 in.) silicon leads and one A99BC-300C temperature sensor with 3 m (9 ft 10 in.) silicon leads are included in the box with the Reset Control Module.
BKT287-1R	DIN Rail; 0.30 m (12 in.) long
BKT287-2R	DIN Rail; 1 m (39-1/3 in.) long
BKT287-3R	DIN Rail; 0.61 m (24 in.) long
BKT287-4R	DIN Rail; 0.36 m (14 in.) long
PLT344-1R	DIN Rail End Clamps (Two clamps)
WHA-C450-100C	System 450 module connection extension cable, 100 cm (3.3 ft) long



System 450™ Expansion Modules with Relay Output (Continued)

Technical Specifications

C450SBN-3C and C450SCN-3C Expansion Modules with Relay Output										
Product	C450SBN-3C: System 450 Expansion Module with one SPDT output relay C450SCN-3C: System 450 Expansion Module with two SPDT output relays									
Power Consumption	C450SBN-3C: 0.8 VA maximum C450SCN-3C: 1.2 VA maximum									
Supply Power	Internal Supply Power: C450YNN-1C Power Supply Module External Supply Power: 24 VAC (20 to 30 VAC) Safety Extra-Low Voltage (SELV) (Europe), Class 2 (North America), 50/60 Hz, 10 VA minimum Note: A System 450 control module or module assembly can use an internal or an external supply power source, but must not be connected to both simultaneously.									
Ambient Operating Conditions	Temperature: -40 to 66°C (-40 to 150°F) Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)									
Ambient Shipping and Storage Conditions	Temperature: -40 to 80°C (-40 to 176°F) Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)									
Output Relay Contacts	General: 1/2 HP at 120/240 VAC, SPDT Specific: <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>AC Motor Ratings</th> <th>120 VAC</th> <th>208/240 VAC</th> </tr> </thead> <tbody> <tr> <td>AC Full-Load Amperes:</td> <td>9.8 A</td> <td>4.9 A</td> </tr> <tr> <td>AC Locked-Rotor Amperes:</td> <td>58.8 A</td> <td>29.4 A</td> </tr> </tbody> </table> 10 Amperes AC Noninductive at 24/240 VAC Pilot Duty: 125 VA at 24/240 VAC	AC Motor Ratings	120 VAC	208/240 VAC	AC Full-Load Amperes:	9.8 A	4.9 A	AC Locked-Rotor Amperes:	58.8 A	29.4 A
AC Motor Ratings	120 VAC	208/240 VAC								
AC Full-Load Amperes:	9.8 A	4.9 A								
AC Locked-Rotor Amperes:	58.8 A	29.4 A								
Control Construction	Independently mounted control, surface mounted with Lexan® 950 enclosure suitable for DIN rail mounting or direct mounting to a hard, even surface.									
Dimensions (H x W x D)	127 x 61 x 61 mm (5 x 2-3/8 x 2-3/8 in.)									
Weight	C450SBN-3C: 172 g (0.38 lb) C450SCN-3C: 186 g (0.41 lb)									
Compliance	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 and the Low Voltage Directive. Australia: Mark: C-Tick Compliant (N1813)									





System 450™ Power Module

Description

System 450™ modules require 24 VAC, Class 2 power. In applications where 24 VAC power is not available, the C450YNN-1C Power Module provides a convenient modular solution for transforming 120/240 VAC to 24 VAC power for your System 450 control systems.

Refer to the following documents for important product application information:

- *System 450™ Series Modular Controls Product Bulletin (LIT-12011458)*
- *System 450™ Series Power Module Installation Instructions (Part No. 24-7664-2691)*

Features

- Durable, compact, interchangeable modular components with plug-together connectors and DIN rail or direct wall mount capability eliminate field wiring between modules and allow you to quickly and easily design, assemble, install, and upgrade your control systems.

Repair Information

If the System 450 Power Module fails to operate within its specifications, replace the unit. For a replacement System 450 Power Module, contact a Johnson Controls® representative.



C450YNN-1C Power Module

Selection Chart

Product Code Number	Product Description
C450YNN-1C	Power Module; provides 24 V to System 450 Module Assembly; 120 VAC or 240 VAC supply power input terminals.
BKT287-1R	DIN Rail; 0.30 m (12 in.) long
BKT287-2R	DIN Rail; 1 m (39-1/3 in.) long
BKT287-3R	DIN Rail; 0.61 m (24 in.) long
BKT287-4R	DIN Rail; 0.36 m (14 in.) long
PLT344-1R	DIN Rail End Clamps (Two clamps)
WHA-C450-100C	System 450 module connection extension cable, 100 cm (3.3 ft) long

Technical Specifications

C450YNN-1C Power Supply Module	
Product	C450YNN-1C: System 450 Power Supply Module; 120 or 240 VAC stepdown to 24 VAC Class 2 (North America) or SELV (Europe)
Supply Power	110/120 VAC or 220/240 VAC at 50/60 Hz (100 mA maximum)
Secondary Power	24 VAC, 10 VA
Ambient Operating Conditions	Temperature: -40 to 66°C (-40 to 150°F) Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)
Ambient Shipping and Storage Conditions	Temperature: -40 to 80°C (-40 to 176°F) Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)
Control Construction	independently mounted control, surface mounted with Lexan® 950 enclosure suitable for DIN rail mounting or direct mounting to a hard, even surface.
Dimensions (H x W x D)	127 x 61 x 61 mm (5 x 2-3/8 x 2-3/8 in.)
Weight	C450YNN-1C: 390 gm (0.86 lb)
Compliance	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 and the Low Voltage Directive. Australia: Mark: C-Tick Compliant (N1813)



System 450™ Compatible Sensors, Transducers, and Accessories

Description

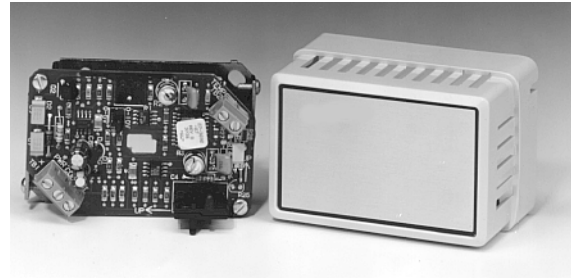
System 450 control modules are designed to operate with a variety of compatible sensors and transducers. The System 450 compatible sensors and transducers cover a wide range of temperature, pressure, and humidity conditions, allowing you to select the sensor or transducer that best fits your control system requirements.

For ease of installation and setup, the Sensor Type that you select in the UI for a sensor or transducer automatically determines the sensed condition, unit of measurement, minimum differential, setup value ranges, and the default setup values for each control system output that references the sensor or transducer.

Refer to the *System 450™ Series Modular Controls Product Bulletin (LIT-12011458)* for important product application information on System 450 Controls.

Refer to the following documents for important product application information on sensors used with System 450 Controls:

- *A99B Series Temperature Sensors Product Technical Bulletin (LIT-125186)*
- *TrueRH™ Series HE-67xx Humidity Element with Temperature Sensors Product Bulletin (LIT-216245)*
- *HE-6800 Series Humidity Transmitters with Temperature Sensor Product Bulletin (LIT-12011625)*
- *P499 Series Electronic Pressure Transducers Product/Technical Bulletin (LIT-12011190)*
- *TE-6000 Series Temperature Sensing Elements Product Bulletin (LIT-216288)*
- *TE-6300 Series Temperature Sensors Product Bulletin (LIT-216320)*
- *TE-6800 Series Temperature Sensors Product Bulletin (LIT-12011542)*
- *Setra Systems Model DPT265 Very Low Differential Pressure Transducer Catalog Page*



Wall-Mount HE67S3 Humidity Sensor



DPT265 Series Low Pressure Differential Pressure Transducers



A99 Temperature Sensors



Duct-Mount HE67S3 Humidity Sensor



TE-6300 Series Temperature Sensors



TE-6000-1 Temperature Sensing Element



**System 450™ Compatible Sensors, Transducers, and Accessories
(Continued)**



**TE-6800 Series Wall Mount Temperature Sensors and
HE-6800 Series Humidity Transmitters
with Temperature Sensors**



P499 Series Electronic Pressure Transducers

Selection Charts

Use these tables to order System 450 compatible sensors, transducers, and accessories.

System 450 Compatible A99B Temperature Sensors and Accessories Ordering Information¹

Product Code Number	Product Description
A99BA-200C	PTC Silicon Sensor with Shielded Cable; Cable Length 2 m (6-1/2 ft); Sensor Temperature Range: -40 to 120°C (-40 to 250°F) Cable Jacket Temperature Range: -40 to 100°C (-40 to 212°F)
A99BB-25C	PTC Silicon Sensor with PVC Cable; Cable Length 0.25 m (9-3/4 in.); Sensor Temperature Range: -40 to 120°C (-40 to 250°F) Cable Jacket Temperature Range: -40 to 100°C (-40 to 212°F)
A99BB-200C	PTC Silicon Sensor with PVC Cable; Cable Length 2 m (6-1/2 ft); Sensor Temperature Range: -40 to 120°C (-40 to 250°F) Cable Jacket Temperature Range: -40 to 100°C (-40 to 212°F)
A99BB-300C	PTC Silicon Sensor with PVC Cable; Cable Length 3 m (9-3/4 ft); Sensor Temperature Range: -40 to 120°C (-40 to 250°F) Cable Jacket Temperature Range: -40 to 100°C (-40 to 212°F)
A99BB-500C	PTC Silicon Sensor with PVC Cable; Cable Length 5 m (16-3/8 ft); Sensor Temperature Range: -40 to 120°C (-40 to 250°F) Cable Jacket Temperature Range: -40 to 100°C (-40 to 212°F)
A99BB-600C	PTC Silicon Sensor with PVC Cable; Cable Length 6 m (19-1/2 ft); Sensor Temperature Range: -40 to 120°C (-40 to 250°F) Cable Jacket Temperature Range: -40 to 100°C (-40 to 212°F)
A99BC-25C	PTC Silicon Sensor with High Temperature Silicon Cable; Cable Length 0.25 m (9-3/4 in.); Sensor Temperature Range: -40 to 120°C (-40 to 250°F) Cable Jacket Rated for Full Sensor Temperature Range.
A99BC-300C	PTC Silicon Sensor with High Temperature Silicon Cable; Cable Length 3 m (9-3/4 ft) Sensor Temperature Range: -40 to 120°C (-40 to 250°F) Cable Jacket Rated for Full Sensor Temperature Range.
A99BC-1500C	PTC Silicon Sensor with High Temperature Silicon Cable; Cable Length 15 m (49 ft) Sensor Temperature Range: -40 to 120°C (-40 to 250°F) Cable Jacket Rated for Full Sensor Temperature Range.
BOX10A-600R	PVC Enclosure for A99 Sensor; Includes Wire Nuts and Conduit Connector (for Outdoor Sensor)
WEL11A-601R	Immersion Well for A99 Sensor Liquid Sensing Applications
A99-CLP-1	Mounting Clip for A99 Temperature Sensor
ADP11A-600R	Conduit Adaptor, 1/2 in. Snap-Fit EMT Conduit Adaptor (box of 10)
TE-6001-1	Duct Mounting Hardware with Handy Box for A99 Sensor
TE-6001-11	Duct Mounting Hardware without Handy Box for A99 Sensor
SHL10A-603R	Sun Shield (for Use with Outside A99 Sensors in Sunny Locations)

1. Refer to the *A99B Series Temperature Sensors Product/Technical Bulletin (LIT-125186)* on the Johnson Controls® Product Literature website for more information.

System 450 Compatible TE-6000 Series 1,000 Ohm Nickel Temperature Sensors and Accessories Ordering Information

Product Code Number	Product Description
TE-6000-x	TE6000 Series 1,000 ohm at 70°F nickel temperature sensors (only). Only the TE-6000-6 sensor can be used for the entire HI°C and HI°F temperature range. Different sensing element packages are available for various applications. For a complete list of compatible 1,000 ohm nickel sensors, including sensor descriptions, technical specifications, and mounting accessories, refer to the <i>TE-6000 Series Temperature Sensing Elements Product Bulletin (LIT-216288)</i> . (System 450 Sensor Types HI°C and HI°F)

System 450 Compatible TE-6300 Series 1,000 Ohm Nickel Temperature Sensors and Accessories Ordering Information

Product Code Number	Product Description
TE-631xx-x	TE6300 Series 1,000 ohm at 70°F nickel averaging and 1,000 ohm thin-film nickel temperature sensors (only). For a complete list of compatible 1,000 ohm nickel averaging and thin-film nickel sensors, including sensor descriptions, technical specifications, and mounting accessories, refer to the <i>TE-6300 Series Temperature Sensors Product Bulletin (LIT-216320)</i> . (System 450 Sensor Types HI°C and HI°F)



**System 450™ Compatible Sensors, Transducers, and Accessories
(Continued)**

System 450 Compatible TE-68NT-0N00S 1,000 Ohm Nickel Temperature Sensor Ordering Information

Product Code Number	Product Description
TE-68NT-0N00S	TE6800 Series 1,000 ohm nickel temperature sensor for wall-mount applications. For more information, including sensor description, technical specifications, and mounting accessories, refer to the <i>TE-6800 Series Temperature Sensors Product Bulletin (LIT-12011542)</i> . (System 450 Sensor Types HI°C and HI°F)

System 450 Compatible HE67S3 Type Humidity Sensors with Integral A99B Temperature Sensor Ordering Information¹

Product Code Number	Product Description
HE-67S3-0N0BT	Wall Mount Humidity Sensor with A99B Type Temperature Sensor: 10 to 90% RH; 0 to 60°C (32 to 140°F)
HE-67S3-0N00P	Duct Mount Humidity Sensor with A99B Type Temperature Sensor: 10 to 90% RH; 0 to 60°C (32 to 140°F)

1. The HE-67S3 sensors require 24 VAC input and must use the 0 to 5 VDC output. Refer to the *TrueRH Series HE-67xx Humidity Element with Temperature Sensors Product Bulletin (LIT-216245)* on the Johnson Controls Product Literature website for more information, including technical specifications and mounting accessories.

System 450 Compatible HE6800 Series Humidity Transmitters with Temperature Sensor Ordering Information¹

Product Code Number	Product Description
HE-68N2-0N00WS	Wall Mount Humidity Transmitter with Nickel Temperature Sensor: 10 to 90 ±2% RH; 0 to 55°C (32 to 131°F)
HE-68N3-0N00WS	Wall Mount Humidity Transmitter with Nickel Temperature Sensor: 10 to 90 ±3% RH; 0 to 55°C (32 to 131°F)

1. The HE-6800 transmitters require 24 VAC input and must use the 0 to 5 VDC output. Refer to the *HE-6800 Series Humidity Transmitters with Temperature Sensor Product Bulletin (LIT-12011625)* on the Johnson Controls Product Literature website for more information, including technical specifications and mounting accessories.

System 450 Compatible Low Pressure Differential Transducer Ordering Information^{1 2}

Product Code Number	Product Description
DPT2650-R25B-AB	Low Pressure Differential Transducer: -0.25 to 0.25 in. W.C. (System 450 Sensor Type: P 0.25) ³
DPT2650-0R5D-AB	Low Pressure Differential Transducer: 0 to 0.5 in. W.C. (System 450 Sensor Type: P 0.5)
DPT2650-2R5D-AB	Low Pressure Differential Transducer: 0 to 2.5 in. W.C. (System 450 Sensor Type: P 2.5)
DPT2650-005D-AB	Low Pressure Differential Transducer: 0 to 5.0 in. W.C. (System 450 Sensor Type: P 5)
DPT2650-10D-AB	Low Pressure Differential Transducer: 0 to 10 in. W.C. (System 450 Sensor Type: P 10)

1. Refer to the *Setra Systems Model DPT265 Very Low Differential Pressure Transducer Catalog Page* on the Johnson Controls Product Literature website for more information.
2. The DPT265 sensors require 24 VAC input and must use the 0 to 5 VDC output. Refer to the *Setra Systems Model DPT265 Very Low Differential Pressure Transducer Catalog Page* on the Johnson Controls Product Literature website for more information.
3. Used only with Communications Control Modules.

System 450 Compatible P499 Series Transducers with 1/4 in. SAE 45 Flare Internal Thread with Depressor (Style 47) Ordering Information¹

Product Code Number	Product Description
P499RCP-401C	-1 to 8 bar; order WHA-PKD3 type wire harness separately
P499RCP-402C	-1 to 15 bar; order WH A-PKD3 type wire harness separately
P499RCP-404C	0 to 30 bar; order WHA-PKD3 type wire harness separately
P499RCP-405C	0 to 50 bar; order WHA-PKD3 type wire harness separately
P499RCPS100C	-10 to 100 psis (sealed for wet and freeze/thaw applications); order WHA-PKD3 type wire harness separately
P499RCPS100K	-10 to 100 psis (sealed for wet and freeze/thaw applications); WHA-PKD3-200C wire harness included
P499RCPS102C	0 to 200 psis (sealed for wet and freeze/thaw applications); order WHA-PKD3 type wire harness separately
P499RCPS102K	0 to 200 psis (sealed for wet and freeze/thaw applications); WHA-PKD3-200C wire harness included
P499RCP-101C	0 to 100 psi; order WHA-PKD3 type wire harness separately
P499RCP-101K	0 to 100 psi; WHA-PKD3-200C wire harness included
P499RCP-105C	0 to 500 psi; order WHA-PKD3 type wire harness separately
P499RCP-105K	0 to 500 psi; WHA-PKD3-200C wire harness included
P499RCP-107C	0 to 750 psi; order WHA-PKD3 type wire harness separately
P499RCP-107K	0 to 750 psi; WHA-PKD3-200C wire harness included

1. The P499 sensors must be powered with the +5 VDC and C terminals and the output is 0.5 to 4.5 VDC. Refer to the *P499 Series Electronic Pressure Transducers Product/Technical Bulletin (LIT-12011190)* on the Johnson Controls Product Literature website for more information.



**System 450™ Compatible Sensors, Transducers, and Accessories
(Continued)**

System 450 Compatible P499 Series Transducers with 1/8 in. 27 NPT External Thread (Style 49) Ordering Information¹

Product Code Number	Product Description
P499RAPS100C	-10 to 100 psis (sealed for wet and freeze/thaw applications); order WHA-PKD3 type wire harness separately
P499RAPS100K	-10 to 100 psis (sealed for wet and freeze/thaw applications); WHA-PKD3-200C wire harness included
P499RAPS102C	0 to 200 psis (sealed for wet and freeze/thaw applications); order WHA-PKD3 type wire harness separately
P499RAPS102K	0 to 200 psis (sealed for wet and freeze/thaw applications); WHA-PKD3-200C wire harness included
P499RAP-101C	0 to 100 psig; order WHA-PKD3 type wire harness separately
P499RAP-101K	0 to 100 psig; WHA-PKD3-200C wire harness included
P499RAP-102C	0 to 200 psig; order WHA-PKD3 type wire harness separately
P499RAP-105C	0 to 500 psig; order WHA-PKD3 type wire harness separately
P499RAP-105K	0 to 500 psig; WHA-PKD3-200C wire harness included
P499RAP-107C	0 to 750 psig; order WHA-PKD3 type wire harness separately
P499RAP-107K	0 to 750 psig; WHA-PKD3-200C wire harness included

1. The P499 sensors must be powered with the +5 VDC and C terminals and the output is 0.5 to 4.5 VDC. Refer to the *P499 Series Electronic Pressure Transducers Product/Technical Bulletin (LIT-12011190)* on the Johnson Controls Product Literature website for more information.

WHA-PKD3 Wire Harnesses Ordering Information¹

Product Code Number	Product Description
WHA-PKD3-200C	Plug and Three-Wire Harness for P499 Electronic Pressure Transducers: 2.0 m (6-1/2 ft) cable
WHA-PKD3-400C	Plug and Three-Wire Harness for P499 Electronic Pressure Transducers: 4.0 m (13 ft) cable
WHA-PKD3-600C	Plug and Three-Wire Harness for P499 Electronic Pressure Transducers: 6.0 m (19-5/8 ft) cable

1. Refer to the *P499 Series Electronic Pressure Transducers Product/Technical Bulletin (LIT-12011190)* on the Johnson Controls Product Literature website for more information.



Ranco® Refrigeration Cross-Reference

Temperature Controls (Part 1 of 2)

Product #	Range	Differential	Switch	Capillary	Bulb	Cover	Notes
Ranco PENN	ETC111000-000 A419ABC-1C	-30/220F -30/212F	1/30F ADJ 1/30F ADJ	SPDT SPDT	96" Lead 78" Lead	0.5x2 0.5X2	NEMA 1 NEMA 1 (14)
Ranco PENN	3130-101 A11B-1C	35/45F 35/45F	12F FXD 12F FXD	Open LO Open LO	None 48"	240" 240"	NEMA 1 NEMA 1
Ranco PENN	3130-201 A11A-1C	35/45F 35/45F	Manual Manual	Open LO Open LO	None 48"	240" 240"	NEMA 1 NEMA 1
Ranco PENN	3311-651 A70BA-17C	37F FXD 35/80F ADJ	Manual Manual	Open LO Open LO	180" 72"	0.5x4.25 3/8x3	NEMA 1 NEMA 1
Ranco PENN	3311-701 A70AA-15C	30F FXD -10/65F ADJ	15F FXD 4/40F ADJ	Open LO Open LO	120" 72"	3/8x6.5 3/8x3	NEMA 1 NEMA 1
Ranco PENN	A22-2237 A11E-6C	41F FXD 35/45F	6F FXD 12F FXD	Open HI SPDT	None 48"	48" 240"	NEMA 1 NEMA 1
Ranco PENN	O10-1010 A11B-1C	0/55F 35/45F	7/55F ADJ 12F FXD	Open LO Open LO	None 48"	48" 240"	NEMA 1 NEMA 1
Ranco PENN	O10-1409 A19ABA-1C	0/55F -30/50F	3/20F ADJ 5/20F ADJ	Open LO Open LO	72" 72"	Yes 3/8x4	NEMA 1 NEMA 1 (1)
Ranco PENN	O10-1410 A19ABA-4C	25/75F 20/80F	3/20F ADJ 3.5/14F ADJ	Open LO Open LO	72" 72"	Yes 3/8x5	NEMA 1 NEMA 1 (1)
Ranco PENN	O10-1416 A11B-1C	0/55F 35/45F	3/20F ADJ 12F FXD	Open LO Open LO	None 48"	72" 240"	NEMA 1 NEMA 1
Ranco PENN	O10-1418 A19BBA-1C	0/55F -30/50F	3/20F ADJ 5/20F ADJ	Open LO Open LO	None None	Coiled Coiled	NEMA 1 NEMA 1 (1)
Ranco PENN	O10-1473 A19ABA-1C	0/55F -30/50F	7/55F ADJ 5/20F ADJ	Open LO Open LO	72" 72"	Yes 3/8x4	NEMA 1 NEMA 1 (1)
Ranco PENN	O10-1490 A19ABA-1C	0/55F -30/50F	2F FXD 5/20F ADJ	Open LO Open LO	72" 72"	Yes 3/8x4	NEMA 1 NEMA 1 (1)
Ranco PENN	O10-1491 A19ABA-4C	25/75F 20/80F	2F FXD 3.5/14F ADJ	Open LO Open LO	72" 72"	Yes 3/8x5	NEMA 1 NEMA 1 (1)
Ranco PENN	O10-1802 A19BAC-1C	25/75F 30/110F	3/20F ADJ 3.5F FXD	Open LO SPDT	None None	Coiled Coiled	NEMA 1 NEMA 1 (1)
Ranco PENN	O10-301 A19BAA-5C	30/95F 30/110F	2F FXD 3.5F FXD	Open LO Open LO	None None	Coiled Coiled	NEMA 1 NEMA 1 (1)
Ranco PENN	O16-104 A19ABC-24C	0/55F -30/100F	3/20F ADJ 3/12F ADJ	SPDT SPDT	72" 96"	Yes 3/8x4	NEMA 1 NEMA 1 (1)
Ranco PENN	O16-111 A11E-6C	0/55F 35/45F	3/20F ADJ 12F FXD	SPDT SPDT	None 48"	72" 240"	NEMA 1 NEMA 1
Ranco PENN	O16-165 A19BAC-1C	30/90F 30/110F	2.5F FXD 3.5F FXD	SPDT SPDT	None None	Coiled Coiled	NEMA 1 NEMA 1 (1)
Ranco PENN PENN	O16-263 A19ACC-6C A70BA-17C	0/55F -30/100F 35/80F	Manual Manual Manual	SPDT SPDT Open LO	72" 72" 72"	Yes 3/8x4 3/8x3	NEMA 1 NEMA 1 NEMA 1 (12)
Ranco PENN PENN	O16-264 A11D-1C A70BA-18C	0/55F 35/45F 15/55F	Manual Manual Manual	SPDT SPDT Open LO	None 48" None	96" 240" 240"	NEMA 1 NEMA 1 NEMA 1 (12)
Ranco PENN PENN	O16-588 A11E-6C A70AA-16C	-15/40F 35/45F 15/55F	1.5F FXD 12F FXD 5F FXD	SPDT SPDT Open LO	None 48" None	72" 240" 240"	NEMA 1 NEMA 1 NEMA 1 (1)
Ranco PENN	O16-594 A19BBC-2C	0/55F -30/100F	2F FXD 3/12F ADJ	SPDT SPDT	None None	Coiled Coiled	NEMA 1 NEMA 1 (1)
Ranco PENN	O16-595 A19ABC-4C	50/100F 50/130F	3/20F ADJ 3.5/14F ADJ	SPDT SPDT	96" 96"	3/8x6 3/8x5	NEMA 1 NEMA 1 (1)
Ranco PENN PENN	O16-601 A19ABC-2C A70AA-15C	22.5/47.5F 20/80F -10/65F ADJ	2.5F FXD 3.5/14F ADJ 10F FXD	SPDT SPDT Open LO	36" 72" 72"	3/8x6 3/8x5 3/8x3	NEMA 1 NEMA 1 NEMA 1 (1) (12)
Ranco PENN PENN	O20-7041 A72AA-3C A72AA-2C	0/100F 50/90F 15/55F	6/20F ADJ ADJ ADJ	DPST Open LO DPST Open LO DPST Open LO	96" 72" 72"	3/8x6 11/16x6 3/4 3/8x3	NEMA 1 NEMA 1 NEMA 1

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Ranco® Refrigeration Cross-Reference (Continued)

Temperature Controls (Part 2 of 2)

Product #	Range	Differential	Switch	Capillary	Bulb	Cover	Notes
Ranco PENN O52-6910 A19PRC-1C	30/95F 30/110F	2F FXD 3/12F ADJ	SPDT SPDT	None None	Coiled Coiled	NEMA 4X NEMA 4X	
Ranco PENN O60-100 A19ABC-24C	-35/95F -30/100F	4/50F ADJ 3/12F ADJ	SPDT SPDT	96" 96"	3/8x6 3/8x4	NEMA 1 NEMA 1	(1)
Ranco PENN O60-101 A19BBC-2C	-35/95F -30/100F	4/50F ADJ 3/12F ADJ	SPDT SPDT	None None	Coiled Coiled	NEMA 1 NEMA 1	(1)
Ranco PENN O60-1072 A19BBA-1C	-15/40F -30/50F	3/20F ADJ 5/20F ADJ	Open LO Open LO	None None	Coiled Coiled	NEMA 1 NEMA 1	(1)
Ranco PENN O60-120 A19ABC-36C	-35/95F -30/100F	4/50F ADJ 3/12F ADJ	SPDT SPDT	240" 240"	3/8x6 3/8x4	NEMA 1 NEMA 1	(1)
Ranco PENN O60-1408 A19ABA-1C	-15/40F -30/50F	3/20F ADJ 5/20F ADJ	Open LO Open LO	72" 72"	Yes 3/8x4	NEMA 1 NEMA 1	(1)
Ranco PENN O60-200 A19ABC-12C	95/240F 100/240F	6/50F ADJ 6/24F ADJ	SPDT SPDT	96" 96"	3/8x6 .29x2.5	NEMA 1 NEMA 1	(1)

Defrost/Fan Delay Temperature Controls

Product #	Range	Differential	Switch	Capillary	Bulb	Cover	Notes
Ranco PENN F25-107 A19ZBC-2C	40/75F 45/85	20F FXD 25F ADJ	SPDT SPDT	60" 72"	3/8x4 0.3x3.125	Open NEMA 1	(10)
Ranco PENN F25-114 A19ZBC-2C	43/73F 45/85	24F FXD 25F ADJ	SPDT SPDT	60" 72"	3/8x4 0.3x3.125	Open NEMA 1	(10)

Pressure Controls (Ranco Series 3126-3161, G20-G23, and O10-O20) (Part 1 of 3)

Product #	Range	Differential	Switch	Capillary	Connection	Cover	Notes
Ranco PENN 3126-116 P20EB-1C	7/125 7/150	25 FXD 29/32 FXD	SPDT SPDT	60" 36"	Sweat Sweat	Open Open	(6)
Ranco PENN 3126-117 P70AB-2C	7/27 20"/100	12 FXD 7/50 ADJ	SPDT Open LO	60" 36"	Sweat w/ Flare	Open NEMA 1	(5)(4)
Ranco PENN 3126-216 P70BA-1C	7/125 20"/100	Manual Manual	Open LO Open LO	60" 36"	Sweat w/ Flare	Open NEMA 1	(5)(4)
Ranco PENN 3126-412 P20EB-1C	7/77 7/150	23/70 29/32 FXD	SPDT SPDT	60" 36"	Sweat Sweat	Open Open	(6)
Ranco PENN 3127-140 P20EB-2C	125/450 100/425	70 FXD 60/77 FXD	Open HI SPDT	60" 36"	Sweat Sweat	Open Open	(6)
Ranco PENN 3127-220 P70DA-1C	125/450 50/450	Manual Manual	SPDT Open HI	60" 36"	Sweat w/ Flare	Open NEMA 1	(5)(4)
Ranco PENN 3127-414 P20EB-2C	150/450 100/425	70/125 60/77 FXD	SPDT SPDT	60" 36"	Sweat Sweat	Open Open	(6)
Ranco PENN 3160-012 P20EB-1C	5/110 7/150	25 FXD 29/32 FXD	SPDT SPDT	60" 36"	Sweat Sweat	Open Open	(6)
Ranco PENN 3160-014 P20EB-1C	5/125 7/150	25 FXD 29/32 FXD	Open LO SPDT	60" 36"	Sweat Sweat	Open Open	(6)
Ranco PENN 3160-212 P70BA-1C	5/110 20"/100	Manual Manual	Open LO Open LO	60" 36"	Sweat w/ Flare	Open NEMA 1	(5)(4)
Ranco PENN 3160-406 P20EB-1C	5/125 7/150	12/50 29/32 FXD	SPDT SPDT	60" 36"	Sweat Sweat	Open Open	(6)
Ranco PENN 3161-002 P20EB-2C	200/475 100/425	75 FXD 60/77 FXD	Open HI SPDT	60" 36"	Sweat Sweat	Open Open	(6)
Ranco PENN 3161-003 P20EB-2C	200/475 100/425	110 FXD 60/77 FXD	Open HI SPDT	60" 36"	Sweat Sweat	Open Open	(6)
Ranco PENN 3161-004 P20EB-2C	200/475 100/425	50 FXD 60/77 FXD	Open HI SPDT	60" 36"	Sweat Sweat	Open Open	(6)
Ranco PENN 3161-009 P20EB-2C	125/285 100/425	50 FXD 60/77 FXD	SPDT SPDT	60" 36"	Sweat Sweat	Open Open	(6)

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Ranco® Refrigeration Cross-Reference (Continued)

Pressure Controls (Ranco Series 3126-3161, G20-G23, and O10-O20) (Part 2 of 3)

Product #	Range	Differential	Switch	Capillary	Connection	Cover	Notes
Ranco PENN 3161-201 P70DA-1C	200/475 50/450	Manual Manual	SPDT Open HI	60" 36"	Sweat w/ Flare	Open NEMA 1	(5)(4)
Ranco PENN 3161-205 P70DA-1C	125/285 50/450	Manual Manual	Open HI Open HI	60" 36"	w/ Flare w/ Flare	NEMA 1	Open (5)
Ranco PENN 3161-403 P20EB-2C	200/475 100/425	50/150 60/77 FXD	SPDT SPDT	60" 36"	Sweat Sweat	Open Open	(6)
Ranco PENN G20-4050 P70AB-2C	7/27 20"/100	12 FXD 7/50 ADJ	Open LO Open LO	60" 36"	Sweat w/ Flare	Open NEMA 1	(5)(4)
Ranco PENN G20-4051 P20EB-1C	7/77 7/150	19/70 29/32 FXD	Open LO SPDT	60" 36"	Sweat Sweat	Open Open	(6)
Ranco PENN G20-4412 P70BA-1C	7/70 20"/100	Manual Manual	Open LO Open LO	60" 36"	Sweat w/ Flare	Open NEMA 1	(5)(4)
Ranco PENN G23-5052 P20EB-2C	150/450 100/425	50/125 60/77 FXD	Open HI SPDT	60" 36"	Sweat Sweat	Open Open	(6)
Ranco PENN G23-5253 P70DA-1C	50/450 50/450	Manual Manual	Open HI Open HI	60" 36"	Sweat w/ Flare	Open NEMA 1	(5)(4)
Ranco PENN O10-1093 P70AB-2C	10"/100 20"/100	10/40 7/50	Open LO Open LO	48" 36"	w/ Flare w/ Flare	NEMA 1	NEMA 1
Ranco PENN O10-1401 P170AB-12C	12"/50 12"/80	5/35 5/35	Open LO Open LO	None None	External Flare External Flare	NEMA 1	NEMA 1
Ranco PENN O10-1402 P70AB-12C	12"/50 12"/80	535 5/35	Open LO Open LO	36" 36"	w/ Flare w/ Flare	NEMA 1	NEMA 1
Ranco PENN O10-1483 P70AB-2C	10"/100 20"/100	10/40 7/50	Open LO Open LO	36" 36"	w/ Flare w/ Flare	NEMA 1	NEMA 1
Ranco PENN O10-1807 P70AA-151C	100/250 50/300	20/100 20/120	Open LO Open LO	None None	External Flare External Flare	NEMA 1	NEMA 1
Ranco PENN O10-1831 P70AB-12C	10"/100 12"/80	10/40 5/35	Open LO Open LO	None 36"	External Flare w/ Flare	NEMA 1 NEMA 1	
Ranco PENN O10-1842 P70AB-12C	12"/50 12"/80	5/35 5/35	Open LO Open LO	48" 36"	w/ Flare w/ Flare	NEMA 1 NEMA 1	
Ranco PENN O10-2000 P70AA-3C	100/250 100/300	20/100 25/75	Open LO Open LO	48" 36"	w/ Flare w/ Flare	NEMA 1 NEMA 1	
Ranco PENN O10-2054 P70AA-118C	100/400 100/400	40/150 35/200	Open LO Open LO	36" 36"	w/ Flare w/ Flare	NEMA 1 NEMA 1	
Ranco PENN O11-1711 P70CA-3C	150/450 50/450	40/150 60/150	Open HI Open HI	36" 36"	w/ Flare w/ Flare	NEMA 1 NEMA 1	
Ranco PENN O11-1713 P70CA-2C	150/450 50/450	40/150 60/150	Open HI Open HI	None None	External Flare External Flare	NEMA 1 NEMA 1	
Ranco PENN O11-1799 P170CA-1C	10"/100 20"/100	10/40 6/70	Open HI Open HI	None None	External Flare External Flare	NEMA 1 NEMA 1	
Ranco PENN O11-3099 P70CA-1C	10"/100 20"/100	10/40 6/70	Open HI Open HI	36" 36"	w/ Flare w/ Flare	NEMA 1 NEMA 1	
Ranco PENN O16-107 P70EA-10C	10"/100 20"/100	10/40 ADJ 5 FXD	SPDT SPDT	None None	External Flare External Flare	NEMA 1 NEMA 1	
Ranco PENN O16-120 P70EA-10C	12"/50 20"/100	5/35 ADJ 5 FXD	SPDT SPDT	None None	External Flare External Flare	NEMA 1 NEMA 1	
Ranco PENN O16-142 P70EA-6C	100/400 100/300	17 FXD 14 FXD	SPDT SPDT	36" 36"	w/ Flare Sweat	NEMA 1 NEMA 1	(4)
Ranco PENN O16-166 P70GA-2C	50/150 20"/100	10/40 7/50	SPDT NO/NC	36" 36"	w/ Flare w/ Flare	NEMA 1 NEMA 1	(12)
Ranco PENN O16-200 P70KA-1C	150/450 50/450	Manual Manual	SPDT NO/NC	48" 36"	w/ Flare w/ Flare	NEMA 1 NEMA 1	(12)
Ranco PENN O16-209 P170KA-1C	150/450 50/450	Manual Manual	SPDT NO/NC	None None	External Flare External Flare	NEMA 1 NEMA 1	(12)
Ranco PENN O16-261 P70HA-2C	10"/100 20"/100	Manual Manual	SPDT NO/NC	48" 36"	w/ Flare w/ Flare	NEMA 1 NEMA 1	(12)
Ranco PENN O16-503 P70JA-18C	150/450 50/450	40/150 60/150	SPDT NO/NC	None None	External Flare External Flare	NEMA 1 NEMA 1	(12)

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Ranco® Refrigeration Cross-Reference (Continued)

Pressure Controls (Ranco Series 3126-3161, G20-G23, and O10-O20) (Part 3 of 3)

Product #	Range	Differential	Switch	Capillary	Connection	Cover	Notes
Ranco PENN O16-527 P70EA-10C	10"/100 20"/100	10/40 ADJ 5 FXD	SPDT SPDT	36" None	w/ Flare External Flare	NEMA 1 NEMA 1	(3)
Ranco PENN O16-557 P70EA-10C	12"/50 20"/100	5/35 ADJ 5 FXD	SPDT SPDT	36" None	w/ Flare External Flare	NEMA 1 NEMA 1	(3)
Ranco PENN O16-585 P70HA-3C	10"/100 20"/100	Manual Manual	SPDT NO/NC	None None	External Flare Internal NPT	NEMA 1 NEMA 1	(4)(12)
Ranco PENN O20-1894 P170AA-118C	100/400 100/400	40/150 35/200	Open LO Open LO	None None	External Flare External Flare	NEMA 1 NEMA 1	
Ranco PENN O20-7002 P72AA-1C	12"/50 20"/100	5/35 7/50	DPST-LO DPST-LO	36" 36"	w/ Flare w/ Flare	NEMA 1 NEMA 1	
Ranco PENN O20-7006 P72AA-27C	100/400 100/400	40/150 35/200	DPST-LO DPST-LO	36" 36"	w/ Flare w/ Flare	NEMA 1 NEMA 1	

Pressure Controls (Ranco Series 3100, MPF, MPH, and MPL) (Part 1 of 3)

Product #	Cut-Out	Cut-In	Range	Switch	Electrical	Pressure	Notes
Ranco PENN 3100-001 P100AA-1C	15 10	40 40	None None	SPST SPST	30" Leads 48" Leads	1/4" Sweat 1/4" Internal Flare	
Ranco PENN 3100-002 P20EB-1C	5 ADJ.	30 N/A	None 7/150	SPST SPDT	72" Leads Arkles	1/4" Internal Flare 36" Cap, Sweat	(4)(5)(6)(7)(8)
Ranco PENN 3100-003 P20EB-1C	20 ADJ.	45 N/A	None 7/150	SPST SPDT	72" Leads Arkles	1/4" Internal Flare 36" Cap, Sweat	(4)(5)(6)(7)(8)
Ranco PENN 3100-004 P100AA-2C	35 35	60 60	None None	SPST SPST	QC 48" Leads	1/4" Internal Flare 1/4" Internal Flare	(8)
Ranco PENN 3100-005 P70AB-1C	15" VAC ADJ.	17.5 N/A	None 20"/100	SPDT SPST	QC Screw Terms.	1/4" Internal Flare 1/4" External Flare	(4)(5)(7)(8)
Ranco PENN 3100-006 P20EB-1C	48 ADJ.	80 N/A	None 7/150	SPDT SPDT	36" Leads Arkles	1/4" Sweat 36" Cap, Sweat	(4)(5)(6)(7)(8)
Ranco PENN 3100-007 P100AA-1C	15 10	40 40	None None	SPST SPST	30" Leads 48" Leads	1/4" Internal Flare 1/4" Internal Flare	
Ranco PENN 3100-009 P70AB-1C	0 ADJ.	20 N/A	None 20"/100	SPST SPST	QC Screw Terms.	1/4" Internal Flare 1/4" External Flare	(4)(5)(7)(8)
Ranco PENN 3100-010 P20EB-1C	45 ADJ.	70 N/A	None 7/150	SPDT SPDT	QC Arkles	1/4" Internal Flare 36" Cap, Sweat	(4)(5)(6)(7)
Ranco PENN 3100-050 P100AA-1C	10 10	30 40	None None	SPST SPST	18" Leads 48" Leads	1/4" Internal Flare 1/4" Internal Flare	
Ranco PENN 3100-051 P20EB-1C	25 ADJ.	80 N/A	None 7/150	SPST SPDT	18" Leads Arkles	1/4" Internal Flare 36" Cap, Sweat	(4)(5)(6)(7)(8)
Ranco PENN 3100-052 P100AA-2C	40 35	80 60	None None	SPST SPST	18" Leads 48" Leads	1/4" Internal Flare 1/4" Internal Flare	
Ranco PENN 3100-075 P70AA-119C	85 ADJ.	135 N/A	None 50/300	SPDT SPST	QC Screw Terms.	1/4" Internal Flare 1/4" Internal Flare	(5)(7)(8)(12)
Ranco PENN 3100-076 P20EB-1C	108 ADJ.	135 N/A	None 7/150	SPST SPDT	QC Arkles	1/4" Internal Flare 36" Cap, Sweat	(4)(5)(6)(7)(12)
Ranco PENN 3100-077 P170AA-118C	115 ADJ.	165 N/A	None 100/400	SPST SPST	QC Screw Terms.	1/4" Internal Flare 1/4" External Flare	(4)(5)(7)(8)
Ranco PENN 3100-078 P170AA-118C	135 ADJ.	185 N/A	None 100/400	SPDT SPST	QC Screw Terms.	1/4" Internal Flare 1/4" External Flare	(4)(5)(7)(8)(12)
Ranco PENN 3100-079 P100AA-4C	165 170	215 250	None None	SPST SPST	QC 48" Leads	1/4" Internal Flare 1/4" Internal Flare	(8)
Ranco PENN 3100-080 P170AA-118C	200 ADJ.	240 N/A	None 100/400	SPDT SPST	QC Screw Terms.	1/4" Internal Flare 1/4" External Flare	(4)(5)(7)(8)(12)
Ranco PENN 3100-081 P170AA-118C	250 ADJ.	300 N/A	None 100/400	SPDT SPST	QC Screw Terms.	1/4" Internal Flare 1/4" External Flare	(4)(5)(7)(8)(12)
Ranco PENN 3100-100 P100CA-2C	425 425	325 325	None None	SPST SPST	72" Leads 48" Leads	1/4" Internal Flare 1/4" Internal Flare	
Ranco PENN 3100-101 P100CA-1C	400 400	300 300	None None	SPST SPST	18" Leads 48" Leads	1/4" Internal Flare 1/4" Internal Flare	

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Cross-Reference

Ranco® Refrigeration Cross-Reference (Continued)

Pressure Controls (Ranco Series 3100, MPF, MPH, and MPL) (Part 2 of 3)

Product #	Cut-Out	Cut-In	Range	Switch	Electrical	Pressure	Notes
Ranco PENN 3100-102 P100CA-2C	220 425	170 325	None None	SPST SPST	QC 48" Leads	1/4" Internal Flare 1/4" Internal Flare	(8)
Ranco PENN 3100-103 P100DA-1C	410 410	Manual Manual	None None	SPST SPST	42" Leads 48" Leads	1/4" Internal Flare 1/4" Internal Flare	
Ranco PENN 3100-104 P70DA-1C	420 ADJ.	Manual Manual	None 50/450	SPST SPST	48" Leads Screw Terms.	1/4" Internal Flare 36" Cap, Flare	(4)(5)(7)(8)
Ranco PENN 3100-105 P70DA-1C	440 ADJ.	Manual Manual	None 50/450	SPST SPST	36" Leads Screw Terms.	.093 Cap. Tube 36" Cap, Flare	(4)(5)(7)(8)
Ranco PENN 3100-106 P100DA-2C	475 475	Manual Manual	None None	SPST SPST	42" Leads 48" Leads	1/4" Sweat w/ Cap. 1/4" Internal Flare	(4)
Ranco PENN 3100-107 P70DA-1C	232 ADJ.	Manual Manual	None 50/450	SPST SPST	84" Leads Screw Terms.	1/4" Internal Flare 36" Cap, Flare	(4)(5)(7)(8)
Ranco PENN 3100-108 P20EB-2C	280 ADJ.	Manual N/A	None 100/425	SPST SPDT	12" Leads Arkles	1/4" NPTF 36" Cap, Sweat	(4)(5)(6)(7)(8)
Ranco PENN 3100-110 P20EB-2C	375 ADJ.	275 N/A	None 100/425	SPDT SPDT	QC Arkles	1/4" Sweat 36" Cap, Sweat	(4)(5)(6)(7)
Ranco PENN 3100-111 P20EB-2C	375 ADJ.	275 N/A	None 100/425	SPST SPDT	QC Arkles	1/4" Internal Flare 36" Cap, Sweat	(4)(5)(6)(7)
Ranco PENN 3100-112 P20EB-2C	275 ADJ.	175 N/A	None 100/425	SPST SPDT	24" Leads Arkles	1/4" Internal Flare 36" Cap, Sweat	(4)(5)(6)(7)(8)
Ranco PENN 3100-113 P20EB-2C	395 ADJ.	295 N/A	None 100/425	SPST SPDT	QC Arkles	1/4" Sweat 36" Cap, Sweat	(4)(5)(6)(7)
Ranco PENN 3100-115 P20EB-2C	350 ADJ.	250 N/A	None 100/425	SPDT SPDT	36" Leads Arkles	1/4" Sweat 36" Cap, Sweat	(4)(5)(6)(7)(8)
Ranco PENN 3100-116 P20EB-2C	213 ADJ.	113 N/A	None 100/425	SPST SPDT	QC Arkles	1/4" Internal Flare 36" Cap, Sweat	(4)(5)(6)(7)
Ranco PENN 3100-117 P20EB-2C	140 ADJ.	190 N/A	None 100/425	SPST SPDT	12" Leads Arkles	.093 Cap. Tube 36" Cap, Sweat	(4)(5)(6)(7)(8)
Ranco PENN 3100-118 P20EB-2C	295 ADJ.	395 N/A	None 100/425	SPST SPDT	QC Arkles	1/4" Internal Flare 36" Cap, Sweat	(4)(5)(6)(7)
Ranco PENN 3100-120 P20EB-2C	420 ADJ.	320 N/A	None 100/425	SPST SPDT	QC Arkles	1/4" Internal Flare 36" Cap, Sweat	(4)(5)(6)(7)
Ranco PENN 3100-121 P20EB-2C	426 ADJ.	272 N/A	None 100/425	SPST SPDT	QC Arkles	1/4" Sweat 36" Cap, Sweat	(4)(5)(6)(7)
Ranco PENN 3100-150 P20EB-2C	350 ADJ.	250 N/A	None 100/425	SPST SPDT	18" Leads Arkles	1/4" Internal Flare 36" Cap, Sweat	(4)(5)(6)(7)(8)
Ranco PENN 3100-151 P100CA-1C	400 400	300 300	None None	SPST SPST	18" Leads 48" Leads	1/4" Internal Flare 1/4" Internal Flare	
Ranco PENN 3100-152 P100CA-1C	400 400	200 300	None None	SPST SPST	18" Leads 48" Leads	1/4" Internal Flare 1/4" Internal Flare	
Ranco PENN 3100-153 P20EB-2C	450 ADJ.	250 N/A	None 100/425	SPST SPDT	18" Leads Arkles	1/4" Internal Flare 36" Cap, Sweat	(4)(5)(6)(7)(8)
Ranco PENN 3100-154 P70LB-1C	500 ADJ.	400 N/A	None 100/500	SPST SPST	18" Leads Screw Terms.	1/4" Internal Flare 36" Cap, Flare	(4)(5)(7)(8)(9)
Ranco PENN 3100-155 P70LB-1C	500 ADJ.	300 N/A	None 100/500	SPST SPST	18" Leads Screw Terms.	1/4" Internal Flare 36" Cap, Flare	(4)(5)(7)(8)(9)
Ranco PENN MPF-7006 P20EB-1C	75 ADJ.	120 N/A	None 7/150	SPST SPDT	18" Leads Arkles	1/4" Internal Flare 36" Cap, Sweat	(6)(7)(8)
Ranco PENN MPF-7007 P20EB-1C	110 ADJ.	170 N/A	None 7/150	SPST SPDT	18" Leads Arkles	1/4" Internal Flare 36" Cap, Sweat	(6)(7)(8)
Ranco PENN MPF-7008 P100AA-3C	150 150	225 225	None None	SPST SPST	18" Leads 48" Leads	1/4" Internal Flare 1/4" External Flare	
Ranco PENN MPF-7009 P20EB-2C	190 ADJ.	275 N/A	None 100/425	SPST SPDT	18" Leads Arkles	1/4" Internal Flare 36" Cap, Sweat	(6)(7)(8)
Ranco PENN MPF-7010 P20EB-2C	300 ADJ.	400 N/A	None 100/425	SPST SPDT	18" Leads Arkles	1/4" Internal Flare 36" Cap, Sweat	(6)(7)(8)
Ranco PENN MPH-7101 P20EB-2C	250 ADJ.	180 N/A	None 100/425	SPST SPDT	18" Leads Arkles	1/4" Internal Flare 36" Cap, Sweat	(6)(7)(8)

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Cross-Reference

Ranco® Refrigeration Cross-Reference (Continued)

Pressure Controls (Ranco Series 3100, MPF, MPH, and MPL) (Part 3 of 3)

Product #	Cut-Out	Cut-In	Range	Switch	Electrical	Pressure	Notes
Ranco PENN MPH-7102 P20EB-2C	270 ADJ.	200 N/A	None 100/425	SPST SPDT	18" Leads Arkles	1/4" Internal Flare 36" Cap, Sweat	(6)(7)(8)
Ranco PENN MPH-7103 P20EB-2C	300 ADJ.	200 N/A	None 100/425	SPST SPDT	18" Leads Arkles	1/4" Internal Flare 36" Cap, Sweat	(6)(7)(8)
Ranco PENN MPH-7104 P20EB-2C	325 ADJ.	225 N/A	None 100/425	SPST SPDT	18" Leads Arkles	1/4" Internal Flare 36" Cap, Sweat	(6)(7)(8)
Ranco PENN MPH-7105 P20EB-2C	350 ADJ.	250 N/A	None 100/425	SPST SPDT	18" Leads Arkles	1/4" Internal Flare 36" Cap, Sweat	(6)(7)(8)
Ranco PENN MPH-7106 P20EB-2C	375 ADJ.	275 N/A	None 100/425	SPST SPDT	18" Leads Arkles	1/4" Internal Flare 36" Cap, Sweat	(6)(7)(8)
Ranco PENN MPH-7107 P100CA-1C	400 400	300 300	None None	SPST SPST	18" Leads 48" Leads	1/4" Internal Flare 1/4" External Flare	
Ranco PENN MPH-7108 P100CA-2C	425 425	325 325	None None	SPST SPST	18" Leads 48" Leads	1/4" Internal Flare 1/4" External Flare	
Ranco PENN MPL-7001 P100AC-1C	5 5	20 20	None None	SPST SPST	18" Leads 48" Leads	1/4" Internal Flare 1/4" External Flare	
Ranco PENN MPL-7002 P100AA-1C	15 10	35 40	None None	SPST SPST	18" Leads 48" Leads	1/4" Internal Flare 1/4" External Flare	
Ranco PENN MPL-7003 P20EB-1C	25 ADJ.	80 N/A	None 7/150	SPST SPDT	18" Leads Arkles	1/4" Internal Flare 36" Cap, Sweat	(6)(7)(8)
Ranco PENN MPL-7004 P100AA-2C	35 35	60 60	None None	SPST SPST	18" Leads 48" Leads	1/4" Internal Flare 1/4" External Flare	
Ranco PENN MPL-7005 P20EB-1C	45 ADJ.	60 N/A	None 7/150	SPST SPDT	18" Leads Arkles	1/4" Internal Flare 36" Cap, Sweat	(6)(7)(8)
Ranco PENN MPL-7011 P20EB-1C	10 ADJ.	25 N/A	None 7/150	SPST SPDT	18" Leads Arkles	1/4" Internal Flare 36" Cap, Sweat	(6)(7)(8)
Ranco PENN MPL-7012 P20EB-1C	20 ADJ.	45 N/A	None 7/150	SPST SPDT	18" Leads Arkles	1/4" Internal Flare 36" Cap, Sweat	(6)(7)(8)
Ranco PENN MPL-7014 P20EB-1C	40 ADJ.	80 N/A	None 7/150	SPST SPDT	18" Leads Arkles	1/4" Internal Flare 36" Cap, Sweat	(6)(7)(8)

Dual Pressure Controls (Part 1 of 2)

Product #	LO Side	Differential	HI Side	Differential	Capillary	Connection	Notes
Ranco PENN O12-1502 P70LB-6C	12"/50 12"/80	5/35 5/35	150/450 100/500	70 FXD 60 FXD	36" 36"	W/ Flare W/ Flare	
Ranco PENN O12-1505 P170LB-6C	12"/50 12"/80	5/35 5/35	100/250 100/500	50 FXD 60 FXD	None None	External Flare External Flare	
Ranco PENN O12-1506 P70LB-6C	12"/50 12"/80	5/35 5/35	100/250 100/500	50 FXD 60 FXD	36" 36"	W/ Flare W/ Flare	
Ranco PENN O12-1549 P70LB-1C	10"/100 20"/100	10/40 7/50	150/450 100/500	70 FXD 60 FXD	36" 36"	W/ Flare W/ Flare	
Ranco PENN O12-1550 P170LB-1C	10"/100 20"/100	10/40 7/50	150/450 100/500	70 FXD 60 FXD	None None	External Flare External Flare	
Ranco PENN O12-1554 P70LB-6C	12"/50 12"/80	5/35 5/35	100/250 100/500	50 FXD 60 FXD	48" 36"	W/ Flare W/ Flare	
Ranco PENN O12-1594 P70NA-1C	10"/100 20"/100	Manual Manual	150/450 100/500	Manual Manual	36" 36"	W/ Flare W/ Flare	
Ranco PENN O12-4139 P170LB-6C	12"/50 12"/80	5/35 5/35	150/450 100/500	70 FXD 60 FXD	None None	External Flare External Flare	
Ranco PENN O12-4833 P70SA-1C	12"/50 12"/80	5/35 5/35	150/450 100/500	70 FXD/Man 60 FXD	48" 36"	W/ Flare W/ Flare	
Ranco PENN O12-4834 P70SA-1C	10"/100 12"/80	10/40 5/35	150/450 100/500	70 FXD/Man 60 FXD	48" 36"	W/ Flare W/ Flare	
Ranco PENN O12-4842 P170SA-1C	12"/50 12"/80	5/35 5/35	150/450 100/500	70 FXD/Man 60 FXD	None None	External Flare External Flare	
Ranco PENN O12-4846 P170SA-1C	10"/100 12"/80	10/40 5/35	150/450 100/500	70 FXD/Man 60 FXD	None None	External Flare External Flare	
Ranco PENN O22-7702 P72LB-1C	12"/50 20"/100	5/35 7/50	100/250 100/500	50 FXD/Man 60 FXD	36" 36"	W/ Flare W/ Flare	(2)

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Ranco® Refrigeration Cross-Reference (Continued)

Dual Pressure Controls (Part 2 of 2)

Product #	LO Side	Differential	HI Side	Differential	Capillary	Connection	Notes
Ranco O22-7706	10"/100	10/40	150/450	70 FXD	36"	W/ Flare	
PENN P72LB-1C	20"/100	7/50	100/500	60 FXD	36"	W/ Flare	(2)

Low Pressure Cutout with Time Delay

Product #	Range	Differential	Time Delay	Capillary	Connection	Cover	Notes
Ranco 3341-161	0/100	5 FXD	120 Secs.	36"	W/ Flare	NEMA 1	
PENN P29NC-38C	20"/100	2.2 FXD	120 Secs.	36"	W/ Flare	NEMA 1	

Lube Oil Pressure Controls

Product #	Range	Reset	Delay	Capillary	Connection	Cover	Notes
Ranco 3321-001	9 FXD	Manual	45,60,90,120	None	External Flare	NEMA 1	
PENN P128AA-**C	8/70 ADJ	Manual	Note (11)	None	External Flare	NEMA 1	(11)
Ranco 3321-009	5 FXD	Manual	45,60,90,120	36"	W/ Flare	NEMA 1	
PENN P28AA-**C	8/70 ADJ	Manual	Note (11)	36"	W/ Flare	NEMA 1	(11)
Ranco 3321-010	9 FXD	Manual	45,60,90,120	36"	W/ Flare	NEMA 1	
PENN P28AA-**C	8/70 ADJ	Manual	Note (11)	36"	W/ Flare	NEMA 1	(11)
Ranco 3321-014	15 FXD	Manual	45,60,90,120	36"	W/ Flare	NEMA 1	
PENN P28AA-**C	8/70 ADJ	Manual	Note (11)	36"	W/ Flare	NEMA 1	(11)
Ranco 3321-015	30 FXD	Manual	45,60,90,120	36"	W/ Flare	NEMA 1	
PENN P28AA-**C	8/70 ADJ	Manual	Note (11)	36"	W/ Flare	NEMA 1	(11)
Ranco P30-3601	8/60 ADJ	Manual	60	36"	W/ Flare	NEMA 1	
PENN P28AA-2C	8/70 ADJ	Manual	60	36"	W/ Flare	NEMA 1	
Ranco P30-3701	8/60 ADJ	Manual	90	36"	W/ Flare	NEMA 1	
PENN P28AA-1C	8/70 ADJ	Manual	90	36"	W/ Flare	NEMA 1	
Ranco P30-3801	8/60 ADJ	Manual	120	36"	W/ Flare	NEMA 1	
PENN P28AA-17C	8/70 ADJ	Manual	120	36"	W/ Flare	NEMA 1	
Ranco P30-5826	9 FXD	Manual	120	36"	W/ Flare	NEMA 1	
PENN P45NCA-12C	9 FXD	Manual	120	36"	W/ Flare	NEMA 1	
Ranco P30-5827	9 FXD	Manual	120	None	External Flare	NEMA 1	
PENN P145NCA-12C	9 FXD	Manual	120	None	External Flare	NEMA 1	

Lube Oil Pressure Controls without Time Delay

Product #	Range	Differential	Cut-In	Switch	Capillary	Connection	Notes
Ranco 3311-101	14 FXD	5 FXD	9 FXD	SPDT	36"	1/4" Internal Flares	
PENN P74AA-1C	8/70 ADJ	8/30 ADJ	ADJ	Open Hi	36"	1/4" Internal Flares	(12)
Ranco 3311-103	4/6 ADJ	5/6	9/12	SPDT	24"	W/1/4" Sweats	
PENN P74EA-8C	2/26 ADJ	3.5 FXD	N/A	SPDT	36"	1/4" Internal Flares	(4)
Ranco 3311-111	4/6 FXD	5/6	9/12	SPDT	84"	1/4" Internal Flares	
PENN P74EA-8C	2/26 ADJ	3.5 FXD	N/A	SPDT	36"	1/4" Internal Flares	
Ranco 3311-115	6 FXD	5 FXD	11 FXD	Open LO	24"	1/4" Internal Flares	
PENN P74BA-1C	8/70 ADJ	7/30 ADJ	ADJ	Open LO	36"	1/4" Internal Flares	
Ranco 3311-118	40 FXD	5 FXD	45 FXD	Open LO	25" & 24"	W/1/4" Sweats	
PENN P74BA-1C	8/70 ADJ	7/30 ADJ	ADJ	Open LO	36"	1/4" Internal Flares	(4)
Ranco 3311-201	7 FXD	Manual	Manual	SPDT	49" & 72"	W/1/4" Sweats	
PENN P74AB-1C	8/70 ADJ	Manual	Manual	Open Hi	None	1/4" Internal NPT	(4)(12)
Ranco 3315-101	14 FXD	5 FXD	9 FXD	SPDT	36"	1/4" Internal Flares	
PENN P74AA-1C	8/70 ADJ	8/30 ADJ	ADJ	Open Hi	36"	1/4" Internal Flares	(12)
Ranco 3315-801	11/14 ADJ	5 FXD	16/19	SPDT	None	External Flares	
PENN P74BA-1C	8/70 ADJ	7/30 ADJ	ADJ	Open LO	36"	1/4" Internal Flares	(4)(12)

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Ranco® Refrigeration Cross-Reference (Continued)

Transformers

Product #	VA	Prim. Volt.	Prim. Lead	Sec. Volt.	Sec. Lead	Mounting	Notes
Ranco 620-205 PENN Y65A13-0	20 40	120 120	8" Leads 8" Leads	24 24	8" Leads 30" Leads	Foot Foot w/ Hubs	
Ranco 620-206 PENN Y65T31-0	20 40	208/240 120/208/240	8" Leads 8" Leads	24 24	8" Leads 3 Terminals	Foot Universal	(8)
Ranco 620-403 PENN Y65T31-0	40 40	120 120/208/240	8" Leads 8" Leads	24 24	8" Leads 3 Terminals	Universal Universal	(8)
Ranco 620-404 PENN Y65T31-0	40 40	208/240 120/208/240	8" Leads 8" Leads	24 24	8" Leads 3 Terminals	Universal Universal	(8)
Ranco 620-405 PENN Y65A13-0	40 40	120 120	8" Leads 8" Leads	24 24	8" Leads 30" Leads	Foot Foot w/ Hubs	
Ranco 620-406 PENN Y65T31-0	40 40	208/240 120/208/240	8" Leads 8" Leads	24 24	8" Leads 3 Terminals	Foot Universal	(8)
Ranco 620-482 PENN Y65A13-0 PENN Y65T31-0	40 40 40	120/208/240 120 120/208/240	8" Leads 8" Leads 8" Leads	24 24 24	8" Leads 30" Leads 3 Terminals	Foot Foot w/ Hubs Universal	(13)
Ranco 620-502 PENN Y63T22-0	50 50	120/208/240 120/208/240	8" Leads 8" Leads	24 24	8" Leads 8" Leads	Universal Universal	(13)
Ranco 620-752 PENN Y66T12-0	75 75	120/208/240 120/208/240	8" Leads 8" Leads	24 24	8" Leads 8" Leads	Foot Foot	(13)
Ranco 620-758 PENN Y66F12-0	75 75	480 277/480	8" Leads 8" Leads	24 24	8" Leads 8" Leads	Foot Foot	

Notes:

- (1) Can use A419ABC-1, -30/212F range, 1/30F differential, SPDT, 78" lead, 0.25 x 2 PTC sensor, NEMA 1.
- (2) Convertible
- (3) Add Ecosafe hose.
- (4) Different pressure element.
- (5) Not as compact.
- (6) Differential depends on setting.
- (7) Not an encapsulated switch as Ranco's is.
- (8) Different electrical connection.
- (9) Dual control, ignore lo side.
- (10) Range is Defrost Termination for both.
- (11) Choose correct one below based on timing required and pressure connection:

P28AA-1	8/70	90 Secs.	36"	W/ Flare
P28AA-2	8/70	60 Secs.	36"	W/ Flare
P28AA-17	8/70	120 Secs.	36"	W/ Flare
P28AA-18	8/70	45 Secs.	36"	W/ Flare
P128AA-1	8/70	90 Secs.	None	External Flare
P128AA-2	8/70	60 Secs.	None	External Flare
P128AA-17	8/70	120 Secs.	None	External Flare
- (12) Different switch.
- (13) Choose which transformer based on primary voltage desired.
- (14) May be extended up to 800 feet.



ALCO® Cross Reference

Temperature Controls



Product #	Range	Differential	Switch	Capillary	Bulb	Cover	Notes
ALCO TF115-S2 AE00	-20/60F	3/30F ADJ	SPDT	NONE	COILED	NEMA 1	
ALCO TSI-X2E 30/40	-20/60F	3/30F ADJ	SPDT	NONE	COILED	NEMA 1	
PENN A19BBC-2C	-30/100F	3/12F ADJ	SPDT	None	Coiled	NEMA 1	(1)
PENN A19BBC-6C	-30/100F	3/12F ADJ	SPDT	None	Coiled	NEMA 1	(1)(2)
ALCO TF115-S3 AE00	15/95F	3/30F ADJ	SPDT	NONE	COILED	NEMA 1	
ALCO TSI-X3E 64/48	15/95F	3/30F ADJ	SPDT	NONE	COILED	NEMA 1	
PENN A19BBC-2C	-30/100F	3/12F ADJ	SPDT	None	Coiled	NEMA 1	(1)
PENN A19BBC-6C	-30/100F	3/12F ADJ	SPDT	None	Coiled	NEMA 1	(1)(2)
ALCO TF115-S4 AF10	-20/95F	5/35F ADJ	SPDT	120"	3/8x2-3/4	NEMA 1	
ALCO TSI-X4F 32/41	-20/95F	5/35F ADJ	SPDT	120"	3/8x2-3/4	NEMA 1	
PENN A19ABC-24C	-30/100F	3/12F ADJ	SPDT	96"	3/8x4	NEMA 1	(1)
PENN A19ABC-36C	-30/100F	3/12F ADJ	SPDT	240"	3/8x4	NEMA 1	(1)

Notes:

- (1) Can use A419ABC-1, -30/212F range, 1/30F differential, SPDT, 78" lead, 0.25 x 2 PTC sensor, NEMA 1.
- (2) Knob assembly/concealed adjustment packed separately.

Pressure Controls



Product #	Range	Differential	Switch	Capillary	Connection	Cover	Notes
ALCO FF115-S1 BAK	24"/42	3/30 ADJ	SPDT	36"	w/ Flare	NEMA 1	
ALCO PS1-X1K 7/15	24"/42	3/30 ADJ	SPDT	36"	w/ Flare	NEMA 1	
PENN P70AB-12C	12"/80	5/35 ADJ	Open LO	36"	w/ Flare	NEMA 1	
ALCO FF115-S3 BAK	15"/100	7/70 ADJ	SPDT	36"	w/ Flare	NEMA 1	
ALCO PS1-X3K 50/65	15"/100	7/70 ADJ	SPDT	36"	w/ Flare	NEMA 1	
PENN P70AB-2C	20"/100	7/50 ADJ	Open LO	36"	w/ Flare	NEMA 1	
ALCO FF115-S3 BAA	15"/100	7/70 ADJ	SPDT	None	External Flare	NEMA 1	
ALCO PS1-X3A 50/65	15"/100	7/70 ADJ	SPDT	None	External Flare	NEMA 1	
PENN P170AB-2C	20"/100	7/50 ADJ	Open LO	None	External Flare	NEMA 1	
ALCO FF115-S4 BAK	15/290	15/145 ADJ	SPDT	36"	w/ Flare	NEMA 1	
ALCO PS1-X4K 115/145	15/290	15/145 ADJ	SPDT	36"	w/ Flare	NEMA 1	
PENN P70AA-2C	0/150	12/40 ADJ	Open LO	36"	w/ Flare	NEMA 1	
PENN P70AA-3C	100/300	25/75 ADJ	Open LO	36"	w/ Flare	NEMA 1	
ALCO FF115-S5 BAK	90/450	30/220	SPDT	36"	w/ Flare	NEMA 1	
ALCO PS1-X5K 230/290	90/450	30/220	SPDT	36"	w/ Flare	NEMA 1	
PENN P70AA-118C	100/400	35/200	Open LO	36"	w/ Flare	NEMA 1	
PENN P70CA-3C	50/450	60/150	Open HI	36"	w/ Flare	NEMA 1	
ALCO FF115-S5 BAA	90/450	30/220	SPDT	None	External Flare	NEMA 1	
ALCO PS1-X5A 140/280	90/450	30/220	SPDT	None	External Flare	NEMA 1	
PENN P170AA-118C	100/400	35/200	Open LO	None	External Flare	NEMA 1	
PENN P170CA-3C	50/450	60/150	Open HI	None	External Flare	NEMA 1	
ALCO FF115-S5 BRK	90/450	Manual	SPDT	36"	w/ Flare	NEMA 1	
ALCO PS1-Y5K 230/290	90/450	Manual	SPDT	36"	w/ Flare	NEMA 1	
PENN P70DA-1C	50/450	Manual	Open HI	36"	w/ Flare	NEMA 1	
PENN P70KA-1C	50/450	Manual	M-Block	36"	w/ Flare	NEMA 1	(3)
ALCO FF115-S5 BRA	90/450	Manual	SPDT	None	External Flare	NEMA 1	
ALCO PS1-Y5A 330/390	90/450	Manual	SPDT	None	External Flare	NEMA 1	
PENN P170DA-1C	50/450	Manual	Open HI	None	External Flare	NEMA 1	

Notes:

- (3) Main opens HI, auxilliary opens LO (primarily used for alarm circuit).



Cross-Reference

ALCO® Cross Reference (Continued)

Dual Pressure Controls



Product #	LO Side	Differential	HI Side	Differential	Capillary	Connection	Notes
ALCO FF215-S9 BAUK	24"/42	3/30	90/450	60 FXD	48"	W/ Flare	
ALCO PS2-Y9K	24"/42	3/30	90/450	60 FXD	48"	W/ Flare	
PENN P70SA-1C	12"/80	5/35	100/500	60 FXD	36"	W/ Flare	
ALCO FF215-S7 BAUK	15"/100	7/70	90/450	60 FXD	48"	W/ Flare	
ALCO PS2-Y7K	15"/100	7/70	90/450	60 FXD	48"	W/ Flare	
PENN P70SA-1C	12"/80	5/35	100/500	60 FXD	36"	W/ Flare	
ALCO FF215-S7 BAUA	15"/100	7/70	90/450	60 FXD	None	External Flare	
ALCO PS2-Y7A	15"/100	7/70	90/450	60 FXD	None	External Flare	
PENN P170SA-1C	12"/80	5/35	100/500	60 FXD	None	External Flare	

Lube Oil Pressure Controls



Product #	Range	Reset	Delay	Capillary	Connection	Cover	Notes
ALCO FD113-ZUK	4/65 ADJ	Manual	20-150 secs.	36"	W/ Flare	NEMA 1	
PENN P28AA-**C	8/70 ADJ	Manual	Note (4)	36"	W/ Flare	NEMA 1	(4)
PENN P45NCA-12C	9.0 FXD	Manual	120 secs.	36"	W/ Flare	NEMA 1	(5)
PENN P45NCA-82C	6.5 FXD	Manual	45 secs.	36"	W/ Flare	NEMA 1	(5)
ALCO FD113-ZU	4/65 ADJ	Manual	20-150 secs.	None	External Flare	NEMA 1	
PENN P128AA-**C	8/70 ADJ	Manual	Note (4)	None	External Flare	NEMA 1	(4)
PENN P145NCA-12C	9.0 FXD	Manual	120 secs.	None	External Flare	NEMA 1	(5)
PENN P145NCA-82C	6.5 FXD	Manual	45 secs.	None	External Flare	NEMA 1	(5)

Notes:

(4) Choose correct control below based on timing required and desired pressure connection:

P28AA-1	8/70#	90 Secs.	36"	W/ Flare
P28AA-2	8/70#	60 Secs.	36"	W/ Flare
P28AA-17	8/70#	120 Secs.	36"	W/ Flare
P28AA-18	8/70#	45 Secs.	36"	W/ Flare
P128AA-1	8/70#	90 Secs.	None	External Flare
P128AA-2	8/70#	60 Secs.	None	External Flare
P128AA-17	8/70#	120 Secs.	None	External Flare

(5) Verify timing specifications.



NOTES

Lined area for taking notes, consisting of multiple horizontal lines.



NOTES



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NOTES

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