



# PENN Controls Products Catalog



A full compliment of temperature, pressure, humidity, air flow and fan speed controls for commercial refrigeration, air conditioning and heating applications.

The power behind **your mission**







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## Refrigerants and Product Material Compatibility

Requirements such as material compatibility with refrigerants, refrigerant oils and other medias, system operating pressures and temperatures, and operating environment must be considered when selecting pressure controls, fan speed controls, water regulating valves and/or pressure transducers for HVACR applications.

Table 1 provides a listing of the Penn products that are materially compatible with the most common commercially available refrigerants. As a standard practice, please review the applicable Penn product technical bulletin to confirm that the respective control's maximum working pressure is suitable for the refrigerant being used. In addition, you should confirm that the product's operating temperatures and enclosure are suitable for the intended application.

- ① **Note:** Controls used with flammable refrigerants typically require special construction and safety agency approvals including ATEX compliance. Selective Penn P77, P78, P100 and P599 series controls are ATEX compliant. The requirement for ATEX compliance and other safety agency approvals depends on the refrigerant and the application's explosion hazard zone. ATEX compliant controls are not always required when flammable refrigerants are involved. However, you should always check with the proper authorities to confirm the requirements.



**Table 1: Refrigerants and product compatibility**

Refrigerant safety class	Refrigerant	P20	P28/ P128	P45	P66	P70/ P170	P74	P77/ P78	P100	P200	P215	P216 (P599 transducer)	P266 (P266SNR-xC)	P315	P545	P599	V46/ V48	V246/ V248	
A1	R22	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
	R124	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
	R134a	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
	R404A	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
	R407A	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
	R407A	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	R407F	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	R407H	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	R410A	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	R422D	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	R438A	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	R448A	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	R449A	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	R449B	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	R450A	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	R452A	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	R507A	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	R513A	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	R744 (CO2)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	A2L	R32	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
R447A		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
R454A		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
R454B		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
R454C		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
R455A		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
R1234yf		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
R1234ze		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
B2L	R717 (NH3)	-	X	-	-	X	X	X	-	-	-	X	X	-	-	X	X	X	
A3	R290 (Propane)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
	R600a (Isobutane)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
	R1270	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	

**Note:**

- The R717 (NH3) Refrigerant in the B2L Refrigerant Safety Class applies to the following selected models only: P28, P74, P77/P78, P266 (P266SNR-1C, 2C), and P599.
- X = Material compatible with refrigerant and refrigerant oils
- - = Material not compatible with refrigerant and refrigerant oils

Always ensure that the control's maximum operating and test pressures do not exceed the equipment's maximum allowable system pressure. Also check for other refrigerant and application-related conditions that may impact control usage.

Product portfolio changes may have occurred since this table was published. Please check with your Johnson Controls® representative to confirm product availability.



## Single-Stage and Two-Stage Electromechanical Temperature Controls



# A11 Series Low Temperature Cutout Controls



## Description

The A11 Series Low Temperature Cutout Controls are available with single-pole, single-throw (SPST) or single-pole, double-throw (SPDT) contact action. 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. You can access the range adjustment screw at the bottom of the control, or at the top of the control when you remove the cover. A factory-set low temperature stop is available when specified.

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

## Features

- Precision repeat accuracy: the control always senses at the coldest point across the full length of the sensing element. The control remains unaffected by ambient temperature at the diaphragm cup and the 4 ft (1.2m) capillary. Install a 20 ft (6.1 m) or 40 ft (12.2 m) sensing element in the controlled area.
- Trip-free manual reset provides the option to reset the lever. Press and release the lever before operation resumes.
- Precision snap-acting contacts in a dust protected enclosure provides for the A11 Control to operate to the fullest potential.
- Direct reading scale provides easy-to-adjust setpoint. You can make adjustments from the top or bottom of the control.

## A11 electrical rating

**Table 2: A11 Series electrical rating**

Description	cULus		
	120	208	240
Volts AC 50/60 Hz			
Full load amperes	16	9.2	8
Lock rotor amperes	96	55.2	48
Resistive amperes	16	9.2	8
Pilot duty	125 VA, 24 VAC to 277 VAC		

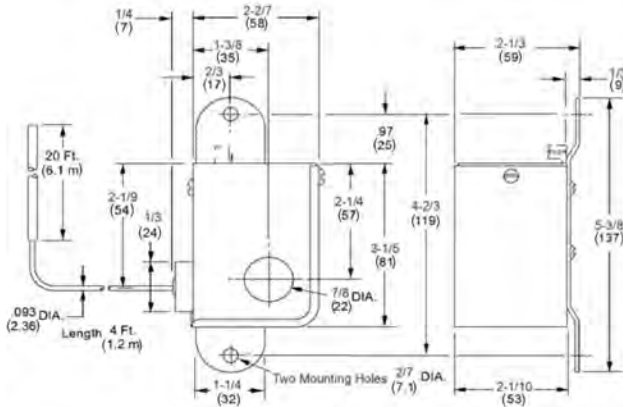
## Selection chart

**Table 3: Selection chart**

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

## Dimensions

**Figure 1: A11 Series Low Temperature Cutout Controls dimensions, in. (mm)**



## All Low Temperature Cutout Controls technical specifications

**Table 4: A11 Low Temperature Cutout Controls technical specifications**

Specification	Description
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°F to 45°F (2°C to 7°C)
Differential	A11A and A11D: Temperature must be 12°F (6.7°C) above cutout point before you can reset the control. A11B and A11E: 12°F (6.7°C)
Maximum temperature at bulb	250°F (121°C)
Sensing element	1/8 in. x 20 ft (3.2 mm x 6.1 m) or 1/8 in. x 40 ft (3.2 mm x 12.2 m)
Capillary length	4 ft (1.2 m)
Switch	Snap-acting contacts in dust-protected enclosure
Material	Case: 0.6 in. (1.6 mm) cold rolled steel Cover: 0.3 in. (0.8 mm) cold rolled steel
Finish	Galvanized steel
Mounting bracket	Standard on all controls
Shipping weight	Individual pack: 1.8 lb (0.8 kg) Overpack of 20 units: 38 lb (17 kg)

## All conformity declaration

**Table 5: Conformity declaration**

Information	Description
Purpose of the control	Low temperature cutout control
Construction of the control	Electromechanical independently mounted control
Number of cycles	30K cycles auto reset, 6K cycles manual reset

**Table 5: Conformity declaration**

Information	Description
Method of mounting the control	Permanently attached through hole in mounting bracket
Method of earthing the control	Wiring binding screw terminal
Type 1 or Type 2 action	Type 1.B; micro-disconnection
External pollution situation	Pollution degree 3
Internal pollution situation	Pollution degree 2
Rated impulse voltage	4,000 VAC
Ball pressure temperature	Switch component 302°F (150°C)
Field wiring rating	Use copper conductors only, rated at least 194°F (90°C)
Switch	SPST (A11A, A11B), SPDT (A11D, A11E)
Enclosure	UL: Type 1 (NEMA)
Wiring connection	Three color-coded screw terminals, SPDT only, and one ground terminal
Conduit connection	One 7/8 in. (22 mm) hole for 1/2 in. (12.7 mm) trade size (or PG16) conduit
Ambient conditions	0°F (-18°C) to 140°F (60°C)
Compliance	North America cULus listed; UL60730, CSA E60730 File SA516



# 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.

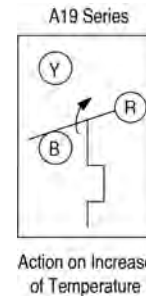
## Features

- 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.

**Figure 2: A19 Series terminal arrangement for Single-Pole, Double-Throw (SPDT)**



## Selection charts

Specify the control model code number, packing nut code number (if required), and bulb well code number (if required).

**Table 6: A19 Series Remote Bulb Control selection chart**

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)
<b>Adjustable Differential (wide range)</b>							
A19ABA-40C <sup>1</sup>	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)

**Table 6: A19 Series Remote Bulb Control selection chart**

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)
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 <sup>2</sup>	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)
<b>Fixed Differential</b>							
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)
<b>Fixed Differential (case compensated)</b>							
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)
<b>Fixed Differential (Close)</b>							
A19AAD-5C <sup>3</sup>	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-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)
<b>Manual Reset</b>							
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 Replaces White-Rodgers® 1609-101
- 2 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
- 3 Case-compensated

**Table 7: 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)*.

# A19 Series Remote Bulb Control technical specifications

**Table 8: Electrical ratings**

Motor ratings VAC	120	208	240
<b>Wide Range—Adjustable Differential</b>			
AC Full Load A	16.0	9.2	8.0
AC Locked Rotor A	96.0	55.2	48.0
Non-Inductive A <sup>1</sup>	22 A, 120 to 277 VAC		
Pilot Duty	125 VA, 24 to 600 VAC		
<b>Fixed Differential and Close Differential</b>			
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		
<b>Case Compensated—Fixed Differential A19AAC-4</b>			
AC Full Load A	16.0	9.2	8.0
AC Locked Rotor A	96.0	55.2	48.0
Non-Inductive A <sup>1</sup>	22 A, 120 to 277 VAC		
Pilot Duty	125 VA, 24 to 600 VAC		
<b>A19AAD-12</b>			
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		
<b>Manual Reset</b>			
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



# Product warranty

This product is covered by a limited warranty, details of which can be found at [www.johnsoncontrols.com/buildingswarranty](http://www.johnsoncontrols.com/buildingswarranty).

# Single point of contact

APAC	Europe	NA/SA
JOHNSON CONTROLS C/O CONTROLS PRODUCT MANAGEMENT NO. 32 CHANGJIANG RD NEW DISTRICT WUXI JIANGSU PROVINCE 214028 CHINA	JOHNSON CONTROLS VOLTAWEG 20 6101 XK ECHT THE NETHERLANDS	JOHNSON CONTROLS 507 E MICHIGAN ST MILWAUKEE WI 53202 USA

# Contact information

Contact your local branch office: [www.johnsoncontrols.com/locations](http://www.johnsoncontrols.com/locations)

Contact Johnson Controls: [www.johnsoncontrols.com/contact-us](http://www.johnsoncontrols.com/contact-us)

# A19 Series High Range Temperature Control



## 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

## Applications

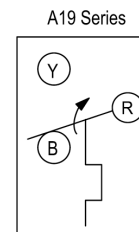
The A19s are suitable for temperature control in HVAC/R applications.

**Figure 3: A19 Series terminal arrangement for SPDT**

## 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.



Action on Increase of Temperature

a19.eps

## Selection charts

**Table 9: A19 Series High Range Temperature Control selection chart**

Product code number <sup>1</sup>	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 <sup>2</sup>	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 <sup>2</sup>	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

**Table 10: Replacement parts**

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

## A19 Series High Range Temperature Control technical specifications

**Table 11: 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 <sup>1</sup>	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 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.

## Selection charts

**Table 12: A19 Series Hot Water Temperature Control (Well Immersion) selection chart**

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)				1/2 in.; 8 ft. capillary		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)

**Table 13: Replacement parts**

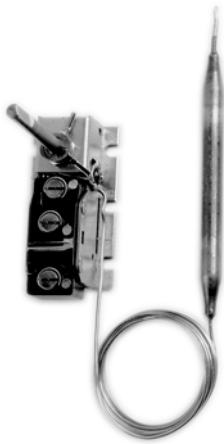
Product code number	Description
CVR28A-617R	Concealed adjustment cover
CVR28A-618R	Visible scale cover
KNB20A-602R	Knob kit

# A19 Series Hot Water Temperature Control technical specifications

**Table 14: 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)



## Features

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

## Applications

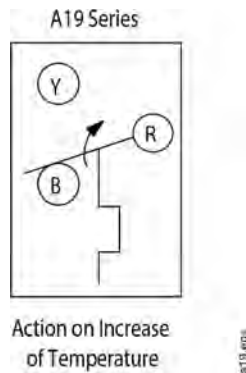
Use for panel-mounted temperature control for a packaged terminal air conditioner or for self-contained HVAC equipment.

## 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.

**Figure 4: A19 Series Terminal Arrangement for SPDT**



## Selection charts

**Table 15: 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)

**Table 16: Replacement parts**

Product code number	Description
CVR28A-617R	Concealed adjustment
CVR28A-618R	Visible scale
KNB20A-602R	Knob kit

## A19 Temperature Control technical specifications

- Back mounting
- Knob supplied by the customer

**Table 17: 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 Temperature Control for Hazardous Locations



## Description

The A19 Series Control provides remote bulb or coiled bulb temperature 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 controls 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.



## Selection chart

**Table 18: 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 Control for Hazardous Locations technical specifications

**Table 19: 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			

# A19 Series Coiled Bulb Space Temperature Control



## Description

The A19 Series Control 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.

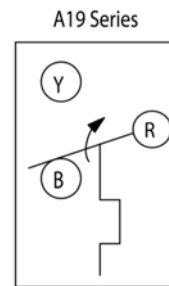
## Features

- Wide temperature range
- NEMA 1 enclosure

## Applications

Use for return air or space temperature sensing.

**Figure 5: A19 Series Terminal Arrangement for SPDT**



Action on Increase of Temperature

a19.eps

## Selection charts

**Table 20: A19 Series Coiled Bulb Space Temperature Control**

Product code number	Switch action	Range °F (°C)	Differential F° (C°)	Bulb and capillary	Range adjuster	Maximum bulb temp °F (°C)
<b>Ventilating, heating</b>						
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	
<b>Cooling</b>						
A19BBC-2C <sup>1</sup>	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.

**Table 21: Replacement parts**

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

## A19 Series Coiled Bulb Space Temperature Control technical specifications

**Table 22: 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 (Not lamp loads) <sup>1</sup>	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 (Not lamp loads) <sup>1</sup>	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 Temperature Control for Chain-Mount and Drop-Cord Heaters



## Description

The A19 Series Temperature Control is a sturdy compact temperature control 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

## Selection chart

**Table 23: 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 Temperature Control for Chain-Mount and Drop-Cord Heaters technical specifications

**Table 24: Electrical ratings**

Motor ratings VAC	120
AC full load A	15
AC locked rotor As	90

## A19 Temperature Control for Chain-Mount and Drop-Cord Coolers



### Applications

- On/off control of portable cooling applications
- Home brewing

### Description

The A19 Series Temperature Control is a sturdy compact temperature control 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

# A19 Temperature Control for Chain-Mount and Drop-Cord Coolers

## technical specifications

**Table 25: Electrical ratings**

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

## Selection chart

**Table 26: 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 temperature controls.

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

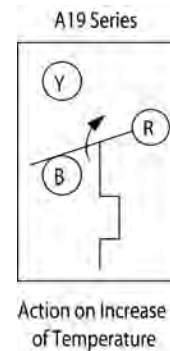
## Features

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.

**Figure 6: A19 Series terminal arrangement for SPDT**



## Selection charts

**Table 27: A19 Series Automatic Changeover with Strap-on Mounting selection chart**

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

**Table 28: Replacement parts**

Product code number	Description
CVR28A-617R	Concealed adjustment cover

## A19 Series Automatic Changeover with Strap-on Mounting technical specifications

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

**Table 29: 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 Control



## 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

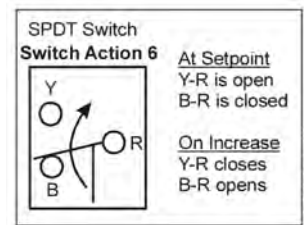
- SPDT switch action provides either high or low temperature detection
- Sealed, dust-protected switch provides reliable and durable On/Off control for commercial and industrial applications
- Color-coded electrical terminals simplify wiring the controls

- 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.

**Figure 7: 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

## A19D Series Surface Mount Temperature Control technical specifications

**Table 30: A19D Series Surface Mount Temperature Control technical specifications**

Specification	Description																														
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 Temp Differential	A19DAC: 10F° or 6.0C°; A19DAF: 3-1/2F° (1.9C°)																														
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	<table border="1"> <thead> <tr> <th></th> <th colspan="2">A19DAC: Standard Differential</th> <th colspan="2">A19DAF: Narrow Differential</th> </tr> </thead> <tbody> <tr> <td>Motor Rating VAC</td> <td>120</td> <td>240</td> <td>120</td> <td>240</td> </tr> <tr> <td>Full Load Amperes</td> <td>10.0</td> <td>6.0</td> <td>6.0</td> <td>3.4</td> </tr> <tr> <td>Locked Rotor Amperes</td> <td>60.0</td> <td>36.0</td> <td>36.0</td> <td>20.4</td> </tr> <tr> <td>Non-Inductive Amperes</td> <td>10.0</td> <td>6.0</td> <td>6.0</td> <td>3.4</td> </tr> <tr> <td>Pilot Duty</td> <td colspan="2">125 VA, 24 to 277 VAC</td> <td colspan="2">125 VA, 24 to 277 VAC</td> </tr> </tbody> </table>		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	
		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 E6688CSA Class No. 4813 02, File LR948C-Tick																														

# A19 Flange Mounted Duct Temperature Control



## Description

The A19 Flange Mounted Duct Temperature Control 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

## Applications

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

## Selection charts

**Table 31: A19 Flange Mounted Duct Temperature Control**

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)

**Table 32: Replacement Parts**

Product Code Number	Description
CVR28A-618R	Visible scale cover

## A19 Flange Mounted Duct Temperature Control technical specifications

**Table 33: 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		



# A19 Temperature Control with Rainproof 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.

## Description

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

## Selection chart

**Table 34: 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)

## A19 Temperature Control with Rainproof Enclosure technical specifications

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

**Table 35: 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 and Industrial Temperature Control 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 Temperature Control 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.

## 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 Agricultural and Industrial Temperature Control with NEMA 4X Enclosure technical specifications

**Table 36: 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) <sup>1</sup>	22 A, 120/277 VAC		
Pilot Duty	125 VA, 24 to 600 VAC		

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



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



### Features

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

### Applications

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

### 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.

## Selection chart

**Table 37: A19 Temperature Control with NEMA 4X Enclosure (Remote Bulb) selection chart**

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)
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-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 Temperature Control with NEMA 4X Enclosure technical specifications

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

**Table 38: 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			



# 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
- Includes Code No. FTG13A-600R Packing Nut as standard
- Replacement cover: CVR61A-600R

## Applications

Use for water chillers.

## Selection chart

Table 39: 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 Water Chiller Control with Locked Cut-Out/Adjustable Cut-In technical specifications

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

Table 40: 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		



# 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.

## Selection chart

**Table 41: 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

## A19 Defrost Duration and Fan Delay Control technical specifications

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

**Table 42: 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		

# 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.

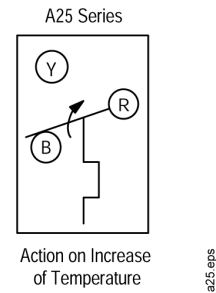
The A25 Control is normally located in a return air duct and is wired to shut down air conditioning or ventilating fans when the temperature of the air becomes excessively hot.

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

## Applications

Use for high temperature cut-out.

Figure 8: A25 Series action diagram



## 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

## Selection chart

Table 43: 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				
A25CP-1C	SPDT	25 to 215 (-4 to 102)	Concealed screwdriver slot	High limit set at 125 (52)

## A25 Warm Air Limit Control technical specifications

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

**Table 44: 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			

## A28 Series Two-Stage Temperature Control

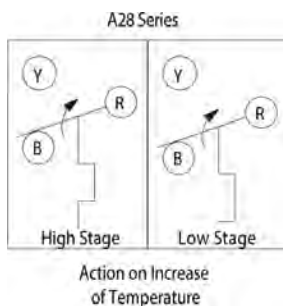


### Description

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 (LIT-125130)* for important product application information.

**Figure 9: A28 Action Diagram**



### 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

**Table 45: Selection Charts**

Product Code Number	Switch Action	Range °F (°C)	Differential F° (C°)	Bulb and Capillary	Bulb Well No. (Order Separately)	Range Adjuster
<b>Coiled Bulb-Fixed Differential</b>						
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
<b>Wide Range-Adjustable Interstage Differential</b>						
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	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
<b>Changeover Control</b>						
A28AB-1C	Two-SPDT <sup>1</sup>	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 Switches within 1 F° (0.6 C°) of each other.

**Table 46: Replacement Parts**

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

## A28 Series Two-Stage Temperature Control technical specifications

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

**Table 47: Electrical Ratings**

Motor Ratings VAC	120	208	240	277
<b>A28AA, A</b>				
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 <sup>1</sup>			
<b>A28AJ</b>				
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 <sup>1</sup>			
<b>A28AB</b>				
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 <sup>1</sup>			

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



# A28 Series Two-Stage Flange Mounted Duct Temperature Control



## 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.

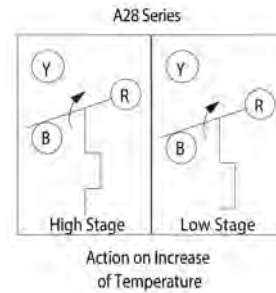
## Features

- Flat flange mounting with special coil 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 temperature controls are used on roof top units, make-up heaters, duct heaters, and air handling systems of all types.

**Figure 10: A28 Action Diagram**



## Selection chart

**Table 48: Selection Chart**

Product Code Number	Number of Stages	Switch Action	Range °F (°C)	Differential F° (C°)		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)

# A28 Series Two-Stage Flange Mounted Duct Temperature Control technical specifications

**Table 49: 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			

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



# A28 Two-Stage Industrial Temperature Control Waterproof and Dustproof



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.

## Description

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

## A28 Two-Stage Industrial Temperature Control Waterproof and Dustproof technical specifications

**Table 50: 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		

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

## Selection chart

**Table 51: A28 Two-Stage Industrial Temperature Control Waterproof and Dustproof 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



### 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

### 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.

## Selection chart

**Table 52: A28 Two-Stage Temperature Control with Weatherproof Enclosure 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 5 (2.8) each stage	3/8 in. x 4 in.; Neoprene-coated 6 ft capillary	Screwdriver slot
A28MA-2C			8 (4.4) between stages	3/8 in. x 4-1/16 in.; 6 ft capillary	

## A28 Two-Stage Temperature Control with Weatherproof Enclosure technical specifications

**Table 53: 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.



# A28 Two-Stage Agricultural Temperature Control 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.

## Selection chart

**Table 54: Selection chart**

Product Code Number	Switch Action	Range °F (°C)	Differential F° (C°)	Bulb and Capillary	Range Adjuster
A28PJ-1C	Two single-pole, double-throw (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

## A28 Two-Stage Agricultural Temperature Control with NEMA 4X Enclosure technical specifications

**Table 55: 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 <sup>1</sup>			
A28PA				
AC Full Load A	16.0	9.2	8.0	-
AC Locked Rotor A	96.0	55.2	48.0	-

**Table 55: Electrical Ratings**

Motor Ratings VAC	120	208	240	277
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 <sup>1</sup>			

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



## 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.

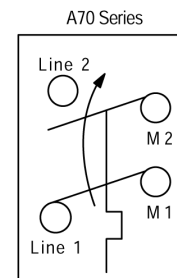
### Features

- 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.

**Figure 11: A70 Series action diagram**



Action on Increase on Temperature

a70s.eps

## Selection charts

**Table 56: 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 <sup>1</sup>	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 <sup>1</sup>			15 to 55 (-9.4 to 12.8)	Manual reset	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)	

<sup>1</sup> On the A70GA-1C and A70HA-1C 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.

**Table 57: Replacement covers**

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

## Technical specifications

**Table 58: Electrical ratings**

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

<sup>1</sup> 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.

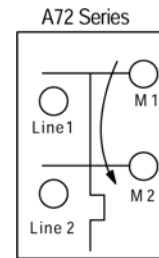
## Features

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.

**Figure 12: A72 action diagram**



Action on Increase on Temperature

a27 eps

## Selection charts

**Table 59: A72 Series Two-Pole Heavy Duty Temperature Controls selection chart**

Product Code Number	Switch Action	Range °F (°C)	Differential F° (C°)	Bulb and Capillary	Maximum Bulb Temperature °F (°C)	Range Adjuster
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. 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)	Screw driver slot
A72AP-1C <sup>1</sup>	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 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.

**Table 60: Replacement covers**

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

## Technical specifications

**Table 61: Electrical ratings**

Motor Ratings VAC	120 Single-Phase	208' Single-Phase	240' Single-Phase	220' 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 <sup>2</sup>	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 Rating does not apply to the A72AP-1C Control.

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



### Features

Open high or close high models are available.

### Applications

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

### 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.

## Selection chart

**Table 62: A72 Series Cooling Tower or Evaporative Condenser Controls 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)

**Table 63: Electrical ratings**

Motor Ratings VAC	120 Single-Phase	208* Single-Phase	240* Single-Phase	220* 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					

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



# Single-Stage Electronic Temperature Controls





# A421 Series Standard Electronic Temperature Controls



## Description

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

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

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

The A421 Controls are available in Type 1, IP20 high-impact plastic enclosures suitable for surface or DIN rail mounting and Type 4X, IP66 watertight, corrosion-resistant surface mount enclosures. Refer

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

## Applications

You can use the A421 Controls to manage a wide range 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
- 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 and benefits

### Control front panel LCD

Displays the temperature, parameters, and status. You can adjust the backlight intensity for ambient light conditions. Custom icons display the system and control status.

## Basic and Advanced programming menu

Provides two levels of parameter adjustment and control. You can set up advanced features in one menu and easily adjust basic parameters in the other menu.

### On/Off temperature adjustment

Select the temperature values at which the relay turns On and Off, which automatically defines the Heating or Cooling mode of operation.

### Switch-activated temperature setback

Shift the On or Off temperature by an adjustable setback value. When a user-supplied switch closes the binary input control circuit, the control operates at the defined setback temperatures.

### Adjustable anti-short cycle delay

Select the minimum time the output relay remains off before the next on cycle; avoiding short cycling, hard starts, and nuisance overload outages on compressors and other inductive applications.

### Adjustable sensor offset

Adjust the displayed temperature to the actual sensed temperature.

### Optional restricted adjustment mode

Restrict the On or Off adjustment to your defined temperature range.

### Sensor failure mode

Select the relay On or Off state in the event of a sensor or sensor wire failure.

### Backlight brightness level

Adjust the LCD backlight intensity.

## Ordering information

Contact your nearest Johnson Controls or PENN distributor or sales representative to order sensors, mounting hardware, and other accessories used to install A421 Controls. Contact your local Johnson Controls or PENN representative for more information on options available for high-

volume purchase models with specific application requirements.

## Selection charts

**Table 64: A421 Series Standard Electronic Temperature Control**

Product code	Description
A421ABC-02C	Line-Voltage Type 1 Electronic Temperature Control: Type 1 (NEMA), IP20 standard enclosure for DIN rail and surface-mount applications. Rated for 120/240 VAC. Includes an A99BB-200C temperature sensor with 6.6 ft (2.0 m) cable.
A421ABC-03C	Line-Voltage Type 1 Electronic Temperature Control: Type 1 (NEMA), IP20 standard enclosure for DIN rail and surface-mount applications. Rated for 120/240 VAC. Includes an A99BB-300C temperature sensor with 9.75 ft (3.0 m) cable.
A421ABC-04C	Line-Voltage Type 1 Electronic Temperature Control: Type 1 (NEMA), IP20 standard enclosure for DIN rail and surface-mount applications. Rated for 120/240 VAC. Includes an A99BB-400C temperature sensor with 13.1 ft (4.0 m) cable.
A421ABC-06C	Line-Voltage Type 1 Electronic Temperature Control: Type 1 (NEMA), IP20 standard enclosure for DIN rail and surface-mount applications. Rated for 120/240 VAC. Includes an A99BB-600C temperature sensor with 19.5 ft (6.0 m) cable.
A421AEC-01C	Line-Voltage Type 4X Electronic Temperature Control: Type 4X (NEMA), IP66 watertight enclosure for surface-mount applications. Rated for 120/240 VAC. Includes an A99BB-25C temperature sensor with 9 7/8 in. (0.25 m) cable.
A421AEC-02C	Line-Voltage Type 4X Electronic Temperature Control: Type 4X (NEMA), IP66 watertight enclosure for surface-mount applications. Rated for 120/240 VAC. Includes an A99BB-200C temperature sensor with 6.6 ft (2.0 m) cable.
A421GBF-02C	Low-Voltage Type 1 Electronic Temperature Control: Type 1 (NEMA), IP20 standard enclosure for DIN rail and surface-mount applications. Rated for 24 VAC Class 2, safety extra low-voltage. Includes an A99BB-200C temperature sensor with 6.6 ft (2.0 m) cable.

**Table 64: A421 Series Standard Electronic Temperature Control**

Product code	Description
A421GEF-01C	Low-Voltage Type 4X Electronic Temperature Control: Type 4X (NEMA), IP66 watertight enclosure for surface-mount applications. Rated for 24 VAC Class 2, safety extra low-voltage. Includes an A99BB-25C temperature sensor with 9 7/8 in. (0.25 m) cable.
A421GEF-02C	Low-Voltage Type 4X Electronic Temperature Control: Type 4X (NEMA), IP66 watertight enclosure for surface-mount applications. Rated for 24 VAC Class 2, safety extra low-voltage. Includes an A99BB-200C temperature sensor with 6.6 ft (2.0 m) cable.

**Table 65: A99 Temperature Sensors**

Product code <sup>1</sup>	Description
A99BA-200C	Positive temperature coefficient (PTC) Temperature Sensor: Standard probe 2 in. (5.1 cm) with 6.6 ft (2.0 m) shielded polyvinyl chloride (PVC) cable; ambient operating temperature range: -40°F to 212°F (-40°C 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°F to 212°F (-40°C to 100°C)
A99BB-200C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 6.6 ft (2.0 m) PVC cable; ambient operating temperature range: -40°F to 212°F (-40°C to 100°C)
A99BB-300C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 9.8 ft (3.0 m) PVC cable; ambient operating temperature range: -40°F to 212°F (-40°C 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°F to 212°F (-40°C to 100°C)
A99BB-600C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 19.7 ft (6.0 m) PVC cable; ambient operating temperature range: -40°F to 212°F (-40°C to 100°C)
A99BC-25C <sup>1</sup>	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°F to 248°F (-40°C to 100°C)
A99BC-100C <sup>1</sup>	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 3.3 ft (1.0 m) high-temperature silicon cable; ambient operating temperature range: -40°F to 248°F (-40°C to 120°C)

**Table 65: A99 Temperature Sensors**

Product code <sup>1</sup>	Description
A99BC-300C <sup>1</sup>	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 9.8 ft (3.0 m) high-temperature silicon cable; ambient operating temperature range: -40°F to 248°F (-40°C to 120°C)
A99BC-500C <sup>1</sup>	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 16.4 ft (5.0 m) high-temperature silicon cable; ambient operating temperature range: -40°F to 248°F (-40°C to 120°C)
A99BC-1500C <sup>1</sup>	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 49.2 ft (15.0 m) high-temperature silicon cable; ambient operating temperature range: -40°F to 248°F (-40°C to 120°C)
A99CB-200C	PTC Temperature Sensor: Extended probe 6 in. (15.2 cm) with 6.6 ft (2.0 m) PVC cable; ambient operating temperature range: -40°F to 212°F (-40°C to 100°C)
A99CB-600C	PTC Temperature Sensor: Extended probe 6 in. (15.2 cm) with 19.7 ft (6.0 m) PVC cable; ambient operating temperature range: -40°F to 212°F (-40°C to 100°C)

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

**Table 66: Accessories for the A421 Controls**

Product code	Description
BKT287-1R	12 in. (305 mm) long DIN rail section
BKT287-2R	36 in. (914 mm) long DIN rail section
PLT344-1R	Two end clamps for DIN rail sections
A99-CLP-1	Surface mounting clip for A99B and A99C Series Temperature Sensors
SHL10-603R	Sun shield for A99B and A99C Series Temperature Sensors
BOX10A-603R	PVC enclosure for A99B and A99C Series Temperature Sensors
WEL11A-601R	Immersion well for applying sensor in fluid applications


## Technical specifications

**Table 67: A421 Series Electronic Temperature Control Technical Specifications**

Specification	Description
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



**Table 67: A421 Series Electronic Temperature Control Technical Specifications**

Specification	Description
Ambient conditions	Type 1/IP20: Operating: -40°F to 150°F (-40°C to 66°C), 0% to 95% RH noncondensing Shipping and storage: -40°F to 185°F (-40°C to 85°C), 0% to 95% RH noncondensing Type 4X/IP66: Operating: -40°F to 140°F or (-40°C to 60°C) Shipping and storage: -40°F to 140°F (-40°C to 60°C)
Temperature control range	-40°F to 212°F or (-40 to 100°C)
Sensor type	A99 PTC temperature sensor: 1,035 ohm at 77°F (25°C)
Sensor offset range	±5°F or ±3°C
Enclosure material	Type 1: IP20 high-impact thermoplastic or Type 4X: IP66 watertight, corrosion-resistant, high-impact thermoplastic  ⓘ <b>Note:</b> Torque the cover screws on the enclosures to 10 in·lbs to 12 in·lbs (1.1 N·m to 1.4 N·m) to achieve Type 1 or Type 4X rating.
Compliance	<b>North America:</b> 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
	<b>Europe:</b> CE Mark – Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive; Low Voltage Directive.
	<b>Australia:</b> RCM Compliant

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

# A421 Series Standard Electronic Temperature Controls with Power Cords



## Description

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

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

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

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

The factory-equipped power cords provide convenient plug-in connection and control of 120 VAC heating and cooling equipment.

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

## Applications

You can use the A421 Control to manage a wide range of single-stage refrigeration or HVAC equipment. Sample temperature control applications include:

- Temperature monitoring and alarming
- On and off control of boilers and chillers
- Boiler and chiller pump control
- Heating and cooling control
- Cooling tower fan control based on water temperature
- Supply, makeup, and mixed air temperature control
- Temperature actuated valve control
- Supply and makeup air damper and fan control
- Condenser fan control based on condenser temperature.

## Features and benefits

### Control front panel LCD

Displays the temperature, parameters, and status. You can adjust the backlight intensity for ambient light conditions. Custom icons display the system and control status.

## Basic and Advanced programming menu

Provides two levels of parameter adjustment and control. You can set up advanced features in one menu and easily adjust basic parameters in the other menu.

### On and off temperature adjustment

Select the temperature values at which the relay turns on and off, which automatically defines the Heating or Cooling mode of operation.

### Switch-activated temperature setback

Shift the On or Off temperature by an adjustable setback value. When a user-supplied switch closes the binary input control circuit, the control operates at the defined setback temperatures.

### Adjustable anti-short cycle delay (ASd)

Select the minimum time the output relay remains off before the next on cycle; avoid short cycling, hard starts, and nuisance overload outages on compressors and other inductive applications.

### Adjustable sensor offset

Adjust the displayed temperature to the actual sensed temperature.

### Optional restricted adjustment mode

Restrict the On or Off adjustment to your defined temperature range.

### Sensor Failure mode

Select the relay On or Off state in the event of a sensor or sensor wire failure.

### Backlight brightness level

Adjust the LCD backlight intensity.

## Ordering information

Contact your nearest Johnson Controls or PENN distributor or sales representative to order sensors, mounting hardware, and other accessories used to install A421 Controls. Contact your local Johnson Controls or PENN representative for more information on options available for high-

volume purchase models with specific application requirements.

## Selection charts

**Table 68: A421 Series Standard Electronic Temperature Control with Power Cords**

Product code	Description
A421ABG-02C	120 VAC Type 1 Electronic Temperature Control with Dual Power Cords: Type 1 (NEMA), IP20 enclosure for DIN rail and surface-mount applications, with 6 ft (1.8 m) cord with 120 VAC grounded male plug and 6 ft (1.8 m) cord with 120 VAC grounded female outlet. Rated for 120 VAC. Includes an A99BB-200C temperature sensor with 6.6 ft (2.0 m) cable.
A421ABJ-02C	120 VAC Type 1 Electronic Temperature Control with Piggyback Power Cord: Type 1 (NEMA), IP20 enclosure for DIN rail and surface-mount applications, with 6 ft (1.8 m) single power cord with 120 VAC combination male/female grounded piggyback plug. Rated for 120 VAC. Includes an A99BB-200C temperature sensor with 6.6 ft (2.0 m) cable.
A421AEJ-01C	120 VAC Type 4X Electronic Temperature Control with Piggyback Power Cord: Type 4X (NEMA), IP66 watertight enclosure for surface-mount applications, with 6 ft (1.8 m) single power cord with 120 VAC combination male/female grounded piggyback plug. Rated for 120 VAC. Includes an A99BB-25C temperature sensor with 9 7/8 in. (0.25 m) cable.
A421AEJ-02C	120 VAC Type 4X Electronic Temperature Control with Piggyback Power Cord: Type 4X (NEMA), IP66 watertight enclosure for surface-mount applications, with 6 ft (1.8 m) single power cord with 120 VAC combination male/female grounded piggyback plug. Rated for 120 VAC. Includes an A99BB-200C temperature sensor with 6.6 ft (2.0 m) cable.

**Table 69: A99 Temperature Sensors**

Product code <sup>1</sup>	Description
A99BA-200C	Positive temperature coefficient (PTC) Temperature Sensor: Standard probe 2 in. (5.1 cm) with 6.6 ft (2.0 m) shielded polyvinyl chloride (PVC) cable; ambient operating temperature range: -40°F to 212°F (-40°C 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°F to 212°F (-40°C to 100°C)

**Table 69: A99 Temperature Sensors**

Product code <sup>1</sup>	Description
A99BB-200C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 6.6 ft (2.0 m) PVC cable; ambient operating temperature range: -40°F to 212°F (-40°C to 100°C)
A99BB-300C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 9.8 ft (3.0 m) PVC cable; ambient operating temperature range: -40°F to 212°F (-40°C 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°F to 212°F (-40°C to 100°C)
A99BB-600C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 19.7 ft (6.0 m) PVC cable; ambient operating temperature range: -40°F to 212°F (-40°C to 100°C)
A99BC-25C <sup>1</sup>	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°F to 248°F (-40°C to 100°C)
A99BC-100C <sup>1</sup>	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 3.3 ft (1.0 m) high-temperature silicon cable; ambient operating temperature range: -40°F to 248°F (-40°C to 120°C)
A99BC-300C <sup>1</sup>	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 9.8 ft (3.0 m) high-temperature silicon cable; ambient operating temperature range: -40°F to 248°F (-40°C to 120°C)
A99BC-500C <sup>1</sup>	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 16.4 ft (5.0 m) high-temperature silicon cable; ambient operating temperature range: -40°F to 248°F (-40°C to 120°C)
A99BC-1500C <sup>1</sup>	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 49.2 ft (15.0 m) high-temperature silicon cable; ambient operating temperature range: -40°F to 248°F (-40°C to 120°C)
A99CB-200C	PTC Temperature Sensor: Extended probe 6 in. (15.2 cm) with 6.6 ft (2.0 m) PVC cable; ambient operating temperature range: -40°F to 212°F (-40°C to 100°C)
A99CB-600C	PTC Temperature Sensor: Extended probe 6 in. (15.2 cm) with 19.7 ft (6.0 m) PVC cable; ambient operating temperature range: -40°F to 212°F (-40°C to 100°C)

<sup>1</sup> When any A99 Series Temperature Sensor is connected to a standard A421 Control model, the range of displayed temperature values is -40°F to 212°F or -40°C to 100°C.

**Table 70: Accessories for the A421 Controls**

Product code	Description
BKT287-1R	12 in. (305 mm) long DIN rail section
BKT287-2R	36 in. (914 mm) long DIN rail section

**Table 70: Accessories for the A421 Controls**

Product code	Description
PLT344-1R	Two end clamps for DIN rail sections
A99-CLP-1	Surface mounting clip for A99B and A99C Series Temperature Sensors
SHL10-603R	Sun shield for A99B and A99C Series Temperature Sensors
BOX10A-603R	PVC enclosure for A99B and A99C Series Temperature Sensors
WEL11A-601R	Immersion well for applying sensor in fluid applications

## Technical specifications

**Table 71: A421 Series Electronic Temperature Controls Technical Specifications**

Specification	Description
Power consumption	1.8 VA maximum
Supply power	110/120 VAC, 50/60 Hz
Ambient conditions	Operating: Type 1 models: -40°F to 150°F (-40°C to 66°C), 0% to 95% RH noncondensing Type 4X models: -40°F to 140°F (-40°C to 60°C), 0% to 95% RH noncondensing Shipping and storage: All models: -40°F to 185°F (-40°C to 85°C), 0% to 95% RH noncondensing
Temperature control range	-40°F to 212°F or -40°C 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
Enclosure material	Type 1, IP20 high-impact thermoplastic or Type 4X, IP66 watertight, corrosion-resistant, high-impact thermoplastic  ① <b>Note:</b> On the Type 4x enclosures, the cover screws must be torqued to 10 in·lbs to 12 in·lbs (1.1 N·m to 1.4 N·m) to achieve Type 4X rating.
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

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



## A421 Series Electronic Temperature Controls with Off Cycle Defrost



### Description

The A421 Series Standard Electronic Temperature Controls are single stage, electronic temperature controls with a single-pole, double-throw (SPDT) output relay. The controls feature an adjustable backlit LCD for viewing the temperature and status of other functions, and a three-button touchpad for setup and adjustment. An LED indicates the On/Off status of the output relay. The A421 Controls are available in 120 VAC and 240 VAC models.

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

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

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

Refer to the *A421 Series Electronic Temperature Controls Product Bulletin (LIT-12012219)* for important product application information.

### Applications

You can use the A421 Control to manage a wide range of single-stage refrigeration or HVAC equipment. Sample temperature control applications include:

- On/off control chillers
- Chiller pump control
- Cooling control

### Features and benefits

#### Control front panel LCD

Displays the temperature, parameters, and status. You can adjust the backlight intensity for ambient light conditions. Custom icons display the system and control status.

#### Basic and Advanced programming menu

Provides two levels of parameter adjustment and control. You can set up advanced features in one menu and adjust basic parameters in the other menu.

### Off-Cycle defrost

Shut off the refrigeration system for defined defrost time interval and frequency. You can also start or stop a manual only defrost off-cycle.

### On/Off temperature adjustment

Select the temperature values at which the relay turns on and off and automatically define the mode of operation.

### Switch-activated temperature setback

Shift the On/Off temperature by an adjustable setback. When a user-supplied switch closes the binary input control circuit, temperature setback is enabled.

### Adjustable anti-short cycle delay (ASd)

Select the minimum time the output relay remains off before the next on-cycle. By selecting this minimal time, you can avoid short cycling, hard starts, and nuisance overload outages on compressors and other inductive applications.

### Adjustable sensor offset

Adjust the displayed temperature to the actual sensed temperature.

### Optional restricted adjustment mode

Restrict the On/Off adjustment to your defined temperature range.

### Sensor failure mode

Run the control continuously in the event of a sensor or sensor wire failure or to shut it down.

### Backlight brightness level

Adjust the brightness of the backlighting of the LCD screen. The backlight brightness level is applied during normal operation. When you set up or adjust the parameters, the LCD automatically goes to the brightest level.

## Ordering information

Contact your nearest Johnson Controls or PENN distributor or sales representative to order sensors, mounting hardware, and other accessories to

install the A421 Controls. Contact your local Johnson Controls or PENN representative for more information on options available for high-volume purchase models with specific application requirements.

## Selection charts

**Table 72: A421 Series Standard Electronic Temperature Control**

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

**Table 73: A99 Temperature Sensors**

Product code <sup>1</sup>	Description
A99BA-200C	Positive temperature coefficient (PTC) Temperature Sensor: Standard probe 2 in. (5.1 cm) with 6.6 ft (2.0 m) shielded polyvinyl chloride (PVC) cable; ambient operating temperature range: -40°F to 212°F (-40°C 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°F to 212°F (-40°C to 100°C)
A99BB-200C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 6.6 ft (2.0 m) PVC cable; ambient operating temperature range: -40°F to 212°F (-40°C to 100°C)
A99BB-300C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 9.8 ft (3.0 m) PVC cable; ambient operating temperature range: -40°F to 212°F (-40°C to 100°C)

**Table 73: A99 Temperature Sensors**

Product code <sup>1</sup>	Description
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°F to 212°F (-40°C to 100°C)
A99BB-600C	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 19.7 ft (6.0 m) PVC cable; ambient operating temperature range: -40°F to 212°F (-40°C to 100°C)
A99BC-25C <sup>1</sup>	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°F to 248°F (-40°C to 120°C)
A99BC-100C <sup>1</sup>	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 3.3 ft (1.0 m) high-temperature silicon cable; ambient operating temperature range: -40°F to 248°F (-40°C to 120°C)
A99BC-300C <sup>1</sup>	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 9.8 ft (3.0 m) high-temperature silicon cable; ambient operating temperature range: -40°F to 248°F (-40°C to 120°C)
A99BC-500C <sup>1</sup>	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 16.4 ft (5.0 m) high-temperature silicon cable; ambient operating temperature range: -40°F to 248°F (-40°C to 120°C)
A99BC-1500C <sup>1</sup>	PTC Temperature Sensor: Standard probe 2 in. (5.1 cm) with 49.2 ft (15.0 m) high-temperature silicon cable; ambient operating temperature range: -40°F to 248°F (-40°C to 120°C)
A99CB-200C	PTC Temperature Sensor: Extended probe 6 in. (15.2 cm) with 6.6 ft (2.0 m) PVC cable; ambient operating temperature range: -40°F to 212°F (-40°C to 100°C)
A99CB-600C	PTC Temperature Sensor: Extended probe 6 in. (15.2 cm) with 19.7 ft (6.0 m) PVC cable; ambient operating temperature range: -40°F to 212°F (-40°C to 100°C)

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

**Table 74: Accessories for the A421 Controls**


Product code	Description
BKT287-1R	12 in. (305 mm) long DIN rail section
BKT287-2R	36 in. (914 mm) long DIN rail section
PLT344-1R	Two end clamps for DIN rail sections
A99-CLP-1	Surface mounting clip for A99B and A99C Series Temperature Sensors
SHL10-603R	Sun shield for A99B and A99C Series Temperature Sensors

**Table 74: Accessories for the A421 Controls**

Product code	Description
BOX10A-603R	PVC enclosure for A99B and A99C Series Temperature Sensors
WEL11A-601R	Immersion well for applying sensor in fluid applications

## Technical specifications

**Table 75: A421 Series Electronic Temperature Control Technical Specifications**

Specification	Description
Power consumption	1.8 VA maximum
Supply power	Class 2: 108/110/115/120 or 208/230/240 VAC, 50/60 Hz
Ambient conditions	Type 1/IP20: Operating: -40°F to 150°F (-40°C to 66°C), 0% to 95% RH noncondensing Shipping and storage: -40°F to 185°F (-40°C to 85°C), 0% to 95% RH noncondensing Type 4X/IP66: Operating: -40°F to 140°F (-40°C to 60°C) Shipping and storage: -40°F to 140°F (-40°C to 60°C)
Temperature control range	-40°F to 212°F or (-40°C to 100°C)
Sensor type	A99 PTC temperature sensor, 1,035 ohm at 77°F (25°C)
Sensor offset range	±5°F or ±3°C
Enclosure material	Type 1: IP20 high-impact thermoplastic or Type 4X: IP66 watertight, corrosion-resistant, high-impact thermoplastic
Compliance	<b>North America:</b> 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  <b>Europe:</b> CE Mark – Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive; Low Voltage Directive. <b>Australia:</b> Regulatory Compliant Mark (RCM)

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



# A421 Series Electronic Temperature Controls with Cycle Timer



## Description

The A421 Series Standard Electronic Temperature Controls are single-stage, electronic temperature controls with a single-pole, double-throw (SPDT) output relay. The controls feature an adjustable backlit LCD for viewing the temperature and status of other functions, and a three-button touchpad for setup and adjustment. An LED indicates the On/Off status of the output relay. The A421 Controls with cycle timer can be powered with either 120 VAC or 240 VAC.

The A421 Control with Cycle Timer is a free-cooling, duty-cycle ventilation control. This control provides timed-ventilation and overcooling protection.

A421 Control with Cycle Timer also provides sensor offset capability and restricted user adjustment. The temperature control range is -40°F to 212°F or -40°C to 100°C.

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

Refer to the *A421 Series Electronic Temperature Controls Product Bulletin (LIT-12012249)* for important product application information.

The control housing base on the Type 4X/IP66 models can be easily rotated 180° relative to the control housing cover and LCD, allowing you to bring the electrical connection to either the top or bottom of the mounted control.

## Applications

The A421 equipped with Cycle Timer is used in agricultural and related applications where free-cooling and ventilation are needed.

## Features and benefits

### Control front panel LCD

Displays the temperature, parameters, and status. You can adjust the backlight brightness for ambient light conditions. Custom icons display the system and control status.

### Basic and Advanced programming menu

Provides two levels of parameter adjustment and control setup. You can set up advanced features in one menu and easily adjust basic parameters in the other menu.

### Free-cooling and ventilation

Adjust for free-cooling and timed-ventilation, and provides over-cooling protection.

### On/Off temperature adjustment

Adjust the On/Off temperature values.



### Switch-activated override

Override the control using a switch connected to the binary input. Closing the switch turns the relay on. Normal control action is resumed when the switch is opened.

### Adjustable sensor offset

Adjust the displayed temperature to the actual sensed temperature.

### Optional restricted adjustment mode

Restrict the On/Off adjustment to your defined temperature range.

### Sensor failure mode

Run the control continuously in the event of a sensor or sensor wire failure or to shut it down.

### Backlight brightness level

Adjust the brightness of the backlighting of the LCD screen. The backlight brightness level is applied during normal operation. When you set up or adjust the parameters, the LCD automatically goes to the brightest level.

## Ordering information

Contact your nearest Johnson Controls or PENN distributor or sales representative to order sensors, mounting hardware, and other accessories used to install A421 Controls. Contact your local Johnson Controls or PENN representative for more information on options available for high-volume purchase models with specific application requirements.

## Selection charts

**Table 76: A421 Series Electronic Temperature Control with Cycle Timer**

Product code	Description
A421ABT-02C	Line-Voltage Type 1 Electronic Temperature Control with Cycle Timer: Type 1 (NEMA), IP20 standard enclosure for DIN rail and surface-mount applications. Rated for 120/240 VAC. Includes A99 positive temperature coefficient (PTC) sensor with 6.6 ft (2.0 m) cable.
A421AET-01C	Line-Voltage Type 4X Electronic Temperature Control with Cycle Timer: Type 4X (NEMA), IP66 watertight enclosure for surface-mount applications. Rated for 120/240 VAC. Includes an A99BB-25C temperature sensor with 9 7/8 in. (0.25 m) cable.

**Table 77: A99 Temperature Sensors**

Product code <sup>1</sup>	Description
A99BA-200C	PTC temperature sensor: Standard probe 2 in. (5.1 cm) with 6.6 ft (2.0 m) shielded polyvinyl chloride (PVC) cable; ambient operating temperature range: -40°F to 212°F (-40°C 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°F to 212°F (-40°C to 100°C)
A99BB-200C	PTC temperature sensor: Standard probe 2 in. (5.1 cm) with 6.6 ft (2.0 m) PVC cable; ambient operating temperature range: -40°F to 212°F (-40°C to 100°C)
A99BB-300C	PTC temperature sensor: Standard probe 2 in. (5.1 cm) with 9.8 ft (3.0 m) PVC cable; ambient operating temperature range: -40°F to 212°F (-40°C 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°F to 212°F (-40°C to 100°C)
A99BB-600C	PTC temperature sensor: Standard probe 2 in. (5.1 cm) with 19.7 ft (6.0 m) PVC cable; ambient operating temperature range: -40°F to 212°F (-40°C to 100°C)
A99BC-25C <sup>1</sup>	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°F to 248°F (-40°C to 100°C)
A99BC-100C <sup>1</sup>	PTC temperature sensor: Standard probe 2 in. (5.1 cm) with 3.3 ft (1.0 m) high-temperature silicon cable; ambient operating temperature range: -40°F to 248°F (-40°C to 120°C)

**Table 77: A99 Temperature Sensors**

Product code <sup>1</sup>	Description
A99BC-300C <sup>1</sup>	PTC temperature sensor: Standard probe 2 in. (5.1 cm) with 9.8 ft (3.0 m) high-temperature silicon cable; ambient operating temperature range: -40°F to 248°F (-40°C to 120°C)
A99BC-500C <sup>1</sup>	PTC temperature sensor: Standard probe 2 in. (5.1 cm) with 16.4 ft (5.0 m) high-temperature silicon cable; ambient operating temperature range: -40°F to 248°F (-40°C to 120°C)
A99BC-1500C <sup>1</sup>	PTC temperature sensor: Standard probe 2 in. (5.1 cm) with 49.2 ft (15.0 m) high-temperature silicon cable; ambient operating temperature range: -40°F to 248°F (-40°C to 120°C)
A99CB-200C	PTC temperature sensor: Extended probe 6 in. (15.2 cm) with 6.6 ft (2.0 m) PVC cable; ambient operating temperature range: -40°F to 212°F (-40°C to 100°C)
A99CB-600C	PTC temperature sensor: Extended probe 6 in. (15.2 cm) with 19.7 ft (6.0 m) PVC cable; ambient operating temperature range: -40°F to 212°F (-40°C to 100°C)

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

**Table 78: Accessories**

Product code	Description
BKT287-1R	12 in. (305 mm) long DIN rail section
BKT287-2R	36 in. (914 mm) long DIN rail section
PLT344-1R	Two end clamps for DIN rail sections
A99-CLP-1	Surface mounting clip for A99B and A99C Series Temperature Sensors
SHL10-603R	Sun shield for A99B and A99C Series Temperature Sensors
BOX10A-603R	PVC enclosure for A99B and A99C Series Temperature Sensors
WEL11A-601R	Brass and copper immersion well for applying sensor in fluid applications
TE-6300W-102	Stainless steel immersion well for applying A99 sensors in fluid applications. (A99CB Type sensors with extended probe are recommended for use with this immersion well.)

## Technical specifications

**Table 79: A421 Series Electronic Temperature Control Technical Specifications**

Specification	Description
Power consumption	1.8 VA maximum
Supply power	110/120 or 208/230/240 VAC, 50/60 Hz

**Table 79: A421 Series Electronic Temperature Control Technical Specifications**

Specification	Description
Ambient conditions	Type 1/IP20: Operating: -40°F to 150°F (-40°C to 66°C), 0% to 95% RH noncondensing Shipping and storage: -40°F to 185°F (-40°C to 85°C), 0% to 95% RH noncondensing Type 4X/IP66: Operating: -40°F to 140°F (-40°C to 60°C) Shipping and storage: -40°F to 140°F (-40°C to 60°C)
Temperature control range	-40°F to 212°F or (-40°C to 100°C)
Sensor type	A99 PTC temperature sensor: 1,035 ohm at 77°F (25°C)
Sensor offset range	±5°F or ±3°C
Enclosure material	Type 1, IP20 high-impact thermoplastic or Type 4X, IP66 watertight, corrosion-resistant, high-impact thermoplastic <b>Note:</b> To maintain type 4X / IP66 rating, tighten enclosure screws to: 10-12 in·lb
Compliance	<b>North America:</b> 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 <b>Europe:</b> CE Mark – Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive; Low Voltage Directive. <b>Australia/NZ:</b> RCM Emissions Compliant

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

# 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.

## 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
- 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

## 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

**Table 80: MR4PMUHV Electronic Temperature/Defrost Control with Relay Pack**

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

**Table 81: 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/1.98 m

## MR4PMUHV Electronic Temperature/Defrost Control with Relay Pack technical specifications

**Table 82: MR4PMUHV Electronic Temperature/Defrost Control with Relay Pack technical specifications**

Specification	Description						
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	<table border="1"> <tr> <td>MR4PMUHV-12C</td> <td>+14° to +111°F/-10° to +44°C; derating 6.25% per 1°C to 60°C; 0 to 95% RH (noncondensing)</td> </tr> <tr> <td>MR4PM12C-12C</td> <td>+14° to +140°F/-10° to +60°C; 0 to 95% RH (noncondensing)</td> </tr> <tr> <td>RP4MRUHV-1C</td> <td>-40° to +111°F/ -40° to +44°C; derating 6.25% per 1°C to 60°C; 0 to 95% RH (noncondensing)</td> </tr> </table>	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)
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	<table border="1"> <tr> <td>MR4PMUHV-12C</td> <td>-22° to +176°F/-30° to +80°C; 0 to 95% RH (noncondensing)</td> </tr> <tr> <td>MR4PM12C-12C</td> <td>-22° to +176°F/-30° to +80°C; 0 to 95% RH (noncondensing)</td> </tr> <tr> <td>RP4MRUHV-1C</td> <td>-40° to +185°F/-40° to +85°C; 0 to 95% RH (noncondensing)</td> </tr> </table>	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)
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						
Agency Listings	UL Listed (File SA516, UL Guide SDFY; cUL Guide SDFY7)						
Shipping Weight	2.9 lb/1,320 g						

**Table 83: 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

**Table 83: Relay Electrical Ratings**

	24	120	208	240
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

**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).



## TC Series Refrigeration and Defrost Controller



### Description

The TC Series controllers are a range of energy efficient, microprocessor-based, multifunctional, programmable temperature controls for self-contained refrigeration systems that operate with both on-off switches and variable speed compressors. Depending on the model you choose, TC Series controllers can also manage alarms, active or passive defrost cycles, evaporator fan functions, and case lighting.

A large, red LED display is standard for all TC Series controllers. These compact controllers are available in panel mounting or DIN rail mounting types. TC Series controllers use EVTPN temperature sensors, so that you can remotely mount the display unit. All TC Series controllers have a variety of optional inputs and output relays to perform compressor, defrost, evaporator fan, lighting control, and alarm management control. TC Series controllers consist of three groups of controllers: TC3B, TC3, and TC3X. Refer to the *Penn TC Series Refrigeration and Defrost Controller Product Bulletin* (LIT-12013344) for important product application information.

### Features and benefits

#### Capacitive touch keys

The patented capacitive touch UI provides the controller with a modern and elegant design. You can easily clean the controller's flat front surface. The capacitive touch keys provide reliable, long-life operation and eliminate a common point of failure with electromechanical keys that many competitive devices contain.

#### Variable speed compressor

The TC3B Series includes a model that drives Tecumseh, Embraco, and Secop variable speed compressors.

#### IP65 rating

The capacitive touch UI achieves an IP65 rating. The water resistant UI minimizes the risk of damage due to water and moisture entering the controller.

#### Adaptive defrost

The controller monitors the heat transfer performance of the evaporator coil to start defrost at the time that the environment requires. If you optimize the defrost cycle based on the system demand, you increase energy efficiency, along with the quality and shelf life of refrigerated products.

#### Compressor protection

Active power line monitoring ensures that the compressor only cycles on at the optimal point.

#### TC3KEY programming key

Use the TC3KEY programming key to automatically program devices. You can store and replicate programmed device configurations on another

TC3 device. Integrated LEDs indicate progress and completion status.

### Reduced depth option

TC3X series controllers are ideal for applications that require a reduced panel-mount depth of 39.5 mm (1 9/16 in.).

### Optional RS485 communications adapter

Some TC3 models are compatible with optional TTL to RS485 serial adapters for Modbus RS485 communications. You can use DIP switches or software parameters to configure the Modbus address.

- ① **Note:** TC3B and TC3X models do not have a TTL connection and are not compatible with the RS485 communications adapters.

### Optional communications adapter real-time clock

The TCIF23 model RS485 communications adapter includes a real-time clock. The clock ensures that the controller performs daily defrost schedules at the correct time of day, and stores all logging samples accurately with a time and a date stamp to facilitate accurate Hazard Analysis and Critical Control Point (HACCP) reporting.

### Optional color display

The standard TC display is red. If you order more than a minimum quantity, you can order controllers with white, blue, or green LED displays.

## Applications

Use the TC Series controllers to control a variety of refrigerators, coolers, and freezers.

- **Important:** Use the TC Series controller only as an operating control. Where failure or malfunction of the TC controller could lead to personal injury or property damage to the controlled equipment or other property, additional precautions must be designed

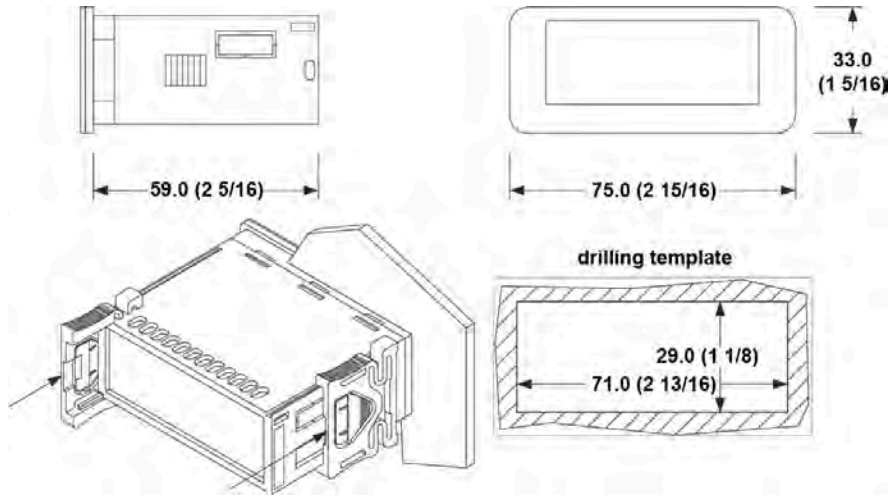
into the control system. Incorporate and maintain other devices, such as supervisory or alarm systems or safety or limit controls, intended to warn of or protect against failure or malfunction of the TC controller.

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

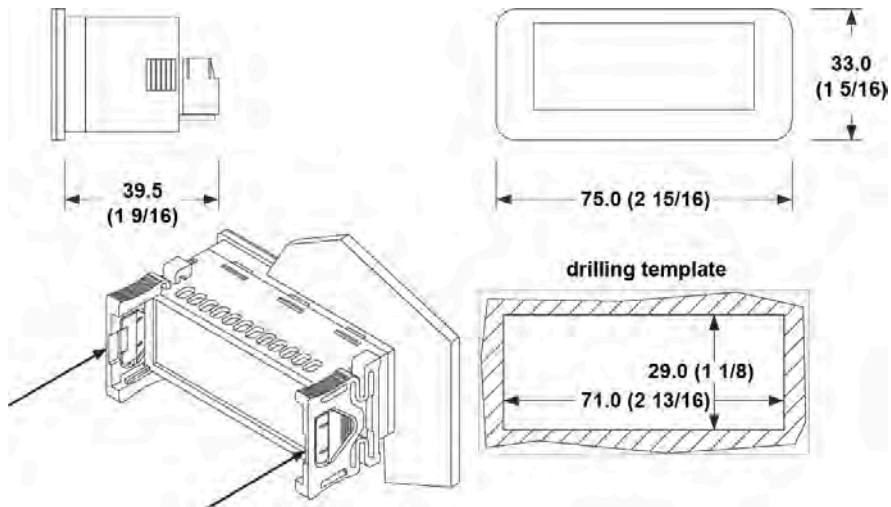
## Dimensions

The following figures show the TC controller dimensions and the panel cut-out dimensions that you require to insert the TC controller into the panel.

**Figure 13: TC3B and TC3 controller dimensions, mm (in.)**



**Figure 14: TC3X controller dimensions, mm (in.)**



## Ordering information

The following tables contain product codes and descriptions for the TC controller models.

- ① **Note:** The function of the K2 relay depends on the model. You can configure the K2 or K4 relays on certain models. For more information, see the following table.

**Table 84: TC controller feature matrix**

Information		Product code															
		TC3221N5V	TC3221N7V	TC3222N5V	TC3222N7V	TC3223N5V	TC3223N7V	TC3224N9R	TC3B21N5V	TC3B21N7V	TC3B22N5V	TC3B22N7V	TC3B23N5V	TC3B23N7V	TC3B54N9V	TC3X21N5V	TC3X21N7V
Temperature	Low temperature			x		x		x			x		x		x		
	Medium temperature	x		x					x		x				x		x
Power	115 VAC (N5)	x		x		x			x		x		x			x	
	230 VAC (N7)		x		x		x			x		x		x			x
	Universal 115 VAC to 230 VAC (N9)						x								x		
Terminals	Screw down	x		x		x			x		x		x		x		x
	Plug-in screw						x										
Inputs	Room and case temperature only	x		x		x		x		x		x		x		x	
	Configurable temperature input			x		x					x		x				
	Configurable temperature or switch input	x				x		x		x					x		x
	Door switch only							x							x		
	Evaporator temperature only							x							x		
Outputs	K1 relay	Compressor only	x		x		x		x		x		x				x
		Configurable													x		
	K2 relay	Defrost only					x		x					x			
		Evaporator fan, defrost, or configurable			x							x			x		
	K3 relay	Evaporator fan only					x		x					x			
		Configurable														x	
	K4 relay	Cabinet light or configurable							x								
Configurable															x		
	PWM triac output														x		
Communications	TTL Modbus	x		x		x		x									
	RS485 Modbus	TCIF22 Adapter		TCIF22 Adapter		TCIF22 Adapter		Built-in									
	Real-time clock and HACCP and RS485 Modbus	TCIF23 Adapter		TCIF23 Adapter		TCIF23 Adapter		Built-in									



**Table 85: TC defrost controller single pack ordering information**

Product code	Summary
TC3221N5V-000C	Two inputs, one output, power supply 115 VAC, TTL Modbus. One EVTPN615F200-1C sensor included.
TC3221N7V-000C	Two inputs, one output, power supply 230 VAC, TTL Modbus. One EVTPN615F200-1C sensor included.
TC3222N5V-000C	Two inputs, two outputs, power supply 115 VAC, TTL Modbus. Two EVTPN615F200-1C sensors included.
TC3222N7V-000C	Two inputs, two outputs, power supply 230 VAC, TTL Modbus. Two EVTPN615F200-1C sensors included.
TC3223N5V-000C	Two inputs, three outputs, power supply 115 VAC, TTL Modbus. Two EVTPN615F200-1C sensors included.
TC3223N7V-000C	Two inputs, three outputs, power supply 230 VAC, TTL Modbus. Two EVTPN615F200-1C sensors included.
TC3224N9R-000C	Two inputs, four outputs, universal power supply 115 VAC to 230 VAC, built-in RS485 Modbus. Two EVTPN615F200-1C sensors included.
TC3B21N5V-000C	Two inputs, one output, power supply 115 VAC, no communication. One EVTPN615F200-1C sensor included.
TC3B21N7V-000C	Two inputs, one output, power supply 230 VAC, no communication. One EVTPN615F200-1C sensor included.
TC3B22N5V-000C	Two inputs, two outputs, power supply 115 VAC, no communication. Two EVTPN615F200-1C sensors included.
TC3B22N7V-000C	Two inputs, two outputs, power supply 230 VAC, no communication. Two EVTPN615F200-1C sensors included.
TC3B23N5V-000C	Two inputs, three outputs, power supply 115 VAC, no communication. Two EVTPN615F200-1C sensors included.
TC3B23N7V-000C	Two inputs, three outputs, power supply 230 VAC, no communication. Two EVTPN615F200-1C sensors included.
TC3B54N9V-000C	Two inputs, four relay outputs, one PWM output, universal power supply 115 VAC to 230 VAC, no communication. Two EVTPN615F200-1C sensors included.
TC3X21N5V-000C	Two inputs, one output, power supply 115 VAC, compact size, no communication. One EVTPN615F200-1C sensor included.
TC3X21N7V-000C	Two inputs, one output, power supply 230 VAC, compact size, no communication. One EVTPN615F200-1C sensor included.

## Sensors and accessories

The following tables contain accessories and sensors that you can order for the controllers. For more information on the communications accessories that you can use with each controller, see Table 84.

**Table 86: Accessories for the TC controller**

Product code	Description
TC3KEY	Programming KEY: A cloning tool to download configuration settings from a controller, and upload the settings to other identical controllers.
TCCBL100	Connecting cable: A cable to connect a TC controller to a PC's USB port. Length: 1 m (3.28 ft).
TCIF22TSX	TTL to RS485 Modbus serial communications interface: Connects to an RS485 Modbus network.
TCIF23TSX	TTL to RS485 Modbus serial communications interface and real-time clock: Connects to an RS485 Modbus network. Adds a real-time clock to the controller for scheduled defrost and HACCP data reporting.

**Figure 15: TC Series accessories TC3KEY (left) and TCIF22TSX/TCIF23TSX (right)**



**Table 87: Sensors for the TC controller**

Product code	Description
EVTPN615F200-1C	10K ohm NTC sensor. IP67 protection level, overmolded thermoplastic material, 1.5 m (4.9 ft) cable length. Single pack, quantity of 1.
EVTPN615F200-1D	10K ohm NTC sensor. IP67 protection level, overmolded thermoplastic material, 1.5 m (4.9 ft) cable length. Bulk pack, quantity of 100.
EVTPN630F200-1C	10K ohm NTC sensor. IP67 protection level, overmolded thermoplastic material, 3.0 m (9.8 ft) cable length. Single pack, quantity of 1.
EVTPN630F200-1D	10K ohm NTC sensor. IP67 protection level, overmolded thermoplastic material, 3.0 m (9.8 ft) cable length. Bulk pack, quantity of 100.
EVTPNW15F200-1C	10K ohm NTC sensor. IP68 water resistant protection level, overmolded thermoplastic material, 1.5 m (4.9 ft) cable length. Single pack, quantity of 1.
EVTPNW15F200-1D	10K ohm NTC sensor. IP68 water resistant protection level, overmolded thermoplastic material, 1.5 m (4.9 ft) cable length. Bulk pack, quantity of 100.
EVTPNW30F200-1C	10K ohm NTC sensor. IP68 water resistant protection level, overmolded thermoplastic material, 3.0 m (9.8 ft) cable length. Single pack, quantity of 1.
EVTPNW30F200-1D	10K ohm NTC sensor. IP68 water resistant protection level, overmolded thermoplastic material, 3.0 m (9.8 ft) cable length. Bulk pack, quantity of 100.

## Electrical ratings

The following tables show the electrical ratings for single-pole, single-throw (SPST) and single-pole, double-throw (SPDT) control relays in the TC controller.

**Table 88: K1 compressor relay ratings**

		cULus (UL 60730)		CE (EN 60730)
Applied voltage at 60 Hz		120 VAC	240 VAC	240 VAC
Resistive amperes	TC3Bxx	12 A	12 A	10 A
	TC3Xxx	10 A	10 A	10 A
	TC32xx	12 A	12 A	12 A
Inductive amperes		—	—	2 A
Full load amperes		10 A	10 A	—
Locked rotor amperes		60 A	60 A	—

**Table 89: K2 defrost, evaporator fan or configurable relay ratings**

		cULus (UL 60730)		CE (EN 60730)
Applied voltage at 60 Hz		120 VAC	240 VAC	240 VAC
Resistive amperes		8 A	8 A	5 A
Inductive amperes		—	—	2 A
Full load amperes		4.4 A	2.9 A	—
Locked rotor amperes		26.4 A	17.4 A	—

**Table 90: K3 evaporator fan relay ratings**

		cULus (UL 60730)		CE (EN 60730)
Applied voltage at 60 Hz		120 VAC	240 VAC	240 VAC
Resistive amperes		5 A	5 A	5 A
Inductive amperes		—	—	1 A
Full load amperes		1.5 A	1.5 A	—
Locked rotor amperes		9 A	9 A	—

**Table 91: K4 cabinet light or configurable relay ratings**

		cULus (UL 60730)		CE (EN 60730)
Applied voltage at 60 Hz		120 VAC	240 VAC	240 VAC
Resistive amperes		5 A	5 A	5 A
Inductive amperes		—	—	1 A
Full load amperes		1.5 A	1.5 A	—
Locked rotor amperes		9 A	9 A	—

# TC Series Refrigeration Controller technical specifications

**Table 92: TC Series models**

Specification	Description						
Purpose of the control device	Function controller						
Construction of the control device	Built-in electronic device						
Container	Black, self-extinguishing						
Category of heat and fire resistance	D						
Mounting methods for the control device	Fits a panel, snap-in brackets provided						
Degree of protection provided by the covering	IP65 (front)						
Connection method	Fixed screw terminal blocks for wires up to 2.5 mm <sup>2</sup> (14 AWG)						
Maximum length for power supply, input and output cables	10 m (32.8 ft)						
Operating temperature	From 0°C to 55°C (from 32°F to 131°F)						
Storage temperature	From -25°C to 70°C (from -13°F to 158°F)						
Operating humidity	Relative humidity without condensate from 10% to 90%						
Pollution status of the control device	2						
Compliance	<p>North America:</p> <p>United States: cURus Recognized; File SA32187 CCN SDFY2; FCC Compliant to CFR47, Part 15, Subpart B, Class A limits</p> <p>Canada: cURus Recognized; File SA32187 CCN SDFY8; Industry Canada (IC) compliant to Canadian ICES-003, Class A limits</p> <p>Europe:</p> <p>CE Mark – Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive, Low Voltage Directive, and RoHS Directive</p>						
Power supply	<table border="1"> <tr> <td>N5 models</td> <td>115 VAC (+10% -15%), 50/60 Hz (±3 Hz), maximum 2 VA</td> </tr> <tr> <td>N7 models</td> <td>230 VAC (+10% -15%), 50/60 Hz (±3 Hz), maximum 2 VA</td> </tr> <tr> <td>N9 models</td> <td>115 VAC to 230 VAC (+10% -15%), 50/60 Hz (±3 Hz), maximum 3.2 VA</td> </tr> </table>	N5 models	115 VAC (+10% -15%), 50/60 Hz (±3 Hz), maximum 2 VA	N7 models	230 VAC (+10% -15%), 50/60 Hz (±3 Hz), maximum 2 VA	N9 models	115 VAC to 230 VAC (+10% -15%), 50/60 Hz (±3 Hz), maximum 3.2 VA
N5 models	115 VAC (+10% -15%), 50/60 Hz (±3 Hz), maximum 2 VA						
N7 models	230 VAC (+10% -15%), 50/60 Hz (±3 Hz), maximum 2 VA						
N9 models	115 VAC to 230 VAC (+10% -15%), 50/60 Hz (±3 Hz), maximum 3.2 VA						
Grounding methods for the control device	None						
Rated impulse-withstand voltage	4 KV						
Over-voltage category	III						
Software class and structure	A						
Analog inputs	1 for NTC cabinet probes						
NTC probes	<table border="1"> <tr> <td>Sensor type</td> <td>B3435 (10 KW @ 25°C, 77°F)</td> </tr> <tr> <td>Measurement field</td> <td>From -40°C to 105°C (from -40°F to 221°F)</td> </tr> <tr> <td>Resolution</td> <td>0.1°C (1.0°F)</td> </tr> </table>	Sensor type	B3435 (10 KW @ 25°C, 77°F)	Measurement field	From -40°C to 105°C (from -40°F to 221°F)	Resolution	0.1°C (1.0°F)
Sensor type	B3435 (10 KW @ 25°C, 77°F)						
Measurement field	From -40°C to 105°C (from -40°F to 221°F)						
Resolution	0.1°C (1.0°F)						
Dry contact	<table border="1"> <tr> <td>Contact type</td> <td>5 VDC, 1.5 mA</td> </tr> <tr> <td>Power supply</td> <td>None</td> </tr> <tr> <td>Protection</td> <td>None</td> </tr> </table>	Contact type	5 VDC, 1.5 mA	Power supply	None	Protection	None
Contact type	5 VDC, 1.5 mA						
Power supply	None						
Protection	None						
PWM signal output	<table border="1"> <tr> <td>Power supply</td> <td>12 VDC (+16%, -12%), 20 mA maximum</td> </tr> <tr> <td>Frequency</td> <td>0 Hz to 150 Hz</td> </tr> <tr> <td>Protection</td> <td>None</td> </tr> </table>	Power supply	12 VDC (+16%, -12%), 20 mA maximum	Frequency	0 Hz to 150 Hz	Protection	None
Power supply	12 VDC (+16%, -12%), 20 mA maximum						
Frequency	0 Hz to 150 Hz						
Protection	None						
Type 1 or Type 2 actions	Type 1						

**Table 92: TC Series models**

Specification	Description
Additional features of Type 1 or Type 2 actions	C
Displays	3 digits custom display, with function icons

**Table 93: TC Series accessory TC3KEY**

Specification	Description
Container	Black, self-extinguishing
Category of heat and fire resistance	D
Measurements:	33.0 mm x 73.5 mm x 13.0 mm (1 5/16 in. x 2 7/8 in. x 1/2 in.)
Degree of protection provided by the covering	IP00
Connection method:	
Clamp connector	Female Micro-B USB connector
Operating temperature	From 0°C to 55°C (from 32°F to 131°F)
Storage temperature	From -25°C to 70°C (from -13°F to 158°F)
Operating humidity	Relative humidity without condensate from 10% to 90%
Compliance	<p>North America:</p> <p>United States: cURus Recognized; File SA32187 CCN SDFY2; FCC Compliant to CFR47, Part 15, Subpart B, Class A limits</p> <p>Canada: cURus Recognized; File SA32187 CCN SDFY8; Industry Canada (IC) compliant to Canadian ICES-003, Class A limits</p> <p>Europe:</p> <p>CE Mark – Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive, Low Voltage Directive, and RoHS Directive</p>
Power supply	USB power supply
Software class and structure	A
Displays	Upload/download status LED

**Table 94: TC Series accessories TCIF22TSX and TCIF23TSX**

Specification	Description
Container	Black, self-extinguishing
Category of heat and fire resistance	D
Measurements	176.0 mm x 30.0 mm x 25.0 mm (6 15/16 in. x 1 3/16 in. x 1 in.)
Mounting methods for the control device	On rigid support, with cable tie (not provided)
Degree of protection provided by the covering	IP00
Connection method:	Pico-Blade connector
Maximum permitted length for connection cables	Fixed screw terminal block for wires up to 2.5 mm <sup>2</sup>
Operating temperature	RS485 Modbus port: 1,000 m (328 ft)
Storage temperature	From 0°C to 55°C (from 32°F to 131°F)
Operating humidity	From -25°C to 70°C (from -13°F to 158°F)
Compliance	Relative humidity without condensate from 5% to 95%
Compliance	<p>Europe:</p> <p>CE Mark – Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive and RoHS Directive</p>

**Table 94: TC Series accessories TCIF22TSX and TCIF23TSX**

Specification	Description
Power supply	The device is powered by the TTL Modbus port of the controller
Software class and structure	A
Displays	TTL Modbus and RS485 Modbus communication status LED
Communications ports:	1 TTL Modbus subordinate port 1 RS485 Modbus subordinate port
TC Series accessory TCIF23TSX only	
Clock	Secondary lithium battery
Clock drift	Less than 60 seconds per month at 25°C (77°F)
Clock battery autonomy in the absence of a power supply	Over 6 months at 25°C (77°F)
Clock battery charging time	24 hours, battery charged by the power supply of the device

## North American emissions compliance

### United States

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

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

### Warning (Part 15.21)

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

### Canada

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

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

### Industry Canada Statement(s)

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:

1. This device may not cause interference, and
2. This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

1. L'appareil ne doit pas produire de brouillage, et
2. L'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

# Single and Multi-Stage Electromechanical Line Voltage Room Thermostats



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



## Description

Use the T22, T25, and T26 Series for line voltage control of residential, commercial, or industrial heating or year-round air conditioning. You do not require heat or cold anticipators. 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)*

## Features

- Attractive beige-colored, high-impact plastic enclosure for the T26 Series
- Close differential without the need for anticipators
- Bi-metal thermometer supplied as standard except where indicated
- Includes adjustable dial stops for the T26 Series

## Specifications

The temperature range is 40°F to 90°F (5°C to 32°C), except for energy conservation models.

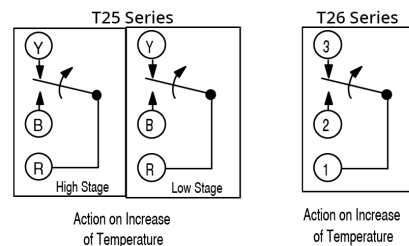
## Accessories

- Replacement knobs and faceplates
- Double trim plate to mount two T22s or T26s

## Applications

Use the thermostats for line voltage control of heating and cooling equipment.

**Figure 16: T25 and T26 action diagrams**



## Selection chart

**Table 95: T22, T25, and T26 Series Line Voltage Wall Thermostat selection chart**

Product code number <sup>1</sup>	Type of adjustment	Application	Selector switch	Differential approximately °F (°C)		Shipping weight (lb)
				Heating	Cooling	
<b>Heating</b>						
T22AAA-1C	Knob	Single-pole, single-throw (SPST)	Off-Auto	1-3/4 (1)	-	1.3
T22ABC-1C			Auto-Off-Fan			
T22ABC-3C	Concealed					
T22BBC-1C	Knob	SPST, medium duty		3 (1.7)		
T22CBC-1C		SPST, heavy duty				
T22CBC-3C	Concealed					
T26A-14C, no thermometer	Knob	SPST, energy conservation heating model, maximum setting 75°F (24°C)	None	2 (1.1)		1.0
T26A-15C, no thermometer		SPST, energy conservation heating model, maximum setting 65°F (18°C)				
<b>Cooling</b>						
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, minimum setting 75°F (24°C)	None			
T26J-9C, no thermometer		SPST, energy conservation cooling model, minimum setting 78°F (26°C)				
<b>Heating and cooling</b>						
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 <sup>2</sup>		SPDT, used to control separate loads on heating and cooling				
T22TFB-1C <sup>2</sup>		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 <sup>3</sup>		SPDT	None	1-3/4 (1)	2-1/4 (1.3)	1.0
T26T-3C <sup>2</sup>		SPDT, heavy duty		3 (1.7)	3 to 4 (1.7 to 2.2)	
<b>Two-stage</b>						
T25A-1C	Knob	Two SPDT switches: two-stage heating, cooling, or one-stage heating and one-stage cooling	None	1-3/4 (1)	2-1/4 (1.3)	1.5
T25A-16C	Concealed			3 (1.7) between stages		

- 1 For the thermostat guard, refer to *G Series Thermostat and Humidistat Guards Catalog Page (LIT-1922145)*.
- 2 To also use the thermostat where one unit provides both heating and cooling, add a jumper between terminals 2 and 3. Refer to *Typical Wiring Diagram and Electrical Ratings for Line Voltage Thermostats Catalog Page (LIT-1922600)*.
- 3 Includes a faceplate for horizontal mounting. The plate is for on-the-job installation over a vertical plate. You 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.

## T22 electrical ratings

**Table 96: T22A, T22J, and T22S electrical ratings**

Description	cULus		
	120	208	240
Volts AC 50/60 Hz	120	208	240
Full load amperes	6.0	3.4	3.0
Lock rotor amperes	36.0	20.4	18.0
Pilot duty	125 VA, 24 VAC to 277 VAC		

**Table 97: T22B electrical ratings**

Description	cULus		
	120	208	240
Volts AC 50/60 Hz	120	208	240
Full load amperes	10.0	6.9	6.0
Lock rotor amperes	60.0	41.4	36.0
Pilot duty	125 VA, 24 VAC to 277 VAC		

**Table 98: T22C electrical ratings**

Description	cULus		
	120	208	240
Volts AC 50/60 Hz	120	208	240
Full load amperes	16.0	9.2	8.0
Lock rotor amperes	96.0	55.2	48.0
Pilot duty	125 VA, 120 VAC to 240 VAC		

**Table 99: T22T cooling side electrical ratings**

Description	cULus		
	120	208	240
Volts AC 50/60 Hz	120	208	240
Full load amperes	8.0	8.0	8.0
Lock rotor amperes	48.0	48.0	48.0
Pilot duty	125 VA, 120 VAC to 240 VAC		

**Table 100: T22T heating side electrical ratings**

Description	cULus		
	120	208	240
Volts AC 50/60 Hz	120	208	240
Full load amperes	16.0	9.2	8.0
Lock rotor amperes	96.0	55.2	48.0
Pilot duty	125 VA, 120 VAC to 240 VAC		

## T25 electrical ratings

**Table 101: T25 electrical ratings**

Motor ratings	120 V	208 V	240 V	277 V
AC full load amperes	6.0	3.5	3.0	-
AC locked rotor amperes	36.0	21.0	18.0	-
Non-inductive amperes	10.0	9.2	8.0	7.2
Pilot duty	125 VA, 24 VAC to 277 VAC			

- **Important:** When you use the T25 as a two-circuit switch, do not create a connection load that exceeds 2,000 VA.

## T26 electrical ratings

**Table 102: T26A and T26S electrical ratings**

Description	cULus			
	120	208	240	277
Volts AC 50/60 Hz	120	208	240	277
Full load amperes	12.0	6.9	6.0	-
Lock rotor amperes	72.0	41.4	36.0	-
Resistive amperes	10.0	10.0	10.0	10.0
Pilot duty	125 VA, 24 VAC to 277 VAC			

**Table 103: T26J electrical ratings**

Description	cULus		
	120	208	240
Volts AC 50/60 Hz	120	208	240
Full load amperes	12.0	6.9	6.0
Lock rotor amperes	72.0	41.4	36.0
Pilot duty	125 VA, 24 VAC to 277 VAC		

**Table 104: T26T electrical ratings**

Description	cULus			
	120	208	240	277
Volts AC 50/60 Hz	120	208	240	277
Full load amperes	16.0	9.2	8.0	-
Lock rotor amperes	96.0	55.2	48.0	-
Resistive amperes	22.0	22.0	22.0	22.0
Pilot duty	125 VA, 24 VAC to 277 VAC			



## T22 conformity declaration

**Table 105: T22 conformity declaration**

Information	Description
Purpose of control	T22 line voltage thermostats
Construction of control	Electromechanical independently mounted control
Number of cycles	100K cycles (auto reset switch) 6K cycles (manual operated rotary switch)
Method of mounting control	Two cross key holes slots in base of case for mounting to a standard or vertical outlet box 2 in. x 4 in. (51 mm x 102 mm)
Method of earthing of control	Wiring binding screw terminal
Type 1 or Type 2 action	Type 1.C (micro-interruption)
External pollution situation	Pollution degree 3
Internal pollution situation	Pollution degree 2
Rated impulse voltage	4,000 VAC
Ball pressure temperature	Auto reset switch component: 302°F (150°C)
Field wiring rating	Use copper conductors only
Switch	SPST: T22A, T22B, T22C, T22J SPDT: T22S, T22T (auto reset switch) SPST 2 position rotary switch: T22xxA SPDT 3 position rotary switch: T22xxB, T22xxC
Enclosure	UL: TYPE 1 (NEMA)
Wiring connection	Screw type terminals, terminal identification molded in the block
Ambient conditions	32°F to 105°F (0°C to 40°C)
Compliance	North America cULus listed; UL60730, E60730 File E6688

## T26 conformity declaration

**Table 106: T26 conformity declaration**

Information	Description
Purpose of control	T26 line voltage thermostats
Construction of control	Electromechanical independently mounted control
Number of cycles	100K cycles (auto reset switch)
Method of mounting control	Two cross key holes slots in base of case for mounting to a standard or vertical outlet box 2 in. x 4 in. (51 mm x 102 mm)
Method of earthing of control	Wiring binding screw terminal
Type 1 or Type 2 action	Type 1.C (micro-interruption)
External pollution situation	Pollution degree 3
Internal pollution situation	Pollution degree 2
Rated impulse voltage	4,000 VAC
Ball pressure temperature	Auto reset switch component: 302°F (150°C)
Field wiring rating	Use copper conductors only
Switch	SPST: T26A, T26J SPDT: T26S, T26T
Enclosure	UL: TYPE 1 (NEMA)
Wiring connection	Screw type terminals, terminal identification on one side of the switch on a label
Ambient conditions	32°F to 105°F (0°C to 40°C)
Compliance	North America cULus listed; UL60730, E60730 File E6688

# Typical Wiring Diagram and Electrical Ratings for Line Voltage



## Technical specifications

Figure 17: Typical wiring diagram for line voltage thermostat

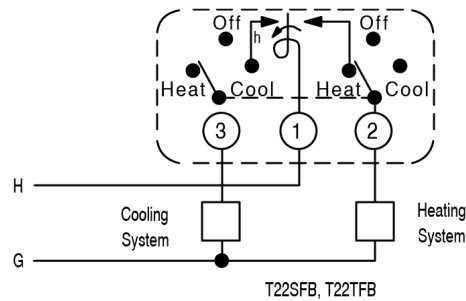


Table 107: Electrical ratings T22A, T22J, T22S, T25A, T26A, T26J, T26S

Motor ratings VAC <sup>1</sup>	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			

<sup>1</sup> 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.

**Table 108: 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		

**Table 109: Electrical ratings T22CBC, T26T**

Motor ratings VAC <sup>1</sup>	120		208		240	
	Heat	Cool	Heat	Cool	Heat	Cool
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 to T22CBC. Non-inductive ratings do not apply to Type T22CBC. Non-inductive rating does not apply to the cooling side of T26T.

**Table 110: 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.

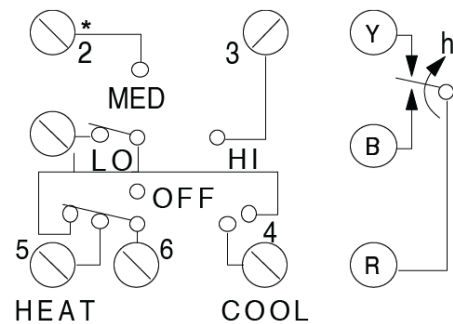
### Features

- 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

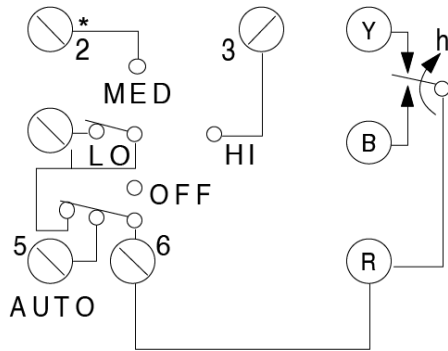
### Applications

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

**Figure 18: T23A Thermostat**



**Figure 19: T23B Thermostat**



## Selection chart

**Table 111: T23 Series Fan Coil Thermostat 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 (10 to 32)	1-3/4 (1)	2-1/4 (1.3)	1.5
T23B-1C	Low-Med-High	Auto-Off				

## T23 Series Fan Coil Thermostat technical specifications

Mounts on a standard double outlet box.

**Table 112: 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)



## 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.

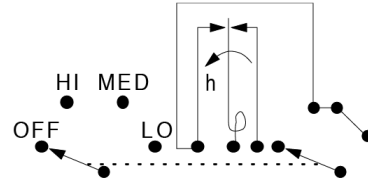
## Features

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

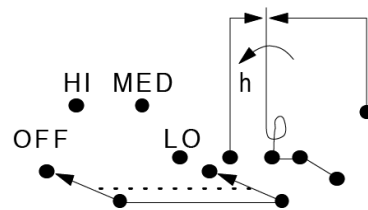
## Applications

Use for line voltage control of heating and cooling equipment.

**Figure 20: T28CD Heating-Cooling Thermostat with Off-Hi-Med-Lo Fan Switch**



**Figure 21: T28DG Sequenced Heating-Cooling Thermostat with Off-Hi-Med-Lo Fan Switch**



## Selection chart

**Table 113: T28 Series Fan Coil Thermostat selection chart**

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

**Table 114: 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.

The T46 Series Thermostat field-installable faceplate combinations of knob or concealed adjustment. 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

### Applications

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



## Selection chart

**Table 115: T46 Series Fan Coil Thermostat selection chart**

Product code number	System switch	Fan switch
<b>Heating</b>		
T46ABH-1C	Auto-off-fan	None
<b>Cooling</b>		
T46JDH-1C	Off-auto	None
T46JEA-1C	On-off	Low-med-high
<b>Heating and cooling</b>		
T46SAA-1C	Heat-off-cool	Low-med-high
T46SDA-1C	Off-auto	Low-med-high

**Table 116: Replacement parts**

Product code number	Description
KNB26A-600R	Plastic push on knob for thermostat

## Accessories

**Table 117: T46 Series Fan Coil Thermostat accessories**

Product code number	Faceplate selection			
	Mounting position	Type of adjustment	Thermometer cutout	Temperature scale
PLT333-3R	Vertical	Concealed	Yes	Fahrenheit
PLT333-5R	Vertical	Knob	Yes	Celsius
PLT333-12R	Vertical	Concealed	No	-

**Note:**

- Faceplates must be ordered in multiples of ten.

- PLT333-1R is supplied with standard wholesaler models.

## Technical specifications

**Table 118: T46 Series Fan Coil Thermostat technical specifications**

Specification	Description	
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 Figure 22 and Figure 23.
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	

**Table 118: T46 Series Fan Coil Thermostat technical specifications**

Specification		Description
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

**Table 119: T46 electrical ratings**

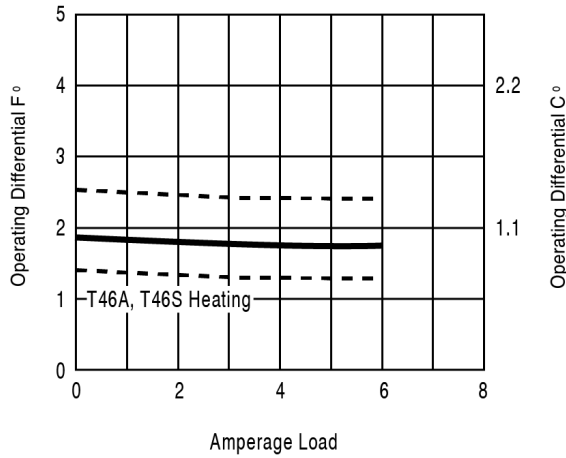
Description	cULus			
	120	208	240	277
Full load amps	12.0	6.9	6.0	5.2
Lock rotor amps	72.0	41.4	36.0	31.2
Resistive amps	6.5	6.5	6.5	-
Pilot duty	125 VA, 24 VAC to 277 VAC			

**Table 120: T46 conformity declaration**

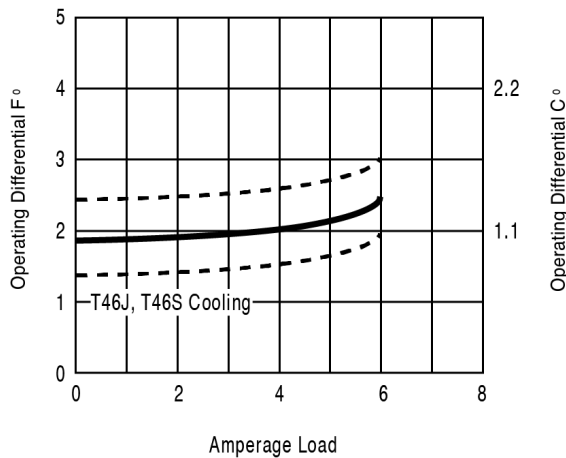
Information	Description
Purpose of control	T46 fan coil thermostats
Construction of control	Electromechanical independently mounted control
Number of cycles	100K cycles (auto reset switch)
	6K cycles (manual operated slide switch)
Method of earthing of control	Wiring binding screw terminal
Type 1 or type 2 action	Type 1.C (micro-interruption)
External pollution situation	Pollution degree 3
Internal pollution situation	Pollution degree 2
Rated impulse voltage	4000 VAC
Ball pressure temperature	Auto reset switch component: 302°F (150°C)
Control adjustment instruction	-
Field wiring rating	Use copper conductors only
Switch	Thermostat SPST; T46A, -J SPDT; T46S (auto reset switch)
	Fan
	System
Enclosure	UL: TYPE 1 (NEMA)
Wiring connection	Color-coded 16 AWG wires, 8 in. long
Ambient conditions	32°F to 105°F (0°C to 40°C)
Compliance	North America cULus listed; UL60730, E60730, file E6688

## Operating differentials

**Figure 22: Operating differential for T46A and heating side of T46S**



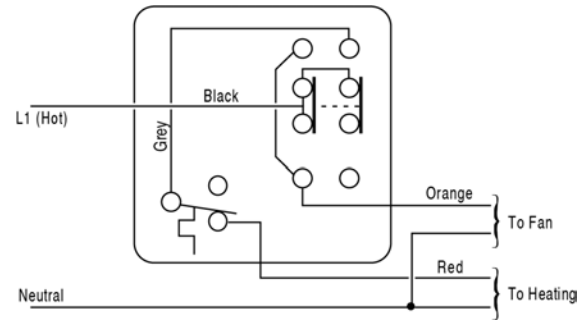
**Figure 23: Operating differential for T46J and cooling side of T46S**



**Note:** The heavy line in Figure 22 and Figure 23 is the nominal operating temperature differential. Production thermostats can vary from the normal temperature, as indicated by the dotted line.

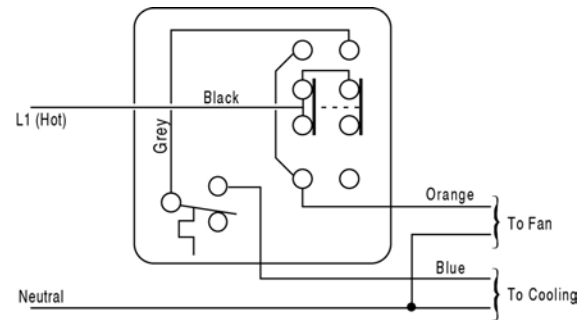
## Typical wiring application for heating

**Figure 24: T46ABH auto-off-fan selector switch with continuous fan for heating only**



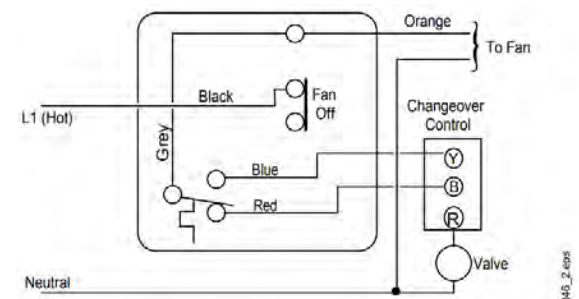
## Typical wiring application for cooling

**Figure 25: T46JBH auto-off-fan selector switch with continuous fan for cooling only**



## Typical wiring application for combination

**Figure 26: T46SDH off-auto selector switch used on fan-coil unit with cycling valve and continuous fan; terminal markings shown for A19CAC changeover control for heating and cooling**



M6\_2\_005



# Multi-Stage Electronic Temperature Controls



# 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

## Applications

**Table 121: Applications**

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

## Selection chart

**Table 122: 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

## MS Series Single-Stage Control Modules with Voltage Input technical specifications

**Table 123: MS Series Single-Stage Control Modules with Voltage Input technical specifications**

Specification	Description
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)

- ⓘ **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.

**Table 123: MS Series Single-Stage Control Modules with Voltage Input technical specifications**

Specification	Description	
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)

**Table 124: 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	---

# 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)

## Selection chart

**Table 125: 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

**Table 126: 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

**Table 127: 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

## MS4PMUHVT Multi-Stage Electronic Temperature Control with Relay Pack technical specifications

**Table 128: MS4PMUHVT Multi-Stage Electronic Temperature Control with Relay Pack technical specifications**

Specification	Description
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 SDFYc UL File SA516, Guide SDFY7
Emissions Compliance	FCC (US), DOC (Canada)

**Table 128: MS4PMUHVT Multi-Stage Electronic Temperature Control with Relay Pack technical specifications**

Specification	Description
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)



## Temperature Control Sensors and Accessories



## 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)

### 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

## Selection chart

**Table 129: A99B Series 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

**Table 130: 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

**Table 130: Accessories**

Product Code Number	Description
SHL10A-600R	Sun Shield for Single Sensor
SHL10A-603R	Sun Shield for Two Sensors
WEL11A-601R	Immersion Well

## A99B Series Temperature Sensor technical specifications

**Table 131: A99B Series Temperature Sensor Technical Specifications**

Specification	Description
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	A99BA: Shielded PVC cable
Wire Insulation	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: -40 to 212°F (-40 to 100°C); A99BB: 0 to 100% RH, condensing A99BC: -40 to 248°F (-40 to 120°C); 0 to 100% RH, condensing
Ambient Storage Conditions	A99BA: 40 to 221°F (-40 to 105°C); A99BB: 0 to 100% RH, condensing A99BC: -40 to 266°F (-40 to 130°C); 0 to 100% RH, condensing

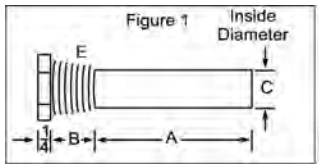
# Bulb Wells

## Description

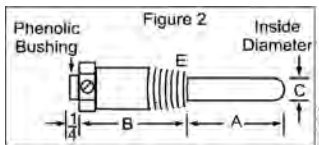
Bulb Wells are used in conjunction with Remote Bulb Temperature Controls where bulb insertion into a vessel or container to sense temperature is required. These wells are used with TE-6000 and TE-6300 Series Sensors.

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.

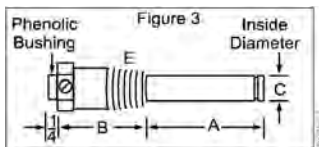
**Figure 27: WEL Series Bulb Well 1**



**Figure 28: WEL Series Bulb Well 2**



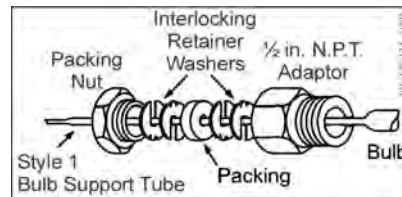
**Figure 29: WEL Series Bulb Well 3**



## 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.

**Figure 30: FTG13A-600R**



## Selection chart

**Table 132: 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 <sup>1</sup>	2	2-3/8	2-5/16	.299	-	1/2	Brass	Copper	250	300	Soft	-
WZ-1000-2 <sup>2</sup>	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 <sup>2</sup>	2	2-3/8	2-5/16	.299	-	1/2	Malleable	Brass	250	300	-	-
WEL14A-601R <sup>3</sup>	3	7-9/16	1-13/16	.430	-	1/2	Brass	Copper	250	300	Silver	Brite-Dip
WEL14A-602R <sup>3</sup>	3	4-15/16	1-13/16	.430	-	1/2	Brass	Copper	250	300	Silver	Brite-Dip
WEL14A-603R <sup>3</sup>	3	5-13/16	1 13/16	.430	-	1/2	Brass	Copper	250	300	Silver	Brite-Dip
WEL16A-600R <sup>1</sup>	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 <sup>3</sup>	1	10-7/16	3/4	.763	1/2	3/4	Malleable	Copper	250	250	Silver	Tin
WEL17A-601R <sup>3</sup>	1	8-11/16	3/4	.763	1/2	3/4	Malleable	Copper	250	250	Silver	Tin
WEL17A-602R <sup>3</sup>	1	10-7/16	3/4	.753	1/2	3/4	Malleable	Steel	250	540	Silver	Tin
WEL17A-604R <sup>3</sup>	1	14-13/32	3/4	.763	1/2	3/4	Malleable	Copper	250	250	Silver	Tin
WEL18A-600R <sup>3</sup>	1	3-1/2	3/4	.773	1/2	3/4	Malleable	Steel	250	150	Silver	Tin
WEL18A-602R <sup>3</sup>	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

**Table 133: 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



Figure 31: GRD10-1R Wire Guard



Figure 32: GRD10A-601 Cast Aluminum Guard



Figure 33: GRD10A-608 Large 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.

## Repair parts

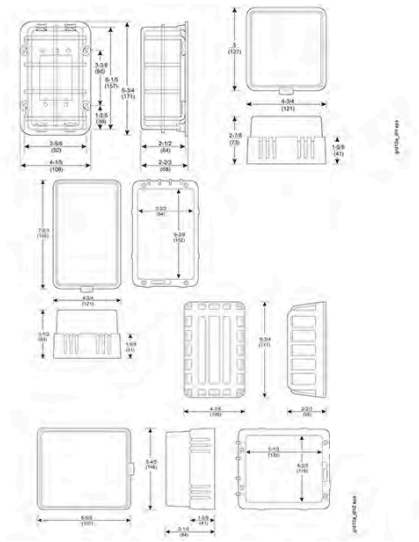
Replacement key KEY12A-600 (set of two) is available.

## Selection chart

**Table 134: Selection Chart**

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

**Figure 34: G Series Dimensions, in. (mm)**



## 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.

### Selection chart

**Table 135: 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

**Table 136: Faceplates**

Product code number	Mounting position	Type of adjustment	Cutout for thermometer	Use with	Temperature scale
<b>Faceplates for T22, T25, T26, T80, T91, and W43 with metal cover</b>					
PLT213-6R	Vertical	Concealed	No	T26, W43 with metal cover	None
<b>Faceplates for T26, W43 AND W45 with plastic cover</b>					
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

**Table 137: Trim plates**

Product code number	Description	Replacement trim plate for
PLT231-1R	Tawny silver trim plate	T22, T25, T26, T28, T58, T91, W42, W43





# Standard Electromechanical Pressure Controls



## P100 Series Encapsulated Pressure Switches



### Description

P100 Series switches are encapsulated, nonadjustable, single-pole, single-throw (SPST) and single-pole, double-throw (SPDT), 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 is available 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 for direct mounting
- Trip-free manual reset on manual reset models; contacts cannot be overridden by continued depression of the reset button
- Use with all non-corrosive refrigerants
- Dust tight encapsulated switch
- 1/4 in. internal flare fitting with built-in Schrader type depressor is standard
- Electrical connections are made to 48 in. (122 cm) leads

### Applications

- Low limit, high limit, and fan cycling control in commercial refrigeration and air-conditioning
- Ice machines
- Food service equipment

## P100 Series Encapsulated Pressure Switches technical specifications

**Table 138: Standard duty electrical contact ratings**

Switch action-model numbers	SPST-P100AA, AC, AG, AJ, CA, CC, CG, CJ, DA, and DC		SPST-P100AP, CP	
Motor ratings	120 V	240 V	120 V	240 V
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	

**Table 139: Heavy duty electrical contact ratings**

Switch action-model numbers	SPST-P100AE and CE				SPDT-P100EE			
Motor ratings	120 V		240 V		120 V		240 V	
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

## Selection charts

The following table provides information about products with a switch action that open on a pressure drop.

**Table 140: Selection Chart**

Product code number	Setpoints - psig (kPa)		Replaces:								
	Opens	Closes	Ranco®	Robert-shaw®	Saginomiya	Danfoss®	Klixon®	Supco	Wilspec	International Refrigeration Products	Gemline
P100AC-1C <sup>1</sup>	5 (34)	20 (138)	MPL-7001	—	ACB-2UA318W	—	PS80-K2-F0305-020-005	SLP0520	HR201A020005D	SLP0520	—
P100AP-355C	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 <sup>1</sup>	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	—

**Table 140: Selection Chart**

Product code number	Setpoints - psig (kPa)		Replaces:									
	Opens	Closes	Ranco®	Robert-shaw®	Saginomiya	Danfoss®	Klixon®	Supco	Wilspec	International Refrigeration Products	Gemline	
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 <sup>2</sup>	75 (517)	120 (827)	—	—	—	—	—	—	SFC75120	—	—	—
P100AP-352C <sup>2</sup>	110 (758)	170 (1,171)	—	—	—	—	—	—	SFC110170	—	—	—
P100AP-353C <sup>2</sup>	126 (868)	264 (1,819)	—	—	—	—	—	—	SFC125265	—	—	—
P100AP-3C <sup>2</sup>	150 (1,034)	225 (1,551)	MPF-7008	—	ACB-2UA685W	—	—	—	SFC150225	—	—	—
P100AP-359C <sup>2</sup>	165 (1,137)	215 (1,481)	—	3100-215	ACB-2UA48W	—	—	—	—	—	—	—
P100AP-4C <sup>2</sup>	170 (1,172)	250 (1,724)	—	—	ACB-2UA631W	—	—	—	SFC170250	—	—	—
P100AP-362C <sup>2</sup>	195 (1,344)	240 (1,654)	—	3100-080	—	—	—	—	—	—	—	—
P100AP-200C <sup>2</sup>	195 (1,344)	275 (1,895)	—	—	—	—	—	—	—	—	—	—
P100AP-354C <sup>2</sup>	210 (1,447)	275 (1,895)	—	—	ACB-2UA319W	—	—	—	SFC210275	—	SFC210275	—
P100EE-79C	300 (2,068)	370 (2,551)	—	—	—	—	—	—	—	—	—	—
P100AP-332C <sup>2</sup>	300 (2,068)	400 (2,758)	MPF7010	—	ACB-2UA627W	061F7514	—	—	SFC300400	—	—	—

- 1 Includes conduit clamp for 3/8 in. flexible metal conduit.
- 2 Models are designed for condenser fan cycling.

The following table provides information about products with a switch action that open on a pressure rise.

**Table 141: Selection chart**

Product code number	Setpoints - psig (kPa)		Replaces:									
	Opens	Closes	Ranco®	Robert-shaw®	Saginomiya	Danfoss®	Klixon®	Supco	Wilspec	International Refrigeration Products	Gemline	
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 <sup>1</sup>	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)	—	—	—	—	—	—	—	—	—	—

**Table 141: Selection chart**

Product code number	Setpoints - psig (kPa)		Replaces:								
	Opens	Closes	Ranco®	Robert-shaw®	Saginomiya	Danfoss®	Klixon®	Supco	Wilspec	International Refrigeration Products	Gemline
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-7108	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)	HR00011B1R704	—	—	—	061F7517	SHP600475	—	—	—
P100CP-85C	665 (4,585)	565 (3,895)	—	—	—	—	—	SHP665565	—	—	—
P100DA-35C	350 (2,413)	Lockout Manual Reset	—	—	ACBPC45M	—	—	—	—	—	—
P100DC-3C <sup>2</sup>	375 (2,586)	Lockout Manual Reset	—	—	—	—	—	—	—	SMR375	—
P100DA-1C	410 (2,827)	Lockout Manual Reset	—	3100-103	ACBPB115M	—	29PSL012-24	SMR410	HM202A410000D	SMR410	PC 103
P100DA-100C	415 (2,859)	Lockout Manual Reset	—	3100-103	—	—	29PSL004-1	—	HM202A415000D	SMR410	—
P100DA-101C	440 (3,032)	Lockout Manual Reset	—	—	—	—	—	SMR440	—	SMR440	—
P100DA-2C	475 (3,275)	Lockout Manual Reset	—	3100-106	—	—	—	—	HM202A475000D	—	—
P100DA-86C	575 (3,964)	Lockout Manual Reset	—	—	—	—	—	SMR575	—	—	—
P100DA-81C	630 (4,343)	Lockout Manual Reset	—	—	—	—	—	SMR630	—	—	—

- 1 Includes conduit clamp for 3/8 in. flexible metal conduit.
- 2 Includes conduit box with opening for 1/2 in. conduit connector.

## P-Series Encapsulated Pressure Controls



### Description

The PENN® P-Series encapsulated pressure controls are compact, economical, direct-mount, snap-action, on or off pressure controls. The P-Series controls are available in a wide variety of factory-calibrated, non-adjustable pressure set points.

The P-Series controls are designed primarily for direct or pilot duty control of motors and other refrigeration or air conditioning application loads that require precise, repeatable pressure control over a wide range of ambient conditions.

You can order the P-Series controls with a variety of pressure connection styles, electrical ratings, and switch actions. Some models feature a high-pressure manual reset lockout.

Refer to the *P-Series Encapsulated Pressure Controls Product Bulletin (LIT-12013066)* for important product application information and single point of contact information.

### WARNING

#### **Risk of Personal Injury.**

Do not install the P-Series encapsulated pressure controls in any application using corrosive or flammable refrigerants. The P-Series encapsulated pressure control is not designed or intended for use with those refrigerants. Use of the P-Series encapsulated pressure controls with corrosive or flammable refrigerants may lead to the release of refrigerant, which could cause property damage, fire, severe personal injury, or death.

### AVERTISSEMENT

#### **Risque de blessure.**

Ne pas installer les P-Series encapsulated pressure controls dans une application utilisant des réfrigérants corrosifs ou inflammables. Le P-Series encapsulated pressure control n'est pas conçu ou destiné à une utilisation avec de tels réfrigérants. L'utilisation du P-Series encapsulated pressure control avec des réfrigérants corrosifs ou inflammables peut entraîner une fuite de réfrigérant, qui risque de provoquer des dégâts matériels, un incendie ou des blessures graves, voire mortelles.

### Features and benefits

#### **Compact size and lightweight construction**

Facilitates mounting the control directly to refrigeration piping or pressure tap points, and reduces space required for controls.

### **Tamper-proof and factory calibrated pressure setpoints**

Provide accurate and repeatable pressure control at pressures ranging from 12 inHg to 750 psig (40.6 to 5171 kPa).

### **Optional trip-free manual reset**

Provide a manual-reset lockout function for unmonitored equipment that you cannot override or reset until the system pressure returns to a specified level.

### **Optional heavy duty electrical contacts**

Provide direct, inline control of most single-phase, fractional horsepower motors.

## **Applications**

The P-Series controls operate in refrigerant and air-conditioning applications. P-Series controls are compatible with all non-corrosive refrigerants and you can use other non-corrosive fluid applications with the P-Series controls.

## **Standard P-Series control models ordering information**

The standard P-Series control models are available for purchase in single piece and quantity orders. See

Table 142 for a list of the available standard P-Series control models. See for an example of a standard P-Series control. You can order standard P-Series controls from an authorized Johnson Controls® or PENN distributor or from your Johnson Controls sales representative. Visit [www.penncontrols.com](http://www.penncontrols.com) to find an authorized PENN Controls distributor near you.

## **Non-standard P-Series control models ordering information**

You can order non-standard P-Series control models to your specifications. See [Control options for non-standard model requests](#) for more information about the available options for non-standard P-Series controls. Most non-standard model requests require a minimum order of at least 100 pieces. Some non-standard model requests require a 250 piece minimum order.

To order non-standard P-Series control models, contact your Johnson Controls representative, or visit [www.penncontrols.com](http://www.penncontrols.com) to submit a model or sample request.

## **Control options for non-standard model requests**

See Table 143 for examples of non-standard models.

# Standard P-Series controls selection chart

**Table 142: Standard P-Series control models**

Product code number	Johnson Controls	Switch action	Setpoints-psig (kPa)		Replaces										
	P100 reference		Opens	Closes	Ranco®	Robertshaw®	Saginomiya®	Danfoss™	Klixon®	Supco®	Wilspec®	IRPs <sup>1</sup>	Gemline®		
PR200-AC-1C <sup>3</sup>	P100AC-1C	Open on pressure drop	5 (34)	20 (138)	MPL-7001	n/a	ACB-2UA318W	n/a	PS80-K2-F0305-020-005	SLP0520	HR201A02-005D	SLP0520	n/a		
PS200-AP-201C	P100AP-201C		10 (69)	32 (221)	MPL-7011	3100-050	ACB-2UA101	n/a		SLP1032		n/a		SLP1032	
PS200-AP-105C	P100AP-105C		30 (207)	60 (414)	n/a	3100-004	ACB-2UA94	n/a		n/a	n/a	SLP3560			
PS200-AP-2C	P100AP-2C		35 (241)	60 (414)	MPL-7004	3100-004	n/a	n/a		SLP3560	n/a	SLP3560			
PS200-AP-361C	P100AP-361C		50 (345)	90 (620)	n/a	n/a	ACB-2UA685W	n/a	PS80-KS-F0328-090-005	SLP5090	HR201A09-005D	SLP5090			
PS200-AP-3C <sup>2</sup>	P100AP-3C		150 (1,034)	225 (1,551)	MPF-7008	n/a				ACB-2UA631W		n/a		SFC1502-25	n/a
PS200-AP-4C <sup>2</sup>	P100AP-4C		170 (1,172)	250 (1,724)	n/a	n/a				n/a	n/a	SFC1702-50		n/a	n/a
PS200-AP-200C <sup>2</sup>	P100AP-200C		195 (1,344)	275 (1,896)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a			
PS200-AP-332C <sup>2</sup>	P100AP-332C	300 (2,068)	400 (2,758)	MPF7010	n/a	ACB-2UA627W	061F7514	n/a	SFC3004-00	n/a	n/a				
PS200-CP-157C	P100CP-157C	Open on pressure rise	225 (1,551)	150 (1,034)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a			
PR200-CC-9C <sup>3</sup>	P100CC-9C		275 (1,896)	175 (1,207)	n/a	3100-112	ACB-2UB724W	n/a	n/a	n/a	n/a	n/a			
PS200-CP-91C	P100CP-91C		300 (2,067)	200 (1,378)	n/a	n/a	ACB-2UB723W	n/a	PS80-K1-0341-300-200	n/a	HR202A30-0200D	SHP300200			
PS200-CP-1C	P100CP-1C		400 (2,758)	300 (2,068)	MPH-7107	3100-151	ACB-2UB35	061F514	PS80-K1-0359-400-300	SHP4003-00	HR202A30-0300D	SHP400300	PC 151		
PS200-CP-2C	P100CP-2C	425 (2,930)	325 (2,241)	MPH-7108	3100-100	ACB-2UB282W	n/a	n/a	SHP4253-25	n/a	n/a	PC 100			
PS200-CP-38C	P100CP-38C	500 (3,447)	325 (2,241)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a			
PS100-CP-85C	P100CP-85C	665 (4,585)	565 (3,895)	n/a	n/a	n/a	n/a	n/a	SHP6655-65	n/a	n/a	n/a			
PM200-DA-1C	P100DA-1C	410 (2,827)	Lockout Manual Reset	n/a	3100-103	ACBPB115M	n/a	29PSL012-24	SMR410	HM202A41-0000D	SMR410	PC 103			
PM200-DA-86C	P100DA-86C	Open on pressure rise	575 (3,964)	Lockout Manual Reset	n/a	n/a	n/a	n/a	n/a	SMR575	n/a	n/a	n/a		
PM200-DA-81C	P100DA-81C		630 (4,344)	Lockout Manual Reset	n/a	n/a	n/a	n/a	n/a	SMR630	n/a	n/a	n/a		

1 International refrigeration products (IRPs)  
 2 Models are designed for condenser fan cycling.  
 3 Model includes conduit clamp for 9.5 mm [3/8 in.] flexible metal conduit.



## Product codes

The following table shows the product code numbers for the P-Series controls that use the code PS200-AP-XXXX.

**Table 143: P-Series controls product code matrix**

Feature	Code and description	Product code example: PS200-AP-XXXX
Series	PC: high current applications	PS
	PM: manual reset	
	PR: large form body	
	PS: standard application	
Switch type	100: SPST, quick-connect devices standard	200
	151: SPDT, quick-connect	
	200: SPST, wire leaded devices standard	
	251: SPDT, wire leaded	
	300: SPST, quick-connect devices extended life	
	351: SPDT, quick-connect extended life	
	400: SPST, wire leaded devices extended life	
451: SPDT, wire leaded extended life		
Contact action	A: SPST, open low automatic reset	A
	C: SPST, open high automatic reset	
	D: SPST, open high manual reset	
	E: SPDT, automatic reset	
Body construction	A: open construction with no conduit clamp	P
	C: conduit clamp	
	E: heavy duty electrical contacts with high current capacity	
	G: high cycle life, 250,000 cycles, open construction with no conduit clamp	
	J: high cycle life, 250,000 cycles, with conduit clamp	
P: open construction with no conduit clamp, smaller style		
Model identifier with a sequence number up to 3 digits		XXX
Packaging	C: individual pack	C
	D: bulk pack	

Some product code matrix combinations are not available. To verify availability of non-standard product code numbers and place quantity orders of non-standard models, contact your Johnson Controls representative, or visit [www.penncontrols.com](http://www.penncontrols.com).

## Electrical ratings

**Table 144: Standard duty electrical contact ratings**

Switch action and models	PC <sup>1</sup>	PM	PR <sup>1</sup>	PS
28 VDC resistive	15 A	n/a	3 A	2 A
24 VAC pilot duty	480 VA		375 VA	125 VA
120 VAC pilot duty	720 VA	375 VA	375 VA	375 VA
240 VAC pilot duty	720 VA	375 VA	375 VA	375 VA
277 VAC pilot duty	720 VA	n/a	n/a	n/a

**Table 144: Standard duty electrical contact ratings**

Switch action and models	PC <sup>1</sup>	PM	PR <sup>1</sup>	PS
120 VAC inductive	13 FLA	5.8 FLA	6 FLA	5.8 FLA
	65 LRA	34.8 LRA	40.2 LRA	34.8 LRA
240 VAC inductive	10 FLA	2.9 FLA	4 FLA	2.9 FLA
	45 LRA	15 LRA	26.4 LRA	17.4 LRA
277 VAC inductive	10 FLA	n/a	4 FLA	n/a
	45 LRA		26.4 LRA	
480 VAC inductive	4 FLA		n/a	
	24 LRA			
600 VAC inductive	3.2 FLA			
	20 LRA			


1 For SPDT configurations, only one contact pair, normally open (N.O.) common (COM), or normally closed (N.C.) can switch a motor load.

### Gold plated contact ratings

- 40 mA at 12 V max, non-arcing loads
- When the gold is burnt out, standard silver contact ratings apply.

## P-Series encapsulated pressure controls technical specifications

**Table 145: P-Series encapsulated pressure controls technical specifications**

Product	P-Series encapsulated pressure controls
Burst pressure	5,000 psig (34,474 kPa)
Maximum overpressure	250 psig (1,724 kPa): overpressure rating for controls with maximum working pressure between 12 inHg to 12 psig (40.6 kPa to 82.7 kPa) 400 psig (2,758 kPa): overpressure rating for controls with a maximum working pressure between 13 psig to 160 psig (89.63 kPa to 1,103 kPa) 600 psig (4,137 kPa): overpressure rating for controls with a maximum working pressure between 161 psig to 500 psig (1,110 kPa to 3,447 kPa) 800 psig (5,516 kPa): overpressure rating for controls with maximum working pressure between 501 psig to 750 psig (3,454 kPa to 5,171 kPa)
Refrigerant temperature	-54°C to 135°C (-65°F to 275°F)
Ambient temperature	Operating: -29°C to 66°C (-20°F to 150°F) Shipping: -40°C to 85°C (-40°F to 185°F)
Ambient humidity	0% to 95% RH non-condensing; maximum dew point 29°C (84°F)
Dielectric strength	750 volts root mean square (VRMS) across open contacts 1,550 VRMS minimum terminals to fitting
Compliance	<b>North America: UL recognized</b> <b>United States:</b> Controllers, Refrigeration components, SDFY2, File SA516, FCC Compliant to CFR47, Part 15, Subpart B <b>Canada:</b> Controllers, Refrigeration components, SDFY8, File SA516, Industry Canada (IC) Compliant to Canadian ICES-003
	<b>Europe:</b> CE Mark— Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive, Low Voltage Directive, and RoHS Directive.

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

## P10 Series Low Pressure Control

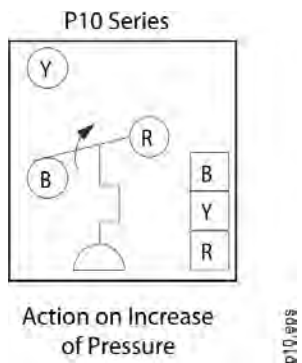


### Description

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.

**Figure 35: 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

## Selection chart

**Table 146: Selection chart**

Product Code Number	No. of Stages	Contact Action	Range psi (kPa)	Factory Setting				Pressure Connector
				psig (kPa)		Switch Diff psi (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	Single-Pole, Single-Throw (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

## P10 Low Pressure Controls 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)

**Table 147: Electrical Ratings**

Motor Ratings VAC	120	208	240	277	600
<b>P10BC-7</b>					
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				
<b>P10BG-3</b>					
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				
<b>P10BJ-1</b>					
AC Full Load A	16.0	9.2	8.0	7	-
AC Locked Rotor A	96.0	55.2	48.0	42	-
Non-Inductive A	Double Throw	16.0	16.0	16.0	16.0
	Single Throw	24.0	24.0	24.0	24.0
Pilot Duty	125 VA, 24 to 600 VAC				

**Table 147: Electrical Ratings**

Motor Ratings VAC	120	208	240	277	600
<b>P10FC-4</b>					
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				
<b>P10PA-11</b>					
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				

# P20 Series Air Conditioning/Pressure Cutout Control

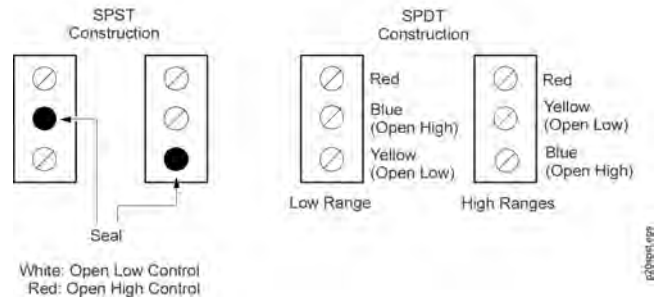


## Description

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.

**Figure 36: Control action is identified by colored sealing compound or terminal markings on switch.**



## Features

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

## Applications

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

## Selection chart

Product Code Number <sup>1</sup>	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 <sup>2</sup>	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 <sup>3</sup>		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 <sup>4</sup>	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 <sup>5</sup>	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

## Accessories

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

## P20 Series Air Conditioning/ Pressure Cutout Control technical specifications

**Table 148: 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			



## 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 Cutout 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

### P29 Series Low Pressure Control with Time Delay 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]*.)

## 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
<b>P29NC-2C</b>	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)
<b>P29NC-3C</b>						36 in. copper capillary tube with	120 seconds
<b>P29NC-49C</b>						1/4 in. flare nut	120 seconds
<b>P29NF-1C<sup>1</sup></b>							

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.

Figure 37: SPST

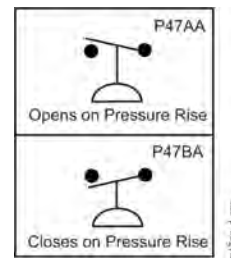
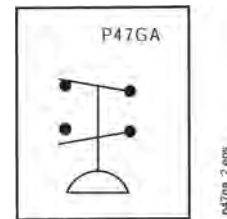


Figure 38: Four-Wire, Two-Circuit Action on Pressure Rise



### Accessories

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

## Selection chart

**Table 149: 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 Circuit <sup>1</sup> – Automatic Reset					
P47GA-9C <sup>1</sup>	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)

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

## Technical specifications

**Table 150: 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			

**Table 151: 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			

**Table 152: Electrical Ratings for P47GA**

Pole Number	Line-M2 (Main)				Line-M1 (Auxiliary)			
	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							

## P67 Series Low Pressure Control



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

### 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

### Applications

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

### Selection chart

**Table 153: Selection Chart**

Product Code Number	Control Action	Scale Range psi <sup>1</sup> (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					
P67EA-5C	L-M2 contacts connect on pressure rise and simultaneously the L- M1 contacts break					1/8 in. External NPT

<sup>1</sup> 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.

# P67 Series Low Pressure Control technical specifications

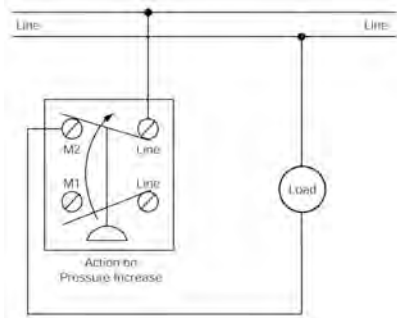
**Table 154: Electrical Ratings for P67AA and P67CA**

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					

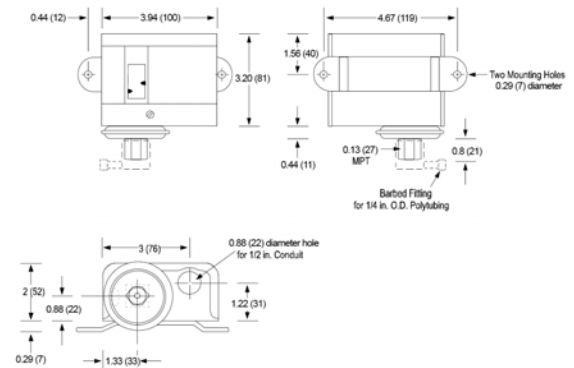
**Table 155: Electrical Ratings for P67EA and P67FA**

Pole Number Motor Rating VAC	LINE-M2 (Main)				LINE-M1 (Auxiliary)			
	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							

**Figure 39: P67 Wiring Diagram (no alarm)**



**Figure 40: P67 Dimensions, in. (mm)**





# P70, P72 Approximate Low Pressure Settings for Typical Applications

## Description

## Low pressure settings for typical applications

The settings in the following table represent approximate starting values. Actual values may vary widely, depending on application-specific guidelines.

**Table 156: P70, P72 approximate low pressure settings for typical applications**

Application	Approximate temperature °F		Pressure - psig <sup>1</sup>									
			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



## 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.

## Selection chart

**Table 157: 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			None
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			Manual reset lockout	36 in. capillary with 1/4 in. flare nut			None
P70BA-1C				1/4 in. external flare connector			
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				1/4 in. external flare connector			
P170AB-2C	SPST open low			36 in. capillary with 1/4 in. flare nut			
P70CA-1C	SPST open high			1/4 in. external flare connector			
P170CA-1C							None
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		Manual reset lockout				
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.

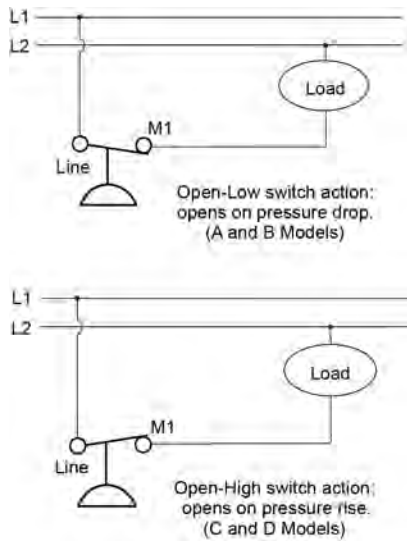
## Technical specifications

**Table 158: Single pressure controls switch action, low event, high event, and models**

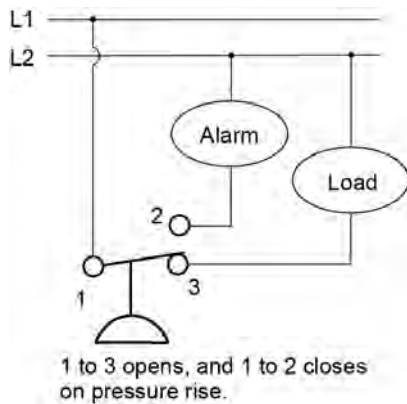
Switch and action	Low event	High event	Models
SPST open low	Cut-out (opens line to M1)	Cut-in (closes line to M1)	P70A, P70B, P170A
SPST open high	Cut-in (closes line to M1)	Cut-Out (opens line to M1)	P70C, P70D, P170C, P170D
SPDT	Opens 1 to 2 and closes 1 to 3	Closes 1 to 2 and opens 1 to 3	P70E, P70F
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



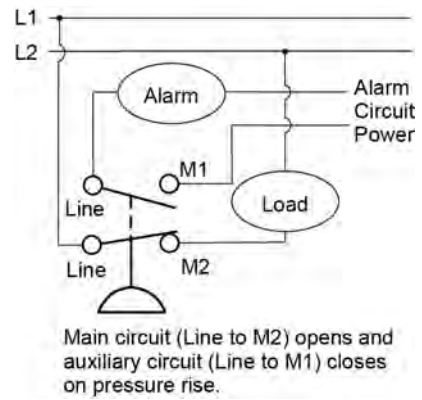
**Figure 41: Wiring for SPST open low switch and open high switch (P70A, B, C, D, and P170A, C, D models)**



**Figure 42: Typical wiring for SPDT switch (P70E and F models)**



**Figure 43: Typical wiring for four-wire two-circuit switch (P70G and H models)**



**Figure 44: Typical wiring for DPST switch (P72A and B models)**

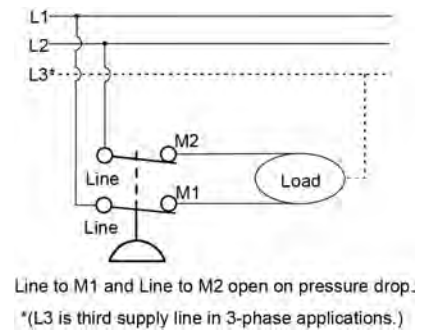


Figure 45: Dimensions for low pressure controls with NEMA 1 enclosure, in. (mm)

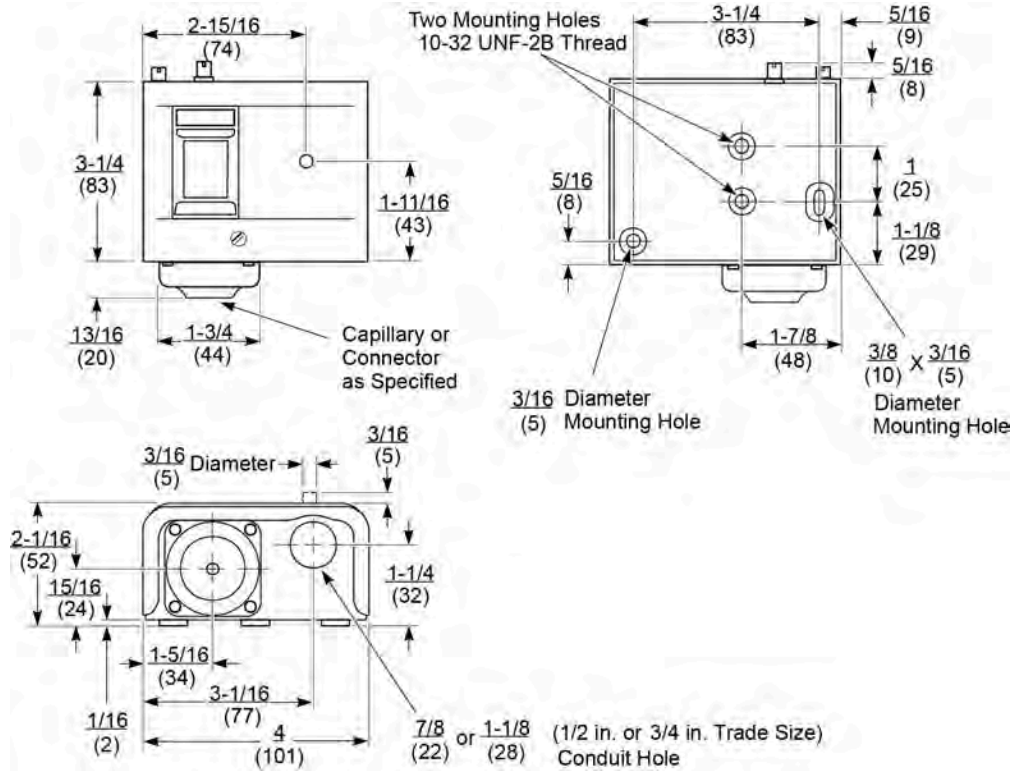
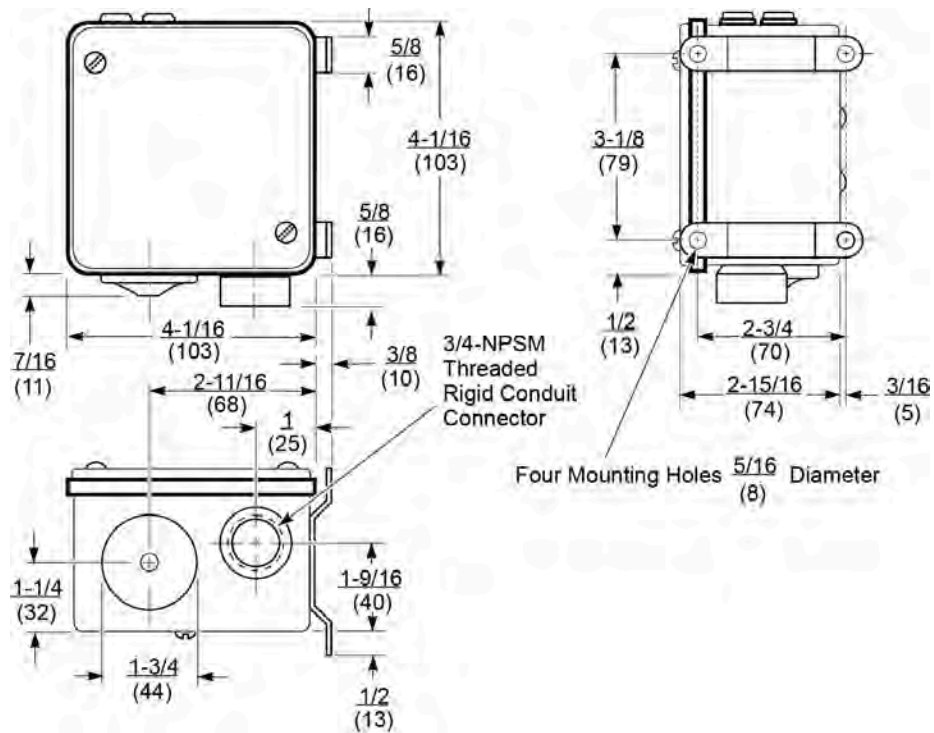


Figure 46: Dimensions for low pressure controls with NEMA 3R enclosure, in. (mm)



① **Note:** These dimensions are nominal and are subject to accepted manufacturing tolerances and application variables.

**Table 159: SPST electrical ratings (P70A, B, C, D, and P170A, C, D models)**

Description	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 at 120 to 600 VAC; 57.5 VA at 120 to 300 VDC			

**Table 160: SPDT electrical ratings 1 hp switch (P70E models)**

Description	Standard single-phase ratings			
	120 VAC	208 VAC	240 VAC	277 VAC <sup>1</sup>
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

<sup>1</sup> Rating for P70EC models only

**Table 161: SPDT electrical ratings 1/4 hp switch (P70F models)**

Description	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		

**Table 162: Four-wire, two-circuit electrical ratings (P70G, H, J, K, and P170K models)**

Description	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							

**Table 163: DPST electrical ratings (P72A, B, C, and D models)**

Description	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	--	--

**Table 163: DPST electrical ratings (P72A, B, C, and D models)**

Description	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
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						



## 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

NEMA 1 enclosures are standard on most models.

#### 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.

### 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.

## Selection chart

**Table 164: P70, P72, and P170 Series Controls for high pressure applications selection chart**

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			1/4 in. external flare connector	
All range controls (for non-corrosive refrigerants)					
P70CA-2C <sup>1</sup>	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 <sup>1</sup>				36 in. capillary with 1/4 in. flare nut	
P70DA-1C <sup>1</sup>					
P70KA-1C	Four-wire, two-circuit Line-M1 close high Line-M2 open high				
P72CA-2C <sup>1</sup>	DPST open-high		Minimum 60 (414) Maximum 150 (1,034)	1/4 in. external flare connector	
P72DA-1C <sup>1</sup>			Manual reset lockout		
P170CA-3C <sup>1</sup>		SPST open high	Minimum 60 (414) Maximum 150 (1,034)		
P170DA-1C			Manual reset lockout		
P170KA-1C	Four-wire, two-circuit Line-M1 close high Line-M2 open high				
Models for high pressure non-corrosive refrigerants <sup>2</sup>					

**Table 164: P70, P72, and P170 Series Controls for high pressure applications selection chart**

Product code number	Switch action	Range psi (kPa)	Differential psi (kPa)	Pressure connection	Max. working pressure
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		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 <sup>1</sup>	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 <sup>1</sup>				1/4 in. external flare connector	
P70DA-400C <sup>1</sup>			Manual reset lockout	36 in. cap. with 1/4 in. flare nut	
P170DA-400C <sup>1</sup>				1/4 in. external flare connector	
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 <sup>1</sup>	SPST open-high	50 to 500 (345 to 3,448)	Minimum 60 (414) Maximum 150 (1,034)		525 psig (3,620 kPa)
P70DA-2C <sup>1</sup>			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.

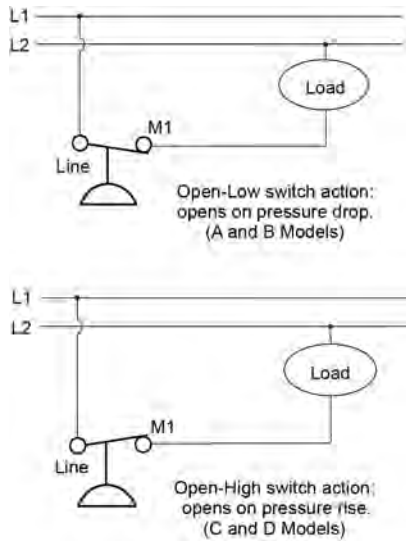
**Note:** To order models not listed in the selection chart, please contact Johnson Controls/PENN® Refrigeration Application Engineering at 1-800-275-5676.

## Technical specifications

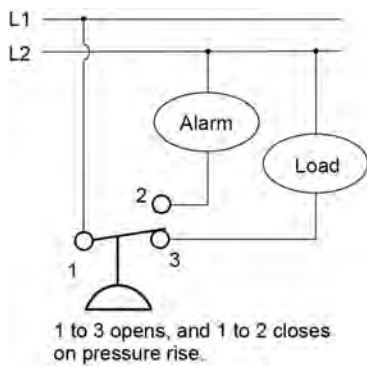
**Table 165: Single pressure controls switch action, low event, high event, and models**

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

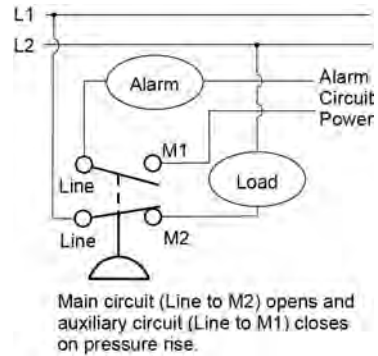
**Figure 47: Typical wiring for SPST (P70A, B, C, D, and P170A, C, D, models)**



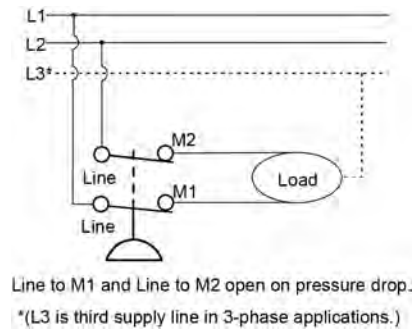
**Figure 48: Typical wiring for SPDT switch (P70E and F models)**



**Figure 49: Typical wiring for four-wire two-circuit switch used for a high pressure cutout application with an alarm circuit (P70J, K, and P170K models)**

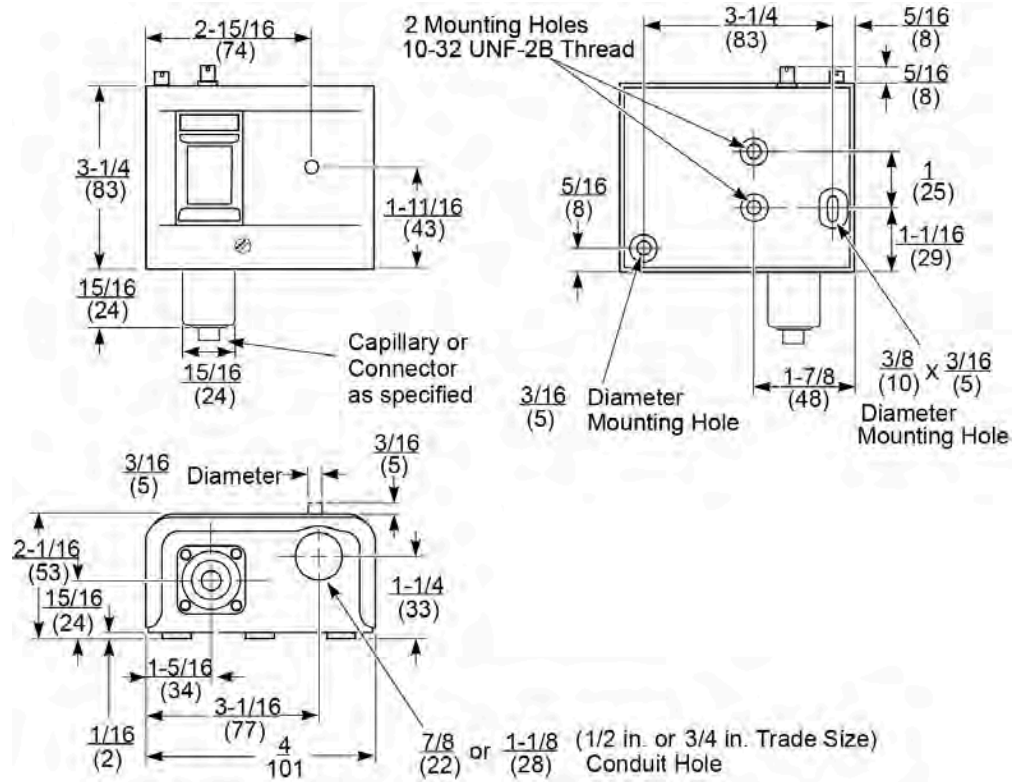


**Figure 50: Typical wiring for DPST switch (P72C and D models)**

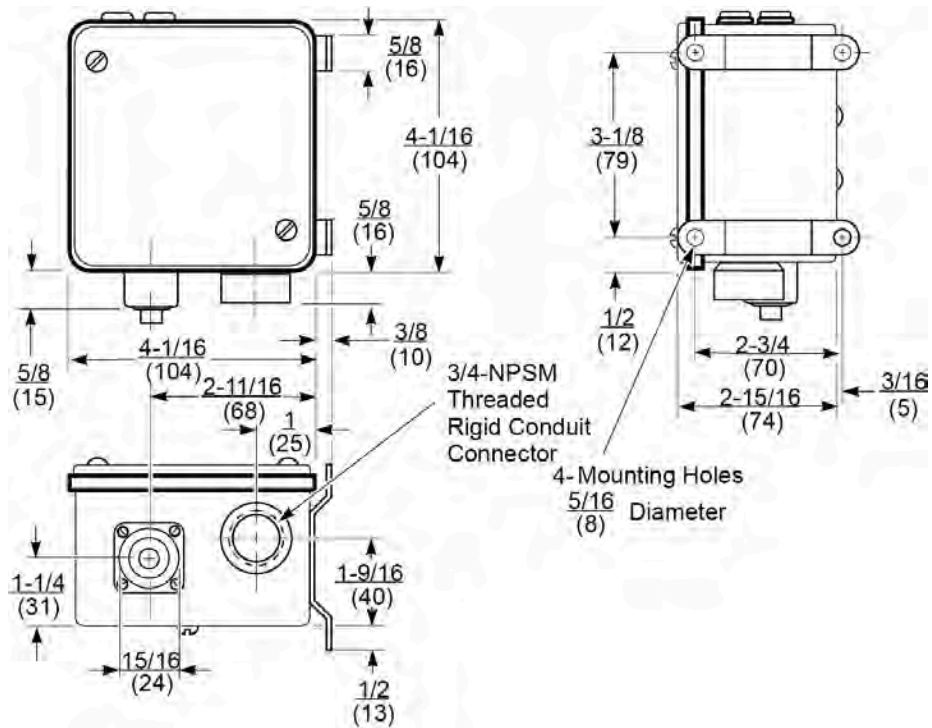




**Figure 51: Dimensions for high pressure controls with NEMA 1 enclosure, in. (mm)**



**Figure 52: Dimensions for high pressure controls with NEMA 3R enclosure, in. (mm)**



① **Note:** These dimensions are nominal and are subject to accepted manufacturing tolerances and application variables.

**Table 166: SPST electrical ratings (P70A, B, C, D, and P170A, C, D models)**

Description	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			

**Table 167: SPDT electrical ratings 1 hp switch (P70E models)**

Description	Standard single-phase ratings			
	120 VAC	208 VAC	240 VAC	277 VAC <sup>1</sup>
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

<sup>1</sup> Rating for P70EC models only

**Table 168: SPDT electrical ratings 1/4 hp switch (P70F models)**

Description	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		

**Table 169: Four-wire, two-circuit electrical ratings (P70G, H, J, K, and P170K models)**

Description	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							

**Table 170: DPST electrical ratings (P72A, B, C, and D models)**

Description	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	--	--

**Table 170: DPST electrical ratings (P72A, B, C, and D models)**

Description	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
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						



## 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

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

### 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.

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

## Selection chart

**Table 171: P70, P72, and P170 Series Controls for dual pressure applications selection chart**

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 <sup>1</sup>	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 <sup>1</sup>					Lockout requires manual reset		None
P70SA-1C <sup>1</sup>	Two independent SPDT				Fixed at 65 (448) or lockout requires manual reset		
P170LB-6C <sup>1</sup>	SPST				Fixed approx. 65 (448)	1/4 in. external flare connector	Low cut-out
P170MA-18C <sup>1</sup>					Lockout requires manual reset		None
P170SA-1C <sup>1</sup>	Two independent SPDT				Fixed at 65 (448) or lockout requires manual reset		
All range controls for non-corrosive refrigerants							
P70LB-1C <sup>1</sup>	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 <sup>1</sup>			Fixed (manual reset)		Lockout requires manual reset		None
P70NA-1C							
P72LA-1C <sup>1</sup>	DPST		Minimum 7 (48) Maximum 50 (345)		Fixed approx. 65 (448)		Low cut-out
P72LB-1C <sup>1</sup>			Lockout requires manual reset		None		
P72MA-1C							
P72NA-1C <sup>1</sup>			Fixed (manual reset)		Lockout requires manual reset		None
All range controls for non-corrosive refrigerants							
P170LB-1C <sup>1</sup>	SPST	20 in.Hg to 100 (-68 to 690)	Minimum 7 (48) Maximum 50 (345)	100 to 500 (690 to 3,447)	Fixed approx. 65 (448)	1/4 in. external flare connector	Low cut-out
P170MA-1C <sup>1</sup>			Fixed (manual reset)		Lockout requires manual reset		None
P170NA-1C							
All range ammonia compatible controls							
P70LA-2C <sup>1</sup>	SPST	20 in. Hg to 100 (-68 to 690)	Minimum 7 (48) Maximum 50 (345)	100 to 500 (690 to 3,447)	Fixed approx. 65 (448)	1/4 in. internal NPT connector	None
P70MA-2C <sup>1</sup>			Lockout requires manual reset				

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

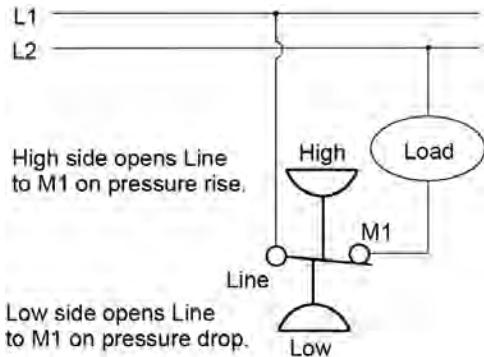
① **Note:** For information on models not listed, please contact Johnson Controls/PENN® Refrigeration Application Engineering at 1-800-275-5676.

## Technical specifications

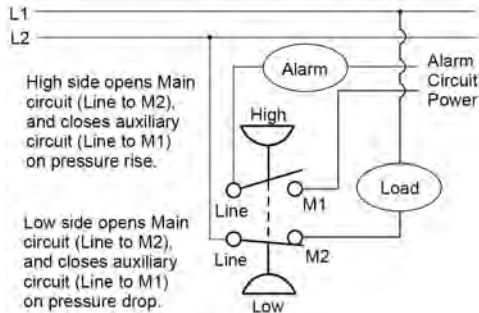
**Table 172: Maximum pressures**

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)

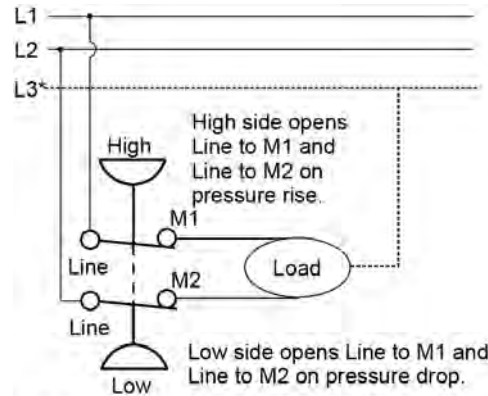
**Figure 53: Typical wiring for SPST switch (P70L, M, N, and P170L, M, N models)**



**Figure 54: Typical wiring for four-wire, two-circuit switch (P70P, Q, and R models)**

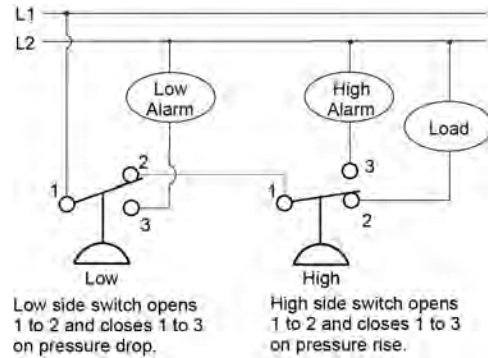


**Figure 55: Typical wiring for DPST switch (P72L, M, and N models)**



\*(L3 is third supply line in 3-phase applications.)

**Figure 56: 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)**



**Figure 57: Two SPDT switches wired to control two different loads (optional high side alarm and low side alarm) (P70S and P170S models)**

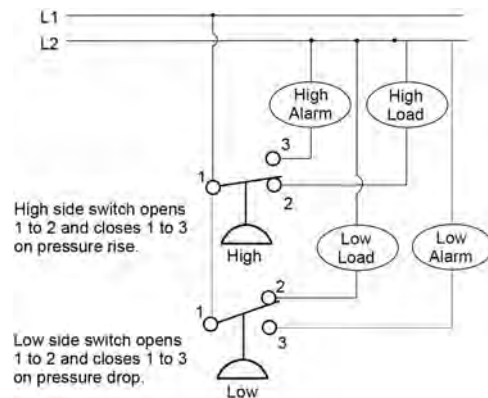


Figure 58: Dimensions for P70, P72, and P170 dual pressure controls with NEMA 1 enclosure, in. (mm)

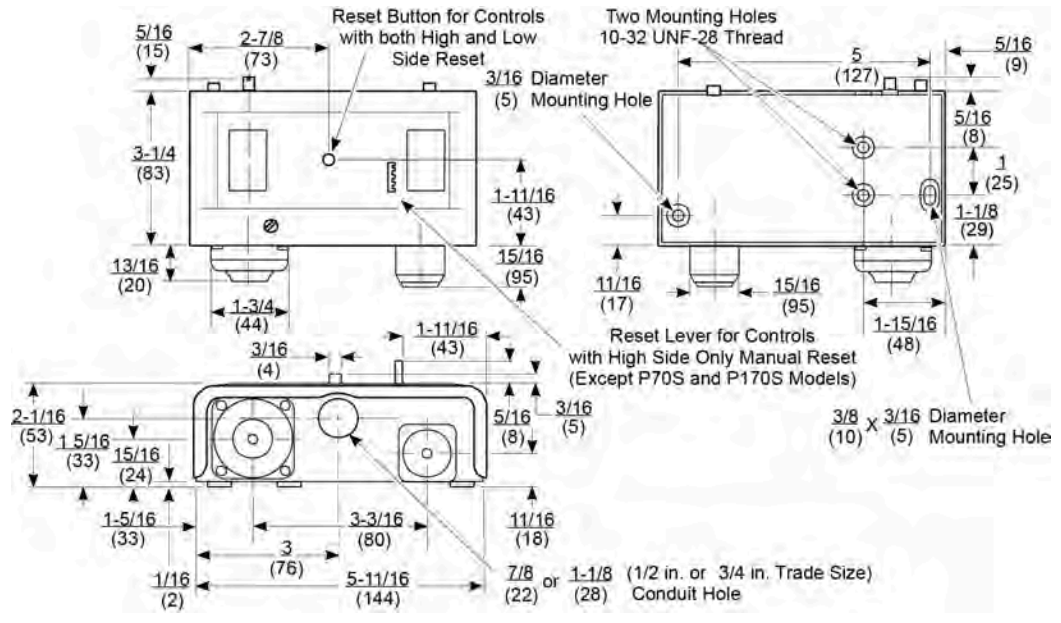
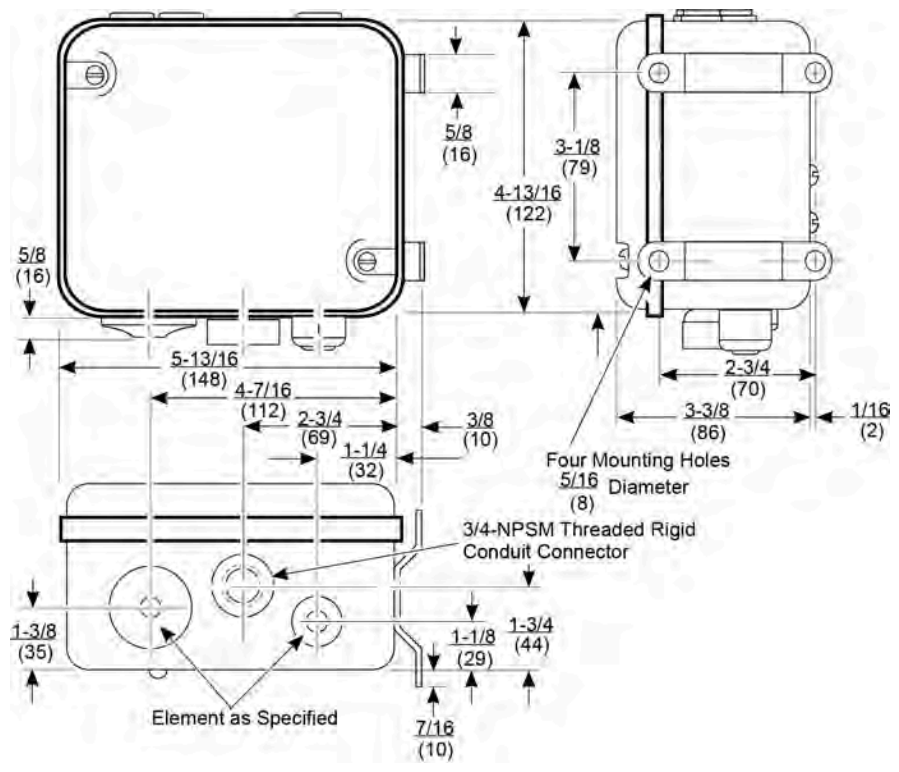


Figure 59: Dimensions for P70, P72, and P170 dual pressure control with NEMA 3R enclosure, in. (mm)



① **Note:** These dimensions are nominal and are subject to accepted manufacturing tolerances and application variables.

## DPST electrical ratings (P72L, M, and N types)

**Table 173: SPST electrical ratings (P70L, M, N, and P170L, M, N types)**

Description	Standard single-phase 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 Amperes	24	18.7	17	15.9	15	24	24
Motor Locked Rotor Amperes	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						

**Table 174: SPST electrical ratings (P70L, M, N, and P170L, M, N types)**

Description	Single-phase ratings			
	Standard single-phase ratings			Hermetic compressor ratings
	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 24 VAC, 720 VA at 120 to 277 VAC			

**Table 175: SPDT electrical ratings (P70S and P170S types)**

Description	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			

**Table 176: SPST electrical ratings (P70L, M, N, and P170L, M, N types)**

Description	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	55.2	48	--	36	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	125 VA at 24 VAC, 720 VA at 120 to 277 VAC							



# P77 Series Controls for Low Pressure Applications



## Description

The P77 Series Controls for Low Pressure Applications are designed primarily for low pressure cut-out control, pump-down control, condenser fan cycling, 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. Controls also are available in several different electrical ratings and Single-Pole, Double-Throw (SPDT) switch configurations.

Refer to the *P77 and P78 Series Controls for Single and Dual Pressure Applications Product Bulletin (LIT-12012399)* for important product application information.

## Features and benefits

### Splash-proof enclosure

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.

### Manual reset lockout option

Provides trip-free lockout that cannot be overridden or reset until pressure returns to a specified level.

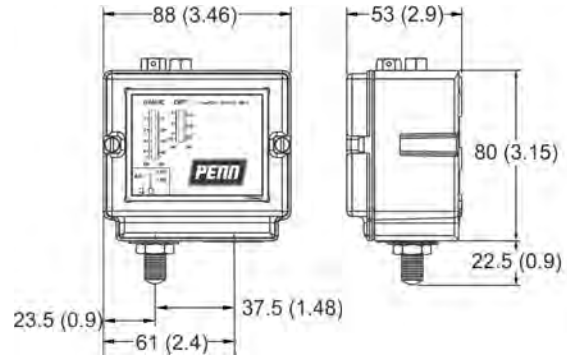
### Generous wiring space

Provides ample space for easy wiring and maintenance.

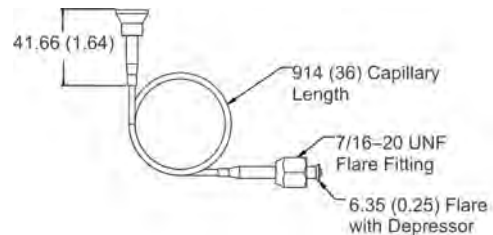
## Applications

The P77 Series Controls for low pressure applications are designed for single pressure control of commercial refrigeration and air-conditioning applications.

**Figure 60: P77 Pressure Controls with 7/16-20 UNF 6 mm (1/4 in.) flare fitting dimensions, mm (in.)**



**Figure 61: Capillary connector dimensions, mm (in.)**



## Selection chart

**Table 177: P77 Series Controls for low pressure applications selection chart**

Model number	Individual pack	Bulkpack	Pressure connection	Switch action	Range bar (psi)	Differential bar (psi)	Maximum bellows pressure bar (psi)
P77AAA	-13000C	-13000D	7/16-20 UNF6 mm (1/4 in.) flare fitting	SPDT	-0.5 to 7 (-7 to 102)	0.6 to 3 (9 to 44)	20 (290)
	-15000C	-15000D	914 mm (36 in.) capillary with 6 mm (1/4 in.) flare fitting				
P77BCA	-13000C	—	7/16-20 UNF6 mm (1/4 in.) flare fitting				
	-15000C	—	914 mm (36 in.) capillary with 6 mm (1/4 in.) flare fitting				

1 The control cannot be reset until the pressure rises 0.5 bar (7 psi) or greater above the low cut-out point.

## Technical specifications

**Table 178: P77 Series electrical ratings**

	UL60730 <sup>1</sup>						
	24	120		208		240	
Volts AC 50/60 Hz	—	Primary contact	Secondary contact	Primary contact	Secondary contact	Primary contact	Secondary contact
Horsepower	—	1	0.33	1	0.75	1	1
Full Load Amperes	—	16	7.2	9.2	7.6	8	8
Locked Rotor Amperes	—	96	43.2	55.2	45.6	48	48
Resistive Amperes	16	16	8	10	8	10	8
Pilot Duty VA	125	720	720	720	720	720	720

1 When the primary contact is A-C, the secondary contact is A-B. When the primary contact is A-B, the secondary contact is A-C.

**Table 179: P77 Series applications**

Specification	Description
Product switch action	Single-Pole, Double-Throw (SPDT)
Pressure connection	7/16-20 UNF for 6 mm (1/4 in. SAE external flare fitting), or 914 mm (36 in.) capillary with 6 mm (1/4 in.) flare fitting
Ambient conditions	Temperature: -40 to 60°C (-40 to 140°F) Humidity: 0 to 95% R.H. non-condensing
Enclosure	Type 1: cast aluminum
Dimensions (H x W x D)	Type 1 enclosure: 88 x 80 x 53 mm (3.48 x 3.15 x 2.09 in.)
Approximate shipping weight	Individual pack: (Type 1 enclosure): 0.5 kg (1.1 lbs) Bulk pack: (Type 1 enclosure in multiples of 35 controls): 19 kg (41.88 lbs)
Compliance	cULus Listed; UL 60730, File SA516

**Table 180: P77 for low pressure applications UL conformity declaration information**

Specification	Description
Purpose of control	Pressure operating control: Automatic reset controls Pressure cut-out: Manual reset controls
Construction of control	Electromechanical
Number of cycles	Automatic: 30,000 Cycles Manual Reset: 6,000 Cycles
Method of mounting control	Independently-mounted control
Type 1 or Type 2 action	Automatic: Type 1; Type 1.C (Micro-Interruption) Manual Reset: Type 2
Pollution degree	Category 3
Heat and fire resistance category	N/A
Rated impulse voltage	4,000 V
Ball pressure temperature	N/A
Field wiring rating	90°C (194°F)
Maximum overpressure	20 bar (290 psi)
Cover screw torque requirements instruction	Tighten enclosure screws to: 1.1–1.4 N·m (10–12 in·lb)

## P77 Series Controls for High Pressure Applications



### Description

The P77 Series Controls for high pressure Applications are designed primarily for high pressure cut-out control, pump-down control, condenser fan cycling, 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. Controls also are available in several different electrical ratings and Single-Pole, Double-Throw (SPDT) switch configurations.

Refer to the *P77 and P78 Series Controls for Single and Dual Pressure Applications Product Bulletin (LIT-12012399)* for important product application information.

### Features and benefits

#### Splash-proof enclosure

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.

#### Manual reset lockout option

Provides trip-free lockout that cannot be overridden or reset until pressure returns to a specified level.

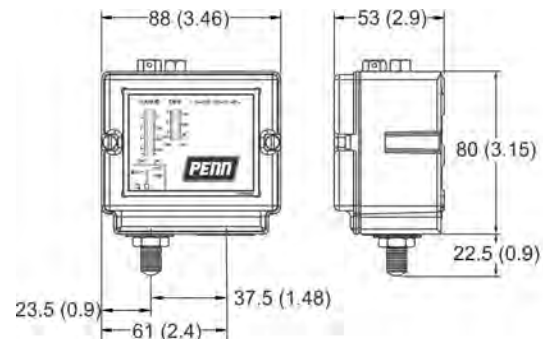
#### Generous wiring space

Provides ample space for easy wiring and maintenance.

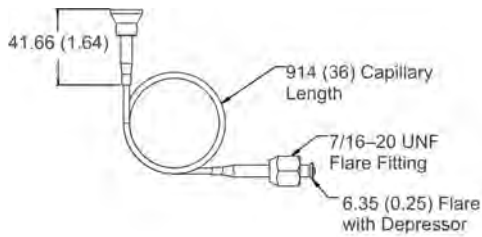
### Applications

The P77 Series Controls for high pressure applications are designed for single pressure control of commercial refrigeration and air-conditioning applications.

**Figure 62: P77 Pressure Controls with 7/16-20 UNF 6 mm (1/4 in.) flare fitting dimensions, mm (in.)**



**Figure 63: Capillary connector dimensions, mm (in.)**



## Selection chart

**Table 181: P77 Series Controls for high pressure applications selection chart**

Model number	Individual pack	Bulkpack	Pressure connection	Switch action	Range bar (psi)	Differential bar (psi)	Maximum bellows pressure bar (psi)
P77AAA	-13500C	-13500D	7/16-20 UNF6 mm (1/4 in.) flare fitting	SPDT	3 to 30 (44 to 435)	3 to 12 (44 to 174)	33 (479)
	-15500C	-15500D	914 mm (36 in.) capillary with 6 mm (1/4 in.) flare fitting				
P77BEA	-13500C	-13500D	7/16-20 UNF6 mm (1/4 in.) flare fitting				
	-15500C	-15500D	914 mm (36 in.) capillary with 6 mm (1/4 in.) flare fitting				

1 The control cannot be reset until the pressure reduces 3 bar (44 psi) or lower below the high cut-out point.

## Technical specifications

**Table 182: P77 Series electrical ratings**

	UL60730 <sup>1</sup>							
	24	120		208		240		
Volts AC 50/60 Hz	-	Primary contact	Secondary contact	Primary contact	Secondary contact	Primary contact	Secondary contact	
Horsepower	-	1	0.33	1	0.75	1	1	
Full Load Amperes	-	16	7.2	9.2	7.6	8	8	
Locked Rotor Amperes	-	96	43.2	55.2	45.6	48	48	
Resistive Amperes	16	16	8	10	8	10	8	
Pilot Duty VA	125	720	720	720	720	720	720	

1 When the primary contact is A-C, the secondary contact is A-B. When the primary contact is A-B, the secondary contact is A-C.

**Table 183: P77 Series applications**

Specification	Description
Product switch action	Single-Pole, Double-Throw (SPDT)
Pressure connection	7/16-20 UNF for 6 mm (1/4 in. SAE external flare fitting), or 914 mm (36 in.) capillary with 6 mm (1/4 in.) flare fitting
Ambient conditions	Temperature: -40 to 60°C (-40 to 140°F) Humidity: 0 to 95% R.H. non-condensing
Enclosure	Type 1: cast aluminum
Dimensions (H x W x D)	Type 1 enclosure: 88 x 80 x 53 mm (3.48 x 3.15 x 2.09 in.)
Approximate shipping weight	Individual pack: (Type 1 enclosure): 0.5 kg (1.1 lbs) Bulk pack: (Type 1 enclosure in multiples of 35 controls): 19 kg (41.88 lbs)
Compliance	cULus Listed; UL 60730, File SA516

**Table 184: P77 for high pressure applications UL conformity declaration information**

Specification	Description
Purpose of control	Pressure operating control: Automatic reset controls Pressure cut-out: Manual reset controls
Construction of control	Electromechanical

**Table 184: P77 for high pressure applications UL conformity declaration information**

Specification	Description
Number of cycles	Automatic: 30,000 Cycles Manual Reset: 6,000 Cycles
Method of mounting control	Independently-mounted control
Type 1 or Type 2 action	Automatic: Type 1; Type 1.C (Micro-Interruption) Manual Reset: Type 2
Pollution degree	Category 3
Heat and fire resistance category	N/A
Rated impulse voltage	4,000 V
Ball pressure temperature	N/A
Field wiring rating	90°C (194°F)
Maximum overpressure	33 bar (479 psi)
Cover screw torque requirements instruction	Tighten enclosure screws to: 1.1–1.4 N·m (10–12 in·lb)

# P78 Series Controls for Dual Pressure Applications



## Description

P78 Series Pressure Controls are designed primarily for high and low pressure cut-out control, pump-down control, condenser fan cycling, 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. Controls also are available in several different electrical ratings and Single-Pole, Double-Throw (SPDT) switch configurations.

Refer to the *P77 and P78 Series Controls for Single and Dual Pressure Applications Product Bulletin (LIT-12012399)* for important product application information.

## Features and benefits

### Splash-proof enclosure

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.

### Manual reset lockout option

Provides trip-free lockout that cannot be overridden or reset until pressure returns to a specified level.

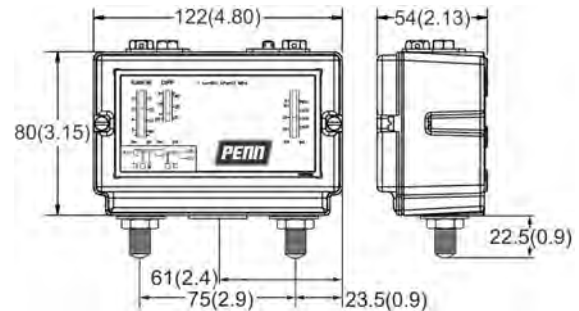
### Generous wiring space

Provides ample space for easy wiring and maintenance.

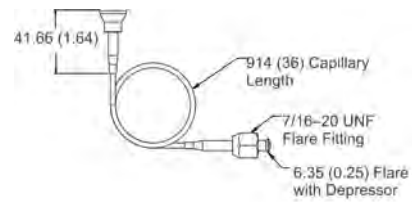
## Applications

The P78 Series Controls for dual pressure applications are designed primarily for use as combination high and low pressure controls on commercial refrigeration and air-conditioning applications.

**Figure 64: P77 Pressure Controls with 7/16-20 UNF 6 mm (1/4 in.) flare fitting dimensions, mm (in.)**



**Figure 65: Capillary connector dimensions, mm (in.)**



## Repair information

If the P78 Series Pressure Control fails to operate within its specifications, replace the unit. For a

replacement P78 Control, contact the nearest Johnson Controls® representative.

## Selection chart

**Table 185: P78 Series Controls for dual pressure applications selection chart**

Model number	Individual pack	Bulkpack	Pressure connection	Low pressure side bar (psi)		High pressure side bar (psi)		Maximum bellows pressure psi (bar)
				Range	Diff.	Range	Diff.	
P78LCA	-13000C	-13000D	7/16-20 UNF6 mm (1/4 in.) flare fitting	-0.5 to 7 (7 to 102)	0.6 to 3 (9 to 44)	3 to 30 (44 to 435)	3 fixed (44)	LP: 20 (290) HP: 33 (479)
	-15000C	-15000D	914 mm (36 in.) capillary with 6 mm (1/4 in.) flare fitting					
P78MCA	-13000C	-13000D	7/16-20 UNF6 mm (1/4 in.) flare nut	-0.5 to 7 (7 to 102)	0.6 to 3 (9 to 44)	3 to 30 (44 to 435)	Manual reset <sup>1</sup>	
	-15000D	-15000D	914 mm (36 in.) capillary with 6 mm (1/4 in.) flare fitting					

1 The control cannot be reset until the pressure reduces 3 bar (44 psi) below the cut-out point.

## Technical specifications

**Table 186: P78 Series electrical ratings**

Volts AC 50/60 Hz	UL60730 <sup>1</sup>						
	24	120		208		240	
	-	Primary contact	Secondary contact	Primary contact	Secondary contact	Primary contact	Secondary contact
Horsepower	-	1	0.33	1	0.75	1	1
Full Load Amperes	-	16	7.2	9.2	7.6	8	8
Locked Rotor Amperes	-	96	43.2	55.2	45.6	48	48
Resistive Amperes	16/8	16	8	10	8	10	8
Pilot Duty VA	125/125	720	720	720	720	720	720

1 The primary contact is A-C; the secondary contacts are A-B and A-D.

**Table 187: P78 Series applications**

Specification	Description
Product switch action	Single-Pole, Double-Throw (SPDT)
Pressure connection	7/16-20 UNF for 6 mm (1/4 in. SAE external flare fitting), or 914 mm (36 in.) capillary with 6 mm (1/4 in.) flare fitting
Ambient storage conditions	Temperature: -40 to 60°C (-40 to 140°F) Humidity: 0 to 95% R.H. non-condensing
Enclosure	Type 1: cast aluminum
Dimensions (H x W x D)	Type 1 enclosure: 122 x 80 x 53 mm (4.80 x 3.15 x 2.09 in.)
Approximate shipping weight	Individual pack: (Type 1 enclosure): 0.7 kg (1.55 lbs) Bulk pack: (Type 1 enclosure in multiples of 24 controls): 24.5 kg (54.01 lbs)
Compliance	cULus Listed; UL 60730, File SA516

**Table 188: P78 for dual pressure applications UL conformity declaration information**

Specification	Description
Purpose of control	Pressure operating control: Automatic reset controls Pressure cut-out: Manual reset controls
Construction of control	Electromechanical
Number of cycles	Automatic 30,000 Cycles Manual Reset 6,000 Cycles
Method of mounting control	Independently-mounted control
Type 1 or Type 2 action	Automatic: Type 1; Type 1.C (Micro-Interruption) Manual Reset: Type 2
Pollution degree	Category 3
Heat and fire resistance category	N/A
Rated impulse voltage	4,000 V

**Table 188: P78 for dual pressure applications UL conformity declaration information**

Specification	Description
Ball pressure temperature	N/A
Field wiring rating	90°C (194°F)
Maximum overpressure	LP: 20 bar (290 psi) HP: 33 bar (479 psi)
Cover screw torque requirements instruction	Tighten enclosure screws to: 1.1–1.4 N·m (10–12 in·lb)





## Single-Stage Electronic Pressure Controls



# P470 Electronic Pressure Control with Display



## Description

The P470 Electronic Pressure Control with Display is a single-stage, on and off, electronic pressure control with a single-pole, double-throw (SPDT) output relay. You can field-set the P470 control to operate in one of the following three pressure ranges, as either an open-high or open-low control: 0 psi to 100 psi, 0 psi to 500 psi, or 50 psi to 750 psi.

The P470 control has a large LCD that displays the sensed pressure, other system-status indicators, and 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 P599 Series Electronic Pressure Transducer and a WHA-PDK3 wiring harness to sense system pressure. This arrangement eliminates almost all refrigerant leaks because there are no capillaries or bellows to break or fail.

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

## Features

- Easy-to-read LCD
- Three field-selectable pressure ranges between 0 psi and 750 psi
- 24 VAC, and 120 VAC 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

## Selection chart

**Note:** P470 Controls do not include a transducer or wiring harness. A P599 transducer and a wiring harness must be purchased separately. Match the transducer to the selected pressure range.

**Table 189: 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 <a href="#">Technical specifications</a> 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 VAC or 208/240 VAC See <a href="#">Technical specifications</a> for complete relay electrical ratings.

**Table 189: Selection chart**

Item	Product code number	Description	
P599 transducers <sup>1</sup>	P599RAPS101C P599RAPS101K	0 psi to 100 psi pressure transducer with 1/8 in. NPT male fitting	
	P599RCPS101C P599RCPS101K	0 psi to 100 psi pressure transducer with 1/4 in. SAE (Schrader®) female fitting with integral valve depressor	
	P599RAPS105C P599RAPS105K	0 psi to 500 psi pressure transducer with 1/8 in. NPT male fitting	
	P599RCPS105C P599RCPS105K	0 psi to 500 psi pressure transducer with 1/4 in. SAE (Schrader) female fitting with integral valve depressor	
	P599RAPS107C P599RAPS107K	0 psi to 750 psi pressure transducer with 1/8 in. NPT male fitting	
	P599RCPS107C P599RCPS107K	0 psi to 750 psi pressure transducer with 1/4 in. SAE (Schrader) female fitting with integral valve depressor	
	Wiring harnesses for P599 transducers	WHA-PKD3-200C	6 ft 6 1/2 in. (2 m) 3-wire cable with plug-in connector for P599 transducer
		WHA-PKD3-400C	13 ft 3 in. (4 m) 3-wire cable with plug-in connector for P599 transducer
		WHA-PKD3-600C	19 ft 8 in. (6 m) 3-wire cable with plug-in connector for P599 transducer

<sup>1</sup> The standard P599 transducers listed in this table are for sale as single-piece items. P599 transducer product code numbers that end in -xxxC are transducers only. Product code numbers that end in -xxxK are kits, and include a transducer and a 2 m (6.6 ft) wire harness.

Refer to the *P599 Electronic Pressure Transducer Product/Technical Bulletin* (LIT-12012446) for more information.

## Technical specifications

**Table 190: Output relay contacts electrical ratings**

	P470EB-1			P470FB-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 VAC to 240 VAC 125 VA (N.C.) at 120 VAC to 240 VAC 50 VA (N.C.) at 24 VAC			

**Table 191: P470 Electronic Pressure Control with Display**

Specification	Description		
Operating pressure ranges	0 psi–100 psi	0 psi–500 psi	50 psi–750 psi
Minimum differential pressure	5 psi	20 psi	20 psi
Displayed resolution	1 psi	3 psi	5 psi
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	P599 Series Electronic Pressure Transducer		
Ambient temperature at control	Operating: -30°F to 140°F (-34°C to 60°C) Shipping: -40°F to 185°F (-40°C 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		



# Electromechanical Lube Oil and Differential Pressure Controls





## 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)*

## Selection chart

**Table 192: Selection Chart**

Product Code Number	Time Delay	Time Delay Heater Circuit VAC	Type of Reset	Range <sup>1</sup> psi (kPa)	Refrigerant (R)	Pressure Connection
P28AA-1C <sup>2</sup>	90 seconds	120/240	Manual	8 to 70 (55 to 483)	Non-corrosive <sup>3</sup>	36 in. capillary with 1/4 in. flare nut
P28AA-17C <sup>4</sup>	120 seconds					
P28AA-18C	45 seconds					

- 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 P30-3801

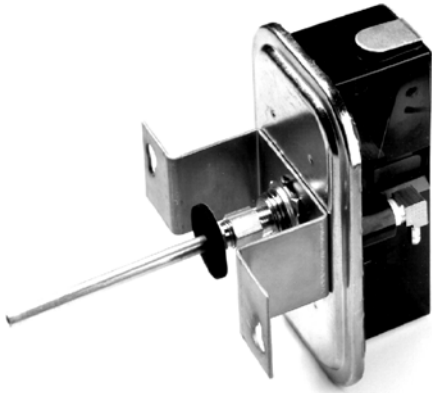
## P28 Series Lube Oil Pressure Cutout Control with Time Delay technical specifications

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

**Table 193: 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

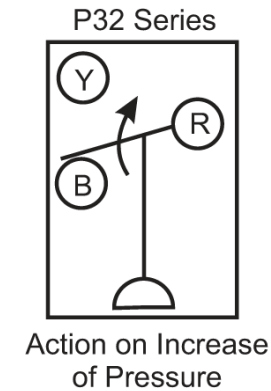


### Description

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.

Figure 66: P28 Action Diagram



p32.eps

### 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

## Selection chart

**Table 194: Selection chart**

Product Code Number	Ambient Temperature Min./Max.	Connector	Maximum Overpressure psig (kPa) <sup>1</sup>	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	1 (6.895)	Single-Pole Double-Throw (SPDT)	0.15 to 12 (0.037 to 2.99)	0.07 (0.017)	Adjustable	Yes	L  BKT182-1
P32AC-2C <sup>2</sup>					0.05 to 5 (0.012 to 1.24)	0.04 (0.01)			U  BKT229-1
P32AF-1C		Low pressure connectors are molded, 1/8 in. internal NPT			0.025 (0.006)	L  BKT182-1			
P32AF-2C <sup>2</sup>					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

**Table 195: Electrical Ratings**

Motor Ratings VAC	120	208	240
Non-Inductive or Resistive Load	10 A, 24 to 277 VAC		
Pilot Duty	125 VA, 24 VAC; 360 VA, 120 to 277 VAC		

## P32 Series Sensitive Pressure Switch technical specifications

**Table 195: Electrical Ratings**

Motor Ratings VAC	120	208	240
<b>Type P32AC (Standard Differential, 1/2 hp)</b>			
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		
<b>Type P32AF (Close Differential, 1/4 hp)</b>			
AC Full Load A	5.8	3.3	2.9
AC Locked Rotor A	34.8	19.8	17.4





## 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.)

## Selection chart

Product Code Number	Time Delay <sup>1</sup>	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) <sup>2</sup>	36 in. capillary with 1/4 in. flare nut
P45NAA-10C	90 seconds					48 in. capillary with 1/4 in. flare nut
P45NCA-12C <sup>3</sup>	120 seconds	120/240				36 in. capillary with 1/4 in. flare nut
P145NCA-12C <sup>4</sup>						1/4 in. external flare (Style 5)
P145NCB-12C <sup>5</sup>						
Carlyle® Compressors						
P45NCA-82C <sup>6</sup>	45 seconds	120/240	Manual	425 (2,390)	6.5 (45) <sup>7</sup>	36 in. capillary with 1/4 in. flare nut
P145NCA-82C <sup>8</sup>						1/4 in. external flare (Style 5)
P145NCB-82C <sup>9</sup>						

- 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)

## Technical specifications

For all non-corrosive refrigerants.

**Table 196: Electrical Rating – Pilot Duty**

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

## 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 include a universal mounting bracket.

## Selection chart

**Table 197: P74 Series Differential Pressure Control selection chart**

Product code number	Switch action	Range pressure differential psig (kPa) <sup>1</sup>	Switch differential	Pressure connections	Bellows material
<b>For all non-corrosive liquids</b>					
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		8 to 60 adjustable (55 to 414)	1.5 fixed	1/4 in. external flare	
P74FA-1C				1/4 in. FNPT	
P74FA-5C					
P74FA-10C					
P74JA-2C		SPDT (floating)	8 to 60 adjustable (55 to 414)	2.5 fixed	

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

## Technical specifications

**Table 198: Electrical ratings**

Motor ratings	120 V	208 V	240 V	277 V
<b>P74AA, P74BA - 1 Phase</b>				
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			
<b>P74EA</b>				
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			
<b>P74FA</b>				
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			
<b>P74JA</b>				
1 A; 24 VAC Class 2; 50/60 Hz				

## 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.

### 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) Catalog Page (LIT-1927185)*. Product specifications for P145 are the same as P45 model. Refer to *P45 Series Lube Oil Pressure Cutout Control (With Time Delay) Catalog Page (LIT-1927200) (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.

## Selection chart

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

## Selection chart

**Table 199: P12 Series Differential Pressure Controls 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



## P400 Single-Point Differential Lube Oil Pressure Switch



### Description

The P400 is a proven, high-performance single point differential pressure switch that eliminates the need for capillary tubes.

### Features

- Brass switch housing provides corrosion resistance.
- Small size allows mounting in tight locations.
- Fast and accurate response to changing pressure provides superior performance.
- Backwards compatibility allows replacement of P300 sensor on P345 and P445 electronic lube oil controls.

## Selection Charts

**Table 200: P400**

Product Code Number	Open Point (Differential Pressure)	Close Point (Differential above Open Point)	Threads	Wiring Harness	Fits Compressors Manufactured by
P400AD-1C <sup>1</sup>	7.0 ± 1.0 psid	less than or equal to 2.0 psid	3/4-16 UNF	WHA-P400-100	Carlyle®
P400AD-2C <sup>1</sup>	12.75 ± 0.75 psid	less than or equal to 1.5 psid			Copeland®
P400BD-1C <sup>1</sup>	10.0 ± 1.5 psid	less than or equal to 3.0 psid	M20 x 1.5	WHA-P400-125	Bitzer

<sup>1</sup> Wiring harness included

**Table 201: Control and Sensor/Switch Compatibility**

Test	P345 or P445 Control with P300 Sensor	P34B5 or P445 Control with P400 Switch	P545 Control and P300 Sensor	P545 Control and P400 Switch
Wiring Harness <sup>1</sup>	WHA-P300-xxx only	WHA-P300-xxx or WHA-P400-xxx	WHA-P300-xxx only	WHA-P300-xxx or WHA-P400-xxx
Test Switch	6-8 Second delay	Does not function <sup>2</sup>	Immediate	Immediate

<sup>1</sup> WHA- P300- xxx is the 3- wire harness supplied with the P345 or P445 control and the P300 sensor. WHA- P400- xxx is the 2- wire harness supplied with the P545 control and the P400 switch.

<sup>2</sup> 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.

## Accessories

**Table 202: Accessories**

Product Code Number	Description
WHA-F400-100C	3 1/3 ft (1 m) length wiring harness
WHA-F400-125C	4 ft (1 1/4 m) length wiring harness
WHA-F400-250C	8 ft (2 1/2 m) length wiring harness
WHA-F400-430C	14 ft (4 1/3 m) length wiring harness

## P400 Pressure Switch for Lube Oil Pressure Control Technical Specifications

**Table 203: P400 Pressure Switch for Lube Oil Pressure Control Technical Specifications**

Specification	Description
Ambient Operating Conditions	0 to 221°F; (-18 to 105°C)
Ambient Storage Conditions	-40 to 250°F; (-40 to 120°C)
Shipping Weight	0.5 lb (0.232 kg)



# Electronic Lube Oil and Differential Pressure Controls



## 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: International Electrotechnical Commission (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

## Selection charts

**Table 204: P545 Series Electronic Lube Oil Control**

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

<sup>1</sup> Switch and wiring harness included

**Table 205: Control and Sensor/Switch Compatibility**

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

<sup>1</sup> WHA-P400-xxx is the two-wire harness supplied with the P545 control and the P400 switch.

<sup>2</sup> 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.

## Accessories

**Table 206: P400 Single-Point Differential Lube Oil Pressure Switch**

Product Code Number <sup>1</sup>	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

<sup>1</sup> Wiring harness included

**Table 207: Wiring Harnesses and Other Accessories**

Product Code Number	Description
KITP545-82C <sup>1</sup>	<ul style="list-style-type: none"> <li>CST29A-600C Sensor Block;</li> <li>P545NCB-82 Control;</li> <li>P400AD-1C Switch;</li> <li>WHA-P400-100C Wiring Harness</li> </ul>
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

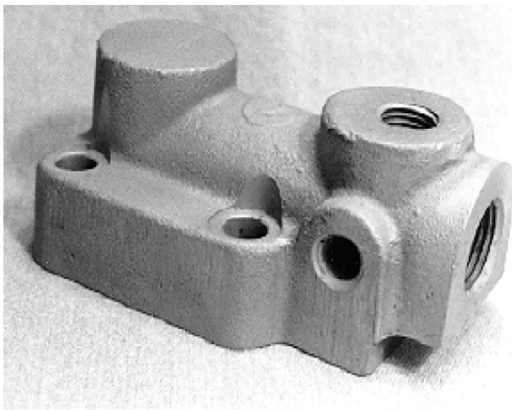
<sup>1</sup> Contact Carlyle Compressor Co. at 1-800-462-2759 to order Sensor Block Gasket 06DA680063.

## P545 Series Electronic Lube Oil Control technical specifications

**Table 208: P545 Series Electronic Lube Oil Control 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)	<ul style="list-style-type: none"> <li>P545NCB-22/P400AD-2: 12.75 ± 0.75 psi (87.9 ± 5.17 kPa)</li> <li>P545NCB-25/P400BD-1: 10 ± 1.5 psi (68.9 ± 10.3 kPa)</li> <li>P545NCB-82 P400AD-1: 7 ± 1.0 psi (48.2 ± 6.9 kPa)</li> </ul>
Lube Oil Time Delay (Factory Settings)	<ul style="list-style-type: none"> <li>P545NCB-22: 120 ± 15 seconds</li> <li>P545NCB-25: 90 ± 12 seconds</li> <li>P545NCB-82: 120 ± 15 seconds</li> </ul>
Anti-Short Cycle Timer	Four selectable positions: 0, 35, 65, and 100 seconds (nominal times)
Type of Refrigerant	Non-corrosive refrigerants only
Electrical Connections	<ul style="list-style-type: none"> <li>Control: Screw type terminals on a barrier terminal strip</li> <li>Sensor: Snap-connect at sensor end, three-pin plug at control end</li> </ul>
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

## CST29A Adapter Block for Carlyle Compressors



### Description

The Johnson Controls/PENN® CST29A Adapter Block is designed for use on Carlyle® compressors (models O6CC, O6D, and O6E) equipped with an oil pump. The adapter 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

### Selection chart

Product Code Number	Description
CST29A-600C	Adapter 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 $7 \pm 1.0$ psi, Close Less than or Equal to 2.0 psig above Open Point
KITP545-82C	Single Pack P545 with Adapter 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 <sup>1</sup>	Adapter Block Gasket for Carlyle Compressor Series O6CC, O6D, and O6E

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

## P599 Series Electronic Pressure Transducers



### Description

The P599 Series Electronic Pressure Transducers are compact, economical, rugged, direct-mount pressure transducers designed for use in commercial and industrial refrigeration and air conditioning applications. These transducers provide a proportional analog signal based on the sensed pressure.

The P599 Series Transducers feature environmentally protected electronics with stainless steel construction. The digitally compensated P599 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 304L stainless steel. No o-rings or organic materials are exposed to the pressure media, allowing for a leak-proof, all-metal, sealed pressure system. The P599 Series Transducers operate with any corrosive or non-corrosive refrigerants that are compatible with stainless steel (304L SS), including water condensate, carbon dioxide, glycol, most refrigerants (including ammonia), and many other compatible fluids and gases. The P599 Transducers also can be used with the following natural refrigerants: NH<sub>3</sub> (ammonia) and CO<sub>2</sub> (carbon dioxide) in accordance with hazardous location requirements.

The P599 Series provides transducers in a variety of pressure ranges, covering most common refrigeration and air conditioning applications. Refer to the *P599 Series Electronic Pressure Transducers*

*Product/Technical Bulletin (LIT-12012446)* for important product application information.

Refer to the *P599 Series Electronic Pressure Transducers Product/Technical Bulletin (LIT-12012446)* for the product code matrix that identifies all of the potential P599 Series Electronic Pressure Transducer models and product code numbers. This table shows the P599 Transducer product code matrix and the potential non-standard transducer models that can be built. Not all non-standard models are available. Non-standard models are only sold in bulk quantity orders of 100 or more. Contact your Johnson Controls Sales Representative for more information regarding bulk purchase of non-standard P599 Transducers

### Features and Benefits

#### Industrial Duty Design

Offers a sealed design that includes a snubber to dampen pressure pulsations and has no o-rings for reliable performance in the most harsh environments.

#### 10 Million Plus Full Scale Pressure Cycle Rated Life Span

Provides life use with no degradation of accuracy or performance over the life of the transducer.

#### Approved for Today's Refrigerants

Use with an extensive number of refrigerants, including HCFC, HFC, CO<sub>2</sub>, and ammonia.

#### Environmentally Protected Electronics

Provide high vibration tolerance and prevent ingress and egress that can occur through suction line icing and thawing.



## Selection Charts

**Figure 67: Standard North American P599 Transducer Examples**



**Table 209: P599 Transducer Standard Models, 0.5 to 4.5 VDC Ratiometric with a Packard Connector for PSI Applications**

Product Code Number	Pressure Range		Pressure Port	Individual or Kit
	Minimum Pressure (Pmin)	Maximum Pressure (Pmax)		
P599RAPS100C	-10 psi (20 in. Hg )	100 psi	1/8 in. - 27 NPT external	Individual
P599RAPS100K			Kit	
P599RCPS100C	0 psi	100 psi	1/4 in. - SAE 45° internal flare with depressor	Individual
P599RCPS100K			Kit	
P599RAPS101C	0 psi	100 psi	1/8 in. - 27 NPT external	Individual
P599RAPS101K			Kit	
P599RCPS101C	0 psi	100 psi	1/4 in. - SAE 45° internal flare with depressor	Individual
P599RCPS101K			Kit	
P599RAPS102C	0 psi	200 psi	1/8 in. - 27 NPT external	Individual
P599RAPS102K			Kit	
P599RCPS102C	0 psi	200 psi	1/4 in. - SAE 45° internal flare with depressor	Individual
P599RCPS102K			Kit	
P599RAPS105C	0 psi	500 psi	1/8 in. - 27 NPT external	Individual
P599RAPS105K			Kit	
P599RCPS105C	0 psi	500 psi	1/4 in. - SAE 45° internal flare with depressor	Individual
P599RCPS105K			Kit	
P599RAPS107C	0 psi	750 psi	1/8 in. - 27 NPT external	Individual
P599RAPS107K			Kit	
P599RCPS107C	0 psi	750 psi	1/4 in. - SAE 45° internal flare with depressor	Individual
P599RCPS107K			Kit	

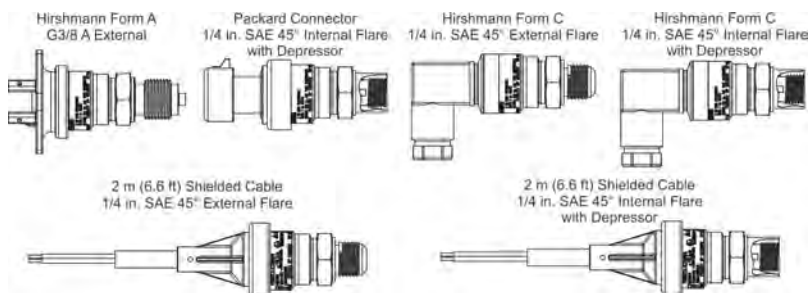
**Table 210: P599 Transducer Standard Models, 0 to 10 VDC with the Packard Connector for PSI Applications**

Product Code Number	Pressure Range		Pressure Port	Individual or Kit
	Minimum Pressure (Pmin)	Maximum Pressure (Pmax)		
P599VAPS101C	0 psi	100 psi	1/8 in. - 27 NPT external	Individual
P599VAPS101K			Kit	
P599VCPS101C	0 psi	100 psi	1/4 in. - SAE 45° internal flare with depressor	Individual
P599VCPS101K			Kit	
P599VAPS105C	0 psi	500 psi	1/8 in. - 27 NPT external	Individual
P599VAPS105K			Kit	
P599VCPS105C	0 psi	500 psi	1/4 in. - SAE 45° internal flare with depressor	Individual
P599VCPS105K			Kit	
P599VAPS107C	0 psi	750 psi	1/8 in. - 27 NPT external	Individual
P599VAPS107K			Kit	
P599VCPS107C	0 psi	750 psi	1/4 in. - SAE 45° internal flare with depressor	Individual
P599VCPS107K			Kit	

**Table 211: P599 Transducer Standard Models, 4 to 20 mA with the Packard Connector for PSI Applications**

Product Code Number	Pressure Range		Pressure Port	Individual or Kit
	Minimum Pressure (Pmin)	Maximum Pressure (Pmax)		
P599AAPS101C	0 psi	100 psi	1/8 in. - 27 NPT external	Individual
P599AAPS101K			1/4 in. - SAE 45° internal flare with depressor	Kit
P599ACPS101C	0 psi	500 psi	1/8 in. - 27 NPT external	Individual
P599ACPS101K			1/4 in. - SAE 45° internal flare with depressor	Kit
P599AAPS105C	0	750	1/8 in. - 27 NPT external	Individual
P599AAPS105K			1/4 in. - SAE 45° internal flare with depressor	Kit
P599ACPS105C	0	750	1/8 in. - 27 NPT external	Individual
P599ACPS105K			1/4 in. - SAE 45° internal flare with depressor	Kit
P599AAPS107C	0	750	1/8 in. - 27 NPT external	Individual
P599AAPS107K			1/4 in. - SAE 45° internal flare with depressor	Kit
P599ACPS107C	0	750	1/8 in. - 27 NPT external	Individual
P599ACPS107K			1/4 in. - SAE 45° internal flare with depressor	Kit

**Figure 68: Standard European P599 Transducer Examples**



**Table 212: P599 Transducer Standard Models, 0.5 to 4.5 VDC Ratiometric for BAR Applications**

Product Code Number	Pressure Range		Pressure Port	Electrical connector
	Minimum Pressure (Pmin)	Maximum Pressure (Pmax)		
P599RCHS401C	-1 bar	8 bar	1/4 in. - SAE 45° internal flare with depressor	Hirschmann® Form C
P599RCPS401C				Packard
P599RCPS402C	-1 bar	15 bar	1/4 in. - SAE 45° internal flare with depressor	Packard
P599RCHS404C	0 bar	30 bar		Hirschmann Form C
P599RCPS404C	0 bar	35 bar	1/4 in. - SAE 45° internal flare with depressor	Packard
P599RCSS409C				Shielded cable
P599RCPS405C	0 bar	50 bar	1/4 in. - SAE 45° internal flare with depressor	Packard
P599RCSS411C	0 bar	52 bar		Packard
P599RJS412C	-1 bar	59 bar	G3/8 A external	Hirschmann Form A
P599RJS413C	-1 bar	159 bar		

**Table 213: P599 Transducer Standard Models, 0 to 10 VDC for BAR Applications**

Product Code Number	Pressure Range		Pressure Port	Electrical connector
	Minimum Pressure (Pmin)	Maximum Pressure (Pmax)		
P599VBHS401C	-1 bar	8 bar	1/4 in. - SAE 45° external flare	Hirschmann Form C
P599VCHS401C			1/4 in. - SAE 45° internal flare with depressor	
P599VCPS401C	-1 bar	9 bar	1/4 in. - SAE 45° internal flare with depressor	Packard
P599VBSS401C			1/4 in. - SAE 45° external flare	Shielded cable
P599VCSS401C	-1 bar	9 bar	1/4 in. - SAE 45° internal flare with depressor	Packard
P599VCPS406C			1/4 in. - SAE 45° internal flare with depressor	

**Table 213: P599 Transducer Standard Models, 0 to 10 VDC for BAR Applications**

Product Code Number	Pressure Range		Pressure Port	Electrical connector
	Minimum Pressure (Pmin)	Maximum Pressure (Pmax)		
P599VBSS402C	-1 bar	15 bar	1/4 in. - SAE 45° external flare	Shielded cable
P599VCHS402C			1/4 in. - SAE 45° internal flare with depressor	Hirschmann Form C
P599VBHS404C	0 bar	30 bar	1/4 in. - SAE 45° external flare	Hirschmann Form C
P599VCHS404C			1/4 in. - SAE 45° internal flare with depressor	
P599VCPS404C			1/4 in. - SAE 45° internal flare with depressor	Packard
P599VBSS404C			1/4 in. - SAE 45° external flare	Shielded cable
P599VCSS404C			1/4 in. - SAE 45° internal flare with depressor	
P599VCPS407C	-1 bar	39 bar	1/4 in. - SAE 45° internal flare with depressor	Packard
P599VCHS405C	0 bar	50 bar	1/4 in. - SAE 45° internal flare with depressor	Hirschmann Form C
P599VCSS405C			1/4 in. - SAE 45° internal flare with depressor	Shielded cable

**Table 214: P599 Transducer Standard Models, 4 to 20 mA for BAR Applications**

Product Code Number	Pressure Range		Pressure Port	Electrical connector
	Minimum Pressure (Pmin)	Maximum Pressure (Pmax)		
P599ABHS401C	-1 bar	8 bar	1/4 in. - SAE 45° external flare	Hirschmann Form C
P599ACHS401C			1/4 in. - SAE 45° internal flare with depressor	
P599ACPS401C			1/4 in. - SAE 45° internal flare with depressor	Packard
P599ABSS401C			1/4 in. - SAE 45° external flare	Shielded cable
P599ACSS401C			1/4 in. - SAE 45° internal flare with depressor	
P599ABHS402C	-1 bar	15 bar	1/4 in. - SAE 45° external flare	Hirschmann Form C
P599ACHS402C			1/4 in. - SAE 45° internal flare with depressor	
P599ACPS402C			1/4 in. - SAE 45° internal flare with depressor	Packard
P599ACPS403C	0 bar	15 bar	1/4 in. - SAE 45° internal flare with depressor	Packard
P599ABHS404C	0 bar	30 bar	1/4 in. - SAE 45° external flare	Hirschmann Form C
P599ACHS404C			1/4 in. - SAE 45° internal flare with depressor	
P599ACPS404C			1/4 in. - SAE 45° internal flare with depressor	Packard
P599ABSS404C			1/4 in. - SAE 45° external flare	Shielded cable
P599ACSS404C			1/4 in. - SAE 45° internal flare with depressor	
P599ACHS405C	0 bar	50 bar	1/4 in. - SAE 45° internal flare with depressor	Hirschmann Form C
P599ACPS405C			1/4 in. - SAE 45° internal flare with depressor	Packard
P599ACSS405C			1/4 in. - SAE 45° internal flare with depressor	Shielded cable

## Accessories

**Table 215: Wire Harnesses for Use with Packard® Connectors**




Product Code Number	Length
WHA-PKD3-200C	2.0 m (6.6 ft)
WHA-PKD3-400C	4.0 m (13 ft)
WHA-PKD3-600C	6.0 m (19.63 ft)

## Technical Specifications

**Table 216: P599 Series Electronic Pressure Transducers Technical Specifications**

Specification	Description
Signal Output Types	0.5 to 4.5 VDC Ratiometric 0 to 10 VDC 4 to 20 mA 0 to 5 VDC 1 to 5 VDC
Pressure Port Type [Required Assembly Torque]	1/8 in. - 27 NPT, external thread ANSI B1.20.1 [16.26 N•m (12 ft•lb)] 1/4 in. SAE 45° flare, external thread [16.26 N•m (12 ft•lb)] 1/4 in. SAE 45° flare with Schrader® Valve depressor, internal thread [16.26 N•m(12 ft•lb)] 1/4 in. - 18 NPT, external thread ANSI B1.20.1 [20.33 N•m (15 ft•lb)] 1/2 in. - 20 UNF-2A external, [20.33 N•m (15 ft•lb)] 1/4 in. - 18 NPTF external, [20.33 N•m (15 ft•lb)] M16 X 1.5 Ermeto® internal thread, ISO 8434-1 [33.89 N•m (25 ft•lb)]
Electrical Connector	AMP, 174357-2 Hirschmann Form C, 9.5 mm EN 175 301 - 803 Hirschmann Form A, 18 mm EN 175 301 - 803 Packard, Metri-Pack 150 series, P2S Shielded cable; shield not connected to the sensor body M12 X 1P, DS/EN 60947-5-2
Units of Measurement	BARS (PSIS) BARA (PSIA)
Temperature Range	Compensated temperature: -40° to 125°C (-40° to 257°F) Media temperature (pressure side): -40° to 125°C (-40° to 257°F) Operating temperature (ambient air): -40° to 100°C (-40° to 212°F) Storage temperature, -40° to 125°C (-40° to 257°F)
Accuracy	Total accuracy: +/- 1.5% Best-Fit Straight Line (BFSL): +/- 0.5% Long term stability (1 year): +/- 1.25%
Required Output Signal Supply Voltage	0.5 to 4.5 VDC Ratiometric: 4.75 to 5.25 VDC 0 to 10 VDC: 12 to 33 VDC 4 to 20 mA: 9 to 32 VDC 0 to 5 VDC and 1 to 5 VDC: 9 to 33 VDC
Maximum Signal Input Current	0.5 to 4.5 VDC Ratiometric: 3 mA 0 to 10 VDC: 5 mA 4 to 20 mA: 24 mA 0 to 5 VDC and 1 to 5 VDC: 5 mA
Electrical Protection	<ul style="list-style-type: none"> <li>Standard response time: 5 mS, +/- 4 mS</li> <li>Output impedance: greater than 25 ohm</li> <li>Output load shall be greater than 10K ohm (resistance signal out can support for volt out models)</li> <li>Reverse wiring protection: (+ and common) (+ and signal out) (common and signal out)</li> <li>Short-circuit protected: (signal out at maximum span to earth)</li> <li>Minimum ohms (body to term): 100 M ohm at 500 VDC</li> </ul>
Physical	<ul style="list-style-type: none"> <li>Pressure cycles: 10 million full scale</li> <li>Burst pressure for transducers with Pmax &lt; 52 bar (750 psi): 259 bar (3,750 psi)</li> <li>Burst pressure for transducers with Pmax &gt; 52 bar (750 psi): 1,034 bar (15,000 psi)</li> <li>Proof pressure: 3x full-scale (Pmax) for 1 minute</li> <li>Minimum pressure: 0 bar (0 psia) indefinitely</li> <li>Proof pressure: 2x full-scale indefinitely</li> <li>Vibration: 16.4 G random</li> <li>Mechanical shock: EN 60068-2-27 (25 g, 11 ms, half sine)</li> <li>Shock/drop: 4 meter 6 times any axis</li> <li>Piezoresistive sensor filled with silicone oil</li> <li>All media side materials: 304L stainless steel</li> <li>Mechanical damping: built-in snubber</li> </ul>

**Table 216: P599 Series Electronic Pressure Transducers Technical Specifications**

Specification	Description
Field Installed Electrical Connection IP Ratings	<ul style="list-style-type: none"> <li>• AMP, IP67</li> <li>• Hirschmann A, IP65</li> <li>• Hirschmann C, IP65</li> <li>• Packard, IP67</li> <li>• Cable, IP67</li> <li>• M12 X 1P, IP67</li> <li>• Factory Assembled Environmental Protection, IP67 stainless steel sensor body to plastic seal</li> </ul>
Compliance    	<p><b>United States:</b> Controllers, Refrigeration - Component, SDFY2.SA516; Controllers, Refrigeration for use in Hazardous Locations - Component STDX2.E483641; Class I, Division 2, Group A, B, C, and D FCC Part 15 Class B</p> <p><b>Canada:</b> Controllers, Refrigeration - Component, SDFY8.SA516 Controllers, Refrigeration for use in Hazardous Locations - Component STDX8.E483641; Class I, Division 2, Group A, B, C, and D</p> <p><b>Europe:</b> LVD, EMC, RoHS, WEEE</p> <p><b>Australia/New Zealand:</b> RCM, Emissions Compliant</p>

## Contact information

Contact your local branch office:  
[www.johnsoncontrols.com/locations](http://www.johnsoncontrols.com/locations)

Contact Johnson Controls:  
[www.johnsoncontrols.com/contact-us](http://www.johnsoncontrols.com/contact-us)

# Pressure Sensors and Accessories



## 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 coils 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 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.

## 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

**Table 217: R310A Series Current Sensing Switch 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 NRNTcUL Guide NRNT7



## Universal Mounting Brackets



### Selection chart

Table 218: Selection chart

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

### 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.

## 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.

## Selection chart

**Table 219: SEC99A UltraCap Armored Capillary selection chart**

Product code number	Description
<b>Schrader Depressor in one end</b>	
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)
<b>Schrader Depressor in both ends</b>	
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)

## Technical specifications

**Table 220: SEC99A UltraCap Armored Capillary technical specifications**

Specification	Description	
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	3,450 psig (23,786 kPa)	
Maximum working pressure	690 psig (4,757 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	

## Refrigerant Sensors and Monitors



# 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

## Selection chart

**Table 221: RLD-H10PRO Refrigerant Leak Detector selection chart**

Product code number	Description
RLD-H10PRO-1	Refrigerant leak detector and charger

## Accessories

**Table 222: RLD-H10PRO Refrigerant Leak Detector 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

## RLD-H10PRO Refrigerant Leak Detector technical specifications

**Table 223: RLD-H10PRO Refrigerant Leak Detector technical specifications**

Specification	Description
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 sensitivity <sup>1</sup>	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)
Shipping weight	5.1 lb (2.3 kg)
Compliance CE	Europe: CE Mark Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive 2004/108/EC.

<sup>1</sup> 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

**Table 224: RLD Refrigerant Leak Detector accessories and replacement parts selection chart**

Product code number	Description	Figure
RLD-H10-100	14 in. flexible probe extension	
RLD-H10-600R	Tune-up kit; Includes: <ul style="list-style-type: none"> <li>• One sensor</li> <li>• 100 filters</li> <li>• Three airflow indicator balls</li> <li>• Three probe tips</li> <li>• One leak vial</li> </ul>	
RLD-H10-601R	Replacement sensor	

**Table 224: RLD Refrigerant Leak Detector accessories and replacement parts selection chart**

Product code number	Description	Figure
RLD-H10-602R	Maintenance kit; Includes: <ul style="list-style-type: none"> <li>• 100 replacement filters</li> <li>• Three airflow indicator balls</li> <li>• Three probe tips</li> </ul>	
RLD-H10-603R	Replacement leak vial	
RLD-H10-606R	Replacement clear plastic probe tip	
RLD-H10-607R	Replacement probe assembly	



# RLD-H10PM Refrigerant Leak Detector



## Description

The RLD-H10PM 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, R502, R22, R404a, R507, R134a and R410A, among others. The RLD-H10PM 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, tune-up kits, probe extensions, battery chargers, and leak vial bottles. The RLD-H10PM is a direct replacement for the RLD-H10P.

## 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
- switchable for manual or automatic balance to allow user to choose preferred method of compensation for background refrigerant levels
- exceeds SAE J1627 moving probe specification, which minimizes call-backs because the leak is found the first time, is verifiable, and the fix can be confirmed
- external calibration source and calibration indicators indicate when the sensor is working properly and serves as a reference point to judge leak size

## Selection chart

For repair information, contact Johnson Controls application engineering at (414) 524-5535.

Code number	Description
RLD-H10PM-1	Refrigerant leak detector and charger

## Accessories

**Table 225: RLD-H10PM Refrigerant Leak Detector accessories**

Code number	Description
RLD-H10-100	14 inch flexible probe extension
RLD-H10-101	120 VAC power supply adapter

**Table 225: RLD-H10PM Refrigerant Leak Detector accessories**

Code number	Description
RLD-H10-102	Cigarette lighter adapter
RLD-H10-103	Replacement battery charger
RLD-H10-104	Replacement battery pack recharger (included in RLD-H10-105)
RLD-H10-105	Rechargeable 12 V battery belt pack
RLD-H10-600R	Tune-up kit includes: sensor, 100 filters, 3 airflow indicator balls, 3 probe tips and leak vial
RLD-H10-601R	Replacement sensor
RLD-H10-602R	Maintenance kit includes: 100 replacement filters, 3 airflow indicator balls, and 3 probe tips
RLD-H10-603R	Replacement leak vial
RLD-H10-604R	Replacement internal battery for RLD-H10P
RLD-H10-606R	Replacement clear plastic probe tip
RLD-H10-607R	Replacement probe assembly

## RLD-H10PM Refrigerant Leak Detector technical specifications

**Table 226: RLD-H10PM Refrigerant Leak Detector technical specifications**

Specification	Description	
Power requirements	12 VDC, charger 13.5 VDC. An adaptor is available to allow unit to run from 120 VAC power (RLD-H10-101).	
Sensing element type	Positive Ion Emission Heated Diode	
Approximate sensitivity	Switch position	
	Small	Alarm Sensitivity (moving probe) >0.05 oz per year CFC and HCFC >0.5 oz per year HFC
	Medium	>0.5 oz per year CFC and HCFC >1.0 oz per year HFC
	Large	>2.0 oz per year CFC and HCFC >5.0 oz per year HFC
Leak alarm	Audible alarm, visible neon lamp	
Response time	Approximately 1 second	
Warmup time	Approximately 2 minutes	
Accuracy	Meets SAE J1627 test requirements	
Probe length	Approximately 4.5 ft (1.4m)	
Ambient operating conditions	32 to 104°F (0 to 40°C); 5-90% RH, non-condensing	
Ambient storage conditions	14 to 140°F (-10 to 60°C); 5-90% RH, non-condensing	
Case	Rugged high-density polyethylene	
Dimensions (H x W x D)	5.5 x 10.5 x 8.5 in. (140 x 267 x 216 mm)	
Shipping weight	5 lb (2.3 kg)	

# RLD-H10G Refrigerant Leak Detector



## Description

The RLD-H10G 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, R502, R22, R404a, R507, R134a and R410A, among others. The RLD-H10G plugs into a 120 VAC outlet.

## Features

- Positive ion emission heated diode sensor provides the most sensitivity available today, while still detecting all halogenated refrigerant gases
- Halogen selective sensing eliminates many sources of possible false alarms due to background contamination
- High quality air pump supplies constant air flow to sensor so it responds quickly to leaks; also helps sensor recover quickly after exposure to refrigerant so leak can be verified
- Visual and audible signal facilitates sensing in noisy equipment rooms with 360° visibility and piercing tone; frequency of noise/light indicates magnitude of leak
- Exceeds SAE J1627 moving probe specification; minimizes service time because the leak is found the first time, is verifiable, and the fix can be confirmed

- External calibration source indicates when the sensor is working properly and serves as a reference point to judge leak size

## Selection Chart

For repair parts, contact your local Johnson Controls/PENN™ representative.

**Table 227: Selection chart**

Code Number	Description
RLD-H10G-1	Refrigerant Leak Detector control unit with a manual balancing circuit, a probe with a 4.5 ft cable, and a 6 ft power cord

## Accessories

**Table 228: Accessories**

Code Number	Description
RLD-H10-100	14 inch flexible probe extension
RLD-H10-600R	Tune-up kit includes: sensor, 100 filters, 3 airflow indicator balls, 3 probe tips and leak vial
RLD-H10-601R	Replacement sensor
RLD-H10-602R	Maintenance kit includes: 100 replacement filters, 3 airflow indicator balls, and 3 probe tips
RLD-H10-603R	Replacement leak vial
RLD-H10-606R	Replacement clear plastic probe tip
RLD-H10-607R	Replacement probe assembly

# RLD-H10G Refrigerant Leak Detector technical specifications

**Table 229: RLD-H10G Refrigerant Leak Detector technical specifications**

Specification	Description
Product	RLD-H10G Refrigerant Leak Detector
Power	120 VAC at 60 Hz
Requirements	
Sensing Element Type	Positive Ion Emission Heated Diode
Approximate Sensitivity	<b>Switch Position Alarm Sensitivity (moving probe)</b> Small >0.05 oz per year CFC or HCFC; >0.5 oz per year HFC Medium >0.5 oz per year CFC or HCFC; >1.0 oz per year HFC Large >3.0 oz per year CFC or HCFC; >5.0 oz per year HFC
Leak Alarm	Audible alarm, visible neon lamp
Response Time	Approximately 1 second
Warm-up Time	Approximately 2 minutes
Accuracy	Meets SAE J1627 test requirements
Probe Length	Approximately 4.5 ft (1.4 m)
Ambient Operating Conditions	32 to 113° F (0 to 45° C); 5 to 90% RH, non-condensing
Ambient Storage Conditions	14 to 140° F (-10 to 60° C); 5 to 90% RH, non-condensing
Case	Vinyl
Dimensions (H x W x D)	2.8 x 8.8 x 5.0 in. (71 x 224 x 127 mm)
Shipping Weight	3.2 lbs (1.4 kg)

# Liquid Level and Flow Controls



# F59 Series Sump Pump Switch

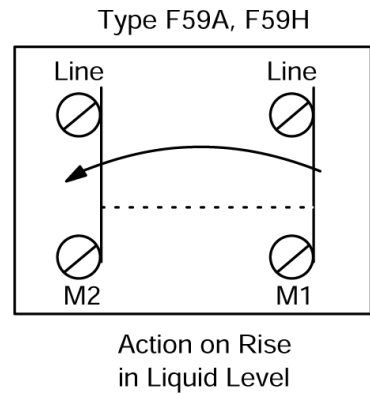


## Description

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.

Figure 69: F59 Series Action Diagram



## 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.

## 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

**Table 230: 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

## F59 Series Sump Pump Switch technical specifications

**Table 231: Electrical Ratings**

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

## F261 Series Fluid Flow Switches



### Features

- Type 3R (NEMA) or Type 4 (NEMA) enclosure allows use in indoor or outdoor applications.
- Viton® diaphragms facilitate use in fluid lines that carry chlorinated water, treated water, or other nonhazardous fluids.
- Low-flow operation on low-flow models actuates switch with less than 2.0 GPM (7.6 L/min) flow for water applications or 11.0 GPM (41.6 L/min) flow for steam applications.
- Maximum fluid pressure of 290 psig (20 bar) facilitates use in a wide range of pressure flow conditions.

### Description

The F261 Series Flow Switches respond to fluid flow in lines that carry 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.



## Selection chart

**Table 232: F261 Series Standard Model Flow Switches**

Product code	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 screw supplied uninstalled ⓘ <b>Note:</b> This model is a low-energy flow switch with gold-plated electrical contacts.

**Table 233: F261 Series Low-Flow Model Flow Switches**

Product code	Description
F261KEH-V01C	Low-flow model flow switch with Type 3R (NEMA) enclosure; 1/2 in. x 1/2 in. female NPTF inlet and outlet
F261KFH-V01C	Low-flow model flow switch with Type 3R (NEMA) enclosure; 3/4 in. x 3/4 in. female NPTF inlet and outlet
F261KFH-V02C	Low-flow model flow switch with Type 3R (NEMA) enclosure; 3/4 in. x 3/4 in. female NPTF inlet and outlet

**Table 233: F261 Series Low-Flow Model Flow Switches**

Product code	Description
F261MEH-V01C	Low-flow model flow switch with Type 4 (NEMA) enclosure; 1/2 in. x 1/2 in. female NPTF inlet and outlet
F261MFH-V01C	Low-flow model flow switch with Type 4 (NEMA) enclosure; 3/4 in. x 3/4 in. female NPTF inlet and outlet

**Table 234: Replacement paddle parts**

Product code	Description
PLT69-11R	Stainless steel 6 in. paddle
KIT21A-602	Stainless steel 6 in., 3 in., 2 in., and 1 in. paddles

## F261 electrical ratings

**Table 235: F261xxH Series standard controls electrical ratings**

Volts 50/60 Hz	UL 60730/UL 1059				EN 60730	
	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

**Table 236: F261xxL Series low energy controls electrical ratings, AC current**

Volts AC, 50/60 Hz	UL 60730/UL 1059EN 60730		
	4 VAC	24 VAC	120 VAC
Resistive amperes <sup>1</sup>	10	10	10
Pilot duty VA <sup>2</sup>	12	72	360

- 1 Maximum dry circuit rating: Resistive only, 400 mW at 28 VAC/VDC. After you use a relay at the general rating level, the dry circuit rating is no longer valid.
- 2 Meets UL 100,000 cycle UL endurance test requirement at switch with T<sub>min</sub> greater than or equal to 32°F (0°C).

**Table 237: F261xxL Series low energy controls electrical ratings, DC current**

Volts DC	UL 60730/UL 1059/EN 60730		
	4 VDC	24 VDC	48 VDC
Resistive amperes <sup>1</sup>	1	1	1

- 1 Maximum dry circuit rating: Resistive only, 400 mW at 28 VAC/VDC. After you use a relay at the general rating level, the dry circuit rating is no longer valid.

## F261 Series flow switches technical specifications

**Table 238: UL conformity declaration information**

Information	Description
Purpose of control	Operating liquid flow switch, automatic action
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

**Table 238: UL conformity declaration information**

Information	Description
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: <ul style="list-style-type: none"> <li>• 140°F (60°C) only permitted when ambient air and media are less than 113°F (45°C)</li> <li>• 167°F (75°C) only permitted when ambient air and media are less than 140°F (60°C)</li> <li>• 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)</li> <li>• 302°F (150°C) permitted when ambient air is less than 140°F (60°C) and media is less than 249°F (121°C)</li> </ul>
Vessel pressure	F261 Fluid Flow Switch: 290 psi (20 bar)

**Table 239: F261 Series fluid flow switches technical specifications**

Specification	Description
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 Low-Flow: 1/2 in. x 1/2 in. Female NPTF; 3/4 in. x 3/4 in. Female NPTF
Maximum fluid pressure	290 psi (20 bar)
Minimum fluid temperature	-20°F (-29°C) ① <b>Note:</b> Ensure that the low liquid temperature combined with the low ambient temperature does not lead to freezing the liquid inside the body or, if applicable, the bellows. Observe the liquid freezing point.
Maximum fluid temperature	250°F (121°C) ① <b>Note:</b> At higher ambient temperatures, the maximum liquid temperature becomes lower. The temperature of the electrical switch inside should not exceed 158°F (70°C).
Ambient conditions	-40°F to 140°F (-40°C to 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
CE	Europe: CE Mark – Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive and the Low Voltage Directive.
	Australia/New Zealand: Mark: RCM Compliant

*The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult Johnson Controls/Penn Refrigeration Application Engineering at 1-800-275-5676. Johnson Controls shall not be liable for damages resulting from misapplication or misuse of its products.*

## 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. You can wire the single-pole, double-throw (SPDT) control 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

Typical applications include:

- Make-up air systems
- Air cooling or heating processes
- Exhaust systems

The control includes a Type 3R (NEMA) enclosure with an integral mounting plate. A mounting plate gasket is supplied with each switch.

### Features

- The Type 3R (NEMA) polycarbonate enclosure provides for use in indoor applications, provides dust protection, and is approved for use in a plenum according to the National Electrical Code (NEC).
- The dependable dust-protected SPDT snap-acting Penn switch detects the presence or absence of airflow.
- Large wiring space makes wiring convenient and easily accessible.
- An easily accessible range adjustment screw provides for easy field adjustment.

### Selection charts

**Table 240: F262 Airflow Switch**

Product code	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

**Table 241: Replacement paddle kits for F262 switch**

Product code	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

**Table 242: F262 Switch electrical ratings**

Volts 50/60 Hz	UL 60730				EN 60730	
	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

**Table 243: F262 Airflow Switch technical specifications**

Specification	Description
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°F to 131°F (0°C to 55°C)
Compliance	<p><b>North America:</b> cULus Listed; UL 60730, File E6688; FCC Compliant to CFR47, Part 15, Subpart B, Class B</p> <p>Plenum rated; UL 2043, suitable for use in other environmental spaces, plenums, in accordance with section 300.22.(c) of the National Electrical Code</p> <p>Industry Canada (IC) Compliant to Canadian ICES-003, Class B limits</p>
CE	<p><b>Europe:</b> CE Mark – Johnson Controls 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><b>Australia/New Zealand</b> Mark: RCM Compliant</p>

## 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

### 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)

## F263 Series Liquid Level Float Switches technical specifications

**Table 244: 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
Pilot Duty VA	125	720	720	720	125	720

**Table 245: UL Conformity Declaration Information**

Information	Description
Purpose of Control	F263 Liquid Level Float 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	F263 Liquid Level Float Switch with Copper Float: 100 psi (690 kPa) F263 Liquid Level Float Switch with Polycarbonate Float: 150 psi (1935 kPa)

**Table 246: F263 Series Liquid Level Float Switches Technical Specifications**

Specification	Description
Switch	Single-Pole, Double-Throw (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
CE	Europe: CE Mark – Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive and 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

 **WARNING****Risk**

This product is made of a copper alloy, which contains lead. The product is therefore not to be used on drinking water.



# 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.

## 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).

## Selection chart

**Table 247: F93 Series Air Volume Controls for Deep Wells 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

## Technical specifications

**Table 248: F93 Series Air Volume Control for Deep Wells technical specifications**

Specification	Description
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)

# Motor Speed Controls





## 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 Fan Speed Control applications include:

- computer room air conditioning
- commercial refrigeration
- commercial air conditioning

## Selection charts

**Table 249: P266 Series Fan Speed Control Model and Kit Product Code Numbers, Descriptions, and Details**

Product Code Number	Description	Transducer Model Included in Kit	Voltage (VAC)	Maximum Output Amperes	High VAC Triacs	Available Auxiliary Fan Control Circuits <sup>1</sup>
P266AAA-100C <sup>2</sup>	P266 Fan Speed Control (only)	N/A	208/240	8	3	0
P266ABA-100C <sup>2</sup>	P266 Fan Speed Control (only)	N/A	208/240	8	3	3
P266ACA-100C <sup>2</sup>	P266 Fan Speed Control (only)	N/A	208/240	8	1	0
P266ADA-100C <sup>2</sup>	P266 Fan Speed Control (only)	N/A	208/240	8	1	3
P266BGA-100C <sup>2</sup>	P266 Fan Speed Control (only)	N/A	460/575	4	2	0
P266BHA-100C <sup>2</sup>	P266 Fan Speed Control (only)	N/A	460/575	4	2	3
P266BCA-100C <sup>2</sup>	P266 Fan Speed Control (only)	N/A	460/575	4	1	0
P266BDA-100C <sup>2</sup>	P266 Fan Speed Control (only)	N/A	460/575	4	1	3
P266CHA-100C <sup>2</sup>	P266 Fan Speed Control (only)	N/A	380/460	4	2	3
P266ABA-1K <sup>2</sup>	P266 Fan Speed Control with <b>one</b> 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 <sup>2</sup>	P266 Fan Speed Control with <b>one</b> 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
P266ABA-2K <sup>2</sup>	P266 Fan Speed Control with <b>two</b> 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 <sup>2</sup>	P266 Fan Speed Control with <b>two</b> 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 <sup>2</sup>	P266 Fan Speed Control with <b>one</b> 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 <sup>2</sup>	P266 Fan Speed Control with <b>one</b> 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 <sup>2</sup>	P266 Fan Speed Control with <b>two</b> 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

**Table 249: P266 Series Fan Speed Control Model and Kit Product Code Numbers, Descriptions, and Details**

Product Code Number	Description	Transducer Model Included in Kit	Voltage (VAC)	Maximum Output Amperes	High VAC Triacs	Available Auxiliary Fan Control Circuits <sup>1</sup>
P266BHA-4K <sup>2</sup>	P266 Fan Speed Control with <b>two</b> 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 <sup>2</sup>	P266 Fan Speed Control with Internal Transformer and <b>one</b> 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 <sup>2</sup>	P266 Fan Speed Control with Internal Transformer and <b>one</b> 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 <sup>2</sup>	P266 Fan Speed Control with Internal Transformer and <b>one</b> 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 <sup>2</sup>	P266 Fan Speed Control with Internal Transformer and <b>one</b> 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 <sup>2</sup>	P266 Fan Speed Control with Internal Transformer and <b>one</b> 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 <b>one</b> 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 <sup>2</sup>	P266 Fan Speed Control with Internal Transformer and <b>one</b> 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 <sup>2</sup>	P266 Fan Speed Control with Internal Transformer and <b>one</b> 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 <sup>2</sup>	P266 Fan Speed Control with Internal Transformer and <b>one</b> 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 <sup>2</sup>	P266 Fan Speed Control with Internal Transformer and <b>one</b> 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 <sup>2</sup>	P266 Fan Speed Control with Internal Transformer and <b>one</b> 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

<sup>1</sup> 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.

**Table 250: 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.
P266SNR-3C	Electronic Pressure Transducer: 0 to 52 bar (0 to 754 psi) total range with a 1/4 in. SAE Internal Flare Connection and a 3 meter (9 ft 10-7/64 in.) cable.

## P266 Series technical specifications

**Table 251: P266 Series Technical Specifications**

Specification	Description
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.  <b>ⓘ Note:</b> 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	<b>North America:</b> cULus, File E244421; FCC Compliant to CFR47, Part 15, Subpart B, Class A Industry Canada (IC) Compliant to Canadian ICES-003, Class A limits
<b>CE</b>	<b>Europe:</b> CE Mark – Johnson Controls 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.
	<b>Australia:</b> C-Tick Compliant (N1813)

# Product warranty

This product is covered by a limited warranty, details of which can be found at [www.johnsoncontrols.com/buildingswarranty](http://www.johnsoncontrols.com/buildingswarranty).

# Single point of contact

APAC	Europe	NA/SA
JOHNSON CONTROLS C/O CONTROLS PRODUCT MANAGEMENT NO. 32 CHANGJIANG RD NEW DISTRICT WUXI JIANGSU PROVINCE 214028 CHINA	JOHNSON CONTROLS VOLTAWEG 20 6101 XK ECHT THE NETHERLANDS	JOHNSON CONTROLS 507 E MICHIGAN ST MILWAUKEE WI 53202 USA

# Contact information

Contact your local branch office: [www.johnsoncontrols.com/locations](http://www.johnsoncontrols.com/locations)

Contact Johnson Controls: [www.johnsoncontrols.com/contact-us](http://www.johnsoncontrols.com/contact-us)





# P66/S66 Series Controls to P266 Series Controls Replacement Guide

## Description

**Table 252: P66/S66 to P266 Series Controls Cross-Reference**

Product Code Number	Operating Range (psig)	Effective throttling range (ETR) (psig)	Start Voltage (%)	Replacement Control <sup>1</sup>	Transducer Sold Separately
P66AAB-1	190/250	60	10	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66AAB-2	190/250	60	10	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66AAB-3	180/240	60	16	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66AAB-4	135/165	30	10	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66AAB-5	90/120	30	16	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66AAB-6	170/230	60	16	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66AAB-7	85/115	30	16	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66AAB-8	190/250	60	16	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66AAB-9	170/230	60	40	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66AAB-10	190/250	60	16	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66AAB-11	140/200	60	16	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66AAB-12	220/280	60	16	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66AAB-13	60/90	30	16	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66AAB-14	220/280	60	40	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66AAB-15	190/250	60	40	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66AAB-16	140/170	30	40	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66AAB-17	160/190	30	40	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66AAB-18	180/240	60	10	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66AAB-19	115/145	30	40	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66AAB-20	220/280	60	16	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66AAB-21	220/280	60	16	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66AAB-22	140/170	30	40	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66AAB-23	160/190	30	40	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66AAB-24	160/190	30	10	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66AAB-25	180/240	60	10	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66AAB-26	220/280	60	40	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66AAB-27	85/115	30	40	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66AAB-28	135/165	30	10	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>

**Table 252: P66/S66 to P266 Series Controls Cross-Reference**

Product Code Number	Operating Range (psig)	Effective throttling range (ETR) (psig)	Start Voltage (%)	Replacement Control <sup>1</sup>	Transducer Sold Separately
P66AAB-29	190/250	60	10	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66AAB-30	170/230	60	16	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66AAB-31	115/145	30	40	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66AAB-32	140/200	60	40	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66AAB-33	115/215	60	40	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66AAB-34	320/410	90	40	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-2C <sup>4</sup>
P66AAB-35	230/320	90	40	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66AAB-36	190/250	60	10	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66AAB-37	320/410	90	10	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-2C <sup>4</sup>
P66AAB-38	360/450	90	40	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-2C <sup>4</sup>
P66AAD-1	160/220	60	25	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66AAD-2	190/250	60	10	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66AAD-3	190/250	60	10	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66AAD-4	180/240	60	10	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66AAD-5	160/190	30	10	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66ABB-20	220/280	60	16	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66ABB-21	220/280	60	16	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66ABB-22	140/170	30	40	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66ABB-23	160/190	30	40	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66ABB-24	190/250	60	16	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66ABB-25	190/250	60	16	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66ABB-26	170/230	60	40	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66ABB-27	190/250	60	40	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>4</sup>
P66ABB-28	320/410	60	16	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-2C <sup>4</sup>
P66BAB-1	190/250	60	10	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>5</sup>
P66BAB-2	190/250	60	10	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>5</sup>
P66BAB-3	170/230	60	16	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>5</sup>
P66BAB-4	190/250	60	16	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>5</sup>
P66BAB-5	190/250	60	40	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>5</sup>
P66BAB-6	220/280	60	40	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>5</sup>
P66BAB-7	190/250	60	10	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>5</sup>
P66BAB-8	170/230	60	16	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>5</sup>
P66BAB-9	320/410	90	40	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-2C <sup>5</sup>
P66BAB-10	360/450	90	40	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-2C <sup>5</sup>
P66BBB-1	190/250	60	16	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>5</sup>
P66BAD-1	160/220	60	25	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>5</sup>
P66BAD-2	190/250	60	10	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>5</sup>
P66BAD-3	190/250	60	10	P266ACA-100C <sup>2</sup> P266BCA-100C <sup>3</sup>	P266SNR-1C <sup>5</sup>
S66AA-1	NA	NA	50	P266ACA-100C <sup>6</sup>	NA
S66DC-1	NA	NA	40	NR	NA
S66FA-1	NA	NA	50	P266ACA-100C <sup>6,7</sup>	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.

① **Note:**

- NA = Not applicable
- NR = No replacement available

## VFD68 Variable Frequency Drives



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 10 hp.
- Simple and advanced end-user settings provide quick and simple application setup and operation, as well as advanced setup parameters for custom applications.

### 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 P599 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, remote terminal unit (RTU) compliant ModBus® subordinate device and can be integrated into a ModBus network.

### 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.

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.

## Selection chart

**Table 253: 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)

**Table 254: 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.)

**Table 254: 460 VAC ±10% Production Models**

Product Code Number	Description
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)

**Table 255: 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.)

**Table 256: Accessories**

Product Code Number	Description	Accessory Information
P599RAPS100K P599RCPS100K	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"> <li>Product code numbers ending in K are P599 kit models that include one P599 Pressure Transducer model and a WHA-PKD3-200C (6-1/2 ft [2 m]) Wire Harness. To order a single P599 Pressure Transducer model (without a WHA-PKD3-200C Wire Harness), replace the K with a C at the end of the P599 product code number.</li> <li>P599RxP type models are 0.5 to 4.5 VDC ratiometric pressure transducers with Packard style electrical connections.</li> <li>P599RAP type models have a 1/8 in. 27 NPT external thread (Style 49) pressure connection.</li> <li>P599RCP type models have a 1/4 in. SAE 45° flare internal thread (7/16-20 UNF) with depressor (Style 47) pressure connection.</li> <li>Refer to the <i>P599 Series Electronic Pressure Transducers Product/Technical Bulletin (LIT-12012446)</i> for more information on P599 Pressure</li> </ul>
P599RAPS102K P599RCPS102K	Electronic Pressure Transducer (0 to 200 psis [sealed for wet and freeze/thaw applications] Range) and one WHA-PKD3-200C Wire Harness	
P599RAPS101K P599RCPS101K	Electronic Pressure Transducer (0 to 100 psig Range) and WHA-PKD3-200C Wire Harness	
P599RAPS102C	Electronic Pressure Transducer (0 to 200 psig Range)	
P599RAPS105K P599RCPS105K	Electronic Pressure Transducer (0 to 500 psig Range) and WHA-PKD3-200C Wire Harness	
P599RAPS107K P599RCPS107K	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)	

## VFD68 Variable Frequency Drives technical specifications

**Table 257: VFD68 Variable Frequency Drives technical specifications**

Specification	Description
Input Power Voltage/Frequency	<ul style="list-style-type: none"> <li>• 230 VAC, 50 Hz (208/230 VAC, 60 Hz);</li> <li>• 400 VAC, 50 Hz (460 VAC, 60 Hz);</li> <li>• 575 VAC, 50 Hz;</li> <li>• Continuous Duty</li> </ul>
Output Voltage/Frequency	<ul style="list-style-type: none"> <li>• 230 VAC, 50 Hz (208/230 VAC, 60 Hz);</li> <li>• 400 VAC, 50 Hz (460 VAC, 60 Hz);</li> <li>• 575 VAC, 50 Hz;</li> <li>• Continuous Duty</li> </ul>
Input Devices	Johnson Controls/PENN® P599 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)

**Table 257: VFD68 Variable Frequency Drives technical specifications**

Specification	Description
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 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	<p>230 VAC ±10% Production Models:</p> <ul style="list-style-type: none"> <li>• VFD68BBB, VFD68BCB: 0.5 kg (1.1 lb)</li> <li>• VFD68BDC: 0.8 kg (1.8 lb)</li> <li>• VFD68BFD: 1.0 kg (2.2 lb)</li> <li>• VFD68BGG, VFD68BHG: 1.4 kg (3.1 lb)</li> <li>• VFD68BJK: 1.8 kg (4.0 lb)</li> <li>• VFD68BKL, VFD68BLL: 3.6 kg (8.0 lb)</li> <li>• VFD68BMP, VFD68BNP: 6.5 kg (14.3 lb)</li> </ul> <p>460 VAC ±10% Production Models:</p> <ul style="list-style-type: none"> <li>• VFD68CDF, VFD68CFF: 1.3 kg (2.9 lb)</li> <li>• VFD68CGG: 1.4 kg (3.1 lb)</li> <li>• VFD68CHH, VFD68CJJ: 1.5 kg (3.3 lb)</li> <li>• VFD68CKL, VFD68CLL: 3.3 kg (7.3 lb)</li> <li>• VFD68CMP, VFD68CNP: 6.5 kg (14.3 lb)</li> </ul> <p>575 VAC +5/-10% Production Models:</p> <ul style="list-style-type: none"> <li>• VFD68DFM: 1.8 kg (3.96 lb)</li> <li>• VFD68DGM, VFD68DHM: 2.0 kg (4.41 lb)</li> <li>• VFD68DJN, VFD68DKN, VFD68DLN: 3.8 kg (8.38 lb)</li> </ul>



# Valves and Valve Accessories





## V43/V243 Series Pressure-Actuated Water-Regulating Valves

### Description

The V43/V243 Pressure-Actuated Water Regulating Valves 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 noncorrosive low- and medium-pressure refrigerants such as R-134A, R-404A, R-502, and R-507.

V243 valves are available for noncorrosive high-pressure refrigerants such as R410A.

Commercial V43/V243 valves feature 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 feature 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 for more precise throttling
- Easy adjustment facilitates service and adjustment without breaking line connections
- Drain plug to remove water during shutdown to reduce the possibility of freeze-up
- Mesh MONEL screen protects pilot valve from items such as dirt and scale and is easy to remove for cleaning and servicing without breaking any line connections

## Selection chart

When you order V43 valves, specify the complete product code number including an optional companion flange and gasket kit. You need a companion flange and gasket kit to mount the water lines to commercial type V43/V243 water-regulating valves.

**Table 258: 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

**Table 259: Flange size**

Designator	Flange size
S	2 in.
T	2 1/2 in.
V	3 in.
W	4 in.

**Table 260: V43 Series pressure-actuated water valves, except NAVSEA valves**

Product code	Pipe size, in.	Inlet and outlet	Opening point adjustment range, psig (kPa)	Shipping weight, lb (kg)
Commercial type – noncorrosive refrigerants (R)				
V43AS-1C	2	Four-hole American Society of Mechanical Engineers (ASME) flange	70 to 150 (483 to 1,034)	59 (26.76)
V43AS-2C			160 to 260 (1,103 to 1,793)	
V43AT-2C	2-1/2	Four-hole ASME flange	140 to 260 (1,103 to 1,793)	65 (29.48)
V43AV-1C	3		70 to 150 (483 to 1,034)	90 (40.82)
V43AV-2C	3		160 to 260 (1,103 to 1,793)	90 (40.82)
V43AW-2C			4	Eight-hole ASME flange
Maritime type – noncorrosive refrigerants (R)				
V43BS-7C			160 to 260 (1,103 to 1,793)	
V43BT-7C			140 to 260 (1,103 to 1,793)	
V43BV-7C			140 to 260 (1,103 to 1,793)	

**Table 261: V43 Series pressure-actuated water valves, Navy NAVSEA certified**

Product code	Pipe size, in.	Inlet and outlet	Pressure connector	Opening point adjustment range, psig (kPa)	Shipping weight, lb (kg)
Navy NAVSEA certified – noncorrosive refrigerants (R)					
V43CS-1C		Six-hole Navy flange	Internal sweat connector	70 to 150 (1,013 to 2,175)	
V43CS-2C					
V43BT-3C	2-1/2	Four-hole ASME flange	1/4 in. external flared connector		65 (29.48)
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		142 (64.41)

**Table 262: V243 Series pressurized actuated water valves**

Product code	Pipe size, in.	Inlet and outlet	Opening point adjustment range, psig (kPa)	Shipping weight, lb (kg)
Commercial type – high pressure refrigerants (R)				
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			90 (40.82)
Maritime type – high pressure refrigerants (R)				
V243HS-1C	2	Four-hole ASME flange	200 to 400 (1,379 to 2,758)	59 (26.76)
V243HT-1C	2-1/2	Four-hole ASME flange		65 (29.48)
V243HV-1C	3			90 (40.82)
V243HW-1C	4	Eight-hole ASME flange		142 (64.41)

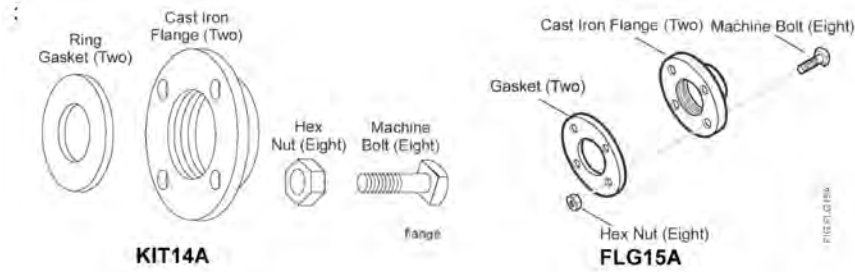
**Table 263: Accessories**

Kit product code	Water valve size, in.	Shipping weight, lb (kg)
KIT14A-613 <sup>1</sup> , <sup>2</sup>	2	11.8 (5.4)
KIT14A-614 <sup>1</sup> , <sup>2</sup>	2-1/2	16.5 (7.5)
FLG15A-600 <sup>1</sup> , <sup>3</sup>	3	20 (9.1)
FLG15A-601 <sup>1</sup> , <sup>3</sup>	4	34 (15.4)

- Commercial valves only.
- These are the parts included in the flange and gasket kit for the 2 in. and 2 1/2 in. valves.
- These are the parts included in the flange and gasket kit for the 3 in. and 4 in. valves.

You need a companion flange and gasket kit to mount the water lines to commercial type V43/V243 water-regulating valves.

**Figure 70: KIT14A and FLG15A**



## Repair parts

**Table 264: Repair parts**

Model	Diaphragm kit	Seat disc and diaphragm kit	Seat repair kit	Screen repair kit	Push rod kit'	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 <sup>1</sup>	DPM18A-600R	DSC16A-600R	STT19A-602R	SCN10A-601R	ROD18A-602R	SEP88A-600R	DBK11A-600R
V43BS-2C <sup>1</sup>	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 <sup>1</sup>	DPM18A-601R	DSC16A-601R	STT19A-603R	SCN10A-601R	ROD18A-603R	SEP88A-600R	DBK11A-601R
V43BT-2C <sup>1</sup>	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 <sup>1</sup>	DPM18A-602R	DSC16A-602R	STT19A-606R	SCN10A-601R	ROD18A-603R	SEP88A-600R	DBK11A-602R
V43BV-2C <sup>1</sup>	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 <sup>1</sup>	DPM18A-602R	DSC16A-602R	STT19A-606R	SCN10A-601R	ROD18A-603R	SEP88A-600R	DBK11A-602R
V43BV-6C <sup>1</sup>	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

**Table 264: Repair parts**

Model	Diaphragm kit	Seat disc and diaphragm kit	Seat repair kit	Screen repair kit	Push rod kit <sup>1</sup>	Sensing element kit	Disc body kit
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
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 or a diaphragm kit when you replace it.

## Parts kits

The following valves, manufactured after date code 8702, contain MONEL interior trim. For a list of replacement kits to order, see Table 264 or refer to *V43xx and V243xx Series Repair Parts Kits Technical Bulletin (LIT-121690)*.

**Table 265: 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

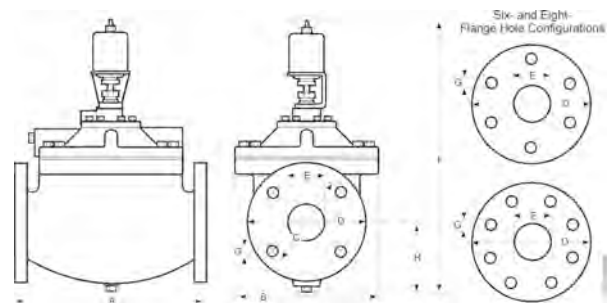
**Table 266: Dimensions**

Symbol	2 in.	2 1/2 in.	3 in.	4 in.
A Flange face to flange face	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)

**Table 266: Dimensions**

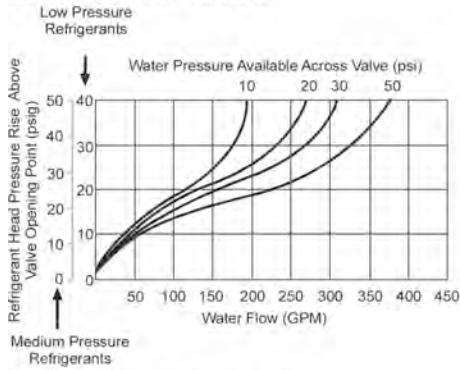
Symbol	2 in.	2 1/2 in.	3 in.	4 in.
F V43 valves	15 1/4 in. (387 mm)	15 9/16 in. (395 mm)	16 9/16 in. (421 mm)	18 7/32 in. (462 mm)
F V243 valves	15 29/32 in. (404 mm)	16 7/32 in. (412 mm)	17 7/32 in. (437 mm)	18 7/8 in. (479 mm)
G	3/4 in. (19 mm)  Diameter (four)	3/4 in. (19 mm)  Diameter (four)	3/4 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)

**Figure 71: V43/V243 Pressure Actuated Water Regulating Valves dimensions**

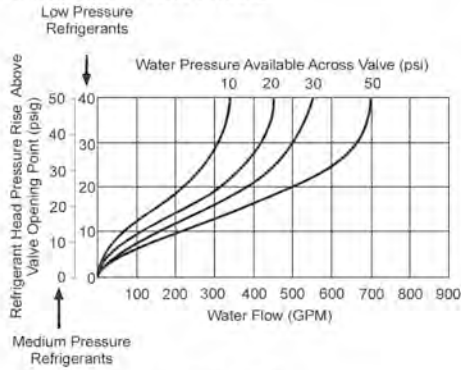


# V43 capacity flow charts

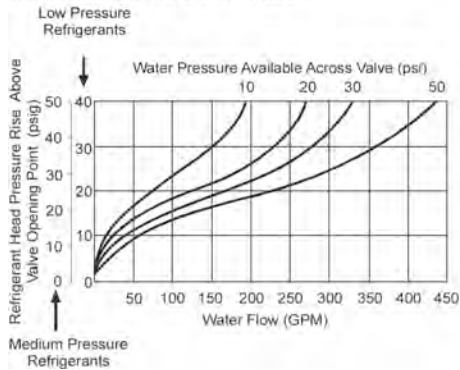
CAPACITY CHART FOR 2 in. VALVE



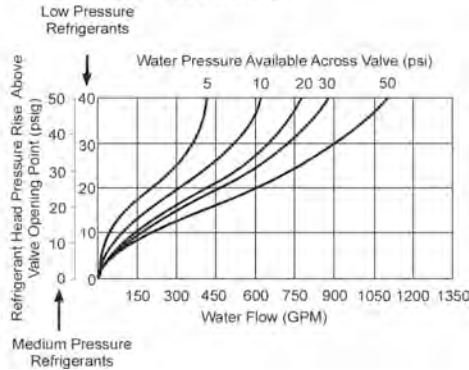
CAPACITY CHART FOR 3 in. VALVE



CAPACITY CHART FOR 2-1/2 in. VALVE

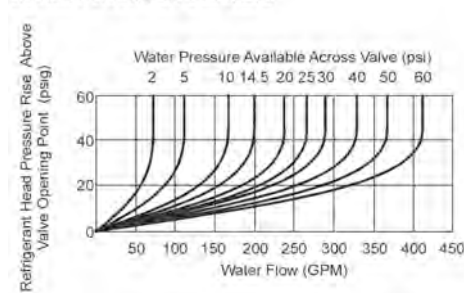


CAPACITY CHART FOR 4 in. VALVE

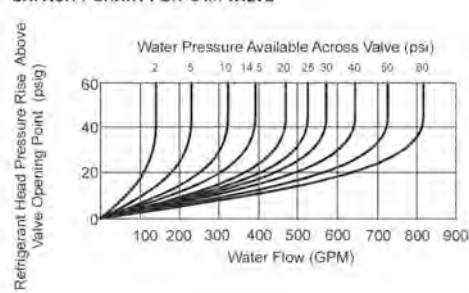


# V243 capacity flow charts

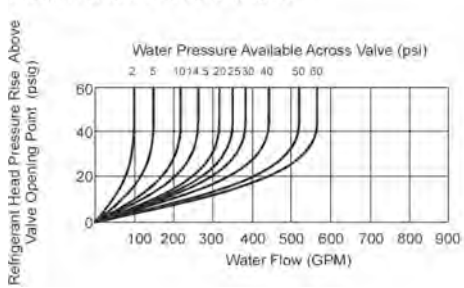
CAPACITY CHART FOR 2 in. VALVE



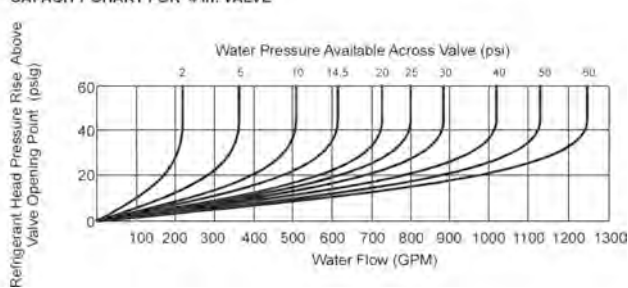
CAPACITY CHART FOR 3 in. VALVE



CAPACITY CHART FOR 2-1/2 in. VALVE



CAPACITY CHART FOR 4 in. VALVE

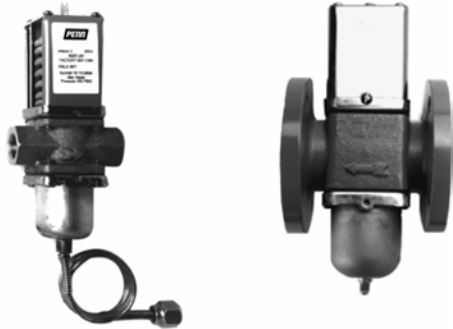


## V43/V243 Series valves technical specifications

Specification		Description	
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)
	V243	High-pressure	200 to 400 psig (1,379 to 2,758 kPa)
Factory settings <sup>1</sup>	V43	Low-pressure refrigerants	90 psig (621 kPa)
		Medium-pressure refrigerants	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		Noncorrosive 1/4 in. SAE external flare	

<sup>1</sup> You can adjust the factory opening setpoint for the valve.

# 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 the flow of water or glycol to a water-cooled condenser on a refrigeration system such as the following:

- Ice machines
- Computer room air conditioning units
- Ice cream machines
- Refrigeration cases

## Selection chart

Refer to *V46 Series Valve Sizing Information — 90% Open Method Catalog Page (LIT-1927400)*. Then specify the code number from the following chart. For companion flange kit code numbers, see [Companion flange and gasket accessories](#).

Standard capillary length on Style 45 and Style 34 elements is 30 inches.

For SEC99AA-36C, a replacement element is supplied with a 1/4 in. external SAE connector. Order the SEC99AA Capillary Kit with two flare nuts separately, if needed.



**Table 267: Commercial type, standard flow - non-corrosive refrigerants**

Product code	Pipe size, in.	Inlet and outlet	Opening point range, psig (kPa)	Pressure element style	Seat repair kit	Replacement power elements	
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	
V46AA-50C				1/4 in. external flare fitting, Style 5.		SEP91A-600R	
V46AB-1C	1/2 NPT			30 in. capillary; 1/4 in. flare nut, Style 45.	STT15A-602R	SEP91A-602R and SEC99AA-36C	
V46AB-25C				1/4 in. external flare fitting, Style 5.		SEP91A-602R	
V46AC-1C	3/4 NPT			30 in. capillary; 1/4 in. flare nut, Style 45.	STT16A-601R	SEP91A-601R and SEC99AA-36C	
V46AC-26C				1/4 in. external flare fitting, Style 5.		SEP91A-601R	
V46AD-1C	1 NPT			30 in. capillary; 1/4 in. flare nut, Style 45.	STT17A-609R	SEP91A-603R and SEC99AA-36C	
V46AD-13C				1/4 in. external flare fitting, Style 5.		SEP91A-603R	
V46AE-17C	1 1/4 NPT				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	SEP107A-602R				
V46AM-2C	1-1/4	STT17A-610R					
V46AR-1C	1 1/2	Four-hole American Society of Mechanical Engineers (ASME) flange	70 to 170 (483 to 1,172)	30 in. capillary; 1/4 in. flare nut, Style 45.		SEP91A-603R and SEC99AA-36C	
V46AR-10C				1/4 in. external flare fitting, Style 5.		SEP91A-603R	
V46AS-1C	2			Use only on valves specified.	STT18A-600R	SEP81A-602R	
V46AS-2C	2					SEP81A-601R	
V46AT-1C	2-1/2			70 to 170 (483 to 1,172)	STT18A-601R	SEP81A-602R	
V46AT-2C	2-1/2			160 to 260 (1,103 to 1,793)		SEP81A-601R	

**Table 268: Commercial type, low flow - non-corrosive refrigerants**

Product code	Pipe size, in.	Inlet and outlet	Opening point range, psig (kPa)	Pressure element style	Seat repair kit	Replacement power elements
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

**Note:** Low water flow valve - 2.5 gpm maximum.

**Table 269: Maritime type - non-corrosive refrigerants**

Product code	Pipe size, in.	Inlet and outlet	Opening point range, psig (kPa)	Pressure element style	Seat repair kit	Replacement power elements
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	Four-hole ASME flange	160 to 260 (1,103 to 1,793)		STT18A-602R	SEP50A-601R
V46BT-4C	2-1/2					

**Table 270: NAVSEA certified – non-corrosive refrigerants**

Product code	Pipe size, in.	Inlet and outlet	Opening point range, psig (kPa)	Pressure element style	Seat repair kit	Replacement power elements	
V46CG-1C	3/8	Threaded	70 to 260 (483 to 1,793)	30 in. capillary with sweat connection, Style 34.	STT14A-601R	SEP13A-602R	
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					
V46BT-3C	2-1/2	Four-hole ASME flange					
V46CT-3C	2-1/2	Six-hole Navy flange					
V46CT-4C	2-1/2		160 to 260 (1,103 to 1,793)				

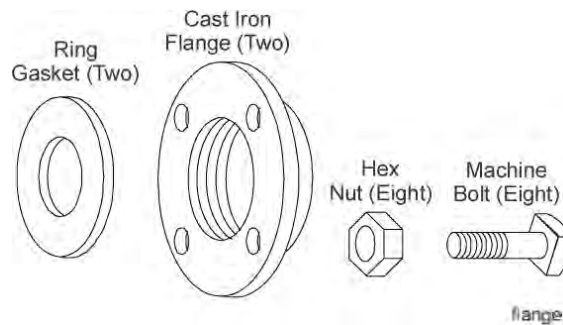
## Companion flange and gasket accessories

Product code	Companion flange kit, see following figure	Water valve size, in.
246-423	KIT14A-612 <sup>1</sup>	1-1/2 in.
246-424	KIT14A-613 <sup>1</sup>	2 in.
246-425	KIT14A-614 <sup>1</sup>	2-1/2 in.

1 For commercial valves only

ⓘ **Note:** The flange has NPT (National Pipe Thread).

**Figure 72: Companion flange kit**



## V46 series pressure-actuated water regulating valve technical specifications

**Table 271: V46 Series pressure-actuated water regulating valves**

Specification	Description	
Maximum water temperature	170°F (77°C)	
Valve body	Commercial	3/8 in. 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

**Table 272: Pressure range specification**

Refrigerant	Opening point range <sup>1</sup> , psig (kPa) V46 A B, C, D	Maximum permissible pressure, psig (kPa)		
		Water		Refrigerant
		Static	ΔP across valve	
Non-corrosive refrigerants (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				
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)

1 Direct-acting valve ranges indicate the valve opening point.

# 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) =

$$\frac{(\text{Tons of Refrigeration} \times 15,000 \text{ Btu/h})}{500 \times (\text{Outlet Temperature} - \text{Inlet Temperature})}$$

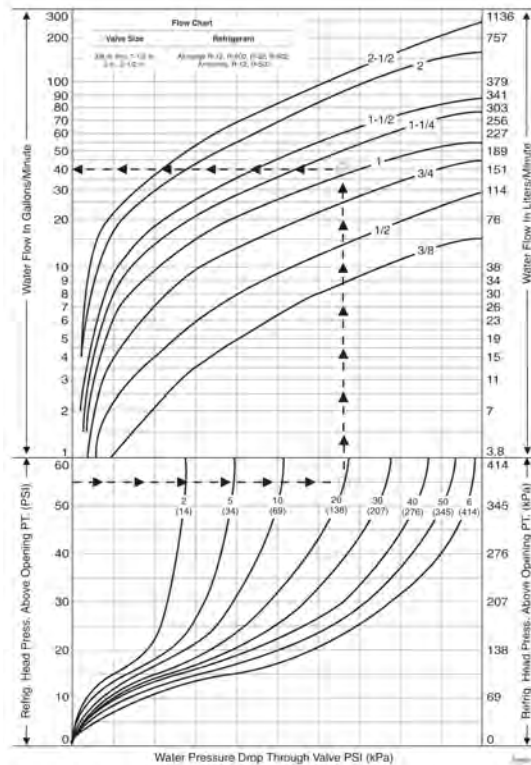
2. Draw horizontal line across upper half of flow chart through flow required as determined by Step 1d above.
3. Determine the available system pressure for use with the valve by the following appropriate method:
  - Open System: Available System Pressure = Inlet Pressure - condenser pressure drop - 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.

**WARNING**

**Risk**

This product is made of copper alloy, which contains lead. The product is therefore not to be used on drinking water.

**Figure 73: Flow Chart, V46 Valve**



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.

### 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).

# V46 Series Valve Dimensions

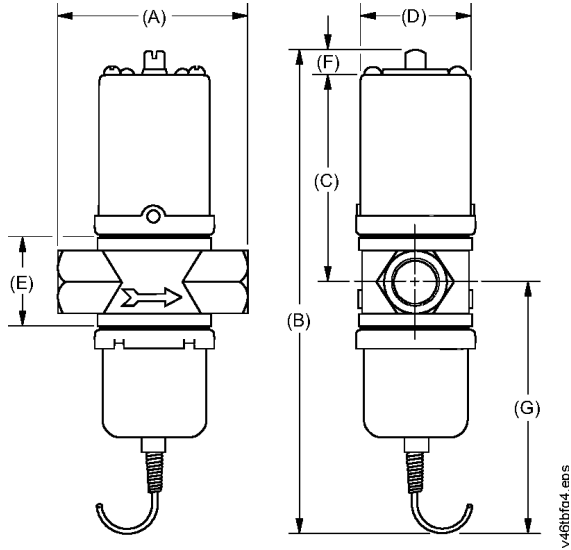
## Roughing-in Dimensions

**Table 273: 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) <sup>1</sup>	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) <sup>1</sup>	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) <sup>1</sup>	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

<sup>1</sup> Values in parenthesis are for maritime valves. All other dimensions remain the same.

**Figure 74: V46 Series Threaded Type Valves**

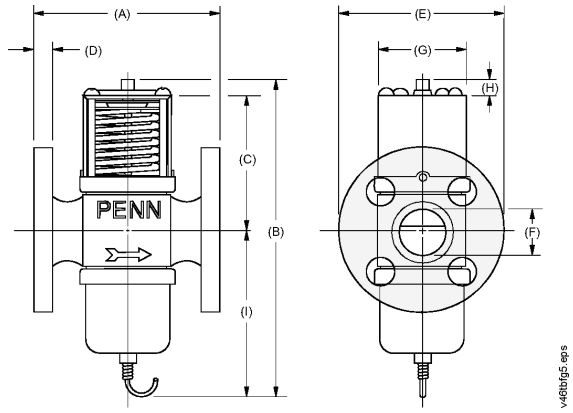


**WARNING**

**Risk**

This product is made of copper alloy, which contains lead. The product is therefore not to be used on drinking water.

**Figure 75: Flange Type Valves**



**Table 274: 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

**Table 275: Maritime Service: American Society of Mechanical Engineers (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

**Table 276: 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

## V47 Series Temperature Actuated Modulating Valve



### 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

### 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.



## Selection chart

Product Code Number <sup>1</sup>	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 <sup>2</sup>	3/8	20 to 65 Cross Ambient	11/16 x 6 <sup>3</sup>	-	STT14A-600R	-	WEL17A-601R
V47AB-2C	1/2	75 to 135 Cross Ambient	11/16 x 10 <sup>3</sup>	-	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 <sup>4</sup>	1/2	40 to 85 Cross Ambient	11/16 x 10 <sup>3</sup>	Yes <sup>5</sup>	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 <sup>5</sup>	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 <sup>5</sup>	STT17A-610R	-	-
V47AR-1	1-1/2 <sup>6</sup>	75 to 135 Cross Ambient	11/16 x 16-1/4	0.093	STT17A-610R	SET29A-605R	-
V47AR-2	1-1/2 <sup>6</sup>	115 to 180 Heating	11/16 x 6	0.093	STT17A-610R	SET29A-629R	WEL17A-601R
V47AR-3	1-1/2 <sup>6</sup>	160 to 230 Heating	11/16 x 6	0.093	STT17A-610R	SET29A-630R	WEL17A-601R
V47AS-1	2 <sup>6</sup>	115 to 160 Heating	11/16 x 10	0.125	STT18A-600R	SET29A-632R	WEL17A-600R
V47AS-2	2 <sup>6</sup>	160 to 205 Heating	11/16 x 10	0.125	STT18A-600R	SET29A-633R	WEL17A-600R
V47AS-3	2 <sup>6</sup>	75 to 115 Cross Ambient	11/16 x 43	0.125	STT18A-600R	SET29A-606R	-
V47AS-13C	2 <sup>6</sup>	40 to 85 Cross Ambient	11/16 x 43	Yes <sup>5</sup>	STT18A-600R	-	-
V47AT-1	2-1/2 <sup>6</sup>	115 to 160 Heating	11/6 x 10	0.125	STT18A-601R	SET29A-632R	WEL17A-600R
V47AT-2	2-1/2 <sup>6</sup>	160 to 205 Heating	11/6 x 10	0.125	STT18A-601R	SET29A-633R	WEL17A-600R
V47AT-3	2-1/2 <sup>6</sup>	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 American Society of Mechanical Engineers (ASME) Flange

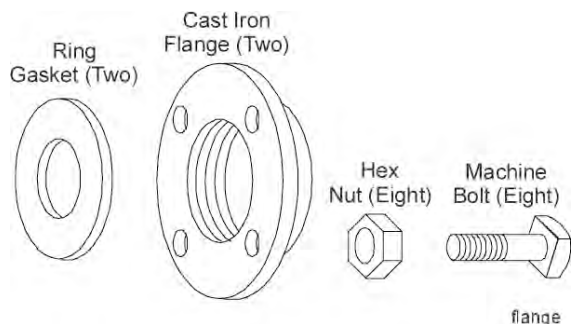
**Note:** For more information on Bulb Wells, refer to *Bulb Wells Catalog Page (LIT-1922135)*.

## Accessories (Companion Flanges and Gaskets)

Product Code Number		
Flange Gasket (One Gasket per Package)	Companion Flange Kit (See Diagram)	Water Valve Size (in.)
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).

**Figure 76: Companion Flange Kit**



## V47 Series Temperature Actuated Modulating Valve 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 <sup>1</sup>
Temperature Bulb Style 4 <sup>2</sup> (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)

**Table 277: 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.

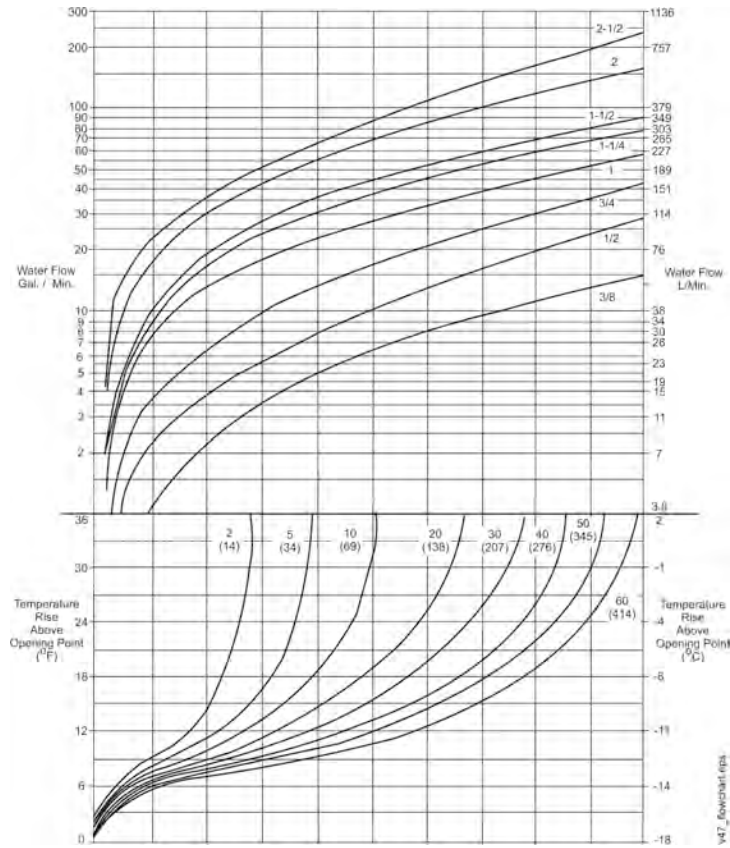
- Determine the maximum water flow required. Draw a horizontal line through this flow across the upper half of the flow chart.
- Use the following method to determine the temperature rise above the opening point.
  - Valve closing point is the highest temperature at which it is desired to have no flow 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.

- 7. If the intersection falls between two curves, use the curve to the left for the required valve size.

**Figure 77: Flow Chart, V47 Valve**



## V48 Series Three-Way Water Regulating Valve



### Applications

To provide the most economical and efficient use of the tower, you can use V48 Series valves on single or multiple condenser hook-ups to the tower.

### Description

V48 Series valves are designed specifically for condensing units that cool either 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.

## Selection chart

① **Note:** Use these valves with noncorrosive refrigerants.

**Table 278: V48 Series selection chart**

Product code	Pipe size, in.	Range opening point of normally closed side, psi (kPa)	Pressure element style	Water supply pressure, psig (kPa)	Inlet and outlet ports	Max bellows overpressure, psig (kPa)	Seat repair kit	Replacement sensing element
V48AB-2C	1/2	145 to 190 (1,000 to 1,310)	30 in. capillary with 1/4 in. flare nut, Style 45 <sup>1</sup>	150 (1,034)	Threaded	320 (2,206)	STT15A- 605R	SEP91A-602R SEC99AA-36C <sup>2</sup>
V48AC-2C	3/4						STT16A- 604R	SEP91A-601R SEC99AA-36C <sup>2</sup>
V48AD-2C	1						STT17A- 616R	SEP91A-603R
V48AE-2C	1 1/4						STT17A- 617R	SEC99AA-36C <sup>2</sup>
V48AF-2C	1 1/2		1/4 in. external flare fitting, Style 5				STT17A- 604R	SEP81A-601R
V48EK-2C	3/4		30 in. capillary with 1/4 in. flare nut, Style 46				Union	370 (2,551)
V48AL-2C	1			320 (2,206)	STT17A- 616R	SEP107A-602R		

1 Standard capillary length on Style 45 elements is 30 in.

2 Replacement element supplied with 1/4 in. external SAE connector. Order SEC99AA capillary kit with two flare nuts separately if you require it. Use only on specified valves.

## V48 Series Three-Way Water Regulating Valve technical specifications

**Table 279: V48 Series factory settings**

Refrigerant (R)	Factory settings, psig (kPa)	
	Opening pressure Port 1 to Port 2	Closing pressure Port 1 to Port 3
Low pressure; for example, R134a	95 (655)	120 (896)
Medium pressure; for example, R-22, R404A	165 (1,138)	215 (1,482)

## V50 Series Crop Drying Module



### Description

The self-operating modulating valves regulate the flow of gas on LP gas-fired crop driers. They maintain a desired delivered air temperature. Temperature setting is easily changed by an adjusting handle.

### Applications

- Portable grain dryers
- Storage grain bins

### Accessories

Orifices supplied with each valve Seat Repair Kit includes seat, disc, diaphragms, and all internal parts to recondition valves. For other available sizes, call Application Engineering.

### Ordering information

Specify the code number from the following selection chart.

## Selection Chart

**Table 280: Selection chart**

Code Number	Temperature Range	Valve Body	Max. Bulb Temp.	Max. Line Pressure	Capillary and Bulb Size	Seat Repair Kit	Replacement Sensing Element
V50AB-1C	90 to 210°F (32 to 99°C)	1/2 in. NPT brass	230°F (110°C)	30 psig (207 kPa)	<ul style="list-style-type: none"> <li>Air bulb, 11/16 in. x 10 in.</li> <li>10 ft armored cap</li> </ul>	STT15A-604R	SET100A-603R
V50AB-3C	55 to 155°F (13 to 68°C)						SET100A-631A

① **Note:** Seat repair kit is a non-stock item and built to order.

# 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.

### WARNING

#### Risk

This product is made of copper alloy, which contains lead. The product is therefore not to be used on drinking water.



## 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 [ $m^3/hr$ ]):

- System Capacity (Tons of Refrigeration)
- Outlet Water Temperature (Temp.  $_{Outlet}$ )
- Inlet Water Temperature (Temp.  $_{Inlet}$ )

Calculate the flow using the following formula:

### Figure 78: Flow Required

$$\text{Flow} = \frac{\text{Tons of Refrigeration} \times 30}{(\text{Temp.}_{Outlet} - \text{Temp.}_{Inlet})}$$

- 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.

### Figure 79: Valve Opening Pressure, EK and AL Models (Top) or GK1 and GL1 Models (Bottom)

$$P_{OPEN} = P_{CLOSE} + 7 \text{ psi (0.5 bar)}$$

$$P_{OPEN} = P_{CLOSE} + 10 \text{ psi (0.7 bar)}$$

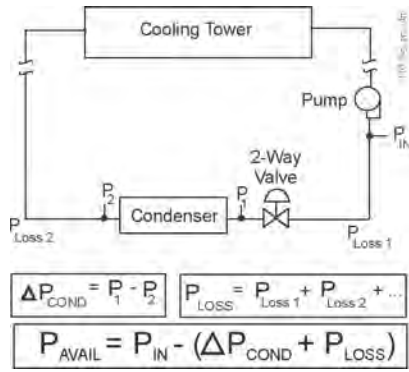
- c. From the Pressure-Temperature Chart for the refrigerant selected, read the Refrigerant Condensing Pressure ( $P_{COND}$ ) (operating head pressure) corresponding to the selected condensing temperature.
- d. Subtract the Valve Opening Pressure from the Refrigerant Condensing Pressure. This gives the head pressure rise.

### Figure 80: Refrigerant Head Pressure Rise

$$P_{RISE} = P_{COND} - P_{OPEN}$$

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 ( $\Delta P_{COND}$ ) 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  $\Delta P_{COND}$  and  $P_{LOSS}$  from  $P_{IN}$ . The result is  $P_{AVAIL}$ .

**Figure 81: Available Water Pressure**

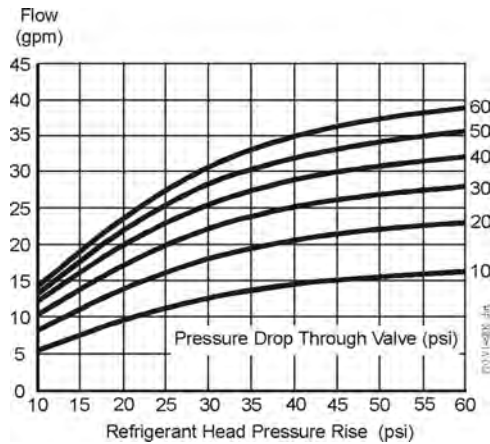


- Select the proper valve size from the flowcharts by locating a point on a chart that satisfies the flow, the head pressure rise above opening point, and the pressure drop across the valve. Use these equations to convert between U.S. and S.I. units.

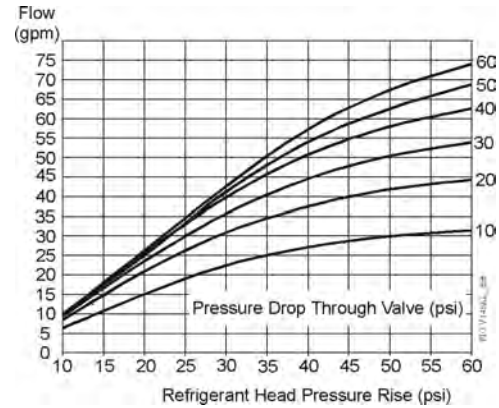
- $1 \text{ dm}^3/\text{s} = 3.6 \text{ m}^3/\text{h} = 15.9 \text{ U.S. gal. /min.} = 13.2 \text{ U.K. gal. /min.}$
- $1 \text{ bar} = 100 \text{ kPa} = 0.1 \text{ MPa} = 1.02 \text{ kg/cm}^2 = 0.987 \text{ atm} = 14.5 \text{ psi}$

The maximum recommended differential water pressure across a valve is 60 psi (4.1 bar).

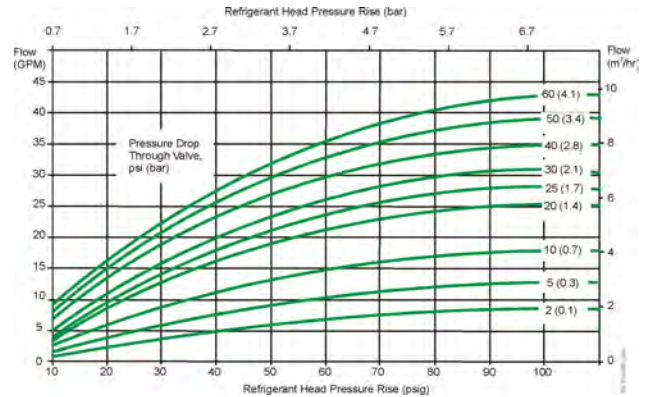
**Figure 82: 3/4 in. V146EK Valve**



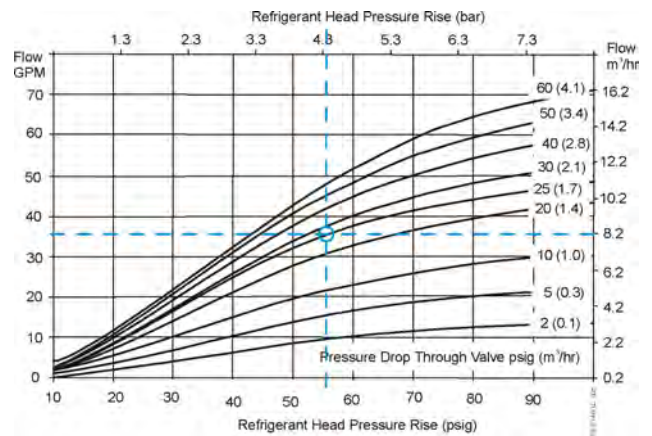
**Figure 83: 1 in. V146AL Valve**



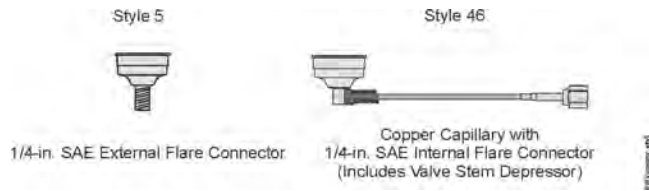
**Figure 84: High Refrigerant Pressure 3/4 in. V146GK1 Valves**



**Figure 85: High Refrigerant Pressure 1 in. V146GL1 Valves**



**Figure 86: Pressure Connection Styles**



## Selection chart

**Table 281: 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)

## V146 Series Two-Way Pressure-Actuated Water-Regulating Valves technical specifications

**Table 282: V146 Series Two-Way Pressure-Actuated Water-Regulating Valves technical specifications**

Specification	Description
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.

### 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 [m<sup>3</sup>/hr]):

- System Capacity (Tons of Refrigeration)
- Outlet Water Temperature (Temp. <sub>Outlet</sub>)
- Inlet Water Temperature (Temp. <sub>Inlet</sub>)

Calculate the flow using the following formula:

**Figure 87: Flow Required**

$$\text{Flow} = \frac{\text{Tons of Refrigeration} \times 30}{(\text{Temp.}_{\text{Outlet}} - \text{Temp.}_{\text{Inlet}})}$$

- 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<sub>RISE</sub>) using the following steps:

- a. The Valve Closing Pressure (P<sub>CLOSE</sub>) 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<sub>OPEN</sub>), 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.

**Figure 88: Valve Opening Pressure, EK and AL Models (Top) or GK1 and GL1 Models (Bottom)**

$$P_{\text{OPEN}} = P_{\text{CLOSE}} + 7 \text{ psi (0.5 bar)}$$

$$P_{\text{OPEN}} = P_{\text{CLOSE}} + 10 \text{ psi (0.7 bar)}$$

- c. From the Pressure-Temperature Chart for the refrigerant selected, read the

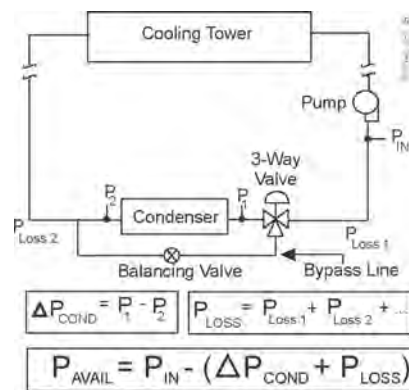
- d. Refrigerant Condensing Pressure (P<sub>COND</sub>) (operating head pressure) corresponding to the selected condensing temperature. Subtract the Valve Opening Pressure from the Refrigerant Condensing Pressure. This gives the head pressure rise.

**Figure 89: Refrigerant Head Pressure Rise**

$$P_{\text{RISE}} = P_{\text{COND}} - P_{\text{OPEN}}$$

3. Determine the available water pressure to the valve (P<sub>AVAIL</sub>) using the following steps. This is the actual water pressure available to force water through the valve.
  - a. Determine the minimum inlet pressure (P<sub>IN</sub>). This is the water pressure from city water mains, pumps, or other sources.
  - b. Pressure drop through condenser (ΔP<sub>COND</sub>) 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<sub>LOSS</sub>).
  - d. Subtract the ΔP<sub>COND</sub> and P<sub>LOSS</sub> from P<sub>IN</sub>. The result is P<sub>AVAIL</sub>.

**Figure 90: Available Water Pressure**

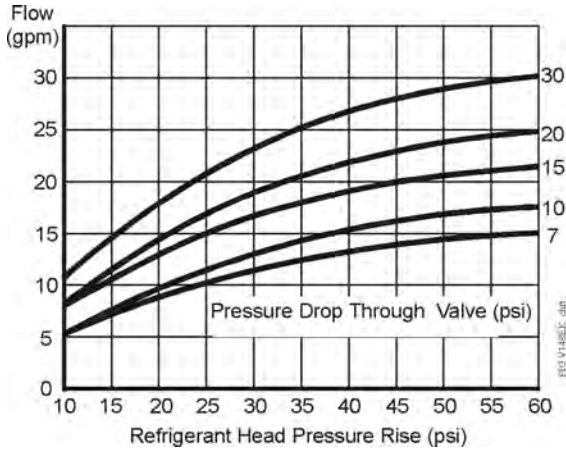


4. Select the proper valve size from the flowcharts by locating a point on a chart that satisfies the flow, the head pressure rise above opening point, and the pressure drop across the valve.

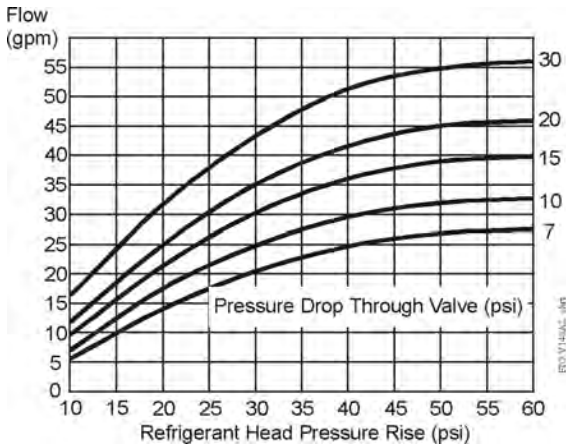
Use these equations to convert between U.S. and S.I. units.

- $1 \text{ dm}^3/\text{s} = 3.6 \text{ m}^3/\text{h} = 15.9 \text{ U.S. gal. /min.} = 13.2 \text{ U.K. gal. /min.}$
- $1 \text{ bar} = 100 \text{ kPa} = 0.1 \text{ MPa} = 1.02 \text{ kg/cm}^2 = 0.987 \text{ atm} = 14.5 \text{ psi}$

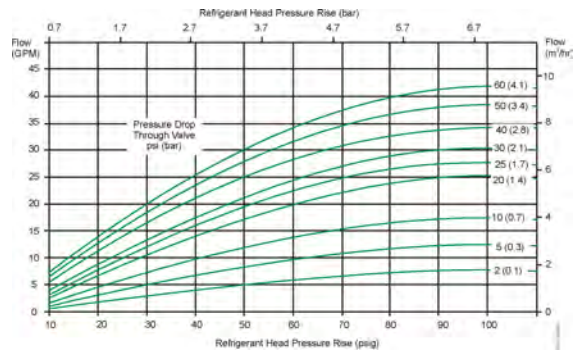
**Figure 91: 3/4 in. V148EK Valve**



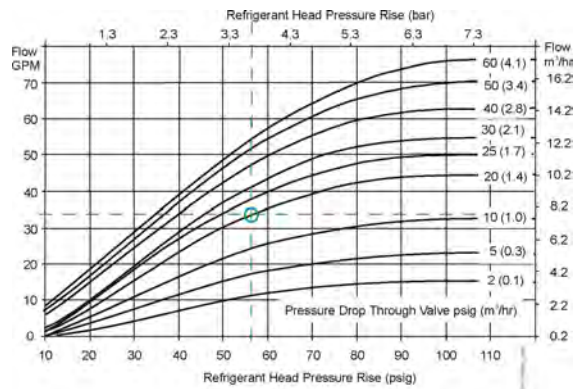
**Figure 92: 1 in. V148AL Valve**



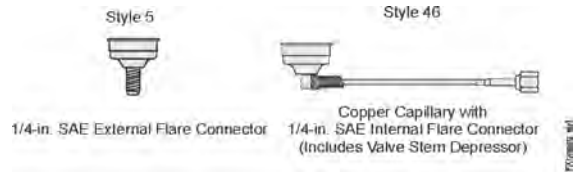
**Figure 93: High Refrigerant Pressure 3/4 in. V148GK1 Valve**



**Figure 94: High Refrigerant Pressure 1 in. V148GL1 Valve**



**Figure 95: Pressure Connection Styles**



**Table 283: 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)

## V148 Series 3-Way Pressure-Actuated Water-Regulating Valves

### technical specifications

Specifications	Description
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



### 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

### Description

The V246 Series Two-Way Pressure-Actuated Water-Regulating Valves for High-Pressure Refrigerants includes direct acting control action. 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. to 2 in. (9.5 mm and 50.8 mm) sizes and have a maximum acceptable water pressure of 150 psig (10.3 bar). Direct acting V246 valves have an adjustable opening point in a refrigerant pressure range of 200 psi to 400 psi (13.8 bar to 27.6 bar). You can use V246 valves with standard non-corrosive 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 *V246 Series 2-Way Pressure-Actuated Water-Regulating Valves for High-Pressure Refrigerants Product Bulletin (LIT-12011514)* for important product application information.



## Selection charts

**Table 284: North American standard production models**

Product code	Construction	Range, psi (bar)	Valve size and connection	Element style	Shipping weight, lb (kg)
V246GA1-001C	Direct acting, commercial	200 to 400 (13.8 to 27.6)	3/8 in. NPT screw	Style 5	1.8 (0.8)
V246GB1-001C	Direct acting, commercial		1/2 in. NPT screw	Style 5	3.0 (1.4)
V246GC1-001C	Direct acting, commercial		3/4 in. NPT screw	Style 5	3.7 (1.7)
V246GD1-001C	Direct acting, commercial		1 in. NPT screw	Style 5	9.3 (4.2)
V246GE1-001C	Direct acting, commercial		1 1/4 in. NPT screw	Style 5	10 (4.5)
V246GM1-001C	Direct acting, commercial		1 1/4 in. union sweat	Style 5	10 (4.5)
V246GR1-001C	Direct acting, commercial		1 1/2 in. flange	Style 5	13.6 (6.2)
V246GS1-001C	Direct acting, commercial		2 in. flange	Style 5	27 (12.3)
V246HB1-001C	Direct acting, maritime		1/2 in. NPT screw	Style 5	3.0 (1.4)
V246HC1-001C	Direct acting, maritime		3/4 in. NPT screw	Style 5	4.3 (2.0)
V246HD1-001C	Direct acting, maritime		1 in. NPT screw	Style 5	9.5 (4.3)
V246HE1-001C	Direct acting, maritime		1 1/4 in. NPT screw	Style 5	10.3 (4.7)
V246HR1-001C	Direct acting, maritime		1 1/2 in. American Society of Mechanical Engineers (ASME) flange	Style 5	13.6 (6.2)
V246HS1-001C	Direct acting, maritime		2 in. ASME flange	Style 5	27 (12.3)

**Table 285: European standard production models**

Product code	Construction	Valve size and connection	Element style	Shipping weight, kg (lb)
V246GA1A001C	Direct acting, commercial	3/8 in. British Standard Pipe Parallel (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. British Standard Pipe Taper (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)
V246GR1B001C	Direct acting, commercial	1 1/2 in. flange, DIN2533	Style 5	6.2 (13.6)

**Table 285: European standard production models**

Product code	Construction	Valve size and connection	Element style	Shipping weight, kg (lb)
V246HA1B001C	Direct acting, maritime	3/8 in. BSPP screw, ISO 228	Style 5	0.8 (1.8)
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 correctly size and design a system to fulfill the appropriate requirements. Typically, a valve is replaced with another valve of the same size in a correctly 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 that you need by locating a point on a flow chart that satisfies these requirements:

- Water flow that the condenser requires (Flow)
- Refrigerant head pressure rise ( $P_{RISE}$ )
- Available water pressure ( $P_{AVAIL}$ )

Follow these steps, and use the information that you obtain to locate a point on one of the flowcharts that satisfies all three requirements.

1. Refer to information from the manufacturer of the condensing unit for the water flow that the condenser requires (Flow). If the manufacturer's information is unavailable, use the following information to make an approximation of water flow in gallons per minute (cubic meters per hour):
  - System capacity (tons of refrigeration)
  - Outlet water temperature ( $Temp_{OUTLET}$ )
  - Inlet water temperature ( $Temp_{INLET}$ )

Calculate the flow using the following formula:

**Figure 96: Required flow**

$$Flow = \frac{\text{Tons of Refrigeration} \times 30}{(Temp_{OUTLET} - Temp_{INLET})}$$

- ① **Note:** If you do not know the outlet temperature, assume it to be 10°F (6°C) above the inlet temperature.

2. Use Figure 98 and the following steps to determine refrigerant head pressure rise above the valve opening point ( $P_{RISE}$ ).
  - a. The valve closing pressure ( $P_{CLOSE}$ ) is equal to the refrigerant pressure at the highest ambient temperature that the refrigeration equipment experiences in the Off cycle. To find this pressure, use a pressure-temperature chart for the selected refrigerant.

- b. To approximate the valve opening pressure ( $P_{OPEN}$ ), add an approximate of 10 psi (0.7 bar) to the valve closing pressure.
- ① **Note:** Add an approximate of 20 psi (1.4 bar for 3/8in. valves).

**Figure 97: Valve opening pressure**

$$P_{OPEN} = P_{CLOSE} + 10 \text{ psi (0.7 bar)}$$

- c. From the pressure-temperature chart for the selected refrigerant, read the refrigerant condensing pressure ( $P_{COND}$ ), also known as operating head pressure, corresponding to the selected condensing temperature.
- d. Subtract the valve opening pressure from the refrigerant condensing pressure. This calculation gives the head pressure rise.

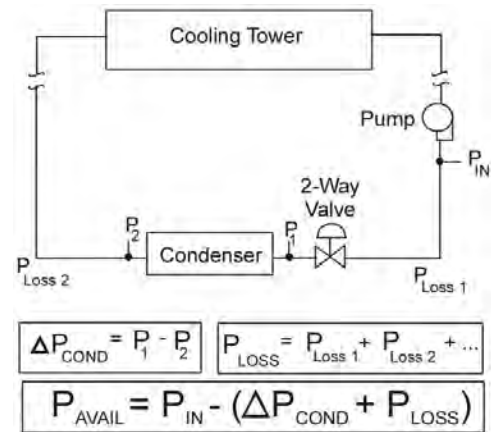
**Figure 98: Refrigerant head pressure rise**

$$P_{RISE} = P_{COND} - P_{OPEN}$$

3. Use the following steps to determine the available water pressure to the valve ( $P_{AVAIL}$ ). 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 ( $\Delta P_{COND}$ ) 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  $\Delta P_{COND}$  and  $P_{LOSS}$  from  $P_{IN}$ . The result is  $P_{AVAIL}$ .

**Figure 99: Available water pressure**



4. Select the correct 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

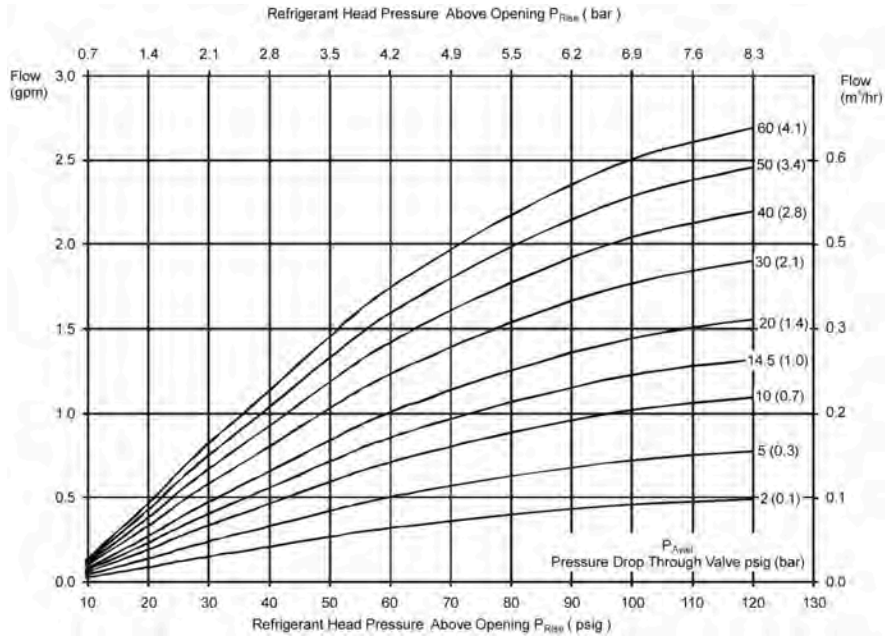
Use these equations to convert between U.S. and S.I. units.

- $1 \text{ dm}^3/\text{s} = 3.6 \text{ m}^3/\text{h} = 15.9 \text{ U.S. gal. /min.} = 13.2 \text{ U.K. gal. /min.}$
- $1 \text{ bar} = 100 \text{ kPa} = 0.1 \text{ MPa} = 1.02 \text{ kg/cm}^2 = 0.987 \text{ atm} = 14.5 \text{ psi}$

## V246 flowcharts

The maximum recommended differential water pressure across a valve is 60 psig (4.1 bar).

**Figure 100: 3/8 in. direct acting low-flow valve flowchart**



**Figure 101: 3/8 in. direct acting valve flowchart**

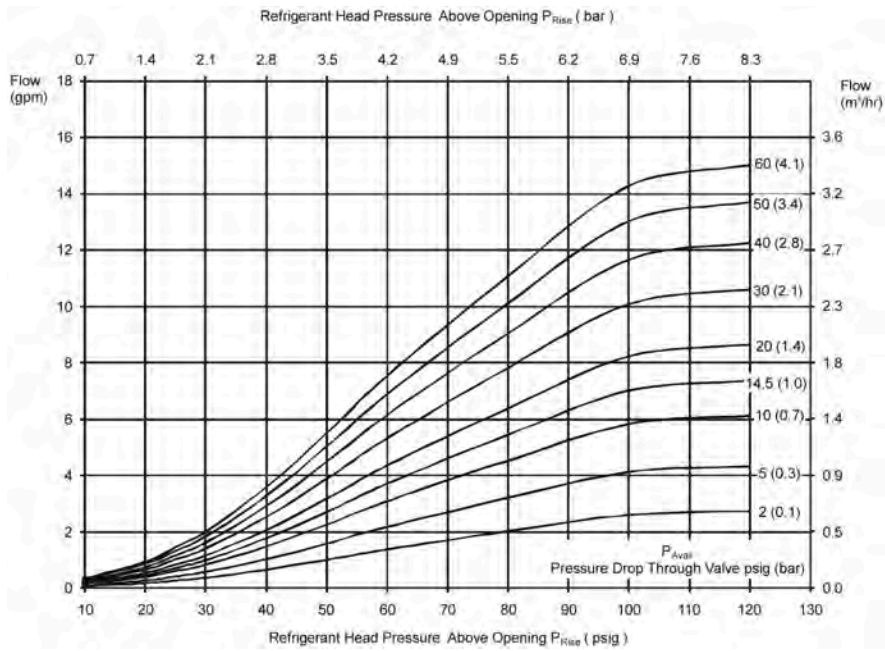


Figure 102: 1/2 in. direct acting valve flowchart

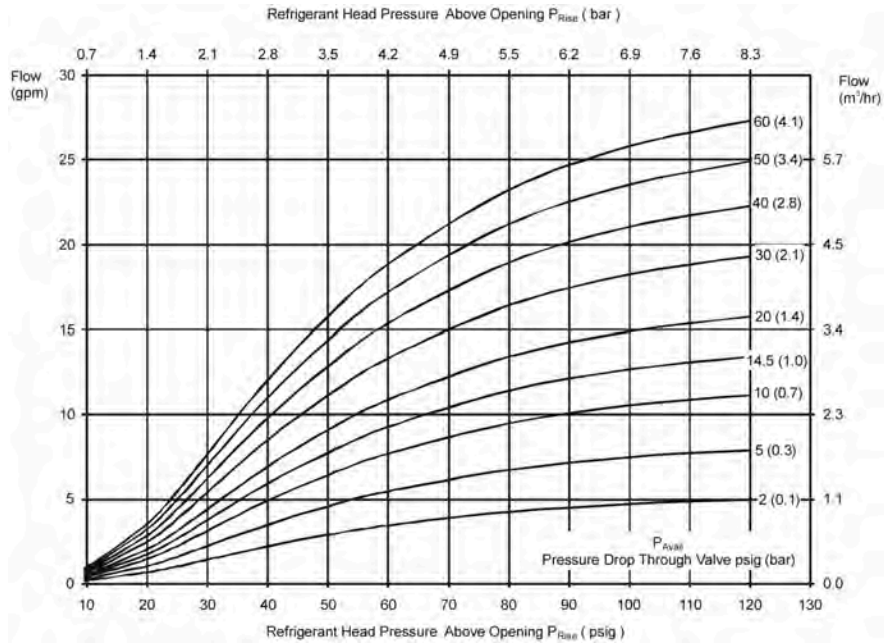
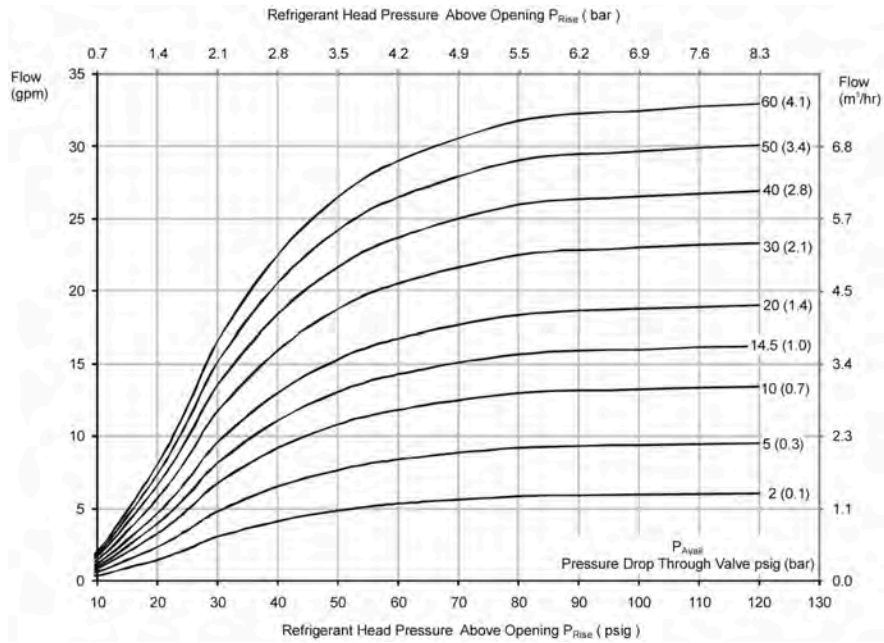
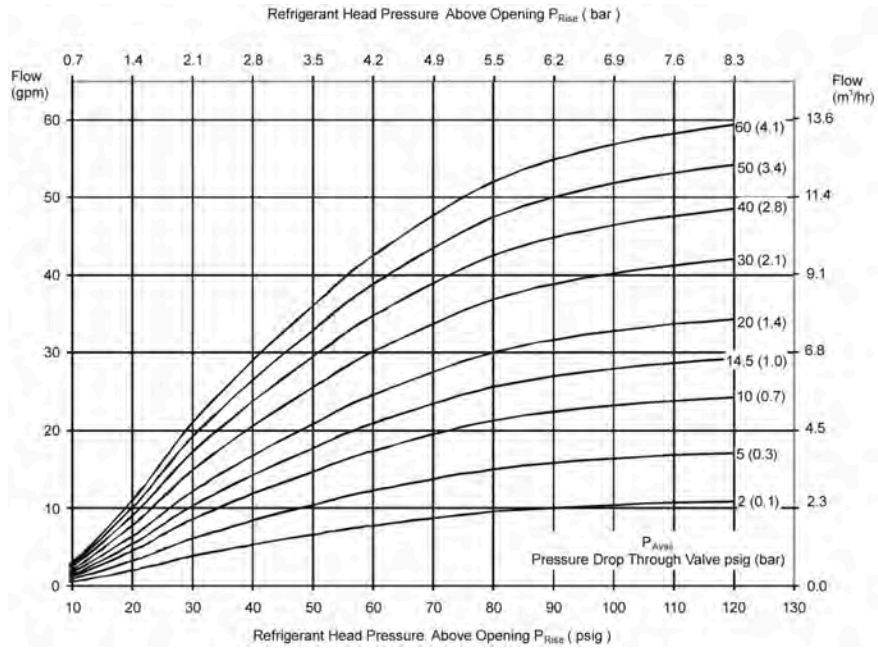


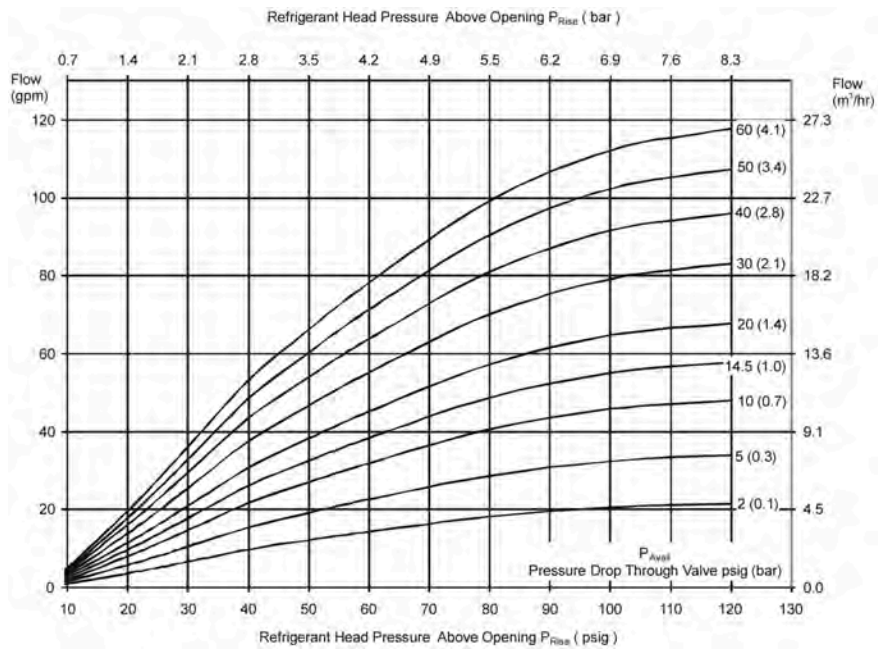
Figure 103: 3/4 in. direct acting valve flowchart



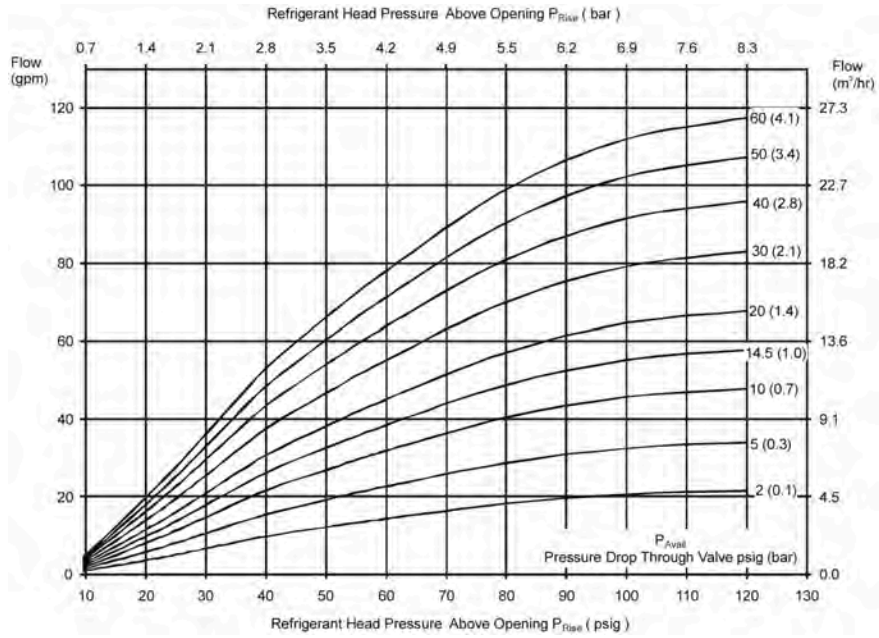
**Figure 104: 1 in. direct acting valve flowchart**



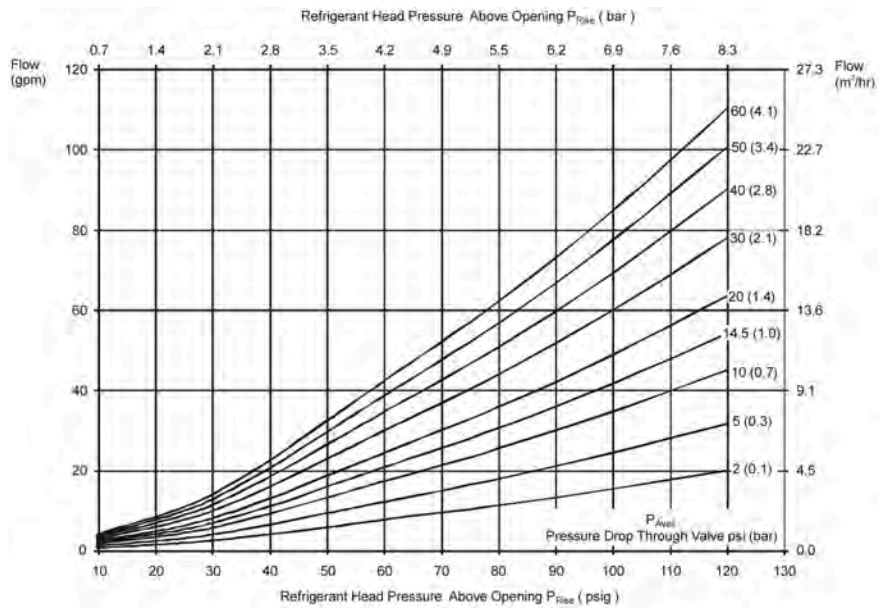
**Figure 105: 1 1/4 in. direct acting valve flowchart**



**Figure 106: 1 1/2 in. direct acting valve flowchart**



**Figure 107: 2 in. direct acting valve flowchart**



## Dimensions

Figure 108: V246 screw connection valves dimensions

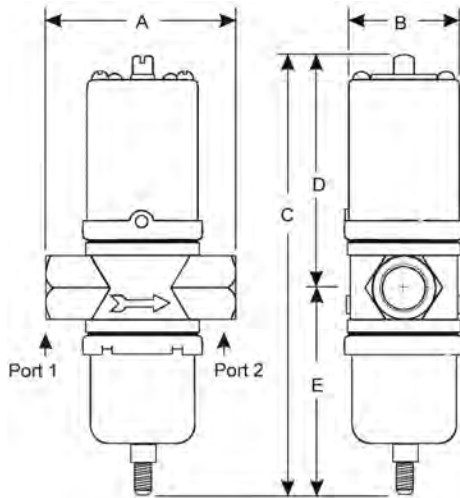


Figure 109: V246 angle-body screw connection valves dimensions

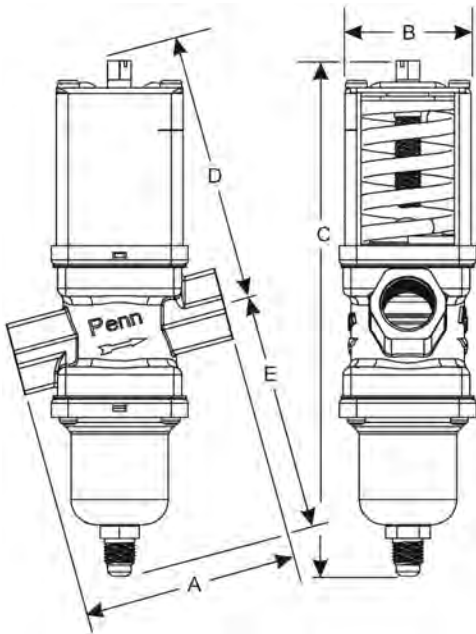


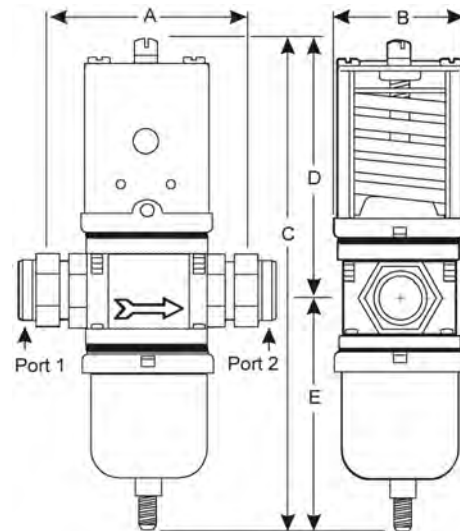
Table 286: V246 screw connection valves dimensions

Valve size	Dimensions, in. (mm)				
	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)

Table 287: V246 angle-body screw connection valves dimensions

Valve size	Dimensions, in. (mm)				
	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)

Figure 110: V246 union sweat connection valves dimensions

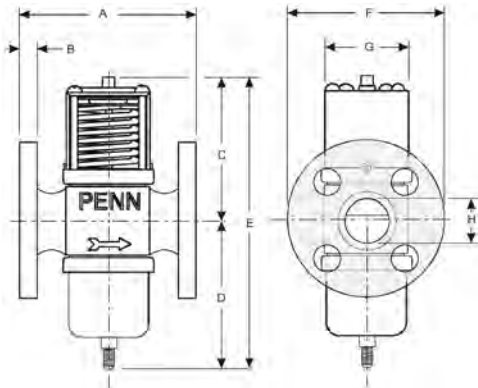




**Table 288: V246 union sweat connection valves dimensions**

Valve size	Dimensions, in. (mm)				
	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)

**Figure 111: V246 flange valve dimensions**



**Table 289: V246 flange valve, commercial service - dimensions**

Valve size	Dimensions, in. (mm)							
	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) <sup>1</sup>	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) <sup>2</sup>	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).

**Table 290: 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

**Table 291: V246 flange valve, maritime service - dimensions**

Valve Size	Dimensions, in. (mm)							
	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) <sup>1</sup>	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) <sup>2</sup>	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).

**Table 292: 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

**Table 293: North American V246 materials**

Nominal valve size:	3/8 in. to 3/4 in., commercial	1 in. to 2 in., commercial	Maritime, all sizes
<b>Material</b>			
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 or extension sleeve	Brass	Brass	MONEL
Diaphragms	Nylon reinforced BUNA-N	Nylon reinforced BUNA-N	Nylon reinforced BUNA-N
<b>Refrigerant contact</b>			

**Table 293: 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				
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

**Table 294: 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 or extension sleeve		Brass	Brass	MONEL
Diaphragms		Nylon reinforced BUNA-N	Nylon reinforced BUNA-N	Nylon reinforced BUNA-N
<b>Refrigerant contact</b>				
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

## V246 Series Two-Way Pressure-Actuated Water-Regulating Valves for High-Pressure Refrigerants technical specifications

**Table 295: V246 Series Two-Way Pressure-Actuated Water-Regulating Valves for High-Pressure Refrigerants**

Specification	Description
Factory-set opening point	200 psig (13.8 bar)
Maximum working pressure	630 psig (43.4 bar)
Opening point adjustment range	200 psi to 400 psi (13.8 bar to 27.6 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
Compliance	United States: cULus Listed; UL 207 File SFJQ.SA45221
	Canada: cULus Listed; UL 207 File SFJQ7.SA45221
	<p>Applies to:</p> <ul style="list-style-type: none"> <li>V246GA1-001C</li> <li>V246GB1-001C</li> <li>V246HA1-001C</li> <li>V246HB1-001C</li> </ul> <p>① <b>Note:</b></p> <ul style="list-style-type: none"> <li>The valve body and internal parts are not compatible with ammonia (R717).</li> <li>The design pressure marked on these components shall not be less than the installed system working pressure or less than the values outlined in ASHRAE 15 for the charged refrigerant. After charging, mark the installed equipment with the refrigerant type and oil used.</li> </ul>





# V248 Series Three-Way Pressure-Actuated Water-Regulating Valves

## 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

## Selection Chart

**Table 296: 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)

**Table 297: 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. British Standard Pipe Taper (BSPT) Screw, ISO 7	Style 5	5.0 (2.3)
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)

## 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 ( $m^3/hr$ )]:
  - System Capacity (Tons of Refrigeration)
  - Outlet Water Temperature ( $Temp_{\text{Outlet}}$ )
  - Inlet Water Temperature ( $Temp_{\text{Inlet}}$ )

Calculate the flow using the following formula:

**Figure 112: Flow Required**

$$\text{Flow} = \frac{\text{Tons of Refrigeration} \times 30}{(\text{Temp}_{\text{Outlet}} - \text{Temp}_{\text{Inlet}})}$$

- ① **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.

**Figure 113: Valve Opening Pressure**

$$P_{OPEN} = P_{CLOSE} + 10 \text{ psi (0.7 bar)}$$

- 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.

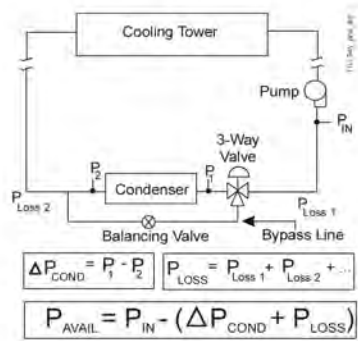
**Figure 114: Refrigerant Head Pressure Rise**

$$P_{RISE} = P_{COND} - P_{OPEN}$$

3. Determine the available water pressure to the valve ( $P_{AVAIL}$ ) using the following steps. This 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 ( $\Delta P_{COND}$ ) 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  $\Delta P_{COND}$  and  $P_{LOSS}$  from  $P_{IN}$ . The result is  $P_{AVAIL}$ .

**Figure 115: Available Water Pressure**



- 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

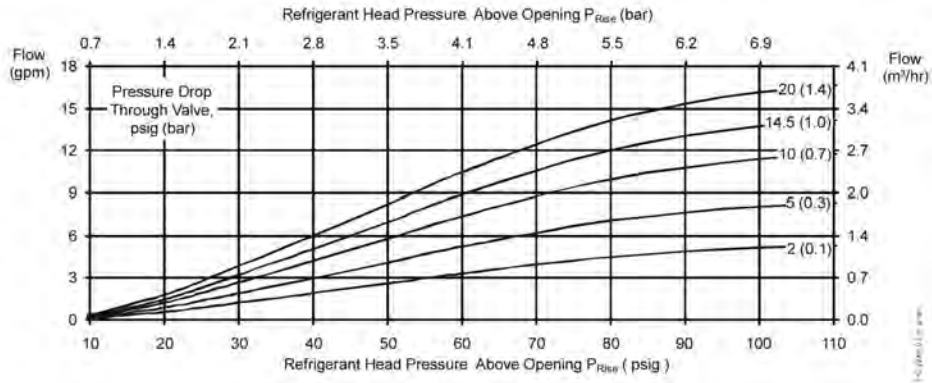
Use these equations to convert between U.S. and S.I. units.

- $1 \text{ dm}^3/\text{s} = 3.6 \text{ m}^3/\text{h} = 15.9 \text{ U.S. gal. /min.} = 13.2 \text{ U.K. gal. /min.}$
- $1 \text{ bar} = 100 \text{ kPa} = 0.1 \text{ MPa} = 1.02 \text{ kg/cm}^2 = 0.987 \text{ atm} = 14.5 \text{ psig}$

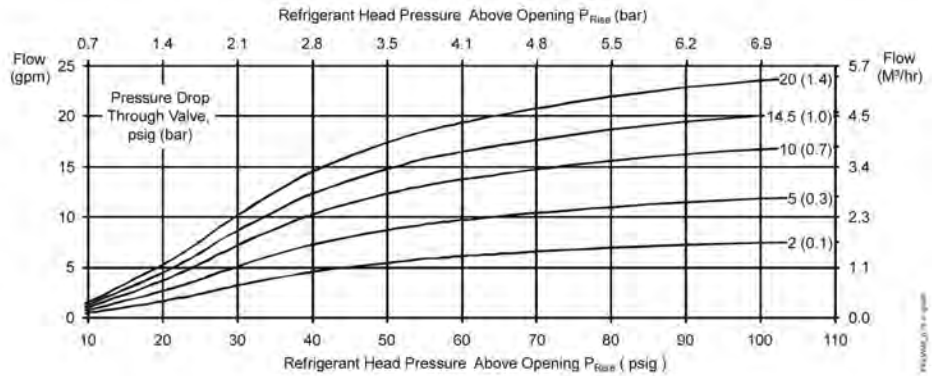
## V248 Flowcharts

The maximum recommended differential water pressure across a valve is 20 psig (1.4 bar).

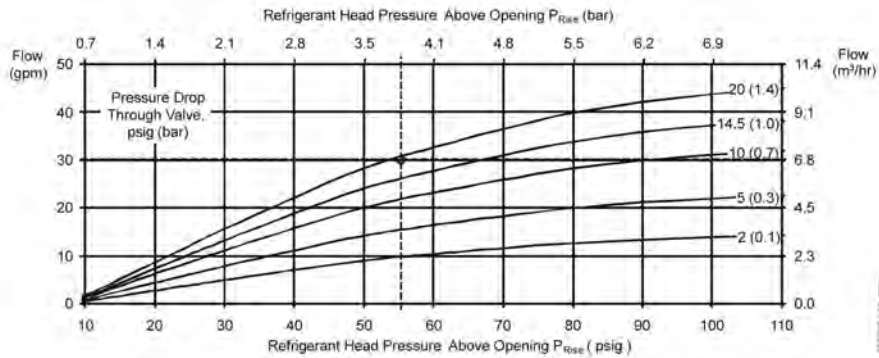
**Figure 116: 1/2 in. Direct Acting Valve Flowchart**



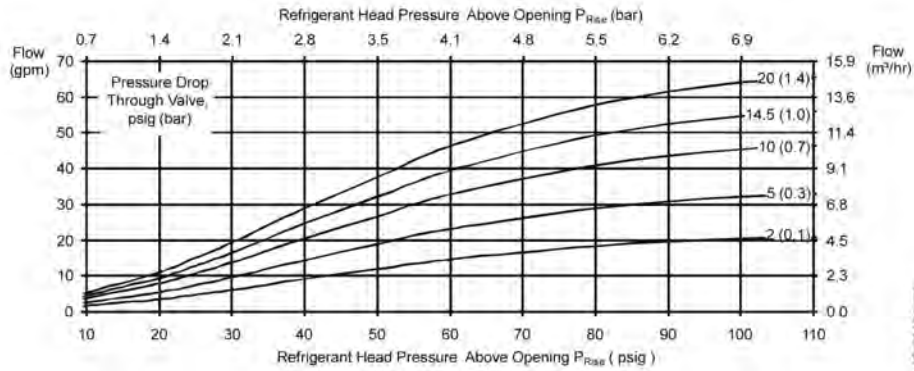
**Figure 117: 3/4 in. Direct Acting Valve Flowchart**



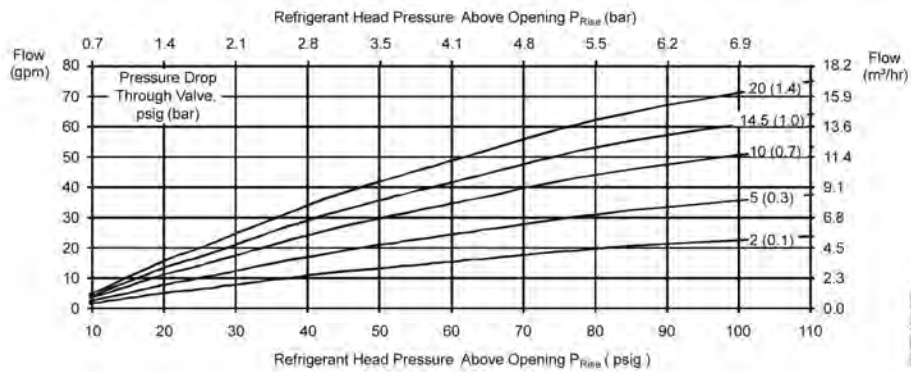
**Figure 118: 1 in. Direct Acting Valve Flowchart**



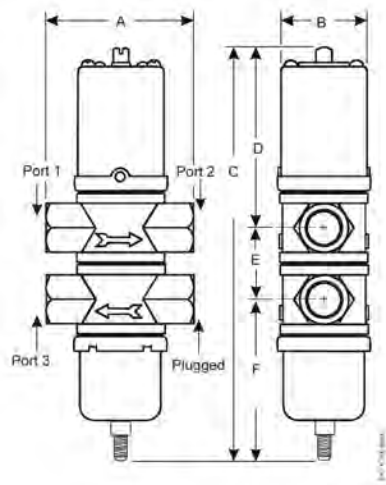
**Figure 119: 1-1/4 in. Direct Acting Valve Flowchart**



**Figure 120: 1-1/2 in. Direct Acting Valve Flowchart**

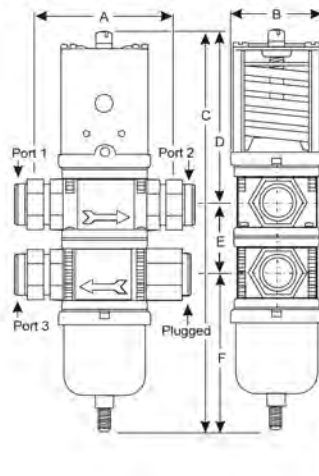


**Figure 121: V248 1/2 in. Through 1-1/4 in. Screw Connection Valves Dimensions**

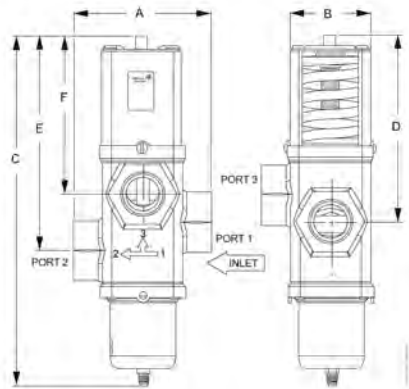




**Figure 122: V248 Union Sweat Connection Valves Dimensions**



**Figure 123: V248 1-1/2 in. Screw Connection Valves Dimensions**



**Table 298: 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)

**Table 299: 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)

**Table 300: 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)

## Materials

**Table 301: 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

**Table 302: 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

## V248 Series Pressure-Actuated Water-Regulating Valves for High-Pressure Refrigerants technical specifications

Specification	Description
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



# 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.

### WARNING

#### Risk

This product is made of copper alloy, which contains lead. The product is therefore not to be used on drinking water.

## Selection chart

Table 303: Selection chart

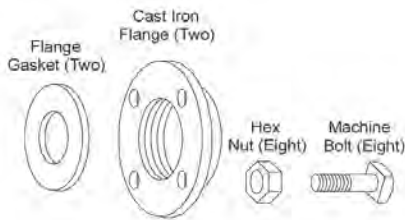
Valve size (in.)	Commercial kit		Monel kit	Diaphragm kits only for all types
	Product code numbers for Series V46A, V46N, V47A, V47N	Product code numbers for Series V48	Product code numbers for Series V46B, V46C, V47B, V47C	
3/8	STT14A-600R	-	STT14A-601R	-
1/2	STT15A-602R	STT15A-605R	STT15A-603R	-
3/4	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.

**Figure 124: Companion Flange Kit**

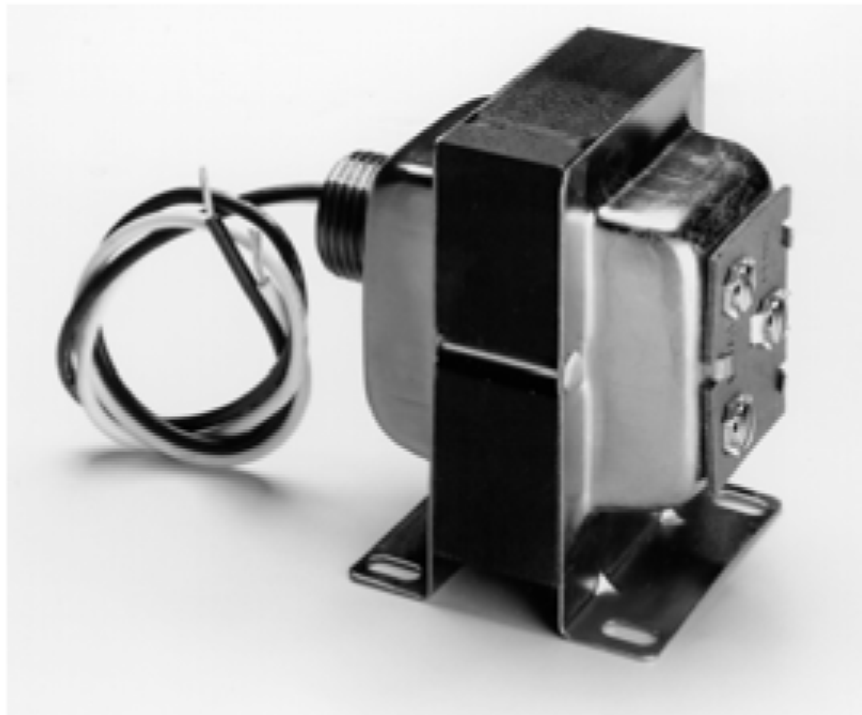


## Selection chart

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 <sup>1</sup>	KIT14A-612
2 in.	KIT14A-613 <sup>1</sup>	KIT14A-613 <sup>1</sup>	KIT14A-613
2-1/2 in.	KIT14A-614 <sup>1</sup>	KIT14A-614 <sup>1</sup>	KIT14A-614
3 in.	FLG15A-600 <sup>1</sup>	—	—
4 in.	FLG15A-601 <sup>1</sup>	—	—

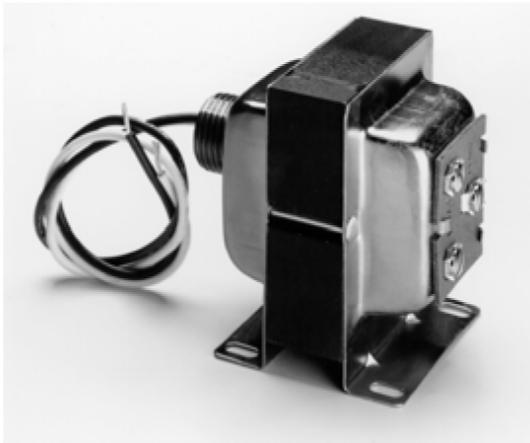
<sup>1</sup> Commercial valves only

## Relays and Transformers





## Y63, Y64, Y65, Y66, and Y69 Series Transformers



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

### 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).

### Selection chart

**Table 304: Y63, Y64, Y65, Y66, and Y69 Series Transformers**

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

**Table 304: Y63, Y64, Y65, Y66, and Y69 Series Transformers**

Product Code Number	Primary Voltage VAC	Secondary Voltage VAC	Primary Connection	Secondary Connection	Mounting	Agency Requirement
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 <sup>1</sup>	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 <sup>1</sup>	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 <sup>1</sup>	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 <sup>1</sup>	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
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

<sup>1</sup> 4 in. x 4 in. plate and nut packed with transformer.

## Y63, Y64, Y65, Y66, Y69 Series Transformers technical specifications

Specification	Description	
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	Series <ul style="list-style-type: none"> <li>• Y63</li> <li>• Y64</li> <li>• Y65</li> <li>• Y66</li> <li>• Y69</li> </ul>	Volt-Amperes <ul style="list-style-type: none"> <li>• 50 VA</li> <li>• 92 VA</li> <li>• 40 VA</li> <li>• 75 VA</li> <li>• 300 VA</li> </ul>
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	<ul style="list-style-type: none"> <li>• Y63</li> <li>• Y64</li> <li>• Y65</li> <li>• Y66</li> <li>• Y69</li> </ul>	<ul style="list-style-type: none"> <li>• 3.0 lb/1.4 kg</li> <li>• 4.0 lb/1.8 kg</li> <li>• 2.0 lb/0.9 kg</li> <li>• 3.0 lb/1.4 kg</li> <li>• 11.0 lb/5.0 kg</li> </ul>
Agency Compliance	<ul style="list-style-type: none"> <li>• UL Listed Y63, Y64, Y65, Y66; File E95575, CCN's XOKV (US) and XOKV7 (Canada)</li> <li>• UL Recognized Y63, Y64, Y65, Y66; File E95575, CCN's XOKV2 (US) and XOKV8 (Canada)</li> <li>• UL Listed Y69; File E95138, CCN's XPTQ (US) and XPTQ7 (Canada)</li> <li>• All transformers are Class 2 except the Y69 (300 VA), which is listed as a power transformer.</li> </ul>	



# Product warranty

This product is covered by a limited warranty, details of which can be found at [www.johnsoncontrols.com/buildingswarranty](http://www.johnsoncontrols.com/buildingswarranty).

## Single point of contact

APAC	Europe	NA/SA
JOHNSON CONTROLS C/O CONTROLS PRODUCT MANAGEMENT NO. 32 CHANGJIANG RD NEW DISTRICT WUXI JIANGSU PROVINCE 214028 CHINA	JOHNSON CONTROLS VOLTAWEG 20 6101 XK ECHT THE NETHERLANDS	JOHNSON CONTROLS 507 E MICHIGAN ST MILWAUKEE WI 53202 USA

## Contact information

Contact your local branch office: [www.johnsoncontrols.com/locations](http://www.johnsoncontrols.com/locations)

Contact Johnson Controls: [www.johnsoncontrols.com/contact-us](http://www.johnsoncontrols.com/contact-us)



## System 450 Modular Electronic Controls



## 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.

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 subordinate 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 and benefits

### **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.

### **Control Modules with Bright Backlit LCDs and Four-Button Touchpad User Interfaces, Up to Three Hard-Wired Input Sensors and Up to Ten Relay or Analog Outputs (In Any Combination) per Control System**

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 HVACR and process conditions in a variety of standard and global units of measurement.

#### **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.

#### **On/Off Delays**

Allow the user to configure an on delay (the time between a setpoint trip and the energizing of a relay) and an off delay (the time between a setpoint trip and the de-energizing of a relay).

## 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-400 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 run-time 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.

**Table 305: System 450 Control Module Capabilities**

Control by _____	System 450 Control Modules				Application Specific
	Standard	Communications	Reset	Hybrid	
	C450CPN-4C C450CQN-4C C450CBN-4C C450CCN-4C	C450CEN-1C C450CRN-1C	C450RBN-3C C450RCN-3C	C450CPW-400C	C450CCU-4C Designed for walk-in coolers, freezer, and large display cases
Controlled Condition					
Temperature	X	X	X	X	X
Pressure	X	X	-	X	X
Humidity	X	X	X	X	-
Combination of Conditions	X	X	X	X	-
Control Capabilities					
On/Off Relay Control	X	X	X	X	X

**Table 305: System 450 Control Module Capabilities**

Control by _____	System 450 Control Modules				Application Specific C450CCU-4C Designed for walk-in coolers, freezer, and large display cases
	Standard	Communications	Reset	Hybrid	
	C450CPN-4C C450CQN-4C C450CBN-4C C450CCN-4C	C450CEN-1C C450CRN-1C	C450RBN-3C C450RCN-3C	C450CPW-400C	
Analog Proportional Control (Direct and Reverse Action)	X	X	X	X	-
Analog Proportional Plus Integral Control (Direct and Reverse Action)	X	X	X	X	-
Combination of On/Off Relay and Analog Output Control	X	X	X	X	-
Stand-Alone Control	X	-	X	X	X
Multi-Stage Control (Relay or Analog)	X	X	X	X	X
Network Communications	-	X	-	-	-
High Input Signal Selection	X	X	-	X	-
Differential Control	X	X	-	X	X
Output Signal Limiting	X	X	-	-	-
Output Signal Update Rate					
Output Signal Deadband					
Binary Input Control for Relay Outputs	X	X	-	-	-
On/Off Duration Time Control	X	X	-	-	-
Minimum On/Off Time					
On/Off Time Delay					
Temperature and Humidity Reset Control	-	-	X	-	-
Scheduling and Temperature Setback Control	-	-	X	-	-
Reset Setpoint Control	-	-	X	-	-
Setback Scheduling	-	-	X	-	-
Run-Time Balancing	-	-	X	-	-
Hybrid Analog Output Control	-	-	-	X <sup>1</sup>	-

1 Only on output OUTA1.

## Selection charts

**Table 306: System 450 Modules and Accessories Ordering Information**

Product Code Number	Product Description
C450CBN-4C	Standard Control Module with LCD, Four-Button Touchpad UI, and Relay Output; provides one relay output (SPDT line-voltage relay) for SPDT control.
C450CCN-4C	Standard Control Module with LCD, Four-Button Touchpad UI, and Relay Output; provides two relay outputs (SPDT line-voltage relays) for SPDT control.
C450CCU-4C	Condensing Unit Control Module with LCD, Four-Button Touchpad, UI; provides two relay outputs (SPDT line-voltage relays). Two A99BB-500C temperature sensors with 5.00 m (16-3/8 ft) cable length are included in the box with the Condensing Unit Control Module.
C450CPN-4C	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-4C	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.

**Table 306: 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.
C450SBG-4C	Relay Output Expansion Module; provides one SPDT low-voltage relay output.
C450SCG-4C	Relay Output Expansion Module; provides two SPDT low-voltage relay outputs.
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.)

**Table 306: System 450 Modules and Accessories Ordering Information**

Product Code Number	Product Description
C450CPW-400C	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-400C as the control module.
C450SBN-4C	Relay Output Expansion Module; provides one SPDT line-voltage relay output.
C450SCN-4C	Relay Output Expansion Module; provides two SPDT line-voltage relay outputs.
C450SBG-4C	Relay Output Expansion Module; provides one SPDT low voltage/current output.
C450SCG-4C	Relay Output Expansion Module; provides two SPDT low voltage/current relay outputs.
C450SPN-4C	Analog Output Expansion Module; provides one analog output (0 to 10 VDC or 4 to 20 mA self-selecting signal) for proportional control.
C450SQN-4C	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

**Table 307: System 450 Compatible A99B Temperature Sensors and Accessories Ordering Information**

Product Code Number	Product Description <sup>1</sup>
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)

**Table 307: System 450 Compatible A99B Temperature Sensors and Accessories Ordering Information**

Product Code Number	Product Description <sup>1</sup>
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)* for more information.


**Table 308: 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)

**Table 309: 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)

**Table 310: 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> .   <b>Note:</b> For correct readings, set the temperature sensor to HI°C or HI°F.

**Table 311: System 450 Compatible HE69xx Type Humidity Sensors With 100 ohm NTC Nickel Temperature Sensor Ordering Information**

Product Code Number	Product Description <sup>1</sup>
HE-69Sx0NP	Duct Mount Humidity Sensor with 1,000 ohm NTC nickel temperature sensor: 10 to 90% RH; 0 to 60°C (32 to 140°F)

- 1 The HE-69xx sensors require 24 VAC input and must use the 0–5 VDC output. Refer to the *HE-69xx Surface-Mount Duct Humidity and Temperature Sensors Product Bulletin (LIT-12012444)* for more information, including technical specifications and mounting accessories.

**Figure 125: HE-69xx**



**Table 312: System 450 Compatible HE6800 Series Humidity Transmitters with Temperature Sensor Ordering Information**

Product Code Number	Product Description <sup>1</sup>
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)* for more information, including technical specifications and mounting accessories.

**Table 313: System 450 Compatible Low Pressure Differential Transducer Ordering Information**

Product Code Number	Product Description <sup>1,2</sup>
DPT2650-R25B-AB	Low Pressure Differential Transducer: -0.25 to 0.25 in. W.C. (System 450 Sensor Type: <b>P 0.25</b> ) <sup>3</sup>
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* 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* for more information.
- 3 Used only with Communications Control Modules.

**Table 314: WHA-PKD3 Wire Harnesses Ordering Information**

Product Code Number	Product Description
WHA-PKD3-200C	Plug and Three-Wire Harness for P599 Electronic Pressure Transducers: 2.0 m (6-1/2 ft) cable
WHA-PKD3-400C	Plug and Three-Wire Harness for P599 Electronic Pressure Transducers: 4.0 m (13 ft) cable
WHA-PKD3-600C	Plug and Three-Wire Harness for P599 Electronic Pressure Transducers: 6.0 m (19-5/8 ft) cable

**Table 315: System 450 Compatible P599 Series Transducers with 1/4 in. SAE 45 Flare Internal Thread with Depressor (Style 47) Ordering Information**

Product Code Number	Product Description <sup>1</sup>
P599RCPS401C	-1 to 8 bar; order WHA-PKD3 wiring harness separately.
P599RCPS402C	-1 to 15 bar; order WHA-PKD3 wiring harness separately.
P599RCPS404C	0 to 30 bar; order WHA-PKD3 wiring harness separately.
P599RCPS405C	0 to 50 bar; order WHA-PKD3 wiring harness separately.
P599RCPS100C	-10 to 100 psig; order WHA-PKD3 wiring harness separately.
P599RCPS100K	-10 to 100 psig; WHA-PKD3 wiring harness included.
P599RCPS101C	0 to 100 psig; order WHA-PKD3 wiring harness separately.
P599RCPS101K	0 to 100 psig; WHA-PKD3 wiring harness included.
P599RCPS102K	0 to 200 psig; WHA-PKD3 wiring harness included.
P599RCPS105C	0 to 500 psig; order WHA-PKD3 wiring harness separately.
P599RCPS105K	0 to 500 psig; WHA-PKD3 wiring harness included.
P599RAPS107K	0 to 750 psig; WHA-PKD3 wiring harness included.
P599RCPS107C	0 to 750 psig; order WHA-PKD3 wiring harness separately.
P599RCPS107K	0 to 750 psig; WHA-PKD3-200C wiring harness included.
P599RCPS102C	0 to 200 psig; sealed for wet, and freeze and thaw applications; order WHA-PKD3 wiring harness separately.

- 1 The P599 sensors must be powered with the +5 VDC and C terminals and the output is 0.5 to 4.5 VDC. Refer to the *P599 Series Electronic Pressure Transducers Product/Technical Bulletin (LIT-12012446, Part No. 24-7664-3264)*.



**Table 316: System 450 Compatible P599 Series Transducers with 1/8 in. 27 NPT External Thread (Style 49) Ordering Information**

Product Code Number	Product Description <sup>1</sup>
P599RAPS100C	-10 to 100 psis; order WHA-PKD3 wiring harness separately.
P599RAPS100K	-10 to 100 psis; WHA-PKD3 wiring harness included.
P599RAPS101C	0 to 100 psis; order WHA-PKD3 wiring harness separately.
P599RAPS101K	0 to 100 psis; WHA-PKD3 wiring harness included.
P599RAPS102C	0 to 200 psis; order WHA-PKD3 wiring harness separately.
P599RAPS102K	0 to 200 psis; WHA-PKD3 wiring harness included.
P599RAPS105C	0 to 500 psis; order WHA-PKD3 wiring harness separately.
P599RAPS105K	0 to 500 psis; WHA-PKD3 wiring harness included.
P599RAPS107C	0 to 750 psis; order WHA-PKD3 wiring harness separately.
P599RAPS107K	0 to 750 psis; WHA-PKD3 wiring harness included.

1 The P599 sensors must be powered with the +5 VDC and C terminals and the output is 0.5 to 4.5 VDC. Refer to the *P599 Series Electronic Pressure Transducers Product/Technical Bulletin (LIT-12012446, Part No. 24-7664-3264)*.


**Table 317: WHA-PKD3 Wire Harnesses Ordering Information**

Product Code Number	Product Description <sup>1</sup>
WHA-PKD3-200C	Plug and 3-Wire Harness for P599 Electronic Pressure Transducers: 2.0 m (6.5 ft) cable
WHA-PKD3-400C	Plug and 3-Wire Harness for P599 Electronic Pressure Transducers: 4.0 m (13 ft) cable
WHA-PKD3-600C	Plug and 3-Wire Harness for P599 Electronic Pressure Transducers: 6.0 m (19.6 ft) cable


1 Refer to the *P599 Series Electronic Pressure Transducers Product/Technical Bulletin (LIT-12012446, Part No. 24-7664-3264)*.

## System 450 Series Modular Controls technical specifications

**Table 318: C450CPN-4C and C450CQN-4C Control Modules with Analog Output Technical Specifications**

Specification	Description
Product	C450CPN-4C and C450CQN-4C: System 450 Control Module models are sensing controls and operating controls with LCD, four-button touchpad, and SPDT analog output C450CPN-4C: Control Module with one analog output C450CQN-4C: Control Module with two analog outputs
Power Consumption	C450CPN-4C: 1.3 VA maximum using 0 to 10 V out; 1.5 VA maximum using 4 to 20 mA out C450CQN-4C: 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   <b>Note:</b> 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.

**Table 318: C450CPN-4C and C450CQN-4C Control Modules with Analog Output Technical Specifications**

Specification	Description
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	<b>Voltage Mode (0-10 VDC):</b> 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. <b>Current Mode (4-20 mA):</b> 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
Enclosure	Type 1, IP20 High-Impact Thermoplastic
Dimensions (H x W x D)	127 x 61 x 61 mm (5 x 2-3/8 x 2-3/8 in.)
Weight	C450CPN-4C: 195 g (0.43 lb) C450CQN-4C: 195 g (0.43 lb)
Compliance	United States: cULus Listed; UL 60730-1, File E27734; FCC Compliant to CFR47, Part 15, Subpart B, Class B Canada: cULus Listed; CAN/CSA-E60730-1, File E27734; Industry Canada (IC) Compliant to Canadian ICES-003, Class B limits   Europe: CE Mark – Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive. Australia and New Zealand: RCM mark, Australia/NZ Emissions Compliant

**Table 319: C450CEN-1C Control Module with Ethernet Communications Technical Specifications**

Specification	Description
Product	C450CEN-1: 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 <b>i</b> <b>Note:</b> 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
Enclosure	Type 1, IP20 High-Impact Thermoplastic
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	United States: cULus Listed; UL 60730-1, File E27734; FCC Compliant to CFR47, Part 15, Subpart B, Class B Canada: cULus Listed; CAN/CSA-E60730-1, File E27734; Industry Canada (IC) Compliant to Canadian ICES-003, Class B limits <b>CE</b> Europe: CE Mark – Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive. Australia and New Zealand: RCM mark, Australia/NZ Emissions Compliant

**Table 320: C450CRN-1C Control Module with RS485 Modbus Communications Technical Specifications**

Specification	Description
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 subordinate 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 <b>i</b> <b>Note:</b> 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)


**Table 320: C450CRN-1C Control Module with RS485 Modbus Communications Technical Specifications**

Specification	Description
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
Enclosure	Type 1, IP20 High-Impact Thermoplastic
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	United States: cULus Listed; UL 60730-1, File E27734; FCC Compliant to CFR47, Part 15, Subpart B, Class B Canada: cULus Listed; CAN/CSA-E60730-1, File E27734; Industry Canada (IC) Compliant to Canadian ICES-003, Class B limits <b>CE</b> Europe: CE Mark – Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive. Australia and New Zealand: RCM mark, Australia/NZ Emissions Compliant


**Table 321: C450CPW-400C Control Module with Hybrid Analog Output Technical Specifications**

Specification	Description
Product	C450CPW-400C 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-400C: 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 <b>i</b> <b>Note:</b> 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


**Table 321: C450CPW-400C Control Module with Hybrid Analog Output Technical Specifications**

Specification	Description
Analog Output	<p><b>Voltage Mode (0–10 VDC):</b> 10 VDC maximum output voltage 10 mA maximum output current</p> <p>Requires an external load of 1,000 ohms or more</p> <p>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><b>Current Mode (4–20 mA):</b> Requires an external load between 0 to 300 ohms</p> <p>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
Enclosure	Type 1, IP20 High-Impact Thermoplastic
Dimensions (H x W x D)	127 x 61 x 61 mm (5 x 2-3/8 x 2-3/8 in.)
Weight	C450CPW-400C: 195 g (0.43 lb)
Compliance	<p>United States: cULus Listed; UL 60730-1, File E27734; FCC Compliant to CFR47, Part 15, Subpart B, Class B</p> <p>Canada: cULus Listed; CAN/CSA-E60730-1, File E27734; Industry Canada (IC) Compliant to Canadian ICES-003, Class B limits</p>
	Europe: CE Mark – Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive.
	Australia and New Zealand: RCM mark, Australia/NZ Emissions Compliant


**Table 322: C450CBN-4C and C450CCN-4C Control Modules with Relay Output Technical Specifications**

Specification	Description
Product	<p>C450CBN-4C and C450CCN-4C: System 450 Control Module models are sensing controls and operating controls with LCD, four-button touchpad, and SPDT relay output</p> <p>C450CBN-4C: Control Module with one SPDT output relay</p> <p>C450CCN-4C: Control Module with two SPDT output relays</p>
Power Consumption	<p>C450CBN-4C: 0.9 VA maximum</p> <p>C450CCN-4C: 1.3 VA maximum</p>
Supply Power	<p>Internal Supply Power: C450YNN-1C Power Supply Module</p> <p>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</p> <p> <b>Note:</b> 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.</p>
Ambient Operating Conditions	<p>Temperature: -40 to 66°C (-40 to 150°F)</p> <p>Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)</p>
Ambient Shipping and Storage Conditions	<p>Temperature: -40 to 80°C (-40 to 176°F)</p> <p>Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)</p>
Input Signal	<p>0 to 5 VDC for humidity sensors and static pressure transducers</p> <p>0.5 to 4.5 VDC for ratiometric pressure transducers</p> <p>1,035 ohms at 25°C (77°F) for A99 PTC temperature sensors</p> <p>1,000 ohms at 21.1°C (70°F) for TE-6xxx Nickel temperature sensors</p>

**Table 322: C450CBN-4C and C450CCN-4C Control Modules with Relay Output Technical Specifications**

Specification	Description
Output Relay Contacts	<p><b>General:</b> 1/2 HP at 120/240 VAC, SPDT</p> <p><b>Specific:</b></p> <p>AC Motor Ratings</p> <p>120 VAC</p> <ul style="list-style-type: none"> <li>AC Full-Load Amperes: 9.8 A</li> <li>AC Locked-Rotor Amperes: 58.8 A</li> </ul> <p>208 / 240 VAC</p> <ul style="list-style-type: none"> <li>AC Full-Load Amperes: 4.9 A</li> <li>AC Locked-Rotor Amperes: 29.4 A</li> </ul> <p>10 Amperes AC Noninductive at 24 / 240 VAC</p> <p>Pilot Duty: 125 VA at 24/240 VAC</p>
Analog Input Accuracy	Resolution: 14 bits
Enclosure	Type 1, IP20 High-Impact Thermoplastic
Dimensions (H x W x D)	127 x 61 x 61 mm (5 x 2-3/8 x 2-3/8 in.)
Weight	<p>C450CBN-4C: 209 g (0.46 lb)</p> <p>C450CCN-4C: 222 g (0.49 lb)</p>
Compliance	<p>United States: cULus Listed; UL 60730-1, File E27734; FCC Compliant to CFR47, Part 15, Subpart B, Class B</p> <p>Canada: cULus Listed; CAN/CSA-E60730-1, File E27734; Industry Canada (IC) Compliant to Canadian ICES-003, Class B limits</p>
	Europe: CE Mark – Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive.
	Australia and New Zealand: RCM mark, Australia/NZ Emissions Compliant

**Table 323: C450RBN-3C and C450RCN-3C Reset Control Modules with Real-Time Clock and Relay Output Technical Specifications**

Specification	Description
Product	<p>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</p> <p>C450RBN-3C: Control Module with one SPDT output relay</p> <p>C450RCN-3C: Control Module with two SPDT output relays</p>
Power Consumption	<p>C450RBN-3C: 0.9 VA maximum</p> <p>C450RCN-3C: 1.3 VA maximum</p>
Supply Power	<p>Internal Supply Power: C450YNN-1C Power Supply Module</p> <p>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</p> <p> <b>Note:</b> 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.</p>
Ambient Operating Conditions	<p>Temperature: -40 to 66°C (-40 to 150°F)</p> <p>Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)</p>
Ambient Shipping and Storage Conditions	<p>Temperature: -40 to 80°C (-40 to 176°F)</p> <p>Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)</p>
Input Signal	<p>0 to 5 VDC for humidity sensors</p> <p>1,035 ohms at 25°C (77°F) for A99 PTC temperature sensors</p>

**Table 323: C450RBN-3C and C450RCN-3C Reset Control Modules with Real-Time Clock and Relay Output Technical Specifications**

Specification	Description
Output Relay Contacts	<p><b>General:</b> 1/2 HP at 120/240 VAC, SPDT</p> <p><b>Specific:</b></p> <p>AC Motor Ratings</p> <p>120 VAC</p> <ul style="list-style-type: none"> <li>AC Full-Load Amperes: 9.8 A</li> <li>AC Locked-Rotor Amperes: 58.8 A</li> </ul> <p>208 / 240 VAC</p> <ul style="list-style-type: none"> <li>AC Full-Load Amperes: 4.9 A</li> <li>AC Locked-Rotor Amperes: 29.4 A</li> </ul> <hr/> <p>10 Amperes AC Noninductive at 24 / 240 VAC</p> <p>Pilot Duty: 125 VA at 24/240 VAC</p>
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
Enclosure	Type 1, IP20 High-Impact Thermoplastic
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	United States: cULus Listed; UL 60730-1, File E27734; FCC Compliant to CFR47, Part 15, Subpart B, Class B
	Canada: cULus Listed; CAN/CSA-E60730-1, File E27734; Industry Canada (IC) Compliant to Canadian ICES-003, Class B limits
<b>CE</b>	Europe: CE Mark – Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive.
	Australia and New Zealand: RCM mark, Australia/NZ Emissions Compliant

**Table 324: C450SPN-4C and C450SQN-4C Expansion Modules with Analog Output Technical Specifications**

Specification	Description
Product	C450SPN-4C: System 450 Expansion Module with one Analog output C450SQN-4C: System 450 Expansion Module with two Analog outputs
Power consumption	C450SPN-4C: 1.1 VA max using 0 to 10 V out; 1.3 VA maximum using 4 to 20 mA out C450SQN-4C: 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
	<b>Note:</b> 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)


**Table 324: C450SPN-4C and C450SQN-4C Expansion Modules with Analog Output Technical Specifications**

Specification	Description
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><b>Voltage Mode (0 to 10 VDC):</b> 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><b>Current Mode (4 to 20 mA):</b> 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>
Enclosure	Type 1, IP20 High-Impact Thermoplastic
Dimensions (H x W x D)	127 x 61 x 61 mm (5 x 2-3/8 x 2-3/8 in.)
Weight	C450SPN-4C: 150 g (0.33 lb) C450SQN-4C: 150 g (0.33 lb)
Compliance	United States: cULus Listed; UL 60730-1, File E27734; FCC Compliant to CFR47, Part 15, Subpart B, Class B
	Canada: cULus Listed; CAN/CSA-E60730-1, File E27734; Industry Canada (IC) Compliant to Canadian ICES-003, Class B limits
<b>CE</b>	Europe: CE Mark – Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive.
	Australia and New Zealand: RCM mark, Australia/NZ Emissions Compliant


**Table 325: C450SBN-4C and C450SCN-4C Expansion Modules with Relay Output Technical Specifications**

Specification	Description
Product	C450SBN-4C: System 450 Expansion Module with one SPDT output relay C450SCN-4C: System 450 Expansion Module with two SPDT output relays
Power Consumption	C450SBN-4C: 0.8 VA maximum C450SCN-4C: 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
	<b>Note:</b> 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)

**Table 325: C450SBN-4C and C450SCN-4C  
Expansion Modules with Relay Output Technical  
Specifications**

Specification	Description
Output Relay Contacts	<p><b>General:</b> 1/2 HP at 120/240 VAC, SPDT</p> <p><b>Specific:</b></p> <p>AC Motor Ratings</p> <p>120 VAC</p> <ul style="list-style-type: none"> <li>• AC Full-Load Amperes: 9.8 A</li> <li>• AC Locked-Rotor Amperes: 58.8 A</li> </ul> <p>208 / 240 VAC</p> <ul style="list-style-type: none"> <li>• AC Full-Load Amperes: 4.9 A</li> <li>• AC Locked-Rotor Amperes: 29.4 A</li> </ul> <hr/> <p>10 Amperes AC Noninductive at 24 / 240 VAC</p> <p>Pilot Duty: 125 VA at 24/240 VAC</p>
Enclosure	Type 1, IP20 High-Impact Thermoplastic
Dimensions (H x W x D)	127 x 61 x 61 mm (5 x 2-3/8 x 2-3/8 in.)
Weight	C450SBN-4C: 172 g (0.38 lb) C450SCN-4C: 186 g (0.41 lb)
Compliance	United States: cULus Listed; UL 60730-1, File E27734; FCC Compliant to CFR47, Part 15, Subpart B, Class B
	Canada: cULus Listed; CAN/CSA-E60730-1, File E27734; Industry Canada (IC) Compliant to Canadian ICES-003, Class B limits
	Europe: CE Mark – Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive.
	Australia and New Zealand: RCM mark, Australia/NZ Emissions Compliant

**Table 326: C450YNN-1C Power Supply Module  
Technical Specifications**

Specification	Description
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)
Enclosure	Type 1, IP20 High-Impact Thermoplastic
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	United States: cULus Listed; UL 60730-1, File E27734; FCC Compliant to CFR47, Part 15, Subpart B, Class B
	Canada: cULus Listed; CAN/CSA-E60730-1, File E27734; Industry Canada (IC) Compliant to Canadian ICES-003, Class B limits
	Europe: CE Mark – Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive and Low Voltage Directive.
	Australia and New Zealand: RCM mark, Australia/NZ Emissions Compliant



## System 450 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 subordinate 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 and benefits

### **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.

### **Control Modules with Bright Backlit LCDs and Four-Button Touchpad User Interfaces, Up to Three Hard-Wired Input Sensors and Up to Ten Relay or Analog Outputs (In Any Combination) per Control System**

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.

### **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.

## Communication control 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.



## 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.

**Table 327: 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

## Technical specifications


**Table 328: C450CEN-1C Control Module with Ethernet Communications Technical Specifications**

Specification	Description
Product	C450CEN-1: 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  ① <b>Note:</b> 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.

**Table 328: C450CEN-1C Control Module with Ethernet Communications Technical Specifications**

Specification	Description
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	United States: cULus Listed; UL 60730-1, File E27734; FCC Compliant to CFR47, Part 15, Subpart B, Class B  Canada: cULus Listed; CAN/CSA-E60730-1, File E27734; Industry Canada (IC) Compliant to Canadian ICES-003, Class B limits  <b>CE</b> Europe: CE Mark – Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive.  Australia and New Zealand: RCM mark, Australia/NZ Emissions Compliant

**Table 329: C450CRN-1C Control Module with RS485 Modbus Communications Technical Specifications**

Specification	Description
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 subordinate 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  ① <b>Note:</b> 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	United States: cULus Listed; UL 60730-1, File E27734; FCC Compliant to CFR47, Part 15, Subpart B, Class B  Canada: cULus Listed; CAN/CSA-E60730-1, File E27734; Industry Canada (IC) Compliant to Canadian ICES-003, Class B limits
	Europe: CE Mark – Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive.
	Australia and New Zealand: RCM mark, Australia/NZ Emissions Compliant



## 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.

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 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.

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 and benefits

#### **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.

### Control Modules with Bright Backlit LCDs and Four-Button Touchpad User Interfaces, Up to Three Hard-Wired Input Sensors and Up to Ten Relay or Analog Outputs (In Any Combination) per Control System

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.

#### 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.

### 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.

**Table 330: 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

**Table 330: Reset System 450 Modules and Accessories Ordering Information**

Product Code Number	Product Description
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

**Table 331: C450RBN-3C and C450RCN-3C Reset Control Modules with Real-Time Clock and Relay Output Technical Specifications**

Specification	Description
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 <b>Note:</b> 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

**Table 331: C450RBN-3C and C450RCN-3C Reset Control Modules with Real-Time Clock and Relay Output Technical Specifications**

Specification	Description
Output Relay Contacts	General: 1/2 HP at 120/240 VAC, SPDT Specific: AC Motor Ratings 120 VAC <ul style="list-style-type: none"> <li>AC Full-Load Amperes: 9.8 A</li> <li>AC Locked-Rotor Amperes: 58.8 A</li> </ul> 208/240 VAC <ul style="list-style-type: none"> <li>AC Full-Load Amperes: 4.9 A</li> <li>AC Locked-Rotor Amperes: 29.4 A</li> </ul> <hr/> 10 Amperes AC Non-inductive at 24 / 240 VAC Pilot Duty: 125 VA at 24 / 240 VAC
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	United States: cULus Listed; UL 60730-1, File E27734; FCC Compliant to CFR47, Part 15, Subpart B, Class B Canada: cULus Listed; CAN/CSA-E60730-1, File E27734; Industry Canada (IC) Compliant to Canadian ICES-003, Class B limits
<b>CE</b>	Europe: CE Mark – Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive.
	Australia and New Zealand: RCM mark, Australia/NZ Emissions Compliant



## 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 and benefits

#### **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.

#### **Control Modules with Bright Backlit LCDs and Four-Button Touchpad User Interfaces, Up to Three Hard-Wired Input Sensors and Up to Ten Relay or Analog Outputs (In Any Combination) per Control System**

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 HVACR 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.

## 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.

**Table 332: Standard System 450 Modules and Accessories Ordering Information**

Product Code Number	Product Description
C450CPN-4C	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-4C	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.

**Table 332: Standard System 450 Modules and Accessories Ordering Information**

Product Code Number	Product Description
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

## C450CPN-4C and C450CQN-4C Control Modules with Analog Output technical specifications

**Table 333: C450CPN-4C and C450CQN-4C Control Modules with Analog Output technical specifications**

Specification	Description
Product	C450CPN-4C and C450CQN-4C: System 450 Control Module models are sensing controls and operating controls with LCD, four-button touchpad, and SPDT analog output C450CPN-4C: Control Module with one analog output C450CQN-4C: Control Module with two analog outputs
Power Consumption	C450CPN-4C: 1.3 VA maximum using 0 to 10 V out; 1.5 VA maximum using 4 to 20 mA out C450CQN-4C: 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 <b>Note:</b> 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)

**Table 333: C450CPN-4C and C450CQN-4C  
Control Modules with Analog Output technical  
specifications**

Specification	Description
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-4C: 195 g (0.43 lb) C450CQN-4C: 195 g (0.43 lb)
Compliance	United States: cULus Listed; UL 60730-1, File E27734; FCC Compliant to CFR47, Part 15, Subpart B, Class B Canada: cULus Listed; CAN/CSA-E60730-1, File E27734; Industry Canada (IC) Compliant to Canadian ICES-003, Class B limits
CE	Europe: CE Mark – Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive.
	Australia and New Zealand: RCM mark, Australia/NZ Emissions Compliant





## 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 and benefits

#### **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.

#### **Control Modules with Bright Backlit LCDs and Four-Button Touchpad User Interfaces, Up to Three Hard-Wired Input Sensors and Up to Ten Relay or Analog Outputs (In Any Combination) per Control System**

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 HVACR 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.

## 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.

**Table 334: Standard System 450 Modules and Accessories Ordering Information**

Product Code Number	Product Description
C450CBN-4C	Standard Control Module with LCD, Four-Button Touchpad UI, and Relay Output; provides one relay output (SPDT line-voltage relay) for SPDT control.
C450CCN-4C	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

## Technical specifications

**Table 335: C450CBN-4C and C450CCN-4C Control Modules with Relay Output Technical Specifications**

Specification	Description
Product	C450CBN-4C and C450CCN-4C: System 450 Control Module models are sensing controls and operating controls with LCD, four-button touchpad, and SPDT relay output C450CBN-4C: Control Module with one SPDT output relay C450CCN-4C: Control Module with two SPDT output relays
Power Consumption	C450CBN-4C: 0.9 VA maximum C450CCN-4C: 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 <b>Note:</b> 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

**Table 335: C450CBN-4C and C450CCN-4C  
Control Modules with Relay Output Technical  
Specifications**

Specification	Description
Output Relay Contacts	<p>General: 1/2 HP at 120/240 VAC, SPDT</p> <p>Specific:</p> <p>AC Motor Ratings</p> <p>120 VAC</p> <ul style="list-style-type: none"> <li>AC Full-Load Amperes: 9.8 A</li> <li>Locked-Rotor Amperes: 58.8 A</li> </ul> <p>208/240 VAC</p> <ul style="list-style-type: none"> <li>AC Full-Load Amperes: 4.9 A</li> <li>Locked-Rotor Amperes: 29.4 A</li> </ul> <hr/> <p>10 Amperes AC Non-inductive at 24 / 240 VAC Pilot Duty: 125 VA at 24 / 240 VAC</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	C450CBN-4C: 209 g (0.46 lb) C450CCN-4C: 222 g (0.49 lb)
Compliance	United States: cULus Listed; UL 60730-1, File E27734; FCC Compliant to CFR47, Part 15, Subpart B, Class B
	Canada: cULus Listed; CAN/CSA-E60730-1, File E27734; Industry Canada (IC) Compliant to Canadian ICES-003, Class B limits
<b>CE</b>	Europe: CE Mark – Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive.
	Australia and New Zealand: RCM mark, Australia/NZ Emissions Compliant



## 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-4C: Analog Expansion Module with one analog output (each 0 to 10 VDC or 4 to 20 mA)
- C450SQN-4C: 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 and benefits

#### **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.

#### **Control Modules with Bright Backlit LCDs and Four-Button Touchpad User Interfaces, Up to Three Hard-Wired Input Sensors and Up to Ten Relay or Analog Outputs (In Any Combination) per Control System**

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.

## Selection chart

**Table 336: Products**


Product Code Number	Product Description
C450SPN-4C	Analog Output Expansion Module; provides one analog output (0 to 10 VDC or 4 to 20 mA self-selecting signal) for proportional control.
C450SQN-4C	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 technical specifications

**Table 337: C450SPN-4C and C450SQN-4C Expansion Modules with Analog Output Technical Specifications**

Specification	Description
Product	C450SPN-4C: System 450 Expansion Module with one analog output C450SQN-4C: System 450 Expansion Module with two analog outputs
Power consumption	C450SPN-4C: 1.1 VA maximum using 0 to 10 V out; 1.3 VA maximum using 4 to 20 mA out C450SQN-4C: 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  ⓘ <b>Note:</b> 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.

**Table 337: C450SPN-4C and C450SQN-4C Expansion Modules with Analog Output Technical Specifications**

Specification	Description
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-4C: 150 g (0.33 lb) C450SQN-4C: 150 g (0.33 lb)
Compliance	United States: cULus Listed; UL 60730-1, File E27734; FCC Compliant to CFR47, Part 15, Subpart B, Class B  Canada: cULus Listed; CAN/CSA-E60730-1, File E27734; Industry Canada (IC) Compliant to Canadian ICES-003, Class B limits
	Europe: CE Mark - Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive.
	Australia and New Zealand: RCM mark, Australia/NZ Emissions Compliant



## 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-4C: Relay Expansion Module with one relay output
- C450SCN-4C: 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 and benefits

**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.

**Control Modules with Bright Backlit LCDs and Four-Button Touchpad User Interfaces, Up to Three Hard-Wired Input Sensors and Up to Ten Relay or Analog Outputs (In Any Combination) per Control System**

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.

## Selection chart

**Table 338: Products**

Product Code Number	Product Description
C450SBN-4C	Relay output Expansion Module provides one SPDT relay output.
C450SCN-4C	Relay output Expansion Module provides two SPDT relay outputs.
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
WHA-C450-100C	System 450 module connection extension cable, 100 cm (3.3 ft) long

## C450SBN-4C and C450SCN-4C Expansion Modules with Relay Output technical specifications

**Table 339: C450SBN-4C and C450SCN-4C Expansion Modules with Relay Output Technical Specifications**

Specification	Description
Product	C450SBN-4C: System 450 Expansion Module with one SPDT output relay C450SCN-4C: System 450 Expansion Module with two SPDT output relays
Power consumption	C450SBN-4C: 0.8 VA maximum C450SCN-4C: 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 <b>i</b> <b>Note:</b> 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)

**Table 339: C450SBN-4C and C450SCN-4C Expansion Modules with Relay Output Technical Specifications**

Specification	Description
Output relay contacts	General: 1/2 HP at 120/240 VAC, SPDT Specific: AC Motor Ratings 120 VAC <ul style="list-style-type: none"> <li>AC Full-Load Amperes: 9.8 A</li> <li>AC Locked-Rotor Amperes: 58.8 A</li> </ul> 208 / 240 VAC <ul style="list-style-type: none"> <li>AC Full-Load Amperes: 4.9 A</li> <li>AC Locked-Rotor Amperes: 29.4 A</li> </ul> <hr/> 10 Amperes AC Noninductive at 24 / 240 VAC Pilot Duty: 125 VA at 24/240 VAC
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-4C: 172 g (0.38 lb) C450SCN-4C: 186 g (0.41 lb)
Compliance	United States: cULus Listed; UL 60730-1, File E27734; FCC Compliant to CFR47, Part 15, Subpart B, Class B Canada: cULus Listed; CAN/CSA-E60730-1, File E27734; Industry Canada (IC) Compliant to Canadian ICES-003, Class B limits <b>CE</b> Europe: CE Mark – Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive. Australia and New Zealand: RCM mark, Australia/NZ Emissions Compliant

## 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 and benefits

**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.

### Selection chart

**Table 340: Products**

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



## C450YNN-1C Power Supply Module technical specifications

**Table 341: C450YNN-1C Power Supply Module technical specifications**

Specification	Description
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	United States: cULus Listed; UL 60730-1, File E27734; FCC Compliant to CFR47, Part 15, Subpart B, Class B
	Canada: cULus Listed; CAN/CSA-E60730-1, File E27734; Industry Canada (IC) Compliant to Canadian ICES-003, Class B limits
CE	Europe: CE Mark – Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive and the Low Voltage Directive.
	Australia and New Zealand: RCM mark, Australia/NZ Emissions Compliant

# 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.

System 450 compatible sensors and transducers come in a variety of styles and configurations, 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)*
- *HE-69xx Series Duct Probe Humidity and Temperature Sensors Product Bulletin (LIT-12013478)*
- *HE-6800 Series Humidity Transmitters with Temperature Sensor Product Bulletin (LIT-12011625)*
- *P599 Series Electronic Pressure Transducers Product/Technical Bulletin (LIT-12012446, Part No. 24-7664-3264)*

- *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*

**Figure 126: Duct Mount HE-69Sx0NP Humidity Sensor**



**Figure 127: DPT265 Series Low Pressure Differential Pressure Transducers**



**Figure 128: A99 Temperature Sensors**



**Figure 129: TE-6300 Series Temperature Sensors**



**Figure 130: TE-6000-1 Temperature Sensing Element**



**Figure 131: TE-6800 Series Wall Mount Temperature Sensors and HE-6800 Series Humidity Transmitters with Temperature Sensors**



**Figure 132: P599 Series Electronic Pressure Transducers**



## Selection charts

Use these tables to order System 450 compatible sensors, transducers, and accessories.

**Table 342: System 450 Compatible A99B Temperature Sensors and accessories ordering information**

Product code	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.

**Table 342: System 450 Compatible A99B Temperature Sensors and accessories ordering information**

Product code	Description
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 **Note:** Refer to the *A99B Series Temperature Sensors Product/Technical Bulletin (LIT-125186)* for more information.

**Table 343: System 450 Compatible TE-6000 Series 1,000 Ohm Nickel Temperature Sensors and accessories ordering information**

Product Code	Description
TE-6000-1 TE-6000-1x TE-6000-6	TE6000 Series 1,000 ohm at 20°C (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)

**Table 344: System 450 Compatible TE-6300 Series 1,000 Ohm Nickel Temperature Sensors and accessories ordering information**

Product code	Description
TE-631xx-x	TE6300 Series 1,000 ohm at 20°C (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)

**Table 345: System 450 Compatible TE-68NT-0N00S 1,000 Ohm Nickel Temperature Sensor ordering information**

Product code	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)

**Table 346: System 450 Compatible HE-69XX Type Humidity Sensors with Integral A99B Temperature Sensor ordering information**

Product code	Description
HE-69Sx0NP	Duct Mount Humidity Sensor with A99B Type Temperature Sensor: 10 to 90% RH; 0 to 60°C (32 to 140°F)

- ① **Note:** The HE-69S3 sensors require 24 VAC input and must use the 0 to 5 VDC output. Refer to the *HE-69xx Series Duct Probe Humidity and Temperature Sensors Product Bulletin (LIT-12013478)* for more information, including technical specifications and mounting accessories.

**Table 347: System 450 Compatible HE6800 Series Humidity Transmitters with Temperature Sensor ordering information**

Product code	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 **Note:** 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)* for more information, including technical specifications and mounting accessories.

**Table 348: System 450 Compatible Low Pressure Differential Transducer ordering information**

Product code	Description
DPT2650-R25B-AB	Low Pressure Differential Transducer: -0.25 to 0.25 in. W.C. System 450 Sensor Type: P 0.25
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 **Note:**
  - Refer to the *Setra Systems Model DPT265 Very Low Differential Pressure Transducer Catalog Page* for more information.
  - 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* for more information.
  - Used only with Communications Control Modules.

**Table 349: System 450 compatible P599 Series Transducers with 1/4 in. SAE 45 Flare Internal Thread with Depressor (Style 47) ordering information**

Product code	Description
P599RCPS100C	-10 to 100 psis (sealed for wet and freeze/thaw applications); order WHA-PKD3 type wire harness separately
P599RCPS100K	-10 to 100 psis (sealed for wet and freeze/thaw applications); WHA-PKD3-200C wire harness included
P599RCPS102C	0 to 200 psis (sealed for wet and freeze/thaw applications); order WHA-PKD3 type wire harness separately
P599RCPS102K	0 to 200 psis (sealed for wet and freeze/thaw applications); WHA-PKD3-200C wire harness included
P599RCPS101C	0 to 100 psi; order WHA-PKD3 type wire harness separately
P599RCPS101K	0 to 100 psi; WHA-PKD3-200C wire harness included
P599RCPS105C	0 to 500 psi; order WHA-PKD3 type wire harness separately
P599RCPS105K	0 to 500 psi; WHA-PKD3-200C wire harness included
P599RCPS107C	0 to 750 psi; order WHA-PKD3 type wire harness separately
P599RCPS107K	0 to 750 psi; WHA-PKD3-200C wire harness included

① **Note:** The P599 sensors must be powered with the +5 VDC and C terminals and the output is 0.5 to 4.5 VDC. Refer to the *P599 Series Electronic Pressure Transducers Product/Technical Bulletin (LIT-12012446, Part No. 24-7664-3264)* for more information.

**Table 350: System 450 Compatible P599 Series Transducers with 1/8 in. 27 NPT External Thread (Style 49) ordering information**

Product code	Description
P599RAPS100C	-10 to 100 psis (sealed for wet and freeze/thaw applications); order WHA-PKD3 type wire harness separately
P599RAPS100K	-10 to 100 psis (sealed for wet and freeze/thaw applications); WHA-PKD3-200C wire harness included
P599RAPS102C	0 to 200 psis (sealed for wet and freeze/thaw applications); order WHA-PKD3 type wire harness separately

**Table 350: System 450 Compatible P599 Series Transducers with 1/8 in. 27 NPT External Thread (Style 49) ordering information**

Product code	Description
P599RAPS102K	0 to 200 psis (sealed for wet and freeze/thaw applications); WHA-PKD3-200C wire harness included
P599RAPS101C	0 to 100 psig; order WHA-PKD3 type wire harness separately
P599RAPS101K	0 to 100 psig; WHA-PKD3-200C wire harness included
P599RAPS102C	0 to 200 psig; order WHA-PKD3 type wire harness separately
P599RAPS105C	0 to 500 psig; order WHA-PKD3 type wire harness separately
P599RAPS105K	0 to 500 psig; WHA-PKD3-200C wire harness included
P599RAPS107C	0 to 750 psig; order WHA-PKD3 type wire harness separately
P599RAPS107K	0 to 750 psig; WHA-PKD3-200C wire harness included

① **Note:** The P599 sensors must be powered with the +5 VDC and C terminals and the output is 0.5 to 4.5 VDC. Refer to the *P599 Series Electronic Pressure Transducers Product/Technical Bulletin (LIT-12012446, Part No. 24-7664-3264)* for more information.

**Table 351: WHA-PKD3 Wire Harnesses ordering information**

Product code	Description
WHA-PKD3-200C	Plug and Three-Wire Harness for P599 Electronic Pressure Transducers: 2.0 m (6-1/2 ft) cable
WHA-PKD3-400C	Plug and Three-Wire Harness for P599 Electronic Pressure Transducers: 4.0 m (13 ft) cable
WHA-PKD3-600C	Plug and Three-Wire Harness for P599 Electronic Pressure Transducers: 6.0 m (19-5/8 ft) cable

① **Note:** Refer to the *P599 Series Electronic Pressure Transducers Product/Technical Bulletin (LIT-12012446, Part No. 24-7664-3264)* for more information.



# System 450 Series C450CCU Condensing Unit Control System

## Introduction

The System 450™ Series condensing unit control module controls space temperature, scheduled defrost cycles, evaporator fans, and optional pump down compressor control on walk-in coolers, freezers, and refrigerated display cases with remote condensing units.

You can use the C450CCU-4 control module, in conjunction with optional System 450 relay output expansion modules, to build a variety of custom condensing unit control systems for small and medium capacity refrigeration applications.

The C450CCU-4 condensing unit control system provides passive, off-cycle defrost control or active, electric heat defrost control. Depending on the application, you can terminate defrost cycles based on time or based on the sensed evaporator temperature. You can use a menu option to manually initiate or terminate a defrost cycle at any time.

You can also control single-speed or two-speed evaporator fans, and add an optional pressure transducer for pump down pressure control of the compressor.

Refer to the following resources for detailed information about how to set up, operate, and troubleshoot a System 450 condensing unit control system:

- *System 450 Series C450CCU Condensing Unit Control System Technical Bulletin (LIT-12013266)*
- *System 450 Series C450CCU Condensing Unit Control Module Installation Guide (Part No. 24-7664-03809)*

## Features

The condensing unit control module provides the following features:

- Temperature control of a refrigerated space
- Defrost control
  - Passive, off-cycle defrost control for medium-temperature applications
  - Active, electric heat defrost control for low-temperature applications
  - Defrost termination sensor or optional defrost termination switch
  - One to eight daily scheduled defrost cycle times
  - Manual start and stop capability of defrost cycles
- Evaporator fan control
  - Control single or two-speed evaporator fans
- Pump-down control
  - Initiate and terminate a pump-down cycle, and minimize compressor failure due to liquid slugging

## Ordering information

**Table 352: System 450 modules**

Product code	Description
C450CCU-4C	Condensing unit control module with LCD, four-button touchpad, UI, and two single-pole, double-throw (SPDT) line-voltage relay outputs Included in the box: quantity of two A99BB-500C temperature sensors with 5.00 m (16 3/8 ft) cable length Sensor temperature range: -40°C to 120°C (-40°F to 250°F) Cable jacket temperature range: -40°C to 100°C (-40°F to 212°F)
C450YNN-1C	Power module; provides 24 V to System 450 module assembly; 120 VAC or 240 VAC supply power input terminals
C450SBN-4C	Relay expansion module with one SPDT relay output
C450SCN-4C	Relay expansion module with two SPDT relay outputs

**Table 353: Mounting accessories**

Product code	Description
BKT287-1R	DIN rail; 0.30 m (12.00 in.)
BKT287-4R	DIN rail; 0.36 m (14.00 in.)
PLT344-1R	2 DIN rail with end clamps

**Table 354: A99 Series temperature sensors**

Product code	Description
A99BA-200C	Positive temperature coefficient (PTC) silicon sensor with shielded cable; cable length 2.00 m (6.50 ft) Sensor temperature range: -40°C to 120°C (-40°F to 250°F) Cable jacket temperature range: -40°C to 100°C (-40°F to 212°F)
A99BB-25C	PTC silicon sensor with polyvinyl chloride (PVC) cable; cable length 0.25 m (9.75 in.) Sensor temperature range: -40°C to 120°C (-40°F to 250°F) Cable jacket temperature range: -40°C to 100°C (-40°F to 212°F)
A99BB-200C	PTC silicon sensor with PVC cable; cable length 2.00 m (6.50 ft) Sensor temperature range: -40°C to 120°C (-40°F to 250°F) Cable jacket temperature range: -40°C to 100°C (-40°F to 212°F)
A99BB-300C	PTC silicon sensor with PVC cable; cable length 3.00 m (9.75 ft) Sensor temperature range: -40°C to 120°C (-40°F to 250°F) Cable jacket temperature range: -40°C to 100°C (-40°F to 212°F)
A99BB-500C	PTC silicon sensor with PVC cable; cable length 5.00 m (16.38 ft) Sensor temperature range: -40°C to 120°C (-40°F to 250°F) Cable jacket temperature range: -40°C to 100°C (-40°F to 212°F)
A99BB-600C	PTC silicon sensor with PVC cable; cable length 6.00 m (19.50 ft) Sensor temperature range: -40°C to 120°C (-40°F to 250°F) Cable jacket temperature range: -40°C to 100°C (-40°F to 212°F)
A99BC-25C	PTC silicon sensor with high temperature silicon cable; cable length 0.25 m (9.75 in.) Sensor temperature range: -40°C to 120°C (-40°F to 250°F) Cable jacket rated for full sensor temperature range
A99BC-300C	PTC silicon sensor with high temperature silicon cable; cable length 3.00 m (9.75 ft) Sensor temperature range: -40°C to 120°C (-40°F to 250°F) Cable jacket rated for full sensor temperature range

**Table 354: A99 Series temperature sensors**

Product code	Description
A99BC-1500C	PTC silicon sensor with high temperature silicon cable; cable length 15.00 m (49 ft) Sensor temperature range: -40°C to 120°C (-40°F to 250°F) Cable jacket rated for full sensor temperature range
A99-CLP-1	Mounting clip for A99 temperature sensor

① **Note:** Refer to the *A99B Series Temperature Sensors Product/Technical Bulletin (LIT-125186)* for more information.

**Table 355: P599 Series transducers with 1/4 in. SAE 45 flare internal thread with depressor (Style 47)**

Product code	Description
P599RCPS100C	-10 psis to 100 psis, sealed for wet and freeze and thaw applications; order WHA-PKD3 type wire harness separately.
P599RCPS100K	-10 psis to 100 psis, sealed for wet and freeze and thaw applications; WHA-PKD3-200C wire harness included.
P599RCPS102C	0 psis to 200 psis, sealed for wet and freeze and thaw applications; order a WHA-PKD3 type wire harness separately.
P599RCPS102K	0 psis to 200 psis, sealed for wet and freeze and thaw applications; WHA-PKD3-200C wire harness included.
P599RCPS101C	0 psig to 100 psig; order a WHA-PKD3 type wire harness separately.
P599RCPS101K	0 psig to 100 psig; WHA-PKD3-200C wire harness included.

**Table 356: P599 Series transducers with 1/8 in. 27 NPT external thread (Style 49)**

Product code	Description
P599RAPS101C	0 psig to 100 psig; order a WHA-PKD3 type wire harness separately.
P599RAPS101K	0 psig to 100 psig; WHA-PKD3-200C wire harness included.
P599RAPS102C	0 psig to 200 psig; order a WHA-PKD3 type wire harness separately.

① **Note:** P599 Series transducers are 0.5 VDC to 4.5 VDC ratiometric transducers. Refer to the *P599 Series Electronic Pressure Transducers Product/Technical Bulletin (LIT-12012446)* for more information.

**Table 357: WHA-PKD3 wire harnesses**

Product code	Description
WHA-PKD3-200C	Plug and 3-wire harness for P599 electronic pressure transducers: 2.00 m (6.50 ft) cable
WHA-PKD3-400C	Plug and 3-wire harness for P599 electronic pressure transducers: 4.00 m (13.00 ft) cable
WHA-PKD3-600C	Plug and 3-wire harness for P599 electronic pressure transducers: 6.00 m (19.60 ft) cable



## C450CCU condensing unit control module technical specifications

**Table 358: C450CCU condensing unit control module technical specifications**

Specification	Description
Product	System 450 Series C450CCU condensing unit control module
Power supply	Use one of the following power supplies: C450YNN power supply module 24 (20-30) VAC safety extra-low voltage (SELV) (Europe) Class 2 (North America), 50/60 Hz, 10 VA minimum 20 VDC–30 VDC, 2 watts minimum for control, and then 1 additional watt for each output you attach <b>Note:</b> Connect a System 450 control module to only one power supply.
Ambient operating conditions	Temperature: -40°C to 66°C (-40°F to 150°F) Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)
Ambient shipping and storage conditions	Temperature: -40°C to 80°C (-40°F 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: <b>120 VAC:</b> AC full-load amperes: 9.8 A AC locked-rotor amperes: 58.8 A <b>208/240 VAC:</b> AC full-load amperes: 4.9 A AC locked-rotor amperes: 29.4 A 10 amperes AC non-inductive at 24/240 VAC Pilot duty: 125 VA at 24/240 VAC
Enclosure	Type 1 (NEMA), IP20 high-impact thermoplastic
Dimensions (H x W x D)	127 mm x 61 mm x 61 mm (5 in. x 2 3/8 in. x 2 3/8 in.)
Weight	C450CCU: 222 g (0.49 lb)
Compliance	United States: ULus Listed; UL 60730-1, File E27734; FCC Compliant to CFR47, Part 15, Subpart B, Class B Canada: cUL Listed; CAN/CSA-E60730-1, File E27734; Industry Canada (IC) Compliant to Canadian ICES-003, Class B limits
<b>CE</b>	Europe: CE Mark – Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive and RoHS Directive. Australia and New Zealand: RCM mark, Australia/NZ emissions compliant

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult Johnson Controls Application Engineering at (414) 524-5535. Johnson Controls shall not be liable for damages resulting from misapplication or misuse of its products.



## System 450 Control Module with Hybrid Analog Output Catalog Page



### 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.

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 and single point of contact 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 and Benefits

#### **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.

**Control Modules with Bright Backlit LCDs and Four-Button Touchpad User Interfaces, Up to Three Hard-Wired Input Sensors and Up to Ten Relay or Analog Outputs (In Any Combination) per Control System**

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.

**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.

**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.

**Table 359: Hybrid System 450 Modules and Accessories Ordering Information**

Product Code Number	Product Description
<b>C450CPW-400C</b>	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-400C as the control module.
<b>BKT287-1R</b>	DIN Rail; 0.30 m (12 in.) long
<b>BKT287-2R</b>	DIN Rail; 1 m (39-1/3 in.) long
<b>BKT287-3R</b>	DIN Rail; 0.61 m (24 in.) long
<b>BKT287-4R</b>	DIN Rail; 0.36 m (14 in.) long
<b>PLT344-1R</b>	DIN Rail End Clamps (Two clamps)
<b>WHA-C450-100C</b>	System 450 module connection extension cable, 100 cm (3.3 ft) long

## C450CPW-400C Technical Specifications

**Table 360: C450CPW-400C Control Module with Hybrid Analog Output Technical Specifications**

Specification	Description
<b>Product</b>	C450CPW-400C System 450 control module is a sensing control and operating control with LCD, four-button touchpad, and analog output with pulse-width modulation capability.
<b>Power Consumption</b>	C450CPW-400C: 1.3 VA maximum using 0 to 10 V out; 1.5 VA maximum using 4 to 20 mA out
<b>Supply Power</b>	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  ① <b>Note:</b> 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.
<b>Ambient Operating Conditions</b>	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)
<b>Ambient Shipping and Storage Conditions</b>	Temperature: -40 to 80°C (-40 to 176°F) Humidity: Up to 95% RH noncondensing; maximum dew point 29°C (85°F)
<b>Input Signal</b>	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

**Table 360: C450CPW-400C Control Module with Hybrid Analog Output Technical Specifications**

Specification	Description
<b>Analog Output</b>	<b>Voltage Mode (0–10 VDC):</b> 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.  <b>Current Mode (4–20 mA):</b> 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.
<b>Analog Input Accuracy</b>	Resolution: 14 bits
<b>Enclosure</b>	Type 1, IP20 High-Impact Thermoplastic
<b>Dimensions (H x W x D)</b>	127 x 61 x 61 mm (5 x 2-3/8 x 2-3/8 in.)
<b>Weight</b>	C450CPW-400C: 195 g (0.43 lb)
<b>Compliance</b>	<b>United States:</b> cULus Listed; UL 60730-1, File E27734; FCC Compliant to CFR47, Part 15, Subpart B, Class B  <b>Canada:</b> cULus Listed; CAN/CSA-E60730-1, File E27734; Industry Canada (IC) Compliant to Canadian ICES-003, Class B limits
<b>CE</b>	<b>Europe:</b> CE Mark – Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive.
	<b>Australia and New Zealand:</b> RCM mark, Australia/NZ Emissions Compliant



# Cross reference

## Ranco to Penn cross reference

**Table 361: Ranco to Penn cross reference, temperature controls**

Product	Product number	Range	Differential	Switch	Capillary	Bulb	Enclosure
Ranco	ETC111000-000	-30/220°F	1/30°F ADJ	Single-pole, double-throw (SPDT)	96 in. Leads	1/2 in. x 2 in.	NEMA 1
Penn	A421ABC-02C <sup>1</sup>	-40/212°F	1/30°F ADJ	SPDT	72 in. Leads	1/2 in. x 2 in.	NEMA 1
Ranco	ETC-111100-000	-30/220°F	1/30°F ADJ	0-10 VDC Output	96 in. Leads	1/2 in. x 2 in.	NEMA 1
Penn	C450CPW-400C <sup>2</sup>	-40/250°F	ADJ	0-10 VDC Output	72 in. Leads	1/2 in. x 2 in.	NEMA 1
Ranco	ETC112000-000 <sup>3</sup>	-30/220°F	1/30°F ADJ	SPDT	96 in. Leads	1/2 in. x 2 in.	NEMA 1
Penn	A421GBF-02C <sup>3</sup>	-40/248°F	1/30°F ADJ	SPDT	72 in. Leads	1/2 in. x 2 in.	NEMA 1
Ranco	ETC-112100-000 <sup>3</sup>	-30/220°F	1/30°F ADJ	0-10 VDC Output	96 in. Leads	1/2 in. x 2 in.	NEMA 1
Penn	C450CPW-400C <sup>3</sup>	-40/250°F	ADJ	0-10 VDC Output	78 in. Leads	1/2 in. x 2 in.	NEMA 1
Ranco	3130-101	35/45°F	12°F FXD	Open LO	None	240 in.	NEMA 1
Penn	A11B-1C	35/45°F	12°F FXD	Open LO	48 in.	240 in.	NEMA 1
Ranco	3130-201	35/45°F	Manual	Open LO	None	240 in.	NEMA 1
Penn	A11A-1C	35/45°F	Manual	Open LO	48 in.	240 in.	NEMA 1
Ranco	3311-651	37°F FXD	Manual	Open LO	180 in.	1/2 in. x 4.25 in.	NEMA 1
Penn	A70BA-17C	35/80°F	Manual	Open LO	72 in.	3/8 in. x 3 in.	NEMA 1
Ranco	3311-701	30°F FXD	15°F FXD	Open LO	120 in.	3/8 in. x 6.5 in.	NEMA 1
Penn	A70AA-15C	-10/65°F	4/40°F ADJ	Open LO	72 in.	3/8 in. x 3 in.	NEMA 1
Ranco	A22-2237	41°F FXD	6°F FXD	Open HI	48 in.	48 in.	NEMA 1
Penn	A11E-6C	35/45°F	12°F FXD	SPDT	48 in.	240 in.	NEMA 1
Ranco	O10-1010	0/55°F	7/55°F ADJ	Open LO	48 in.	48 in.	NEMA 1
Penn	A11B-1C	35/45°F	12°F FXD	Open LO	48 in.	240 in.	NEMA 1
Ranco	O10-1408	-15/40°F	3/20°F ADJ	Open LO	72 in.	3/8 in. x 4 in.	NEMA 1
Penn	A19ABC-24C <sup>4</sup>	-30/100°F	3/12°F ADJ	SPDT	96 in.	3/8 in. x 4 in.	NEMA 1
Ranco	O10-1409	0/55°F	3/20 ADJ	Open LO	72 in.	3/8 in. x 5.11 in.	NEMA 1
Penn	A19ABA-1C <sup>4</sup>	-30/50°F	5/20°F ADJ	Open LO	72 in.	3/8 in. x 5.11 in.	NEMA 1
Ranco	O10-1410	25/75°F	3/20°F ADJ	Open LO	72 in.	3/8 in. x 4 in.	NEMA 1
Penn	A19ABA-4C <sup>4</sup>	20/80°F	3.5/14°F ADJ	Open LO	72 in.	3/8 in. x 5.11 in.	NEMA 1
Ranco	O10-1416	0/55°F	3/20°F ADJ	Open LO	72 in.	3/8 in. x 4 in.	NEMA 1
Penn	A11B-1C	35/45°F	12°F FXD	Open LO	48 in.	240 in.	NEMA 1
Ranco	O10-1418	0/55°F	3/20°F ADJ	Open LO	None	Coiled	NEMA 1
Penn	A19BBA-1C <sup>4</sup>	-30/50°F	5/20°F ADJ	Open LO	None	Coiled	NEMA 1
Ranco	O10-1473	0/55°F	7/55°F ADJ	Open LO	72 in.	3/8 in. x 4 in.	NEMA 1
Penn	A19ABA-1C <sup>4</sup>	-30/50°F	5/20°F ADJ	Open LO	72 in.	3/8 in. x 5.11 in.	NEMA 1
Ranco	O10-1490	0/55°F	2°F FXD	Open LO	72 in.	3/8 in. x 4 in.	NEMA 1
Penn	A19ABA-1C <sup>4</sup>	-30/50°F	5/20°F ADJ	Open LO	72 in.	3/8 in. x 5.11 in.	NEMA 1

- 1 May be extended up to 800 feet
- 2 Requires the C450YNN-1C. The C450CPW-400C does not include a temperature sensor. Select the A99BB-200C sensor for 72 in. leads.
- 3 24 VAC input voltage
- 4 Can use A421ABC-02C, -30/212°F range, 1/30°F differential, SPDT, 78 in. lead, 0.25 x 2 PTC sensor, NEMA 1



**Table 362: Ranco to Penn cross reference, temperature controls**

Product	Product number	Range	Differential	Switch	Capillary	Bulb	Enclosure
Ranco	O10-1491	25/75°F	2°F FXD	Open LO	72 in.	3/8 in. x 4 in.	NEMA 1
Penn	A19ABA-4C <sup>1</sup>	20/80°F	3.5/14°F ADJ	Open LO	72 in.	3/8 in. x 5.11 in.	NEMA 1
Ranco	O10-1802	25/75°F	3/29°F ADJ	Open LO	None	Coiled	NEMA 1
Penn	A19BAC-1C <sup>1</sup>	30/110°F	3.5°F FXD	SPDT	None	Coiled	NEMA 1
Ranco	O10-301	30/95°F	2°F FXD	Open LO	None	Coiled	NEMA 1
Penn	A19BAA-5C <sup>1</sup>	30/110°F	3.5°F FXD	Open LO	None	Coiled	NEMA 1
Ranco	O16-104	0/55°F	3/20°F ADJ	SPDT	72 in.	3/8 in. x 4 in.	NEMA 1
Penn	A19ABC-24C <sup>1</sup>	-30/100°F	3/12°F ADJ	SPDT	96 in.	3/8 in. x 4 in.	NEMA 1
Ranco	O16-111	0/55°F	3/20°F ADJ	SPDT	72 in.	None	NEMA 1
Penn	A11E-6C	35/45°F	12°F FXD	SPDT	48 in.	240 in.	NEMA 1
Ranco	O16-165	30/90°F	2.5°F FXD	SPDT	None	Coiled	NEMA 1
Penn	A19BAC-1C <sup>1</sup>	30/110°F	3.5°F FXD	SPDT	None	Coiled	NEMA 1
Ranco	O16-263	0/55°F	Manual	SPDT	72 in.	3/8 in. x 4 in.	NEMA 1
Penn	A19ACC-6C	30/100°F	Manual	SPDT	72 in.	3/8 in. x 3.67 in.	NEMA 1
Penn	A70BA-17C <sup>2</sup>	35/80°F	Manual	Open LO	72 in.	3/8 in. x 3 in.	NEMA 1
Ranco	O16-264	0/55°F	Manual	SPDT	96 in.	None	NEMA 1
Penn	A11D-1C	35/45°F	Manual	SPDT	48 in.	240 in.	NEMA 1
Penn	A70BA-18C <sup>2</sup>	15/55°F	Manual	Open LO	None	240 in.	NEMA 1
Ranco	O16-588	-15/40°F	1.5°F FXD	SPDT	None	72 in.	NEMA 1
Penn	A11E-6C <sup>1</sup>	35/45°F	12°F FXD	SPDT	48 in.	240 in.	NEMA 1
Penn	A70AA-16C	15/55°F	5°F FXD	Open LO	None	240 in.	NEMA 1
Ranco	O16-594	0/55°F	2°F FXD	SPDT	None	Coiled	NEMA 1
Penn	A19BBC-2C <sup>1</sup>	-30/100°F	3/12°F ADJ	SPDT	None	Coiled	NEMA 1
Ranco	O16-595	50/130°F	3/20°F ADJ	SPDT	96 in.	3/8 in. x 6 in.	NEMA 1
Penn	A19ABC-4C <sup>1</sup>	50/130°F	3.5/14°F ADJ	SPDT	96 in.	3/8 in. x 5 in.	NEMA 1
Ranco	O16-601	22.5/47.5°F	2.5°F FXD	SPDT	36 in.	3/8 in. x 6 in.	NEMA 1
Penn	A19ABC-2C <sup>1</sup>	20/80°F	3.5/14°F ADJ	SPDT	72 in.	3/8 in. x 5 in.	NEMA 1
Penn	A70AA-15C <sup>2</sup>	-10/65°F	10°F FXD	Open LO	72 in.	3/8 in. x 3 in.	NEMA 1
Ranco	O20-7041	0/100°F	6/20 ADJ	Double-pole, single-throw (DPST), Open LO	96 in.	3/8 in. x 6 in.	NEMA 1
Penn	A72AA-3C	50/90°F	ADJ	DPST, Open LO	72 in.	11/16 in. x 6-3/4 in.	NEMA 1
Penn	A72AA-2C	15/55°F	ADJ	DPST, Open LO	72 in.	3/8 in. x 3 in.	NEMA 1
Ranco	O52-6910	30/95°F	2°F FXD	SPDT	None	Coiled	NEMA 4X
Penn	A19PRC-1C	30/110°F	3/12°F ADJ	SPDT	None	Coiled	NEMA 4X
Ranco	O60-100	-35/95°F	4/50°F ADJ	SPDT	96 in.	3/8 in. x 6 in.	NEMA 1
Penn	A19ABC-24C <sup>1</sup>	-30/100°F	3/12°F ADJ	SPDT	96 in.	3/8 in. x 4 in.	NEMA 1
Ranco	O60-101	-35/95°F	4/50°F ADJ	SPDT	None	Coiled	NEMA 1
Penn	A19BBC-2C <sup>1</sup>	-30/100°F	3/12°F ADJ	SPDT	None	Coiled	NEMA 1
Ranco	O60-120	-35/95°F	4/50°F ADJ	SPDT	240 in.	3/8 in. x 6 in.	NEMA 1
Penn	A19ABC-36C <sup>1</sup>	-30/100°F	3/12°F ADJ	SPDT	240 in.	3/8 in. x 4 in.	NEMA 1
Ranco	O60-1072	-15/40°F	3/20°F ADJ	Open LO	None	Coiled	NEMA 1
Penn	A19BBA-1C <sup>1</sup>	-30/50°F	5/20°F ADJ	Open LO	None	Coiled	NEMA 1
Ranco	O60-200	95/240°F	6/50°F ADJ	SPDT	96 in.	3/8 in. x 6 in.	NEMA 1
Penn	A19ABC-12C <sup>1</sup>	100/240°F	6/24°F ADJ	SPDT	96 in.	9/32 in. x 2.5 in.	NEMA 1

1 Can use A421ABC-02C, -30/212°F range, 1/30°F differential, SPDT, 78 in. lead, 0.25 x 2 PTC sensor, NEMA 1  
 2 Different switch



**Table 363: Ranco to Penn cross reference, defrost and fan delay temperature controls**

Product	Product number	Range	Differential	Switch	Capillary	Bulb	Enclosure
Ranco	F25-107	40/75°F	20°F FXD	SPDT	60 in.	3/8 in. x 4 in.	Open
Penn	A19ZBC-2C <sup>1</sup>	45/85°F	25°F ADJ	SPDT	72 in.	3/10 in. x 3 1/8 in.	NEMA 1
Ranco	F25-114	43/73°F	24°F FXD	SPDT	60 in.	3/8 in. x 4 in.	Open
Penn	A19ZBC-2C <sup>1</sup>	45/85	25°F ADJ	SPDT	72 in.	3/10 in. x 3 1/8 in.	NEMA 1

1 Range is Defrost Termination for both

**Table 364: Ranco to Penn cross reference, pressure controls**

Product	Product number	Range	Differential	Switch	Capillary	Connection	Enclosure
Ranco	3126-116	7/125 psig	25 psig FXD	SPDT	60 in.	Sweat	Open
Penn	P20EB-1C <sup>1</sup>	7/150 psig	29/32 psig FXD	SPDT	36 in.	Sweat	Open
Ranco	3126-117	7/27 psig	12 psig FXD	SPDT	60 in.	Sweat	Open
Penn	P70AB-2C <sup>2,3</sup>	20 in./100 psig	7/50 psig ADJ	Open LO	36 in.	w/ Flare nut	NEMA 1
Ranco	3126-216	7/125 psig	Manual	Open LO	60 in.	Sweat	Open
Penn	P70BA-1C <sup>2,3</sup>	20 in./100 psig	Manual	Open LO	36 in.	w/ Flare nut	NEMA 1
Ranco	3126-412	7/77 psig	23/70 psig	SPDT	60 in.	Sweat	Open
Penn	P20EB-1C <sup>1</sup>	7/150 psig	29/32 psig FXD	SPDT	36 in.	Sweat	Open
Ranco	3127-140	125/450 psig	70 psig FXD	Open HI	60 in.	Sweat	Open
Penn	P20EB-2C <sup>1</sup>	100/425 psig	60/77 psig FXD	SPDT	36 in.	Sweat	Open
Ranco	3127-220	125/450 psig	Manual	SPDT	60 in.	Sweat	Open
Penn	P70DA-1C <sup>2,3</sup>	50/450 psig	Manual	Open HI	36 in.	w/ Flare nut	NEMA 1
Ranco	3127-414	150/450 psig	70/125 psig	SPDT	60 in.	Sweat	Open
Penn	P20EB-2C <sup>1</sup>	100/425 psig	60/77 psig FXD	SPDT	36 in.	Sweat	Open
Ranco	3160-012	5/110 psig	25 psig FXD	SPDT	60 in.	Sweat	Open
Penn	P20EB-1C <sup>1</sup>	7/150 psig	29/32 psig FXD	SPDT	36 in.	Sweat	Open
Ranco	3160-014	5/125 psig	25 psig FXD	Open LO	60 in.	Sweat	Open
Penn	P20EB-1C <sup>1</sup>	7/150 psig	29/32 psig FXD	SPDT	36 in.	Sweat	Open
Ranco	3160-212	5/110 psig	Manual	Open LO	60 in.	Sweat	Open
Penn	P70BA-1C <sup>2,3</sup>	20 in./100 psig	Manual	Open LO	36 in.	w/ Flare nut	NEMA 1
Ranco	3160-406	5/125 psig	12/50 psig	SPDT	60	Sweat	Open
Penn	P20EB-1C <sup>1</sup>	7/150 psig	29/32 psig FXD	SPDT	36 in.	Sweat	Open
Ranco	3161-002	200/475 psig	75 psig FXD	Open HI	60 in.	Sweat	Open
Penn	P20EB-2C <sup>1</sup>	100/425 psig	60/77 psig FXD	SPDT	36 in.	Sweat	Open
Ranco	3161-003	200/475 psig	110 psig FXD	Open HI	60 in.	Sweat	Open
Penn	P20EB-2C <sup>1</sup>	100/425 psig	60/77 psig FXD	SPDT	36 in.	Sweat	Open

- 1 Differential depends on setting
- 2 Different pressure element.
- 3 Not as compact



**Table 365: Ranco to Penn cross reference, pressure controls**

Product	Product number	Range	Differential	Switch	Capillary	Connection	Enclosure
Ranco	3161-004	200/475 psig	50 psig FXD	Open HI	60 in.	Sweat	Open
Penn	P20EB-2C <sup>3</sup>	100/425 psig	60/77 psig FXD	SPDT	36 in.	Sweat	Open
Ranco	3161-009	125/285 psig	50 psig FXD	SPDT	60 in.	Sweat	Open
Penn	P20EB-2C <sup>3</sup>	100/425 psig	60/77 psig FXD	SPDT	36 in.	Sweat	Open
Ranco	3161-201	200/475 psig	Manual	SPDT	60 in.	Sweat	Open
Penn	P70DA-1C <sup>1,2</sup>	50/450 psig	Manual	Open HI	36 in.	w/ Flare nut	NEMA 1
Ranco	3161-205	125/285 psig	Manual	Open HI	60 in.	w/ Flare nut	Open
Penn	P70DA-1C <sup>1</sup>	50/450 psig	Manual	Open HI	36 in.	w/ Flare nut	NEMA 1
Ranco	3161-403	200/475 psig	50/150 psig	SPDT	60 in.	Sweat	Open
Penn	P20EB-2C <sup>3</sup>	100/425 psig	60/77 psig FXD	SPDT	36 in.	Sweat	Open
Ranco	G20-4050	7/27 psig	12 psig FXD	Open LO	60 in.	Sweat	Open
Penn	P70AB-2C <sup>1,2</sup>	20 in./100 psig	7/50 psig ADJ	Open LO	36 in.	w/ Flare nut	NEMA 1
Ranco	G20-4051	7/77 psig	19/70 psig	Open LO	60 in.	Sweat	Open
Penn	P20EB-1C <sup>3</sup>	7/150 psig	29/32 psig FXD	SPDT	36 in.	Sweat	Open
Ranco	G20-4412	7/70 psig	Manual	Open LO	60 in.	Sweat	Open
Penn	P70BA-1C <sup>1,2</sup>	20 in./100 psig	Manual	Open LO	36 in.	w/ Flare nut	NEMA 1
Ranco	G23-5052	150/450 psig	50/125 psig	Open HI	60 in.	Sweat	Open
Penn	P20EB-2C <sup>3</sup>	100/425 psig	60/77 psig FXD	SPDT	36 in.	Sweat	Open
Ranco	G23-5253	50/450 psig	Manual	Open HI	60 in.	Sweat	Open
Penn	P70DA-1C <sup>1,2</sup>	50/450 psig	Manual	Open HI	36 in.	w/ Flare nut	NEMA 1
Ranco	O10-1093	10 in./100 psig	10/40 psig	Open LO	48 in.	w/ Flare nut	NEMA 1
Penn	P70AB-2C	20 in./100 psig	7/50 psig	Open LO	36 in.	w/ Flare nut	NEMA 1
Ranco	O10-1401	12 in./50 psig	5/35 psig	Open LO	None	External Flare	NEMA 1
Penn	P170AB-12C	12 in./80 psig	5/35 psig	Open LO	None	External Flare	NEMA 1
Ranco	O10-1402	12 in./50 psig	5/35 psig	Open LO	36 in.	w/ Flare nut	NEMA 1
Penn	P70AB-12C	12 in./80 psig	5/35 psig	Open LO	36 in.	w/ Flare nut	NEMA 1
Ranco	O10-1483	10 in./100 psig	10/40 psig	Open LO	36 in.	w/ Flare nut	NEMA 1
Penn	P70AB-2C	20 in./100 psig	7/50 psig	Open LO	36 in.	w/ Flare nut	NEMA 1
Ranco	O10-1807	100/250 psig	20/100 psig	Open LO	None	External Flare	NEMA 1
Penn	P70AA-151C	50/300 psig	20/120 psig	Open LO	None	External Flare	NEMA 1
Ranco	O10-1831	10 in./100 psig	10/40 psig	Open LO	None	External Flare	NEMA 1
Penn	P70AB-12C	12 in./80 psig	5/35 psig	Open LO	36 in.	w/ Flare nut	NEMA 1
Ranco	O10-1842	12 in./50 psig	5/35 psig	Open LO	48 in.	w/ Flare nut	NEMA 1
Penn	P70AB-12C	12 in./80 psig	5/35 psig	Open LO	36 in.	w/ Flare nut	NEMA 1
Ranco	O10-2000	100/250 psig	20/100 psig	Open LO	48 in.	w/ Flare nut	NEMA 1
Penn	P70AA-3C	100/300 psig	25/75 psig	Open LO	36 in.	w/ Flare nut	NEMA 1
Ranco	O10-2054	100/400 psig	40/150 psig	Open LO	36 in.	w/ Flare nut	NEMA 1
Penn	P70AA-118C	100/400 psig	35/200 psig	Open LO	36 in.	w/ Flare nut	NEMA 1
Ranco	O11-1711	150/450 psig	40/150 psig	Open HI	36 in.	w/ Flare nut	NEMA 1
Penn	P70CA-3C	50/450 psig	60/150 psig	Open HI	36 in.	w/ Flare nut	NEMA 1
Ranco	O11-1713	150/450 psig	40/150 psig	Open HI	None	External Flare	NEMA 1
Penn	P70CA-2C	50/450 psig	60/150 psig	Open HI	None	External Flare	NEMA 1

- 1 Not as compact
- 2 Different pressure element
- 3 Differential depends on setting





**Table 366: Ranco to Penn cross reference, pressure controls**

Product	Product number	Range	Differential	Switch	Capillary	Connection	Enclosure
Ranco	O11-1799	10 in./100 psig	10/40 psig	Open HI	None	External Flare	NEMA 1
Penn	P170CA-1C	20 in./100 psig	6/70 psig	Open HI	None	External Flare	NEMA 1
Ranco	O11-3099	10 in./100 psig	10/40 psig	Open HI	36 in.	w/ Flare nut	NEMA 1
Penn	P70CA-1C	20 in./100 psig	6/70 psig	Open HI	36 in.	w/ Flare nut	NEMA 1
Ranco	O16-107	10 in./100 psig	10/40 psig ADJ	SPDT	None	External Flare	NEMA 1
Penn	P70EA-10C	20 in./100 psig	5 psig FXD	SPDT	None	External Flare	NEMA 1
Ranco	O16-108	100/400 psig	40/150 psig	SPDT	36 in.	w/ Flare nut	NEMA 1
Penn	P77AAA-15500	44/435 psig	44/174 psig	SPDT	36 in.	w/ Flare nut	NEMA 3R
Ranco	O16-120	12 in./50 psig	5/35 psig ADJ	SPDT	None	External Flare	NEMA 1
Penn	P70EA-10C	20 in./100 psig	5 psig FXD	SPDT	None	External Flare	NEMA 1
Ranco	O16-142	100/400 psig	17 psig FXD	SPDT	36 in.	w/ Flare nut	NEMA 1
Penn	P70EA-6C <sup>3</sup>	100/300 psig	14 psig FXD	SPDT	36 in.	Sweat	NEMA 1
Ranco	O16-166	50/150 psig	10/40 psig	SPDT	36 in.	w/ Flare nut	NEMA 1
Penn	P70GA-2C <sup>1</sup>	20 in./100 psig	7/50 psig	NO/NC	36 in.	w/ Flare nut	NEMA 1
Ranco	O16-200	150/450 psig	Manual	SPDT	48 in.	w/ Flare nut	NEMA 1
Penn	P70KA-1C <sup>1</sup>	50/450 psig	Manual	NO/NC	36 in.	w/ Flare nut	NEMA 1
Ranco	O16-209	150/450 psig	Manual	SPDT	None	External Flare	NEMA 1
Penn	P170KA-1C <sup>1</sup>	50/450 psig	Manual	NO/NC	None	External Flare	NEMA 1
Ranco	O16-261	10 in./100 psig	Manual	SPDT	48 in.	w/ Flare nut	NEMA 1
Penn	P70HA-2C <sup>1</sup>	20 in./100 psig	Manual	NO/NC	36 in.	w/ Flare nut	NEMA 1
Ranco	O16-503	150/450 psig	40/150 psig	SPDT	None	External Flare	NEMA 1
Penn	P70JA-18C <sup>1</sup>	50/450 psig	60/150 psig	NO/NC	None	External Flare	NEMA 1
Ranco	O16-527	10 in./100 psig	10/40 psig ADJ	SPDT	36 in.	w/ Flare nut	NEMA 1
Penn	P70EA-10C <sup>2</sup>	20 in./100 psig	5 psig FXD	SPDT	None	External Flare	NEMA 1
Ranco	O16-557	12 in./50 psig	5/35 psig ADJ	SPDT	36 in.	w/ Flare nut	NEMA 1
Penn	P70EA-10C <sup>2</sup>	20 in./100 psig	5 psig FXD	SPDT	None	External Flare	NEMA 1
Ranco	O16-585	10 in./100 psig	Manual	SPDT	None	External Flare	NEMA 1
Penn	P70HA-3C <sup>1,3</sup>	20 in./100 psig	Manual	NO/NC	None	Internal NPT	NEMA 1
Ranco	O20-1894	100/400 psig	40/150 psig	Open LO	None	External Flare	NEMA 1
Penn	P170AA-118C	100/400 psig	35/200 psig	Open LO	None	External Flare	NEMA 1
Ranco	O20-7002	12 in./50 psig	5/35 psig	DPST-LO	36 in.	w/ Flare nut	NEMA 1
Penn	P72AA-1C	20 in./100 psig	7/50 psig	DPST-LO	36 in.	w/ Flare nut	NEMA 1
Ranco	O20-7006	100/400 psig	40/150 psig	DPST-LO	36 in.	w/ Flare nut	NEMA 1
Penn	P72AA-27C	100/400 psig	35/200 psig	DPST-LO	36 in.	w/ Flare nut	NEMA 1

- 1 Different switch.
- 2 Add SEC99A UltraCap armored capillary
- 3 Different pressure element



**Table 367: Ranco to Penn cross reference, pressure controls**

Product	Product number	Cut-Out	Cut-In	Range	Switch	Electrical	Pressure
Ranco	3100-001	15 psig	40 psig	None	Single-pole, single-throw (SPST)	30 in. Leads	1/4 in. Sweat
Penn	P100AA-1C	10 psig	40 psig	None	SPST	48 in. Leads	1/4 in. Internal Flare
Ranco	3100-002	5 psig	30 psig	None	SPST	72 in. Leads	1/4 in. Internal Flare
Penn	P20EB-1C <sup>2,3,4,5</sup>	ADJ.	N/A	7/150 psig	SPDT	Arkles	36 in. Cap, Sweat
Ranco	3100-003	20 psig	45 psig	None	SPST	72 in. Leads	1/4 in. Internal Flare
Penn	P20EB-1C <sup>1,2,3,4,5</sup>	ADJ.	N/A	7/150 psig	SPDT	Arkles	36 in. Cap, Sweat
Ranco	3100-004	35 psig	60 psig	None	SPST	QC	1/4 in. Internal Flare
Penn	P100AA-2C <sup>5</sup>	35 psig	60 psig	None	SPST	48 in. Leads	1/4 in. Internal Flare
Ranco	3100-005	15 in. VAC	17.5 psig	None	SPDT	QC	1/4 in. Internal Flare
Penn	P70AB-1C <sup>1,2,4,5</sup>	ADJ.	N/A	20 in./100 psig	SPST	Screw Terms.	1/4 in. External Flare
Ranco	3100-006	48 psig	80 psig	None	SPDT	36 in. Leads	1/4 in. Sweat
Penn	P20EB-1C <sup>1,2,3,4,5</sup>	ADJ.	N/A	7/150 psig	SPDT	Arkles	36 in. Cap, Sweat
Ranco	3100-007	15 psig	40 psig	None	SPST	30 in. Leads	1/4 in. Internal Flare
Penn	P100AA-1C	10 psig	40 psig	None	SPST	48 in. Leads	1/4 in. Internal Flare
Ranco	3100-009	0 psig	20 psig	None	SPST	QC	1/4 in. Internal Flare
Penn	P70AB-1C <sup>1,2,4,5</sup>	ADJ.	N/A	20 in./100 psig	SPST	Screw Terms.	1/4 in. External Flare
Ranco	3100-010	45 psig	70 psig	None	SPDT	QC	1/4 in. Internal Flare
Penn	P20EB-1C <sup>1,2,3,4</sup>	ADJ.	N/A	7/150 psig	SPDT	Arkles	36 in. Cap, Sweat
Ranco	3100-050	10 psig	30 psig	None	SPST	18 in. Leads	1/4 in. Internal Flare
Penn	P100AA-1C	10 psig	40 psig	None	SPST	48 in. Leads	1/4 in. Internal Flare
Ranco	3100-051	25 psig	80 psig	None	SPST	18 in. Leads	1/4 in. Internal Flare
Penn	P20EB-1C <sup>1,2,3,4,5</sup>	ADJ.	N/A	7/150 psig	SPDT	Arkles	36 in. Cap, Sweat
Ranco	3100-052	40 psig	80 psig	None	SPST	18 in. Leads	1/4 in. Internal Flare
Penn	P100AA-2C	35 psig	60 psig	None	SPST	48 in. Leads	1/4 in. Internal Flare
Ranco	3100-075	85 psig	135 psig	None	SPDT	QC	1/4 in. Internal Flare
Penn	P70AA-119C <sup>4,5,6</sup>	ADJ.	N/A	50/300 psig	SPST	Screw Terms.	1/4 in. Internal Flare
Ranco	3100-076	108 psig	135 psig	None	SPST	QC	1/4 in. Internal Flare
Penn	P20EB-1C <sup>1,2,3,4,6</sup>	ADJ.	N/A	7/150 psig	SPDT	Arkles	36 in. Cap, Sweat
Ranco	3100-077	115 psig	165 psig	None	SPST	QC	1/4 in. Internal Flare
Penn	P170AA-118C <sup>1,2,4,5</sup>	ADJ.	N/A	100/400 psig	SPST	Screw Terms.	1/4 in. External Flare
Ranco	3100-078	135 psig	185 psig	None	SPDT	QC	1/4 in. Internal Flare
Penn	P170AA-118C <sup>1,2,4,5,6</sup>	ADJ.	N/A	100/400 psig	SPST	Screw Terms.	1/4 in. External Flare
Ranco	3100-079	165 psig	215 psig	None	SPST	QC	1/4 in. Internal Flare
Penn	P100AA-4C <sup>5</sup>	170 psig	250 psig	None	SPST	48 in. Leads	1/4 in. Internal Flare
Ranco	3100-080	200 psig	240 psig	None	SPDT	QC	1/4 in. Internal Flare
Penn	P170AA-118C <sup>1,2,4,5,6</sup>	ADJ.	N/A	100/400 psig	SPST	Screw Terms.	1/4 in. External Flare
Ranco	3100-081	250 psig	300 psig	None	SPDT	QC	1/4 in. Internal Flare
Penn	P170AA-118C <sup>1,2,4,5,6</sup>	ADJ.	N/A	100/400 psig	SPST	Screw Terms.	1/4 in. External Flare

- 1 Different pressure element
- 2 Not as compact
- 3 Differential depends on setting
- 4 Not an encapsulated switch as Ranco's is
- 5 Different electrical connection
- 6 Different switch



**Table 368: Ranco to Penn cross reference, pressure controls**

Product	Product number	Cut-Out	Cut-In	Range	Switch	Electrical	Pressure
Ranco	3100-100	425 psig	325 psig	None	SPST	72 in. Leads	1/4 in. Internal Flare
Penn	P100CA-2C	425 psig	325 psig	None	SPST	48 in. Leads	1/4 in. Internal Flar
Ranco	3100-101	400 psig	300 psig	None	SPST	18 in. Leads	1/4 in. Internal Flare
Penn	P100CA-1C	400 psig	300 psig	None	SPST	48 in. Leads	1/4 in. Internal Flare
Ranco	3100-102	220 psig	170 psig	None	SPST	QC	1/4 in. Internal Flare
Penn	P100CA-2C <sup>1</sup>	425 psig	325 psig	None	SPST	48 in. Leads	1/4 in. Internal Flare
Ranco	3100-103	410 psig	Manual	None	SPST	42 in. Leads	1/4 in. Internal Flare
Penn	P100DA-1C	410 psig	Manual	None	SPST	48 in. Leads	1/4 in. Internal Flare
Ranco	3100-104	420 psig	Manual	None	SPST	48 in. Leads	1/4 in. Internal Flare
Penn	P70DA-1C <sup>1,2,3,4</sup>	ADJ.	Manual	50/450 psig	SPST	Screw Terms.	36 in. Cap, Flare
Ranco	3100-105	440 psig	Manual	None	SPST	36 in. Leads	.093 Cap. Tube
Penn	P70DA-1C <sup>1,2,3,4</sup>	ADJ.	Manual	50/450 psig	SPST	Screw Terms.	36 in. Cap, Flare
Ranco	3100-106	475 psig	Manual	None	SPST	42 in. Leads	1/4 in. Sweat w/ Cap.
Penn	P100DA-2C <sup>2</sup>	475 psig	Manual	None	SPST	48 in. Leads	1/4 in. Internal Flare
Ranco	3100-107	232 psig	Manual	None	SPST	84 in. Leads	1/4 in. Internal Flare
Penn	P70DA-1C <sup>1,2,3,4</sup>	ADJ.	Manual	50/450 psig	SPST	Screw Terms.	36 in. Cap, Flare
Ranco	3100-108	280 psig	Manual	None	SPST	12 in. Leads	1/4 in. NPTF
Penn	P20EB-2C <sup>1,2,3,4,5</sup>	ADJ.	N/A	100/425 psig	SPDT	Arkles	36 in. Cap, Sweat
Ranco	3100-110	375 psig	275 psig	None	SPDT	QC	1/4 in. Sweat
Penn	P20EB-2C <sup>1,2,3,4,5</sup>	ADJ.	N/A	100/425 psig	SPDT	Arkles	36 in. Cap, Sweat
Ranco	3100-111	375 psig	275 psig	None	SPST	QC	1/4 in. Internal Flare
Penn	P20EB-2C <sup>1,2,3,4,5</sup>	ADJ.	N/A	100/425 psig	SPDT	Arkles	36 in. Cap, Sweat
Ranco	3100-112	275 psig	175 psig	None	SPST	24 in. Leads	1/4 in. Internal Flare
Penn	P20EB-2C <sup>1,2,3,4,5</sup>	ADJ.	N/A	100/425 psig	SPDT	Arkles	36 in. Cap, Sweat
Ranco	3100-113	395 psig	295 psig	None	SPST	QC	1/4 in. Sweat
Penn	P20EB-2C <sup>1,2,3,4,5</sup>	ADJ.	N/A	100/425 psig	SPDT	Arkles	36 in. Cap, Sweat
Ranco	3100-115	350 psig	250 psig	None	SPDT	36 in. Leads	1/4 in. Sweat
Penn	P20EB-2C <sup>1,2,3,4,5</sup>	ADJ.	N/A	100/425 psig	SPDT	Arkles	36 in. Cap, Sweat
Ranco	3100-116	213 psig	113 psig	None	SPST	QC	1/4 in. Internal Flare
Penn	P20EB-2C <sup>1,2,3,4,5</sup>	ADJ.	N/A	100/425 psig	SPDT	Arkles	36 in. Cap, Sweat
Ranco	3100-117	140 psig	190 psig	None	SPST	12 in. Leads	.093 Cap. Tube
Penn	P20EB-2C <sup>1,2,3,4,5</sup>	ADJ.	N/A	100/425 psig	SPDT	Arkles	36 in. Cap, Sweat
Ranco	3100-118	295 psig	395 psig	None	SPST	QC	1/4 in. Internal Flare
Penn	P20EB-2C <sup>1,2,3,4,5</sup>	ADJ.	N/A	100/425 psig	SPDT	Arkles	36 in. Cap, Sweat
Ranco	3100-120	420 psig	320 psig	None	SPST	QC	1/4 in. Internal Flare
Penn	P20EB-2C <sup>1,2,3,4,5</sup>	ADJ.	N/A	100/425 psig	SPDT	Arkles	36 in. Cap, Sweat
Ranco	3100-121	426 psig	272 psig	None	SPST	QC	1/4 in. Sweat
Penn	P20EB-2C <sup>1,2,3,4,5</sup>	ADJ.	N/A	100/425 psig	SPDT	Arkles	36 in. Cap, Sweat
Ranco	3100-150	350 psig	250 psig	None	SPST	18 in. Leads	1/4 in. Internal Flare
Penn	P20EB-2C <sup>1,2,3,4,5</sup>	ADJ.	N/A	100/425 psig	SPDT	Arkles	36 in. Cap, Sweat

- 1 Different electrical connection
- 2 Different pressure element
- 3 Not as compact
- 4 Not an encapsulated switch as Ranco's is
- 5 Differential depends on setting



**Table 369: Ranco to Penn cross reference, pressure controls**

Product	Product number	Cut-Out	Cut-In	Range	Switch	Electrical	Pressure
Ranco	3100-151	400 psig	300 psig	None	SPST	18 in. Leads	1/4 in. Internal Flare
Penn	P100CA-1C	400 psig	300 psig	None	SPST	48 in. Leads	1/4 in. Internal Flare
Ranco	3100-152	400 psig	200 psig	None	SPST	18 in. Leads	1/4 in. Internal Flare
Penn	P100CA-1C	400 psig	300 psig	None	SPST	48 in. Leads	1/4 in. Internal Flare
Ranco	3100-153	450 psig	250 psig	None	SPST	18 in. Leads	1/4 in. Internal Flare
Penn	P20EB-2C <sup>1,4,5,6</sup>	ADJ.	N/A	100/425 psig	SPDT	Arkles	36 in. Cap, Sweat
Ranco	3100-154	500 psig	400 psig	None	SPST	18 in. Leads	1/4 in. Internal Flare
Penn	P70LB-1C <sup>3,4,5</sup>	ADJ.	N/A	100/500 psig	SPST	Screw Terms.	36 in. Cap, Flare
Ranco	3100-155	500 psig	300 psig	None	SPST	18 in. Leads	1/4 in. Internal Flare
Penn	P70LB-1C <sup>3,4,5</sup>	ADJ.	N/A	100/500 psig	SPST	Screw Terms.	36 in. Cap, Flare
Ranco	MPF-7006	75 psig	120 psig	None	SPST	18 in. Leads	1/4 in. Internal Flare
Penn	P20EB-1C <sup>4,5,6</sup>	ADJ.	N/A	7/150 psig	SPDT	Arkles	36 in. Cap, Sweat
Ranco	MPF-7007	110 psig	170 psig	None	SPST	18 in. Leads	1/4 in. Internal Flare
Penn	P20EB-1C <sup>4,5,6</sup>	ADJ.	N/A	7/150 psig	SPDT	Arkles	36 in. Cap, Sweat
Ranco	MPF-7008	150 psig	225 psig	None	SPST	18 in. Leads	1/4 in. Internal Flare
Penn	P100AA-3C	150 psig	225 psig	None	SPST	48 in. Leads	1/4 in. External Flare
Ranco	MPF-7009	190 psig	275 psig	None	SPST	18 in. Leads	1/4 in. Internal Flare
Penn	P20EB-2C <sup>5,6</sup>	ADJ.	N/A	100/425 psig	SPDT	Arkles	36 in. Cap, Sweat
Ranco	MPF-7010	300 psig	400 psig	None	SPST	18 in. Leads	1/4 in. Internal Flare
Penn	P20EB-2C <sup>5,6</sup>	ADJ.	N/A	100/425 psig	SPDT	Arkles	36 in. Cap, Sweat
Ranco	MPH-7101	250 psig	180 psig	None	SPST	18 in. Leads	1/4 in. Internal Flare
Penn	P20EB-2C <sup>5,6</sup>	ADJ.	N/A	100/425 psig	SPDT	Arkles	36 in. Cap, Sweat
Ranco	MPH-7102	270 psig	200 psig	None	SPST	18 in. Leads	1/4 in. Internal Flare
Penn	P20EB-2C <sup>5,6</sup>	ADJ.	N/A	100/425 psig	SPDT	Arkles	36 in. Cap, Sweat
Ranco	MPH-7103	300 psig	200 psig	None	SPST	18 in. Leads	1/4 in. Internal Flare
Penn	P20EB-2C <sup>5,6</sup>	ADJ.	N/A	100/425 psig	SPDT	Arkles	36 in. Cap, Sweat
Ranco	MPH-7104	325 psig	225 psig	None	SPST	18 in. Leads	1/4 in. Internal Flare
Penn	P20EB-2C <sup>5,6</sup>	ADJ.	N/A	100/425 psig	SPDT	Arkles	36 in. Cap, Sweat
Ranco	MPH-7105	350 psig	250 psig	None	SPST	18 in. Leads	1/4 in. Internal Flare
Penn	P20EB-2C <sup>5,6</sup>	ADJ.	N/A	100/425 psig	SPDT	Arkles	36 in. Cap, Sweat
Ranco	MPH-7106	375 psig	275 psig	None	SPST	18 in. Leads	1/4 in. Internal Flare
Penn	P20EB-2C <sup>5,6</sup>	ADJ.	N/A	100/425 psig	SPDT	Arkles	36 in. Cap, Sweat
Ranco	MPH-7107	400 psig	300 psig	None	SPST	18 in. Leads	1/4 in. Internal Flare
Penn	P100CA-1C	400 psig	300 psig	None	SPST	48 in. Leads	1/4 in. External Flare
Ranco	MPH-7108	425 psig	325 psig	None	SPST	18 in. Leads	1/4 in. Internal Flare
Penn	P100CA-2C	425 psig	325 psig	None	SPST	48 in. Leads	1/4 in. External Flare
Ranco	MPL-7001	5 psig	20 psig	None	SPST	18 in. Leads	1/4 in. Internal Flare
Penn	P100AC-1C	5 psig	20 psig	None	SPST	48 in. Leads	1/4 in. External Flar
Ranco	MPL-7002	15 psig	35 psig	None	SPST	18 in. Leads	1/4 in. Internal Flare
Penn	P100AA-1C	10 psig	40 psig	None	SPST	48 in. Leads	1/4 in. External Flare
Ranco	MPL-7003	25 psig	80 psig	None	SPST	18 in. Leads	1/4 in. Internal Flare
Penn	P20EB-1C <sup>1,5,6</sup>	ADJ.	N/A	7/150 psig	SPDT	Arkles	36 in. Cap, Sweat

- 1 Not as compact
- 2 Different pressure element
- 3 Dual control, ignore low side
- 4 Not an encapsulated switch as Ranco's is
- 5 Different electrical connection
- 6 Differential depends on setting



**Table 370: Ranco to Penn cross reference, pressure controls**

Product	Product number	Cut-Out	Cut-In	Range	Switch	Electrical	Pressure
Ranco	MPL-7004	35 psig	60 psig	None	SPST	18 in. Leads	1/4 in. Internal Flare
Penn	P100AA-2C	35 psig	60 psig	None	SPST	48 in. Leads	1/4 in. External Flare
Ranco	MPL-7005	45 psig	60 psig	None	SPST	18 in. Leads	1/4 in. Internal Flare
Penn	P20EB-1C <sup>1,2,3</sup>	ADJ.	N/A	7/150 psig	SPDT	Arkles	36 in. Cap, Sweat
Ranco	MPL-7011	10 psig	25 psig	None	SPST	18 in. Leads	1/4 in. Internal Flare
Penn	P20EB-1C <sup>1,2,3</sup>	ADJ.	N/A	7/150 psig	SPDT	Arkles	36 in. Cap, Sweat
Ranco	MPL-7012	20 psig	45 psig	None	SPST	18 in. Leads	1/4 in. Internal Flare
Penn	P20EB-1C <sup>1,2,3</sup>	ADJ.	N/A	7/150 psig	SPDT	Arkles	36 in. Cap, Sweat
Ranco	MPL-7014	40 psig	80 psig	None	SPST	18 in. Leads	1/4 in. Internal Flare
Penn	P20EB-1C <sup>1,2,3</sup>	ADJ.	N/A	7/150 psig	SPDT	Arkles	36 in. Cap, Sweat

- 1 Not an encapsulated switch as Ranco's is
- 2 Different electrical connection
- 3 Differential depends on setting



**Table 371: Ranco to Penn cross reference, dual pressure controls**

Product	Product number	LO Side	Differential	HI Side	Differential	Capillary	Connection
Ranco	O12-1502	12 in./50 psig	5/35 psig	150/450 psig	70 psig FXD	36 in.	W/ Flare nut
Penn	P70LB-6C	12 in./80 psig	5/35 psig	100/500 psig	60 psig FXD	36 in.	W/ Flare nut
Ranco	O12-1505	12 in./50 psig	5/35 psig	100/250 psig	50 psig FXD	None	External Flare
Penn	P170LB-6C	12 in./80 psig	5/35 psig	100/500 psig	60 psig FXD	None	External Flare
Ranco	O12-1506	12 in./50 psig	5/35 psig	100/250 psig	50 psig FXD	36 in.	W/ Flare nut
Penn	P70LB-6C	12 in./80 psig	5/35 psig	100/500 psig	60 psig FXD	36 in.	W/ Flare nut
Ranco	O12-1549	10 in./100 psig	10/40 psig	150/450 psig	70 psig FXD	36 in.	W/ Flare nut
Penn	P70LB-1C	20 in./100 psig	7/50 psig	100/500 psig	60 psig FXD	36 in.	W/ Flare nut
Ranco	O12-1550	10 in./100 psig	10/40 psig	150/450 psig	70 psig FXD	None	External Flare
Penn	P170LB-1C	20 in./100 psig	7/50 psig	100/500 psig	60 psig FXD	None	External Flare
Ranco	O12-1554	12 in./50 psig	5/35 psig	100/250 psig	50 psig FXD	48 in.	W/ Flare nut
Penn	P70LB-6C	12 in./80 psig	5/35 psig	100/500 psig	60 psig FXD	36 in.	W/ Flare nut
Ranco	O12-1594	10 in./100 psig	Manual	150/450 psig	Manual	36 in.	W/ Flare nut
Penn	P70NA-1C	20 in./100 psig	Manual	100/500 psig	Manual	36 in.	W/ Flare nut
Ranco	O12-4139	12 in./50 psig	5/35 psig	150/450 psig	70 psig FXD	None	External Flare
Penn	P170LB-6C	12 in./80 psig	5/35 psig	100/500 psig	60 psig FXD	None	External Flare
Ranco	O12-4833	12 in./50 psig	5/35 psig	150/450 psig	70 psig FXD/Man	48 in.	W/ Flare nut
Penn	P70SA-1C	12 in./80 psig	5/35 psig	100/500 psig	60 FXD	36 in.	W/ Flare nut
Ranco	O12-4834	10 in./100 psig	10/40 psig	150/450 psig	70 psig FXD/Man	48 in.	W/ Flare nut
Penn	P70SA-1C	12 in./80 psig	5/35 psig	100/500 psig	60 psig FXD	36 in.	W/ Flare nut
Ranco	O12-4842	12 in./50 psig	5/35 psig	150/450 psig	70 FXD/Man	None	External Flare
Penn	P170SA-1C	12 in./80 psig	5/35 psig	100/500 psig	55 psig FXD	None	External Flare
Ranco	O12-4846	10 in./100 psig	10/40 psig	150/450 psig	70 psig FXD/Man	None	External Flare
Penn	P170SA-1C	12 in./80 psig	5/35 psig	100/500 psig	55 psig FXD	None	External Flare
Ranco	O12-4848	10 in./100 psig	10/40 psig	150/450 psig	70 psig FXD/Manual	None	External Flares
Penn	P170SA-1C	12 in./80 psig	5/35 psig	100/500 psig	55 psig FXD	None	External Flares
Ranco	O22-7702	12 in./50 psig	5/35 psig	100/250 psig	50 psig FXD/Man	36 in.	W/ Flare nut
Penn	P72LB-1C <sup>1</sup>	20 in./100 psig	7/50 psig	100/500 psig	60 psig FXD	36 in.	W/ Flare nut
Ranco	O22-7706	10 in./100 psig	10/40 psig	150/450 psig	70 psig FXD	36 in.	W/ Flare nut
Penn	P72LB-1C <sup>1</sup>	20 in./100 psig	7/50 psig	100/500 psig	60 psig FXD	36 in.	W/ Flare nut

1 Convertible

**Table 372: Ranco to Penn cross reference, low pressure cutout with time delay**

Product	Product number	Range	Differential	Time Delay	Capillary	Connection	Enclosure
Ranco	3341-161	0/100 psig	5 psig FXD	120 Secs.	36 in.	W/ Flare nut	NEMA 1
Penn	P29NC-38C	20 in./100 psig	2.2 psig FXD	120 Secs.	36 in.	W/ Flare nut	NEMA 1



**Table 373: Ranco to Penn cross reference, lube oil pressure controls**

Product	Product number	Range	Reset	Delay	Capillary	Connection	Enclosure
Ranco	3321-001	9 psig FXD	Manual	45, 60, 90, 120	None	External Flare	NEMA 1
Penn	P128AA-**C <sup>1</sup>	8/70 psig ADJ	Manual	See Table 376	None	External Flare	NEMA 1
Ranco	3321-009	5 psig FXD	Manual	45, 60, 90, 120	36 in.	W/ Flare nut	NEMA 1
Penn	P28AA-**C <sup>1</sup>	8/70 psig ADJ	Manual	See Table 376	36 in.	W/ Flare nut	NEMA 1
Ranco	3321-010	9 psig FXD	Manual	45, 60, 90, 120	36 in.	W/ Flare nut	NEMA 1
Penn	P28AA-**C <sup>1</sup>	8/70 psig ADJ	Manual	See Table 376	36 in.	W/ Flare nut	NEMA 1
Ranco	3321-014	15 psig FXD	Manual	45, 60, 90, 120	36 in.	W/ Flare nut	NEMA 1
Penn	P28AA-**C <sup>1</sup>	8/70 psig ADJ	Manual	See Table 376	36 in.	W/ Flare nut	NEMA 1
Ranco	3321-015	30 psig FXD	Manual	45, 60, 90, 120	36 in.	W/ Flare nut	NEMA 1
Penn	P28AA-**C <sup>1</sup>	8/70 psig ADJ	Manual	See Table 376	36 in.	W/ Flare nut	NEMA 1
Ranco	P30-3601	8/60 psig ADJ	Manual	60	36 in.	W/ Flare nut	NEMA 1
Penn	P28AA-2C	8/70 psig ADJ	Manual	60	36 in.	W/ Flare nut	NEMA 1
Ranco	P30-3701	8/60 psig ADJ	Manual	90	36 in.	W/ Flare nut	NEMA 1
Penn	P28AA-1C	8/70 psig ADJ	Manual	90	36 in.	W/ Flare nut	NEMA 1
Ranco	P30-3801	8/60 psig ADJ	Manual	120	36 in.	W/ Flare nut	NEMA 1
Penn	P28AA-17C	8/70 psig ADJ	Manual	120	36 in.	W/ Flare nut	NEMA 1
Ranco	P30-5826	9 psig FXD	Manual	120	36 in.	W/ Flare nut	NEMA 1
Penn	P45NCA-12C	9 psig FXD	Manual	120	36 in.	W/ Flare nut	NEMA 1
Ranco	P30-5827	9 psig FXD	Manual	120	None	External Flare	NEMA 1
Penn	P145NCA-12C	9 psig FXD	Manual	120	None	External Flare	NEMA 1

1 See Table 376.

**Table 374: Ranco to Penn cross reference, lube oil pressure controls without time delay**

Product	Product number	Range	Differential	Cut-In	Switch	Capillary	Connection
Ranco	3311-101	14 psig FXD	5 psig FXD	9 psig FXD	SPDT	36 in.	1/4 in. Internal Flares
Penn	P74AA-1C <sup>1</sup>	8/70 psig ADJ	8/30 psig ADJ	ADJ	Open Hi	36 in.	1/4 in. Internal Flares
Ranco	3311-103	4/6 psig ADJ	5/6 psig	9/12 psig	SPDT	24 in.	W/1/4 in. Sweats
Penn	P74EA-8C <sup>2</sup>	2/26 psig ADJ	3.5 psig FXD	N/A	SPDT	36 in.	1/4 in. Internal Flares
Ranco	3311-111	4/6 psig FXD	5/6 psig	9/12 psig	SPDT	84 in.	1/4 in. Internal Flares
Penn	P74EA-8C	2/26 psig ADJ	3.5 psig FXD	N/A	SPDT	36 in.	1/4 in. Internal Flares
Ranco	3311-115	6 psig FXD	5 psig FXD	11 psig FXD	Open LO	24 in.	1/4 in. Internal Flares
Penn	P74BA-1C	8/70 psig ADJ	7/30 psig ADJ	ADJ	Open LO	36 in.	1/4 in. Internal Flares
Ranco	3311-118	40 psig FXD	5 psig FXD	45 psig FXD	Open LO	25 in. and 24 in.	W/1/4 in. Sweats
Penn	P74BA-1C <sup>2</sup>	8/70 psig ADJ	7/30 psig ADJ	ADJ	Open LO	36 in.	1/4 in. Internal Flares
Ranco	3311-201	7 psig FXD	Manual	Manual	SPDT	49 in. and 72 in.	W/1/4 in. Sweats
Penn	P74AB-1C <sup>1,2</sup>	8/70 psig ADJ	Manual	Manual	Open Hi	None	1/4 in. Internal NPT
Ranco	3315-101	14 psig FXD	5 psig FXD	9 psig FXD	SPDT	36 in.	1/4 in. Internal Flares
Penn	P74AA-1C <sup>1</sup>	8/70 psig ADJ	8/30 psig ADJ	ADJ	Open Hi	36 in.	1/4 in. Internal Flares
Ranco	3315-801	11/14 psig ADJ	5 psig FXD	16/19 psig	SPDT	None	External Flares
Penn	P74BA-1C <sup>1,2</sup>	8/70 psig ADJ	7/30 psig ADJ	ADJ	Open LO	36 in.	1/4 in. Internal Flares

1 Different switch type

2 Different pressure element



**Table 375: Ranco to Penn cross reference, transformers**

Product	Product number	VA	Prim. Volt.	Prim. Lead	Sec. Volt.	Sec. Lead	Mounting
Ranco	620-205	20	120	8 in. Leads	24	8 in. Leads	Foot
Penn	Y65A13-0	40	120	8 in. Leads	24	30 in. Leads	Foot w/ Hubs
Ranco	620-206	20	208/240	8 in. Leads	24	8 in. Leads	Foot
Penn	Y65T31-0 <sup>1</sup>	40	120/208/240	8 in. Leads	24	3 Terminals	Universal
Ranco	620-403	40	120	8 in. Leads	24	8 in. Leads	Universal
Penn	Y65T31-0 <sup>1</sup>	40	120/208/240	8 in. Leads	24	3 Terminals	Universal
Ranco	620-404	40	208/240	8 in. Leads	24	8 in. Leads	Universal
Penn	Y65T31-0 <sup>1</sup>	40	120/208/240	8 in. Leads	24	3 Terminals	Universal
Ranco	620-405	40	120	8 in. Leads	24	8 in. Leads	Foot
Penn	Y65A13-0	40	120	8 in. Leads	24	30 in. Leads	Foot w/ Hubs
Ranco	620-406	40	208/240	8 in. Leads	24	8 in. Leads	Foot
Penn	Y65T31-0 <sup>1</sup>	40	120/208/240	8 in. Leads	24	3 Terminals	Universal
Ranco	620-482	40	120/208/240	8 in. Leads	24	8 in. Leads	Foot
Penn	Y65A13-0 <sup>2</sup>	40	120	8 in. Leads	24	30 in. Leads	Foot w/ Hubs
Penn	Y65T31-0	40	120/208/240	8 in. Leads	24	3 Terminals	Universal
Ranco	620-502	50	120/208/240	8 in. Leads	24	8 in. Leads	Universal
Penn	Y63T22-0 <sup>2</sup>	50	120/208/240	8 in. Leads	24	8 in. Leads	Universal
Ranco	620-752	75	120/208/240	8 in. Leads	24	8 in. Leads	Foot
Penn	Y66T12-0 <sup>2</sup>	75	120/208/240	8 in. Leads	24	8 in. Leads	Foot
Ranco	620-758	75	480	8 in. Leads	24	8 in. Leads	Foot
Penn	Y66F12-0	75	277/480	8 in. Leads	24	8 in. Leads	Foot

- 1 Different electrical connection
- 2 Choose which transformer based on primary voltage desired

Choose correct P28 series control below based on time delay and pressure connection required. Verify specifications.

**Table 376: Penn P28 series lube oil controls - specifications**

Product code number	Range	Time delay	Capillaries	Pressure connection
P28AA-1	8/70 psi ADJ	90 s	36 in.	W/ Flare nut
P28AA-2	8/70 psi ADJ	60 s	36 in.	W/ Flare nut
P28AA-17	8/70 psi ADJ	120 s	36 in.	W/ Flare nut
P28AA-18	8/70 psi ADJ	45 s	36 in.	W/ Flare nut
P128AA-1	8/70 psi ADJ	90 s	None	External Flare
P128AA-2	8/70 psi ADJ	60 s	None	External Flare
P128AA-17	8/70 psi ADJ	120 s	None	External Flare





## ALCO to Penn cross reference

**Table 377: ALCO to Penn cross reference, temperature controls**

Product	Product number	Range	Differential	Switch	Capillary	Bulb	Enclosure
ALCO	TF115-S2 AE00	-20/60°F	3/30°F ADJ	Single-pole, double-throw (SPDT)	None	Coiled	NEMA 1
ALCO	TSI-X2E 30/40	-20/60°F	3/30°F ADJ	SPDT	None	Coiled	NEMA 1
Penn	A19BBC-2C <sup>1</sup>	-30/100°F	3/12°F ADJ	SPDT	None	Coiled	NEMA 1
Penn	A19BBC-6C <sup>1, 2</sup>	-30/100°F	3/12°F ADJ	SPDT	None	Coiled	NEMA 1
ALCO	TF115-S3 AE00	15/95°F	3/30°F ADJ	SPDT	None	Coiled	NEMA 1
ALCO	TSI-X3E 64/48	15/95°F	3/30°F ADJ	SPDT	None	Coiled	NEMA 1
Penn	A19BBC-2C <sup>1</sup>	-30/100°F	3/12°F ADJ	SPDT	None	Coiled	NEMA 1
Penn	A19BBC-6C <sup>1, 2</sup>	-30/100°F	3/12°F ADJ	SPDT	None	Coiled	NEMA 1
ALCO	TF115-S4 AF10	-20/95°F	5/35°F ADJ	SPDT	120 in.	3/8x2-3/4	NEMA 1
ALCO	TSI-X4F 32/41	-20/95°F	5/35°F ADJ	SPDT	120 in.	3/8x2-3/4	NEMA 1
Penn	A19ABC-24C <sup>1</sup>	-30/100°F	3/12°F ADJ	SPDT	96 in.	3/8x4	NEMA 1
Penn	A19ABC-36C <sup>1</sup>	-30/100°F	3/12°F ADJ	SPDT	240 in.	3/8x4	NEMA 1

1 Can use A419ABC-1, -30/212°F range, 1/30°F differential, SPDT, 78" lead, 0.25 x 2 PTC sensor, NEMA 1.

2 Knob assembly/concealed adjustment packed separately.

**Table 378: ALCO to Penn cross reference, single pressure controls**

Product	Product number	Range	Differential	Switch	Capillary	Connection	Enclosure
ALCO	FF115-S1 BAK	24 in./42 psig	3/30 psig ADJ	SPDT	36 in.	w/ Flare nut	NEMA 1
ALCO	PS1-X1K 7/15	24 in./42 psig	3/30 psig ADJ	SPDT	36 in.	w/ Flare nut	NEMA 1
Penn	P70AB-12C	12 in./80 psig	5/35 psig ADJ	Open LO	36 in.	w/ Flare nut	NEMA 1
ALCO	FF115-S3 BAK	15 in./100 psig	7/70 psig ADJ	SPDT	36 in.	w/ Flare nut	NEMA 1
ALCO	PS1-X3K 50/65	15 in./100 psig	7/70 psig ADJ	SPDT	36 in.	w/ Flare nut	NEMA 1
Penn	P70AB-2C	20 in./100 psig	7/50 psig ADJ	Open LO	36 in.	w/ Flare nut	NEMA 1
ALCO	FF115-S3 BAA	15 in./100 psig	7/70 psig ADJ	SPDT	None	External Flare	NEMA 1
ALCO	PS1-X3A 50/65	15 in./100 psig	7/70 psig ADJ	SPDT	None	External Flare	NEMA 1
Penn	P170AB-2C	20 in./100 psig	7/50 psig ADJ	Open LO	None	External Flare	NEMA 1
ALCO	FF115-S4 BAK	15/290 psig	15/145 psig ADJ	SPDT	36 in.	w/ Flare nut	NEMA 1
ALCO	PS1-X4K 115/145	15/290 psig	15/145 psig ADJ	SPDT	36 in.	w/ Flare nut	NEMA 1
Penn	P70AA-2C	0/150 psig	12/40 psig ADJ	Open LO	36 in.	w/ Flare nut	NEMA 1
Penn	P70AA-3C	100/300 psig	25/75 psig ADJ	Open LO	36 in.	w/ Flare nut	NEMA 1
ALCO	FF115-S5 BAK	90/450 psig	30/220 psig	SPDT	36 in.	w/ Flare nut	NEMA 1
ALCO	PS1-X5K 230/290	90/450 psig	30/220 psig	SPDT	36 in.	w/ Flare nut	NEMA 1
Penn	P70AA-118C	100/400 psig	35/200 psig	Open LO	36 in.	w/ Flare nut	NEMA 1
Penn	P70CA-3C	50/450 psig	60/150 psig	Open HI	36 in.	w/ Flare nut	NEMA 1
ALCO	FF115-S5 BAA	90/450 psig	30/220 psig	SPDT	None	External Flare	NEMA 1
ALCO	PS1-X5A 140/280	90/450 psig	30/220 psig	SPDT	None	External Flare	NEMA 1
Penn	P170AA-118C	100/400 psig	35/200 psig	Open LO	None	External Flare	NEMA 1
Penn	P170CA-3C	50/450 psig	60/150 psig	Open HI	None	External Flare	NEMA 1
ALCO	FF115-S5 BRK	90/450 psig	Manual	SPDT	36 in.	w/ Flare nut	NEMA 1
ALCO	PS1-Y5K 230/290	90/450 psig	Manual	SPDT	36 in.	w/ Flare nut	NEMA 1
Penn	P70DA-1C	50/450 psig	Manual	Open HI	36 in.	w/ Flare nut	NEMA 1
Penn	P70KA-1C <sup>1</sup>	50/450 psig	Manual	M-Block	36 in.	w/ Flare nut	NEMA 1
ALCO	FF115-S5 BRA	90/450 psig	Manual	SPDT	None	External Flare	NEMA 1
ALCO	PS1-Y5A 330/390	90/450 psig	Manual	SPDT	None	External Flare	NEMA 1
Penn	P170DA-1C	50/450 psig	Manual	Open HI	None	External Flare	NEMA 1

1 Main opens HI, auxilliary opens LO (primarily used for alarm circuit).

**Table 379: ALCO to Penn cross reference, dual pressure controls**

Product	Product number	LO Side	Differential	HI Side	Differential	Capillary	Connection
ALCO	FF215-S9 BAUK	24 in./42 psig	3/30 psig	90/450 psig	60 psig FXD	48 in.	W/ Flare nut
ALCO	PS2-Y9K	24 in./42 psig	3/30 psig	90/450 psig	60 psig FXD	48 in.	W/ Flare nut
Penn	P70SA-1C	12 in./80 psig	5/35 psig	100/500 psig	60 psig FXD	36 in.	W/ Flare nut
ALCO	FF215-S7 BAUK	15 in./100 psig	7/70 psig	90/450 psig	60 psig FXD	48 in.	W/ Flare nut
ALCO	PS2-Y7K	15 in./100 psig	7/70 psig	90/450 psig	60 psig FXD	48 in.	W/ Flare nut
Penn	P70SA-1C	12 in./80 psig	5/35 psig	100/500 psig	60 psig FXD	36 in.	W/ Flare nut
ALCO	FF215-S7 BAUA	15 in./100 psig	7/70 psig	90/450 psig	60 psig FXD	None	External Flare
ALCO	PS2-Y7A	15 in./100 psig	7/70 psig	90/450 psig	60 psig FXD	None	External Flare
Penn	P170SA-1C	12 in./80 psig	5/35 psig	100/500 psig	60 psig FXD	None	External Flare

**Table 380: ALCO to Penn cross reference, lube oil pressure controls**

Product	Product number	Range	Reset	Delay	Capillary	Connection	Enclosure
ALCO	FD113-ZUK	4/65 ADJ	Manual	20-150 secs.	36 in.	W/ Flare	NEMA 1
Penn	P28AA-**C (See )	8/70 ADJ	Manual	See .	36 in.	W/ Flare	NEMA 1
Penn	P45NCA-12C (See )	9.0 FXD	Manual	120 secs.	36 in.	W/ Flare	NEMA 1
Penn	P45NCA-82C (See )	6.5 FXD	Manual	45 secs.	36 in.	W/ Flare	NEMA 1
ALCO	FD113-ZU	4/65 ADJ	Manual	20-150 secs.	None	External Flare	NEMA 1
Penn	P128AA-**C (See )	8/70 ADJ	Manual	See .	None	External Flare	NEMA 1
Penn	P145NCA-12C (See )	9.0 FXD	Manual	120 secs.	None	External Flare	NEMA 1
Penn	P145NCA-82C (See )	6.5 FXD	Manual	45 secs.	None	External Flare	NEMA 1

Choose correct P28 series control below based on time delay and pressure connection required. Verify specifications.

**Table 381: Penn P28 Series Lube Oil Controls - Specifications**

Product code number	Range	Time delay	Capillaries	Pressure connection
P28AA-1	8/70 psi ADJ	90 s	36 in.	W/ Flare nut
P28AA-2	8/70 psi ADJ	60 s	36 in.	W/ Flare nut
P28AA-17	8/70 psi ADJ	120 s	36 in.	W/ Flare nut
P28AA-18	8/70 psi ADJ	45 s	36 in.	W/ Flare nut
P128AA-1	8/70 psi ADJ	90 s	None	External Flare
P128AA-2	8/70 psi ADJ	60 s	None	External Flare
P128AA-17	8/70 psi ADJ	120 s	None	External Flare



## Danfoss to Penn cross reference

**Table 382: Danfoss to Penn cross reference, temperature controls**

Manufacturer	Product number	Range	Differential	Switch	Capillary	Bulb	Enclosure	Notes
Danfoss	O60L2150	-30/80°F	3.6/12.6°F ADJ	SPDT	120 in.	3/8 in. x 4 in.	NEMA 1	KPU 19 Series
Penn	A19ABC-37C <sup>1</sup>	-30/100°F	3/12°F ADJ	SPDT	120 in.	3/8 in. x 4 in.	NEMA 1	
Danfoss	O60L2151	-30/80°F	3.6/12.6°F ADJ	SPST, Open LO	80 in.	3/8 in. x 4 in.	NEMA 1	KPU 19 Series
Penn	A19ABC-24C <sup>1</sup>	-30/100°F	3/12°F ADJ	SPDT	96 in.	3/8 in. x 4 in.	NEMA 1	
Danfoss	O60L2152	-30/80°F	3.6/12.6°F ADJ	SPDT	None	Air Coil	NEMA 1	KPU 19 Series
Penn	A19BBC-2C <sup>1</sup>	-30/100°F	3/12°F ADJ	SPDT	None	Air Coil	NEMA 1	
Danfoss	O60L5201	-20/60°F	2.5/13°F ADJ	SPDT	80 in.	3/8 in. x 4 in.	NEMA 1	KPU 61 Series
Penn	A19ABC-24C <sup>1</sup>	-30/100°F	3/12°F ADJ	SPDT	96 in.	3/8 in. x 4 in.	NEMA 1	
Danfoss	O60L5203	-20/60°F	2.5/13°F ADJ	SPDT	80 in.	3/8 in. x 2-3/4 in.	NEMA 1	KPU 61 Series
Penn	A19ABC-24C <sup>1</sup>	-30/100°F	3/12°F ADJ	SPDT	96 in.	3/8 in. x 4 in.	NEMA 1	
Danfoss	O60L5206	-20/60°F	2.5/13°F ADJ	SPDT	None	Air Coil	NEMA 1	KPU 61 Series
Penn	A19BBC-2C <sup>1</sup>	-30/100°F	3/12°F ADJ	SPDT	None	Air Coil	NEMA 1	
Danfoss	O60L-5215	25/95°F	3/13°F ADJ	SPDT	None	Air Coil	NEMA 1	KPU 61 Series
Penn	A19BBC-2C <sup>1</sup>	-30/100°F	3/12°F ADJ	SPDT	None	Air Coil	NEMA 1	
Danfoss	O60L5208	-15/60°F	5/50°F ADJ	SPDT	80 in.	3/8 in. x 4 in.	NEMA 1	KPU 61 Series
Penn	A72AP-1C	-10/65°F	4/40°F ADJ	DPST, Open LO	72 in.	11/16 in. x 6-3/4 in.	NEMA 1	
Danfoss	O60L5218	25/70°F	4/16°F ADJ	SPDT	80 in.	3/8 in. x 4 in.	NEMA 1	KPU 61 Series
Penn	A72AP-1C	-10/65°F	4/40°F ADJ	DPST, Open LO	72 in.	11/16 in. x 6-3/4 in.	NEMA 1	
Danfoss	O60L5223	60/140°F	6.3/18°F ADJ	SPDT	80 in.	3/8 in. x 4 in.	NEMA 1	KPU 61 Series
Penn	A19ABC-4C <sup>1</sup>	50/130°F	3.5/14°F ADJ	SPDT	96 in.	3/8 in. x 4 in.	NEMA 1	

<sup>1</sup> The Danfoss control is square shaped. The Penn control is rectangular. Check physical dimensions.

**Table 383: Danfoss to Penn cross reference, single pressure controls**

Manufacturer	Product number	Range	Differential	Switch	Capillary	Connection	Enclosure	Notes
Danfoss	O60-117366	116/464 psig	43 psig FXD	SPDT	None	External Flare	NEMA 1	Manual Reset
Penn	P170DA-1C <sup>1</sup>	50/500 psig	60 psig FXD	SPST, Open HI	None	External Flare	NEMA 1	Manual Reset
Danfoss	O60-5231	6 in./108 psig	10/60 psig ADJ	SPST, Open LO	None	External Flare	NEMA 1	KPU 1
Penn	P170AB-2C	20 in./100 psig	7/50 psig ADJ	SPST, Open LO	None	External Flare	NEMA 1	
Danfoss	O60-5232	28 in./100 psig	10 psig FXD	SPDT	None	External Flare	NEMA 1	Manual Reset, KPU 1B
Penn	P70EA-10C	20 in./100 psig	5 psig FXD	SPDT	None	External Flare	NEMA 1	Manual Reset
Danfoss	O60-5233	6 in./108 psig	10/60 psig ADJ	SPST, Open LO	36 in.	W / Flare Nut	NEMA 1	KPU 1
Penn	P70AB-2C	20 in./100 psig	7/50 psig ADJ	SPST, Open LO	36 in.	W / Flare Nut	NEMA 1	
Danfoss	O60-5234	28 in./100 psig	10 psig FXD	SPDT	36 in.	W / Flare Nut	NEMA 1	Manual Reset, KPU 1B
Penn	P70AB-2C	20 in./100 psig	7/50 psig ADJ	SPST, Open LO	36 in.	W / Flare Nut	NEMA 1	
Danfoss	O60-5235	6 in./73 psig	6/30 psig ADJ	SPST, Open LO	36 in.	W / Flare Nut	NEMA 1	KPU 2
Penn	P70AB-12C	12 in./80 psig	5/35 psig ADJ	SPST, Open LO	36 in.	W / Flare Nut	NEMA 1	
Danfoss	O60-5237	6 in./73 psig	6/30 psig ADJ	SPST, Open LO	None	External Flare	NEMA 1	KPU 2
Penn	P170AB-12C	12 in./80 psig	5/35 psig ADJ	SPST, Open LO	None	External Flare	NEMA 1	
Danfoss	O60-5239	6 in./73 psig	6/30 psig ADJ	SPDT	None	External Flare	NEMA 1	KPU 2
Penn	P170EA-14C	12 in./80 psig	5/35 psig ADJ	SPDT	None	External Flare	NEMA 1	
Danfoss	O60-5240	6 in./73 psig	6/30 psig ADJ	SPDT	36 in.	W / Flare Nut	NEMA 1	KPU 2
Penn	P70EA-14C	12 in./80 psig	5/35 psig ADJ	SPDT	36 in.	W / Flare Nut	NEMA 1	
Danfoss	O60-5241	100/465 psig	26.1/87 psig ADJ	SPST, Open LO	None	External Flare	NEMA 1	Fan Cycling, KPU 5
Penn	P170AA-118C	100/400 psig	35/200 psig ADJ	SPST, Open LO	None	External Flare	NEMA 1	Fan Cycling
Danfoss	O60-5242	100/465 psig	26.1/87 psig ADJ	SPST, Open LO	36 in.	W / Flare Nut	NEMA 1	Fan Cycling, KPU 5
Penn	P70AA-118C	100/400 psig	35/200 psig ADJ	SPST, Open LO	36 in.	W / Flare Nut	NEMA 1	Fan Cycling
Danfoss	O60-5243	100/600 psig	58/145 psig ADJ	SPDT	None	External Flare	NEMA 1	KPU 6W
Penn	P170CA-400C <sup>1,2</sup>	200/610 psig	60/150 psig ADJ	SPST, Open HI	None	External Flare	NEMA 1	
Danfoss	O60-5244	100/600 psig	60 psig FXD	SPDT	None	External Flare	NEMA 1	Manual Reset, KPU 6B
Penn	P170DA-1C	50/500 psig	60 psig FXD	SPST, Open HI	None	External Flare	NEMA 1	Manual Reset
Danfoss	O60-5245	100/600 psig	58/145 psig ADJ	SPDT	36 in.	W / Flare Nut	NEMA 1	KPU 6W
Penn	P70CA-400C <sup>1,2</sup>	200/610 psig	60/150 psig ADJ	SPST, Open HI	36 in.	W / Flare Nut	NEMA 1	
Danfoss	O60-5246	100/600 psig	60 psig FXD	SPDT	36 in.	W / Flare Nut	NEMA 1	Manual Reset, KPU 6B
Penn	P70DA-1C	50/500 psig	60 psig FXD	SPDT	36 in.	W / Flare Nut	NEMA 1	Manual Reset

- 1 Switch types are different
- 2 UL Listed as refrigeration pressure limiting control

**Table 384: Danfoss to Penn cross reference, dual pressure controls**

Manufacturer	Product number	LO Side	Differential	HI Side	Differential	Capillary	Connections	Notes
Danfoss	O60-5247	6/108 psig	10/60 psig ADJ	100/465 psig	60 psig FXD	None	External Flares	KPU 15
Penn	P170LB-1C <sup>1</sup>	20 in./100 psig	7/50 psig ADJ	100/500 psig	65 psig FXD	None	External Flares	
Danfoss	O60-5248	6/108 psig	10/60 psig ADJ	100/465 psig	60 psig FXD	36 in.	W / Flare Nuts	KPU 15
Penn	P70LB-1C <sup>1</sup>	20 in./100 psig	7/50 psig ADJ	100/500 psig	65 psig FXD	36 in.	W / Flare Nuts	
Danfoss	O60-5249	6/108 psig	10/60 psig ADJ	100/465 psig	60 psig FXD	None	External Flares	Manual Reset, KPU 15B
Penn	P170MA-1C <sup>1</sup>	20 in./100 psig	6/50 psig ADJ	100/500 psig	55 psig FXD	None	External Flares	Manual Reset
Danfoss	O60-5250	6/108 psig	10/60 psig ADJ	100/465 psig	60 psig FXD	36 in.	W / Flare Nuts	Manual Reset, KPU 15B
Penn	P70MA-1C <sup>1</sup>	20 in./100 psig	6/50 psig ADJ	100/500 psig	55 psig FXD	36 in.	W / Flare Nuts	Manual Reset
Danfoss	O60-5251	6/108 psig	10/60 psig ADJ	100/600 psig	60 psig FXD	None	External Flares	KPU 16W
Penn	P170LB-1C <sup>1</sup>	20 in./100 psig	7/50 psig ADJ	100/500 psig	65 psig FXD	None	External Flares	
Danfoss	O60-5252	6/108 psig	10/60 psig ADJ	100/600 psig	60 psig FXD	36 in.	W / Flare Nuts	KPU 16W
Penn	P70LB-1C <sup>1</sup>	20 in./100 psig	7/50 psig ADJ	100/500 psig	65 psig FXD	36 in.	W / Flare Nuts	
Danfoss	O60-5253	6/108 psig	10/60 psig ADJ	100/600 psig	60 psig FXD	None	External Flares	KPU 16B
Penn	P170LB-1C <sup>1</sup>	20 in./100 psig	7/50 psig ADJ	100/500 psig	65 psig FXD	None	External Flares	
Danfoss	O60-5254	6/108 psig	10/60 psig ADJ	100/600 psig	60 psig FXD	36 in.	W / Flare Nuts	KPU 16B
Penn	P70LB-1C <sup>1</sup>	20 in./100 psig	7/50 psig ADJ	100/500 psig	65 psig FXD	36 in.	W / Flare Nuts	

1 UL Listed as refrigeration pressure limiting control

**Table 385: Danfoss to Penn cross reference, lube oil controls**

Manufacturer	Product number	Range	Reset	Time delay	Capillary	Connection	Enclosure	Notes
Danfoss	O60B200266	29 in./175 psig	Manual	90 s	None	External Flares	NEMA 1	MP54
Penn	P128AA-1C <sup>1</sup>	8 to 70 psig	Manual	90 s	None	External Flares	NEMA 1	
Danfoss	O60B200366	29 in./175 psig	Manual	120 s	None	External Flares	NEMA 1	MP54
Penn	P145NCB-12C <sup>1</sup>	9 psi FXD	Manual	120 s	None	External Flares	NEMA 1	
Danfoss	O60B200766	29 in./175 psig	Manual	120 s	None	External Flares	NEMA 1	MP55
Penn	P28AA-17C <sup>1</sup>	8 to 70 psig	Manual	120 s	None	External Flares	NEMA 1	
Danfoss	O60B200866	29 in./175 psig	Manual	45 s	None	External Flares	NEMA 1	MP54
Penn	P145NCB-82C <sup>1</sup>	6.5 psi FXD	Manual	45 s	None	External Flares	NEMA 1	
Danfoss	O60B201266	29 in./175 psig	Manual	60 s	None	External Flares	NEMA 1	MP54
Penn	P128AA-2C <sup>1</sup>	8 to 70 psig	Manual	60 s	None	External Flares	NEMA 1	
Danfoss	O60B205066	29 in./175 psig	Manual	45 s	36 in.	W / Flare Nuts	NEMA 1	MP54
Penn	P145NCB-82C <sup>1, 2</sup>	6.5 psi FXD	Manual	45 s	36 in.	W / Flare Nuts	NEMA 1	
Danfoss	O60B205366	29 in./175 psig	Manual	120 s	36 in.	W / Flare Nuts	NEMA 1	MP54
Penn	P145NCB-12C <sup>1, 2</sup>	9 psi FXD	Manual	120 s	36 in.	W / Flare Nuts	NEMA 1	
Danfoss	O60B205466	29 in./175 psig	Manual	45 s	36 in.	W / Flare Nuts	NEMA 1	MP55
Penn	P28AA-18C <sup>1</sup>	8 to 70 psig	Manual	45 s	36 in.	W / Flare Nuts	NEMA 1	
Danfoss	O60B205766	29 in./175 psig	Manual	120 s	None	External Flares	NEMA 1	MP55
Penn	P28AA-17C <sup>1</sup>	8 to 70 psig	Manual	120 s	None	External Flares	NEMA 1	

1 Verify compressor time delay requirements

2 Use two SEC99AA-36C UltraCap armored capillaries



## Honeywell to Penn cross reference

**Table 386: Honeywell to Penn cross reference, temperature controls**

Manufacturer	Product number	Range	Differential	Switch	Capillary	Bulb	Enclosure	Notes
Honeywell	L6018C-1006	55/85°F	3.5°F FXD	SPDT	96 in.	1/2 in. x 4-3/16 in.	NEMA 1	
Penn	A19ABC-24C	-30/100°F	3/12°F ADJ	SPDT	96 in.	3/8 in. x 4 in.	NEMA 1	
Honeywell	L6021A-1005	15/75°F	3.5°F FXD	SPDT	96 in.	1/2 in. x 4-3/16 in.	NEMA 1	
Penn	A19ABC-24C	-30/100°F	3/12°F ADJ	SPDT	96 in.	3/8 in. x 4 in.	NEMA 1	
Honeywell	T675A1011	0/100°F	3/10°F ADJ	SPDT	60 in.	1/2 in. x 4-3/16 in.	NEMA 1	
Penn	A19ABC-24C	-30/100°F	3/12°F ADJ	SPDT	96 in.	3/8 in. x 4 in.	NEMA 1	
Honeywell	T675A1136	0/100°F	1°F FXD	SPDT	240 in.	1/2 in. x 4-3/16 in.	NEMA 1	
Penn	A19ABC-36C	-30/100°F	3/12°F ADJ	SPDT	240 in.	3/8 in. x 4 in.	NEMA 1	
Honeywell	T675A1425	55/175°F	3.6/12°F ADJ	SPDT	240 in.	1/2 in. x 3-9/16 in.	NEMA 1	
Penn	A19ABB-2C <sup>1</sup>	50/200°F	6/24°F ADJ	SPDT	120 in.	1/3 in. x 2-1/2 in.	NEMA 1	
Honeywell	T675A1508	0/100°F	1°F FXD	SPDT	60 in.	1/2 in. x 4-3/16 in.	NEMA 1	Includes bulb duct holder
Penn	A19ABC-24C	-30/100°F	3/12°F ADJ	SPDT	96 in.	3/8 in. x 4 in.	NEMA 1	
Honeywell	T675A1516	0/100°F	1°F FXD	SPDT	60 in.	1/2 in. 4-3/16 in.	NEMA 1	Includes bulb duct holder
Penn	A19ABC-24C	-30/100°F	3/12°F ADJ	SPDT	96 in.	3/8 in. x 4 in.	NEMA 1	
Honeywell	T675A1532	160/260°F	3/10°F ADJ	SPDT	60 in.	1/2 in. x 4-3/16 in.	NEMA 1	
Penn	A19AAC-9C	100/240°F	6°F FXD	SPDT	72 in.	3/8 in. x 4 in.	NEMA 1	
Honeywell	T675A1565	0/100°F	3/10°F ADJ	SPDT	240 in.	1/2 in. x 4-3/16 in.	NEMA 1	Includes bulb duct holder
Penn	A19ABC-36C	-30/100°F	3/12°F ADJ	SPDT	240 in.	3/8 in. x 4 in.	NEMA 1	
Honeywell	T775A2009	-40/248°F	1/150°F ADJ	SPDT	9 in.	1/2 in. x 2 in.	NEMA 1	
Penn	A421ABC-02C <sup>2</sup>	-40/212°F	1/30°F ADJ	SPDT	78 in.	1/2 in. x 2 in.	NEMA 1	
Honeywell	T4031A-1008	-30/50°F	3.5°F FXD	SPDT	60 in.	3/8 in. x 3 in.	NEMA 1	
Penn	A19ABC-24C	-30/100°F	3/12°F ADJ	SPDT	96 in.	3/8 in. x 4 in.	NEMA 1	
Honeywell	T4031A-1073	-30/50°F	3.5°F FXD	SPDT	96 in.	3/8 in. 3 in.	NEMA 1	
Penn	A19ABC-24C	-30/100°F	3/12°F ADJ	SPDT	96 in.	3/8 in. x 4 in.	NEMA 1	
Honeywell	T6031A-1011	15/90°F	3.5°F FXD	SPDT	60 in.	3/8 in. 3 in.	NEMA 1	
Penn	A19ABC-24C	-30/100°F	3/12°F ADJ	SPDT	96 in.	3/8 in. x 4 in.	NEMA 1	
Honeywell	T6031A-1029	-30/90°F	3.5/16°F ADJ	SPDT	96 in.	3/8 in. x 3 in.	NEMA 1	
Penn	A19ABC-24C	-30/100°F	3/12°F ADJ	SPDT	96 in.	3/8 in. x 4 in.	NEMA 1	

1 Switch types are different

2 Provides on/off temperature control only



## Product and contact information

### Repair information

If the product fails to operate within its specifications, replace the unit. For a replacement, contact the nearest Johnson Controls® representative.

### Product warranty

This product is covered by a limited warranty, details of which can be found at [www.johnsoncontrols.com/buildingswarranty](http://www.johnsoncontrols.com/buildingswarranty).

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