

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

Installation Instructions

Part No. 24-7664-1601, Rev. H
Issued September 2018

Applications

P70, P72, and P170 Series Controls for Low Pressure Applications provide low-side pressure control on commercial refrigeration and air-conditioning applications.

IMPORTANT: Use this P70, P72, or P170 Series Control for Low Pressure Applications only as an operating control. Where failure or malfunction of the P70, P72, or P170 Series Control could lead to personal injury or property damage to the controlled equipment or other property, additional precautions must be designed into the control system. Incorporate and maintain other devices, such as supervisory or alarm systems or safety or limit controls, intended to warn of or protect against failure or malfunction of the P70, P72, or P170 Series Control.

P70A and P170A type models with Single-Pole Single-Throw (SPST) Open-Low switch action are the most popular models and are typically used for Open-Low operation and pump-down control. See Table 1 through Table 4.

P70 and P170 Series control models are also available with SPST Open-High switch action and are typically used for capacity control. See Table 3 and Table 4. Control models with Single-Pole Double-Throw (SPDT) or 4-wire, 2-circuit switch action allow users to install alarm devices or other control circuits. See Table 4.

P72 Series control models have a Double-Pole Single-Throw (DPST) switch with load-carrying contacts that provide direct control of 208/240 VAC single-phase motors up to 3 hp, 480 VAC single-phase, non-compressor motors, and 208/220 VAC 3-phase motors up to 5 hp. See Table 4.

These controls are available in several pressure ranges and are compatible with most common refrigerants. They may also be used on air, water, and other non-corrosive fluid applications. Ammonia-compatible models are also available. See Table 3.

The MICRO-SET® option provides fine adjustment of the differential setting for precision pressure control of critical low pressure applications.

Some models feature Limited Knob Adjustment, which restricts adjustment of the pressure settings and deters overadjustment or tampering. See *Limited Knob Adjustment*.

The Manual Reset Lockout mechanism does not allow the control to automatically reset after the control has Cutout, providing shutdown capability for unmonitored equipment. See *Manual Reset Operation*.

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



Table 1 through Table 4 list the standard models and features of P70, P72, and P170 controls for low pressure applications. These standard models are available through most authorized Johnson Controls/PENN® distributors.

Table 1: Standard P70, P72 and P170 MICRO-SET® Control Models for Low Pressure Applications (for Non-corrosive Refrigerants)

Model Number	Switch Action	Range in. Hg to psig (kPa)	Differential psi (kPa)	Pressure Connection	Maximum Overpressure psig (kPa)
P70AB-12	SPST Open-Low	12 in. Hg to 80 psig (-41 to 551 kPa)	Minimum 5 (34) Maximum 35 (241)	36 in. Cap. with 1/4 in. Flare Nut	325 (2,241)
P170AB-12				1/4 in. Male Flare Connector	

Table 2: Standard P70, P72 and P170 Control Models for Low Pressure Applications (For High Pressure Non-Corrosive Refrigerants)

Model Number	Switch Action	Range in. Hg to psig (kPa)	Differential psi (kPa)	Pressure Connection	Maximum Overpressure psig (kPa)
P70AA-2	SPST Opens-Low	0 to 150 psig (0 to 1,034 kPa)	Adjustable 10 to 70 (69 to 483)	36 in. Capillary with 1/4 in. Flare Nut	325 (2,241)
P170AA-2				1/4 in. Male Flare Connector	

Table 3: Standard P70, P72 and P170 Control All-Range Models for Low Pressure Applications (Ammonia Compatible)

Model Number	Switch Action	Range in. Hg to psig (kPa)	Differential psi (kPa)	Pressure Connection	Maximum Overpressure psig (kPa)
P70AA-5	SPST Open-Low	20 in. Hg to 100 psig (-68 to 690 kPa)	Minimum 7 (48) Maximum 50 (345)	1/4 in. SS Female NPT	325 (2,241)
P70CA-4	SPST Open-High				

Table 4: Standard P70, P72 and P170 All-Range Control Models for Low Pressure Applications (For Non-Corrosive Refrigerants)

Model Number	Switch Action	Range in. Hg to psig (kPa)	Differential psi (kPa)	Pressure Connection	Maximum Overpressure psig (kPa)
P70AB-1	SPST Open-Low	20 in. Hg to 100 psig (-68 to 690 kPa)	Minimum 7 (48) Maximum 50 (345)	1/4 in. Male Flare Connector	325 (2,241)
P70AB-2				36 in. Cap. with 1/4 in. Flare Nut	
P70CA-1	SPST Open-High			36 in. Cap. with 1/4 in. Flare Nut	
P70EA-10	SPDT 1 to 3 Open-Low 1 to 2 Close-Low		5 (34) Fixed	1/4 in. Male Flare Connector	
P72AA-1	DPST Open-Low		Minimum 7 (48) Maximum 50 (345)	36 in. Cap. with 1/4 in. Flare Nut	
P72AB-1					
P170AB-2	SPST Open-Low			1/4 in. Male Flare Connector	
P170CA-1	SPST Open-High				

Installation

Dimensions

See Figure 1 and Figure 2 for dimensional information. These dimensions are nominal and are subject to accepted manufacturing tolerances and application variables.

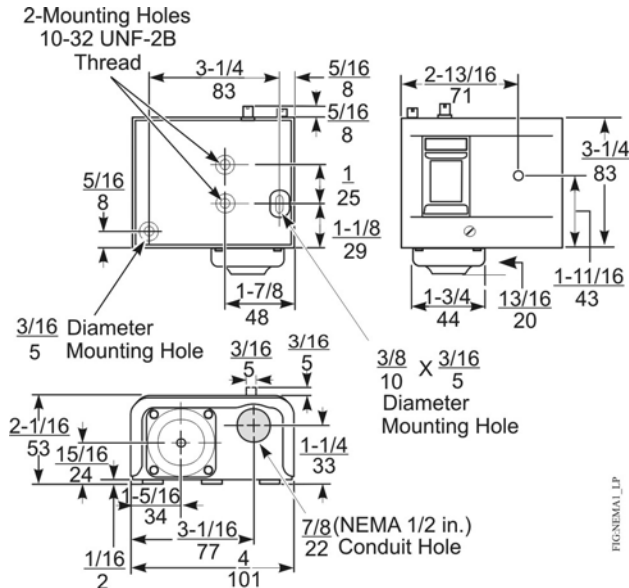


Figure 1: Dimensions of P70, P72, and P170 Pressure Controls with NEMA 1 Enclosures, in. (mm)

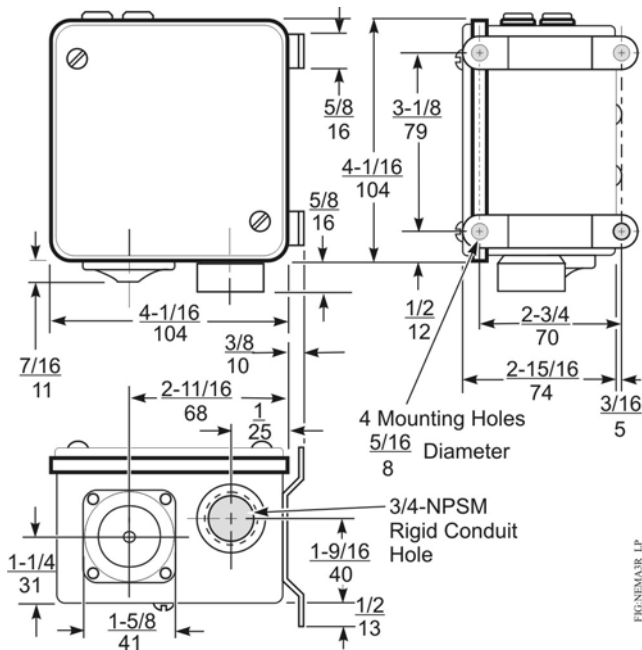


Figure 2: Dimensions of P70, P72, and P170 Pressure Controls with NEMA 3R Enclosures, in. (mm)

Mounting



CAUTION: Risk of Property Damage.

Mount the pressure control separately from the electrical cabinet and seal all electrical piping to prevent ammonia from migrating to electrical components. Where there may be exposure to ammonia, use only ammonia-compatible control modules and pressure connections. System shutdown due to improper adjustment may cause property damage.



CAUTION: Risk of Property Damage.

Mount the P70, P72, or P170 Pressure Control according to the instructions and guidelines included with the control. These instructions and guidelines are intended to reduce the risk of malfunction of the product and resulting property damage. Failure to follow these instructions and guidelines could cause the control to malfunction, resulting in property damage.

IMPORTANT: Use only the mounting screws supplied with the Universal Mounting Bracket to avoid damaging internal components. Be careful not to distort or bend the control case when mounting the control to an uneven surface. Using other screws or bending the control case will void the warranty.

Observe the following guidelines when installing this device:

- Mount the control in an accessible position, where the control and pressure-connection lines are not subject to damage.
- Mount the pressure control upright and level.
- Position the pressure-connection lines to allow drainage away from control bellows.
- Locate pressure-tap points on the topside of the refrigerant lines to reduce the possibility of oil, liquids, or sediment accumulating in the bellows, which could cause control malfunction.
- Mount controls with NEMA 1 enclosures on horizontal or vertical flat surfaces.
 - Use two screws or bolts through the two outer holes on the back of the control case when mounting the control directly to a flat vertical surface. See Figure 3.
 - Use the two inner holes with the Universal Mounting Bracket (and screws supplied) when mounting the control to a flat horizontal surface. See Figure 3.

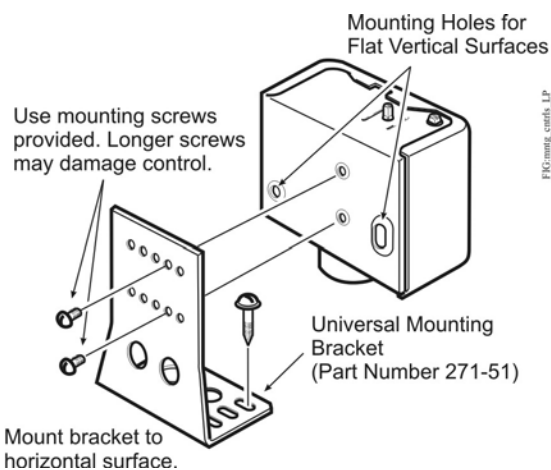


Figure 3: Mounting the P70, P72, and P170 Low Pressure Controls with NEMA 1 Enclosures

- Mount controls with NEMA 3R enclosures in a level, upright position with the bellows and conduit connection facing down. Ensure that all gaskets are in place. Mounting controls with NEMA 3R enclosures in any position other than upright and level may trap water in the enclosure and submerge internal components.

Wiring



WARNING: Risk of Electric Shock.

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

IMPORTANT: Use copper conductors only. Make all wiring connections in accordance with local, national, and regional regulations. Do not exceed the control's electrical ratings.

IMPORTANT: Use terminal screws furnished in the switch block. Using other terminal screws will void the warranty and may damage the switch.

P70, P72, and P170 controls for low pressure applications are available with several switch options and electrical ratings. Check the label inside the control cover for model number, switch action, and electrical rating. Check the wiring terminal designations on the control switch block, and see the following applicable wiring diagrams, when wiring the control. See Figure 4 through Figure 7 and Table 5 for switch actions and models. Also see [Technical Specifications](#).

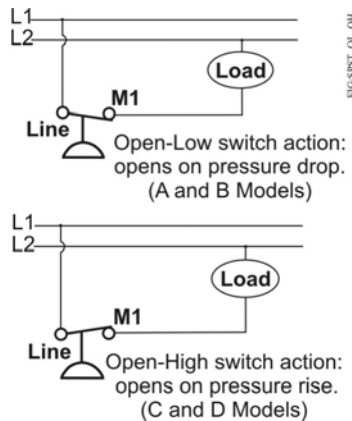


Figure 4: Typical Wiring for SPST Open-Low Switch and Open-High Switch (P70A, B, C, D and P170A, C, D Type Models)

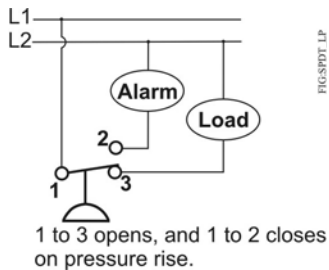


Figure 5: Typical Wiring for SPDT Switch (P70E and F Type Models)

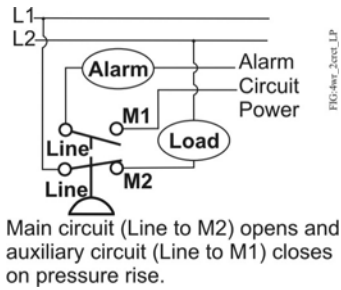


Figure 6: Typical Wiring for 4-Wire, 2-Circuit Switch (P70G and H Type Models)

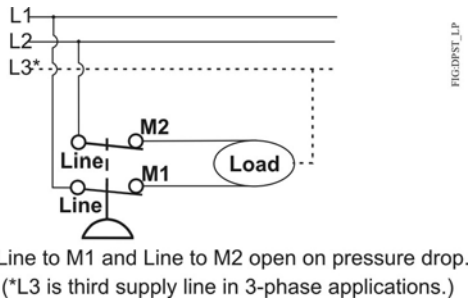


Figure 7: Typical Wiring for DPST Switch (P72A and B Type Models)

Table 5: Single Pressure Controls Switch Action, Low Events, High Events, Model Types, and Electrical Rating Table References

Switch and Action	Low Event	High Event	Model Types
Single-Pole Single-Throw (SPST) Open-Low	Cutout (Opens Line to M1)	Cut In (Closes Line to M1)	P70A, P70B, P170A
SPST Open-High	Cut In (Closes Line to M1)	Cutout (Opens Line to M1)	P70C, P70D, P170C, P170D
Single-Pole Double-Throw (SPDT)	Opens 1 to 2 and Closes 1 to 3	Closes 1 to 2 and Opens 1 to 3	P70E
4-Wire, 2-Circuits, 1 N.O., 1 N.C. Open-Low	Cutout (Opens M2 to Line and Closes M1 to Line)	Cut In (Closes M2 to Line and Opens M1 to Line)	P70G, P70H
4-Wire, 2-Circuits, 1 N.O., 1 N.C. Open-High	Cut In (Closes M2 to Line and Opens M1 to Line)	Cutout (Opens M2 to Line and Closes M1 to Line)	P70J, P70K, P170K
Double-Pole Single-Throw (DPST) Open-Low	Cutout (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)	Cutout (Opens M1 to Line and M2 to Line)	P72C, P72D

Piping



CAUTION: Risk of Environmental and Property Damage.

Avoid sharp bends in the capillary tubes. Sharp bends can weaken or kink capillary tubes, which may result in refrigerant leaks or restrictions of flow.



CAUTION: Risk of Environmental and Property Damage.

Coil and secure excess capillary tubing away from contact with sharp or abrasive objects or surfaces. Vibration or sharp or abrasive objects in contact with capillary tubes can cause damage that may result in refrigerant leaks [or loss of element charge], which may result in damage to the environment or property.

IMPORTANT: If the control is installed on equipment that contains hazardous or regulated materials such as certain refrigerants or lubricants, you must comply with all standards and regulations governing the containment and handling of those materials.

IMPORTANT: Do not apply more than 9 ft-lb (12 N·m) of torque to the flare nuts on pressure connection line fittings. Overtightening or applying more than 9 ft-lb (12 N·m) of torque may cause seal failure and will void the warranty.

P70, P72, and P170 low pressure controls are connected to the controlled equipment by a capillary or flexible hose (except ammonia models). Controls are available with a variety of pressure-connection styles.

Avoid severe pressure pulsation at high side pressure connections. Install pressure connection to pressure-tap points away from the compressor, to minimize the effects of pressure pulsation from reciprocating compressors.

IMPORTANT: After installing the control, evacuate pneumatic and pressure connection lines to remove air, moisture, and other contaminants in a manner consistent with applicable environmental regulations and standards.

Setup and Adjustments



CAUTION: Risk of Property Damage.

Obtain and use the compressor manufacturer's net oil bearing pressure specifications. If necessary, reset the cut-out pressure difference to the manufacturer's specifications. Using improper pressure settings may damage the control, compressor, or other controlled equipment.

IMPORTANT: Use the pressure control settings recommended by the manufacturer of the controlled equipment. Do not exceed the pressure ratings of the controlled equipment or any of its components when checking pressure control operation or operating the controlled equipment.

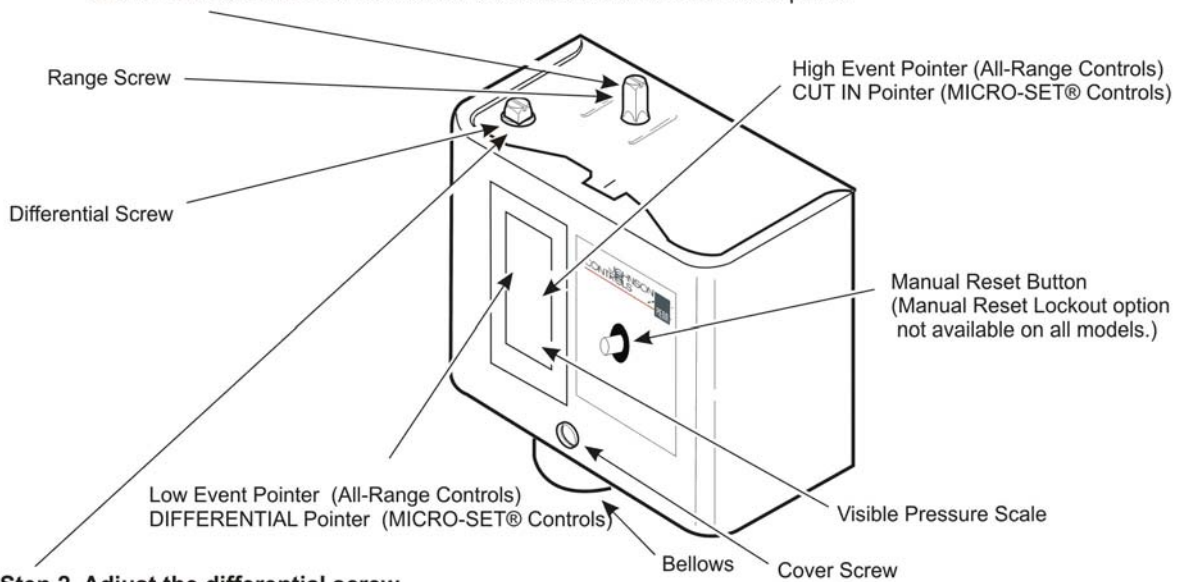
IMPORTANT: After mounting, wiring, and evacuating the control, attach a reliable set of gauges to the controlled equipment, and operate the equipment (at least) three cycles at the pressures necessary to verify control setpoints and proper equipment operation.

Adjustment of the P70, P72, and P170 low pressure controls varies, depending on the model. The following guidelines and diagrams illustrate the procedures for adjusting these controls. Refer to the product label inside the control cover for model number and switch action, and check the front of the control cover to determine if the control is an All-Range or MICRO-SET® model. See Table 5 for switch action, low event, and high event of the various control models. See Figure 8 for an illustration and instructions on control adjustments.

Step 1. Set high event by adjusting range screw.

All-Range Controls: Turn screw clockwise to raise high event.

MICRO-SET® Controls: Turn screw clockwise to lower CUT IN setpoint.



Step 2. Adjust the differential screw.

All-Range Controls: Turning the differential screw changes the low event.

Turn screw clockwise to lower Low Event.

MICRO-SET® Controls: Turning the differential screw changes the differential setting.

Turn screw clockwise to increase DIFFERENTIAL.

Figure 8: Adjusting P70, P72, and P170 Controls for Low Pressure Applications

FIG. 8: P70, P72, P170

All-Range Controls

All-Range pressure controls have scaleplates that display the Cut In and Cutout setpoints. (See the visible scale on the control.) Turn the range screw to adjust the Cut In and Cutout setpoints up or down simultaneously while maintaining a constant pressure differential. Turn the differential screw to adjust (only) the low event on the left side of the scale (which changes the differential pressure value).

MICRO-SET® Controls

MICRO-SET® low-side pressure controls have scaleplates that display the Cut In setpoint and Differential setting. (See visible scale on control.) Turn the range screw to adjust the Cut In setpoint on the right side of the scale. Turn the differential screw to adjust the differential setting on the left side (which changes the Cutout pressure value).

Limited Knob Adjustment

Some models are supplied with a Limited Knob Adjustment Kit which limits adjustments to the pressure control and helps to deter over-adjustment or tampering.

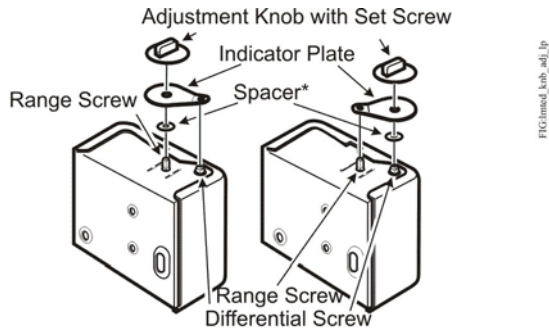
To lock the differential setting and allow limited adjustment of the low event and high event setpoints, install the knob on the range screw.

To lock the high event setpoint and allow limited adjustment of the low event setpoint (on All-Range controls) or differential setting (on MICRO-SET® controls), install the knob on the differential screw.

To install the Limited Knob Adjustment Kit:

1. Adjust control pointers to desired high event and low event setpoints (on All-Range controls) or differential setting (on MICRO-SET® controls).
2. Place spacer on the proper adjustment screw.
 - All-Range controls (with Limited Knob Adjustment Kit) have round and knurled adjustment screws; the spacer must always be placed on the range screw.

- MICRO-SET® controls have square adjustment screws. Always place the spacer on the same adjustment screw as the knob.
3. Place the indicator plate, as shown in Figure 9, to lock either the range screw or differential screw in the desired setting.
 4. Install the knob on the other adjustment screw and tighten the setscrew. A stop on the bottom of the knob limits screw adjustment to less than one turn.



Installation of Knob Kit to Lock Differential Screw and Allow Limited Adjustment of Range Screw

Installation of Knob Kit to Lock Range Screw, and Allow Limited Adjustment of Differential Screw

*On MICRO-SET® controls, place spacer on same adjustment screw as knob.

On All-Range controls, always place spacer on range screw.

Figure 9: Installing Limited Knob Adjustment

Checkout Procedure for Low Pressure Cut-out Controls

IMPORTANT: Use the pressure control settings recommended by the manufacturer of the controlled equipment. Do not exceed the pressure ratings of the controlled equipment or any of its components when checking pressure control operation or operating the controlled equipment.

IMPORTANT: After mounting, wiring, and evacuating the control, attach a reliable set of gauges to the controlled equipment, and operate the equipment (at least) three cycles at the pressures necessary to verify control setpoints and proper equipment operation.

Use the following procedure to check control operation on a typical low pressure cut-out application.

1. Check the product label on the inside of the control cover, for model number and switch action. (See Table 5 for low and high events that correspond to control model and switch action.)
2. Attach a reliable gauge to the suction service port and run the system at normal conditions.
3. Slowly front seat the suction valve and allow the low side to pump down. Observe the control's low event switching pressure on the gauge.
4. Slowly back the suction valve off the front-seated position and allow the low side pressure to rise. Observe the control's high event switching pressure on the gauge.
5. Adjust settings as needed. (See Figure 8.) Repeat checkout procedure if necessary.

Manual Reset Operation

Pressure controls with the Manual Reset option lock out when they reach Cutout pressure and must be manually reset by the user to restart the controlled equipment. The manual reset mechanism is trip-free and cannot be overridden by blocking or tying the reset button down.

On equipment with locked out controls, first determine and remedy the cause of the lockout, and allow the sensed pressure to return to the Cut In setpoint. Then, press and release the reset button on the front of the control to restore operation of the controlled equipment.

Technical Specifications

Table 6: SPST Electrical Ratings (P70A, B, C, D, and P170A, B, C, D Type Models)

	Standard Single-Phase Ratings					Hermetic Compressor Single-Phase Ratings
	120 VAC	208 VAC	240 VAC	480 VAC ¹	600 VAC ¹	208/240 VAC
Motor Full-Load Amperes	24	18.7	17	5	4.8	24
Motor Locked-Rotor Amperes	144	112.2	102	30	28.8	144
Non-Inductive Amperes	22	22	22	--	--	--
Pilot Duty	125 VA at 120–600 VAC; 57.5 VA at 120–300 VDC					

1. Not for compressor motor loads.

Table 7: SPDT Electrical Ratings Standard Differential Switch (P70E Type Models)

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

1. Rating for P70EC models only

Table 8: 4-Wire, 2-Circuit Electrical Ratings (P70G, H, J, K, and P170K Type Models)

	Standard Single-Phase Ratings									
	Line-M2(Main Contacts)						Line-M1(Auxiliary Contacts)			
	120 VAC	208 VAC	240 VAC	277 VAC	480 VAC ¹	600 VAC ¹	120 VAC	208 VAC	240 VAC	277 VAC
Motor Full Load Amperes	16.0	9.2	8.0	--	5	4.8	6.0	3.3	3.0	--
Motor Locked Rotor Amperes	96.0	55.2	48.0	--	30	28.8	36.0	19.8	18.0	--
Non-Inductive Amperes	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 24–600 VAC; 57.5 VA at 120–300 VDC									

1. Not for compressor motor loads

Table 9: DPST Electrical Ratings (P72A, B, C, and D Type Models)

	Standard Ratings							Hermetic Compressor Ratings	
	120 VAC 1Ø	208 VAC 1Ø	240 VAC 1Ø	208 VAC 3Ø	220 VAC 3Ø	480 VAC 1Ø ¹	600 VAC 1Ø ¹	208 VAC 1Ø	240 VAC 1Ø
Motor Full-Load Amperes	24	18.7	17	15.9	15	5	4.8	24	24
Motor Locked-Rotor Amperes	144	112.2	102	95.4	90	30	28.8	144	144
AC Non-Inductive Amperes	24	24	24	24	24	--	--	--	--
DC Non-Inductive Amperes	3	0.5	0.5	0.5	0.5	--	--	--	--
Pilot Duty	125 VA at 120–600 VAC; 57.5 VA at 120–300 VDC								

1. Not for compressor motor loads

P70, P72 and P170 Series Controls for Low Pressure Applications

Product Switch Action	P70, P170: SPST; 4-wire/2-circuit; or SPDT PENN® switch P72: DPST
Pressure Connection	P70, P72 Standard Models: various connections available. P170 Standard Models: 1/4 in. SAE male flare Ammonia Compatible Models: 1/4 in. stainless steel female NPT connection
Ambient Temperature	P70E and P70F Type Models: 50 to 104°F (10 to 40°C) All Other Models: -40 to 140°F (-40 to 60°C)
Case and Cover	NEMA 1 Enclosures: Case is galvanized steel; cover is plated and painted steel. NEMA 3R Enclosures: Case and cover are plated and painted steel.
Dimensions (H x W x D)	NEMA 1 Enclosure: 3-1/4 x 4 x 2-1/16 in. (83 x 101 x 53 mm) NEMA 3R Enclosure: 4-1/16 x 4-1/16 x 2-15/16 in. (104 x 104 x 74 mm)
Approximate Shipping Weight	Individual Pack: (NEMA 1 Enclosure) 2.4 lb (1.08 kg); Bulk Pack: (NEMA 1 Enclosure in multiples of 25 controls) 60 lb (27.2 kg)
Compliance	For information on specific models, contact Refrigeration Application Engineering at 1-800-275-5676.
Accessories	271-51 Universal Mounting Bracket (supplied with standard controls)

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

European Single Point of Contact:

JOHNSON CONTROLS
WESTENDHOF 3
45143 ESSEN
GERMANY

NA/SA Single Point of Contact:

JOHNSON CONTROLS
507 E MICHIGAN ST
MILWAUKEE WI 53202
USA

APAC Single Point of Contact:

JOHNSON CONTROLS
C/O CONTROLS PRODUCT MANAGEMENT
NO. 22 BLOCK D NEW DISTRICT
WUXI JIANGSU PROVINCE 214142
CHINA



www.penncontrols.com

® Johnson Controls and PENN are registered trademarks of Johnson Controls in the United States of America and/or other countries. All other trademarks used herein are the property of their respective owners. © Copyright 2018 by Johnson Controls. All rights reserved.