

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

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 208-240 volt single-phase motors up to 3 hp, and 208-220 volt 3-phase motors up to 5 horsepower.



Figure 1: P70AB-12 MICRO-SET™ Low Pressure Control

Features and Benefits	
<input type="checkbox"/> <b>All Steel Case and Cover</b>	Built to provide long lasting, rugged protection for internal components
<input type="checkbox"/> <b>“Sight-Set” Calibrated Pressure Adjustment</b>	Displays a visible pressure scale, fully adjustable through the range without removing the cover (on NEMA 1 enclosure models)
<input type="checkbox"/> <b>MICRO-SET™ Differential Option</b>	Allows for precise control on critical low pressure applications
<input type="checkbox"/> <b>Manual Reset Lockout Option</b>	Provides “trip-free” low pressure lockout that cannot be overridden or reset until pressure returns to specified level
<input type="checkbox"/> <b>Limited Knob Adjustment Option</b>	Restricts control adjustment ranges and deters tampering and over-adjustment

# Application

P70, P72, and P170 controls for low pressure applications are designed primarily to provide low-side pressure control on commercial refrigeration and air conditioning applications.

**IMPORTANT:** Except for those models listed as *Refrigeration Pressure Limiting Controls*, the P70, P72, and P170 Series controls for low pressure applications are intended to control equipment under normal operating conditions. Where failure or malfunction of the P70, P72, and P170 pressure controls could lead to an abnormal operating condition that could cause personal injury or damage to the equipment or other property, other devices (limit or safety controls) or systems (alarm or supervisory systems) intended to warn of, or protect against, failure or malfunction of the P70, P72, and P170 pressure controls must be incorporated into and maintained as part of the control system.

- **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 4-wire, 2-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 hp, and 208-220 V 3-phase motors up to 5 hp. Refer to Table 8.

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.

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

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

 **CAUTION:** **Equipment Damage Hazard.** Ammonia is very corrosive to copper and brass components. On ammonia applications, **only** ammonia-compatible control models and pressure connections must be used. The pressure control must be mounted separately from the electrical cabinet and all electrical piping sealed to prevent ammonia from migrating to electrical components.

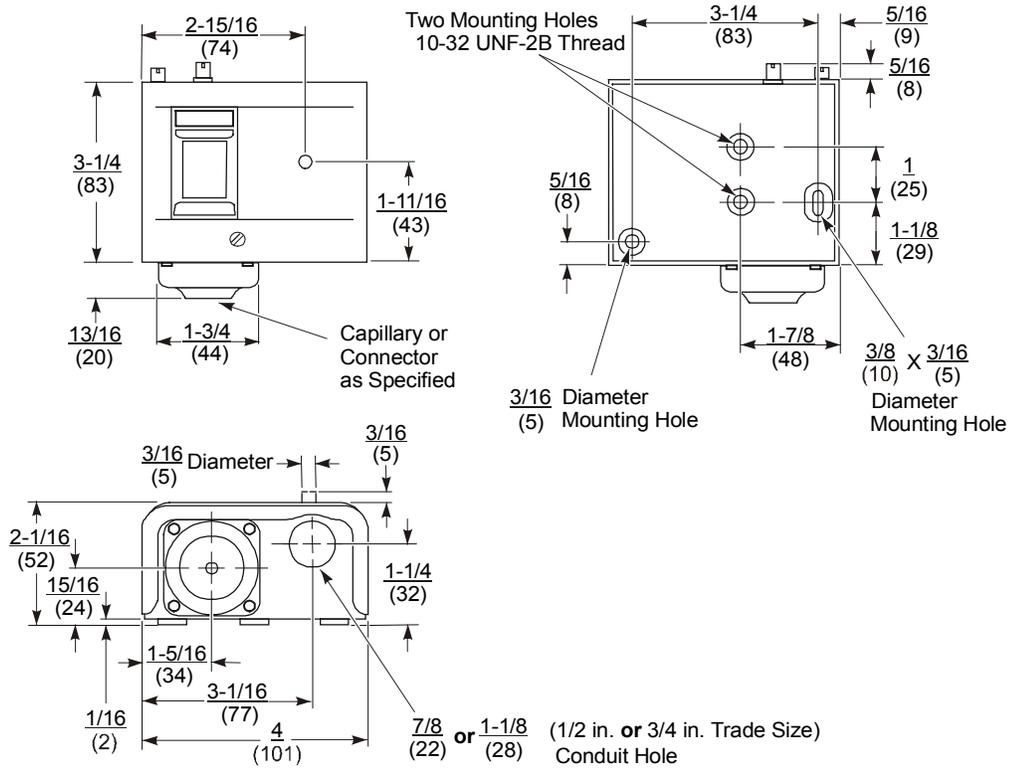
The **Manual Reset Lockout** mechanism does not allow the pressure control to automatically reset after the control has cut out, providing shutdown capability for unmonitored equipment. See *Manual Reset Operation*.

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

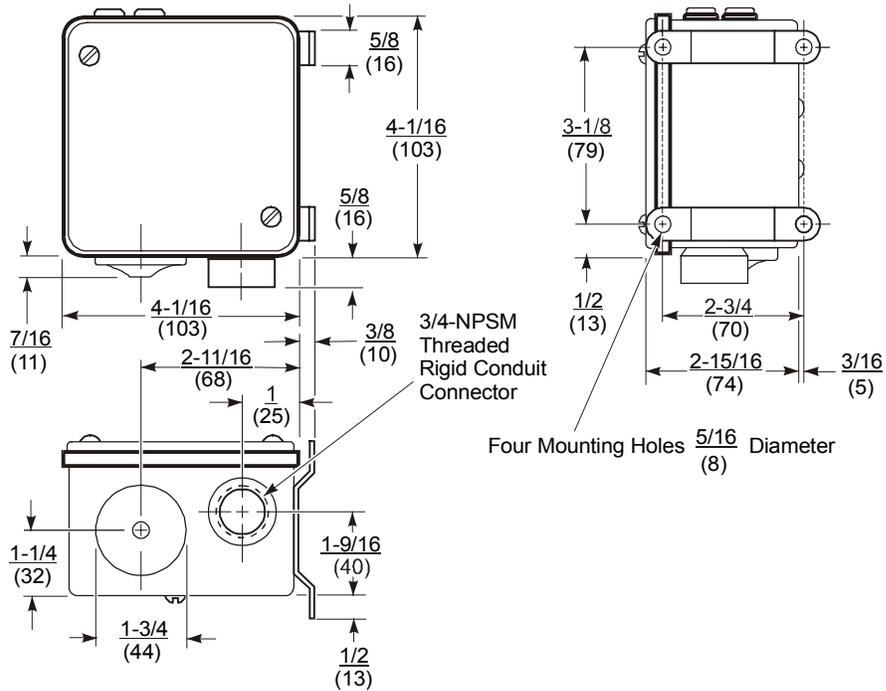
## Operation

A pressure-actuated bellows on the control is connected to a pressure tap on the controlled equipment by a capillary or a field-installed hose (except ammonia models). The bellows responds to equipment pressure changes and operates a snap-action electrical switch.

# Dimensions



**Figure 2: Dimensions for Low Pressure Controls with NEMA 1 Enclosure, in. (mm)**



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

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

# Mounting

Mount the control in an accessible position, where the control and pressure connection line will not be subject to damage.

**CAUTION:** **Equipment Damage Hazard.** Mount the pressure control upright and level. Position the pressure connection line to allow drainage away from control bellows. Pressure tap points must be located on the top side of the refrigerant lines. This reduces the possibility of oil, liquids, or sediment accumulating in the pressure connection line or control bellows, which could cause control malfunction.

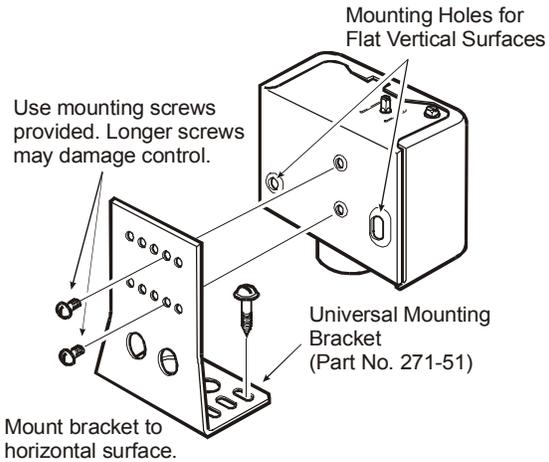
Controls with NEMA 1 enclosures may be mounted on flat, horizontal or vertical surfaces.

Use two screws or bolts through the two outer holes on the back of the control case when mounting control directly to a flat vertical surface.

Use the two inner holes with the Universal Mounting Bracket (and screws supplied) when mounting the control to a flat horizontal surface.

**IMPORTANT:** Use **only** the mounting screws provided with the Universal Mounting Bracket to avoid damaging internal components. Do not warp control case when mounting control to uneven surface.

Controls with NEMA 3R enclosures are designed to be mounted in a level, upright position with the sensing element and conduit connection facing down. All gaskets must be in place. Mounting NEMA 3R enclosures in any position other than upright and level may trap water in the enclosure and submerge internal control components.



**Figure 4: Mounting the P70, P72, and P170 Low Pressure Control with NEMA 1 Enclosure**

## Pressure Connections

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. See Figure 11 for pressure connection styles.

Follow these guidelines when installing pressure connection lines.

**IMPORTANT:** If these controls are installed on equipment that contain hazardous or regulated materials, such as refrigerants or lubricants, the installer and user should observe all regulations governing the handling and containment of those materials.

### **Avoid Sharp Bends in the Capillary Tube**

Sharp bends can weaken or kink capillary tubes, which may result in leaks or restrictions.

### **Allow for Slack in the Capillary Tube**

Leaving a little slack in the capillary tube helps dampen mechanical vibration that can weaken or damage capillary tubes.

### **Coil and Secure Excess Capillary Tubing**

Carefully loop any excess capillary tubing into smooth, circular coils (approximately 3 in. diameter). Securely fasten the coiled tubing.

**Avoid Contact between the Capillary Tubing and Sharp or Abrasive Objects**

Vibration of sharp or abrasive objects in contact with capillary tubes can result in leaks.

**Do Not Overtighten Flare Nuts on Pressure Connection Line Fittings**

Overtightening flare connections may damage the threads on the flare nuts or flare connectors, and may result in leaks. Do not exceed 9 ft·lb (12 N·m) of torque when tightening brass flare connections.

**Avoid Severe Pressure Pulsation at Pressure Connections**

Install pressure connection lines to pressure tap points away from the compressor, to minimize the effects of pressure pulsation from reciprocating compressors.

**IMPORTANT:** After installing control, evacuate control and pressure connection lines in accordance with applicable EPA and other regulations, to remove air, moisture, and other contaminants.

**Wiring**

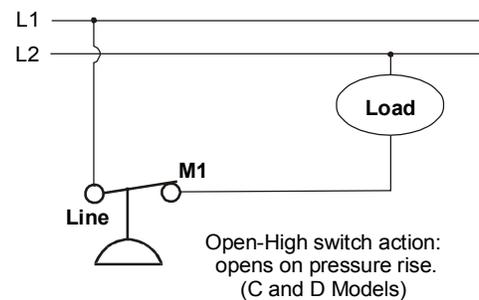
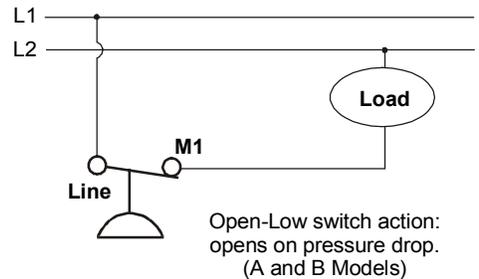
P70, P72, and P170 controls for low pressure applications are available with several switch options and electrical ratings. Check the label inside the control cover for model number, switch action, and electrical rating. (See Table 1 for switch actions and models.)

Check the wiring terminal designations on the control switch-block and refer to the following guidelines and applicable wiring diagrams, when wiring the control.

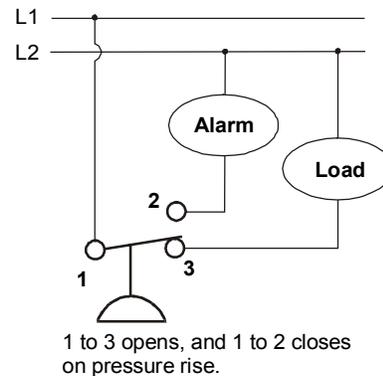
 **WARNING: Risk of Electrical Shock.** Disconnect power supply before making electrical connections to avoid possible electrical shock or equipment damage.

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

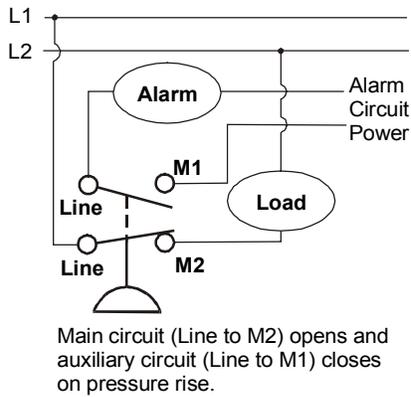
**IMPORTANT:** Make all wiring connections in accordance with the National Electrical Code and all local regulations. Use copper conductors only. Do not exceed the control's electrical rating.



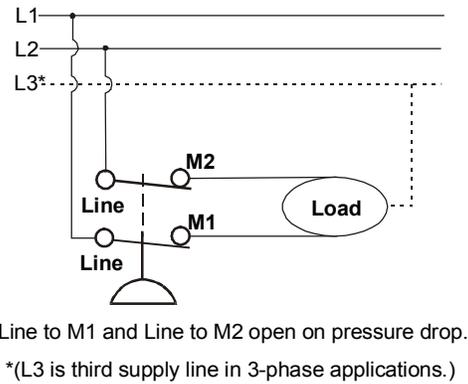
**Figure 5: Typical Wiring for SPST Open-Low Switch and Open-High Switch (P70A, B, C, D, and P170A, C, D, Models)**



**Figure 6: Typical Wiring for SPDT Switch (P70E, F Models)**



**Figure 7: Typical Wiring for 4-wire 2-circuit Switch (P70G and H Models)**



**Figure 8: Typical Wiring for DPST Switch (P72A and B Models)**

**Table 1: Single Pressure Controls Switch Action, Low Event, High Event, and Models**

Switch and Action	Low Event	High Event	Models
Single-Pole Single-Throw (SPST) Open-low	Cut Out (Opens Line to M1)	Cut In (Closes Line to M1)	P70A, P70B, P170A
Single-Pole Single-Throw (SPST) Open-high	Cut In (Closes Line to M1)	Cut Out (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, P70F
4-wire, 2-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
4-wire, 2-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
Double-Pole Single-Throw (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
Double-Pole Single-Throw (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

# Adjustments

Adjustment of the P70, P72, and P170 low pressure controls vary, 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 All-Range or MICRO-SET. (Refer to Table 1 for switch action, low event, and high event of the various control models.)

## All-Range Controls

All-Range pressure controls have a scaleplate that displays the CUT IN and CUT OUT setpoints. (See the visible scale on control.) Turning the range screw adjusts the CUT IN and CUT OUT setpoints up or down simultaneously, while maintaining a constant pressure differential. Turning the differential screw adjusts only the low event on the left side of the scale, and changes the pressure differential.

## MICRO-SET Controls

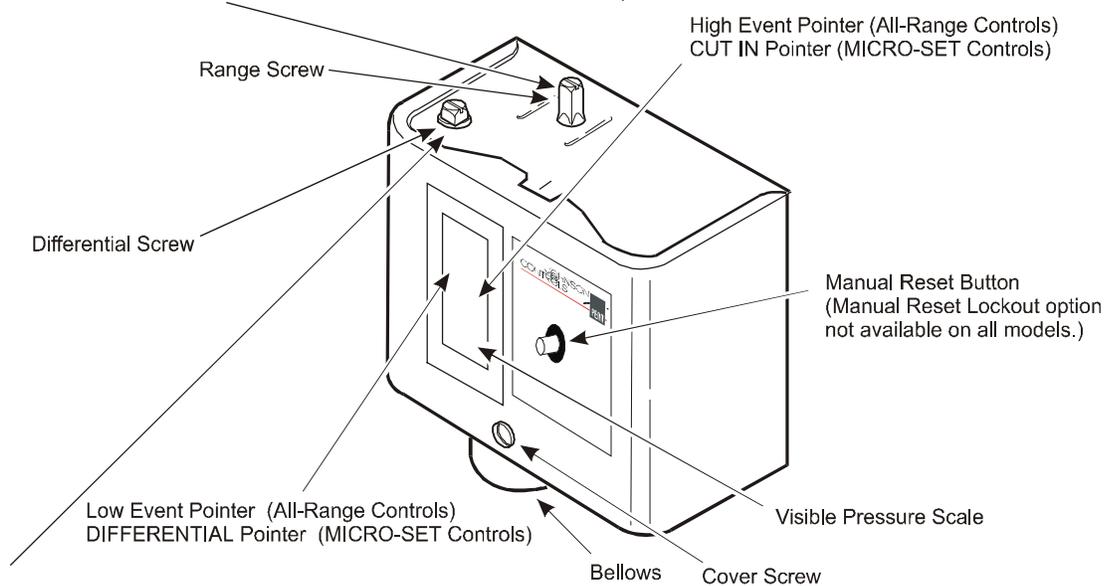
MICRO-SET low-side pressure controls have a scaleplate that displays the CUT IN setpoint and DIFFERENTIAL setting. (See visible scale on control.) Turning the range screw adjusts the CUT IN setpoint on the right side of the scale. Turning the differential screw adjusts the DIFFERENTIAL setting on the left side, which changes the resulting cut-out pressure.

**IMPORTANT:** Do not adjust pointers beyond the highest or lowest indicator marks on the control's pressure scale. Adjusting pointers beyond indicator marks may damage screw threads and cause inaccurate control operation.

### 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 raise low event.

**Micro-Set Controls:** Turning the differential screw changes the differential setting. Turn screw clockwise to increase DIFFERENTIAL.

**Figure 9: Adjusting P70, P72, and P170 Controls for Low Pressure Applications**

## Limited Knob Adjustment

Some models are supplied with a Limited Knob Adjustment kit, which limits adjustments to the pressure control and help 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.

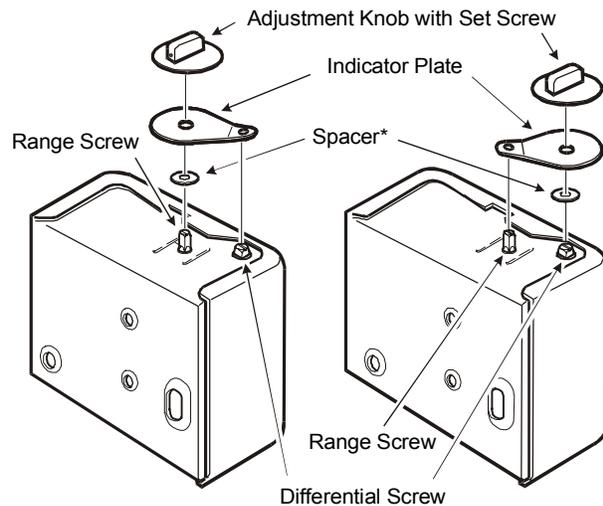
To lock the high event setpoint and allow limited adjustment of the low event setpoint (on All-Range controls) or differential setting (on MICRO-SET controls), install the knob on the differential screw.

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 10, 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.

**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 installing and adjusting pressure control, and before leaving installation, cycle the controlled equipment several times (at least three) at normal operating conditions. Use reliable pressure gauges to verify proper control settings and equipment operation.



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 10: Installing Limited Knob Adjustment Kit**

## Manual Reset Operation

Pressure controls with the Manual Reset option, lock out when they reach cut out pressure and must be manually reset by the user to restart the controlled equipment. The manual reset mechanism is “trip-free” and cannot be over-riden 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.

## Ordering Information

P70, P72, and P170 controls for low pressure applications are available in a variety of standard and non-standard models.

Table 2 lists the standard models available through most Johnson Controls/PENN Authorized Distributors.

Table 3 is a model identification matrix that depicts all the potential P70, P72, and P170 control models. Not all control models depicted in Table 3 are manufactured and available.

Figure 11 illustrates the pressure connection styles available on P70, P72, and P170 control models.

Contact your Johnson Controls/PENN Authorized Representative for availability and price.

**Table 2: Standard P70, P72, and P170 Controls for Low Pressure Applications**

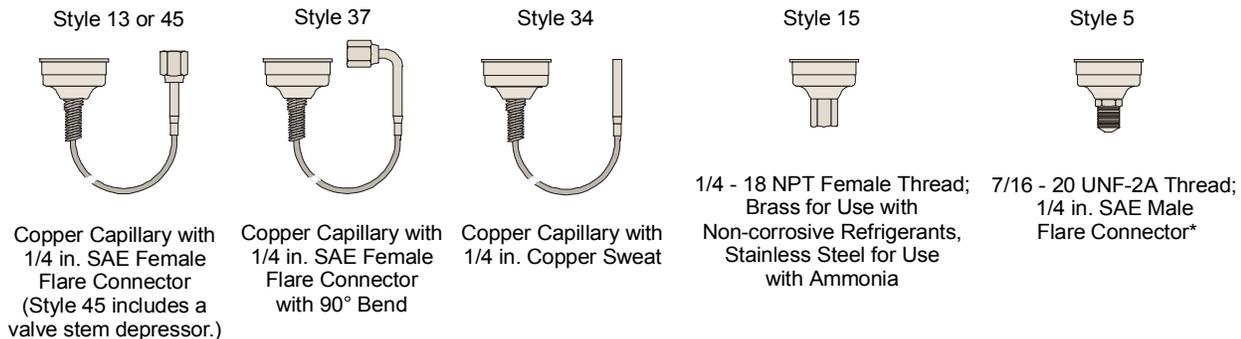
Code Number	Switch Action	Range psig (kPa)	Differential psi (kPa)	Pressure Connection	Limited Knob Adjustment	
<b>MICRO-SET Controls (For Non-Corrosive Refrigerants)</b>						
<b>P70AB-12</b>	SPST Open Low	12 in. Hg to 80 (-41 to 551)	Minimum 5 (34) Maximum 35 (241)	36 in. Cap. with 1/4 in. Flare Nut	Supplied, but not assembled	
<b>P170AB-12</b>				1/4 in. Male Flare Connector		
<b>ALL-RANGE Controls (For Non-Corrosive Refrigerants)</b>						
<b>P70AB-1</b>	SPST Open Low	20 in. Hg to 100 (-68 to 690)	Minimum 7 (48) Maximum 50 (345)	1/4 in. Male Flare Connector	Supplied, but not assembled	
<b>P70AB-2</b>				36 in. Cap. with 1/4 in. Flare Nut		
<b>P70CA-1</b>	SPST Open High			36 in. Cap. with 1/4 in. Flare Nut	None	
<b>P70EA-10</b>	SPDT 1 to 3 Open Low 1 to 2 Close Low		5 (34) Fixed	1/4 in. Male Flare Connector	None	
<b>P72AA-1</b>	DPST Open Low		Minimum 7 (48) Maximum 50 (345)	36 in. Cap. with 1/4 in. Flare Nut	None	
<b>P72AB-1</b>					Mounted on Differential Screw	
<b>P170AB-2</b>					SPST Open Low	1/4 in. Male Flare Connector
<b>P170CA-1</b>	SPST Open High			None		
<b>ALL-RANGE Controls (Ammonia Compatible)</b>						
<b>P70AA-5</b>	SPST Open Low		20 in. Hg to 100 (-68 to 690)	Minimum 7 (48) Maximum 50 (345)	1/4 in. SS Female NPT	None
<b>P70CA-4</b>	SPST Open High					

Note: See *Dimensions* and *Specifications* for additional model information including Maximum Working Pressure and Maximum Over-pressure ratings.

**Table 3: P70, P72, and P170 Pressure Control Identification Matrix**

<b>P70</b>	Various pressure connection styles available on many models (See <i>Figure 11.</i> )
<b>P170</b>	1/4 in. male flare pressure connection only (Style 5, see <i>Figure 11.</i> )
<b>P72</b>	DPST switch only, 3/4 in. conduit opening on most models, (E, F, G, H, J, and K, models not available)
<b>A</b>	SPST switch (DPST in P72), Open-low, automatic reset
<b>B</b>	SPST switch (DPST in P72), Open-low, manual reset lockout
<b>C</b>	SPST switch (DPST in P72), Open-high, automatic reset
<b>D</b>	SPST switch (DPST in P72), Open-high, manual reset lockout
<b>E</b>	1 hp SPDT switch (n/a in P72), automatic reset
<b>F</b>	1/4 hp SPDT switch (n/a in P72), automatic reset
<b>G</b>	4-wire, 2-circuit switch (n/a in P72), main switch Open-low, automatic reset
<b>H</b>	4-wire, 2-circuit switch (n/a in P72), main switch Open-low, manual reset lockout
<b>J</b>	4-wire, 2-circuit switch (n/a in P72), main switch Open-high, automatic reset
<b>K</b>	4-wire, 2-circuit switch (n/a in P72), main switch Open-high, manual reset lockout
<b>A</b>	NEMA 1 enclosure, no adjustment knob
<b>B</b>	NEMA 1 enclosure, with adjustment knob
<b>C</b>	No enclosure, no adjustment knob
<b>D</b>	No enclosure, with adjustment knob
<b>E</b>	NEMA 3R enclosure, no adjustment knob
<b>G</b>	NEMA 3R enclosure, no adjustment knob
<b>H</b>	NEMA 1 enclosure, no adjustment knob, 1/4 in. quick connects
<b>J</b>	NEMA 1 enclosure with adjustment knob, 1/4 in. quick connects
<b>N</b>	NEMA 1 enclosure no adjustment knob, transportation application
<b>P</b>	NEMA 1 enclosure with adjustment knob, transportation application
<b>S</b>	NEMA 3R enclosure, no adjustment knob, transportation application

Note: Not all combinations shown on this chart are available. To verify product availability and for quantity orders of non-standard items, please contact Refrigeration Application Engineering at (414) 524-5535.



\*Note: Style 5, 1/4 in. SAE Male Flare Connector may require a copper flare saver gasket, which must be purchased separately.

**Figure 11: Pressure Connections Styles Available on P70, P72, and P170 Controls**

## Electrical Ratings

**Table 4: SPST Electrical Ratings (P70A, B, C, and D, and P170A, C, and D Models)**

	Standard Single-Phase Ratings			Hermetic Compressor Single-Phase Ratings
	120 VAC	208 VAC	240 VAC	208/240 VAC
Motor Horsepower	1.5	3	3	--
Motor Full-Load Amperes	20	18.7	17	20
Motor Locked-Rotor Amperes	120	112.2	102	120
Non-Inductive Amperes	22	22	22	--
Pilot Duty	125 VA at 120 to 600VAC; 57.5 VA at 120 to 300 VDC			

**Table 5: SPDT Electrical Ratings 1hp Switch (P70E Models)**

	Standard Single-Phase Ratings			
	120 VAC	208 VAC	240 VAC	277 VAC*
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	9.2	8.0	-
Pilot Duty	125 VA at 120 to 600 VAC			125 VA at 24 to 600 VAC

\* Rating for P70EC models only

**Table 6: SPDT Electrical Ratings 1/4 hp Switch (P70F Models)**

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

**Table 7: 4-wire, 2-circuit Electrical Ratings (P70G, H, J, and K, and P170K Models)**

	Standard Single-Phase Ratings							
	Line-M2 (Main Contacts)				Line-M1 (Auxiliary Contacts)			
	120 VAC	208 VAC	240 VAC	277 VAC	120 VAC	208 VAC	240 VAC	277 VAC
Motor Full Load Amperes	16.0	9.2	8.0	--	6.0	3.3	3.0	--
Motor Locked Rotor Amperes	96.0	55.2	48.0	--	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 to 600 VAC; 57.5 VA at 120 to 300 VDC							

**Table 8: DPST Electrical Ratings (P72A, B, C, and D Models)**

	Standard Ratings					Hermetic Compressor Ratings	
	120 VAC 1Ø	208 VAC 1Ø	240 VAC 1Ø	208 VAC 3Ø	220 VAC 3Ø	208 VAC 1Ø	240 VAC 1Ø
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 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 to 600VAC; 57.5 VA at 120 to 300 VDC						

## Specifications

<b>Product</b>	P70, P72, and P170 Controls for Low Pressure Applications		
<b>Switch Action</b>	P70, P170: SPST; 4-wire/2-circuit; or SPDT PENN switch		P72: DPST
<b>Pressure Connection</b>	<b>P70, P72 Standard Models</b> various connections available See Figure 11.	<b>P170 Standard Models</b> 1/4 in. SAE male flare See Figure 11.	<b>Ammonia Compatible Models</b> 1/4 in. stainless steel female NPT connection See Figure 11.
<b>Maximum Overpressure</b>	All-Range: 325 psig (2239 kPa) MICRO-SET: 525 psig (3617 kPa)		
<b>Maximum Working Pressure</b>	All-Range: 100 psig (690 kPa) MICRO-SET: 80 psig (551kPa)		
<b>Ambient Temperature</b>	50 to 104°F (10 to 40°C)		
<b>Case and Cover</b>	NEMA 1 Enclosures—case is galvanized steel; cover is plated and painted steel. NEMA 3R Enclosures—case and cover are plated and painted steel.		
<b>Dimensions (H x W x D)</b>	NEMA 1 Enclosure: 3.25 x 3.98 x 2.09 in. (83 x 101 x 53 mm) NEMA 3R Enclosure: 4.08 x 4.08 x 2.92 in. (104 x 104 x 74 mm)		
<b>Approximate Shipping Weight</b>	Individual: (NEMA 1 Enclosure) 2.4 lb (1.08 kg); Bulk pack: (NEMA 1 Enclosure in multiples of 25 controls) 60 lb (27.2 kg)		
<b>Agency Listings</b>	For information on specific items, contact Refrigeration Application Engineering at (414) 524-5535.		
<b>Accessories</b>	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 (414) 524-5535. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.*



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