P28 and P128 Series Lube Oil Controls with Built-in Time Delay Relay

The P28 and P128 Series Lube Oil Controls provide dependable and economical oil pressure cutout for pressure-lubricated refrigeration compressors. The field-adjustable pressure differential of these controls provides compressor operation according to the manufacturer's specifications. The P28 and P128 controls measure the net lube oil pressure and de-energize the compressor if the pressure falls below the differential setpoint.

Manual reset models are available with factory set and sealed time delays of 30, 45, 60, 90, or 120 seconds. Not all time delays are available for all models. The P128 is the same control as the P28 but with 1/4 in. male flare pressure connections.

Figure 1: P28AA

Features and benefits	
❑ **Built-in time delay relay with ambient compensation**	Minimizes timing fluctuations due to temperature variations
❑ **Trip-free manual reset**	Provides manual reset that cannot be overridden by pressing and holding the reset button
❑ **Replaceable time delay relay assembly**	Allows easy field replacement of the time delay relay and terminal board
❑ **Available with runlight and alarm terminals**	Allows the control to be wired for normal oil pressure runlight signals and shutdown alarm circuits for remote monitoring of oil pressure status

Part No. 24-7664-605, Rev. D
Code No. LIT-125420

Introduction

WARNING: **Personal injury hazard.** All P28 and P128 controls are designed as lubrication protection controls. Failure of the P28 or P128 could allow the refrigeration compressor to be damaged in a way that may not be apparent upon visual inspection. Follow proper procedures and the compressor manufacturer's instructions, as well as any warning signs on or around the equipment, when discharging and disassembling the compressor.

Environmental damage hazard. If leakage of sensed media such as refrigerant or oil can be harmful to the environment, or hazardous in any way, the user must provide for proper containment.

The P28 and P128 controls measure the net oil pressure available to circulate oil throughout a pressure-lubricated refrigeration system. The net oil pressure is the difference between the oil pressure at the pump discharge and the refrigerant pressure in the compressor crankcase.

Example: If the oil pressure pump discharge reading is 90 psi (621 kPa) and the crankcase pressure is 70 psi (483 kPa), the net oil pressure is 20 psi (138 kPa).

The P28 and P128 have a built-in time delay relay. This relay allows the oil pressure to build up for the time delay period before the compressor trips. This also prevents nuisance lockouts due to intermittent loss of oil pressure. The time delay relay is a trip-free device. The manual reset cannot be overridden by pressing and holding the reset button.

Manual reset models are available with time delays of 30, 45, 60, 90, or 120 seconds. The time delay relay is compensated to minimize the effect of ambient temperature variations. However, the time delay relay is affected by voltage variations.

Dimensions

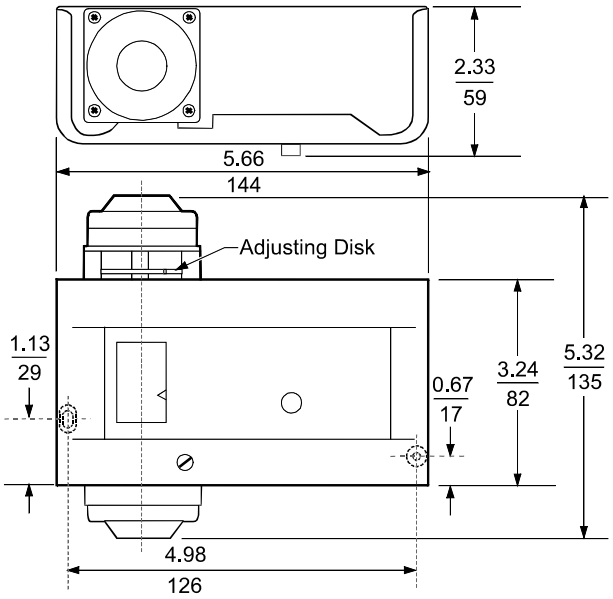


Figure 2: P28 or P128 dimensions, in. (mm)

Operation

When the compressor starts, the timer is energized because the net oil pressure of the system is zero. During normal operation, the net oil pressure builds up to the pressure switch's cut-out setting, also known as scale setting, plus the switch differential which is 3 psi to 5 psi (21 kPa to 34 kPa), in the required time delay. This causes the time delay relay to de-energize.

If the net oil pressure does not rise to the cut-out pressure setting plus the switch differential within the required time delay, the time delay relay trips and stops the compressor.

If the net oil pressure drops below the cut-out pressure setting during the compressor's run cycle, the time delay relay energizes. If the net oil pressure returns within the time delay, the time delay relay de-energizes and the compressor continues to operate normally. If the net oil pressure does not return within the time delay, the control shuts down and locks out the compressor.

Example: The bearings require a 9 psi (62 kPa) net oil pressure, which is the oil pump pressure minus crankcase pressure. The installer sets the control scale setting to 9 psi (62 kPa). The switch differential is 5 psi (34 kPa). Upon initial start of the compressor, the time delay relay energizes. If the net oil pressure does not build up to 14 psi (97 kPa), or the scale setting (9 psi) plus the switch differential (5 psi), during the time delay, the control breaks the circuit to the compressor. If the pressure of 14 psi (97 kPa) is reached during the time delay, the time delay relay de-energizes and the compressor continues to operate normally.

Installation

Mounting

CAUTION: **Equipment damage hazard.**

- A P28AN or P28DN control used for ammonia service must be mounted separately from the electrical cabinet. An ammonia leak could damage the electrical circuitry.
- Use only the mounting screws supplied with the control. Damage to internal components may occur if other screws are used.

The P28 and P128 controls are not position-sensitive and you can mount them in any position.

Use the two mounting screw holes located on the back of the control case to mount the control directly to a wall or panel board. Mount the control so that the pressure connections on the bellows are above the crankcase liquid level of the equipment being controlled.

Note: When mounting the control to a compressor is required, a mounting bracket (Part No. 271-51) is available.

Pressure connections

CAUTION: **Equipment damage hazard.**

- Avoid sharp bends or kinks in the capillary or tubing to avoid damage to the capillary.
- Coil and secure excess capillary or tubing. Because harmonic vibration can break the capillary or tubing, some slack must be provided.
- Do not allow the capillary or tubing to rub against metal surfaces where friction can cause damage.
- When using a control with 1/4 in. (6.4 mm) tubing, a pulsation damper must be used. Pulsation can cause excessive wear and damage the control.

1. Purge all tubing and lines before connecting the pressure control.
2. Connect the oil pressure line pump discharge to the pressure connector labeled OIL.
3. Connect the crankcase pressure line to the pressure connector labeled LOW.
4. Coil and secure the excess capillary or tubing to avoid vibration.

Wiring

WARNING: **Shock hazard.** Disconnect all power supplies before making wiring connections to avoid electrical shock or damage to the equipment.

- Ensure all wiring connections use copper conductors only.
- Wire in accordance with the National Electric Code and local regulations. For the maximum electrical rating of the control, see the label inside the control cover.
- Use the terminal screws furnished (8-32 x 1/4 in. binder head). Substitution of other screws may cause faulty connections.

See Figure 3 to Figure 10 for typical wiring diagrams or refer to the compressor manufacturer's specifications.

When the P28 or P128 control is supplied with a Terminal 3, you can wire it to operate a runlight to indicate when there is sufficient net oil pressure. When the control is supplied with a Terminal A, you can wire it to operate a shutdown alarm or signal to indicate when the compressor has tripped.

For standard applications that use a 208 V control circuit, use one leg of the 208 V circuit and a neutral or ground wire as a 120 V source to power the time delay relay.

When you install a P28 or P128 on a 440 VAC or 550 VAC system, use an external step-down transformer to provide either 120 V or 240 V to the pilot and time delay relay circuits. Ensure that the transformer is of sufficient volt ampere capacity to operate the motor starter and the time delay relay. Table 1 presents the power requirements for the P28 or P128 time delay relay. Table 2 presents the electrical ratings.

Table 1: Electrical power required for time delay relay

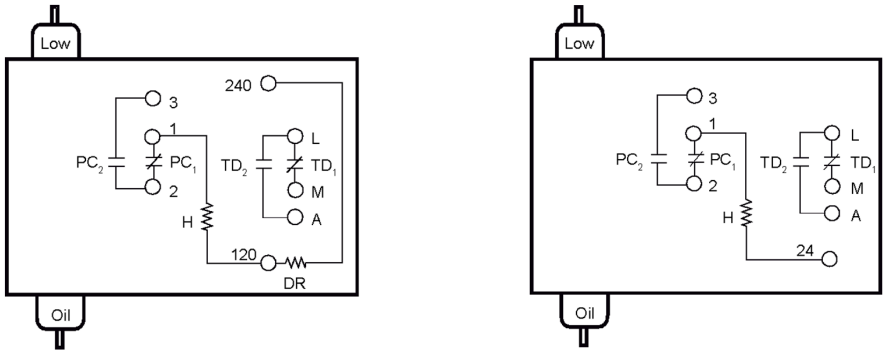
Timing in seconds	Voltage	
	24 V or 120 V	240 V
30, 45, 60, 90, or 120	15 VA	30 VA

Table 2: Electrical ratings, pilot duty

Time delay relay circuit	Pilot circuit	Alarm circuit*	Crankcase heater** Terminal 1	Runlight** Terminal 3
120/240 VAC	750 VA, 120/240 VAC	10W Tungsten, 120/240 VAC	10 A, 120 VAC 5 A, 240 VAC	10 W Tungsten
24 VAC/VDC	125 VA, 24 VAC	125 VA, 24 VAC	--	10 W Tungsten

* Must be the same voltage as the pilot circuit.

** Must be the same voltage as the time delay relay circuit.



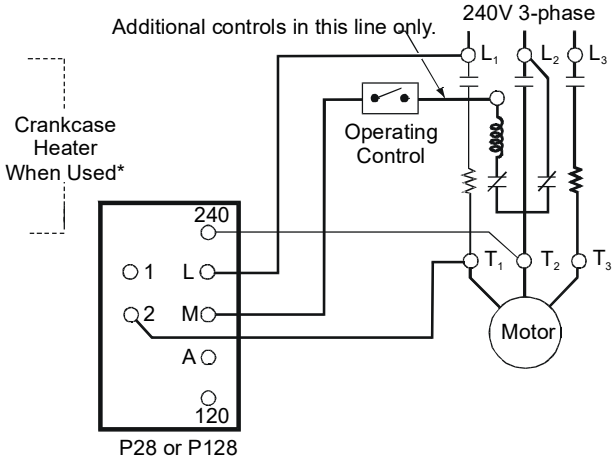
120/240 VAC models Low voltage models

Figure 3: P28 or P128 internal wiring circuit, with alarm circuit and runlight terminals

PC_1: Pressure actuated contacts. The contacts open on an increase in pressure difference between oil and low pressure connectors. The contacts make and break the time delay heater circuit.
PC_2: The contacts close simultaneously when PC_1 contacts open. Use PC_2 for the runlight circuit.
TD_1: Time delay relay. The contacts open after the time delay interval if the pressure difference between oil and low pressure connectors is not established or maintained.
TD_2: The contacts close simultaneously when TD_1 contacts open. Use TD_2 for the alarm circuit.
DR: Voltage dropping resistor used in dual voltage models.
H: Heater for time delay relay.

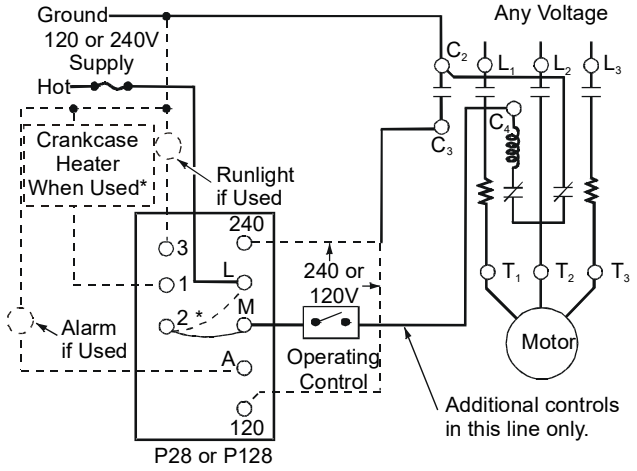
Connect Terminals L and M as a single-pole switch.
Connect Terminals 2 and 240 or 120 to energize the circuit only when the motor starter is closed.

Important: For Figure 5 to Figure 7, install the jumper between 2 and M or L in the field.



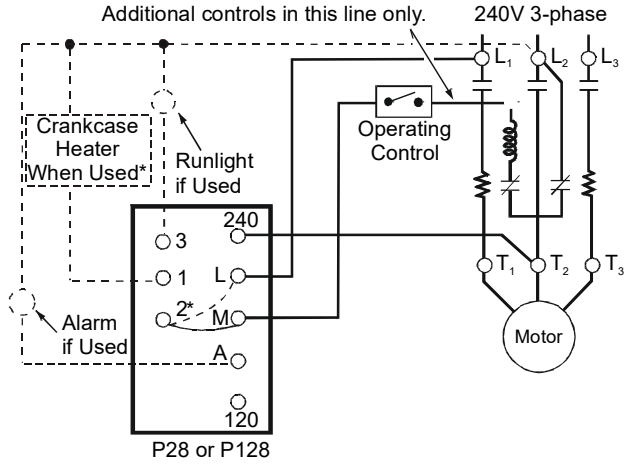
* You cannot cycle the crankcase heater with this wiring configuration. To do this, see Figure 5.

Figure 4: P28 or P128 on a 240 V system with 240 V magnetic starter coil



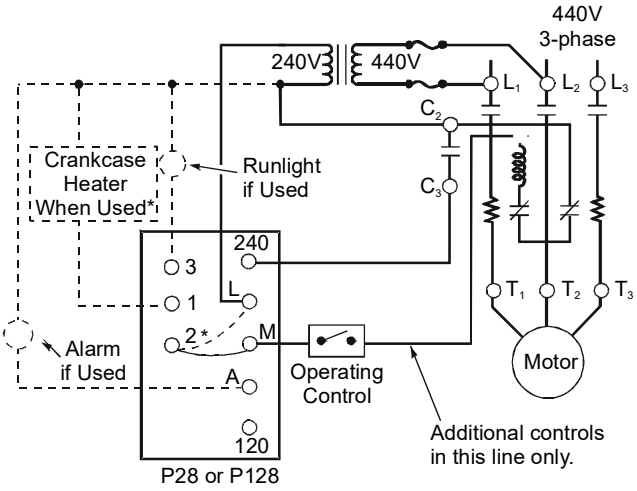
* When you use a crankcase heater, disconnect the jumper from 2 to M and reconnect it from 2 to L.

Figure 6: P28 or P128 with separate supply for the control circuit



* When you use a crankcase heater, disconnect the jumper from 2 to M and reconnect it from 2 to L.

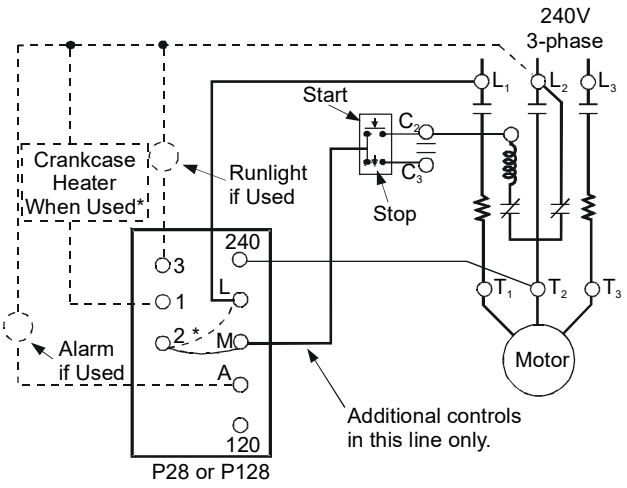
Figure 5: P28 or P128 wired for 3-wire control



* When you use a crankcase heater, disconnect the jumper from 2 to M and reconnect it from 2 to L. Ensure that the control circuit transformer has sufficient output for additional load.

Figure 7: P28 or P128 wired for 440 V supply and 240 V magnetic start coil, also applies for 550 V with appropriate transformer

Important: For Figure 8 and Figure 9, install the jumper between 2 and M or L in the field.



* When you use a crankcase heater, disconnect the jumper from 2 to M and reconnect it from 2 to L.

Figure 8: P28 or P128 with manual Start-Stop pushbutton station

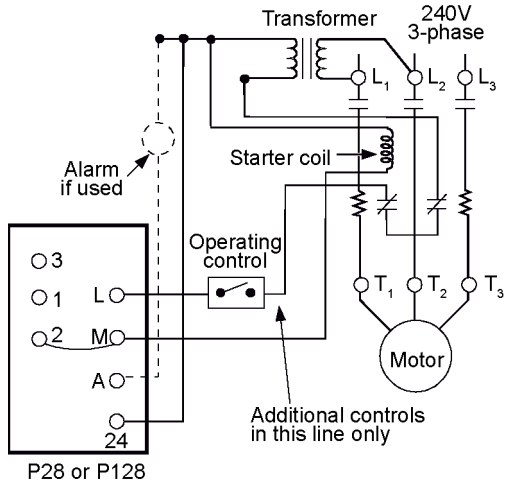


Figure 9: P28 or P128 with 24 V control circuit power from a step-down transformer

Note: For the following figure, the system provides shutdown on low lube oil pressure in either of two compressors that the common motor operates.

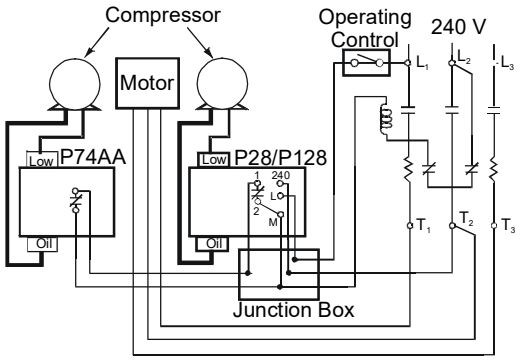


Figure 10: P28 or P128 and P74AA wired for an oil pressure control system with one motor operating two compressors

Adjustments

The P28 and P128 controls are shipped with a cutout pressure differential of 9 psi (62 kPa). However, you can adjust the controls according to the compressor manufacturer's specifications.

Note: When the controls are shipped as an accessory to the compressor unit, time delay and cut-out pressure are set to manufacturer's specifications. Make sure that replacement controls duplicate the manufacturer's specifications.

CAUTION: **Equipment damage hazard.** To avoid damage to the compressor, obtain the compressor manufacturer's net oil pressure specifications as soon as possible. If necessary, reset the cutout pressure difference to the manufacturer's specifications.

Setting the cutout pressure differential

When you do not know the manufacturer's specifications, complete the following steps to set the cutout pressure differential.

1. With the compressor running, read the oil pressure and the crankcase pressure.

2. Subtract the crankcase pressure reading from the oil pressure pump discharge reading. This is the net oil pressure to the bearings.

3. Use a standard screwdriver on the adjusting disk to set the cut-out pointer 6 psi to 8 psi (41 kPa to 55 kPa) below the established running net oil pressure.

   To increase the cut-out pressure, turn the adjusting disk counterclockwise. To decrease the pressure, turn the disk clockwise.

   To raise the pressure differential, turn the adjusting disk to the left when viewing the front of the control. See Figure 2. Turn the adjusting disk to the right to lower the pressure differential.

Testing for shutdown

Immediately after you install the control, and at regular intervals thereafter, test the time delay relay to verify that all circuits operate correctly.

> ⚠ WARNING: **Shock hazard.** Disconnect the power from the control before testing for shutdown to avoid electrical shock or damage to the equipment.

To test for shutdown, complete the following steps:

1. Remove the power from the control and remove the control cover.

2. Connect a jumper between Terminal 1 and Terminal 2. See Figure 3 for terminal locations.

   Note: If the control is mounted on a condensing unit where air from auxiliary equipment such as blowers or fans can strike the control, replace the control cover before you proceed to Step 3.

3. Apply power to start the compressor. Expect the time delay relay to trip after the time interval and stop the compressor.

4. Remove power from the control and remove the jumper between Terminals 1 and 2.

5. Replace the cover on the control and apply power.

6. Manually reset the time delay relay if required.

Checkout procedure

Before you leave the installation, observe at least three complete operating cycles to be sure that all components function correctly.

Repairs and replacement

Do not make field repairs, except for replacement of the time delay relay assembly. For a replacement control or time delay relay assembly, contact the nearest Johnson Controls representative or Refrigeration Application Engineering at 414-525-5535.

Table 3: Replacement time delay relay assemblies

Part number	Voltage	Reset type	Timing in seconds	Alarm circuit
RLY13A-600R	120/240 VAC	Manual	60	No
RLY13A-609R	24 VAC/VDC	Manual	120	No
RLY13A-610R	120/240 VAC	Manual	30	No
RLY13A-616R	120/240 VAC	Manual	120	No
RLY13A-617R	120/240 VAC	Manual	45	No

Ordering information

Table 4: Ordering information

Series part number	Pressure connections*	Reset type	Refrigerant	Time delay relay voltage	Alarm terminal	Runlight terminal
P28AA	Style 13	Manual	Non-corrosive All-range	120/240 VAC	No	No
P128AA	Style 5	Manual	Non-corrosive All-range	120/240 VAC	No	No
P28AN	Style 15	Manual	Ammonia	120/240 VAC	No	No
P28DN	Style 15	Manual	Ammonia	120/240 VAC	Yes	Yes
P28PA	Style 5	Manual	Non-corrosive All-range	24 VAC/VDC	No	No

* Style 5 connections are 1/4 in. / 6.4 mm SAE male flare connectors (no capillary tubing). Style 13 connections are 36 in. / 914 mm capillary tubing and 1/4 in. / 6.4 mm flare nut. Style 15 connections are 1/4 in. / 6.4 mm female National Pipe Thread connectors.

Specifications

Specification	Description
Product	P28 and P128 Series Lube Oil Controls with Built-in Time Delay Relay
Power requirements	See Table 1 and Table 2.
Pressure specifications	Adjustable cutout pressure difference: 8 to 70 psi (55 to 483 kPa)* Maximum differential: 70 psi (483 kPa) Maximum working pressure: 250 psig (1724 kPa) on the high side Maximum overpressure: 325 psi (2240 kPa) oil and low side pressure **The time delay relay de-energizes 3 psi to 5 psi (21 kPa to 34 kPa) above the cutout scale setting.*
Pressure switch units	Enclosed dust-protected Pennswitch
Ambient operating conditions	32 to 104°F / 0 to 40°C
Material	Case: 0.062 in. / 1.6 mm galvanized steel Cover: 0.028 in. / 0.7 mm cold rolled steel (plated and painted)
Wiring terminal	Large 8-32 x 1/4 in. binder head screws
Agency listings	UL Guide No. SDFY, File SA516 cUL Guide No. SDFY7, File SA516
Dimensions (H x W x D)	5.66 in. x 5.32 in. x 2.09 in. / 144 mm x 135 mm x 53 mm
Shipping weight	3.0 lb / 1.36 kg

Conformity declaration information

Specification	Description
Purpose of control	Pressure operating controls
Method of mounting control	Flat surface or with a universal mounting bracket (Part No. 271-51)
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
Rated impulse voltage	4,000 VAC

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult the local Johnson Controls Refrigeration Application Engineering at 414-525-5535. Johnson Controls shall not be liable for damages resulting from misapplication or misuse of its products.

Single point of contact

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