BULKY DOCUMENTS

(Exceeds 100 pages)

Proceeding/Serial No: 77612049

Filed: 8/24/2010

Title: REQUEST FOR RECONSIDERATION AFTER FINAL ACTION.

Part 2 of 2

77612049

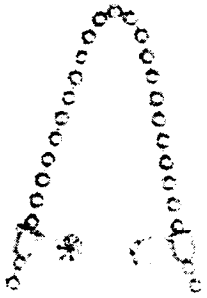


Fig. 2 – Beaded chain with sleeves installed. The "snap" plugs are used to hold the chain in the thermostat.

Fig. 3 – Back view of thermostat illustrating method of installing chain.

4. Be sure the thermostat is installed in a location where direct air from doors, windows and other cold air sources; or heat from heater discharge, lights and other heat sources will not unduly affect the thermostat operation.
5. Plug the heater cord into the thermostat extension cord. The heater cord should be 3-wire type with 3-prong plug for 120 Volt service and the "Green" wire should be connected to heater enclosure. For longer runs use only 3-wire extension cords which have 3-prong grounding type plugs and adequate wire size.

CAUTION: Do not dent or deform the sensitive bulb of this control. Denting or deforming will change the calibration and cause the control to cycle at a temperature lower than the dial setting.

Electrical Ratings

Volts, AC	120
Full Load Amps.	15
Locked Rotor Amps.	90
Non-Inductive	1800 Watts 120 VAC
Pilot Duty — 125 VA, 24/120 VAC	

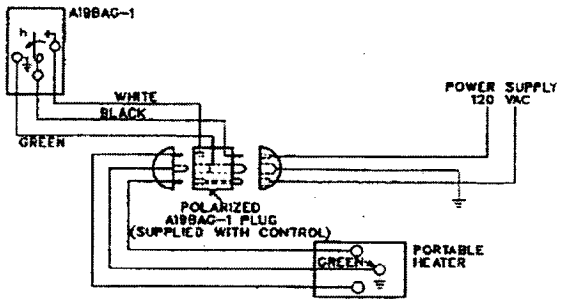
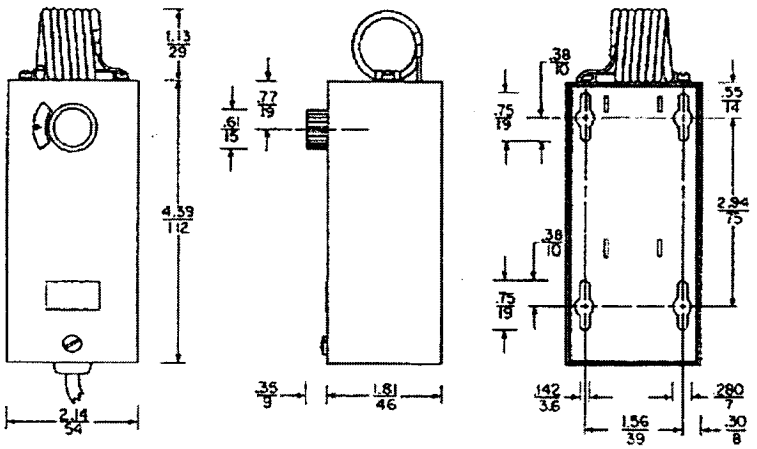


Fig. 4 — Schematic wiring hookup of Product Number A19BAG-1 with portable construction heater.



Dimensions In.
mm

Checkout Procedure

Before leaving the installation, observe at least three complete operating cycles to be sure that all components are functioning correctly.

Repairs and Replacement

Field repairs must not be made. For a replacement thermostat, contact the nearest Johnson Controls wholesaler.

Performance specifications appearing herein are nominal and are subject to accepted manufacturing tolerances and application variables.

JOHNSON CONTROLS

Controls Group
507 E. Michigan Street
P.O. Box 423
Milwaukee, WI 53202

Printed in U.S.A.

Types A19AUC, A19BUC Fixed Differential Thermostat For Hazardous Location

Application

The A19AUC and A19BUC thermostats are designed for use in locations where flammable and explosive mixtures of vapors and gases with air or combustible dust in air are present. Listed at UL for "Hazardous Locations, Class I, Group D (NEMA 7) and Class II, Groups E, F and G (NEMA 9)" as defined in the National Electrical Code. The SPDT contact unit provides open high or close high action for either heating or cooling applications.

The thermostats are available to cover sensed temperatures from -30 to 475°F (-34 to 246°C). Closed tank fittings and bulb wells are available for immersion applications.

All Series A19 thermostats are designed for use *only* as operating controls. Where an operating control failure would result in personal injury and/or loss of property, it is the responsibility of the installer to add devices (safety, limit controls) or systems (alarm, supervisory systems) that protect against, or warn of, control failure.

Features

- Dependable and precise snap-acting contacts enclosed in a dust protected case and the liquid filled sensing element are field proven.
- Unaffected by barometric pressure and cross ambient temperature problems for "repeat" accuracy.
- SPDT contacts for use on either heating or cooling applications.
- UL Listed, CSA Certified for "Hazardous Locations."

General Description

The temperature sensing elements are liquid filled, providing uniform differential throughout the selected adjustment range. Remote bulb elements are regularly supplied with a 6 foot. (1.8 m) capillary. Requests for other construction variations should be sent to Customer Service.

The range adjustment changes the cut-in and cutout points alike. The differential is nonadjustable.

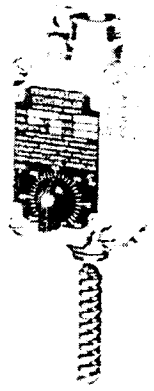


Fig. 1 – A19BUC thermostat with air bulb.

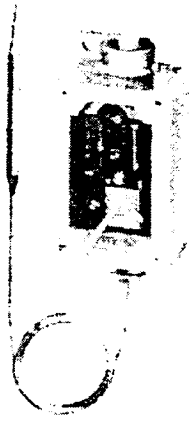


Fig. 2 – Interior view of the A19AUC with clamp on bulb.

Specifications

Type Number	**A19AUC**	SPDT Contact Action, Remote Sensing Element
	A19BUC	SPDT Contact Action, Coiled Bulb
Range, Differential and Maximum Temperature		See Selection and Range Table
Enclosure		UL Listed for Hazardous Locations
Switch		Snap-Acting Contacts in Dust Protected Enclosure
Capillary	**A19AUC**	6 ft (1.8 m) Standard Length
Finish		Natural Aluminum
Conduit Opening		½" Female, NPT
Mounting		Two 3/8" Diameter Holes
Wiring Connections		Screw Type Terminals
Shipping Weight		2.6 lb (1.2 kg)

These thermostats are suitable for installation in hazardous locations as defined in the National Electrical Code, where the atmosphere may contain the following:

1. Certain vapors and gases.
2. Dust such as aluminum, magnesium or their commercial alloys.
3. Carbon black, coal or coke dusts.
4. Flour, starch or grain dusts.

© 1991 Johnson Controls, Inc.

Code No. LIT-121035
Part No. 3544, Rev. I

Installation Instructions
Issue Date August 24, 2005

A28PA and A28PJ Type Two-Stage Temperature Controls with NEMA Type 4X Raintight Enclosures

Application

IMPORTANT: The A28PA and A28PJ Type Temperature Controls are intended to control equipment under normal operating conditions. Where failure or malfunction of an A28PA or A28PJ temperature control 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) intended to warn of or protect against failure or malfunction of the A28PA or A28PJ temperature control must be incorporated into and maintained as part of the control system.

The A28PA and A28PJ type two-stage electromechanical temperature controls are designed for use in many agricultural applications. The A28PA and A28PJ controls have rugged Noryl plastic enclosures and are UL Listed as NEMA Type 4X. A28PA and A28PJ controls are also UL Listed for use in National Electrical Code (NEC) Article 547 Agricultural Environments (ANSI/NFPA 70).

Two Single-Pole, Double-Throw (SPDT) switches allow independent stage control circuits. Each switch may be wired for open-high or close-high action, providing automatic changeover on heating/cooling applications. A jumper across the switches' common (red) terminals is supplied as a standard feature.

The adjustable A28PA and A28PJ type temperature controls have O-ring sealed external setpoint adjustment knobs and range scales with oversized markings for easy readability in low light.

IMPORTANT: Do not dent, bend, uncoil, or otherwise alter the position of the sensing element (coil) mounted on the base of the A28PA and A28PJ type controls. Damaging the sensing element (coil) may change the control calibration and voids any warranties on the control.

Operation

The circuit between R and Y of the low stage switch (RY_L) closes, and R and B (RB_L) opens on temperature increase to the setpoint (dial setting). On a further temperature increase, the high stage switch closes RY_H and opens RB_H. The reverse sequence occurs on a temperature decrease.

Installation

Dimensions

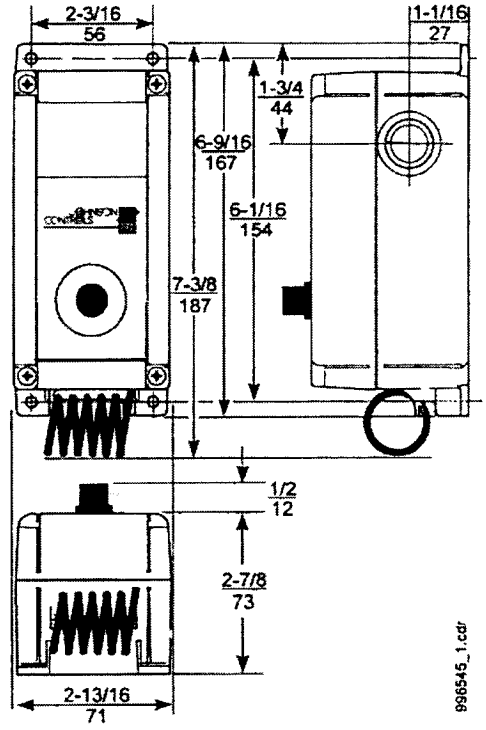


Figure 1: Dimensions for A28PA and A28PJ Type Temperature Controls with NEMA Type 4X Enclosures, in./mm

Mounting

Mount the temperature control where it is exposed to the average temperature of the controlled space. Do not mount it where it can be affected by unusual heat or cold, such as over an animal stall or in direct sunlight. Avoid locations near doors, windows, or other sources of non-ambient air drafts. Do not mount the control on an outside wall or where temperature at the sensing element exceeds 140°F (60°C).

© 2005 Johnson Controls, Inc.

Mount the temperature control to a flat surface with screws through the holes in the mounting ears on the back of the case. See **Error! Reference source not found.**.

Wiring

WARNING: Risk of Electric Shock. Disconnect each of multiple power supplies before making electrical connections. More than one disconnect 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: All wiring must conform to all local, national, and regional regulations. Use copper conductors only for all wire connections.

IMPORTANT: Do not use A28 temperature controls on applications where the electrical load across the control's switch may exceed the electrical ratings shown on the temperature control's label.

IMPORTANT: Use only the terminal screws furnished with the switch. Using other screws in the switch voids the warranty, may damage the switch, and may cause problems in making secure connections.

Wiring terminals of each switch are color coded to simplify wiring. Red (R) is the common terminal. The red to yellow (Y) circuit closes on temperature increase and is typically used to control cooling or ventilating equipment. The red to blue (B) circuit opens on temperature increase and is typically used to control heating equipment.

To make wiring connections, proceed as follows:

1. Loosen the four cover screws and remove the cover and knob assembly. The knob is secured in the cover and must not be removed. Do not damage the O-ring.
2. Select the knockout to be removed. Place a screwdriver blade on the knockout near the edge. Apply a sharp blow to the screwdriver handle to loosen the knockout.

Note: For watertight connection to rigid conduit, connect an approved watertight conduit fitting to the conduit first, and then connect the fitting to the A28PA or A28PJ control enclosure.

3. Insert wire through conduit opening.
4. Make wiring connections to the screw terminals. See Figure 2, Figure 3, and Figure 4.
5. Ensure that the O-ring is seated properly. Replace the cover and knob assembly. Be sure to check the alignment of the range adjustment knob.

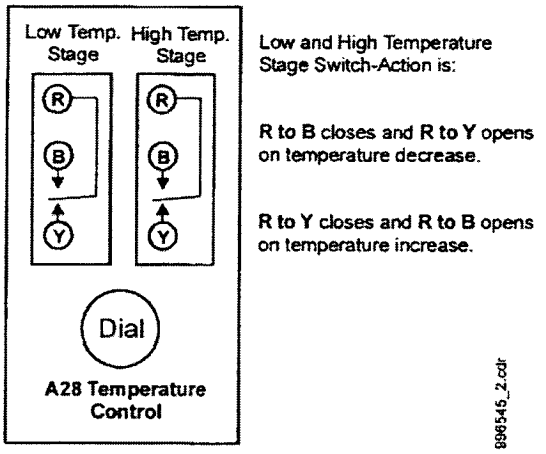


Figure 2: A28 Temperature Control Switch Action

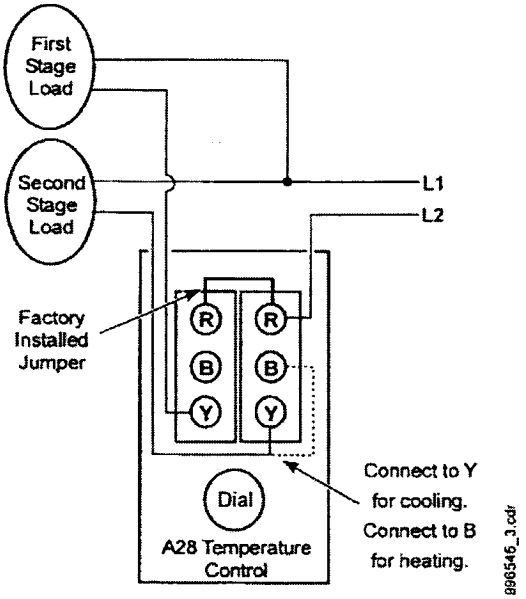


Figure 3: Typical A28 Control Wiring for Two-Stage Control Circuit

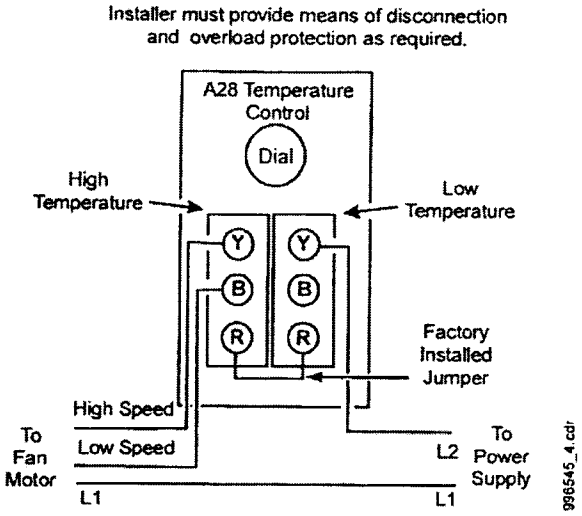


Figure 4: Typical A28 Control Wiring for Two-Speed Ventilating Fan

Setup and Adjustments

Turn the knob on the front of the A28 temperature control to adjust both of the control's temperature setpoints simultaneously.

> **WARNING: Risk of Electric Shock.**
> Disconnect all electric power sources from the A28 thermostat before removing the A28 thermostat cover. Contact with internal components carrying hazardous voltage can cause electric shock and may result in severe personal injury or death.

All A28 thermostat models have a fixed differential on each switch. Some models have an adjustable inter-stage differential. To adjust those models with inter-stage differential:

1. Remove the control cover and rotate the adjusting wheel counterclockwise to increase the differential. (Increase spread as per label on control).
2. Use a small screwdriver and insert into serrated wheel at the lower left corner of the low temperature stage switch.
3. Replace and secure cover with screws when adjustments are complete.

Checkout

Before leaving the installation, observe at least three complete operating cycles of the controlled equipment to ensure that all components are functioning correctly.

Adjust the dial to a lower or higher set point and check contact action of the switches to see that they are operating as illustrated in Figure 2, Figure 3, and Figure 4.

Repairs and Replacement

All A28 temperature controls are not field repairable. Do not attempt to repair any control that is not functioning properly. Contact your Johnson Controls/PENN® sales representative or authorized distributor for a replacement control.

Technical Specifications

Product	A28PA and A28PJ Type Two-Stage Temperature Controls with NEMA Type 4X Raintight Enclosures					
A28PA Type Switch Electrical Ratings (per switch)	**Applied VAC**	**24**	**120**	**208**	**240**	**277**
	Motor, full load Amperes	-	16	9.2	8	-
	Motor, locked rotor Amperes	-	96	55.2	48	-
	Non-inductive Amperes	-	16	9.2	8	7.2
	Pilot duty Volt-Amperes	125	125	125	125	125
	Total connected load not to exceed 2,000 VA					
A28PJ Type PENN® Switch Electrical Ratings (per switch)	**Applied VAC**	**24**	**120**	**208**	**240**	**277**
	Motor, full load Amperes	-	6	3.4	3	-
	Motor, locked rotor Amperes	-	36	20.4	18	-
	Non-inductive Amperes	-	10	9.2	8	7.2
	Pilot duty Volt-Amperes	125	125	125	125	125
	Total connected load not to exceed 2,000 VA					
Ambient Operating Temperature	-26 to 140°F (-32 to 60°C)					
Ambient Storage Conditions	-40 to 140°F (-40 to 60°C)					
Shipping Weight	1.2 lb (0.54 kg)					
Agency Listings	UL Listed; File E6688, CCN XAPX (US) and XAPX7 (Canada) UL Listed as Type 4X and for NEC Article 547 Agricultural Environments					

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

JOHNSON CONTROLS

Controls Group
507 E. Michigan Street
P.O. Box 423
Milwaukee, WI 53201

Published in U.S.A.
www.johnsoncontrols.com

A28 Series Two-Stage Temperature Controls With NEMA 1 Enclosure

Application

These two-stage controls are designed to cover a broad range of general purpose operating temperature control applications in the refrigeration, air conditioning and heating fields.

Two SPDT switches permit independent control circuits. Each switch may be wired for "open high" or "close high" action, as required, providing automatic changeover on heating-cooling or similar requirements. Models are available with close differential on each switch. A jumper across the "common" terminals is supplied as a standard feature. Models are available for fixed or adjustable between stage differential.

All Series A28 temperature controls are designed for use only as operating controls. Where an operating control failure would result in personal injury and/or loss of property, it is the responsibility of the installer to add devices (safety, limit controls) or systems (alarm, supervisory systems) that protect against, or warn of, control failure.

Operation

Figure 8 illustrates the operation of the A28AA. On a temperature increase to the dial setting, the circuit between R and Y of the low stage switch (RY_L) closes. Simultaneously the circuit between R and B (RB_L) opens. On a further increase in temperature the high stage switch operates and closes RY_H while simultaneously opening RB_H. The reverse sequencing takes place on a temperature fall.

Installation

Follow equipment manufacturer's instructions if provided. If instructions are not provided, proceed as follows:

Mounting

Controls are normally mounted to a surface through holes in back of case.

▲ CAUTION: On rough mounting surfaces use the top two mounting holes only. When these controls are mounted on an uneven surface using screws in all four holes, the case can be twisted enough to affect the control's calibration and operation.

For closed tank applications without well assembly, Part FTG 13A-600R packing nut assembly may be supplied. See Fig. 4 for sequence of installation. Place parts over support tube section of the element, placing bulb into tank (be sure tank is drained so liquid level is below tank opening). Tighten the 1/2 in. NPT adapter. Screw packing nut into adapter with the retaining washers and packing in place as shown.

To install models supplied with a bulb well, first install the bulb well into the tank opening. Remove bushing from the bulb well and slide the bushing over capillary. Place the bulb and bushing into the well. Push bulb into position in bottom of the well. Tighten set screw in end of the adapter to hold bulb in position. See Fig. 5 for bulb well installation.

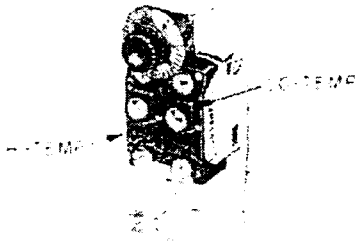


Fig. 1 -- Interior view showing high stage and low stage switches.

▲ CAUTION: Do not dent or deform the sensing bulb of this control. A dent or deformation will change the calibration and cause the control to cycle at a temperature lower than the dial setting. When the bulb mounting clip is used to mount the bulb near the refrigerant tubing, be sure the sheet metal screw does not pierce the tubing.

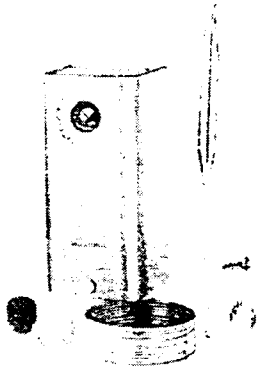


Fig. 2 -- The A28 with remote bulb and convertible adjustment has a snap-in plug in the cover, a knob for field installation, and a bulb mounting clip with sheet metal screw.

© 1988 Johnson Controls, Inc.
Code No. LIT-121090
Part No. 996-318

Wiring

▲ CAUTION: Disconnect power supply before wiring connections are made to avoid possible electrical shock or damage to equipment.

Follow equipment manufacturer's diagrams if provided. Wiring should conform to local codes and the National Electrical Code. Wiring terminals of each

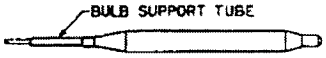


Fig. 3 — Style 1 swaged bulb with support tube for clamp-on or closed tank applications.

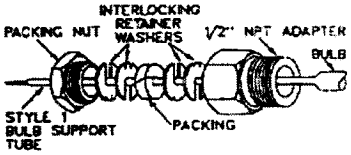
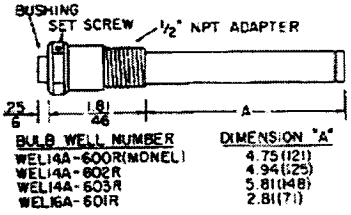


Fig. 4 — Part Number FTG13A-600R packing nut assembly. (Use with Style 1 bulb with support tube for direct immersion applications.)



BULB WELL NUMBER	DIMENSION "A"
WELL4A-600R(MONEL)	4.75 (121)
WELL4A-602R	4.94 (125)
WELL4A-603R	5.81 (148)
WELL6A-601R	2.81 (71)

Fig. 5 — Bulb well for liquid immersion applications where a temperature bulb may be removed without draining tank.

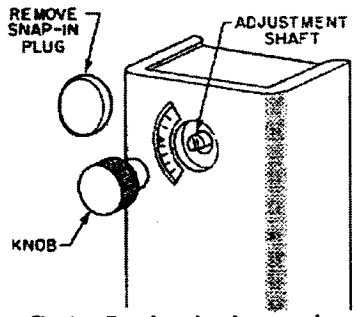


Fig. 6 — Drawing showing snap-in plug removed and the knob in line to assemble. Press the knob onto the slotted shaft.

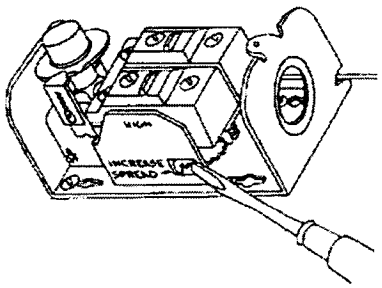


Fig. 7 — Between-stages differential can be increased by rotating adjusting cam counterclockwise as illustrated above.

Pennswitch are color coded for convenience and to simplify wiring. Red is the common terminal; red to yellow circuit closes on temperature increase, red to blue circuit opens on temperature increase. Use copper conductors only.

▲ CAUTION: Use terminal screws furnished (8-32 x 1/4 in. binder head). Substitution of other screws may cause problems in making proper connections.

Adjustments

All models have fixed differential on each Pennswitch. To adjust controls with between-stage differential, rotate adjusting wheel *counterclockwise* to widen the differential (increase spread). Use a small screwdriver and insert into serrated wheel. (See Fig. 7.)

Knob range adjustment or screwdriver slot adjustment supplied on range screw. Convertible adjustment models can be field converted from

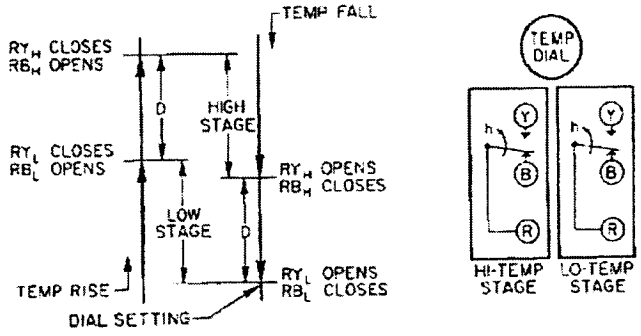


Fig. 8 — Switching action of the two-stage control is illustrated in the sketch above, RB_H, RY_H indicates HI-TEMP stage; RB_L, RY_L, indicates LO-TEMP stage. "D" represents the differential between stages.

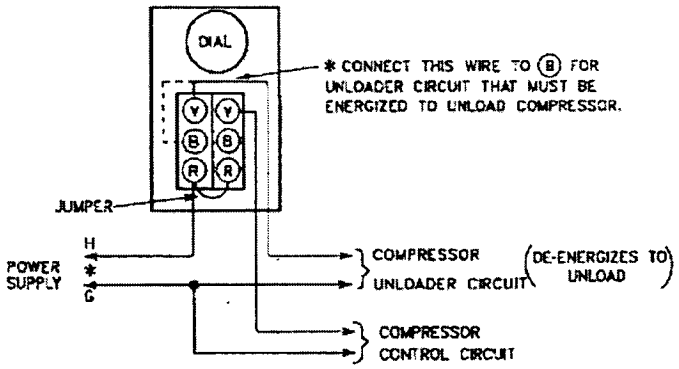


Fig. 9 — Typical wiring diagram of a refrigeration compressor with single stage unloader. Two compressor packages may be sequenced with same circuit.

Notes

JOHNSON CONTROLS

Controls Group
507 E. Michigan Street
P.O. Box 423
Milwaukee, WI 53202

Printed in U.S.A.

JOHNSON CONTROLS PEMI

Master Catalog 125
Temperature Controls Section A
Product Bulletin A28
Issue Date 0988

A28 Series Two-Stage Temperature Controls with NEMA 1 Enclosure

Application

These two-stage controls are designed to cover a broad range of general purpose operating temperature control applications in the refrigeration, air conditioning and heating fields.

Two SPDT switches permit independent control circuits. Each switch may be wired for "open high" or "close high" action, as required. Models are available with close differential on each switch. A jumper across the "common" terminals is supplied as a standard feature.

Models are available for fixed or adjustable between stage differential.

All Series A28 temperature controls are designed for use *only* as operating controls. Where an operating control failure would result in personal injury and/or loss of property, it is the responsibility of the installer to add devices (safety, limit controls) or systems (alarm, supervisory systems) that protect against, or warn of, control failure.

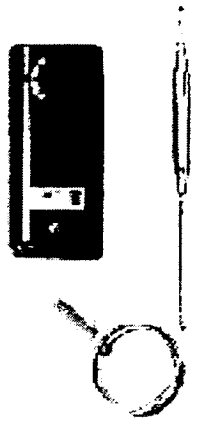


Fig. 1 – Exterior of the A28. Knob range adjustment is shown.

Specifications

Type Number	**A28AA**	Two SPDT Switches, Standard Differential
	A28AJ	Two SPDT Switches, Close Differential
Conduit Opening		7/8" (22 mm) Dia. Hole for 1/2" Conduit
Contact Action		Red to Yellow Closes on Temperature Rise Red to Blue Opens on Temperature Rise
Switch		SPDT, Snap-Acting Contacts in Dust Protected Enclosure
Differential	**Each Switch**	Fixed
	Between Stages	Adjustable or Fixed, As Specified
Enclosure	**Case**	0.062" (1.6 mm) Cold Rolled Steel
	Cover	0.025" (0.6 mm) Cold Rolled Steel
Finish		Gray Baked Enamel
Shipping Weight	**Individual Pack**	1.1 lb (0.5 kg)
	Overpack of 50 Units	56 lb (25 kg)

Features

- "Repeat" accuracy which is unaffected by barometric pressure and cross ambient temperature problems.
- Dependable single-pole, double-throw snap acting contacts in dust protected enclosure.
- Special close differential models available for critical requirements.

Range and Bulb Specifications

Adjustable Range (1) °F (°C)	Differential °F (°C) Each Switch, Fixed Standard	Each Switch, Fixed Close	Between Stages Adjustable or Fixed	Maximum Bulb Temperature (2) °F (°C)	Bulb Size in (mm)	Bulb Style (3)
–30 to +50	5	2.5	2 to 7 as Specified	140	.375 x 4	1 or
(–35 to +10)	(2.8)	(1.4)	(1.1 to 3.9)	(60)	(9.5 x 102)	4
20 to 80	3.5	2	2 to 7 as Specified	140	.375 x 5	1 or
(–7 to +28)	(1.9)	(1.1)	(1.1 to 3.9)	(60)	(9.5 x 127)	4
40 to 90	3	1.5	2 to 7 as Specified	140	.375 x 6	1 or
(5 to 30)	(1.7)	(0.8)	(1.1 to 3.9)	(60)	(9.5 x 152)	4
30 to 110	3.5	2	2 to 7 as Specified	140	.094 x 144	9
(0 to 43)	(1.9)	(1.1)	(1.1 to 3.9)	(60)	(2.4 x 3658)	

(1) Other available ranges on quantity orders are –20 to +60°F (–29 to +15°C), –10 to +70°F (–23 to +21°C), 40 to 120°F (5 to 49°C), 50 to 200°F (10 to 90°C), 60 to 130°F (15 to 55°C), 60 to 140°F (15 to 60°C) and 100 to 240°F (40 to 120°C).

(2) Maximum bulb temperature which the element can withstand at infrequent intervals during the life of the control, such as shipping conditions. This is not the temperature which the control can withstand on repeat cycles.

(3) Style 4 is obtained by using Style 1 with support tube and adding FTG13A-600R packing nut assembly for 1/2" NPT tapping.

© 1988 Johnson Controls, Inc.

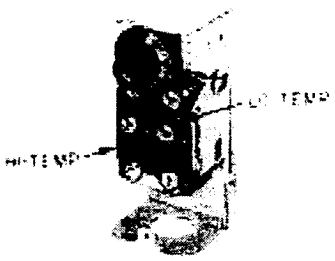


Fig. 2 – Interior view showing high temperature (stage) and low temperature (stage) switches.

General Description

Controls are compact with nonadjustable differential on each switch. Knob range adjustment and visible scale are standard. Models are available with a knob for field convertible adjustment. These models are supplied with a snap-in plug in the cover for concealed screwdriver slot adjustment. Other features include a liquid-filled, copper sensing element which is unaffected by barometric pressure and cross-ambient temperature problems.

Controls may be supplied for immersion applications for use with a closed tank connector or with a bulb well assembly. A low cutout stop, which can be set in the field, is an integral part of the control.

Optional Constructions

Ambient Compensation

Available at extra cost.

Bulb

Coil bulb for low movement air application may be supplied. Also available is a 3/16 in. (4.76 mm) diameter by 22 in. (558 mm) long bulb for detecting the average temperature in air ducts.

Capillary

Capillary longer than 6 feet (1.8 m) available at extra cost. Capillary from 6 to 10 feet (1.8 to 3 m) in 2 foot (0.6 m) increments; over 10 feet (3 m) in 5 foot (1.5 m) increments.

Packing Nut

Part No. FTG 13A-600R is available for closed tank applications where the temperature does not fall below –35°F (–37°C) or exceed +250°F (121°C).

Maximum liquid pressure limit is 150 psig (1034 kPa). For applications where the temperature or liquid pressure exceeds these limits, specify Style 4 element with all metal packing nut as an integral part of the control.

Range Adjuster

Screwdriver slot with visible scale or screwdriver slot with internal scale and solid cover optional at no extra cost (quantity orders only). Models are available with knob, snap-in plug and remote bulb mounting clip for field convertible adjustment. This provides conversion to knob, concealed screwdriver slot or external screwdriver slot adjustment.

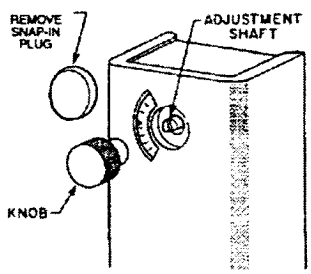


Fig. 3 – Drawing showing snap-in plug removed and the knob in line to assemble. Press the knob onto the slotted shaft.

Electrical Ratings

A28AA — Standard Differential

Volts, AC	120	208	240	277
Full Load Amp	16.0	9.2	8.0	—
Locked Rotor Amp	96.0	55.2	48.0	—
Non-Inductive or Resistance Load Amp (Not Lamp Loads)	16.0	9.2	8.0	7.2
Pilot Duty — 125 VA, 24/277 VAC				

NOTE: When used as a two circuit switch, the total connected load must not exceed 2000 VA.

A28AJ — Close Differential

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

NOTE: When used as a two circuit switch, the total connected load must not exceed 2000 VA.

Ordering Information

To order, specify:

1. Type number (see Type Number Selection).
2. Range required.
3. Between-stage differential (nonadjustable models only).
4. Capillary length, if other than 6 feet (1.8 m).
5. Packing nut assembly or bulb well, if required.
6. Specify type of range adjustment if other than knob adjustment.

Repairs and Replacement

Field repairs must not be made. For a replacement control, contact the nearest Johnson Controls wholesaler.

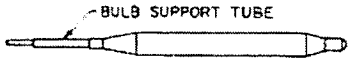


Fig. 4 – Style 1 swaged bulb with support tube for clamp-on or closed tank applications

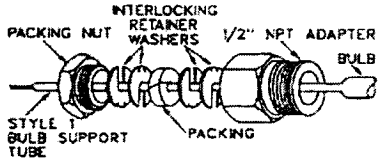
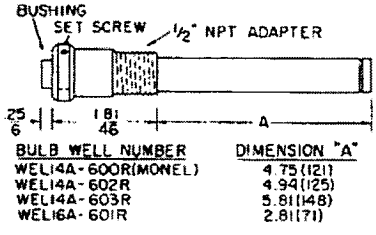


Fig. 5 – Part Number FTG13A-600R packing nut assembly. (Use with Style 1 bulb with support tube for direct immersion applications.)



BULB WELL NUMBER	DIMENSION "A"
WELI4A-600R(MONEL)	4.75(121)
WELI4A-602R	4.94(125)
WELI4A-603R	5.81(148)
WELI6A-601R	2.81(71)

Fig. 6 – Bulb well for liquid immersion applications where a temperature bulb may be removed without draining tank.

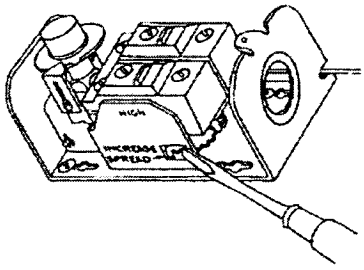


Fig. 7 – Between-stages differential can be increased by rotating adjusting cam counterclockwise as illustrated above.

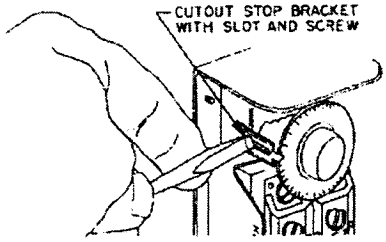


Fig. 8 – The controls have a screw type cutout stop. The stop screw must be loosened and moved to the stop setting desired. Tighten screw after setting is made.

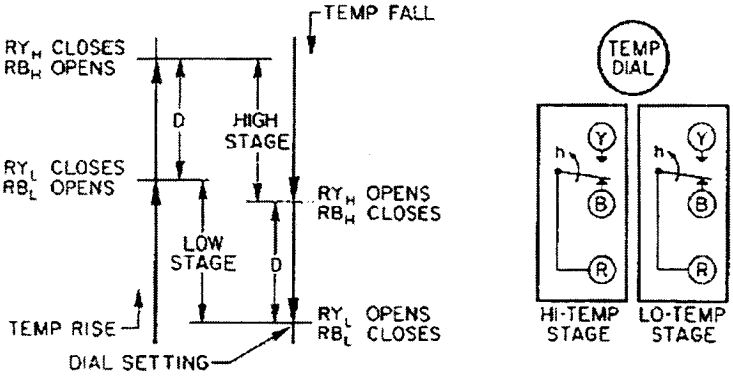


Fig. 9 – Switching action of the two-stage control is illustrated in the sketch above. RB_H, RY_H indicates HI-TEMP stage; RB_L, RY_L indicates LO-TEMP stage. "D" represents the differential between stages.

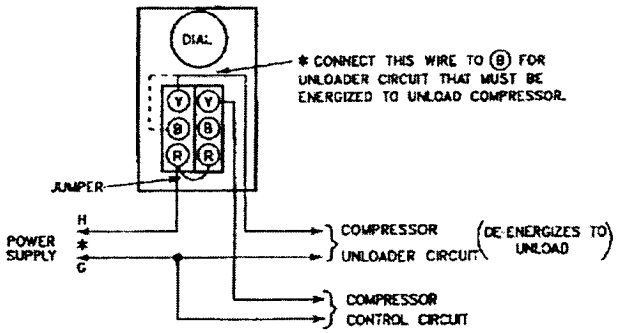
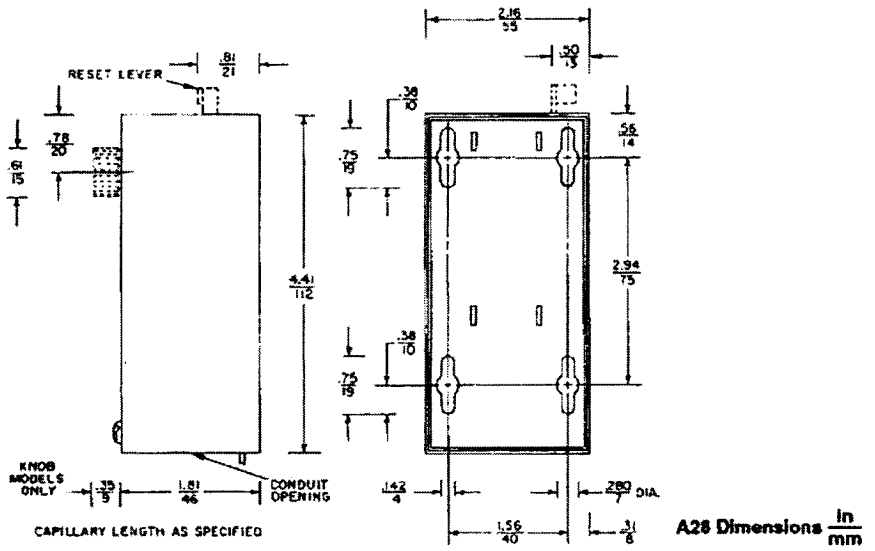
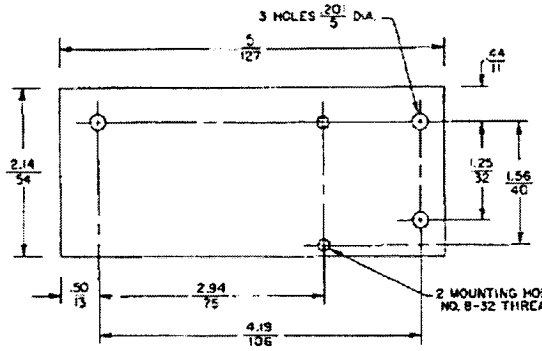


Fig. 10: Typical wiring diagram of a refrigeration compressor with single-stage unloader. Two compressor packages may be sequenced with the same circuit.



A28 Dimensions $\frac{\text{in}}{\text{mm}}$



Optional Mounting Bracket Dimensions $\frac{\text{in}}{\text{mm}}$

Performance specifications appearing herein are nominal and are subject to accepted manufacturing tolerances and application variables.

JOHNSON CONTROLS

Controls Group
507 E. Michigan Street
P.O. Box 423
Milwaukee, WI 53201

UL Guide No. XAPX
File No. E6688
CSA Class No. 4813 02
File LR948

Printed in U.S.A.

A28 Series Two-Stage Temperature Controls Less Enclosure

Application

These two-stage open type temperature controls are designed for mounting in cases or enclosures that are a part of the equipment on which they are installed. Controls are designed to cover a broad range of general purpose operating temperature control applications in the refrigeration, air conditioning and heating fields. Two SPDT switches permit independent control circuits. Each switch may be wired for "open high" or "close high" action as required, providing automatic changeover on heating-cooling or similar requirements.

Available with close differential on each switch. A jumper across the "common" terminals is supplied as standard. Models are available for fixed or adjustable between stage differential.

All Series A28 temperature controls are designed for use *only* as operating controls. Where an operating control failure would result in personal injury and/or loss of property, it is the responsibility of the installer to add devices (safety, limit controls) or systems (alarm, supervisory systems) that protect against, or warn of, control failure.

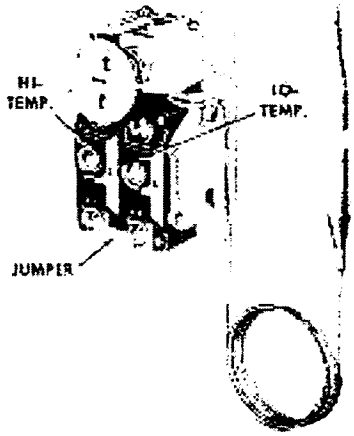


Fig. 1 -- The A28GA with calibrated dial and pointer.

Specifications

Type Number	**A28GA**	Two SPDT Switches, Standard Differential
	A28GJ	Two SPDT Switches, Close Differential
Switch		SPDT, Snap-Acting Contacts in Dust Protected Enclosure
Differential	**Each Switch**	Fixed
	Between Stages	Adjustable or Fixed, As Specified
Finish		Zinc Plate
Material	**Baseplate**	0.063" (1.6 mm) Cold Rolled Steel
	Frame	0.050" (1.3 mm) Cold Rolled Steel
Shipping Weight	**Individual Pack**	0.8 lb (0.36 kg)
	Overpack 40 Units	34 lb (15.4 kg)
	Bulk Pack 50 Units	44 lb (20 kg)

Electrical Ratings

A28GA — Standard Differential

Volts, AC	120	208	240	277
Full Load Amp	16.0	9.2	8.0	—
Locked Rotor Amp	96.0	55.2	48.0	—
Non-Inductive or Resistance Load Amp* (Not Lamp Loads)	16.0	9.2	8.0	7.2
Pilot Duty — 125 VA, 24 to 277 VAC				

*SPST Rating. Total connected load must not exceed 2000 VA.

A28GJ — Close Differential

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

*Total connected load must not exceed 2000 VA.

Features

- Dependability -- precision snap-acting contacts in a dust protected enclosure.
- Flexibility -- wide choice of ranges, mounting and element styles.
- Precision repeat accuracy which is unaffected by barometric pressure and cross ambient problems.
- Special close differential models with case compensation of ambient temperatures available for critical requirements.

© 1991 Johnson Controls, Inc.
Code No. LIT-125125

General Description

These controls have a nonadjustable differential on each switch. Available with 1/4 in. shaft and choice of .156 in. or .187 in. flat for knob mounting (knob not supplied), screwdriver adjustment or factory sealed setting on quantity orders (see Optional Constructions). Standard shaft rotation is clockwise for warmer when facing adjusting shaft. Also available with calibrated dial and pointer.

Other features include a liquid-filled, copper sensing element which is unaffected by barometric pressure and cross ambient temperature problems. Controls may be supplied for immersion applications for use with a closed tank connector or with a bulb well assembly.

CAUTION: Do not dent or deform the sensitive bulb of this control. A dent or deformation will change the calibration and cause the control to cycle at a temperature lower than the dial setting.

Optional Constructions

Sensing Elements

3/8 in. (9.5 mm) diameter bulb and 6 ft (1.8 m) capillary are standard.

Optional construction at extra cost, on quantity orders, include:

1. Capillary longer than 6 feet.
2. Bulbs 3/16 in. (4.8 mm), 1/4 in. (6.4 mm) or 5/16 in. (7.9 mm) O.D.
3. Coil bulbs for low movement air applications.
4. 3/16 in. x 22 in. long bulb for detecting the average temperature in airducts (20 to 90°F [-7 to +32°C] range only).

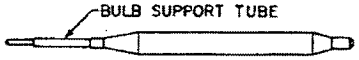


Fig. 2 — Style 1 swaged bulb with support tube for clamp-on or closed tank applications.

Adjustment Options

Range adjustment changes cut-in and cutout points alike. Available with fixed or adjustable differential between stages. Adjustment options, on quantity orders, are:

1. 1/4 in. (6.4 mm) shaft with .156 in. (3.96 mm) or .187 in. (4.75 mm) milled flat for buyers' knobs (Fig. 11).
2. Screwdriver slot with stops, colder-warmer dial (Fig. 9).

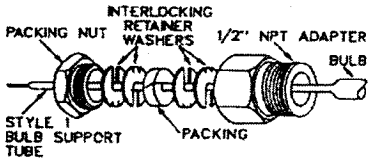
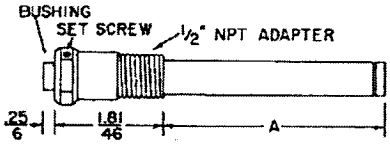


Fig. 3 — Part Number FTG13A-600R packing nut assembly. (Use with Style 1 bulb with support tube for direct immersion application.)

3. Factory sealed setting (Fig. 10).
4. Calibrated dial and pointer, with factory adjustable (not field) low cutout or high cutout stops when specified on quantity orders (Fig. 8).

Example: Low temperature thermostat may have low cutout stop set from -10 to -30°F (-23 to -34°C). High cutout stop may be set from +30 to +50°F (-1.1 to 10°C).



BULB WELL NUMBER	DIMENSION "A"
WEL14A-600R(MONEL)	4.75 (121)
WEL14A-602R	4.94 (125)
WEL14A-603R	5.81 (148)
WEL16A-601R	2.81 (71)

Fig. 4 — Bulb well for liquid immersion applications where a temperature bulb may be removed without draining tank.

Range, Differential and Bulb Specifications

Adjustable Range °F / °C	Differential °F / °C: Each Stage, Fixed — Standard	Each Stage, Fixed — Close	Between Stages — Adjustable or Fixed	Maximum Bulb Temperature(1) °F / °C	Bulb Size in. / mm	Bulb Style (2)
-30 to +50 / -35 to +10	5 / 2.8	2.5 / 1.4	2 to 7 as specified / 1.1 to 3.9	140 / 60	3/8 x 4 / 9.5 x 102	1 or 4
20 to 90 / -7 to +32	3.5 / 1.9	2 / 1.1	2 to 7 as specified / 1.1 to 3.9	140 / 60	3/8 x 5 / 9.5 x 127	1 or 4
40 to 90 / 5 to 30	3 / 1.7	1.5 / 0.8	2 to 5 as specified / 1.1 to 2.8	140 / 60	3/8 x 6 / 9.5 x 152	1 or 4
60 to 90 / 15 to 35	2.5 / 1.4	1.5 / 0.8	2 to 5 as specified / 1.1 to 2.8	140 / 60	3/8 x 7 / 9.5 x 178	1 or 4
100 to 240 / 38 to 116	5.5 / 3.1	2.75 / 1.5	2 to 7 as specified / 1.1 to 3.9	290 / 143	3/8 x 3 7/8 / 9.5 x 98	1 or 4

(1) Maximum bulb temperature which the element can withstand at infrequent intervals during life of control, such as shipping conditions. This is not the temperature which the control can withstand on repeat cycles.

(2) Style 4 is obtained by using Style 1 with support tube and adding FTG13A-600R packing nut assembly for 1/2" NPT tapping.

Terminals

1. Number 8-32 binder head screw terminals, standard.
2. 1/4 in. x .032 in. male quick-connect terminals on models without calibrated dial, at extra cost.

Packing Nut

Part Number FTG13A-600R is available for closed tank applications where the temperature is within -35 to +250°F (-37 to 121°C). Maximum liquid pressure limit is 150 PSIG (1034 kPa). For applications where the temperature or liquid pressure exceeds these limits specify Style 4 element with all metal packing nut as an integral part of the control.

Packaging

Bulk pack is standard. Orders for a single shipment of less than 50 controls will be individually packaged. Individual packaging charges will apply.

Repairs and Replacement

Field repairs must not be made. Controls requiring attention should be returned to the factory. When ordering a replacement control specify Product and Serial Number as shown on the control.

Ordering Information

To order, specify:

1. Type Number (see Specification Table).
2. Range required.
3. Between stage differential (nonadjustable models only).
4. Capillary length, if other than 6 feet.
5. Type of bulb.
6. Type of mounting.
7. Type of adjustment. If knob shaft is required, specify length (Dim. "B"), flat (Dim. "A") and length of flat (Dim. "C"). (See Figs. 11 and 13.)
8. Packing nut or bulb well, if required.

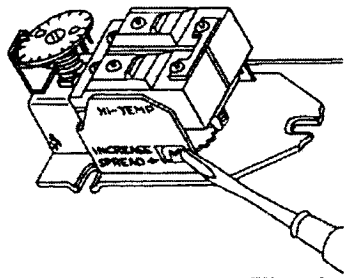


Fig. 5 — Between-stages differential can be increased by rotating adjusting cam counterclockwise as illustrated above.

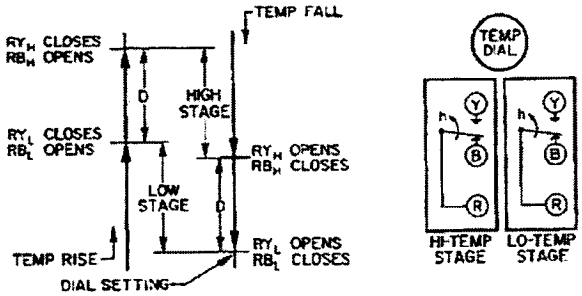


Fig. 6 — Switching action of the two-stage control is illustrated in the sketch above, RB$_H$, RY$_H$ indicates HI-TEMP; RB$_L$, RY$_L$ indicates LO-TEMP. "D" represents the differential between stages.

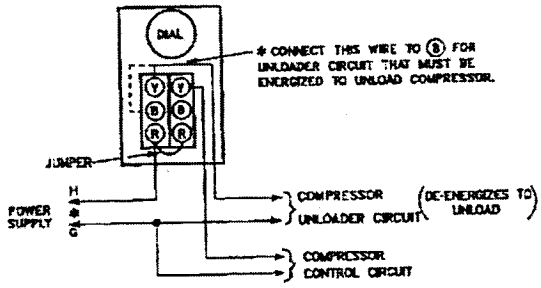


Fig. 7 — Typical wiring diagram of a refrigeration compressor with single stage unloader. Two compressor packages may be sequenced with same circuit.

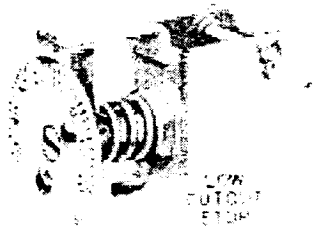


Fig. 8 — Calibrated dial and pointer with factory adjustable low cutout stop.

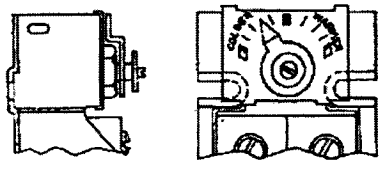


Fig. 9 — Drawing showing screwdriver slot range adjustment with stops.

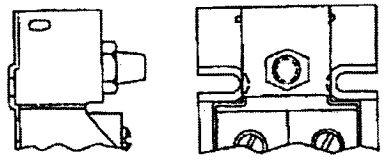


Fig. 10 — Drawing showing factory sealed setting.

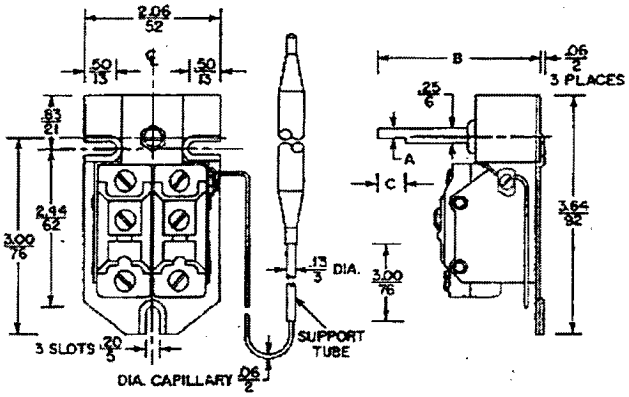


Fig. 11 — Dimension drawing showing side and front views (1/4" [6 mm] shaft adjustment shown).

Dimension A: .156/3.96 or .187/4.74 specify

Dimension B: as specified (3.5/89 Maximum at standard prices)

Dimension C: as specified

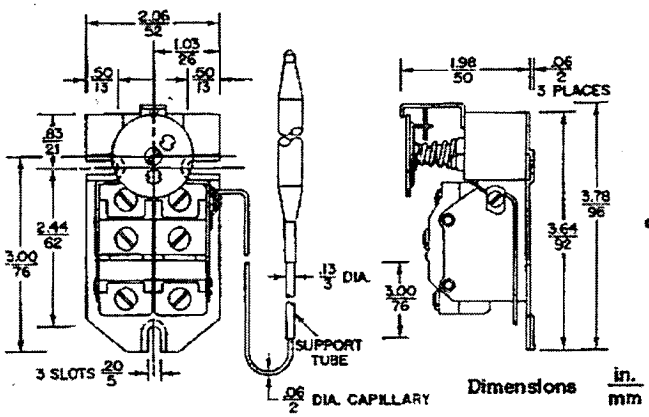


Fig. 12 — Front and side view of calibrated dial and pointer option.

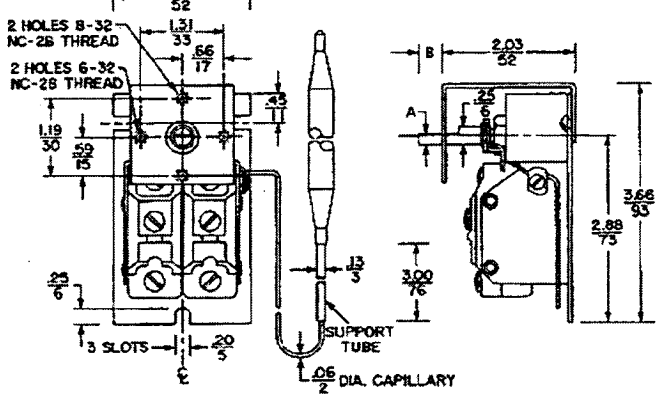


Fig. 13 — Center support, front mounting. Bracket optional at extra cost.

Dimension A: .156/3.96 or .187/4.74 specify

Dimension B: as specified (1.53/39 Max. at standard prices)

Performance specifications appearing herein are nominal and are subject to accepted manufacturing tolerances and application variables.

UL Guide No. XAPX2
File E6688

CSA Class 4813 02
File LR948

Controls Group
507 E. Michigan Street
P.O. Box 423
Milwaukee, WI 53202

Printed in U.S.A.

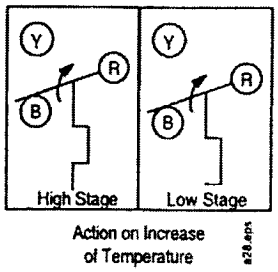
Code No. LIT-1927110
Issued February 1, 2009

A28 Series

Two Stage Temperature Control

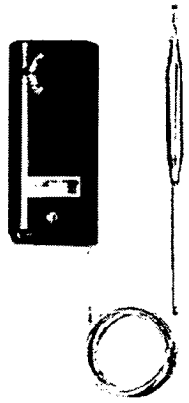
Description

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



A28 Action Diagram

A28AA-4



A28AB-29

Features

- wide temperature ranges available
- constant differential throughout the entire range
- 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/Refrigeration equipment.

Accessories

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

Selection Charts

Code Number	Switch Action	Range °F (°C)	Diff F° (C°)	Bulb and Capillary	Bulb Well No. (order separately)	Range Adjuster
COILED BULB–FIXED DIFFERENTIAL						
A28AA-4C	2-SPDT	30 to 110 (-1 to 43)	3 1/2 (1.9) Ea. Stage 3 (1.7) Fixed Between Stages	1-3/8 in. x 2-1/4 in Coiled	–	Convertible
CASE COMPENSATED–FIXED DIFFERENTIAL						
A28AA-9C	2-SPDT	20 to 80 (-7 to 27)	3 1/2 (1.9) Ea. Stage 3 (1.7) Fixed Between Stages	3/8 in. x 5 in. 6 ft Cap.[1]	**WEL14A-603R**	Knob
WIDE RANGE–ADJUSTABLE INTERSTAGE DIFFERENTIAL						
A28AA-28C	2-SPDT	30 to 110 (-1 to 43)	3 1/2 (1.9) Ea. Stage 2 to 7 Adj. Between Stages	12 ft averaging bulb 6 ft Cap.	–	Screwdriver Slot
A28AA-29C	2-SPDT	-30 to 100 (-34 to 38)	5 (2.8) Ea. Stage 2 to 7 Adj. Between Stages	3/8 in. x 4 in. 8 ft Cap.[1]	**WEL14A-602R**	Convertible
A28AA-36C	2-SPDT	40 to 90 (4 to 32)	3 Ea. Stage 2 to 7 Adj. Between Stages	3/8 in. x 5-3/4 in. 6 ft Cap.	–	Knob
A28AA-37C	2-SPDT	60 to 140 (16 to 60)	5 Ea. Stage 2 to 7 Adj. Between Stages	3/8 in. x 4 in. 6 ft Cap.	**WEL14A-602R**	Knob
A28AJ-4C	2-SPDT	20 to 80 (-7 to 27)	2 Ea. Stage 2 to 7 Adj. Between Stages	3/16 in. x 22 in. 6 ft Cap.	–	Knob
CHANGEOVER CONTROL						
A28AB-1C	2-SPDT[2]	20 to 80 (-7 to 27)	3 1/2 (1.9)	3/8 in. x 5 in. 6 ft Cap	**WEL14A-603R**	Screwdriver Slot
A28AB-2C[3]	2-SPDT[4]	60 to 90 (16 to 32)	5 (2.8)	Strap-on Grid Bulb 42 in. Cap.	–	Screwdriver Slot

1. Packing nut assembly available for direct immersion applications (Part No. **FTG13A-600R**).
2. Switches within 1 F° (0.6 C°) of each other.
3. Maximum sensing element temperature is 250°F (121°C).
4. Switches within 1.5 F° (0.9 C°) of each other.

The performance specifications are nominal and conform to acceptable industry standards. For applications at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products. © 2009 Johnson Controls, Inc.

Two Stage Temperature Control (Continued)

Replacement Parts

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

Technical Specifications

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

Electrical Ratings

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

1. When used as two circuit control, the total connected load must not exceed 2000 VA.

The performance specifications are nominal and conform to acceptable industry standards. For applications at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products. © 2009 Johnson Controls, Inc. www.johnsoncontrols.com

Code No. LIT-1927115
Issued February 1, 2009

A28 Series

Two Stage Flange Mounted Duct Thermostat

Description

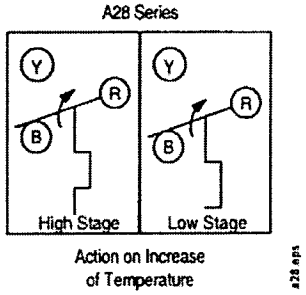
The A28AK is a two stage temperature control with special air coil sensing element and adjustable mounting flange.

Features

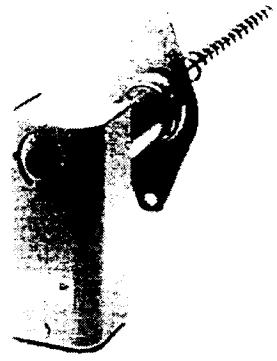
- Flat flange mounting with special coil element permits positioning of sensing bulb in the appropriate portion of the air stream
- 2 SPDT snap-acting switches
- unaffected by barometric pressure or cross ambient temperatures

Applications

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



A28 Action Diagram



A28AK

Selection Chart

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

Technical Specifications

Electrical Ratings

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

Note: When used as a two-circuit control, the total connected load must not exceed 2000 VA.

The performance specifications are nominal and conform to acceptable industry standards. For applications at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products. © 2009 Johnson Controls, Inc.

Code No. LIT-1927130
Issued February 1, 2009

A28

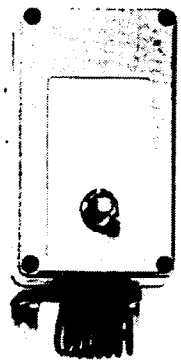
Two Stage Agricultural Thermostat With NEMA 4X Enclosure

Description

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

Applications

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



A28PJ, A28PA

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

Selection Chart

Code Number	Switch Action	Range °F (°C)	Diff F° (C°)	Bulb and Capillary	Range Adjuster
A28PJ-1C	2-SPDT	30 to 110 (-1 to 43)	2 (1.1) Ea. Stage 2 to 7 (1.1 to 3.9) Adj. Between Stages	1-3/8 in.x 2-1/4 in. Coiled	Knob
A28PA-2C	2-SPDT	30 to 110 (-1 to 43)	2 (1.1) Ea. Stage 2 to 7 (1.1 to 3.9) Adj. Between Stages	1-3/8 in.x 2-1/4 in Coiled	Knob

Technical Specifications

Electrical Ratings

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

1. When used as a two-circuit control, the total connected load must not exceed 2000 VA.

The performance specifications are nominal and conform to acceptable industry standards. For applications at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products. © 2009 Johnson Controls, Inc

Master Catalog 125
Temperature Controls Section A
Product Bulletin A28MA
Issue Date 1088

A28MA Type Two-Stage Tower Fan Control
Two-Stage Air Cooled Condenser Fan Control

Application

The A28MA temperature controls are designed to maintain optimum head pressure on refrigeration and air conditioning installations by controlling the operation of two-speed fan motors or dual fans. The fan motor operation is controlled by temperature change at the sensing bulb. Two basic constructions are available.

- *For Cooling Towers or Evaporative Condensers* -- The A28MA-1 and -4 controls with Neoprene coated bulb and capillary are for sump water temperature control. The coated element resists mechanical abrasion and chemical damage.
- *For Air Cooled Condensers* -- The A28MA-2 and -3 controls with tin plated bulb and capillary are for clamp-on application to the condenser or liquid line.

The A28MA controls have two SPDT switches for flexibility of application shown in Figs. 4 and 5. The operating sequence of the two switches cycled by a single temperature sensing element cannot be altered in the field. The single dial adjustment moves both high stage and low stage settings by a like amount.

All Series A28 temperature controls are designed for use *only* as operating controls. Where an operating control failure would result in personal injury and/or loss of property, it is the responsibility of the installer to add devices (safety, limit controls) or systems (alarm, supervisory systems) that protect against, or warn of, control failure.

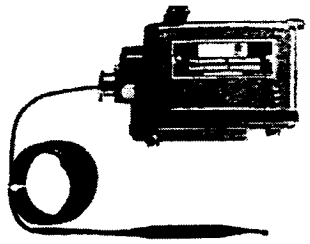


Fig. 1: An A28MA-1 Cooling Tower Fan Control.

Features

- Weather resistant gasketed enclosure has gray UL Listed outdoor finish.
- Liquid-filled sensing element is unaffected by barometric pressure and cross ambient temperatures.
- Strain-free mounting on three rubber cushioned mounting feet.

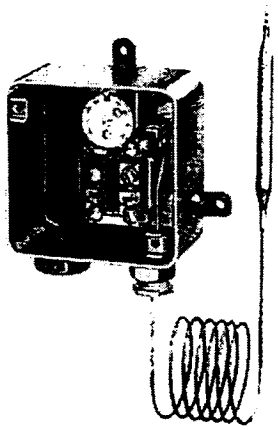


Fig. 2: An A28MA Control with the cover removed.

Specifications

Product Number	**A28MA-1**	40 to 120°F Range Plate, Neoprene Coated Bulb and Capillary, for Cooling Tower or Evaporative Condensers
	A28MA-2	40 to 120°F Range Plate, Tin Plated Bulb and Capillary, for Air Cooled Condensers
	A28MA-3	5 to 50°C Range Plate, Tin Plated Bulb and Capillary, for Air Cooled Condensers
	A28MA-4	5 to 50°C Range Plate, Neoprene Coated Bulb and Capillary, for Cooling Tower or Evaporative Condensers
Differential (Fixed)	**Each Stage**	5F° (2.8C°)
	Between Stages	8F° (4.4C°)
Maximum Bulb Temperature		210°F (99°C), Overrun At Infrequent Intervals
Switches		Two SPDT Pennswitches With Snap-Acting Contacts In Dust Protected Enclosure
Sensing Element		3/8" (9.5 mm) x 4" (102 mm) Bulb With 6 foot (1.8 m) Capillary
Range Adjuster		Internal Screwdriver Slot and Dial
Wiring Connections		Screw Type Terminals
Enclosure		Rainproof With Gasketed Cover (NEMA 3R)
Finish		UL Listed Outdoor Gray Enamel
Material		.062" (1.6 mm) Cold Drawn Steel
Mounting		Three Rubber Cushioned Mounting Feet
Conduit Opening		Welded 3/4" Female Connector
Shipping Weight		2.3 lb (1.0 kg)

©Copyright 1988 Johnson Controls, Inc.
All rights reserved.

Code No. LIT-125135
Part No. 3534, Rev. D

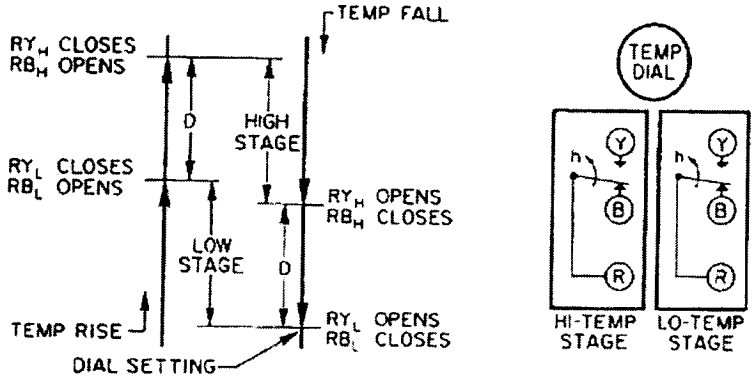


Fig. 3: Switching action of the two-stage control is illustrated above. RBH, RYH indicates HI-TEMP stage; RBL, RYL indicates LO-TEMP stage. "D" represents the differential between stages.

General Description

The A28MA controls have two enclosed SPDT switches. The red terminal is common. When the red to blue terminals are wired, the circuit opens on a temperature increase. (See Fig. 3.) When the red to yellow terminals are wired, the circuit closes on a temperature increase. The switch differential and between stage differential are fixed.

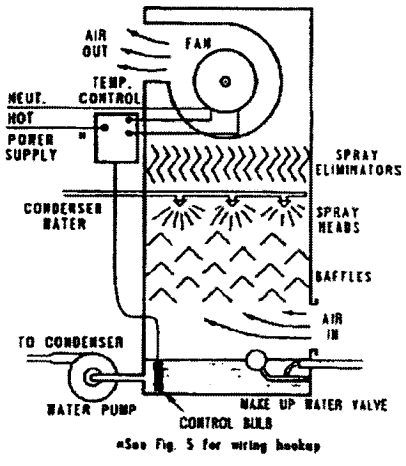


Fig 4: Wiring hookup and installation of the A28MA-1 Cooling Tower Fan Control with a forced draft cooling tower.

Accessories

A bulb well is available for use with the tin plated sensing bulb, if required. Specify Part No. WEL 14A-602R.

Ordering Information

To order specify Product Number only.

Installation

> ⚠ CAUTION: To avoid possible electrical shock or damage to the equipment, disconnect the power supply before wiring and mounting connections are made.
>
> Use terminal screws furnished (8-32 × 1/4 in. binder head). Substitution of other screws may cause problems in making proper connections.

Make all wiring connections using copper conductors only, and in accordance with the National Electrical Code and local regulations.

When the A28MA is mounted indoors, it may be mounted in any position with screws or bolts through the rubber bushings in the three mounting feet. When the A28MA will be exposed directly to the outdoor weather, the control should be mounted with the electrical connection and capillary fitting facing downward as shown in Fig. 1.

> ⚠ CAUTION: Do not dent or deform the sensitive bulb of this control. A dent or deformation will change the calibration and cause the control to cycle at a temperature lower than the dial setting.

Adjustment

The temperature set point may be changed to meet the requirements of the installation. Remove the cover to change the set point. Using a screwdriver, rotate the dial to the desired set point.

Checkout Procedure

Before leaving the installation, observe at least three complete operating cycles to be sure that all components are functioning correctly.

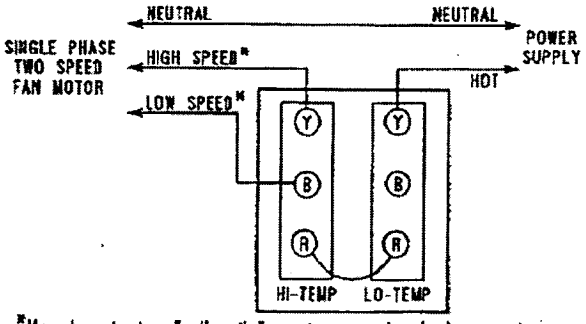
Repairs and Replacement

Field repairs must not be made. For a replacement control, contact the nearest Johnson Controls wholesaler.

Electrical Ratings

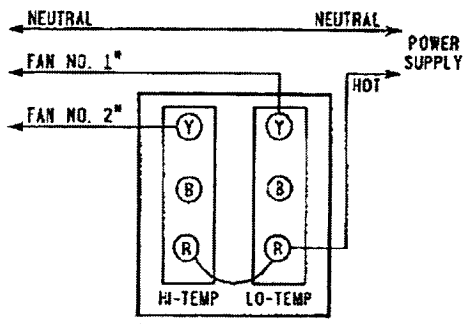
Voltage, AC	120	208	240	277
Full Load Amp	16.0	9.2	8.0	—
Locked Rotor Amp	96.0	55.2	48.0	—
Non-Inductive or Resistance Load Amp (Not Lamp Loads)	16.0	9.2	8.0	7.2
Pilot Duty — 125 VA, 24/277 VAC				

NOTE: When used as a two circuit switch, the total connected load must not exceed 2000 VA and must have a common return.



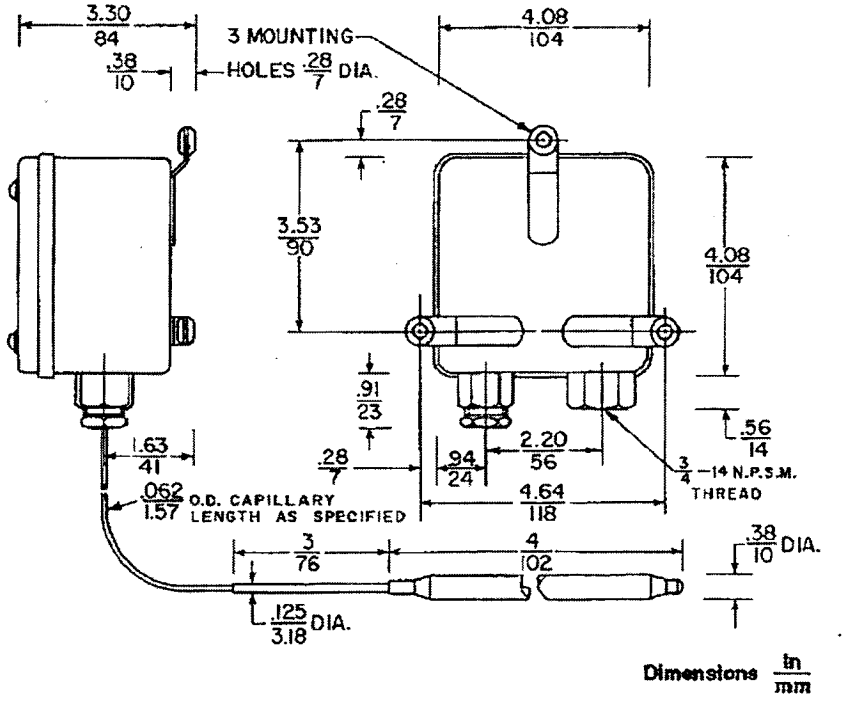
*May be starter "pull coils" on two-speed polyphase motors.

Fig. 5 — Typical wiring hookup for two-speed fan motors provides high speed, low speed and "Off" control.



*May be starter "pull coils" on two-speed polyphase motors or motors in excess of control rating.

Fig. 6 — Typical wiring hookup for two fan control provides dual fan, single fan and "Off" control.



Performance specifications appearing herein are nominal and are subject to accepted manufacturing tolerances and application variables.

JOHNSON CONTROLS

Controls Group
507 E. Michigan Street
P.O. Box 423
Milwaukee, WI 53202

Printed in U.S.A.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of:

JOHNSON CONTROLS, INC.

Serial No. 77/612,049

Filed: November 11, 2008

Mark: KNOB AND DISPLAY CONFIGURATION (3 dimensional configuration)
087394.001019

DECLARATION UNDER SECTION 2(f) OF TRADEMARK ACT

I, George Rudich, declare as follows:

1. I am Engineering Manager, Refrigeration Products, of Johnson Controls, Inc. (hereinafter "JCI"), and make this declaration in support of federal registration of the above mark.

2. The KNOB AND DISPLAY CONFIGURATION mark has been in substantially exclusive and continuous use by JCI as a trademark and service mark for decades, believed to date back at least as early as the 1940's.

3. JCI is a leader in, inter alia, refrigeration and temperature control industry and has gone to great lengths to build goodwill in its valuable KNOB AND DISPLAY CONFIGURATION mark.

4. JCI holds the overwhelming majority of market share for the types of temperature control devices that are the subject of this trademark application, believed to exceed 70% and perhaps closer to 80%.

5. At any given time over the years, there is likely to be upwards of 20 million of the temperature control devices that are the subject of this trademark application in the marketplace in the United States. Customers of these devices immediately know these devices to be JCI devices upon sight.

6. From 2000 through 2009, JCI's sales under its KNOB AND DISPLAY CONFIGURATION trademark exceeded $130 million in the United States alone.

7. In 2000, JCI's sales under its KNOB AND DISPLAY CONFIGURATION trademark were in excess of $15,000,000 in the United States.

8. In 2001, JCI's sales under its KNOB AND DISPLAY CONFIGURATION trademark

were in excess of $14,000,000 in the United States.

9. In 2002, JCI's sales under its KNOB AND DISPLAY CONFIGURATION trademark were in excess of $13,000,000 in the United States.

10. In 2003, JCI's sales under its KNOB AND DISPLAY CONFIGURATION trademark were in excess of $14,000,000 in the United States.

11. In 2004, JCI's sales under its KNOB AND DISPLAY CONFIGURATION trademark were in excess of $14,000,000 in the United States.

12. In 2005, JCI's sales under its KNOB AND DISPLAY CONFIGURATION trademark were in excess of $15,000,000 in the United States.

13. In 2006, JCI's sales under its KNOB AND DISPLAY CONFIGURATION trademark were in excess of $15,000,000 in the United States.

14. In 2007, JCI's sales under its KNOB AND DISPLAY CONFIGURATION trademark were in excess of $15,000,000 in the United States.

15. In 2008, JCI's sales under its KNOB AND DISPLAY CONFIGURATION trademark were in excess of $15,000,000 in the United States.

16. In 2009, JCI's sales under its KNOB AND DISPLAY CONFIGURATION trademark were in excess of $13,000,000 in the United States.

17. JCI has advertised and promoted its goods under its KNOB AND DISPLAY CONFIGURATION mark Examples of JCI's advertising of goods under its KNOB AND DISPLAY CONFIGURATION mark over the years are attached hereto as Exhibit A.

18. Since 2000 alone, JCI has sold well over 6 million devices under its KNOB AND DISPLAY CONFIGURATION trademark.

19. As a result of JCI's exclusive and continuous use of its trademark KNOB AND DISPLAY CONFIGURATION in its industry, customers in the relevant industry have come to recognize the trademark KNOB AND DISPLAY CONFIGURATION as solely designating JCI as the source of goods sold by JCI.

20. Further, the design of the temperature control device at issue in this trademark application is not merely functional. In fact, squared edges on the casing would provide a functional advantage in terms of room inside the casing and ability to enlarge knobs and dials. Squared edges may also lead to tooling advantages. Additionally, the notched temperature display is not nearly as advantageous as a mere painted line to indicate temperature from a cost or machining standpoint.

21. All claimed features could be designed many different ways, and the appearance of these features on the device at issue is unique to JCI and recognized as an identifying feature of each of the JCI devices.

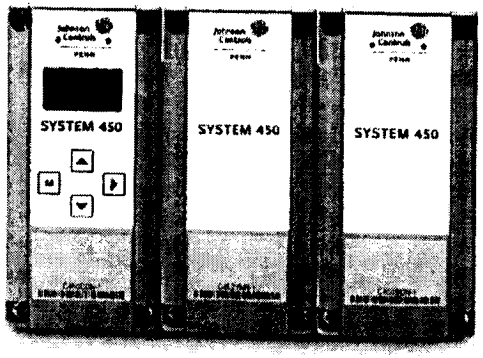
The undersigned being warned that willful false statements and the like are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001, and that such willful false statements and the like may jeopardize the validity of the application or document or any registration resulting therefrom, declares that all statements made of his/her own knowledge are true; and all statements made on information and belief are believed to be true.

George Rudich

8/24/2010

Date

EXHIBIT A



Compact, customizable, configurable, cost effective.

Now you can get hundreds of control options and flexibility from just nine control modules. The new System 450™ electronic controls from Johnson Controls/PENN provide all the convenience and ease of use of plug together modular controls with improved efficiency and accuracy. Plus, you can control pressure, humidity and temperature with a single system.

JOHNSON CONTROLS/PENN
90
1919-2009

Printed on recycled paper.

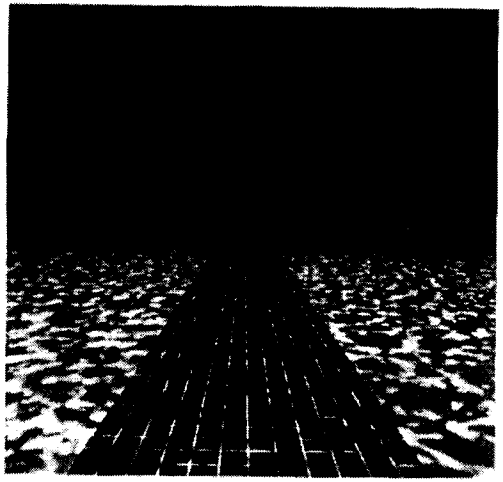
© 2009 Johnson Controls, Inc.
P.O. Box 423, Milwaukee, WI 53201
Printed in USA PUBL-5751
www.johnsoncontrols.com

Johnson Controls

SYSTEM 450™ MODULAR ELECTRONIC CONTROLS

Do more with less

Johnson Controls



The New System 450

Modular Electronic Controls

Compatible with:

- A99 Temperature Sensors
- P499 Ratiometric Transducers
- HE-67S3 Humidity Sensors

A99
Temperature
Sensor

P499
Ratiometric
Transducer

HE-67S3
Humidity
Sensor

Control up to three applications simultaneously with System 450.

System 450 modules can be used as standalone devices, or in conjunction with expansion modules, to control a wide range of single-stage, multi-stage, and proportional refrigeration, HVAC and industrial applications. With System 450, each control module accepts up to three inputs configurable for humidity, temperature or pressure applications. That means that a system can control humidity, temperature and pressure, or any combination of the three.

Typical temperature applications include heating and cooling control, stage boiler control and boiler circulating pump control. Pressure applications include condenser fan control and constant air velocity control. Humidity applications include clean rooms, computer rooms and pharmaceutical manufacturing.

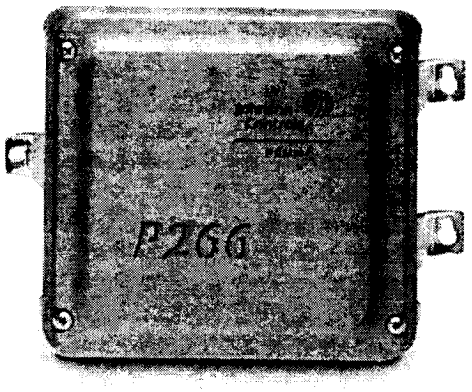
Because System 450 can handle up to three applications simultaneously, it's easier to control rooms with multiple conditions like wine cellars, greenhouses, swimming pools and spas.

Get more with less and with greater accuracy.

- Up to three inputs per control provide flexibility and reduce number of controls required, creating a smaller carbon footprint
- Factory default settings for selected sensor
- Easy to read backlit LCD and four-button touch pad
- Up to ten stages of control
- A total of nine System 450 modules replace 60 System 350 modules, which means fewer parts to order and stock
- UL, cUL, CE, C-Tick, RoHS compliant
- Universal modules include:
  - C450CRN-1 single relay control module with LCD
  - C450CCN-1 dual relay control module with LCD
  - C450CPN-1 PI analog output module with LCD
  - C450SRN-1 single relay expansion module
  - C450SCN-1 dual relay expansion module
  - C450SPN-1 PI analog output expansion module

The New P266 Series

Condenser Fan Controls with new patented technology



JOHNSON CONTROLS/PENN

90

1919-2009

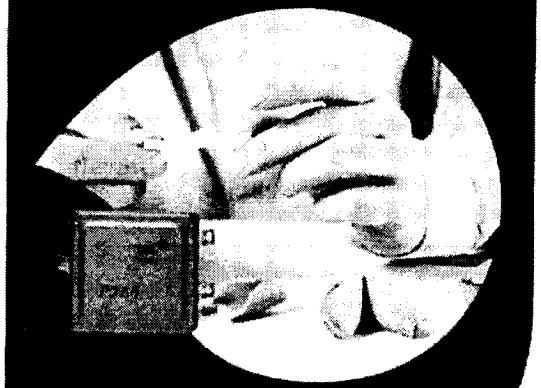
Printed on recycled paper.

© 2009 Johnson Controls, Inc.
P.O. Box 423, Milwaukee, WI 53201
Printed in USA PUBL-5727
www.johnsoncontrols.com

Johnson Controls

P266 CONDENSER FAN SPEED CONTROL

Your fan motor will enjoy a long, cool life



Johnson Controls

A four-in-one combo for greater reliability and longer life.

Replace four separate controllers with the new Johnson Controls/PENN P266 Condenser Fan Speed Control. This microprocessor-based control is engineered for condensing unit operation in low ambient conditions on HVAC/R equipment. Instead of mechanical pressure sensors, the P266 uses an advanced hermetically sealed stainless steel electronic pressure transducer. This provides superior refrigerant leak prevention. Plus it is compatible with all types of refrigerants.

The P266 is ideal for controlling single or multiple fan condensers. This single control can replace:

- On/Off fan cycling controls
- Variable speed motors
- Condenser flood back systems
- Temperature controls

In addition to controlling the speed of one fan motor, up to three 24 VAC auxiliary output triacs are available for cycling additional stages of condenser fans. The result is better control and greater efficiency.

- Patented technology allows the modulated fan motor to run cooler to extend motor life
- EMI noise filter - doesn't interfere with other electronics
- Single, dual or three main triac outputs
- Electronic pressure transducers available in two ranges
- NEMA 3R enclosure
- 208/230 & 460/575V (50/60 Hz) models
- Features hermetically sealed stainless steel electronic pressure transducers
- Field-adjustable minimum & maximum speed, pressures, voltage & minimum speed/cutoff
- High signal select option (for dual circuit applications) - up to two inputs from two P266SNR transducers
- Three optional 24V auxiliary triac outputs provide for on/off vernier control of additional fans based on system pressure
- New design option provides for reduced power and motor temperature at lower speeds, increasing motor life and energy savings
- ETL, cETL and CE agency approved

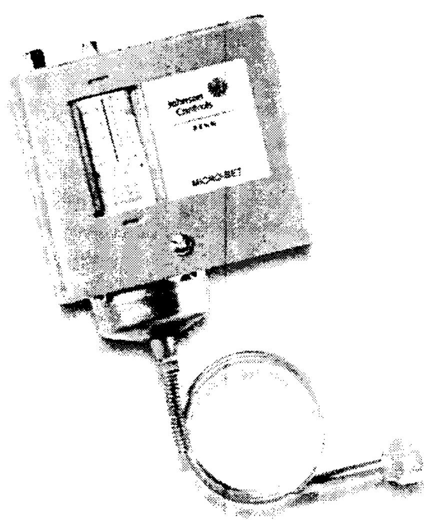
REFRIGERATION PRODUCTS

Cool. Fresh. Smart.

Johnson Controls

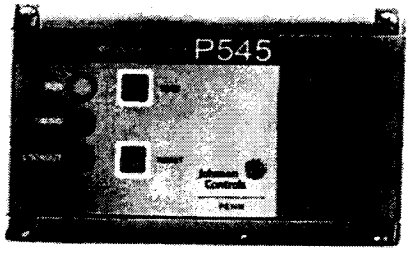
We know refrigeration inside and out

For over 90 years, Johnson Controls/PENN has been the number one choice for refrigeration controls. You'll find our products at work in more supermarkets, convenience stores, hotels, restaurants and other places than any other brand of refrigeration controls. Count on us wherever there's a critical need to keep products and people cool. Even though we've been around since the beginning of time in refrigeration, Johnson Controls/PENN still delivers the freshest ideas in the business. We're continuously building on our experience to provide superior control technology for all types of refrigeration and air conditioning equipment.



Stay cool with Johnson Controls/PENN

There are Johnson Controls/PENN products for low and high pressure control in freezers. Defrost controls. Electronic three-phase fan speed control of head pressure. Multi-function controls. We make hundreds of temperature controls, electronic and electromechanical, for hundreds of different uses, from bulk milk tanks to ice cream freezers. Our products perform indoors and out, and work with corrosive and non-corrosive refrigerants. We control lube pressure in compressors. We manufacture water regulating valves for condensing temperature control and water flow switches engineered to interlock with other controls to assure chillers operate properly. Whatever the application, every Johnson Controls/PENN product has one thing in common: worry-free operation.

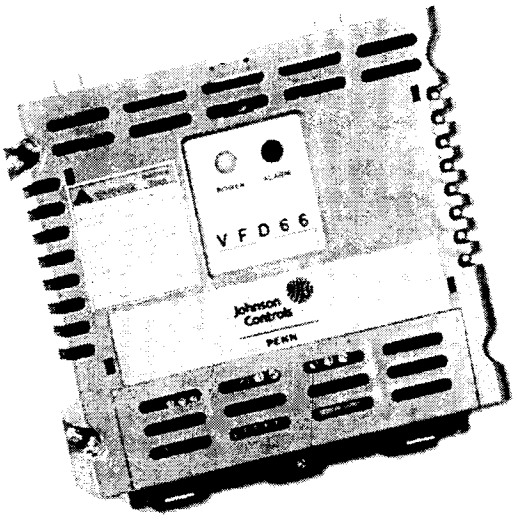


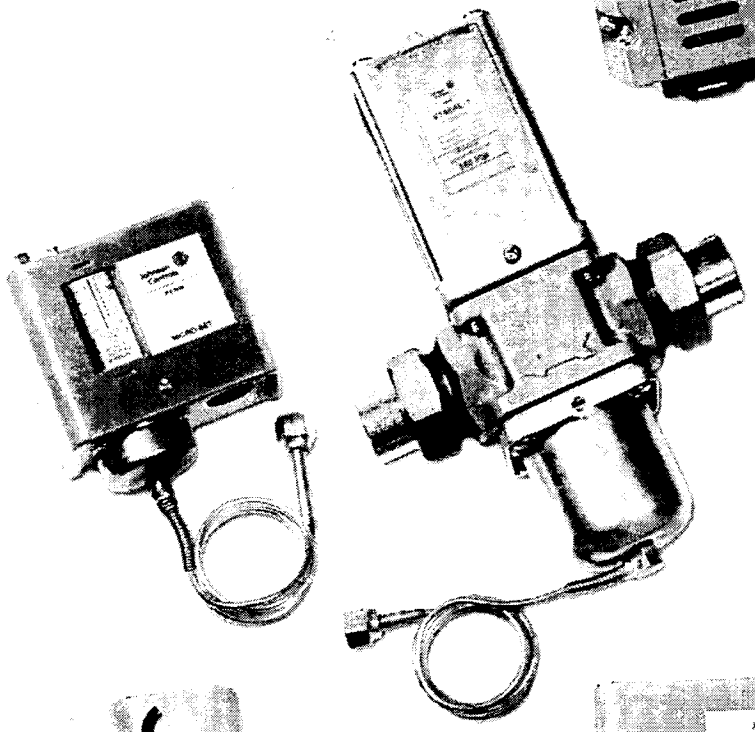
As part of our ongoing, corporate-wide commitment to sustainability and the environment, we offer a complete line of high-pressure controls that are compatible with CFC-free R-410A refrigerant. These environmentally-friendly products include the P70 and P170 pressure controls, P100 pressure switches, P266 fan speed controls, and V246 and V248 water regulating valves.

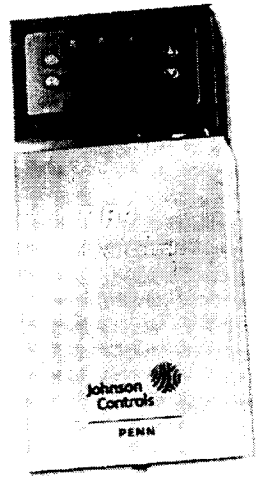
Johnson Controls/PENN is also taking a proactive approach by using more environmentally-friendly substances in our products. All of our temperature controls with liquid filled sensing elements now contain a new, "green" fluid that is safer for the environment. This industry-leading, eco-friendly fluid is nonflammable, non-toxic and non-reactive. It can be found in the A19, A28, A36, T19, T22, T23, T25, T26 and T46 series of controls, helping to create a more comfortable, safe and sustainable world.

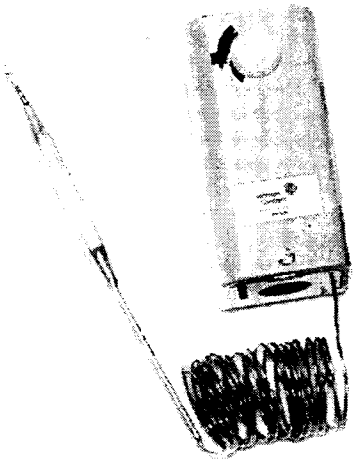
You name it we control it.

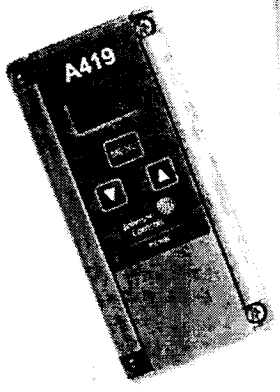
From the very beginning, dependability has been a hallmark of Johnson Controls/PENN. Frankly, once you install one of our controls, you can forget about it. We offer proven, long-life durability over a wide range of temperature and pressure applications. But do remember that the rugged, dependable designs and quality construction give you peace of mind, and performance that outlasts other products.

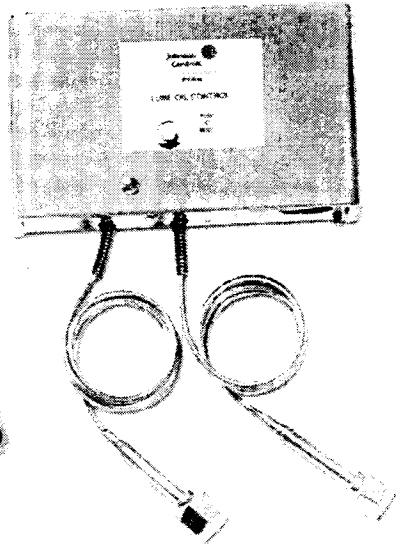




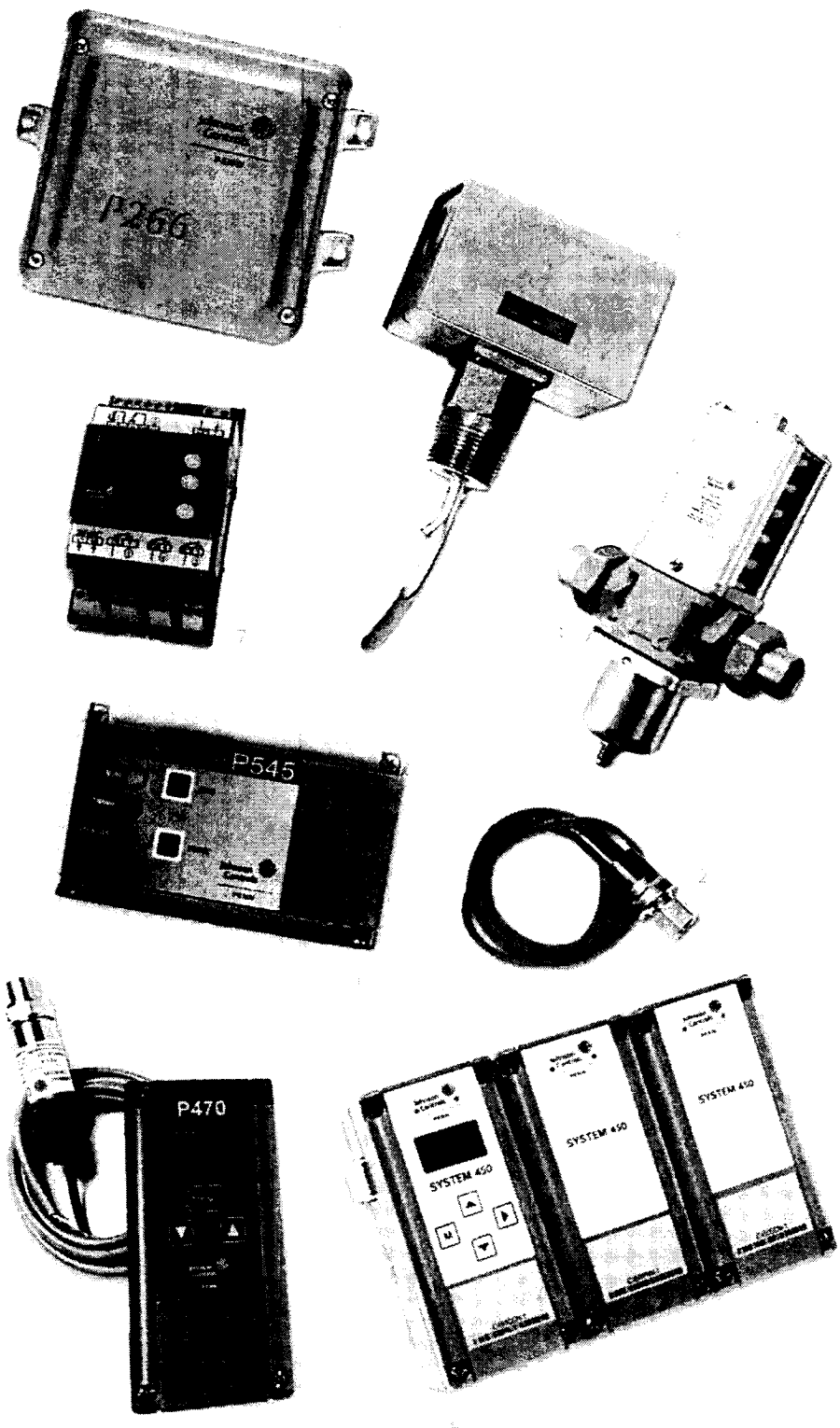








1. Temperature Controls
   - A19
   - A419
2. Pressure Controls
   - P70/P170
   - P499
   - P100
   - P470
3. Flow Switches
   - F61
4. Water Valves
   - V146
   - V246
5. Fan Speed Controls
   - VFD66
   - P266
6. Defrost Controls
   - MR Series
7. Space Controls
   - MS Series
8. System 450 Modular Electronic Controls
9. Unit Ventilator Controls
   - P545
   - P145/P28/P45



Long lasting dependability

Continuously innovative

A long history of tried and true performance

The latest in control technology

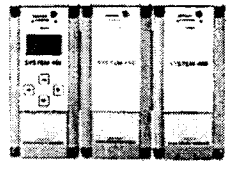
Worry-free operation

Advanced electronic controls for increased reliability and efficiency

From fresh flowers, to frozen foods, to server farms

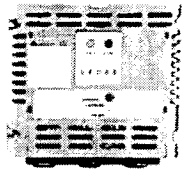
Tried and true technology, like that offered by our P70 pressure controls, V46 water valves and other electromechanical products, has long met the needs of our customers. But times change. Your requirements change. So we continue to develop new control solutions that will even better meet your needs for efficiency, dependability and ease-of-use. As a result, Johnson Controls/PENN leads the way in electronic and digital control technology.

The new P266 Condenser Fan Speed Control features a stainless steel electronic pressure sensor for greater reliability and longer life, along with field adjustable speed pressures, start voltage and minimum speed/cutoff.

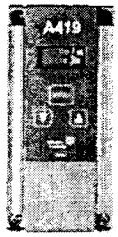


With the new System 450™ Modular Electronic Controls, you get more control options and flexibility. System 450 modules provide accurate, stand alone control for a wide range of field-configurable, single stage, multiple stage and proportional control for temperature, pressure and humidity. Plus, you have plug together installation convenience.

Our VFD66 Electronic Fan Speed Controller simplifies condenser fan speed control for three phase motors. Its compact size increases mounting flexibility.

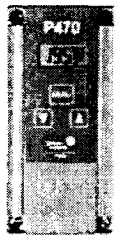


The A419 Electronic Temperature Controller is an easy-to-read, digital display temperature controller in a compact, easy to program design.



Get greater versatility, reliability and ease-of-use for a wide range of pressure applications with the P470 Electronic Pressure Control.

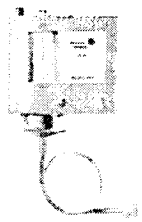
MR Controls combine the functions of a timer, thermostat, temperature display, defrost termination device and interconnecting wiring into a single control. Also, control up to four stages of heating, cooling, humidity or pressure with the MS Series.

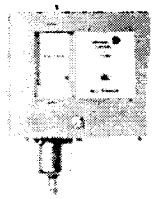


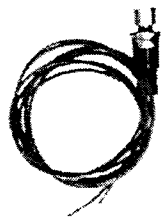
Advanced technology. Unsurpassed accuracy. Dependability. Efficiency. Whatever you're looking for in a refrigeration control, Johnson Controls/PENN delivers. That's why we're the top choice in the industry. Plus, we back you with excellent warranties and a wide ranging aftermarket distribution network, offering replacement parts and expert training in refrigeration applications. When your reputation is on the line, count on the quality and performance of Johnson Controls/PENN.

Pressure Controls Compatible with R-410A

	PRODUCT	SWITCH ACTION	BOTTOM OF RANGE	TOP OF RANGE	MAXIMUM WORKING PRESSURE	TYPICAL APPLICATIONS
P70 SERIES ADJUSTABLE ON/OFF PRESSURE CONTROLS	**P70AA-2C**	SPST Open Low	0	150	325	Suction pressure control – loss of charge
	P70AA-400C	SPST Open Low	100	470	690	Fan cycling for head pressure control
	P70CA-400C	SPST Open High	200	610	690	High pressure compressor shutdown – Auto Reset
	P70DA-400C	SPST Open High	200	610	690	High pressure compressor shutdown – Manual Reset
P170 SERIES ADJUSTABLE ON/OFF PRESSURE CONTROLS	**P170AA-2C**	SPST Open Low	0	150	325	Suction pressure control – loss of charge
	P170AA-400C	SPST Open Low	100	470	690	Fan cycling for head pressure control
	P170CA-400C	SPST Open High	200	610	690	High pressure compressor shutdown – Auto Reset
	P170DA-400C	SPST Open High	200	610	690	High pressure compressor shutdown – Manual Reset
P100 SERIES NON-ADJUSTABLE ON/OFF PRESSURE SWITCHES	**P100AP-332C**	SPST Open Low	300	400	600	Fan cycling for head pressure control
	P100AP-201C	SPST Open Low	10	32	600	Low pressure switch – loss of charge Compressor cycling Auto Reset
	P100DA-81C/D[2]	SPST Open High	Manual Reset	630	800	High pressure compressor shutdown - Manual Reset
	P100DA-86D[2]	SPST Open High	Manual Reset	575	800	High pressure compressor shutdown – Manual Reset
	P100CP-85D[2]	SPST Open High	565	665	800	High pressure compressor shutdown – Auto Reset
	P100CE-11D[1]	SPST Open High HD Contacts	450	550	800	High pressure compressor shutdown – Auto Reset
P266 SERIES ADJUSTABLE MODULATING ELECTRONIC FAN SPEED CONTROLS	**P266Axx[3]**	Modulating	30	720	765	Head pressure control 208/230/240 V
	P266Bxx[3]	Modulating	30	720	765	Head pressure control 460/480/575 V







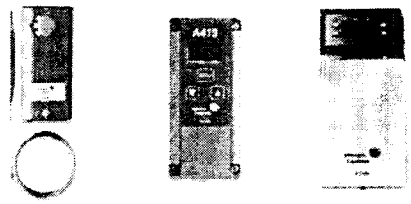
1. Bulk Pack Only. 50 per box. Minimum order 250.
2. Bulk Pack Only. 50 per box. Minimum order 100.
3. R-410A compatibility offered with P266SNR-2K transducer

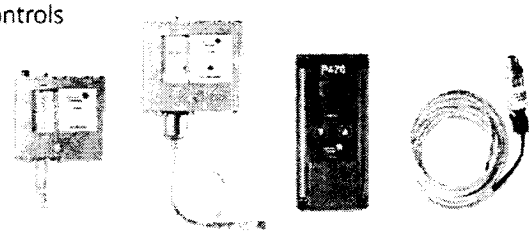
© 2008 Johnson Controls, Inc. P.O. Box 423, Milwaukee, WI 53201 Printed in USA PUBL-5453
www.johnsoncontrols.com

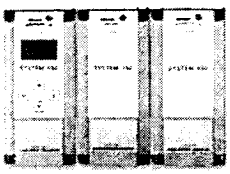
Johnson Controls

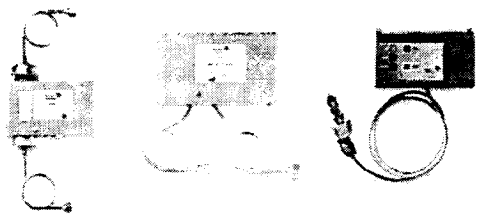
Refrigeration Controls

	TYPICAL APPLICATIONS
TEMPERATURE CONTROLS A19 Temperature Controls A419 Electronic Temperature Controls MR Defrost Controls	· Temperature control in HVAC/R applications · Supermarket display cases · Boiler control · Home brewery · Fan or cut-out control
PRESSURE CONTROLS P70/170 Pressure Controls P100 Encapsulated Pressure Switches P470 Electronic Pressure Controls P499 Electronic Pressure Transducers	· High or low-pressure cut-out controls · Head pressure control · Condenser fan cycling control · Pump down control · Capacity control
SYSTEM 450™ MODULAR ELECTRONIC CONTROLS C450C Temperature, Pressure and Humidity Controls C450Y Power Module C450S Expansion Modules	· Clean rooms and computer rooms · Greenhouses · Condenser fan cycling · Frozen/refrigerated display cases · Cooling tower control · Temperature indication
LUBE OIL CONTROLS P28/P128 Lube Oil Controls P45/P145 Lube Oil Controls P545 Electronic Lube Oil Controls	· Lube oil pressure protection for semi-hermetic refrigeration compressors





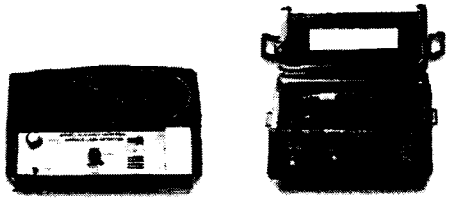




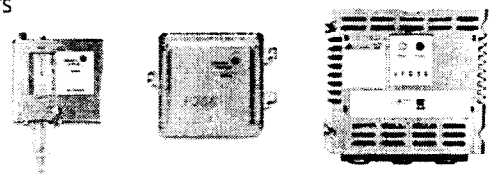
Johnson Controls

Refrigeration Controls

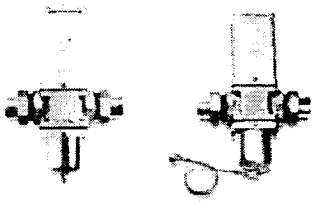
	TYPICAL APPLICATIONS
REFRIGERANT LEAK DETECTORS RLD-H10G–line voltage RLD-H10PM–battery driven	· Leak detection of CFC, HCFC, and HFC refrigerants and blends



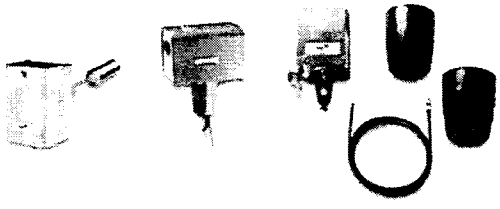
CONDENSER FAN CONTROLS P70/P170 Pressure Controls P266 Electronic Fan Speed Controls VFD66 Condenser Fan Speed Controls	· Fan cycling control · Commercial air-cooled condensers · Cooling tower fans · Fans in evaporative condensing units



WATER REGULATING VALVES V43/V46 Water Regulating Valves V146 High Pressure Regulating Valves V246/V248 Water Regulating Valves for High Pressure Refrigerants	· Ice machines · Computer rooms · Refrigerated cases · Water cooled heat pumps · Water cooled refrigeration condensers



FLOW & FLOAT CONTROLS F61 Flow Switches F63 Float Switches F59 Sump Pump Switches	· Water purification and treatment systems · Sump pumps · Booster pumps · Cooling tower sumps



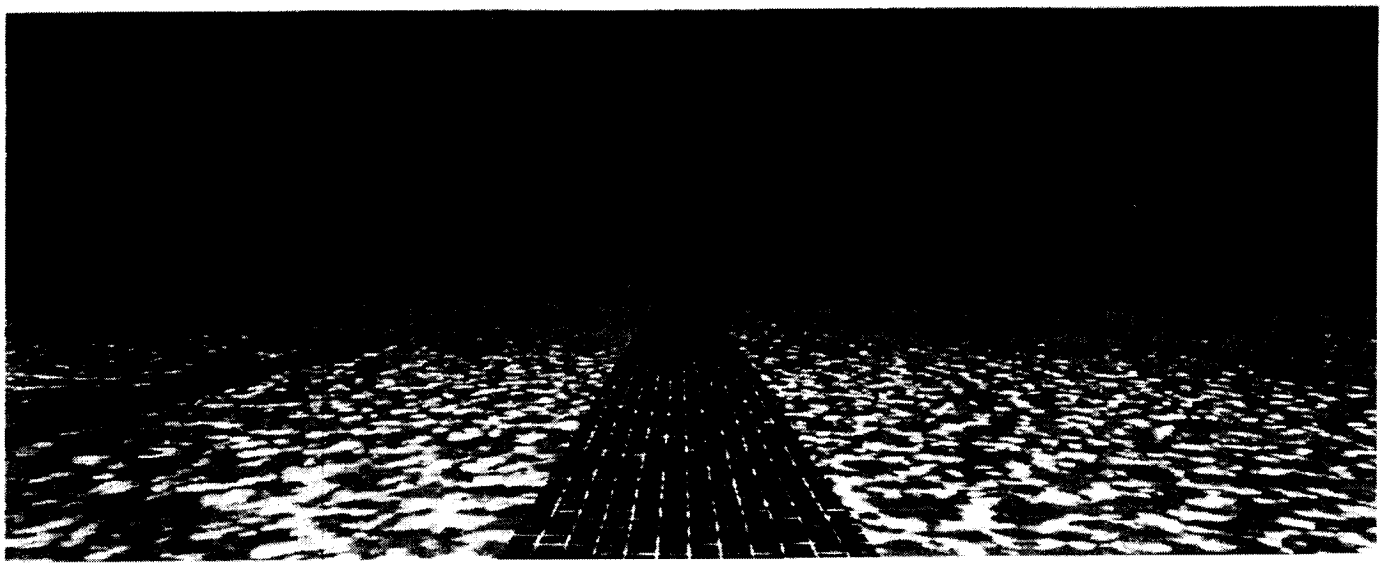
© 2008 Johnson Controls, Inc. P.O. Box 423, Milwaukee, WI 53201 Printed in USA PUBL-5452
www.johnsoncontrols.com

Johnson Controls

Clear and simple control

Johnson Controls

Do more with less.

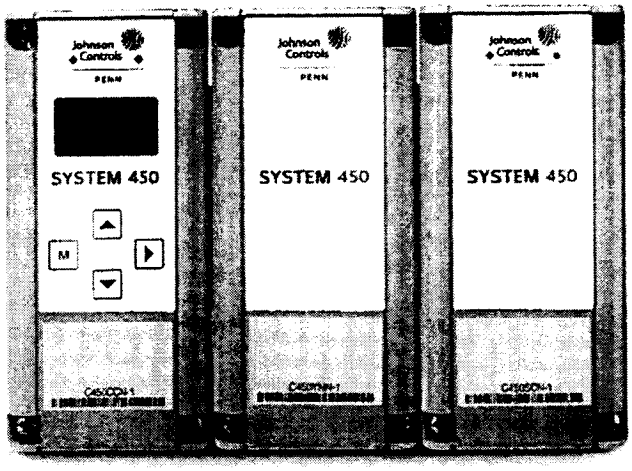


Compact, customizable, configurable, cost-effective

Now you can get hundreds of control options and flexibility from just nine control modules. The new System 450™ electronic controls from Johnson Controls/PENN provide all the convenience and ease of use of plug together modular controls with improved efficiency and accuracy. Plus, you can control pressure, humidity and temperature with a single system.

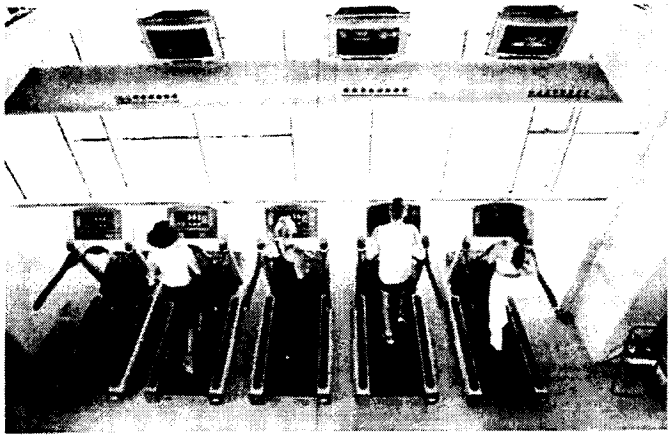
Get more with less and with greater accuracy

- Up to three inputs per control provide flexibility and reduce number of controls required, creating a smaller carbon footprint
- Factory default settings for selected sensor
- Easy to read backlit LCD and four-button touch pad
- Up to ten stages of control
- Nine System 450 modules replace 80 System 350™ modules, which means fewer parts to order and stock
- UL, cUL, CE, C-Tick, RoHS compliant
- Universal modules include:
  - C450CBN-1 single relay control module with LCD
  - C450CCN-1 dual relay control module with LCD
  - C450CPN-1 PI analog output module with LCD
  - C450SBN-1 single relay expansion module
  - C450SCN-1 dual relay expansion module
  - C450SPN-1 PI analog output expansion module



Features:

- SPDT relay outputs provide On/Off control of the equipment in your controlled system
  - Set up multiple relay outputs to create a variety of equipment staging configurations
  - Available in single & dual relay output modules
- Analog output generates a direct-acting or reverse-acting proportional output signal (0-10 VDC or 0-20 mA)
  - Proportional plus Integral (PI) control capability, allows controlled system loop to get closer to the desired set point even under full load conditions



Control up to three applications simultaneously with System 450

System 450 modules can be used as standalone devices, or in conjunction with expansion modules, to control a wide range of single-stage, multi-stage, and proportional refrigeration, HVAC and industrial applications. With System 450, each control module accepts up to three inputs configurable for humidity, temperature or pressure applications. That means that a system can control humidity, temperature and pressure, or any combination of the three.

Because System 450 can handle up to three applications simultaneously, it's easier to control rooms with multiple conditions like wine cellars, greenhouses, swimming pools and spas.

Compatible with:

- A99 Temperature Sensors
- P499 Ratiometric Transducers
- HE-67S3 Humidity Sensors

A99
Temperature Sensor

P499
Ratiometric Transducer

HE-67S3
Humidity Sensor

- Clean rooms
- Computer rooms
- Pharmaceutical manufacturing
- Museums and libraries
- Greenhouses
- Paper manufacturing and storage
- Space humidity control
- Humidity monitoring and display
- High/low humidity alarm
- Humidification/dehumidification control
- Staged On/Off or proportional humidity control

- Heating & cooling control with deadband
- Stage boiler control
- Boiler circulating pump control
- Mixed-air damper control
- Water mixing valve control
- Modulated or staged temperature damper actuator control

- Staged On/Off condenser fan control
- Two-speed fan motor control
- Floating pressure control of an actuator
- Constant duct static pressure control
- Constant air velocity control
- Relief damper building pressurization control
- Relief fan building pressurization control
- Electric forced air systems
- Room or building static pressure
- Supply side static pressure
- Refrigeration compressor capacity control

For more information about
System 450 contact your
local sales representative
or visit us online at
www.johnsoncontrols.com

Printed on recycled paper.

© 2009 Johnson Controls, Inc. P.O. Box 423, Milwaukee, WI 53201 Printed in USA PUBL-5728
www.johnsoncontrols.com

Johnson Controls

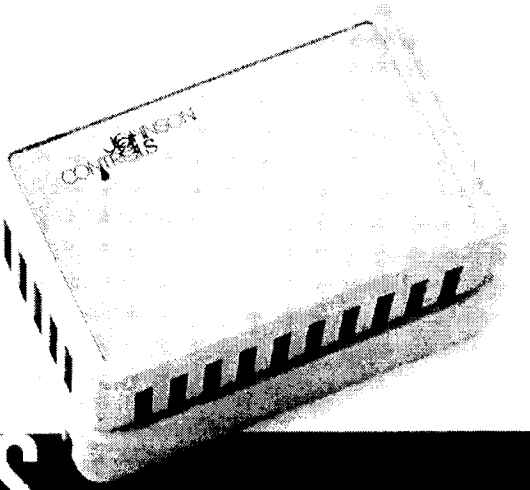
Johnson Controls Parts Direct

ph: 800-482-2778 • fx: 800-811-1338

JOHNSON CONTROLS

© 2013 Johnson Controls, Inc.
P.O. Box 423, Milwaukee, WI 53201
Printed in USA PUBL-4824
www.johnsoncontrols.com

3 THINGS



you need to know about parts.

JOHNSON CONTROLS

Johnson Controls Parts Direct

ph: 800-482-2778 • fx: 800-811-1338

Actuators
Electric and pneumatic for valve and damper applications.

Valves
Globe, ball, butterfly and zone valves for water and steam applications.

Pneumatics
Johnson Controls has been manufacturing pneumatic products for over 100 years.

Dampers
Round and rectangular for control, fire and smoke applications.

BAS
Metasys building management system components, Johnson Controls legacy systems components and other manufacturers' reconditioned BAS/fire components.

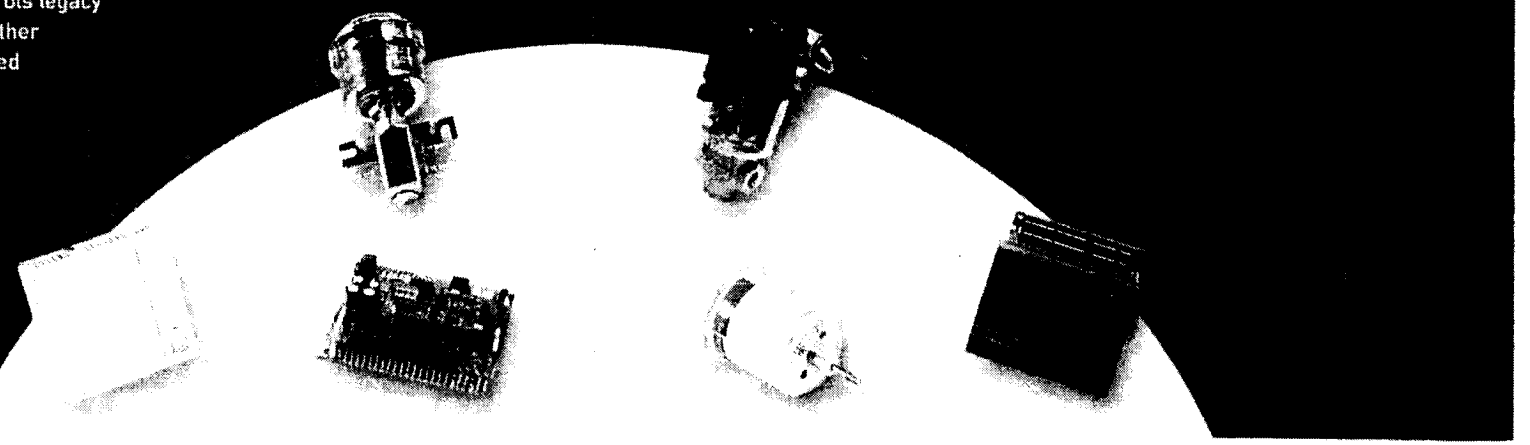
Refrigeration
Johnson Controls/PENN electronic and electromechanical products for temperature, pressure, flow and water regulating control.

Sensors
Temperature, humidity, pressure and CO_2.

Repair Center
Johnson Controls Repair Center can recondition building components for HVAC, fire and security systems. We offer this service for Johnson Controls BAS products and many other manufacturers' products.

Maintaining your facility and optimizing its performance requires a source for quality HVAC, refrigeration and building automation system components. From scheduled maintenance to emergency repairs, you need the right parts, at the right time, at the right price.

Johnson Controls is the world's leading manufacturer and supplier of building systems and controls. Nobody knows more about parts than we do. You can go direct to the source for tens of thousands of HVAC products, refrigeration products, Metasys® building management system components and more. Plus, we can help you with rare, hard-to-find parts and reconditioned BAS and fire components from other manufacturers.




JOHNSON
CONTROLS
Update
P470
PENN

REFRIGERATION PRODUCTS

Stay cool.

For nearly 100 years, Johnson Controls/PENN has been the number one choice for refrigeration controls. You'll find our products at work in more supermarkets, convenience stores, hotels, restaurants and other places than any other brand of refrigeration controls. Count on us wherever there's a critical need to keep products and people cool. Even though we've been around since the beginning of time in refrigeration, Johnson Controls/PENN still delivers the freshest ideas in the business. We're continuously building on our experience to provide superior control technology for all types of refrigeration and air conditioning equipment.

We're plugged into your needs.

Tried and true technology, like that offered by our P70 pressure controls, V46 water valves and other electromechanical products, has long met the needs of our customers. But times change. Your requirements change. So we continue to develop new control solutions that will even better meet your needs for efficiency, dependability and ease-of-use.

As a result, Johnson Controls/PENN leads the way in electronic and digital control technology.

The A419 Electronic Temperature Controller is an easy-to-read, digital display temperature controller in a compact, easy to program design.

Our VFD66 Electronic Fan Speed Controller simplifies condenser fan speed control for three phase motors. Its compact size increases mounting flexibility.

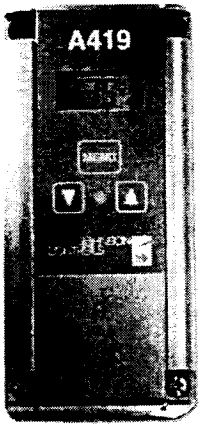
The P470 Electronic Pressure Control covers a wide range of pressure applications in a single control, with greater versatility, reliability and ease-of-use than electromechanical controls offer.

Johnson Controls System 350™ Modular Electronic Controls give you more control options and flexibility. System 350 modules give you accurate, stand alone control for a wide range of single stage, multiple stage and proportional control for temperature, pressure and humidity. Plus, you have plug together installation convenience.

The MR Controls combine the functions of a timer, thermostat, temperature display, defrost termination device and interconnecting wiring into a single control. The MS Series can control up to four stages of heating, cooling, humidity or pressure.

We're on top of refrigeration.

Advanced technology. Unsurpassed accuracy. Dependability. Efficiency. Whatever you're looking for in a refrigeration control, Johnson Controls/PENN delivers. That's why we're the top choice in the industry. Plus, we back you with excellent warranties and a wide ranging aftermarket distribution network, offering replacement parts and expert training in refrigeration applications. When your reputation is on the line, count on the quality and performance of Johnson Controls/PENN.



JOHNSON CONTROLS PENN

REFRIGERATION PRODUCTS

Long lasting dependability

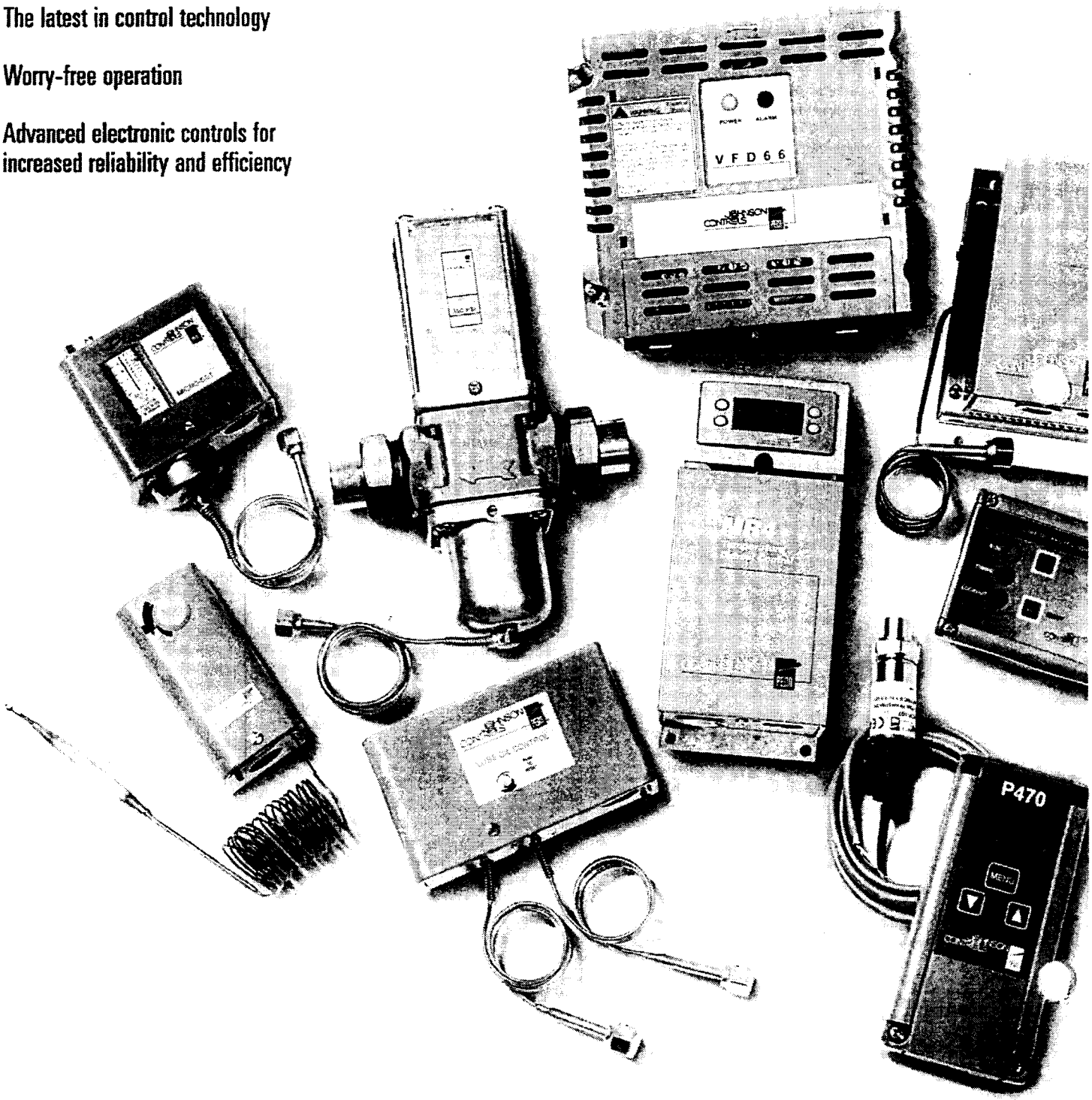
Continuously innovative

A long history of tried and true performance

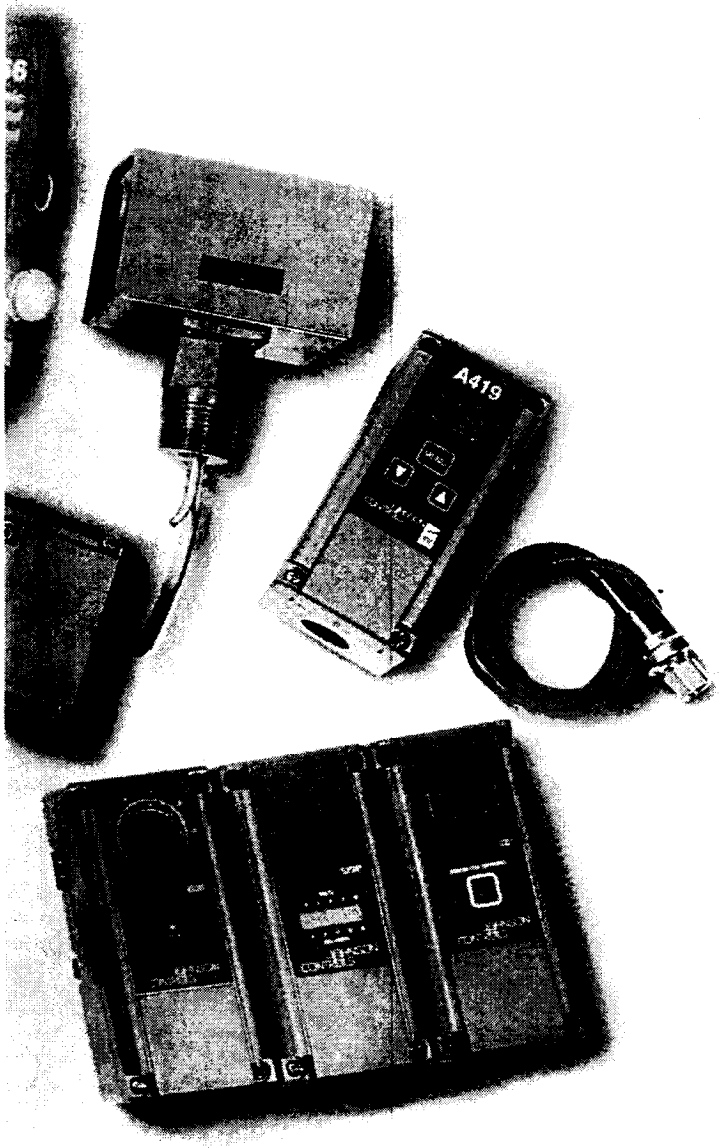
The latest in control technology

Worry-free operation

Advanced electronic controls for increased reliability and efficiency



You name it, we control it.



1 Temperature Controls
- A19
- A419

2 Pressure Controls
- P70/P170
- P499
- P100
- P470

3 Flow Switches
- F61

4 Water Valve
- V146

5 Fan Speed Controls
- VFD66
- P66

6 Defrost Control
- MR Series

7 Stage Controls
- MS Series

8 System 350™ Modular Controls

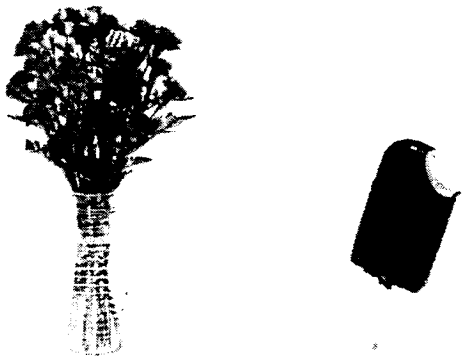
9 Lube Oil Control
- P545
- P145/P28/P45

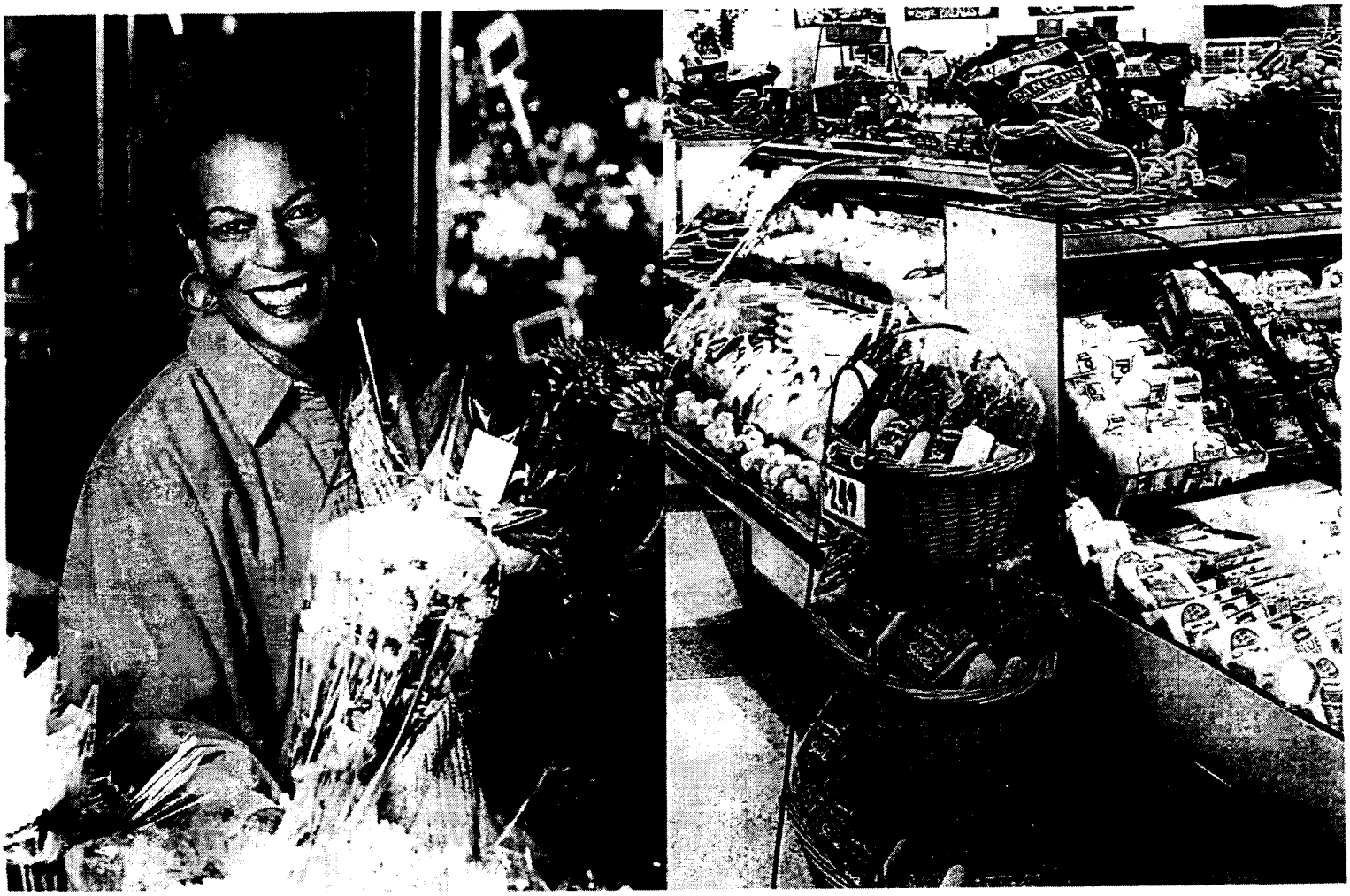
REFRIGERATION PRODUCTS

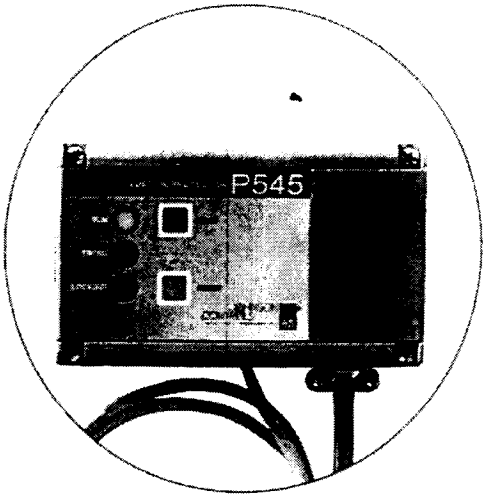
From fresh flowers,

to frozen foods,

to server farms.







Johnson Controls/PENN advanced technology is helping customers worldwide improve the performance and efficiency of their refrigeration systems, particularly in supermarkets.

We know refrigeration inside and out.

If there's refrigerant in it, chances are, there's a Johnson Controls/PENN product connected to it. Our products perform indoors and out, and work with corrosive and non-corrosive refrigerants.

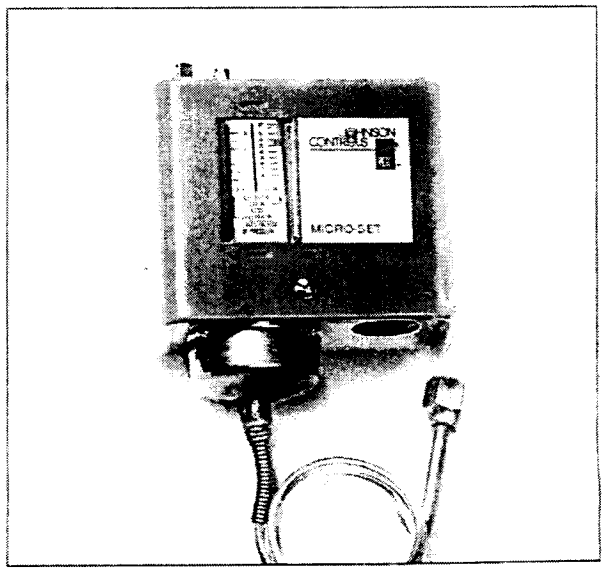
There are Johnson Controls/PENN products for low and high pressure control in freezers. Defrost controls. Electronic three-phase fan speed control of head pressure. Multi-function controls. We make hundreds of temperature controls, electronic and electromechanical, for hundreds of different uses, from bulk milk tanks to ice cream freezers. We control lube pressure in compressors. We manufacture water regulating valves for condensing temperature control and water flow switches engineered to interlock with other controls to assure chillers operate properly. Whatever the application, every Johnson Controls/PENN product has one thing in common: worry-free operation.

R410A compatibility.

We also offer a complete line of high-pressure controls that are compatible with CFC-free R410A refrigerant. This is just one example of our ongoing, corporate-wide commitment to sustainability and the environment.

It's easy to forget about us.

From the very beginning, dependability has been a hallmark of Johnson Controls/PENN. Frankly, once you install one of our controls, you can forget about it. We offer proven, long-life durability over a wide range of temperature and pressure applications. But do remember that the rugged, dependable designs and quality construction give you peace of mind, along with performance that outlasts other products.



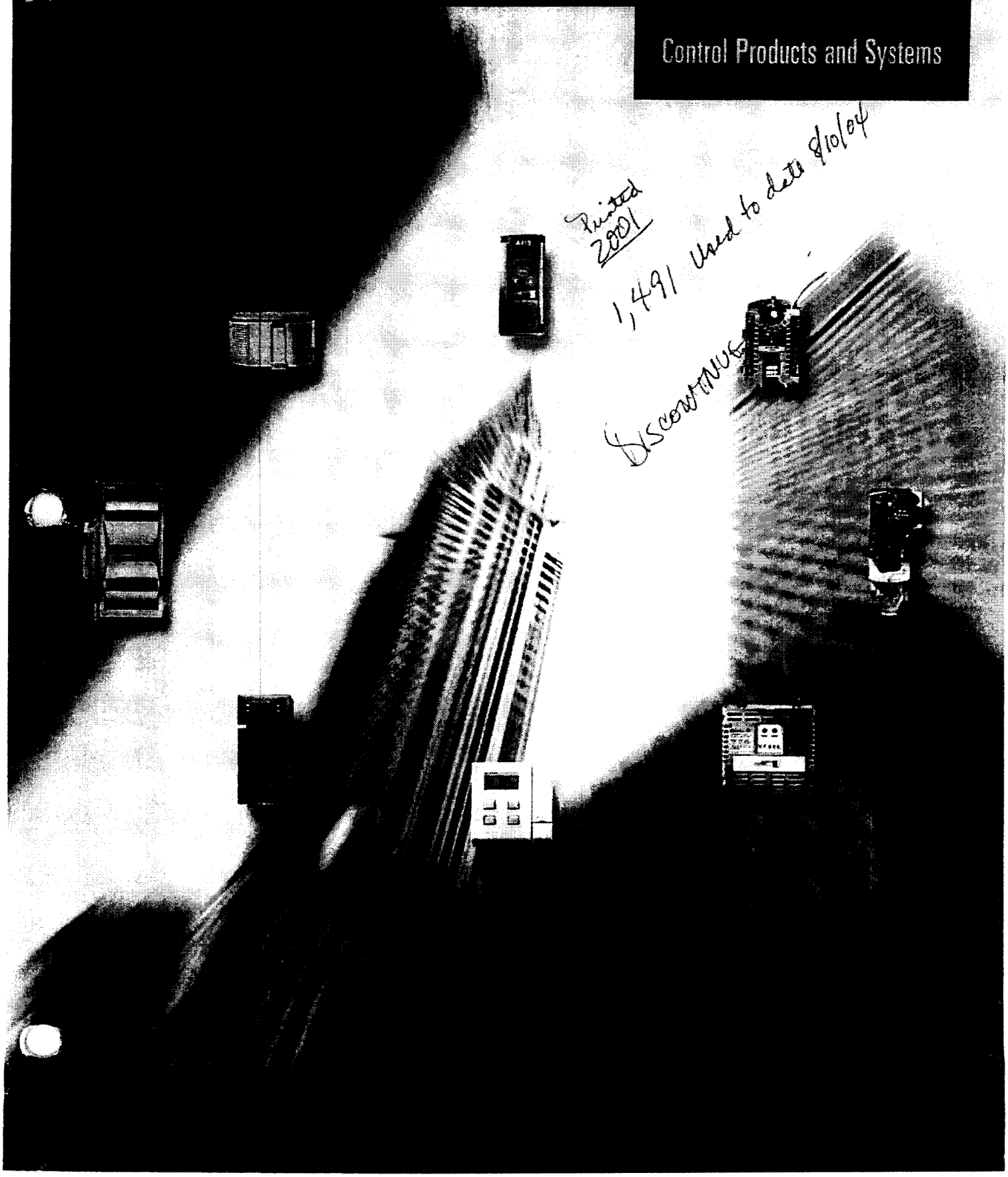
JOHNSON CONTROLS

Control Products and Systems

Printed 2001

1,491 Used to date 8/10/04

Discontinued

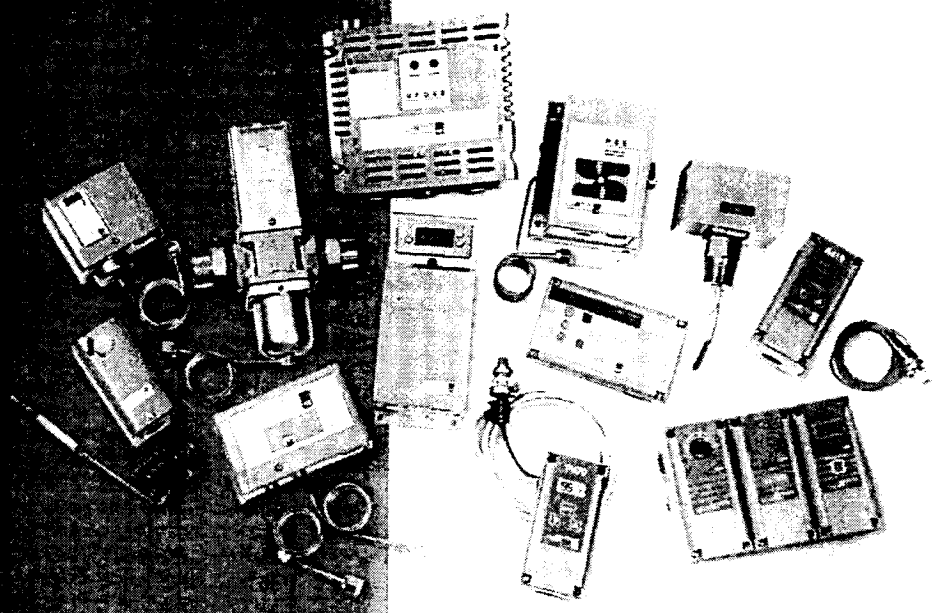


Johnson Controls...

is a company dedicated to developing technology that touches people. Tens of thousands of building owners and managers worldwide turn to Johnson Controls to improve the quality of their indoor environments by maximizing comfort, productivity, safety and energy efficiency.

Since 1885, Johnson Controls has been a leading manufacturer and installer of HVAC and refrigeration controls and systems. As a global leader in the controls industry, Johnson Controls is a single source for electronic, electromechanical and pneumatic control products and sensors of all types. We design and manufacture custom controls for hundreds of OEM customers. Our experts also engineer and install advanced facility management systems, direct digital controls and pneumatic systems to meet a wide range of customer environmental control needs.

With over 200 offices throughout the world, the company has vast, unmatched expertise in working with schools, hospitals, commercial and industrial buildings, hotels, government and other facilities. We back our products with industry leading three-year warranty protection. In addition, our more than 2,500 stocking wholesale locations make our products easy to obtain. So they're available when and where you need them.



Refrigeration Controls

Johnson Controls/PENN has been in the business of commercial refrigeration control for nearly 100 years. Today, our products and systems combine advanced electronics with long-term dependability. You can benefit from controls that deliver long-life durability and versatility over a wide range of temperature and pressure applications. All designed around your needs for efficiency, product safety and productivity.

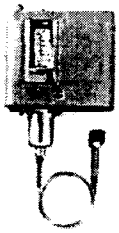
P470 Electronic Pressure Control with Display, with three field-selectable pressure ranges, covers a wide range of refrigeration and HVAC applications and uses a P399 Electronic Pressure Transducer. **A419 Electronic Temperature Control** is an innovative, economical control for both heating or cooling applications. **VFD66 Condenser Fan Speed Control** can use either pressure or temperature signals for economical 3-phase fan speed control on refrigeration and HVAC condensing units. **P445 Electronic Lube Oil Control** provides accurate and reliable electronic monitoring and control of compressor lube-oil circuits. No capillary tubes provide greater flexibility and reduce potential refrigerant losses. **V46 Water Regulating Valves** provide uniform pressure response and stable adjustment in operating ranges up to 150 psi. **P66 Electronic Fan Speed Control** ensures refrigeration systems perform efficiently, even in low ambient temperatures.

JOHNSON CONTROLS

ALCO Cross Reference

TEMPERATURE Controls

Product	# Range	Diff.	Switch	Capillary	Bulb	Cover	Notes	
ALCO	TF115-S2 AE00	-20/60F	3/30F ADJ	SPDT	NONE	COILED	NEMA 1	
ALCO	TSI-X2E 30/40	-20/60F	3/30F ADJ	SPDT	NONE	COILED	NEMA 1	
PENN	**A19BBC-2C**	**-30/100F**	**3/12F ADJ**	**SPDT**	**NONE**	**COILED**	**NEMA 1**	**(1)**
PENN	**A19BBC-6C**	**-30/100F**	**3/12F ADJ**	**SPDT**	**NONE**	**COILED**	**NEMA 1**	**(1)(3)**
ALCO	TF115-S3 AE00	15/95F	3/30F ADJ	SPDT	NONE	COILED	NEMA 1	
ALCO	TSI-X3E 64/48	15/95F	3/30F ADJ	SPDT	NONE	COILED	NEMA 1	
PENN	**A19BBC-2C**	**-30/100F**	**3/12F ADJ**	**SPDT**	**NONE**	**COILED**	**NEMA 1**	**(1)**
PENN	**A19BBC-6C**	**-30/100F**	**3/12F ADJ**	**SPDT**	**NONE**	**COILED**	**NEMA 1**	**(1)(3)**
ALCO	TF115-S4 AF10	-20/95F	5/35F ADJ	SPDT	120"	3/8x2-3/4	NEMA 1	
ALCO	TSI-X4F 32/41	-20/95F	5/35F ADJ	SPDT	120"	3/8x2-3/4	NEMA 1	
PENN	**A19ABC-24C**	**-30/100F**	**3/12F ADJ**	**SPDT**	**96"**	**3/8X4**	**NEMA 1**	**(1)**
PENN	**A19ABC-36C**	**-30/100F**	**3/12F ADJ**	**SPDT**	**240"**	**3/8X4**	**NEMA 1**	**(1)**



PRESSURE Controls

Product	# Range	Diff.	Switch	Capillary	Connection	Cover	Notes	
ALCO	FF115-S1 BAK	24"/42	3/30 ADJ	SPDT	36"	W/ FLARE	NEMA 1	
ALCO	PS1-X1K 7/15	24"/42	3/30 ADJ	SPDT	36"	W/ FLARE	NEMA 1	
PENN	**P70AB-12C**	**12"/80**	**5/35 ADJ**	**OPEN LO**	**36"**	**W/ FLARE**	**NEMA 1**	
ALCO	FF115-S3 BAK	15"/100	7/70 ADJ	SPDT	36"	W/ FLARE	NEMA 1	
ALCO	PS1-X3K 50/65	15"/100	7/70 ADJ	SPDT	36"	W/ FLARE	NEMA 1	
PENN	**P70AB-2C**	**20"/100**	**7/50 ADJ**	**OPEN LO**	**36"**	**W/ FLARE**	**NEMA 1**	
ALCO	FF115-S3 BAA	15"/100	7/70 ADJ	SPDT	NONE	MALE FLARE	NEMA 1	
ALCO	PS1-X3A 50/65	15"/100	7/70 ADJ	SPDT	NONE	MALE FLARE	NEMA 1	
PENN	**P170AB-2C**	**20"/100**	**7/50 ADJ**	**OPEN LO**	**NONE**	**MALE FLARE**	**NEMA 1**	
ALCO	FF115-S4 BAK	15/290	15/145 ADJ	SPDT	36"	W/ FLARE	NEMA 1	
ALCO	PS1-X4K 115/145	15/290	15/145 ADJ	SPDT	36"	W/ FLARE	NEMA 1	
PENN	**P70AA-2C**	**0/150**	**12/40 ADJ**	**OPEN LO**	**36"**	**W/ FLARE**	**NEMA 1**	
PENN	**P70AA-3C**	**100/300**	**25/75 ADJ**	**OPEN LO**	**36"**	**W/ FLARE**	**NEMA 1**	
ALCO	FF115-S5 BAK	90/450	30/220	SPDT	36"	W/ FLARE	NEMA 1	
ALCO	PS1-X5K 230/290	90/450	30/220	SPDT	36"	W/ FLARE	NEMA 1	
PENN	**P70AA-118C**	**100/400**	**35/200**	**OPEN LO**	**36"**	**W/ FLARE**	**NEMA 1**	
PENN	**P70CA-3C**	**50/450**	**60/150**	**OPEN HI**	**36"**	**W/ FLARE**	**NEMA 1**	
ALCO	FF115-S5 BAA	90/450	30/220	SPDT	NONE	MALE FLARE	NEMA 1	
ALCO	PS1-X5A 140/280	90/450	30/220	SPDT	NONE	MALE FLARE	NEMA 1	
PENN	**P170AA-118C**	**100/400**	**35/200**	**OPEN LO**	**NONE**	**MALE FLARE**	**NEMA 1**	
PENN	**P170CA-3C**	**50/450**	**60/150**	**OPEN HI**	**NONE**	**MALE FLARE**	**NEMA 1**	
ALCO	FF115-S5 BRK	90/450	MANUAL	SPDT	36"	W/ FLARE	NEMA 1	
ALCO	PS1-Y5K 230/290	90/450	MANUAL	SPDT	36"	W/ FLARE	NEMA 1	
PENN	**P70DA-1C**	**50/450**	**MANUAL**	**OPEN HI**	**36"**	**W/ FLARE**	**NEMA 1**	
PENN	**P70KA-1C**	**50/450**	**MANUAL**	**M-BLOCK**	**36"**	**W/ FLARE**	**NEMA 1**	**(5)**
ALCO	FF115-S5 BRA	90/450	MANUAL	SPDT	NONE	MALE FLARE	NEMA 1	
ALCO	PS1-Y5A 330/390	90/450	MANUAL	SPDT	NONE	MALE FLARE	NEMA 1	
PENN	**P170DA-1C**	**50/450**	**MANUAL**	**OPEN HI**	**NONE**	**MALE FLARE**	**NEMA 1**	

JOHNSON CONTROLS PENN

Cross Reference

TEMPERATURE Controls

Product #		Range	Diff.	Switch	Capillary	Bulb	Cover	Notes
Ranco	ETC111000-000	-30/220F	1/30F ADJ	SPDT	96" LEAD	0.5X2	NEMA 1	
PENN	A419ABC-1C	-30/212F	1/30F ADJ	SPDT	78" LEAD	0.5X2	NEMA 1	(14)
Ranco	3130-101	35/45F	12F FXD	OPEN LO	NONE	240"	NEMA 1	
PENN	A11B-1C	35/45F	12F FXD	OPEN LO	48"	240"	NEMA 1	
Ranco	3130-201	35/45F	MANUAL	OPEN LO	NONE	240"	NEMA 1	
PENN	A11A-1C	35/45F	MANUAL	OPEN LO	48"	240"	NEMA 1	
Ranco	3311-651	37F FXD	MANUAL	OPEN LO	180"	0.5X4.25	NEMA 1	
PENN	A70BA-17C	35/80F ADJ	MANUAL	OPEN LO	72"	3/8X3	NEMA 1	
Ranco	3311-701	30F FXD	15F FXD	OPEN LO	120"	3/8X6.5	NEMA 1	
PENN	A70AA-15C	-10/65F ADJ	4/40F ADJ	OPEN LO	72"	3/8X3	NEMA 1	
Ranco	A22-2237	41F FXD	6F FXD	OPEN HI	NONE	48"	NEMA 1	
PENN	A11E-6C	35/45F	12F FXD	SPDT	48"	240"	NEMA 1	
Ranco	O10-1010	0/55F	7/55F ADJ	OPEN LO	NONE	48"	NEMA 1	
PENN	A11B-1C	35/45F	12F FXD	OPEN LO	48"	240"	NEMA 1	
Ranco	O10-1409	0/55F	3/20F ADJ	OPEN LO	72"	YES	NEMA 1	
PENN	A19ABA-1C	-30/50F	5/20F ADJ	OPEN LO	72"	3/8X4	NEMA 1	(1)
Ranco	O10-1410	25/75F	3/20F ADJ	OPEN LO	72"	YES	NEMA 1	
PENN	A19ABA-4C	20/80F	3.5/14F ADJ	OPEN LO	72"	3/8X5	NEMA 1	(1)
Ranco	O10-1416	0/55F	3/20F ADJ	OPEN LO	NONE	72"	NEMA 1	
PENN	A11B-1C	35/45F	12F FXD	OPEN LO	48"	240"	NEMA 1	
Ranco	O10-1418	0/55F	3/20F ADJ	OPEN LO	NONE	COILED	NEMA 1	
PENN	A19BBA-1C	-30/50F	5/20F ADJ	OPEN LO	NONE	COILED	NEMA 1	(1)
Ranco	O10-1473	0/55F	7/55F ADJ	OPEN LO	72"	YES	NEMA 1	
PENN	A19ABA-1C	-30/50F	5/20F ADJ	OPEN LO	72"	3/8X4	NEMA 1	(1)
Ranco	O10-1490	0/55F	2F FXD	OPEN LO	72"	YES	NEMA 1	
PENN	A19ABA-1C	-30/50F	5/20F ADJ	OPEN LO	72"	3/8X4	NEMA 1	(1)
Ranco	O10-1491	25/75F	2F FXD	OPEN LO	72"	YES	NEMA 1	
PENN	A19ABA-4C	20/80F	3.5/14F ADJ	OPEN LO	72"	3/8X5	NEMA 1	(1)
Ranco	O10-1802	25/75F	3/20F ADJ	OPEN LO	NONE	COILED	NEMA 1	
PENN	A19BAC-1C	30/110F	3.5F FXD	SPDT	NONE	COILED	NEMA 1	(1)
Ranco	O10-301	30/95F	2F FXD	OPEN LO	NONE	COILED	NEMA 1	
PENN	A19BAA-5C	30/110F	3.5F FXD	OPEN LO	NONE	COILED	NEMA 1	(1)
Ranco	O16-104	0/55F	3/20F ADJ	SPDT	72"	YES	NEMA 1	
PENN	A19ABC-24C	-30/100F	3/12F ADJ	SPDT	96"	3/8X4	NEMA 1	(1)
Ranco	O16-111	0/55F	3/20F ADJ	SPDT	NONE	72"	NEMA 1	
PENN	A11E-6C	35/45F	12F FXD	SPDT	48"	240"	NEMA 1	
Ranco	O16-165	30/90F	2.5F FXD	SPDT	NONE	COILED	NEMA 1	
PENN	A19BAC-1C	30/110F	3.5F FXD	SPDT	NONE	COILED	NEMA 1	(1)
Ranco	O16-263	0/55F	MANUAL	SPDT	72"	YES	NEMA 1	
PENN	A19ACC-6C	-30/100F	MANUAL	SPDT	72"	3/8X4	NEMA 1	
PENN	A70BA-17C	35/80F	MANUAL	OPEN LO	72"	3/8X3	NEMA 1	(12)
Ranco	O16-264	0/55F	MANUAL	SPDT	NONE	96"	NEMA 1	
PENN	A11D-1C	35/45F	MANUAL	SPDT	48"	240"	NEMA 1	
PENN	A70BA-18C	15/55F	MANUAL	OPEN LO	NONE	240"	NEMA 1	(12)
Ranco	O16-588	-15/40F	1.5F FXD	SPDT	NONE	72"	NEMA 1	
PENN	A11E-6C	35/45F	12F FXD	SPDT	48"	240"	NEMA 1	(1)
PENN	A70AA-16C	15/55F	5F FXD	OPEN LO	NONE	240"	NEMA 1	
Ranco	O16-594	0/55F	2F FXD	SPDT	NONE	COILED	NEMA 1	
PENN	A19BBC-2C	-30/100F	3/12F ADJ	SPDT	NONE	COILED	NEMA 1	(1)
Ranco	O16-595	50/100F	3/20F ADJ	SPDT	96"	3/8X6	NEMA 1	
PENN	A19ABC-4C	50/130F	3.5/14F ADJ	SPDT	96"	3/8X5	NEMA 1	(1)
Ranco	O16-601	22.5/47.5F	2.5F FXD	SPDT	36"	3/8X6	NEMA 1	
PENN	A19ABC-2C	20/80F	3.5/14F ADJ	SPDT	72"	3/8X5	NEMA 1	(1)
PENN	A70AA-15C	-10/65F ADJ	10F FXD	OPEN LO	72"	3/8X3	NEMA 1	(12)
Ranco	O20-7041	0/100F	6/20F ADJ	DPST OPEN LO	96"	3/8X6	NEMA 1	
PENN	A72AA-3C	50/90F	ADJ	DPST OPEN LO	72"	11/16X6 3/4	NEMA 1	
PENN	A72AA-2C	15/55F	ADJ	DPST OPEN LO	72"	3/8X3	NEMA 1	
Ranco	O52-6910	30/95F	2F FXD	SPDT	NONE	COILED	NEMA 4X	
PENN	A19PRC-1C	30/110F	3/12F ADJ	SPDT	NONE	COILED	NEMA 4X	
Ranco	O60-100	-35/95F	4/50F ADJ	SPDT	96"	3/8X6	NEMA 1	
PENN	A19ABC-24C	-30/100F	3/12F ADJ	SPDT	96"	3/8X4	NEMA 1	(1)
Ranco	O60-101	-35/95F	4/50F ADJ	SPDT	NONE	COILED	NEMA 1	
PENN	A19BBC-2C	-30/100F	3/12F ADJ	SPDT	NONE	COILED	NEMA 1	(1)
Ranco	O60-1072	-15/40F	3/20F ADJ	OPEN LO	NONE	COILED	NEMA 1	
PENN	A19BBA-1C	-30/50F	5/20F ADJ	OPEN LO	NONE	COILED	NEMA 1	(1)
Ranco	O60-120	-35/95F	4/50F ADJ	SPDT	240"	3/8X6	NEMA 1	
PENN	A19ABC-36C	-30/100F	3/12F ADJ	SPDT	240"	3/8X4	NEMA 1	(1)

TEMPERATURE Controls, cont.

Product#	Range	Diff.	Switch	Capillary	Bulb	Cover	Notes
Ranco O60-1408	-15/40F	3/20F ADJ	OPEN LO	72"	YES	NEMA 1	
PENN A19ABA-1C	-30/50F	5/20F ADJ	OPEN LO	72"	3/8X4	NEMA 1	(1)
Ranco O60-200	95/240F	6/50F ADJ	SPDT	96"	3/8X6	NEMA 1	
PENN A19ABC-12C	100/240F	6/24F ADJ	SPDT	96"	.29X2.5	NEMA 1	(1)

DEFROST / FAN DELAY Temperature Controls

Ranco F25-107	40/75F	20F FXD	SPDT	60"	3/8X4	OPEN	
PENN A19ZBC-2C	45/85	25F ADJ	SPDT	72"	0.3X3.125	NEMA 1	(10)
Ranco F25-114	43/73F	24F FXD	SPDT	60"	3/8X4	OPEN	
PENN A19ZBC-2C	45/85	25F ADJ	SPDT	72"	0.3X3.125	NEMA 1	(10)

PRESSURE Controls

Product#	Range	Diff.	Switch	Capillary	Connection	Cover	Notes
Ranco 3126-116	7/125	25 FXD	SPDT	60"	SWEAT	OPEN	
PENN P20EB-1C	7/150	29/32 FXD	SPDT	36"	SWEAT	OPEN	(6)
Ranco 3126-117	7/27	12 FXD	SPDT	60"	SWEAT	OPEN	
PENN P70AB-2C	20"/100	7/50 ADJ	OPEN LO	36"	W/ FLARE	NEMA 1	(5)(4)
Ranco 3126-216	7/125	MANUAL	OPEN LO	60"	SWEAT	OPEN	
PENN P70BA-1C	20"/100	MANUAL	OPEN LO	36"	W/ FLARE	NEMA 1	(5)(4)
Ranco 3126-412	7/77	23/70	SPDT	60"	SWEAT	OPEN	
PENN P20EB-1C	7/150	29/32 FXD	SPDT	36"	SWEAT	OPEN	(6)
Ranco 3127-140	125/450	70 FXD	OPEN HI	60"	SWEAT	OPEN	
PENN P20EB-2C	100/425	60/77 FXD	SPDT	36"	SWEAT	OPEN	(6)
Ranco 3127-220	125/450	MANUAL	SPDT	60"	SWEAT	OPEN	
PENN P70DA-1C	50/450	MANUAL	OPEN HI	36"	W/ FLARE	NEMA 1	(5)(4)
Ranco 3127-414	150/450	70/125	SPDT	60"	SWEAT	OPEN	
PENN P20EB-2C	100/425	60/77 FXD	SPDT	36"	SWEAT	OPEN	(6)
Ranco 3160-012	5/110	25 FXD	SPDT	60"	SWEAT	OPEN	
PENN P20EB-1C	7/150	29/32 FXD	SPDT	36"	SWEAT	OPEN	(6)
Ranco 3160-014	5/125	25 FXD	OPEN LO	60"	SWEAT	OPEN	
PENN P20EB-1C	7/150	29/32 FXD	SPDT	36"	SWEAT	OPEN	(6)
Ranco 3160-212	5/110	MANUAL	OPEN LO	60"	SWEAT	OPEN	
PENN P70BA-1C	20"/100	MANUAL	OPEN LO	36"	W/ FLARE	NEMA 1	(5)(4)
Ranco 3160-406	5/125	12/50	SPDT	60"	SWEAT	OPEN	
PENN P20EB-1C	7/150	29/32 FXD	SPDT	36"	SWEAT	OPEN	(6)
Ranco 3161-002	200/475	75 FXD	OPEN HI	60"	SWEAT	OPEN	
PENN P20EB-2C	100/425	60/77 FXD	SPDT	36"	SWEAT	OPEN	(6)
Ranco 3161-003	200/475	110 FXD	OPEN HI	60"	SWEAT	OPEN	
PENN P20EB-2C	100/425	60/77 FXD	SPDT	36"	SWEAT	OPEN	(6)
Ranco 3161-004	200/475	50 FXD	OPEN HI	60"	SWEAT	OPEN	
PENN P20EB-2C	100/425	60/77 FXD	SPDT	36"	SWEAT	OPEN	(6)
Ranco 3161-009	125/285	50 FXD	SPDT	60"	SWEAT	OPEN	
PENN P20EB-2C	100/425	60/77 FXD	SPDT	36"	SWEAT	OPEN	(6)
Ranco 3161-201	200/475	MANUAL	SPDT	60"	SWEAT	OPEN	
PENN P70DA-1C	50/450	MANUAL	OPEN HI	36"	W/ FLARE	NEMA 1	(5)(4)
Ranco 3161-205	125/285	MANUAL	OPEN HI	60"	W/ FLARE	OPEN	
PENN P70DA-1C	50/450	MANUAL	OPEN HI	36"	W/ FLARE	NEMA 1	(5)
Ranco 3161-403	200/475	50/150	SPDT	60"	SWEAT	OPEN	
PENN P20EB-2C	100/425	60/77 FXD	SPDT	36"	SWEAT	OPEN	(6)
Ranco G20-4050	7/27	12 FXD	OPEN LO	60"	SWEAT	OPEN	
PENN P70AB-2C	20"/100	7/50 ADJ	OPEN LO	36"	W/ FLARE	NEMA 1	(5)(4)
Ranco G20-4051	7/77	19/70	OPEN LO	60"	SWEAT	OPEN	
PENN P20EB-1C	7/150	29/32 FXD	SPDT	36"	SWEAT	OPEN	(6)
Ranco G20-4412	7/70	MANUAL	OPEN LO	60"	SWEAT	OPEN	
PENN P70BA-1C	20"/100	MANUAL	OPEN LO	36"	W/ FLARE	NEMA 1	(5)(4)
Ranco G23-5052	150/450	50/125	OPEN HI	60"	SWEAT	OPEN	
PENN P20EB-2C	100/425	60/77 FXD	SPDT	36"	SWEAT	OPEN	(6)
Ranco G23-5253	150/450	MANUAL	OPEN HI	60"	SWEAT	OPEN	
PENN P70DA-1C	50/450	MANUAL	OPEN HI	36"	W/ FLARE	NEMA 1	(5)(4)
Ranco O10-1093	10"/100	10/40	OPEN LO	48"	W/ FLARE	NEMA 1	
PENN P70AB-2C	20"/100	7/50	OPEN LO	36"	W/ FLARE	NEMA 1	
Ranco O10-1401	12"/50	5/35	OPEN LO	NONE	MALE FLARE	NEMA 1	
PENN P170AB-12C	12"/80	5/35	OPEN LO	NONE	MALE FLARE	NEMA 1	
Ranco O10-1402	12"/50	535	OPEN LO	36"	W/ FLARE	NEMA 1	
PENN P70AB-12C	12"/80	5/35	OPEN LO	36"	W/ FLARE	NEMA 1	
Ranco O10-1483	10"/100	10/40	OPEN LO	36"	W/ FLARE	NEMA 1	
PENN P70AB-2C	20"/100	7/50	OPEN LO	36"	W/ FLARE	NEMA 1	
Ranco O10-1807	100/250	20/100	Open LO	None	Male Flare	NEMA 1	
PENN P70AA-151C	50/300	20/120	OPEN LO	NONE	MALE FLARE	NEMA 1	

PRESSURE Controls, cont.

Product#	Range	Diff.	Switch	Capillary	Connection	Cover	Notes
Ranco O10-1831	10"/100	10/40	OPEN LO	NONE	MALE FLARE	NEMA 1	
PENN P70AB-12C	12"/80	5/35	OPEN LO	36"	W/ FLARE	NEMA 1	
Ranco O10-1842	12"/50	5/35	OPEN LO	48"	W/ FLARE	NEMA 1	
PENN P70AB-12C	12"/80	5/35	OPEN LO	36"	W/ FLARE	NEMA 1	
Ranco O10-2000	100/250	20/100	OPEN LO	48"	W/ FLARE	NEMA 1	
PENN P70AP-3C	100/300	25/75	OPEN LO	36"	W/ FLARE	NEMA 1	
Ranco O10-2054	100/400	40/150	OPEN LO	36"	W/ FLARE	NEMA 1	
PENN P70AA-118C	100/400	35/200	OPEN LO	36"	W/ FLARE	NEMA 1	
Ranco O11-1711	150/450	40/150	OPEN HI	36"	W/ FLARE	NEMA 1	
PENN P70CP-3C	50/450	60/150	OPEN HI	36"	W/ FLARE	NEMA 1	
Ranco O11-1713	150/450	40/150	OPEN HI	NONE	MALE FLARE	NEMA 1	
PENN P70CA-2C	50/450	60/150	OPEN HI	NONE	MALE FLARE	NEMA 1	
Ranco O11-1799	10"/100	10/40	OPEN HI	NONE	MALE FLARE	NEMA 1	
PENN P170CA-1C	20"/100	6/70	OPEN HI	NONE	MALE FLARE	NEMA 1	
Ranco O11-3099	10"/100	10/40	OPEN HI	36"	W/ FLARE	NEMA 1	
PENN P70CA-1C	20"/100	6/70	OPEN HI	36"	W/ FLARE	NEMA 1	
Ranco O16-107	10"/100	10/40 ADJ	SPDT	NONE	MALE FLARE	NEMA 1	
PENN P70EA-10C	20"/100	5 FXD	SPDT	NONE	MALE FLARE	NEMA 1	
Ranco O16-120	12"/50	5/35 ADJ	SPDT	NONE	MALE FLARE	NEMA 1	
PENN P70EA-10C	20"/100	5 FXD	SPDT	NONE	MALE FLARE	NEMA 1	
Ranco O16-142	100/400	17 FXD	SPDT	36"	W/ FLARE	NEMA 1	
PENN P70EA-6C	100/300	14 FXD	SPDT	36"	SWEAT	NEMA 1	(4)
Ranco O16-166	50/150	10/40	SPDT	36"	W/ FLARE	NEMA 1	
PENN P70GA-2C	20"/100	7/50	NO/NC	36"	W/ FLARE	NEMA 1	(12)
Ranco O16-200	150/450	MANUAL	SPDT	48"	W/ FLARE	NEMA 1	
PENN P70KA-1C	50/450	MANUAL	NO/NC	36"	W/ FLARE	NEMA 1	(12)
Ranco O16-209	150/450	MANUAL	SPDT	NONE	MALE FLARE	NEMA 1	
PENN P170KA-1C	50/450	MANUAL	NO/NC	NONE	MALE FLARE	NEMA 1	(12)
Ranco O16-261	10"/100	MANUAL	SPDT	48"	W/ FLARE	NEMA 1	
PENN P70HA-2C	20"/100	MANUAL	NO/NC	36"	W/ FLARE	NEMA 1	(12)
Ranco O16-503	150/450	40/150	SPDT	NONE	MALE FLARE	NEMA 1	
PENN P70JA-18C	50/450	60/150	NO/NC	NONE	MALE FLARE	NEMA 1	(12)
Ranco O16-527	10"/100	10/40 ADJ	SPDT	36"	W/ FLARE	NEMA 1	
PENN P70EA-10C	20"/100	5 FXD	SPDT	NONE	MALE FLARE	NEMA 1	(3)
Ranco O16-557	12"/50	5/35 ADJ	SPDT	36"	W/ FLARE	NEMA 1	
PENN P70EA-10C	20"/100	5 FXD	SPDT	NONE	MALE FLARE	NEMA 1	(3)
Ranco O16-585	10"/100	MANUAL	SPDT	NONE	MALE FLARE	NEMA 1	
PENN P70HA-3C	20"/100	MANUAL	NO/NC	NONE	FEMALE NPT	NEMA 1	(4)(12)
Ranco O20-1894	100/400	40/150	OPEN LO	NONE	MALE FLARE	NEMA 1	
PENN P170AA-118C	100/400	35/200	OPEN LO	NONE	MALE FLARE	NEMA 1	
Ranco O20-7002	12"/50	5/35	DPST-LO	36"	W/ FLARE	NEMA 1	
PENN P72AA-1C	20"/100	7/50	DPST-LO	36"	W/ FLARE	NEMA 1	
Ranco O20-7006	100/400	40/150	DPST-LO	36"	W/ FLARE	NEMA 1	
PENN P72AA-27C	100/400	35/200	DPST-LO	36"	W/ FLARE	NEMA 1	

Product #	Cut-Out	Cut-In	Range	Switch	Electrical	Pressure	Notes
Ranco 3100-001	15	40	NONE	SPST	30" LEADS	1/4" SWEAT	
PENN P100AP-1C	10	40	NONE	SPST	48" LEADS	1/4" FEM. FLARE	
Ranco 3100-002	5	30	NONE	SPST	72" LEADS	1/4" FEM. FLARE	
PENN P20EB-1C	ADJ.	N/A	7/150	SPDT	ARKLES	36" CAP, SWEAT	(4)(5)(6)(7)(8)
Ranco 3100-003	20	45	NONE	SPST	72" LEADS	1/4" FEM. FLARE	
PENN P20EB-1C	ADJ.	N/A	7/150	SPDT	ARKLES	36" CAP, SWEAT	(4)(5)(6)(7)(8)
Ranco 3100-004	35	60	NONE	SPST	QC	1/4" FEM. FLARE	
PENN P100AP-2C	35	60	NONE	SPST	48" LEADS	1/4" FEM. FLARE	(8)
Ranco 3100-005	15" VAC	17.5	NONE	SPDT	QC	1/4" FEM. FLARE	
PENN P70AB-1C	ADJ.	N/A	20"/100	SPST	SCREW TERMS.	1/4" MALE FLARE	(4)(5)(7)(8)
Ranco 3100-006	48	80	NONE	SPDT	36" LEADS	1/4" SWEAT	
PENN P20EB-1C	ADJ.	N/A	7/150	SPDT	ARKLES	36" CAP, SWEAT	(4)(5)(6)(7)(8)
Ranco 3100-007	15	40	NONE	SPST	30" LEADS	1/4" FEM. FLARE	
PENN P100AP-1C	10	40	NONE	SPST	48" LEADS	1/4" FEM. FLARE	
Ranco 3100-009	0	20	NONE	SPST	QC	1/4" FEM. FLARE	
PENN P70AB-1C	ADJ.	N/A	20"/100	SPST	SCREW TERMS.	1/4" MALE FLARE	(4)(5)(7)(8)
Ranco 3100-010	45	70	NONE	SPDT	QC	1/4" FEM. FLARE	
PENN P20EB-1C	ADJ.	N/A	7/150	SPDT	ARKLES	36" CAP, SWEAT	(4)(5)(6)(7)
Ranco 3100-050	10	30	NONE	SPST	18" LEADS	1/4" FEM. FLARE	
PENN P100AP-1C	10	40	NONE	SPST	48" LEADS	1/4" FEM. FLARE	
Ranco 3100-051	25	80	NONE	SPST	18" LEADS	1/4" FEM. FLARE	
PENN P20EB-1C	ADJ.	N/A	7/150	SPDT	ARKLES	36" CAP, SWEAT	(4)(5)(6)(7)(8)
Ranco 3100-052	40	80	NONE	SPST	18" LEADS	1/4" FEM. FLARE	
PENN P100AP-1C	35	60	NONE	SPST	48" LEADS	1/4" FEM. FLARE	
Ranco 3100-075	85	135	NONE	SPDT	QC	1/4" FEM. FLARE	
PENN P70AA-119C	ADJ.	N/A	50/300	SPST	SCREW TERMS.	1/4" FEM. FLARE	(5)(7)(8)(12)
Ranco 3100-076	105	135	NONE	SPST	QC	1/4" FEM. FLARE	
PENN P20EB-1C	ADJ.	N/A	7/150	SPDT	ARKLES	36" CAP, SWEAT	(4)(5)(6)(7)(12)
Ranco 3100-077	115	165	NONE	SPST	QC	1/4" FEM. FLARE	
PENN P170AA-118C	ADJ.	N/A	100/400	SPST	SCREW TERMS.	1/4" MALE FLARE	(4)(5)(7)(8)

PRESSURE Controls, cont.

Product #	Cut-Out	Cut-In	Range	Switch	Electrical	Pressure	Notes
Ranco 3100-078	135	185	NONE	SPDT	QC	1/4" FEM. FLARE	
PENN P170AA-118C	ADJ.	N/A	100/400	SPST	SCREW TERMS.	1/4" MALE FLARE	(4)(5)(7)(8)(12)
Ranco 3100-079	165	215	NONE	SPST	QC	1/4" FEM. FLARE	
PENN P100AP-4C	170	250	NONE	SPST	48" LEADS	1/4" FEM. FLARE	(8)
Ranco 3100-080	200	240	NONE	SPDT	QC	1/4" FEM. FLARE	
PENN P170AA-118C	ADJ.	N/A	100/400	SPST	SCREW TERMS.	1/4" MALE FLARE	(4)(5)(7)(8)(12)
Ranco 3100-081	250	300	NONE	SPDT	QC	1/4" FEM. FLARE	
PENN P170AA-118C	ADJ.	N/A	100/400	SPST	SCREW TERMS.	1/4" MALE FLARE	(4)(5)(7)(8)(12)
Ranco 3100-100	425	325	NONE	SPST	72" LEADS	1/4" FEM. FLARE	
PENN P100CP-2C	425	325	NONE	SPST	48" LEADS	1/4" FEM. FLARE	
Ranco 3100-101	400	300	NONE	SPST	18" LEADS	1/4" FEM. FLARE	
PENN P100CP-1C	400	300	NONE	SPST	48" LEADS	1/4" FEM. FLARE	
Ranco 3100-102	220	170	NONE	SPST	QC	1/4" FEM. FLARE	
PENN P100CP-2C	425	325	NONE	SPST	48" LEADS	1/4" FEM. FLARE	(8)
Ranco 3100-103	410	MANUAL	NONE	SPST	42" LEADS	1/4" FEM. FLARE	
PENN P100DA-1C	410	MANUAL	NONE	SPST	48" LEADS	1/4" FEM. FLARE	
Ranco 3100-104	420	MANUAL	NONE	SPST	48" LEADS	1/4" FEM. FLARE	
PENN P70DA-1C	ADJ.	MANUAL	50/450	SPST	SCREW TERMS.	36" CAP, FLARE	(4)(5)(7)(8)
Ranco 3100-105	440	MANUAL	NONE	SPST	36" LEADS	.093 CAP TUBE	
PENN P70DA-1C	ADJ.	MANUAL	50/450	SPST	SCREW TERMS.	36" CAP, FLARE	(4)(5)(7)(8)
Ranco 3100-106	475	MANUAL	NONE	SPST	42" LEADS	1/4" SWEAT W/ CAP	
PENN P100DA-2C	475	MANUAL	NONE	SPST	48" LEADS	1/4" FEM. FLARE	(4)
Ranco 3100-107	232	MANUAL	NONE	SPST	84" LEADS	1/4" FEM. FLARE	
PENN P70DA-1C	ADJ.	MANUAL	50/450	SPST	SCREW TERMS.	36" CAP, FLARE	(4)(5)(7)(8)
Ranco 3100-108	280	MANUAL	NONE	SPST	12" LEADS	1/4" NPTF	
PENN P20EB-2C	ADJ.	N/A	100/425	SPDT	ARKLES	36" CAP, SWEAT	(4)(5)(6)(7)(8)
Ranco 3100-110	375	275	NONE	SPDT	QC	1/4" SWEAT	
PENN P20EB-2C	ADJ.	N/A	100/425	SPDT	ARKLES	36" CAP, SWEAT	(4)(5)(6)(7)
Ranco 3100-111	375	275	NONE	SPST	QC	1/4" FEM. FLARE	
PENN P20EB-2C	ADJ.	N/A	100/425	SPDT	ARKLES	36" CAP, SWEAT	(4)(5)(6)(7)
Ranco 3100-112	275	175	NONE	SPST	24" LEADS	1/4" FEM. FLARE	
PENN P20EB-2C	ADJ.	N/A	100/425	SPDT	ARKLES	36" CAP, SWEAT	(4)(5)(6)(7)(8)
Ranco 3100-113	395	295	NONE	SPST	QC	1/4" SWEAT	
PENN P20EB-2C	ADJ.	N/A	100/425	SPDT	ARKLES	36" CAP, SWEAT	(4)(5)(6)(7)
Ranco 3100-115	350	250	NONE	SPDT	36" LEADS	1/4" SWEAT	
PENN P20EB-2C	ADJ.	N/A	100/425	SPDT	ARKLES	36" CAP, SWEAT	(4)(5)(6)(7)(8)
Ranco 3100-116	213	113	NONE	SPST	QC	1/4" FEM. FLARE	
PENN P20EB-2C	ADJ.	N/A	100/425	SPDT	ARKLES	36" CAP, SWEAT	(4)(5)(6)(7)
Ranco 3100-117	140	190	NONE	SPST	12" LEADS	.093 CAP TUBE	
PENN P20EB-2C	ADJ.	N/A	100/425	SPDT	ARKLES	36" CAP, SWEAT	(4)(5)(6)(7)(8)
Ranco 3100-118	295	395	NONE	SPST	QC	1/4" FEM. FLARE	
PENN P20EB-2C	ADJ.	N/A	100/425	SPDT	ARKLES	36" CAP, SWEAT	(4)(5)(6)(7)
Ranco 3100-120	420	320	NONE	SPST	QC	1/4" FEM. FLARE	
PENN P20EB-2C	ADJ.	N/A	100/425	SPDT	ARKLES	36" CAP, SWEAT	(4)(5)(6)(7)
Ranco 3100-121	426	272	NONE	SPST	QC	1/4" SWEAT	
PENN P20EB-2C	ADJ.	N/A	100/425	SPDT	ARKLES	36" CAP, SWEAT	(4)(5)(6)(7)
Ranco 3100-150	350	250	NONE	SPST	18" LEADS	1/4" FEM. FLARE	
PENN P20EB-2C	ADJ.	N/A	100/425	SPDT	ARKLES	36" CAP, SWEAT	(4)(5)(6)(7)(8)
Ranco 3100-151	400	300	NONE	SPST	18" LEADS	1/4" FEM. FLARE	
PENN P100CP-1C	400	300	NONE	SPST	48" LEADS	1/4" FEM. FLARE	
Ranco 3100-152	400	200	NONE	SPST	18" LEADS	1/4" FEM. FLARE	
PENN P100CP-1C	400	300	NONE	SPST	48" LEADS	1/4" FEM. FLARE	
Ranco 3100-153	450	250	NONE	SPST	18" LEADS	1/4" FEM. FLARE	
PENN P20EB-2C	ADJ.	N/A	100/425	SPDT	ARKLES	36" CAP, SWEAT	(4)(5)(6)(7)(8)
Ranco 3100-154	500	400	NONE	SPST	18" LEADS	1/4" FEM. FLARE	
PENN P70LB-1C	ADJ.	N/A	100/500	SPST	SCREW TERMS.	36" CAP, FLARE	(4)(5)(7)(8)(9)
Ranco 3100-155	500	300	NONE	SPST	18" LEADS	1/4" FEM. FLARE	
PENN P70LB-1C	ADJ.	N/A	100/500	SPST	SCREW TERMS.	36" CAP, FLARE	(4)(5)(7)(8)(9)
Ranco MPF-7006	75	120	NONE	SPST	18" LEADS	1/4" FEM. FLARE	
PENN P20EB-1C	ADJ.	N/A	7/150	SPDT	ARKLES	36" CAP, SWEAT	(6)(7)(8)
Ranco MPF-7007	110	170	NONE	SPST	18" LEADS	1/4" FEM. FLARE	
PENN P20EB-1C	ADJ.	N/A	7/150	SPDT	ARKLES	36" CAP, SWEAT	(6)(7)(8)
Ranco MPF-7008	150	225	NONE	SPST	18" LEADS	1/4" FEM. FLARE	
PENN P100AP-3C	150	225	NONE	SPST	48" LEADS	1/4" MALE FLARE	
Ranco MPF-7009	190	275	NONE	SPST	18" LEADS	1/4" FEM. FLARE	
PENN P20EB-2C	ADJ.	N/A	100/425	SPDT	ARKLES	36" CAP, SWEAT	(6)(7)(8)
Ranco MPF-7010	300	400	NONE	SPST	18" LEADS	1/4" FEM. FLARE	
PENN P20EB-2C	ADJ.	N/A	100/425	SPDT	ARKLES	36" CAP, SWEAT	(6)(7)(8)
Ranco MPH-7101	250	180	NONE	SPST	18" LEADS	1/4" FEM. FLARE	
PENN P20EB-2C	ADJ.	N/A	100/425	SPDT	ARKLES	36" CAP, SWEAT	(6)(7)(8)
Ranco MPH-7102	270	200	NONE	SPST	18" LEADS	1/4" FEM. FLARE	
PENN P20EB-2C	ADJ.	N/A	100/425	SPDT	ARKLES	36" CAP, SWEAT	(6)(7)(8)
Ranco MPH-7103	300	200	NONE	SPST	18" LEADS	1/4" FEM. FLARE	
PENN P20EB-2C	ADJ.	N/A	100/425	SPDT	ARKLES	36" CAP, SWEAT	(6)(7)(8)
Ranco MPH-7104	325	225	NONE	SPST	18" LEADS	1/4" FEM. FLARE	
PENN P20EB-2C	ADJ.	N/A	100/425	SPDT	ARKLES	36" CAP, SWEAT	(6)(7)(8)

PRESSURE Controls, cont.

Product #	Cut-Out	Cut-In	Range	Switch	Electrical	Pressure	Notes
Ranco MPH-7105	350	250	NONE	SPST	18" LEADS	1/4" FEM. FLARE	
PENN P20EB-2C	ADJ.	N/A	100/425	SPDT	ARKLES	36" CAP, SWEAT	(6)(7)(8)
Ranco MPH-7106	375	275	NONE	SPST	18" LEADS	1/4" FEM. FLARE	
PENN P20EB-2C	ADJ.	N/A	100/425	SPDT	ARKLES	36" CAP, SWEAT	(6)(7)(8)
Ranco MPH-7107	400	300	NONE	SPST	18" LEADS	1/4" FEM. FLARE	
PENN P100CP-1C	400	300	NONE	SPST	48" LEADS	1/4" MALE FLARE	
Ranco MPH-7109	425	325	NONE	SPST	18" LEADS	1/4" FEM. FLARE	
PENN P100CP-2C	425	325	NONE	SPST	48" LEADS	1/4" MALE FLARE	
Ranco MPL-7001	5	20	NONE	SPST	18" LEADS	1/4" FEM. FLARE	
PENN P100AC-1C	5	20	NONE	SPST	48" LEADS	1/4" MALE FLARE	
Ranco MPL-7002	15	35	NONE	SPST	18" LEADS	1/4" FEM. FLARE	
PENN P100AP-1C	10	40	NONE	SPST	48" LEADS	1/4" MALE FLARE	
Ranco MPL-7003	25	80	NONE	SPST	18" LEADS	1/4" FEM. FLARE	
PENN P20EB-1C	ADJ.	N/A	7/150	SPDT	ARKLES	36" CAP, SWEAT	(6)(7)(8)
Ranco MPL-7004	35	60	NONE	SPST	18" LEADS	1/4" FEM. FLARE	
PENN P100AP-2C	35	60	NONE	SPST	48" LEADS	1/4" MALE FLARE	
Ranco MPL-7005	45	60	NONE	SPST	18" LEADS	1/4" FEM. FLARE	
PENN P20EB-1C	ADJ.	N/A	7/150	SPDT	ARKLES	36" CAP, SWEAT	(6)(7)(8)
Ranco MPL-7011	10	25	NONE	SPST	18" LEADS	1/4" FEM. FLARE	
PENN P20EB-1C	ADJ.	N/A	7/150	SPDT	ARKLES	36" CAP, SWEAT	(6)(7)(8)
Ranco MPL-7012	20	45	NONE	SPST	18" LEADS	1/4" FEM. FLARE	
PENN P20EB-1C	ADJ.	N/A	7/150	SPDT	ARKLES	36" CAP, SWEAT	(6)(7)(8)
Ranco MPL-7014	40	80	NONE	SPST	18" LEADS	1/4" FEM. FLARE	
PENN P20EB-1C	ADJ.	N/A	7/150	SPDT	ARKLES	36" CAP, SWEAT	(6)(7)(8)

DUAL PRESSURE Controls

Product #	LO Side	Diff.	HI Side	Diff.	Capillary	Connection	Notes
Ranco O12-1502	12"/50	5/35	150/450	70 FXD	36"	W/ FLARE	
PENN P70LB-6C	12"/80	5/35	100/500	60 FXD	36"	W/ FLARE	
Ranco O12-1505	12"/50	5/35	100/250	50 FXD	NONE	MALE FLARE	
PENN P170LB-6C	12"/80	5/35	100/500	60 FXD	NONE	MALE FLARE	
Ranco O12-1506	12"/50	5/35	100/250	50 FXD	36"	W/ FLARE	
PENN P70LB-6C	12"/80	5/35	100/500	60 FXD	36"	W/ FLARE	
Ranco O12-1549	10"/100	10/40	150/450	70 FXD	36"	W/ FLARE	
PENN P70LB-1C	20"/100	7/50	100/500	60 FXD	36"	W/ FLARE	
Ranco O12-1550	10"/100	10/40	150/450	70 FXD	NONE	MALE FLARE	
PENN P170LB-1C	20"/100	7/50	100/500	60 FXD	NONE	MALE FLARE	
Ranco O12-1554	12"/50	5/35	100/250	50 FXD	48"	W/ FLARE	
PENN P70LB-6C	12"/80	5/35	100/500	60 FXD	36"	W/ FLARE	
Ranco O12-1594	10"/100	MANUAL	150/450	MANUAL	36"	W/ FLARE	
PENN P70NA-1C	20"/100	MANUAL	100/500	MANUAL	36"	W/ FLARE	
Ranco O12-4139	12"/50	5/35	150/450	70 FXD	NONE	MALE FLARE	
PENN P170LB-6C	12"/80	5/35	100/500	60 FXD	NONE	MALE FLARE	
Ranco O12-4833	12"/50	5/35	150/450	70 FXD/MAN	48"	W/ FLARE	
PENN P70SA-1C	12"/80	5/35	100/500	60 FXD	36"	W/ FLARE	
Ranco O12-4834	10"/100	10/40	150/450	70 FXD/MAN	48"	W/ FLARE	
PENN P70SA-1C	12"/80	5/35	100/500	60 FXD	36"	W/ FLARE	
Ranco O12-4842	12"/50	5/35	150/450	70 FXD/MAN	NONE	MALE FLARE	
PENN P170SA-1C	12"/80	5/35	100/500	60 FXD	NONE	MALE FLARE	
Ranco O12-4846	10"/100	10/40	150/450	70 FXD/MAN	NONE	MALE FLARE	
PENN P170SA-1C	12"/80	5/35	100/500	60 FXD	NONE	MALE FLARE	
Ranco O22-7702	12"/50	5/35	100/250	50 FXD/MAN	36"	W/ FLARE	(2)
PENN P72LB-1C	20"/100	7/50	100/500	60 FXD	36"	W/ FLARE	
Ranco O22-7706	10"/100	10/40	150/450	70 FXD	36"	W/ FLARE	(2)
PENN P72LB-1C	20"/100	7/50	100/500	60 FXD	36"	W/ FLARE	

LOW PRESSURE CUTOUT with Time Delay

Product #	Range	Diff.	Time Delay	Capillary	Connection	Cover	Notes
Ranco 3341-161	0/100	5 FXD	120 SECS	36"	W/ FLARE	NEMA 1	
PENN P29NC-38C	20"/100	2.2 FXD	120 SECS.	36"	W/ FLARE	NEMA 1	

LUBE OIL PRESSURE Controls

Product #	Range	Reset	Delay	Capillary	Connection	Cover	Notes
Ranco 3321-001	9 FXD	MANUAL	45,60,90,120	NONE	MALE FLARE	NEMA 1	
PENN P128AA-**C	8/70 ADJ	MANUAL	NOTE (11)	NONE	MALE FLARE	NEMA 1	(11)
Ranco 3321-009	5 FXD	MANUAL	45,60,90,120	36"	W/ FLARE	NEMA 1	
PENN P28AA-**C	8/70 ADJ	MANUAL	NOTE (11)	36"	W/ FLARE	NEMA 1	(11)
Ranco 3321-010	9 FXD	MANUAL	45,60,90,120	36"	W/ FLARE	NEMA 1	
PENN P28AA-**C	8/70 ADJ	MANUAL	NOTE (11)	36"	W/ FLARE	NEMA 1	(11)
Ranco 3321-014	15 FXD	MANUAL	45,60,90,120	36"	W/ FLARE	NEMA 1	
PENN P28AA-**C	8/70 ADJ	MANUAL	NOTE (11)	36"	W/ FLARE	NEMA 1	(11)
Ranco 3321-015	30 FXD	MANUAL	45,60,90,120	36"	W/ FLARE	NEMA 1	
PENN P28AA-**C	8/70 ADJ	MANUAL	NOTE (11)	36"	W/ FLARE	NEMA 1	(11)

LUBE OIL PRESSURE Controls, cont.

Product #	Range	Reset	Delay	Capillary	Connection	Cover	Notes
Ranco P30-3601	8/60 ADJ	MANUAL	60	36"	W/ FLARE	NEMA 1	
PENN P28AA-2C	8/70 ADJ	MANUAL	60	36"	W/ FLARE	NEMA 1	
Ranco P30-3701	8/60 ADJ	MANUAL	90	36"	W/ FLARE	NEMA 1	
PENN P28AA-1C	8/70 ADJ	MANUAL	90	36"	W/ FLARE	NEMA 1	
Ranco P30-3801	8/60 ADJ	MANUAL	120	36"	W/ FLARE	NEMA 1	
PENN P28AA-17C	8/70 ADJ	MANUAL	120	36"	W/ FLARE	NEMA 1	
Ranco P30-5826	9 FXD	MANUAL	120	36"	W/ FLARE	NEMA 1	
PENN P45NCA-12C	9 FXD	MANUAL	120	36"	W/ FLARE	NEMA 1	
Ranco P30-5827	9 FXD	MANUAL	120	NONE	MALE FLARE	NEMA 1	
PENN P145NCA-12C	9 FXD	MANUAL	120	NONE	MALE FLARE	NEMA 1	

LUBE OIL PRESSURE Controls without Time Delay

Product #	Range	Diff.	Cut-In	Switch	Capillary	Connection	Notes
Ranco 3311-101	14 FXD	5 FXD	9 FXD	SPDT	36"	1/4" FEM. FLARES	
PENN P74AA-1C	8/70 ADJ	8/30 ADJ	ADJ	OPEN HI	36"	1/4" FEM. FLARES	(12)
Ranco 3311-103	4/6 ADJ	5/6	9/12	SPDT	24"	W/1/4" SWEATS	
PENN P74EA-8C	2/26 ADJ	3.5 FXD	N/A	SPDT	36"	1/4" FEM. FLARES	(4)
Ranco 3311-111	4/6 FXD	5/6	9/12	SPDT	84"	1/4" FEM. FLARES	
PENN P74EA-8C	2/26 ADJ	3.5 FXD	N/A	SPDT	36"	1/4" FEM. FLARES	
Ranco 3311-115	6 FXD	5 FXD	11 FXD	OPEN LO	24"	1/4" FEM. FLARES	
PENN P74BA-1C	8/70 ADJ	7/30 ADJ	ADJ	OPEN LO	36"	1/4" FEM. FLARES	
Ranco 3311-118	40 FXD	5 FXD	45 FXD	OPEN LO	25" & 24"	W/1/4" SWEATS	
PENN P74BA-1C	8/70 ADJ	7/30 ADJ	ADJ	OPEN LO	36"	1/4" FEM. FLARES	(4)
Ranco 3311-201	7 FXD	MANUAL	MANUAL	SPDT	49" & 72"	W/1/4" SWEATS	
PENN P74AB-1C	8/70 ADJ	MANUAL	MANUAL	OPEN HI	NONE	1/4" FEM. NPT	(4)(12)
Ranco 3315-101	14 FXD	5 FXD	9 FXD	SPDT	36"	1/4" FEM. FLARES	
PENN P74AA-1C	8/70 ADJ	8/30 ADJ	ADJ	OPEN HI	36"	1/4" FEM. FLARES	(12)
Ranco 3315-801	11/14 ADJ	5 FXD	16/19	SPDT	NONE	MALE FLARES	
PENN P74BA-1C	8/70 ADJ	7/30 ADJ	ADJ	OPEN LO	36"	1/4" FEM. FLARES	(4)(12)

TRANSFORMERS

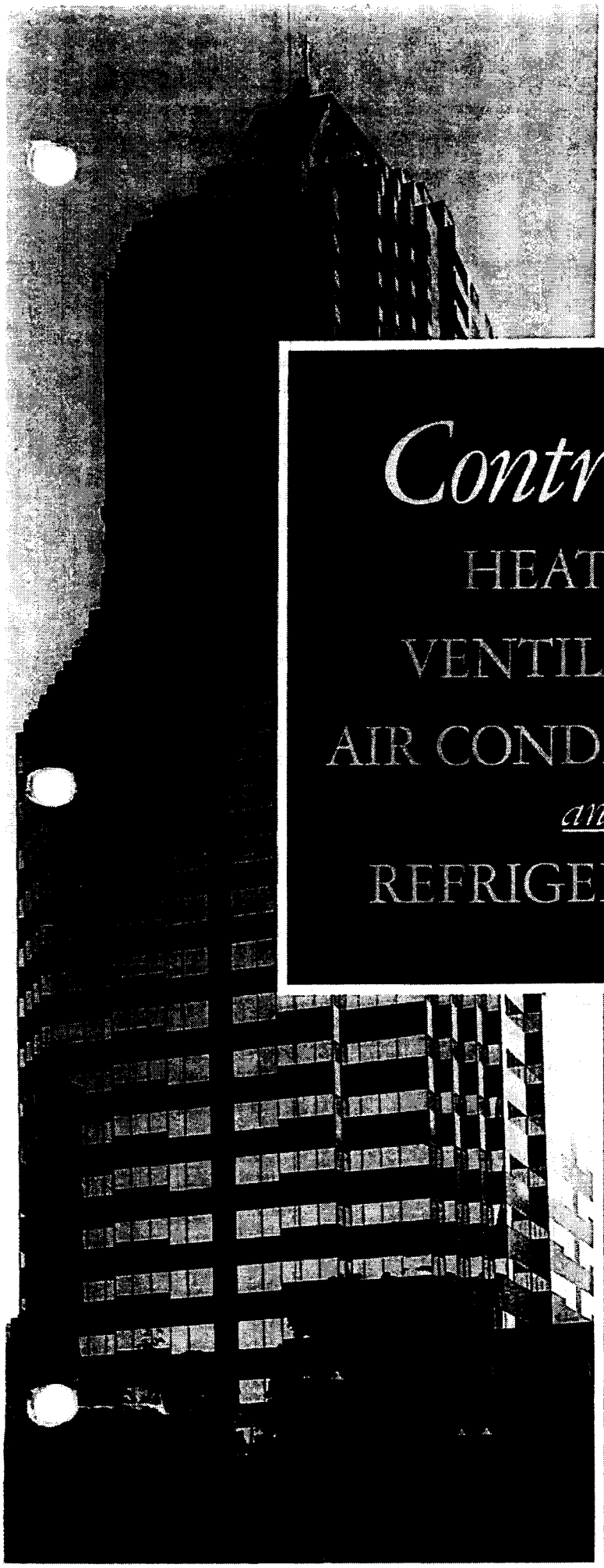
Product #	VA	Prim. Volt.	Prim. Lead	Sec. Volt.	Sec. Lead	Mounting	Notes
Ranco 620-205	20	120	8" LEADS	24	8" LEADS	FOOT	
PENN Y65A13-0	40	120	8" LEADS	24	30" LEADS	FOOT W/ HUBS	
Ranco 620-206	20	208/240	8" LEADS	24	8" LEADS	FOOT	
PENN Y65T31-0	40	120/208/240	8" LEADS	24	3 TERMINALS	UNIVERSAL	(8)
Ranco 620-403	40	120	8" LEADS	24	8" LEADS	UNIVERSAL	
PENN Y65T31-0	40	120/208/240	8" LEADS	24	3 TERMINALS	UNIVERSAL	(8)
Ranco 620-404	40	208/240	8" LEADS	24	8" LEADS	UNIVERSAL	
PENN Y65T31-0	40	120/208/240	8" LEADS	24	3 TERMINALS	UNIVERSAL	(8)
Ranco 620-405	40	120	8" LEADS	24	8" LEADS	FOOT	
PENN Y65A13-0	40	120	8" LEADS	24	30" LEADS	FOOT W/ HUBS	
Ranco 620-406	40	208/240	8" LEADS	24	8" LEADS	FOOT	
PENN Y65T31-0	40	120/208/240	8" LEADS	24	3 TERMINALS	UNIVERSAL	(8)
Ranco 620-482	40	120/208/240	8" LEADS	24	8" LEADS	FOOT	
PENN Y65A13-0	40	120	8" LEADS	24	30" LEADS	FOOT W/ HUBS	(13)
PENN Y65T31-0	40	120/208/240	8" LEADS	24	3 TERMINALS	UNIVERSAL	
Ranco 620-502	50	120/208/240	8" LEADS	24	8" LEADS	UNIVERSAL	
PENN Y63T22-0	50	120/208/240	8" LEADS	24	8" LEADS	UNIVERSAL	(13)
Ranco 620-752	75	120/208/240	8" LEADS	24	8" LEADS	FOOT	
PENN Y66T12-0	75	120/208/240	8" LEADS	24	8" LEADS	FOOT	(13)
Ranco 620-758	75	480	8" LEADS	24	8" LEADS	FOOT	
PENN Y66F12-0	75	277/480	8" LEADS	24	8" LEADS	FOOT	

Notes

(1) Can use A419ABC-1, -30/212F range, 1/30F diff., SPDT, 78" lead, 0.25 x 2 PTC sensor, NEMA 1.
(2) Convertible
(3) Add Ecosafe hose.
(4) Different pressure element.
(5) Not as compact.
(6) Differential depends on setting.
(7) Not an encapsulated switch as Ranco's is.
(8) Different electrical connection.
(9) Dual control, ignore lo side.
(10) Range is Defrost Termination for both.
(11) Choose correct one below based on timing required and pressure connection:

P28AA-1	8/70	90 Secs.	36"	W/ Flare
P28AA-2	8/70	60 Secs.	36"	W/ Flare
P28AA-17	8/70	120 Secs.	36"	W/ Flare
P28AA-18	8/70	45 Secs.	36"	W/ Flare
P128AA-1	8/70	90 Secs.	None	Male Flare
P128AA-2	8/70	60 Secs.	None	Male Flare
P128AA-17	8/70	120 Secs.	None	Male Flare

(12) Different switch.
(13) Choose which transformer based on primary voltage desired.
(14) May be extended up to 800 feet.



Control Products and Systems

Controls for HEATING, VENTILATION, AIR CONDITIONING *and* REFRIGERATION.

JOHNSON CONTROLS

Johnson Controls manufactures electronic, electromechanical and pneumatic control products and sensors of all types. We design and manufacture custom controls for more than 100 OEM customers. The company also engineers and installs advanced facility management systems, direct digital control and pneumatic systems to meet a wide range of customer environmental control needs.

Since 1885, Johnson Controls has been a leader in the manufacture and installation of HVAC and refrigeration controls and systems. With over 200 offices around the world, the company has vast expertise in working with schools, hospitals, commercial buildings, government and other facilities to help create comfortable, productive and safe building environments. And with over 2,500 stocking wholesale locations, our products are easy to obtain and replace.

ISO 9000 Certified: A HANDS-ON APPROACH TO QUALITY

Quality improvement is a continuous process at Johnson Controls. Our quality management system is in place for one reason: to ensure that we exceed customer expectations. The success of our quality management system is in the hands of each of our employees. The ISO 9000 certification of Controls Group design and manufacturing facilities affirms our performance in meeting strict global standards. Plus, it's your assurance that Johnson Controls products and services can meet yet another set of quality standards that's even more important — yours.

Why did we choose to be certified according to ISO 9000 standards? It gives you the confidence that we can satisfy recognized international standards for performance and quality. ISO also gives us a structure to apply to our quality management system, along with the ability to have it audited and registered on a regular basis by independent sources.

When a Johnson Controls product leaves our hands and reaches yours, the quality is uncompromised. For more detailed information on our quality systems, see your Johnson Controls representative.

JOHNSON CONTROLS

Design Facilities

Headquarters and North American Design Center
Milwaukee, WI USA
ISO-9001

Design & Manufacturing Facilities

JCI Regelungstechnik GmbH
Essen, Germany
ISO-9001

Johnson Controls S.p.A.
Lomagna, Italy
ISO-9001

Johnson Controls Nederland B.V.
Leeuwarden, The Netherlands
ISO-9001

Johnson Yokogawa
Newnan, GA USA
ISO-9002

Manufacturing Facilities

Humboldt Valve Facility
Milwaukee, WI USA
ISO-9002

Controls Mfg. Facility
Goshen, IN USA
ISO-9002

Panel Facility
Poteau, OK USA
ISO-9002

Controles Reynosa
Reynosa, Tamaulipas, Mexico
ISO-9002

Controles de Presion
[illegible]tarez,Chih., Mexico
ISO-9002

Electronic Repair Center
Milwaukee, WI USA
ISO-9002

Gas Valve/Dampers Mfg. Facility
Watertown, WI USA
ISO-9002

Maclaren Products
Glasgow, Scotland
ISO-9002

Distribution Facilities

Distribution Center
Erlanger, KY USA
ISO-9002

Distribution Center
Toronto, Canada
ISO-9002

Johnson Controls/PENN Refrigeration Controls

Temperature Controls
A319
A9

Pressure Controls
P70
P345
P28/P45

Flow Switches
F61

Water Valves
V46

Ecosafe™ Hose

For over 75 years, equipment manufacturers have preferred Johnson Controls/PENN refrigeration products. No other products can match them for long-life durability and versatility over a wide range of temperature and pressure applications.

- Dependable, "bullet-proof" controls
- Continuously innovative
- Decades of tried and true performance
- Advanced electronic controls for increased reliability

P70 Series Pressure Controls are fully adjustable for all low, high or dual pressure applications.

A19 Series Temperature Controls have a wide selection of temperature ranges and feature a liquid-filling sensing element.

P45 Lube Oil Pressure Controls are designed for use with all major brands of pressure lubricated refrigeration compressors.

F61 Flow Switches handle liquid flow ranges down to 2 1/2 GPM and are available for indoor or outdoor use.

V46 Water Regulating Valves provide uniform pressure response and stable adjustment over operating ranges from 70 to 280 PSIG.

A319 Electronic Temperature Control is an economical way to achieve accurate, reliable control of both heating and cooling equipment.

Ecosafe™ Hose, unlike conventional hoses, doesn't effuse refrigerant through its walls. It's made with a corrugated stainless steel core and protective stainless steel braid.

Heating Products

Ignition Controls

Gas Valves

Pilot Burners

Combi-Valves

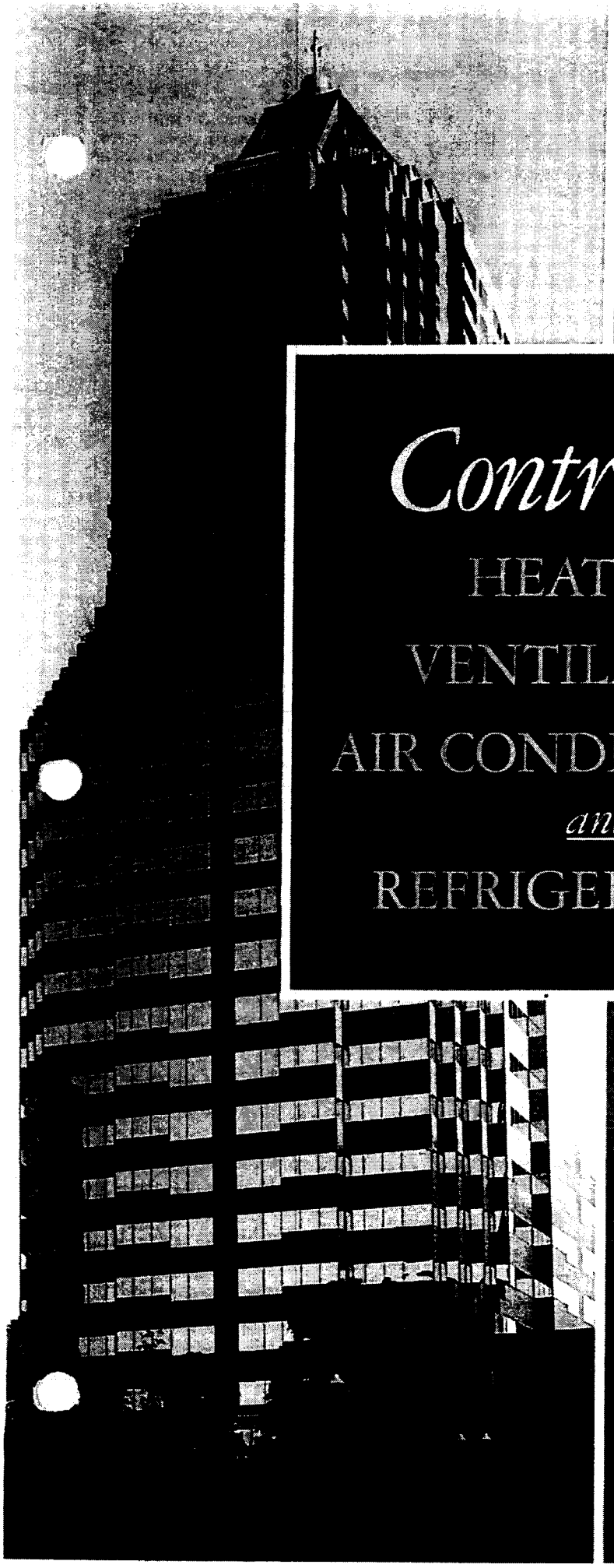
Whether you have a 100-ton rooftop unit or a 40,000 BTU furnace, Johnson Controls has a full line of gas heating controls designed to meet your performance expectations — as well as industry standards, including IAS standards and ΔC for commercial cooking.

- A global line of commercial & residential gas controls
- Over 80 years experience
- Integrated hardware and software solutions
- Flexible designs

We offer a variety of Ignition Controls used in gas-fired equipment up to 400,000 BTU/H, and higher, if needed. This includes a full line of microprocessor based controls designed for direct spark ignition, hot surface ignition and intermittent pilot ignition.

Gas Valves come in a broad selection for low to medium flow in commercial cooking, heating and residential heating applications.

Combi-valves are designed for industrial process control applications up to 1.2 million BTU/H. Replaces conventional gas train assemblies.



Control Products and Systems

Controls for HEATING, VENTILATION, AIR CONDITIONING *and* REFRIGERATION.

JOHNSON CONTROLS

Johnson Controls manufactures electronic, electromechanical and pneumatic control products and sensors of all types. We design and manufacture custom controls for more than 100 OEM customers. The company also engineers and installs advanced facility management systems, direct digital control and pneumatic systems to meet a wide range of customer environmental control needs.

Since 1885, Johnson Controls has been a leader in the manufacture and installation of HVAC and refrigeration controls and systems. With over 200 offices around the world, the company has vast expertise in working with schools, hospitals, commercial buildings, government and other facilities to help create comfortable, productive and safe building environments. And with over 2,500 stocking wholesale locations, our products are easy to obtain and replace.

ISO 9000 Certified: A HANDS-ON APPROACH TO QUALITY

Quality improvement is a continuous process at Johnson Controls. Our quality management system is in place for one reason: to ensure that we exceed customer expectations. The success of our quality management system is in the hands of each of our employees. The ISO 9000 certification of Controls Group design and manufacturing facilities affirms our performance in meeting strict global standards. Plus, it's your assurance that Johnson Controls products and services can meet yet another set of quality standards that's even more important — yours.

Why did we choose to be certified according to ISO 9000 standards? It gives you the confidence that we can satisfy recognized international standards for performance and quality. ISO also gives us a structure to apply to our quality management system, along with the ability to have it audited and registered on a regular basis by independent sources.

When a Johnson Controls product leaves our hands and reaches yours, the quality is uncompromised. For more detailed information on our quality systems, see your Johnson Controls representative.

Design Facilities
Headquarters and North American Design Center
Milwaukee, WI USA
ISO-9001

Design & Manufacturing Facilities
JCI Regelungstechnik GmbH
Essen, Germany
ISO-9001

Johnson Controls S.p.A.
Lomagna, Italy
ISO-9001

Johnson Controls Nederland B.V.
Leeuwarden, The Netherlands
ISO-9001

Manufacturing Facilities
Controls Mfg. Facility
Goshen, IN USA
ISO-9002

Panel Facility
Poteau, OK USA
ISO-9002

Controles Reynosa
Reynosa, Tamaulipas, Mexico
ISO-9002

Controles de Presion
Cd. Juarez,Chih., Mexico
ISO-9002

Electronic Repair Center
Milwaukee, WI USA
ISO-9002

Gas Valve/Dampers Mfg. Facility
[illegible]ertown, WI USA
ISO-9002

Maclaren Products
Glasgow, Scotland
ISO-9002

Distribution Facilities
Distribution Center
Erlanger, KY USA
ISO-9002

Distribution Center
Toronto, Canada
ISO-9002

JOHNSON CONTROLS

Johnson Controls/PENN Refrigeration Controls

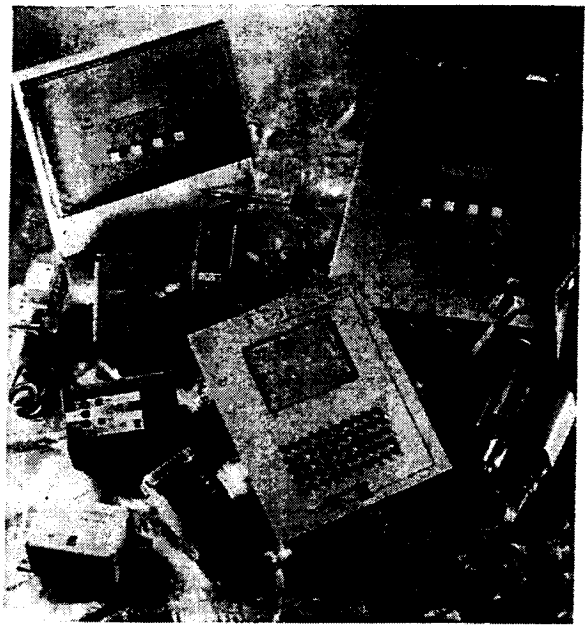
Temperature Controls
A19
A19

Pressure Controls
P70
P345
P28/P45

Flow Switches
F61

Water Valves
V46

Ecosafe™ Hose



For over 75 years, equipment manufacturers have preferred Johnson Controls/PENN refrigeration products. No other products can match them for long-life durability and versatility over a wide range of temperature and pressure applications.

- Dependable, "bullet-proof" controls
- Continuously innovative
- Decades of tried and true performance
- Advanced electronic controls for increased reliability

P70 Series Pressure Controls are fully adjustable for all low, high or dual pressure applications.

A19 Series Temperature controls have a wide selection of temperature ranges and feature a liquid-filling sensing element.

P45 Lube Oil Pressure Controls are designed for use with all major brands of pressure lubricated refrigeration compressors.

F61 Flow Switches handle liquid flow ranges down to 2 1/2 GPM and are available for indoor or outdoor use.

V46 Water Regulating Valves provide uniform pressure response and stable adjustment over operating ranges from 70 to 280 PSIG.

A319 Electronic Temperature Control is an economical way to achieve accurate, reliable control of both heating and cooling equipment.

Electronic Case Controllers offer advanced refrigeration electronics for state-of-the-art control of racks, merchandisers, cases, and coolers, plus HVAC and lighting can be integrated.

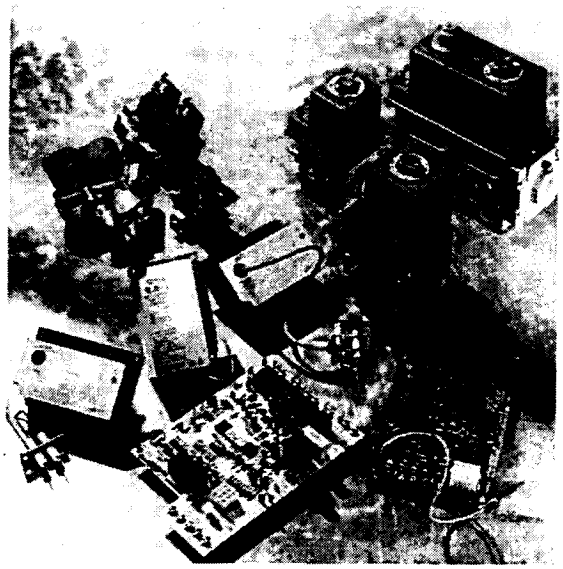
Heating Products

Ignition Controls

Gas Valves

Pilot Burners

Combi-Valves



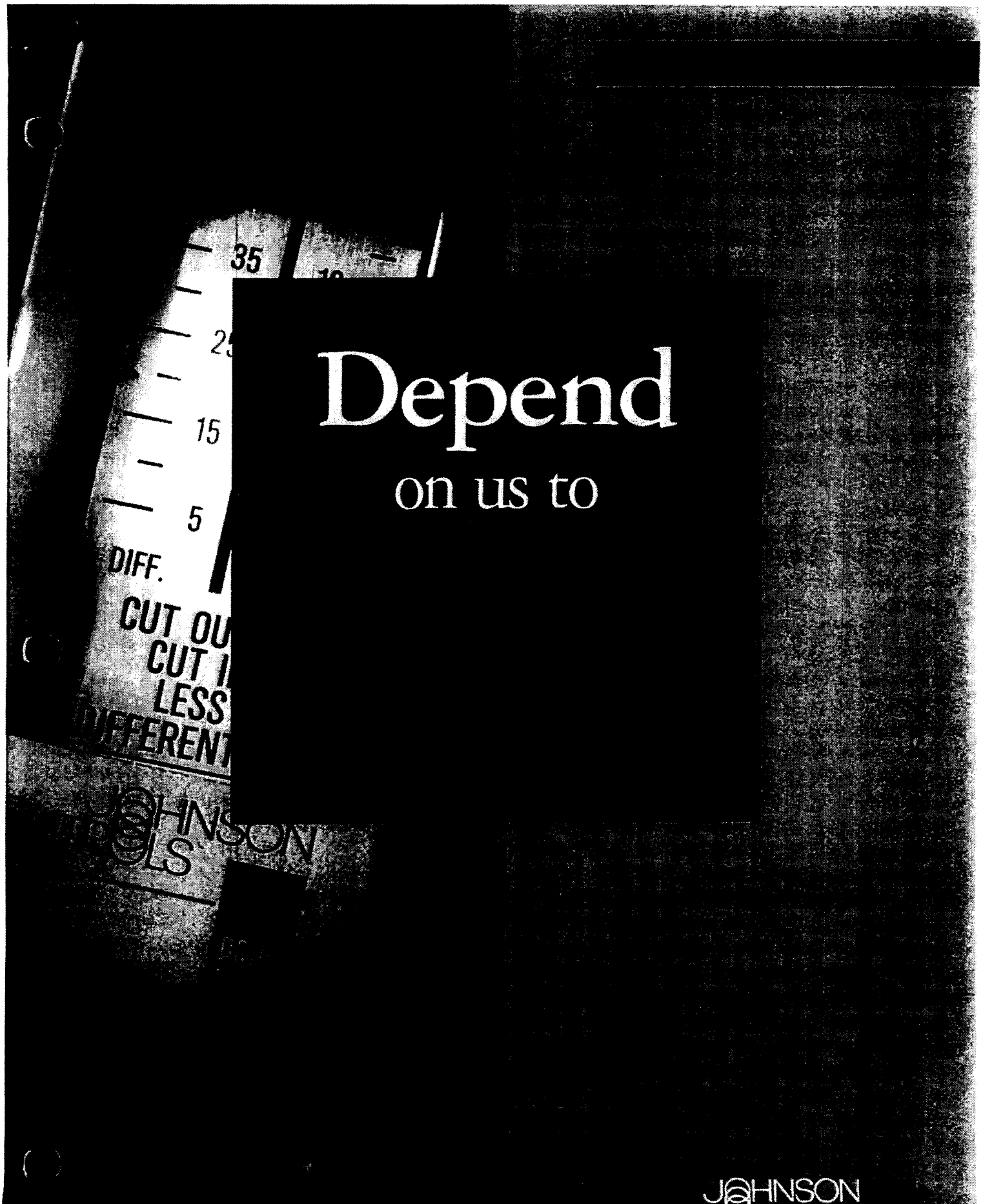
Whether you have a 100-ton rooftop unit or a 40,000 BTU furnace, Johnson Controls has a full line of gas heating controls designed to meet your performance expectations — as well as industry standards, including IAS standards and ΔC for commercial cooking.

- A global line of commercial & residential gas controls
- Over 80 years experience
- Integrated hardware and software solutions
- Flexible designs

Ignition Controls are used in gas-fired equipment up to 400,000 BTU/H, and higher, if needed. This includes a full line of microprocessor based controls designed for direct spark ignition, hot surface ignition and intermittent pilot ignition.

Gas Valves come in a broad selection for low to medium flow in commercial cooking, heating and residential heating applications.

Combi-valves are designed for industrial process control applications up to 1.2 million BTU/H. Replaces conventional gas train assemblies.



Depend
on us to

JOHNSON CONTROLS

PENN

Dependable, "bullet-proof" controls

Continuously innovative

A long history of tried and true performance

Temperature Controls
A28
A19
A419

Pressure Controls
P70
P145/P28/P45
P445
P100

Flow Switches
F63/F61

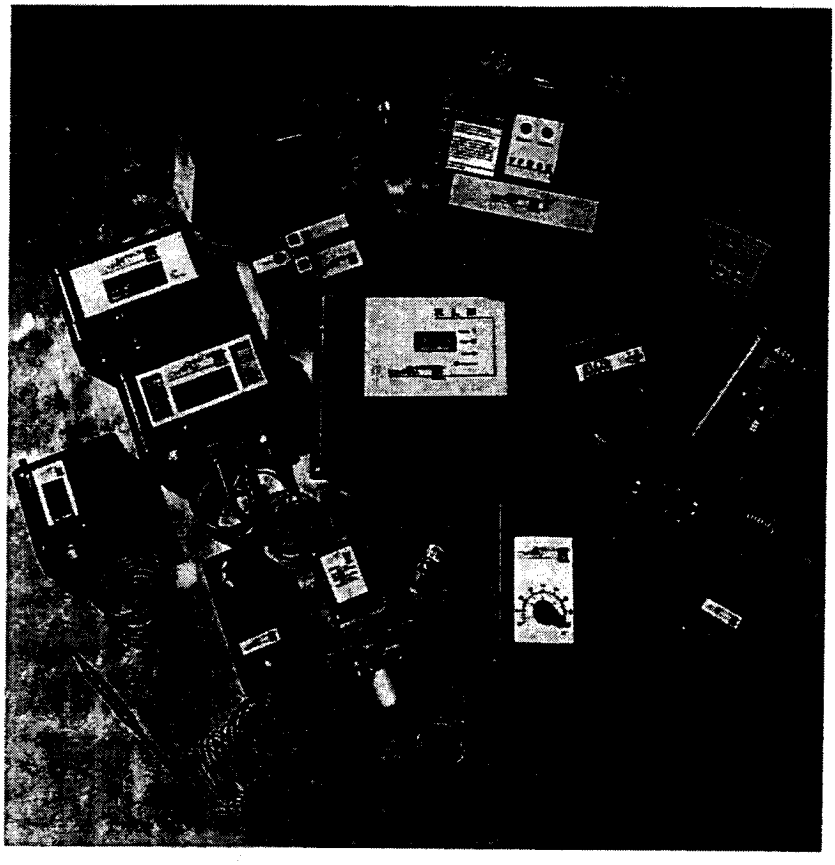
Water Valve
V46

Refrigerant Leak
Monitor
RLM

Fan Speed Controls
VFD66
S66

Defrost Controls
MR Series

Stage Controls
MS Series



The latest in control technology

Worry-free operation for long life

Advanced electronic controls for increased reliability

Can you keep something cool

for over 80 years? Johnson Controls and PENN refrigeration products have been doing it. Since 1919, we've been the top choice for refrigeration controls. But even though PENN products are at work in more supermarkets, restaurants and hotels than any other brand, chances are you haven't thought about us lately. Because once you put our products in, you can forget about them. And while we may have been around for what seems like forever, remember, we didn't get to be the preferred choice in refrigeration controls by offering stale ideas.

Fw: Product configuration mark applications

Karen E Spors to Darlene VanAacken 02/02/2010 03:39 PM

Cc: "Tidman, Mark H."

History: This message has been forwarded.

Darlene, it is once again time to think about this after getting an update from you. We will need direction if you want us to proceed. I would suggest a phone call with Mark to evaluate the course. Thanks,

Karen E Spors
Senior Group Counsel - Building Efficiency
Johnson Controls, Inc.
507 W. Michigan Street
P.O. Box 423
Milwaukee, WI 53201-0423

414 524 5110 direct
262 844 3944 cell

---- Forwarded by Karen E Spors/NA/Johnson_Controls on 02/02/2010 03:36 PM ----

From:	"Tidman, Mark H." <mtidman@bakerlaw.com>
To:	<Karen.E.Spors@jci.com>
Cc:	"Weber, John" <JWeber@bakerlaw.com>, "Trademarks-BakerHostetler" <Trademarks-BakerHostetler@bakerlaw.com>, "34311-LITE" <34311-LITE@litematter.jci.com>
Date:	02/02/2010 03:35 PM
Subject:	FW: Product configuration mark applications

URGENT

Dear Karen,

Please note our correspondence below and the upcoming deadline of **February 18, 2010**. We look forward to your instructions, noting that we will need to get some declarations in place etc. to proceed.

Best,

Mark

My Bio **Web site** **V-card**

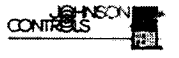
T 202.861.1670
F 202.861.1783
M
www.bakerlaw.com

Mark Tidman
mtidman@bakerlaw.com

Baker & Hostetler LLP
Washington Square, Suite 1100
1050 Connecticut Avenue, N.W.
Washington, D.C. 20036-5304

You've been training to install our modular electronic controls your whole life.

Installation of System 350 modular electronic controls is a snap. Quite literally. What could be easier? Well, maybe adding more modules as needs change. Because our System 350 controls simply plug together. There's no programming required. Set a few knobs and jumpers, and installation is complete. Start with a control for

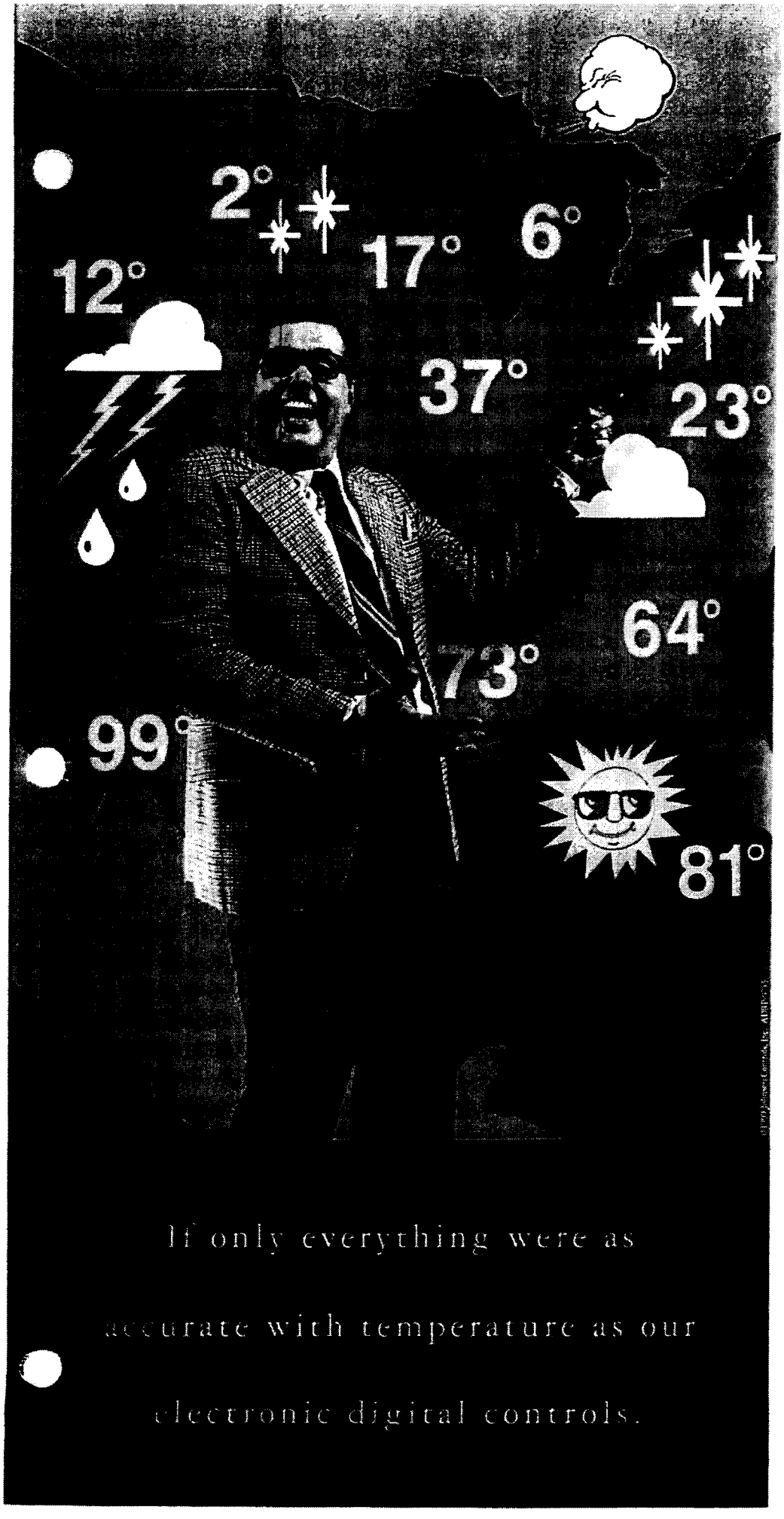


temperature,

pressure, or humidity. Then, add a stage module. Add a display module. Add a slave module. And, this year, we've added three new modules, including the S350P stage module for proportional output to any of our "A" series temperature controls. Throw in low cost and an unmatched 3-year warranty, and the System 350 Series seems like the obvious answer. To learn more, see your Johnson Controls/PENN representative, or call us at 1-800-972-8040, ext. 406. You're more than ready.

JOHNSON CONTROLS

www.johnsoncontrols.com



If only everything were as accurate with temperature as our electronic digital controls.

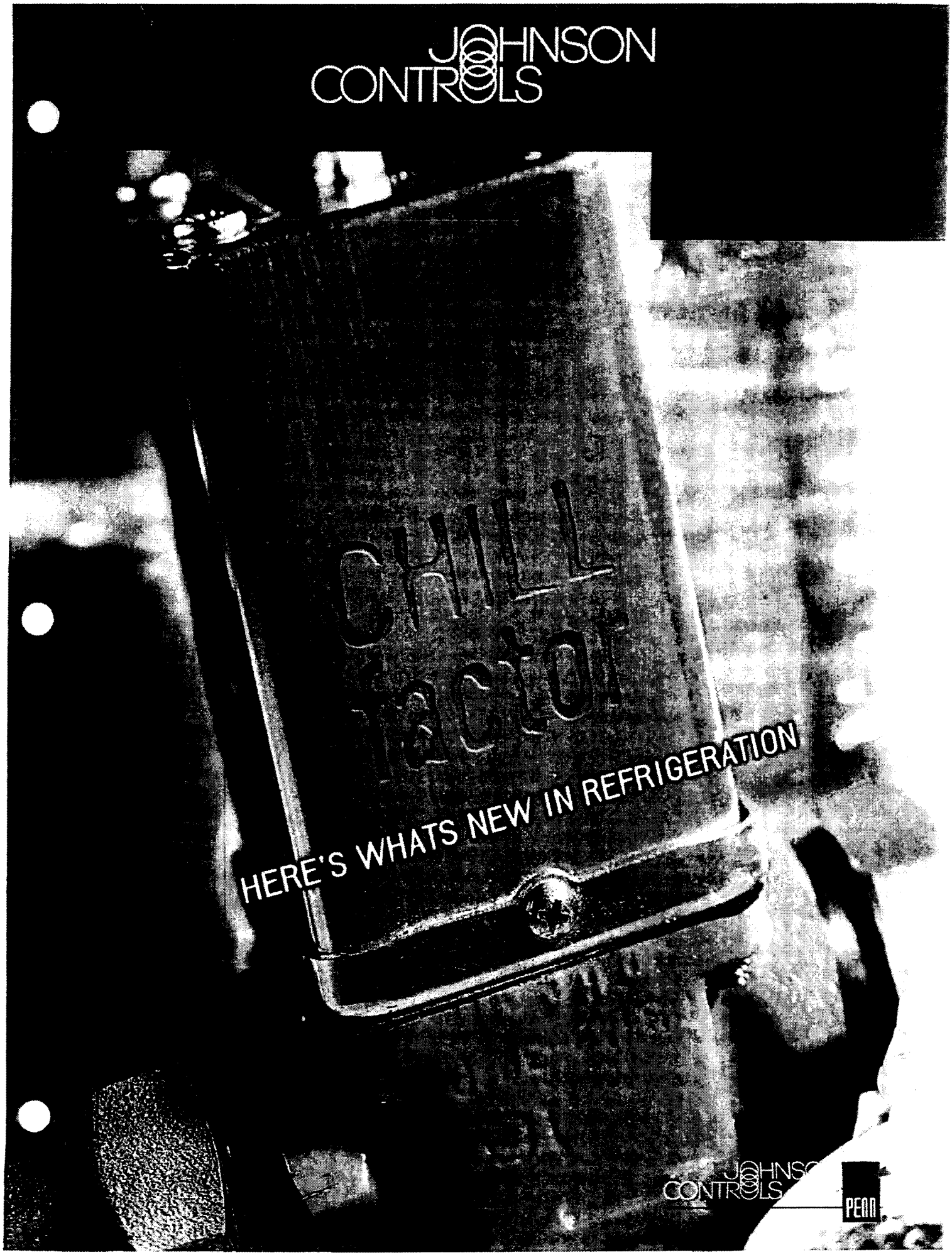
If you want precision, you can't beat the new Johnson Controls/ PENN A419 Electronic Temperature Control with a new, easy-to-read, easy-to-set digital display. It has exclusive features you won't find on ordinary digital controls. Like a temperature offset function that saves energy during non-peak hours and maintains product integrity. The A419's

adjustable differential allows for tighter control than electromechanical products. And the built-in anti-short cycle delay can extend the life of your compressors. Get the A419 for your refrigeration needs. Then, at least there's one place where you'll always know exactly what the temperature will be. To find out more, see your Johnson Controls/PENN representative or call 1-800-972-8040, ext. 404.

JOHNSON CONTROLS

www.johnsoncontrols.com

JOHNSON CONTROLS

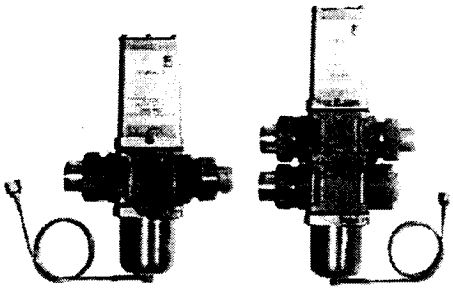


HERE'S WHATS NEW IN REFRIGERATION

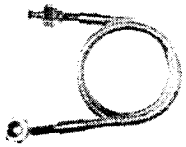
JOHNSON CONTROLS

PENN

In this issue of Chill Factor, Johnson Controls presents our latest high-pressure water valves, the V146 2-way and V148 3-way valves. We're also pleased to announce the lower price of our SEC99A UltraCap Armored Capillary pressure connection. And our P399 Transducer and Cable, still the best choice in pressure sensor solutions, now come conveniently packaged together.



Rely on Johnson Controls/PENN for high-quality, dependable valves. The V146 2-way valves and V148 3-way valves are our newest lines of high-pressure water valves, featuring a rugged, union-body design. The V146 and V148 valves regulate water flow and control refrigerant head pressure in systems with water-cooled condensers. These valves are ideal for use in high-rise buildings, or high water-pressure systems. The high-pressure design allows use in systems with up to 350 psi (2413 kPa) water pressure. The pressure-balanced design resists changes to setpoints caused by gradual or sudden water pressure changes. The V146 and V148 have no close-fitting or sliding parts in water passages, providing control in less-than-ideal water conditions.



Check out the lower price of the SEC99A UltraCap. The UltraCap is designed for use as a pressure connection in refrigeration and air-conditioning applications. It minimizes pressure pulsation and is compatible with all non-corrosive refrigerants. The armored capillary cover provides extra protection for the copper capillary tube. Select from a variety of lengths for your specific application. Schrader Valve Depressors are available on one or both ends. Straight or angled fit a variety of applications and space constraints.

Still the best choice in pressure sensor solutions, the P399 Transducer and 6 1/2 foot Cable are now conveniently packaged together. The P399 Electronic Pressure Transducer features:

- Direct-mounting to minimize service and replacement costs.
- Environmentally sealed electronics and rugged design to withstand adverse conditions.
- Compatibility with many Johnson Controls products, and other manufacturers' rack controllers.
- A variety of pressure ranges up to 750 psi.
- Ratiometric output, 0-5 VDC.

JOHNSON CONTROLS

© 2002 Johnson Controls, Inc.

P.O. Box 423, Milwaukee, WI USA 53201
www.johnsoncontrols.com

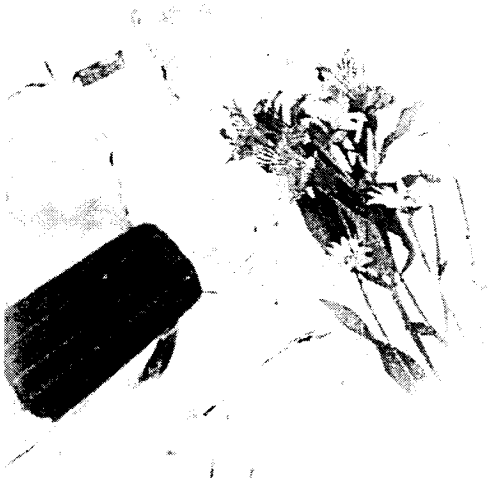
PUBL-3601

JOHNSON CONTROLS PENN

THE CHILL FACTOR

Newsletter for Refrigeration Products Distributors and Customers

VOLUME 4, NUMBER 1 2000



MESSAGE TO OUR PARTNERS

Welcome to the new millennium! The future is here and Johnson Controls/PENN is busy updating our line of controls to meet your present and future application needs.

As the refrigeration industry continues its transition from electromechanical to electronic control, your customers benefit from the improved accuracy, greater reliability and increased functionality that are the hallmarks of electronic controls.

In this issue of *The Chill Factor*, we feature three of our electronic offerings:

- The A419 electronic temperature control with display, now available in a 24 VAC version.
- The RLM Refrigerant Area Monitor, designed with state-of-the-art infra-red sensing technology.
- And, the VFD66 Condenser Fan Speed Controller, whose programming advantages, energy savings, and installation ease are highlighted in our Success Story.

So, take a look inside and see what the future can bring you. As always, we welcome your comments and questions.

Regards,

Ted R. Krueger

MEET JCI

Meet Darlene Van Aacken

Associate product manager for refrigeration controls, Darlene Van Aacken is responsible for flow controls such as the F61, F63 and F59. She also is responsible for new product introductions, and providing daily support solutions regarding pricing to distributors, OEMs, engineering services, customer service and the company branch network.

A seasoned employee, Darlene began work at Johnson Controls in 1992 as a design and development engineer for pneumatic products. Prior to joining the refrigeration team, Darlene had been working with the valve and pneumatic marketing group providing marketing support in the areas of pricing analysis, program development and sales activities.

Darlene received both her mechanical engineering degree and MBA from the University of Wisconsin-Milwaukee.

Meet Michael Garding

Product manager Michael Garding oversees pricing, forecasting and marketing for the temperature product line: A19, A319, A419, A11 and A28; the VFD66, P66, and S66.

Prior to joining Johnson Controls over a year ago, Mike worked as Division Manager with Hill-Phoenix, Chicago, supervising refrigeration equipment installations for grocery retailer American Stores Co. He also managed the installation of secondary coolant systems at Dominicks Supermarkets Inc.

While an application engineer for Tyler Refrigeration, Waxahachie, Texas and Niles, Mich., Mike designed and priced refrigeration mechanical systems and enclosed mechanical centers for refrigerated cases and walk-in coolers for commercial supermarkets.

Mike received his MBA in marketing from the University of Texas at Arlington in 1995 after completing undergraduate work in industrial management at Purdue University.

PRODUCT UPDATES

A419 Electronic Temperature Control Accurate, Easy-To-Use

Johnson Controls/PENN A419 Electronic Temperature Control provides electronic accuracy and greater built-in control versatility.

The A419 Temperature Control handles a wide variety of single-stage applications including frozen and refrigerated food cases, beverage coolers, pumps and boilers.

The A419 Control features an easy-to-read/easy-to-set Liquid Crystal Display (LCD) and fingertip control programming. Setpoint and temperature are readily visible, and the front-panel keypad allows quick changes of the setpoint, differential and other functions.

Cost-saving benefits include a temperature offset function that can be used to conserve energy during non-peak hours while maintaining product integrity. The built-in, adjustable, anti-short cycle delay extends compressor life. On-board jumpers allow the A419 Control to cut-in or cut-out at setpoint and to lockout the keypad to prevent unauthorized use.

For flexibility in location, sensors can be up to 800 feet from the control, and the A419 Control's high-impact, plastic enclosure is suitable for surface or DIN rail mounting.

For more information, request Product Bulletin LIT-125188, ad reprint ADRP-9755 and stuffer PUBL-3041.

Refrigerant Leak Monitors Accurate and Reliable With Infrared Sensing Technology

Johnson Controls/PENN RLM Series Area Refrigerant Leak Monitors provide accurate and reliable detection of airborne refrigerant levels using state-of-the-art infrared sensing technology.

The RLM Leak Monitors are single-point, refrigerant-specific, programmable infrared, area leak monitors, designed to detect airborne refrigerants and issue alarm

Product Update continued on page 3

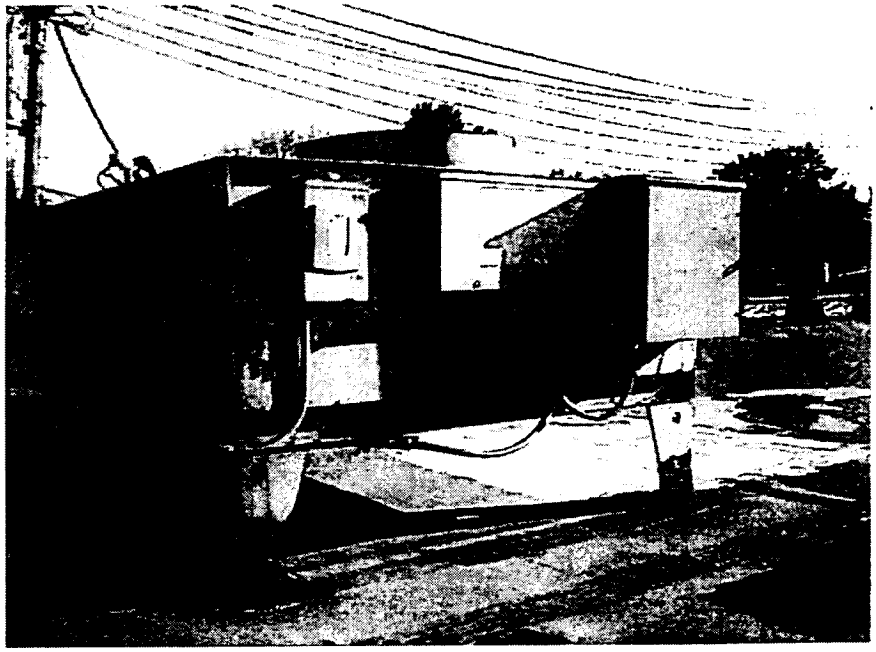
SUCCESS STORY

VFD66 Fan Controller Smoothes Refrigeration System

Sendik's Food Market, Whitefish Bay, WI, is a 22,000-square-foot store known for its fresh produce, meat, flowers and customer service. "Obviously, correct temperature for our fresh and frozen food cases is critical to our business," co-owner Jim Balistreri says. "So when I was approached by Johnson Controls/PENN to install a three-phase fan speed control that would improve efficiency, I agreed to try it."

The VFD66 Fan Control was installed by Sendik's refrigeration contractor, John Gnas, owner of Advantage Refrigeration, Milwaukee, which specializes in refrigeration systems for grocery stores.

"Our business philosophy is to take care of our customers," Gnas says. "We look at what the customer's needs are and we select the equipment that's best for that application."



Unit Delivers Chilling Performance

"I thought the VFD66 would be a good fit in the Sendik's application," Gnas says. "The advantage of the VFD, compared with standard fan controls, is the unit can be programmed to specific needs such as head pressure or drop leg temperature and it also provides continuous response to load conditions, especially low ambient, as they change."

The VFD saves energy because it only runs at full speed when required. Its variable output capability takes out the seesaw effect of the refrigeration system, compared to a standard fan control, which only has on and off capabilities.

Success Story continued on page 3

SUCCESS STORY CONTINUED

Keeping the Customer Happy

The VFD66 has been in use at Sendik's for over a year. "The system has been great," Balistreri says. "The product support between Johnson Controls/PENN and John Gnas has been fantastic. Johnson Controls/PENN repeatedly checked on the system to make sure it was working properly."

Product support is critical to contractors when selecting a product, Gnas agrees. "Johnson Controls/PENN has an excellent response factor. That's important and contractors look for that. I have no hesitation in using Johnson Controls/PENN products because they've always been very supportive."

The VFD66 is designed for refrigeration and HVAC condensers and is available for 208/460 VAC 50/60Hz motors from one horsepower to three horsepower. Isolated input circuitry permits application with 0-5 or 0-10 VDC controllers, sensors and transducers, including Johnson Controls/PENN System 350.

REFRIGERATION EXPERTS

Ted Krueger . . . . . (219) 538-6116
ted.krueger@jci.com

Annette Braun . . . . . (414) 274-4975
annette.braun@jci.com

Application Engineering:

Jeff J. Eisenhut . . . . . (414) 274-5505
jeffrey.j.eisenhut@jci.com

John McMullen . . . . . (414) 274-5504
thomas.j.mcmullen@jci.com

Roy Everett . . . . . (414) 274-5506
roy.everett@jci.com

Help Line . . . . . (414) 274-5535

Johnson Controls, Inc.
P.O. Box 423
Milwaukee, WI 53201

BULK RATE
U.S. POSTAGE
PAID
Milwaukee WI
Permit No. 5502

If you have a unique story lead

or any questions, please call

Ted Krueger at (219) 538-6116

or fax (219) 533-5852.

JOHNSON CONTROLS PENN

THE CHILL FACTOR

Newsletter for Refrigeration Products Distributors and Customers

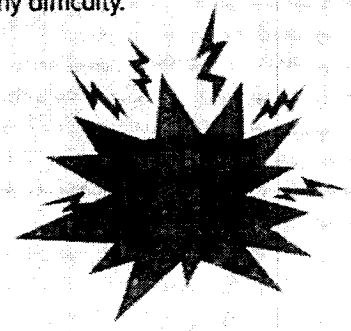
VOLUME 4, NUMBER 2 2000

UPDATE...UPDATE...UPDATE

A reminder for those of you who don't often call headquarters in downtown Milwaukee. We are now using a new number for our phone prefix.

The new prefix is 524, replacing 274, which went out of service in June. Our area code remains the same at 414.

We hope this hasn't caused you any difficulty.



MESSAGE TO OUR PARTNERS

Greetings Everyone!

By now, I hope all of you are aware of the addition of two new series of pressure controls to the System 350™ product line — and the P399 Electronic Pressure Transducer that makes them all possible.

As many of you know, the refrigeration industry has been working towards a lower-cost pressure transducer for years — and now Johnson Controls has delivered it. The P399 transducer provides a single line of transducers for all refrigeration and air-conditioning application needs.

The P399 transducer also allowed us to respond to your requests for additional pressure ranges for the System 350™ product line. The 352AB on/off pressure controls are now available in three different setpoint pressure ranges: 0-100 psi, 90-250 psi, and 240-600 psi. With System 350 pressure controls and the P399 transducers, the application possibilities are endless.

At the same time, we have also developed three new P352PN proportional pressure control models with the same pressure ranges to provide versatile electronic alternatives to present electromechanical-only installations. This makes it possible to position dampers, flow-valves, and other modulating devices that require a variable control input.

Because they are electronic, the new P352 pressure controls provide greater setpoint precision, closer tolerances, and modular plug-in control expansion capabilities.

The best product innovations and enhancements are the result of a joint effort — those in sales sharing the needs and ideas of their customers and a company like Johnson Controls/PENN with the technical expertise to make them happen.

So don't hesitate to let us know what your customers are looking for. Your ongoing feedback can only lead to greater sales success for us all.

Share your thoughts with your Johnson Controls rep, or call me directly at 219-538-6116 (Goshen, IN). Or you can e-mail me at Ted.Krueger@jci.com.

Regards,

Ted R. Krueger

Ted R. Krueger

MEET JCI

Meet Chuck Otto

Johnson employee "gets up" with the job

The thing Chuck Otto likes best about his job as a product manager in the refrigeration group is interacting with the customer. "I enjoy working directly with the customers and being responsible for developing products that meet their needs," he says.

Customers know that when they speak with Chuck, they are getting the voice of experience — Chuck is celebrating his 20th year at Johnson Controls.

"I was in the trades 15 years before I started working with Johnson Controls, so I can say I grew up in the business. I still have my tools," he says.

Chuck's first position at Johnson was as National Service Manager for PENN products. "I really enjoyed that position because I had a lot of direct contact with the end user. It was very gratifying because I was a problem-solver."

After stints as an application engineer and account executive, Chuck moved into his current job as product manager. Today his product responsibilities include water valves, lube oil controls, MR Series refrigeration temperature controls and MS Series multi-stage electronic controls.

"In the last 20 years, it's been a slow yet steady transition from electromechanical controls to electronics," he says. "The electromechanical controls are still a big player in the industry but electronics and microprocessor-based controls are gaining more acceptance."

Chuck also shares his HVAC-R expertise as a member of two professional organizations — the Air-conditioning Refrigeration Institute (ARI) and the Refrigeration Service Engineers Society (RSES).

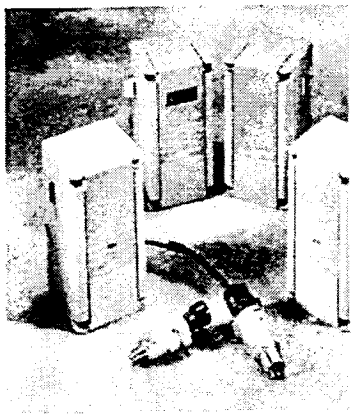
Meet JCI continued on page 3

NEW PRODUCT INTRODUCTION

The P399 Electronic Pressure Transducer

The new, economical P399 Electronic Pressure Transducer for the System 350™, ACT2-CS, and the VFD66 fan speed controller, is now available from Johnson Controls/PENN.

"The P399 transducer was designed in response to customers' requests for a more versatile, low-cost pressure transducer," says Darlene Van Aacken, associate product manager for refrigeration controls. "The P399 transducer covers most common refrigeration and air-conditioning applications with its 0-5 VDC signal and three pressure ranges — 0-100 psi, 0-500 psi and 0-750 psi."



Other beneficial P399 transducer features include:

- Welded stainless steel construction — provides a durable assembly, eliminating potential of refrigerant loss due to O-ring failures. Resists Electromagnetic Interference (EMI) and damage due to physical shock, vibration and pressure pulsations.
- Environmentally-sealed electronics — withstands the effects of adverse conditions found in typical equipment rooms. Resistant to wide temperature fluctuations, high humidity, condensation and icing, it is suitable for use with all non-corrosive refrigerants as well as ammonia.
- Reliable, repeatable performance and long operating life — minimizes service and replacement costs.

Additionally, the need for an adapter is eliminated because pressure connections are available in two standard styles:

– 1/4-inch SAE female flare fitting (with Schrader valve depressor)

– 1/8-inch NPT male fitting

For more information, request Product Lit. 125515.

PRODUCT INFORMATION

Additions to System 350™ Line Now Available

The versatility of System 350™ — the modular control series for medium- to large-scale temperature, humidity and pressure applications — is extended with the addition of several new modules to the product line.

"We know that customers will be pleased to learn System 350 is capable of handling even more cooling and refrigeration applications," says Ted Krueger, product manager for refrigeration products.

"With the addition of the P399 Electronic Pressure Transducer (see New Product Introduction above) Johnson Controls/PENN was able to develop four new modules for the System 350 that add versatility and provide cost and energy saving benefits to the end-user."

Product Information continued on page 3

PRODUCT INFORMATION CONTINUED

System 350 modules simply plug together which eliminates wiring between modules, minimizes installation costs and reduces wiring errors. The modules can be DIN rail or surface mounted.

"Customers will find they can configure literally hundreds of different control systems using various combinations of these easy-to-install modules and their accessories," Krueger says.

P352AB Electronic Pressure Controls

The P352AB electronic pressure controls are on/off controls with reverse mode or direct-acting mode of operation, adjustable differential and interchangeable pressure transducer.

The controls are used with the P399 electronic pressure transducer to monitor pressure in psi. Three models cover the ranges of 0-100 psi, 90-250 psi and 240-600 psi.

The P352AB control can be used as a stand-alone device or in conjunction with System 350 plug-together accessory modules for single or multiple stage refrigeration and HVAC pressure control applications. Typical applications include condenser fan cycling and compressor cycling and unloading.

The P352AB operates on 24 VAC and has an SPDT relay output. A front-panel LED indicates when the relay is energized.

For more information, request Product Bulletin LIT-930038.

P352PN Series

A P352PN Series pressure control may be set as a proportional-only control or as a proportional plus integral control, to generate two standard analog output signals (0 to 10 VDC and 0 to 20 mA.) Typical P352PN pressure control applications include condenser fan speed control, damper positioning and flow valve positioning.

Three models with overlapping setpoint ranges of 0–100 psi, 90-250 psi and 240-600 psi reduce inventory while providing control for most positive-pressure refrigeration and HVAC applications.

The P352PN control operates on 24 VAC and a 10-segment front panel LED bar graph indicates percentage of output. Adjustable features include: setpoint; minimum output; throttling range (proportional band); integration constant; reverse acting or direct acting mode of operation.

The P352PN proportional plus integral (PI) pressure control incorporates integral (or reset) control action along with proportional-only control action. The PI design effectively eliminates proportional offset and the PI control can adjust the output signal to not only match a steady load on the system, but also drive the system process towards setpoint.

For more information, request Product Bulletin LIT-930044.

Product Information continued on back page

MEET JCI CONTINUED

His ARI affiliation includes membership on the Industry Competency Exam (ICE) committee. "We develop three exams that vo-tech schools give to their graduating students, which indicates they are qualified for an entry-level position in the industry," he says.

He also serves on the Manufacturers Service Advisory Council (MSAC) of the RSES. The Council updates and contributes materials for continuing education within the industry.

Chuck is married, has two daughters, and resides in picturesque Cedarburg, WI.

Meet Chris Belsky

An opportunity too good to pass up is how product engineer Chris Belsky recalls his decision to join the Johnson Controls refrigeration team.

Chris, a 1998 graduate of Milwaukee School of Engineering (MSOE), recently finished up a year-long project developing the new pressure controller line for System 350™.

"I was offered the position at Johnson Controls with an opportunity to jump right into product design," Chris says. "Usually at an entry level job, you are in a supporting role, so I was very lucky to be able to work on such a significant project."

Chris' transition from student to product engineer was a smooth one thanks to an 18-month internship with Johnson Controls while he was still a student at MSOE.

"One of the best things about working at Johnson Controls is the mutual respect among co-workers," Chris reports. "Egos don't get in the way of everyone working hard to get the job done and I consider myself very fortunate to have landed here."

PRODUCT INFORMATION CONTINUED

D352 Display Module

The D352 display module provides a digital readout of sensor or setpoint values at the push of a button with a 0-750 psi display range.

System 350 display modules — D350, D351 and D352 — have a three-digit LCD that continuously displays sensed output values from A350 temperature, W351 humidity, and P352 pressure controls. Display modules feature a setpoint button located on front of the module to obtain actual space conditions or setpoint readings.

Display modules can be permanently installed in a System 350 Control System or used for remote setup or troubleshooting.

Modules include:

- Temperature — D350 displays actual space temperature and setpoint for temperature indication (local or remote in conjunction with any A350 control).
- Humidity — D351 provides continuous readout of the actual humidity sensed by the HE6300 or HE6310 series humidity transmitters.
- Pressure — D352 provides continuous readout of the actual pressure sensed by the P399 or DPT transmitter.

For more information, request Product Bulletin LIT-930070.

S352 Pressure Stage Modules

The S352 Stage Module is used with the P352 On/Off Pressure Control to add multi-stage capability to condenser fans. Using a Y350R power module, up to five S352s can be added to the P352 via the five-pin plug-together connector. Using a 40 VA or greater external transformer, up to nine S352s can be added.

The S352 has a SPDT output relay with LED indicators and three adjustments — offset (stage setpoint), differential and mode (reverse or direct acting).

The modular design permits the system to be configured to equipment making convenient, future expansion easy. Plug-together connectors and 35mm DIN rail mounting eliminated wiring between modules and reduces installation costs.

For more information, request Product Bulletin LIT-930080.

Johnson Controls, Inc.
P.O. Box 423
Milwaukee, WI 53201

If you have a unique story lead

or any questions, please call

Ted Krueger at (219) 538-6116

or fax (219) 533-5852.

Installation Instructions
Issue Date January 9, 2003

T19PC Type Temperature Controls with NEMA 4X Raintight Enclosures

Application

IMPORTANT: The T19PC Type Temperature Controls are intended to control equipment under normal operating conditions. Where failure or malfunction of a T19 control 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) intended to warn of or protect against failure or malfunction of the T19 control must be incorporated into and maintained as part of the control system.

The T19PC type electromechanical temperature controls are designed for use in many agricultural applications. The T19PC controls have rugged Noryl® plastic enclosures and are (UL) Listed as NEMA Type 4X and for use in National Electrical Code (NEC) Article 547 Agricultural Environments (ANSI/NFPA 70). See Figure 1 and *Technical Specifications*.

The adjustable T19PC type temperature controls have O-ring sealed external setpoint adjustment knobs and range scales with oversized markings for easy readability in low light. The exposed portion of the liquid expansion sensing elements has been tested per Article 547 of the NEC.

IMPORTANT: Do not dent, bend, uncoil, or otherwise alter the position of the sensing element (coil) mounted on the base of the T19PC type controls. Damaging the sensing element (coil) may change the control calibration and void any warranties on the control.

Operation

When the temperature at the sensing element rises to the setpoint (dial setting), the switch between R and Y closes, and the switch between R and B opens on Single-Pole Double-Throw (SPDT) models. See Figures 2, 3, and 4.

Installation

Dimensions

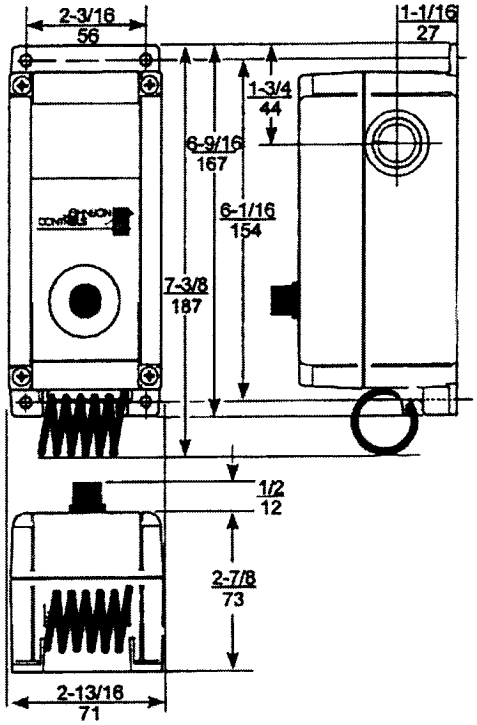


Figure 1: Dimensions for T19PC Temperature Controls with NEMA 4X Enclosures, in./mm

Mounting

Mount the temperature control on a wall where it is exposed to the average temperature of the controlled space. Do not mount the control where it will be affected by unusual heat or cold, such as directly over an animal stall or in sunlight. Avoid locations near a door, window, or other sources of non-ambient air drafts. Do not mount the control on an outside wall or where temperature at the sensing element (coil) exceeds 140°F (60°C).

Mount the temperature control to a flat surface with screws through the holes in the mounting ears on the back of the case. See Figure 1.

© 2003 Johnson Controls, Inc.

Wiring

WARNING: Risk of Electrical Shock.
To avoid the risk of electrical shock, disconnect all power sources to the control before wiring any connections. More than one disconnect may be required to completely de-energize the control and equipment.

IMPORTANT: All wiring must conform to all local, national, and regional regulations. Use copper conductors only for all wire connections.

IMPORTANT: Do not use T19 temperature controls on applications where the electrical load across the control's switch may exceed the electrical ratings shown on the temperature control's label.

IMPORTANT: Use only the terminal screws furnished with the switch. Using other screws in the switch voids the warranty, may damage the switch, and may cause problems in making secure connections.

There are three 1/2 in. (Trade-size) conduit knockouts on the T19PC NEMA 4X enclosure.To make wiring connections:

1. Loosen the four cover screws and remove the cover and knob assembly. The knob is secured in the cover and must not be removed. Do not damage the O-ring seal.
2. Select the knockout to be removed. Place a screwdriver blade on the knockout near the edge. Apply a sharp blow to the screwdriver handle to loosen the knockout.
3. For watertight connection to rigid conduit, connect an approved watertight conduit fitting to the conduit first, and then connect the fitting to the T19PC control enclosure.
4. Insert the wire through conduit opening.
5. Make wiring connections to the screw terminals. See Figures 2, 3, and 4.
6. Ensure that the O-ring seal is properly seated. Replace the cover and knob assembly. Check the alignment of the range adjustment knob.

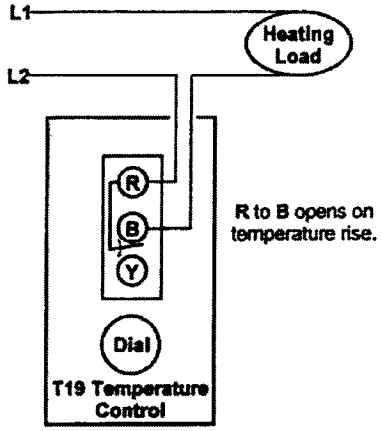


Figure 2: Typical Wiring for Heating Applications

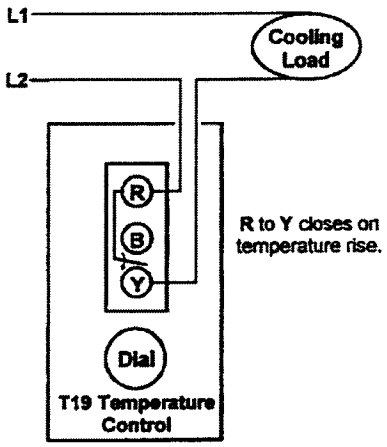


Figure 3: Typical Wiring for Cooling Applications

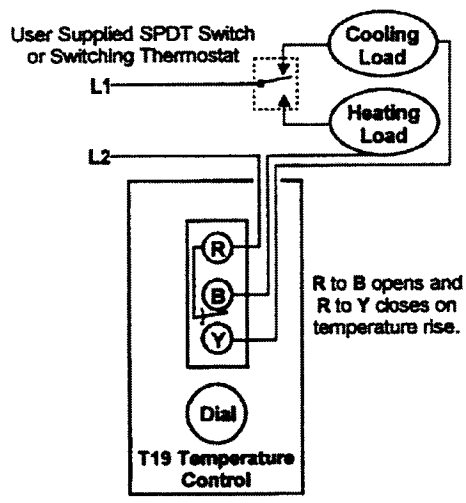


Figure 4: Typical Wiring for Combination Heating and Cooling Applications

Setup and Adjustments

Turn the knob on the front of the temperature control to adjust the control temperature setpoint.

Checkout

Before leaving the installation, observe at least three complete operating cycles of the controlled equipment to ensure that all components are functioning correctly.

Follow the guidelines below to check for proper T19PC temperature control operation.

For Heating applications: Turn the dial clockwise to a setpoint greater than the space temperature, and the heating system should cycle on. Turn the dial counterclockwise to a setpoint less than the space temperature, and the heating system should cycle off.

For Cooling or Ventilating applications: Turn the dial clockwise to a setpoint greater than the space temperature, and the ventilating or cooling system should cycle off. Turn the dial counterclockwise to a setpoint less than the space temperature, and the ventilating or cooling system should cycle on.

If the temperature control does not operate in the manner described above, check the wiring for short circuits. Ensure all wiring connections are tight.

Repairs and Replacement

The T19PC type controls are not field-reparable. Do not attempt to repair a control that is not functioning properly. Contact your Johnson Controls/PENN® sales representative or authorized distributor for a replacement control.

Technical Specifications

Product	T19PC Type Temperature Controls with NEMA 4X Raintight Enclosures						
Switch Contact Ratings	**Applied VAC**	**24**	**120**	**208**	**240**	**277**	**600**
	Motor, Full Load Amperes	-	16	9.2	8	-	-
	Motor, Locked Rotor Amperes	-	96	55.2	48	-	-
	Non-inductive, SPST Amperes	-	22	22	22	22	-
	Non-inductive, SPDT Amperes	-	16	16	16	16	-
	Pilot duty VA	125	125	125	125	125	125
Ambient Operating Conditions	-26 to 140°F; (-32 to 60°C)						
Ambient Storage Conditions	-40 to 140°F; (-40 to 60°C)						
Shipping Weight	1.2 lb (0.54 kg)						
Agency Listings	UL Listed; File E6688, CCN XAPX (US) and XAPX7 (Canada) UL Listed as Type 4X and for NEC Article 547 Agricultural Environments						

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

JOHNSON CONTROLS

Controls Group
507 E. Michigan Street
P.O. Box 423
Milwaukee, WI 53201

Published in U.S.A.
www.johnsoncontrols.com

PENN

series 219-239

TEMPERATURE CONTROLS FOR REFRIGERATION

PENN CONTROLS, Inc., Goshen, Indiana

APPLICATION

Series 219-239 controls are designed to cover a broad range of general purpose temperature control applications in the refrigeration field with a minimum number of models. Typical applications are: frozen food cases, display cases, beverage coolers, milk coolers, walk in boxes, water chillers, etc. Various control ranges are available to cover working temperatures from — 30° F. to 130° F. Closed tank fittings and bulb wells are available for immersion applications.

GENERAL DESCRIPTION

The Series 219 is a small compact control with non-adjustable differential. It is available with or without external range adjustment and visible scale. The Series 239 is a slightly larger version of the same control with both external range and differential adjusters as well as visible scale.

On both the 219 and 239 Series, a specially designed, field-proved, liquid-filled sensing element provides precision "repeat" accuracy which is unaffected by barometric pressure and cross-ambient temperature problems.

The 5T7 freeze protection thermostat features a locked low-limit stop which can be adjusted with a special tool from 38° F. to approximately 48° F. A separate adjustment of the cut-in temperature may be set from 8° F. above the cutout temperature to as high as 80° F. This adjustment, which does not affect the cutout temperature, provides for short or long recycle time as required by the particular application.

MISCELLANEOUS SPECIFICATIONS

Case: .062" cold rolled steel. Special corrosion resistant aluminum finish.

Cover: .025" cold rolled steel. Gray baked enamel finish.

Contact Unit: Precision snap-acting contacts in dust-tight tamper proof enclosure.

Mounting Brackets: Standard on Series 239. Optional at extra cost on Series 219 (quantity orders only).

Contact Action: Electrical contacts of Types 219, 219C and 239 CLOSE on temperature rise. Contacts of Types 219X, 239X and 219XC are single-pole double throw.

ELECTRICAL RATINGS

Types 219, 219X, 239, 239X

Volts A.C.	120	208	240
Full Load Amps.	16	9.2	8
Locked Rotor Amps.	96	55.2	48
Non-Inductive (SPST and only one side of SPDT controls)	5000 Watts		240/277 V. A.C.
	2500 Watts		120 V. A.C.
Pilot Duty — 125 VA. 24/277 V. A.C.			

Types 219C, 219XC

Volts A.C.	120	208	240
Full Load Amps.	5.8	3.3	2.9
Locked Rotor Amps.	34.8	19.8	17.4
Non-Inductive 15 Amps. 120/277 V. A.C.			
Pilot Duty — 125 VA. 24/277 V. A.C.			

ORDERING INFORMATION

1. To order, please specify order code shown in specification table.

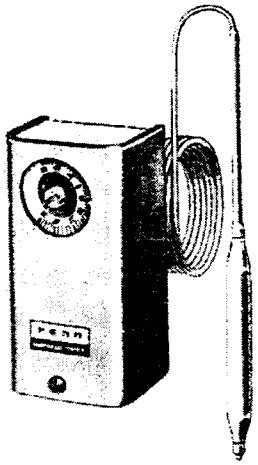


Fig. 1 — Type 219 with external range adjustment.

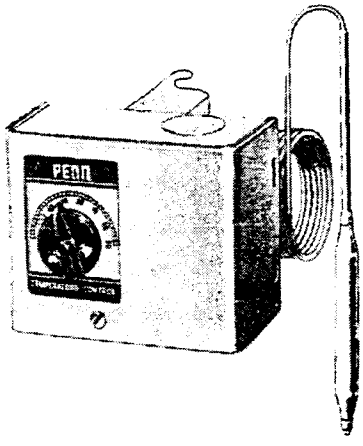


Fig. 2 — Type 239 with external range and differential adjustment.

Fig. 3 — Type 219 Space Thermostat with range adjustment knob and integral air bulb.

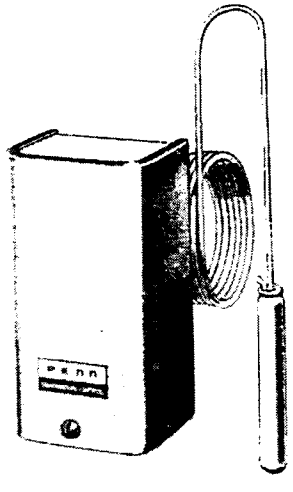


Fig. 4 — Type 219 without external range adjustment.

SPECIFICATIONS — SERIES 219

Ordering Code	Type	Application	Range ° F.	Diff. ° F.	Stop	Bulb Style	Bulb Size and Finish	Bulb Well If Required Specify	Cap. Length	Bulb Support	Cover		Range Adjuster		Switch Action
											Plain	Scale	Screw-drive Slot	Knob	
*†5T10	219	General Purpose	−30 to 50	5	Low Limit	1 or 4 **	⅜ x 4⅝ tin plate	239-608	6'	3"		X	X		Close High SPST
*†5T11	219	General Purpose	20 to 80	3½	Low Limit	1 or 4 **	⅜ x 5⅛ tin plate	239-610	6'	3"		X	X		Close High SPST
219C 1104	219C	Milk Cooler	30 to 50	2		1	⅜ x 2⅛ Copper	442-642	6'	—	X		X		Close High SPST
††5T12	219C	Milk Cooler	30 to 50	2		1	⅜ x 2⅛ Copper	442-642	6'	—	X		X		Close High SPST
†5T13	219C	General Purpose Close Diff.	40 to 90	1½	High Limit	1 or 4 **	⅜ x 6⅛ tin plate		6'	3"		X	X		Close High SPST
†5T14	219XC	General Purpose Photo Tank	40 to 90	1½	High Limit	1	⅜ x 6⅝ Syn. Rubber Plated		6'	3"		X	X		SPDT
*5T15	219	Space Thermostat	−30 to 50	5	Low Limit	3	Coil Black		—	—		X		X	Close High SPST
*5T16	219	Space Thermostat	20 to 80	3½	Low Limit	3	Coil Black		—	—		X		X	Close High SPST

**NOTE — Style 4 is obtained by using Style 1 with support tube and adding 442-638 packing nut assembly for ½" N.P.T. tapping.
*Available with special close differential construction on quantity orders — extra charge. Differentials approximately ½ those shown above.
†Case compensation optional on quantity orders at extra charge.
††Case compensation standard on 5T12.
Fixed sealed settings available on quantity orders — no charge (See Page 3).

SPECIFICATIONS — SERIES 239

Ordering Code	Type	Application	Range ° F.	Diff. ° F.	Stop	Bulb Style	Bulb Size and Finish	Bulb Well If Required Specify	Cap. Length	Bulb Support	Cover		Range Adjuster		Switch Action
											Plain	Scale	Screw-drive Slot	Knob	
5T4	239	General Purpose	−30 to 50	5 to 20		1 or 4 **	⅜ x 4⅝ tin plated	239-608	6'	3"		X		X	Close High SPST
5T5	239	General Purpose	20 to 90	3½ to 20		1 or 4 **	⅜ x 5⅛ tin plated	239-610	6'	3"		X		X	Close High SPST
5T6	239X	General Purpose Duct Thermo.	50 to 130	3½ to 20		1 or 4 **	⅜ x 5⅛ tin plated	239-610	8'	3"		X		X	SPDT
5T7	239	Freeze Protection Water Chillers	38 to 80	8 to 40	Low Limit	1 or 4 **	⅜ x 3⅞ tin plated	442-642	6'	442-638 Supplied as Standard		X		X	Close High SPST

**Style 4 is obtained by using Style 1 with support tube and adding 442-638 packing nut assembly.

ORDERING INFORMATION (Cont'd)

2. Where no order code is shown, specify Type and Model.
3. Specify special close differential "C" switch, if desired, only on models where it is available (see specification table).
4. Specify bulb well, if required, by part number.
5. Specify Part No. 442-638 packing nut assembly, if required. (Standard on 5T7.)

REPAIRS AND REPLACEMENT

Repairs are not recommended in the field other than replacement of the cover, well assembly and packing nut assembly. When ordering replacement parts, give control Type, Model and Serial numbers. Controls requiring attention should be returned to the factory or nearest Penn Authorized Replacement Station for inspection and service.

SHIPPING WEIGHTS

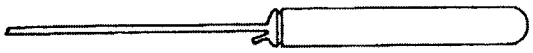
Type	Individual Pack	Overpack of	
		10	50
219	1 lb.	—	40 lbs.
239	2 lbs. 11 ozs.	31½ lbs.	—

Performance specifications appearing herein are nominal and are subject to accepted manufacturing tolerances and application variables.

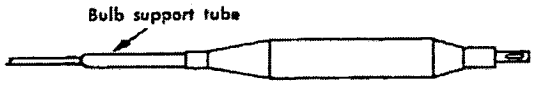
U.L. Guide No.: Series 219 400 EO
Series 239 361 E5.30

File: Series 219 E6688A
Series 239 SA5168

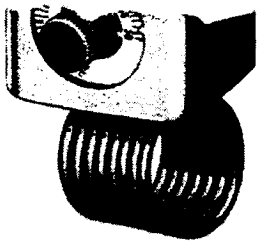
BULB AND BULB ACCESSORIES



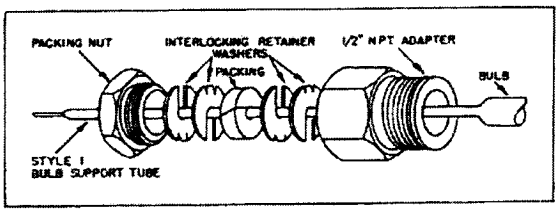
Style 1 drawn bulb.



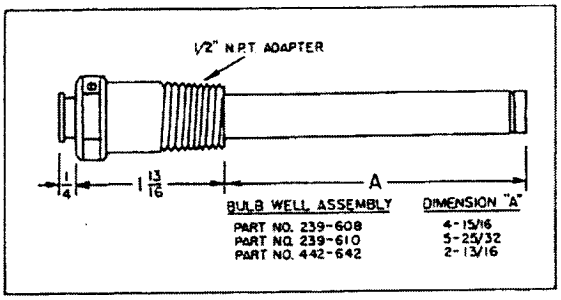
Style 1 swaged bulb with support tube.



Style 3 element attached to Type 219 case.

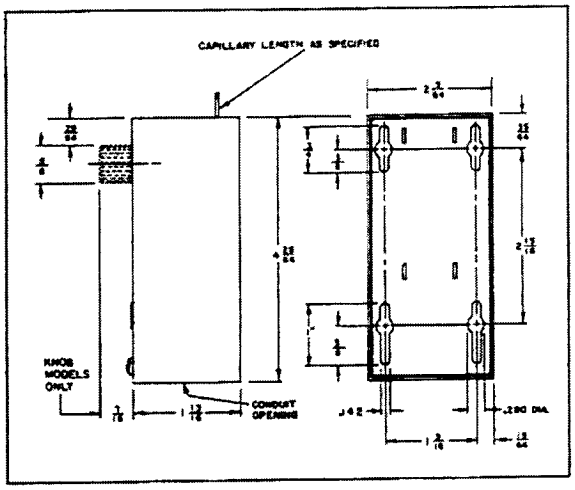


Part No. 442-638 packing nut assembly. (Use with Style 1 bulb with support tube for direct immersion application.)

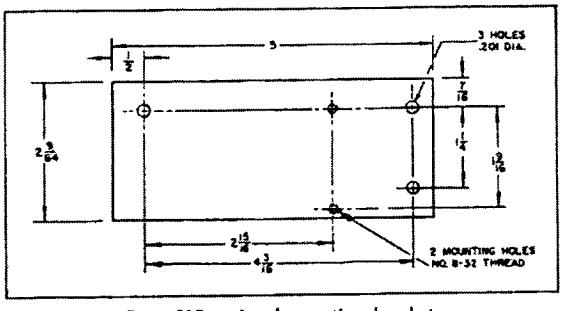


Bulb well dimensions.

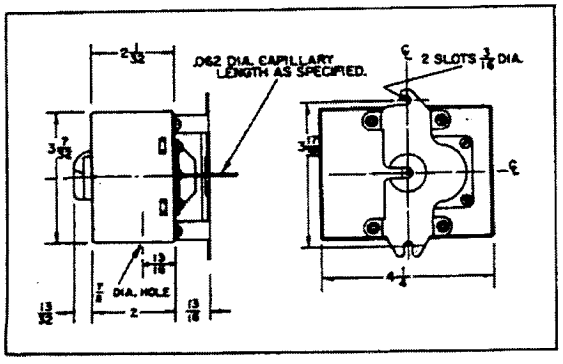
DIMENSION DRAWINGS



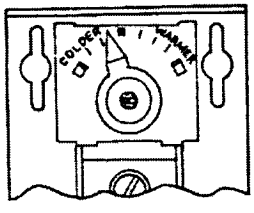
Type 219



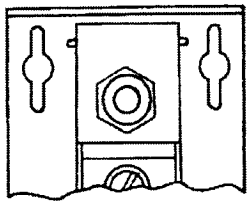
Type 219 optional mounting bracket.



Type 239



Interior view of range adjustment furnished on Type 219C Milk Cooler controls: 30° to 50° F. range. Not available on other models.



Factory sealed setting (Series 219 only — optional on quantity orders).

PENN CONTROLS, INC.
General Offices: Goshen, Indiana
FACTORIES: GOSHEN, INDIANA—SYRACUSE, INDIANA—FOREST PARK, ILLINOIS — MILWAUKEE, WISCONSIN—WATERTOWN, WISCONSIN—COSTA MESA, CALIFORNIA

CANADA: PENN CONTROLS LIMITED, 928 WARDEN AVENUE, SCARBOROUGH, (TORONTO), ONTARIO.
THE NETHERLANDS: PENN CONTROLS NEDERLAND, N.V., NIEUWE KEIZERSGRACHT 29, AMSTERDAM (C).
ARGENTINA: PENN CONTROLS ARGENTINA S.A., GENERAL ROCA 3549, FLORIDA F.C.G.B.M. (BUENOS AIRES).
JAPAN: SAGINOMIYA PENN CONTROLS (JAPAN), LTD., 510, 1-CHOME, SAGINOMIYA, NAKANO-KU, TOKYO.

AUTOMATIC CONTROLS FOR HEATING, REFRIGERATION, AIR CONDITIONING, APPLIANCES, PUMPS, AIR COMPRESSORS, ENGINES

series 219T2X

TWO-STAGE TEMPERATURE CONTROLS

APPLICATION

Series 219T2X two-stage temperature controls are applicable to a variety of uses where a staging thermostat is required. Two SPDT switches permit independent control circuits. Each switch can be wired to make or break the control circuit as required. A jumper across the "common" terminals is supplied as standard. Models are available for fixed or adjustable between-stage differential.

Models with close differential on each switch contain the letter "C" in the Type Number (example, 219T2XC).

For applications requiring two-stage controls less enclosure, see Bulletin 3372. For single stage temperature controls, see Bulletin 3270.

For single and two-stage space thermostats for Farm and General Purpose see Bulletin 3350.

GENERAL DESCRIPTION

Series 219T2X are compact two-stage controls with non-adjustable differential on each switch. Knob range adjustment and visible scale are standard. Other features include a liquid-filled, copper sensing element which is unaffected by barometric pressure and cross-ambient temperature problems.

Controls may be supplied for immersion applications for use with a closed tank connector or with a bulb well assembly. A low limit stop, which can be set in the field, is an integral part of the control.

TYPE NUMBER SELECTION

TYPE	BETWEEN-STAGE DIFFERENTIAL °F.	DIFF. °F. EACH SWITCH		
		−30/+50	20/80	40/90
219T2X	2 to 7 as specified Non-Adj.	5	3½	3
219T2XA	2 to 7 Field Adj.	5	3½	3
219T2XC	2 to 7 as specified Non-Adj.	2½	2	1½
219T2XCA	2 to 7 Field Adj.	2½	2	1½

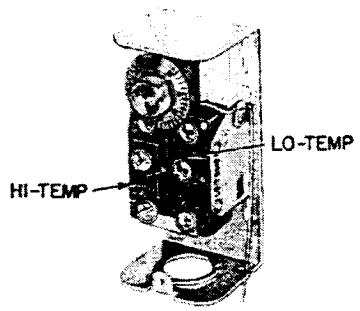


Fig. 2 — Interior of Series 219T2X. High stage and low stage contact units are identified.

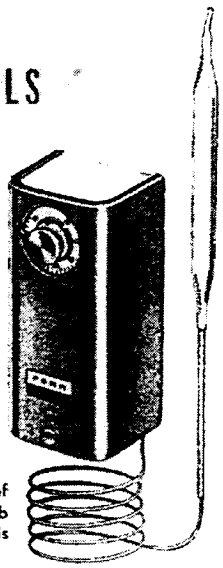


Fig. 1 — Exterior of Series 219T2X. Knob range adjustment is shown.

SPECIFICATIONS

RANGE	BULB SIZE	BULB STYLE	BULB WELL IF REQ'D.	CAP. LENGTH
−30 to +50° F.	⅜" x 4⅜"	1 or 4*	239-608	6'
20 to 80° F.	⅜" x 5⅜"	1 or 4*	239-610	6'
40 to 90° F.	⅜" x 6⅜"	1 or 4*	—	6'

*Style 4 is obtained by using Style 1 with support tube and adding 442-638 packing nut assembly for ½" N.P.T. tapping.
See "Optional Constructions" for other bulb styles.

ELECTRICAL RATINGS

TYPES 219T2X, 219T2XA

Volts A.C.	120	208	240	277
Full Load Amps.	16.0	9.2	8.0	—
Locked Rotor Amps.	96.0	55.2	48.0	—
Non-Inductive or Resistance Load Amps. (Not Lamp Loads)	16.0	9.2	8.0	7.2
Pilot Duty — 125 VA, 24/277 V.A.C.				

NOTE: When used as a two circuit switch, the total connected load must not exceed 2000 VA and must have a common return.

TYPES 219T2XC, 219T2XCA

Volts A.C.	120	208	240	277
Full Load Amps.	6.0	3.4	3.0	—
Locked Rotor Amps.	36.0	20.4	18.0	—
Non-Inductive or Resistance Load Amps. (Not Lamp Loads)	10.0	9.2	8.0	7.2
Pilot Duty — 125 VA, 24/277 V.A.C.				

NOTE: When used as a two circuit switch, the total connected load must not exceed 2000 VA and must have a common return.

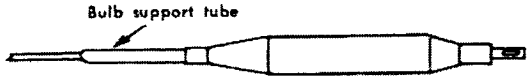


Fig. 3 — Style 1 swaged bulb with support tube for clamp-on or closed tank applications.

OPTIONAL CONSTRUCTIONS

Range Adjuster: Screwdriver slot with visible scale (see Fig. 9) or screwdriver slot with internal scale and solid cover optional at no extra cost (Quantity orders).

Capillary: Capillary longer than 6 feet available at extra cost. Capillary from 6 to 10 feet in 2 feet increments; over 10 feet in 5 feet increments.

Bulb: Coil bulb for low movement air application may be supplied. Also available is a 3/16" dia. by 22" long bulb for detecting the average temperature in air ducts.

MISCELLANEOUS SPECIFICATIONS

Case: .062" cold rolled steel, cadmium plated.

Cover: .025" cold rolled steel, gray baked enamel.

Contact Units: Sealed, dust-tight Pennswitch, SPDT.

SHIPPING WEIGHTS

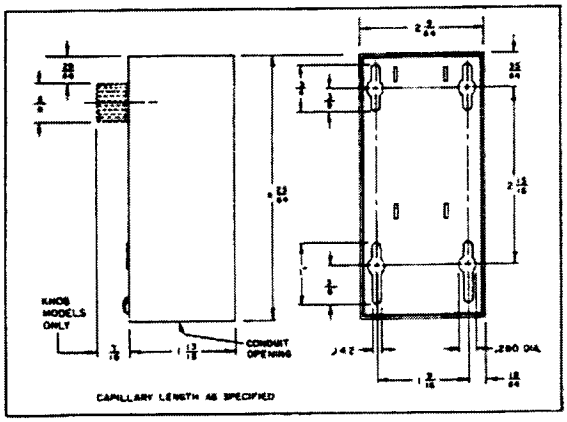
INDIVIDUAL PACK	OVERPACK OF 50 UNITS
1.1 lbs.	55 lbs.

ORDERING INFORMATION

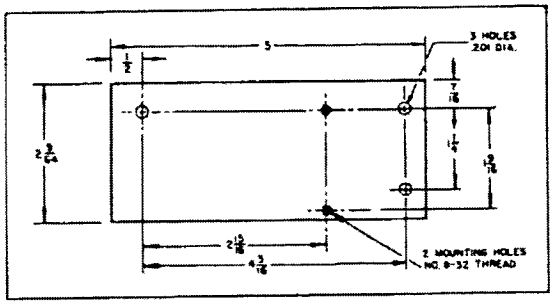
To order, specify:

1. Type number (see Type Number Selection).
2. Range required.
3. Between stage differential (non-adjustable models only).
4. Capillary length, if other than 6 feet.
5. Packing nut assembly or bulb well, if required.
6. Specify type of range adjustment if other than knob adjustment.

DIMENSION DRAWINGS



Series 219T2X



Optional mounting bracket.

Performance specifications appearing herein are nominal and are subject to accepted manufacturing tolerances and application variables.

INSTALLATION AND MOUNTING

Controls are normally mounted to a flat surface by the mounting holes located in back of case. Mounting may be in any convenient position, see Dimension Drawings for mounting hole dimensions. An optional mounting bracket is available when required, see Dimension Drawings.

CAUTION — ON ROUGH MOUNTING SURFACE USE TOP TWO MOUNTING HOLES ONLY.

When you mount this control on an uneven surface and pull all four mounting screws down tight — you can twist the case enough to affect thermostat calibration and operation.

Do not bend or dent the 3/16" by 22" bulb. Damage to the bulb will result in a shift in the control calibration.

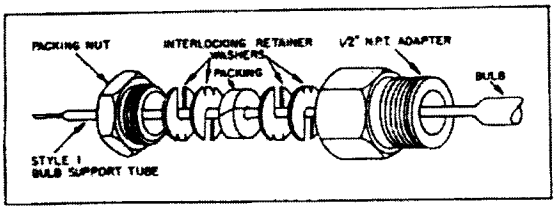


Fig. 4 — Part Number 442-638 packing nut assembly. (Use with Style 1 bulb with support tube for direct immersion application.)

For closed tank applications without well assembly, Part 442-638 packing nut assembly may be supplied; see Figure 4 for sequence of installation. Place parts over support tube section of the element, placing bulb into tank (be sure tank is first drained so liquid level is below tank opening). Screw packing nut into adapter with the retaining washers and packing in place as shown.

To install models with bulb well first install bulb well into tank. Remove bushing from bulb well and slide bushing over capillary (see Fig. 5). Replace bushing into bulb well, gently pushing bulb into position in bottom of well. Tighten set screw in end of adapter to hold bulb in position.

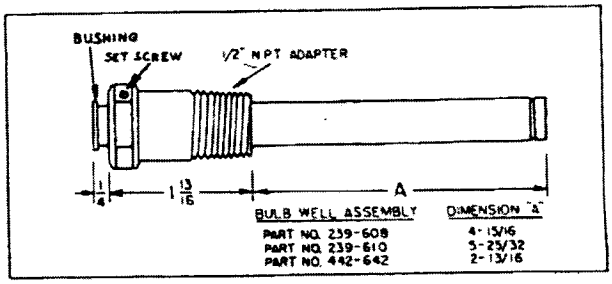


Fig. 5 — Bulb well for liquid immersion applications where a temperature bulb may be removed without draining tank.

WIRING

Follow equipment manufacturer's diagrams if provided. Wiring should conform to local codes and the National Electrical Code. Wiring terminals of each Pennswitch are color coded for convenience and to simplify wiring. Red is the common terminal; red to white circuit closes on temperature increase, red to blue circuit opens on temperature increase.

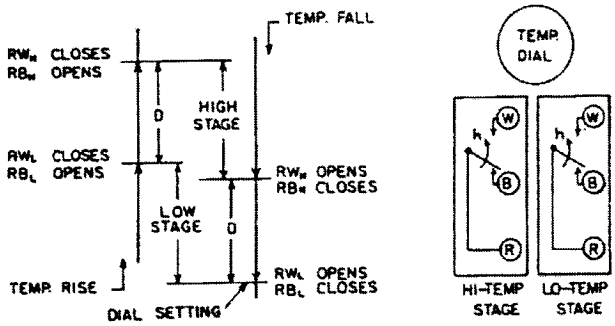


Fig. 6 — Switching action of the two-stage control is illustrated in the sketch above. RB_H, RW_H indicates HI-TEMP; RB_L, RW_L indicates LO-TEMP. "D" represents the differential between stages.

ADJUSTMENTS

Types 219T2XA, 219T2XCA controls are supplied with adjustable differential between stages. Types 219T2X, 219T2XC do not have adjustable between stage settings. *All models have fixed differential on each Pennswitch.* To adjust between-stage differential, rotate adjusting wheel *counterclockwise* to widen the differential (increase spread). Use a small screwdriver and insert into serrated wheel, see Fig. 7.

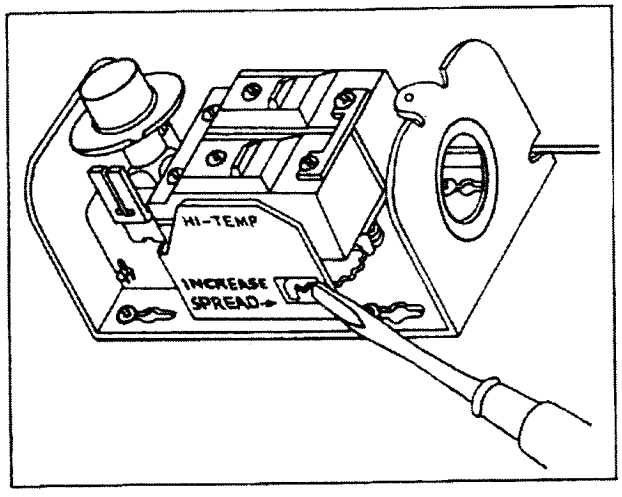


Fig. 7 — Between-stages differential can be increased on Type Numbers ending with "A" by rotating adjusting cam counterclockwise as illustrated above.

Knob range adjustment or screwdriver slot adjustment supplied on range screw. Dial pointer is located on control cover. The switch mounting frame is stamped to indicate the HI-TEMP switch and the LO-TEMP switch, see Fig. 2.

Low limit stop is an integral part of the control and can be adjusted by the sliding stop. To set low limit stop proceed as follows:

1. Set dial to temperature at which stop is desired. If control has a solid cover remove cover, set dial so desired setting is in line with slot in limit stop bracket.
2. Remove control cover.
3. Slide dial stop to front of control (toward dial) against step behind dial, see Fig. 9. NOTE: Sometimes an exact stop setting is not possible and the stop must be set to the closest step corresponding to the dial setting.

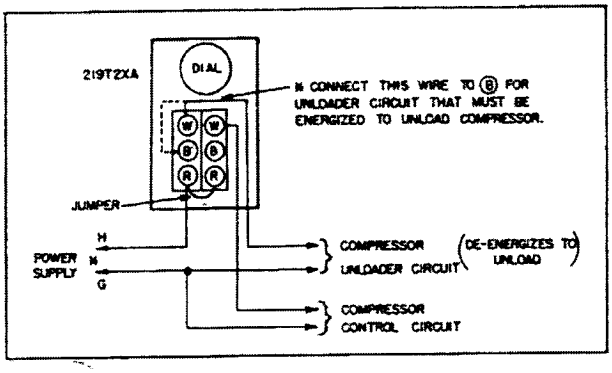


Fig. 8 — Typical wiring diagram of a refrigeration compressor with single stage unloader. Two compressor packages may be sequenced with same circuit.

Fig. 9 — Sliding stop to front of thermostat to set limit stop. Screwdriver slot range adjustment is illustrated.

REPAIR AND REPLACEMENT

Repairs are not recommended in the field. Controls requiring attention should be returned to the factory. When ordering a replacement control specify Type, Model and Serial Number as shown on the cover label of the contrrol.

PENN CONTROLS, INC.
General Offices: Goshen, Indiana
FACTORIES: GOSHEN, INDIANA—SYRACUSE, INDIANA—FOREST PARK, ILLINOIS — MILWAUKEE, WISCONSIN —WATERTOWN, WISCONSIN—COSTA MESA, CALIFORNIA

CANADA: PENN CONTROLS LIMITED, 929 WARDEN AVENUE, SCARBOROUGH, (TORONTO), ONTARIO.
THE NETHERLANDS: PENN CONTROLS NEDERLAND, N.V., NIEUWE KEIZERSGRACHT 29, AMSTERDAM (C).
ARGENTINA: PENN CONTROLS ARGENTINA S.A., GENERAL ROCA 3549, FLORIDA F.C.G.B.M. (BUENOS AIRES).
JAPAN: SAGINOMIYA PENN CONTROLS (JAPAN), LTD., 510, 1-CHOME, SAGINOMIYA, NAKANO-KU, TOKYO.

AUTOMATIC CONTROLS FOR HEATING, REFRIGERATION, AIR CONDITIONING, APPLIANCES, PUMPS, AIR COMPRESSORS, ENGINES

Litho in U.S.A.

7-3-64

JOHNSON CONTROLS

A19 Series

LIT-1927010

Remote Bulb Control

Description

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

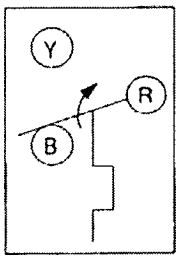
Features

- 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

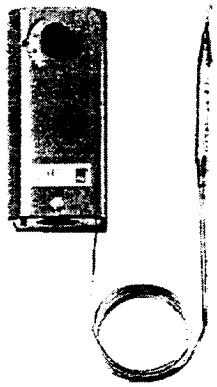
The A19 is suitable for temperature control in heating, ventilating, and refrigeration.

A19 Series



Action on Increase of Temperature

A19 Series Terminal Arrangement for SPDT



A19ABC-24

Selection Charts

A19 Series Remote Bulb Control[1]

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)
Adjustable Differential (Wide Range)							
A19ABA-40C [2]	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 Cap.	WEL14A-602R	Screwdriver Slot	140 (60)
A19ABC-4C	SPDT	50 to 130 (10 to 55)	3 1/2 to 14 (1.9 to 8)	3/8 in. x 5 in., 8 ft Cap.	WEL14A-603R	Knob	170 (77)
A19ABC-24C [3]	SPDT	-30 to 100 (-34 to 38)	3 to 12 (1.7 to 6.7)	3/8 in. x 4 in., 8 ft Cap.	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 Cap.	WEL14A-602R	Convertible	140 (60)
A19ABC-37C	SPDT	-30 to 100 (-34 to 38)	3 to 12 (1.7 to 6.7)	3/8 in. x 4 in., 10 ft Cap.	WEL14A-602R	Screwdriver slot	140 (60)
A19ABC-74C	SPDT	-30 to 100 (-34 to 38)	3 to 12 (1.7 to 6.7)	3/8 in. x 4 in., 6 ft Cap.	WEL14A-602R	Screwdriver slot	140 (60)
Fixed Differential							
A19AAF-12C	SPDT	25 to 225 (-4 to 107)	3 1/2 (1.9)	3/8 in. x 3 in., 10 ft Cap.	WEL14A-602R	Screwdriver slot	275 (135)
Fixed Differential (Case Compensated)							
A19AAC-4C	SPDT	0 to 80 (-18 to 27)	5 (2.8)	3/8 in. x 4 in., 6 ft Cap.	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 Cap.	WEL14A-602R	Screwdriver slot	140 (60)
Fixed Differential (Close)							
A19AAD-5C [4]	SPST Open Low	30 to 50 (-1 to 10) **(Bulk Milk Cooler)**	2 1/2 (1.4)	3/8 in. x 2 5/8 in., 6 ft Cap.	WEL16A-601R	Screwdriver slot	190 (88)
A19AAF-20C	SPDT	-30 to 100 (-34 to 38)	2 1/2 (1.4)	3/8 in. x 4 in., 6 ft Cap.	WEL14A-602R	Screwdriver slot	140 (60)
A19AAF-21C	SPDT	40 to 90 (4 to 32)	1 1/2 (0.8)	3/8 in. x 5 3/4 in., 6 ft Cap.	WEL14A-603R	Screwdriver slot	140 (60)
Manual Reset							
A19ACA-14C	SPST Open Low	-30 to 100 (-34 to 38)	Manual Reset	3/8 in. x 4 in. 6 ft Cap.	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 Cap.	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 Cap.	WEL14A-602R	Knob	290 (143)
A19ADN-1C	SPST Open High	100 to 240 (38 to 116)	Manual Reset	3/8 in. x 4 in. 6 ft Cap.	WEL14A-602R	Screwdriver slot	290 (143)

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

Replacement Parts

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 part number **FTG13A-600R**. Bulb wells (WEL14A Series) are available for liquid immersion applications. Refer to the selection chart or to *Bulb Wells* on Page 42.

A19

LIT-1927055

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

Description

Sturdy compact thermostat designed especially for temporary installations.

Features

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

Applications

- on/off control of portable space heaters
- agriculture

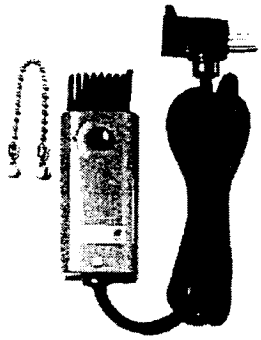
Technical Specifications

Electrical Ratings

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

Selection Chart

Code Number	Switch Action	Range °F (°C)	Diff F° (C°)	Max. Bulb Temp. °F (°C)
A19BAG-1C	SPST Open High "No Heat" Position	35 to 95 (2 to 35)	3 (1.7) Non-Adj.	140 (60)



A19BAG-1

A19 Series

LIT-1927060

Automatic Changeover with Strap-on Mounting

Description

This is a changeover control for use with combination heating and cooling thermostats.

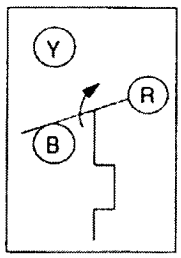
Features

This control automatically selects the correct thermostat function.

Applications

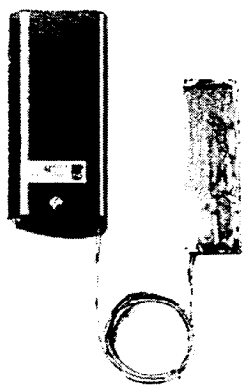
Recommended for convectors, fan coils, and blast coil units, and similar devices. The A19CAC-2 can be mounted directly on either a vertical or a horizontal pipe, using the can mounting strap supplied with control. The A19CAC-1 has a remote bulb for greater mounting convenience.

A19 Series



Action on Increase of Temperature

A19 Series Terminal Arrangement for SPDT



A19CAC-1 (Remote Bulb Model)

Technical Specifications

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

Electrical Ratings

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

Selection Charts

A19 Series Automatic Changeover with Strap-on Mounting

Code Number	Switch Action	Range °F (°C)	Diff F°(C°)	Mounting
A19CAC-1C	SPDT	60 to 90 (16 to 32)	10 (5.6)	42 in. cap.
A19CAC-2C	SPDT	60 to 90 (16 to 32)	10 (5.6)	Direct

Replacement Parts

Code Number	Description
CVR28A-617R	Concealed adjustment cover

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

JOHNSON CONTROLS

A28 Series

LIT-1927110

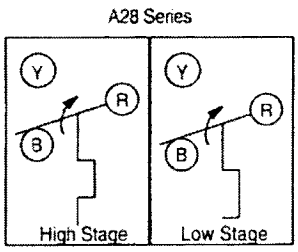
Two Stage Temperature Control

Description

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

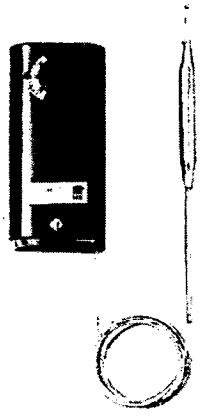
Applications

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



A28 Action Diagram

A28AA-4



A28AB-29

Features

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

Accessories

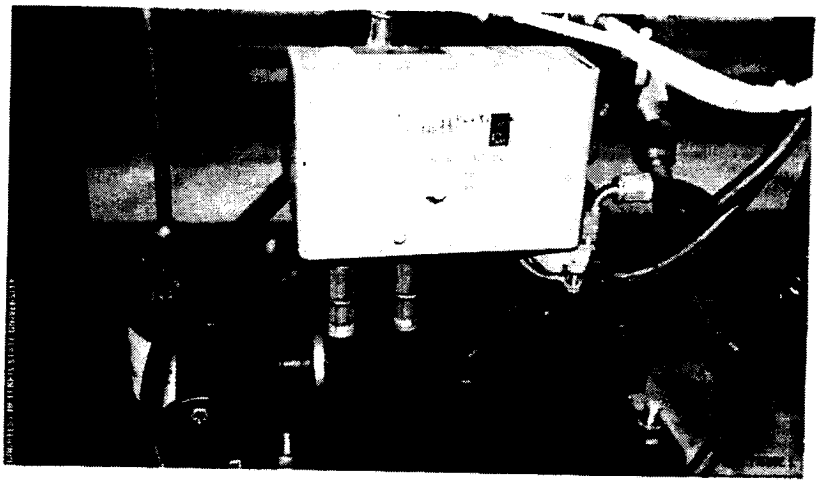
- packing nut assembly available for direct immersion applications (Part No. **FTG13A-600R**)
- remote bulb models include 5/8 in. mounting clip

Selection Charts

Code Number	Switch Action	Range °F (°C)	Diff F° (C°)	Bulb and Capillary	Bulb Well No. (order separately)	Range Adjuster
COILED BULB–FIXED DIFFERENTIAL						
A28AA-4C	2-SPDT	30 to 110 (-1 to 43)	3 1/2 (1.9) Ea. Stage 3 (1.7) Fixed Between Stages	1 3/8 in. x 2 1/4 in. Coiled	–	Convertible
CASE COMPENSATED–FIXED DIFFERENTIAL						
A28AA-9C	2-SPDT	20 to 80 (-7 to 27)	3 1/2 (1.9) Ea. Stage 3 (1.7) Fixed Between Stages	3/8 in. x 5 in. 6 ft Cap.[1]	WEL14A-603R	Knob
WIDE RANGE–ADJUSTABLE INTERSTAGE DIFFERENTIAL						
A28AA-28C	2-SPDT	30 to 110 (-1 to 43)	3 1/2 (1.9) Ea. Stage 2 to 7 Adj. Between Stages	12 ft averaging bulb 6 ft Cap.	–	Screwdriver Slot
A28AA-29C	2-SPDT	-30 to 100 (-34 to 38)	5 (2.8) Ea. Stage 2 to 7 Adj. Between Stages	3/8 in. x 4 in. 8 ft Cap.[1]	WEL14A-602R	Convertible
A28AA-36C	2-SPDT	40 to 90 (4 to 32)	3 Ea. Stage 2 to 7 Adj. Between Stages	3/8 in. x 5 3/4 in. 6 ft Cap.	–	Knob
A28AA-37C	2-SPDT	60 to 140 (16 to 60)	5 Ea. Stage 2 to 7 Adj. Between Stages	3/8 in. x 4 in. 6 ft Cap.	WEL14A-602R	Knob
A28AJ-4C	2-SPDT	20 to 80 (-7 to 27)	2 Ea. Stage 2 to 7 Adj. Between Stages	3/16 in. x 22 in. 6 ft Cap.	–	Knob
CHANGEOVER CONTROL						
A28AB-1C	2-SPDT[2]	20 to 80 (-7 to 27)	3 1/2 (1.9)	3/8 in. x 5 in. 6 ft Cap.	WEL14A-603R	Screwdriver Slot
A28AB-2C[3]	2-SPDT[4]	60 to 90 (16 to 32)	5 (2.8)	Strap-on Grid Bulb 42 in. Cap.	–	Screwdriver Slot

1. Packing nut assembly available for direct immersion applications (Part No. FTG13A-600R).
2. Switches within 1 F° (0.6 C°) of each other.
3. Maximum sensing element temperature is 250°F (121°C).
4. Switches within 1.5 F° (0.9 C°) of each other.

FIGURE 1 (RIGHT). The tubing connected to the bellows can be a high-pressure rubber hose, such as shown in the lower right of this photo.
FIGURE 2 (MIDDLE). Internal action of the bellows type controller.
FIGURE 3 (BOTTOM). The addition of a current relay on one leg of the compressor will tell the electronic controller that the compressor is not running and will open a circuit to the safety heater on the oil safety control.



If a motor is equipped with both an internal inherent motor protector and an oil safety controller, the oil safety controller may trip due to a motor overheating or overloading problem on some systems.

SAFETY CONTROLLERS

continued from page 12

that the difference between these two pressures is the net oil pressure.

Oil pump discharge pressure
- Crankcase pressure
Net oil pressure

So, if there is a fall in net oil pressure below 9 pounds per square inch differential (psid), the pressure differential switch will close and a heater in series with the pressure differential switch will be energized. There is usually a two-minute delay before the heater will warp a bimetallic strip. This warping action will open the timing switch contacts, which are in series with the motor starter or contactor coil. This action takes the motor out of service and must be manually reset on most controls.

Notice that manually pushing the reset button will reset (close) the timing switch contacts once the bimetal strip cools down. The reason for the two-minute time delay is to prevent nuisance trips of the oil safety controller. Often, there are times when the crankcase may have liquid refrigerant in it from an imperfect system. The two-minute delay gives the crankcase time to clear any unwanted refrigerant during periods when refrigerant migration or flooding has occurred. It also avoids shutdowns during short fluctuations in net oil pressure on start-ups.

Remember, when the compressor is off, the net oil pressure is 0 psi and the differential pressure switch contacts are closed. The heater in the oil safety controller will not be energized during the off-cycle because it is wired to the line side of the motor starter contacts. When the motor starter contacts are opened, this action takes L2 out of the heater circuit. At start-up, when the motor starter contacts close and the compressor starts, the differential pressure switch contacts will stay closed and the heater will be energized until at least 9 psid of net oil pressure is developed. As mentioned before, this time delay will prevent nuisance trips of the controller at start-ups.

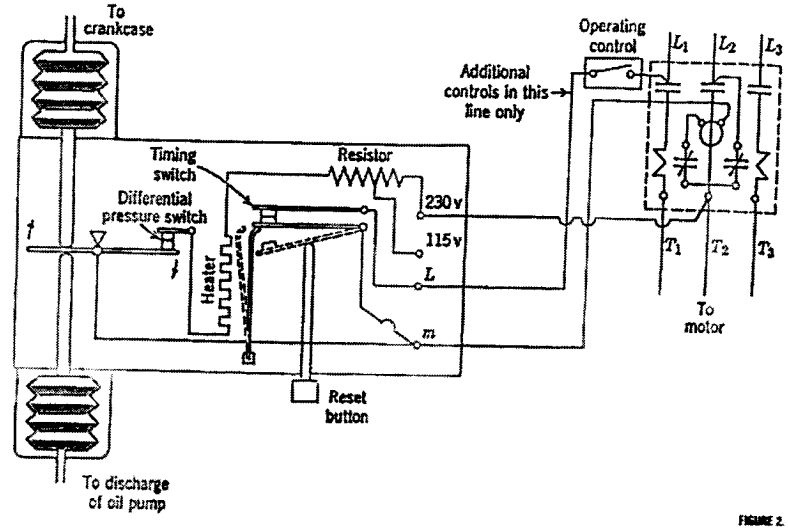


FIGURE 2.

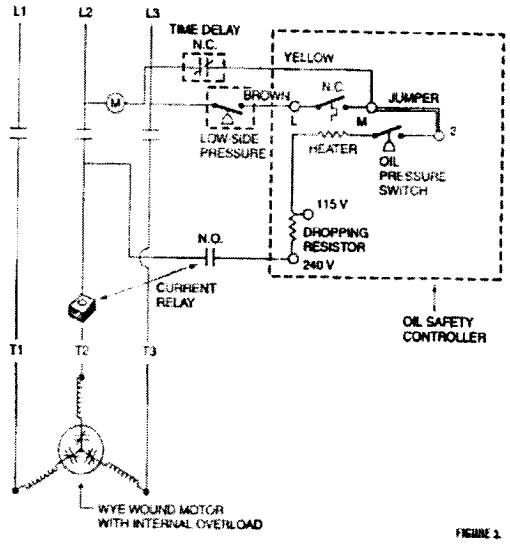


FIGURE 3.

If a motor is equipped with both an internal inherent motor protector and an oil safety controller, the oil safety controller may trip due to a motor overheating or overloading problem on some systems. When the internal overload opens, the motor is shut off but the motor starter coil remains energized with contacts closed. This will trip the oil safety controller in a matter of two minutes because of a lack of net oil pressure. However, the addition of a current relay on one of the legs of the compressor will tell the electronic controller that the compressor is not running and will open a circuit to the safety heater on the oil safety controller (Figure 3). ■

John Tomczyk is a professor of HVACR at Ferris State University, Big Rapids, Mich., and the author of Troubleshooting and Servicing Modern Air Conditioning & Refrigeration Systems, *published by ESCO Press. To order, call 800-726-9696. Tomczyk can be reached by e-mail at tomczykj@ferris.edu.*

Come join the party.

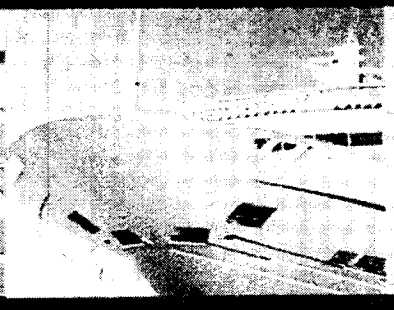
ENTER FOR A CHANCE TO WIN A

90-HOUR CRUISE

WITH EVERY QUALIFYING
JOHNSON CONTROLS PRODUCT PURCHASE

GRAND PRIZE

90-hour
Caribbean cruise for two



Winners will enjoy a four-day, four-night getaway, including cruise, transfers, airfare and more.

Scheduled for February 2010.

18 winners
9 contractor customers + guest
9 distributor salespeople + guest

2ND PRIZE

$500 Visa gift card

18 winners
9 contractor customers
9 distributor salespeople

3RD PRIZE

$250 Visa gift card

18 winners
9 contractor customers
9 distributor salespeople

4TH PRIZE

$125 Visa gift card

18 winners
9 contractor customers
9 distributor salespeople

5TH PRIZE

$90 Visa gift card

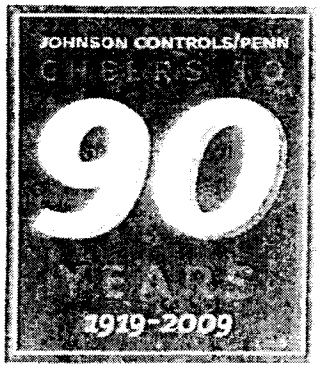
18 winners
9 contractor customers
9 distributor salespeople

QUALIFYING JOHNSON CONTROLS PRODUCT PURCHASE:
The "Cheers to 90 Years" contest includes ALL Johnson Controls and Johnson Controls/PENN product purchases EXCEPT repair parts, Metasys® and Facility Explorer building management system products.

No purchase necessary. Void where prohibited. The "Cheers to 90 Years" promotion is open to legal residents of the 50 U.S. states, D.C. and Canada, 21 years and older. Official rules at distributors. Contest begins April 1, 2009 and ends September 30, 2009; entries must be received by October 12, 2009. Sponsored by Johnson Controls, Inc., 507 E. Michigan Street, Milwaukee, WI 53202.

Johnson Controls

P.O. Box 423, Milwaukee, WI 53201
© 2009 Johnson Controls, Inc. Printed in USA
www.johnsoncontrols.com



ENTRY FORM

Attention contractor customers and distributor salespeople:

Enter together for a chance to win a 90-hour Caribbean cruise with every qualifying Johnson Controls product purchase.

Contractor's Name: _____

Contractor's Address: _____

City/State/Zip: _____

Daytime Phone: _____

E-mail: _____

Contractor's Company Name: _____

Products Purchased: _____

Distributor Salesperson's Name: _____

Daytime Phone: _____

E-mail: _____

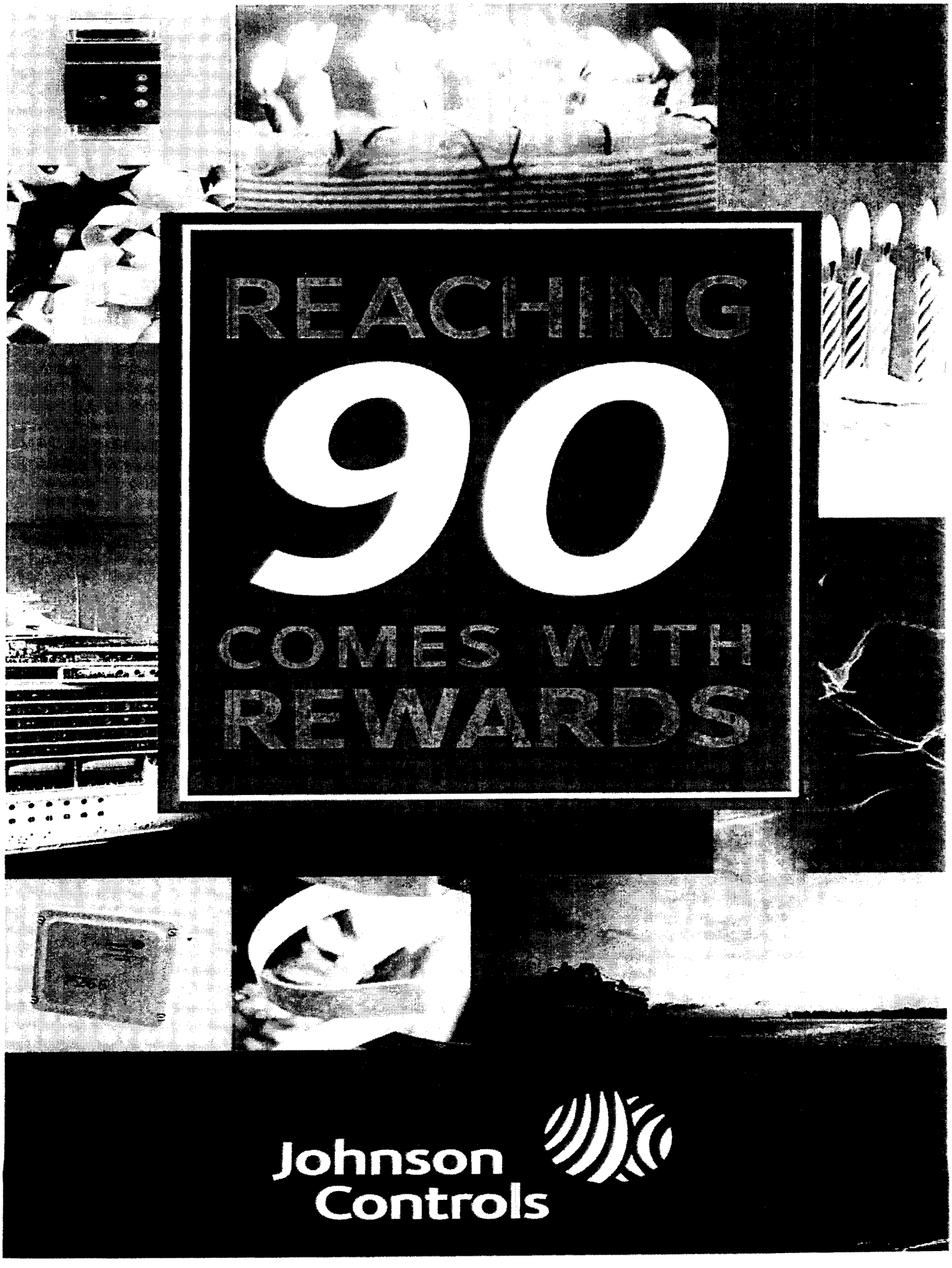
Distributor Name: _____

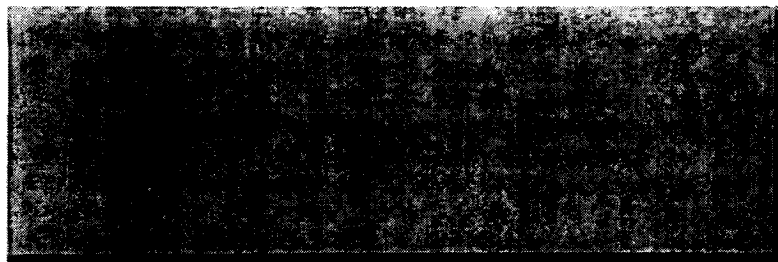
Distributor Address: _____

City/State/Zip: _____

Only completed, legible entries are eligible.

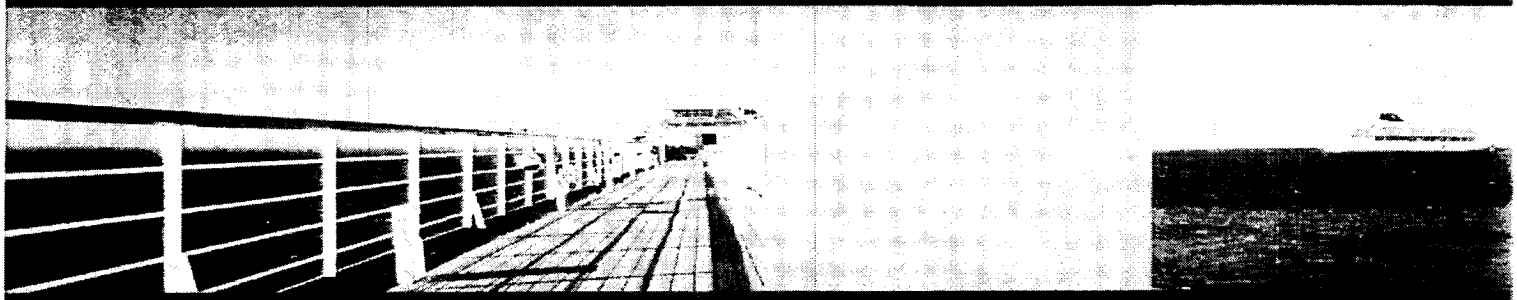
Johnson Controls


REACHING
90
COMES WITH
REWARDS
Johnson
Controls



GRAND PRIZE

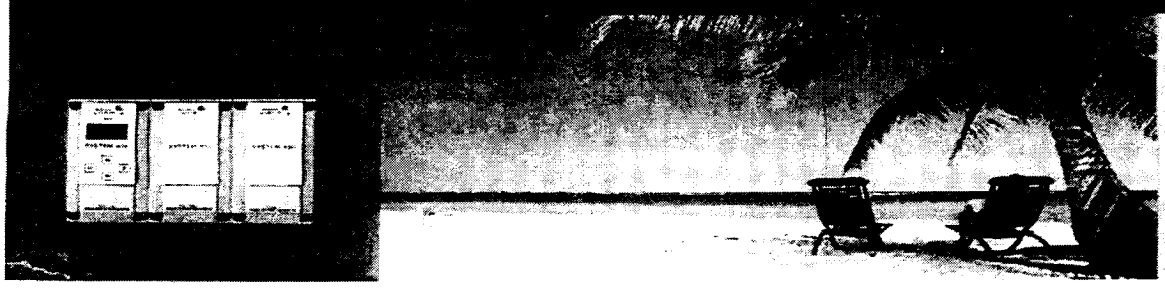
90-hour Caribbean cruise for two



Winners will enjoy a four-day, four-night getaway, including cruise, transfers, airfare and more.

Scheduled for February 2010

18 winners
9 contractor customers + guest
9 distributor salespeople + guest



2ND PRIZE

$500 Visa gift card

18 winners
9 contractor customers
9 distributor salespeople

3RD PRIZE

$250 Visa gift card

18 winners
9 contractor customers
9 distributor salespeople

4TH PRIZE

$125 Visa gift card

18 winners
9 contractor customers
9 distributor salespeople

5TH PRIZE

$90 Visa gift card

18 winners
9 contractor customers
9 distributor salespeople

90 WINNERS

Enter the "Cheers to 90 Years" contest today

When you play the "Cheers to 90 Years" contest from Johnson Controls, you're destined to be a winner. You already know about the quality and reliability of every Johnson Controls and Johnson Controls/PENN product. Now, every time you buy one of our proven products, you're getting closer to one of our 90 prizes.

How to play:

1) Buy any Johnson Controls or Johnson Controls/PENN brand product and you'll get an entry form. See official rules on back for entry without purchase.
   (Excludes repair parts, Metasys® and Facility Explorer building management system products.)

2) Complete the "Cheers to 90 Years" entry form with your distributor salesperson and drop it in the counter display. Now you both have a chance to win the grand prize – a 90-hour Caribbean cruise for two. Or the $500 second prize. Or the $250 third prize. Don't forget there are even more prizes – a $125 fourth prize and $90 fifth prize.

3) Repeat steps 1 and 2 above. The more you buy, the better chance you and your distributor salesperson have to win.

Best of all, 10 prizes will be awarded to a contractor customer and a distributor salesperson in each of the nine regions across the U.S. and Canada. That's a total of 90 winners!

Come join the party.

Join the "Cheers to 90 Years" contest for your chance to win one of 90 prizes.

Every time you purchase a qualifying Johnson Controls or Johnson Controls/PENN brand product, you can enter for a chance to win the grand prize – a 90-hour Caribbean cruise for two.

Get ready to celebrate!

Only completed, legible entries are eligible. Complete and deposit printed entry with purchase of qualifying Johnson Controls or Johnson Controls/PENN brand product by September 30, 2009, or for entry without purchase, hand write name, address, phone, employer and the words: "Cheers to 90 Years" on a 3x5 card and send postmarked by September 30, 2009, to: "Cheers to 90 Years," Johnson Controls, Inc., M19, 507 E. Michigan Street, Milwaukee, WI 53202, received by October 12, 2009. Sponsor not responsible for lost, late, illegible or misdirected entries or award notifications. Entry constitutes acceptance of all rules.

You must be at least 21 years old and a legal resident of the 50 United States (includes D.C.) or Canada to enter and win. Void where prohibited or restricted. All federal, state, provincial and local laws and regulations apply. Contest runs in designated 90-day period (varies by locale) between April 1, 2009 and September 30, 2009. All entries must be received by October 12, 2009. Employees (and immediate families and households) of Johnson Controls, Inc., its subsidiaries and affiliates are not eligible to enter or win. Winning names will be posted.

A Grand, Second, Third, Fourth and Fifth prize will be awarded to one contractor and one distributor's inside salesperson in each of nine regions. (See No. 6, below.) Eighteen Grand Prize Winners will receive a 4-day, 4-night Caribbean cruise for two (one adult guest), including travel, accommodations, meals, taxes and gratuities, all as determined by Sponsor. Cruise is scheduled for February 2010 and valued between $1,600-$2,000 (USD) for two people, depending on airfare. Restrictions and conditions apply. No cash in lieu of prize. No transfers. Trip must be taken. A valid U.S. passport is required for all winners and guests of the Grand Prize. Florida residents may, at Sponsor's option, be provided with ground travel stipend rather than airfare. If the winner can't go, the prize will be forfeited and a new winner will be randomly selected. Winner must agree to participate in publicity as arranged by Sponsor, or prize will be forfeited, except where prohibited. Grand Prize in the eight U.S. regions only also includes a $400 cash payment to help offset tax obligation or other expenses. Sponsor's decisions final in all matters.

a $500 (U.S.) Visa gift card
a $250 (U.S.) Visa gift card
a $125 (U.S.) Visa gift card
a $90 (U.S.) Visa gift card

(Sponsor reserves right to substitute like prize of equal or greater value for Second, Third, Fourth and Fifth Prizes due to availability. Second, Third, Fourth and Fifth Prizes will be awarded to winners within four to six weeks of validation of eligibility.)

Total value of all 90 Contest Prizes to be awarded estimated at $53,000 (USD), depending on airfare. Total value of all 10 Contest Prizes in each of the eight U.S. regions estimated at $5,930 (USD), depending on airfare; estimated value in Canadian region $5,130 (USD), depending on airfare.

Potential Grand, Second, Third, Fourth and Fifth Prize winners in each region will be selected by Sponsor in a random drawing from among all eligible entries in each region, to be held on or about October 13, 2009. Potential winners will be notified by October 21, 2009 by phone or by express delivery at the address listed on the entry form. To become prize recipient, potential Grand Prize winner will be required to execute and return an affidavit of eligibility, publicity release, and mutually acceptable release of liability within 20 days of notification, or an alternate winner may be selected, chosen by random drawing. Prize will be awarded to the prize recipient only. Second, Third, Fourth and Fifth Prize winners may be required to provide affidavit of eligibility and liability release or other evidence of eligibility. Transfer, cash redemption, exchange or substitution of prize is not allowed, except at the sole discretion of Sponsor, whose decisions are final. Except where prohibited, acceptance of prize constitutes recipient's consent to the use of his or her name, likeness and biographical data for advertising and promotional purposes without additional compensation. Chance of winning depends on the number of entries received.

Potential prize winners in Canada must complete an appropriate mathematical test of skill before claiming prize, or alternate winner will be chosen. As to Quebec: Any litigation respecting the conduct or organization of a publicity contest may be submitted to the Regie des alcohols, des courses et des jeux for a ruling. Any litigation respecting the awarding of a prize may be submitted to the Regie only for the purpose of helping the parties reach settlement.

Qualifying products for entry with purchase include all Johnson Controls and Johnson Controls/PENN brand products, but excludes all repair parts as well as Metasys® and Facility Explorer building management systems products.

Johnson Controls, Inc. has divided the U.S. and Canada into nine regions. A Grand prize, Second prize, Third prize, Fourth prize and Fifth prize will be awarded to a distributor's contractor customer and an inside salesperson in each of these nine regions:

- Northwest Region: Washington, Oregon, Montana, Idaho, Wyoming, Utah, Colorado, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, Alaska, Minnesota
- West Region: California, Arizona, Nevada, Hawaii
- South Region: New Mexico, Texas, Louisiana, Mississippi, Arkansas
- Southeast Region: Georgia, South Carolina, North Carolina, Alabama, Florida
- Central Region: Wisconsin, Illinois, Michigan, Iowa, Missouri
- East Central Region: Indiana, Ohio, Kentucky, Tennessee, West Virginia
- Northeast Region: Maine, New Hampshire, Vermont, New York, Massachusetts, Connecticut, Rhode Island
- Mid-Atlantic Region: Pennsylvania, Maryland, Delaware, Virginia, D.C., New Jersey
- Canadian Region: All of Canada

Mailed entries will be designated by Sponsor into the proper regional drawing.

By participating, participants release and hold harmless Sponsor and its parents, subsidiaries, affiliates, directors, officers, employees, and agents from any and all liability for any injuries, including but not limited to, personal injury or death, loss or damage of any kind arising from or in connection with the contest or any prize won. Sponsor's decisions in all contest matters are final. Sponsor reserves the right to alter or terminate this program at its sole discretion in the event of extreme, unexpected or unusual circumstances that compromise the integrity or intended play of the contest. Sponsor not responsible for printing, typographical, mechanical, validation or other errors, including such errors that may lead to erroneous appearance of qualification for a prize or premium. Winners are responsible for all fees, costs or expenses associated with receipt of prize, including all federal, state, provincial and local taxes. Sponsor will comply with all tax reporting obligations.

At the end of the "Cheers to 90 Years" promotion, return all completed entries to:
Cheers to 90 Years - M19
Johnson Controls, Inc.
507 E. Michigan Street
Milwaukee, WI 53202

Metasys® is a registered trademark of Johnson Controls, Inc.

P.O. Box 423, Milwaukee, WI 53201
© 2009 Johnson Controls, Inc. Printed in USA
www.johnsoncontrols.com

Johnson Controls

Cheers to savings

The more you buy, the more you save

on Johnson Controls/PENN and Johnson Controls brand product orders of $160,000 and up

on Johnson Controls/PENN and Johnson Controls brand product orders of $60,000 to $159,999

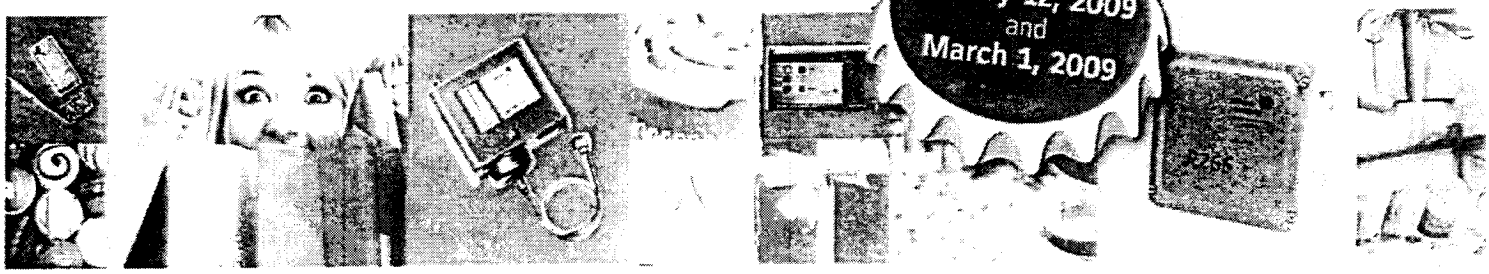
on Johnson Controls/PENN and Johnson Controls brand product orders of $15,000 to $59,999

Save on these

Johnson Controls/PENN products*

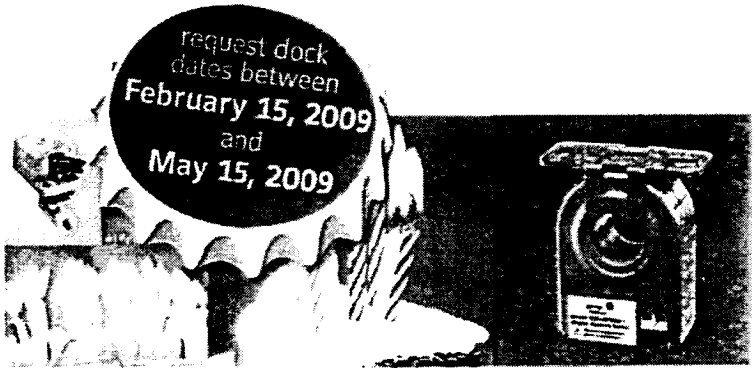
- A19 Temperature Controls
- A419 Electronic Temperature Controls
- P266 Series Electronic Fan Speed Controls
- P70 Pressure Controls
- P470 Electronic Pressure Controls
- P545 Electronic Lube Oil Controls
- System 350™ Modular Electronic Controls
- System 450™ Modular Electronic Controls
- VFD66 Fan Speed Controls
- Plus all other Johnson Controls/PENN brand products

order between **January 12, 2009** and **March 1, 2009**



Save on these
Johnson Controls products:

- CSD Series Current Sensors
- Direct Mount M9000 Series Actuators
- Round Control Damper Products
- T60x Series Thermostat Controllers
- T-4000 Series Pneumatic Thermostats
- T-5800 Pneumatic Receiver Controllers
- TE Series Sensors
- Thermocouples
- VG1000 Ball Valves
- VG7000 Globe Valves
- Variable Speed Drives



Shipping information

$15,000 - $59,999	3
$60,000 - $159,999	3
$160,000 and up	4

Releases must ship to your account location. Standard shipping and payment terms apply. Requested dock date for releases must be between February 15 and May 15, 2009.

Orders must be received between January 12, 2009 and March 1, 2009. Mention code CELEBRATE and your P.O. number to receive your discount via electronic order, fax or phone. All electronic orders must be accompanied by a fax confirmation sent to Tamara at 414-524-7074 within one hour of transmission.

Discount only applies to Johnson Controls/PENN and Johnson Controls products listed in this brochure. Place one order for maximum discount and up to 4 releases, based on order value. Discount level determined by original order value of the Johnson Controls/PENN and Johnson Controls products.

No product returns allowed for products ordered under this stock up promotion.

Johnson Controls reserves the right to cancel or modify this program at any time

Celebrate the savings during the Johnson Controls/PENN 90-year anniversary

The more you order the more you save

Take advantage of our best discounts ever when you stock up on Johnson Controls/PENN and Johnson Controls products, including the new P266 and System 450. The more you order between January 12, 2009 and March 1, 2009, the more you'll save.

Achieve fantastic prizes

Look for our summer promotion, celebrating the Johnson Controls/PENN 90-year anniversary, that will help move inventory off your shelf and give you something to cheer about.

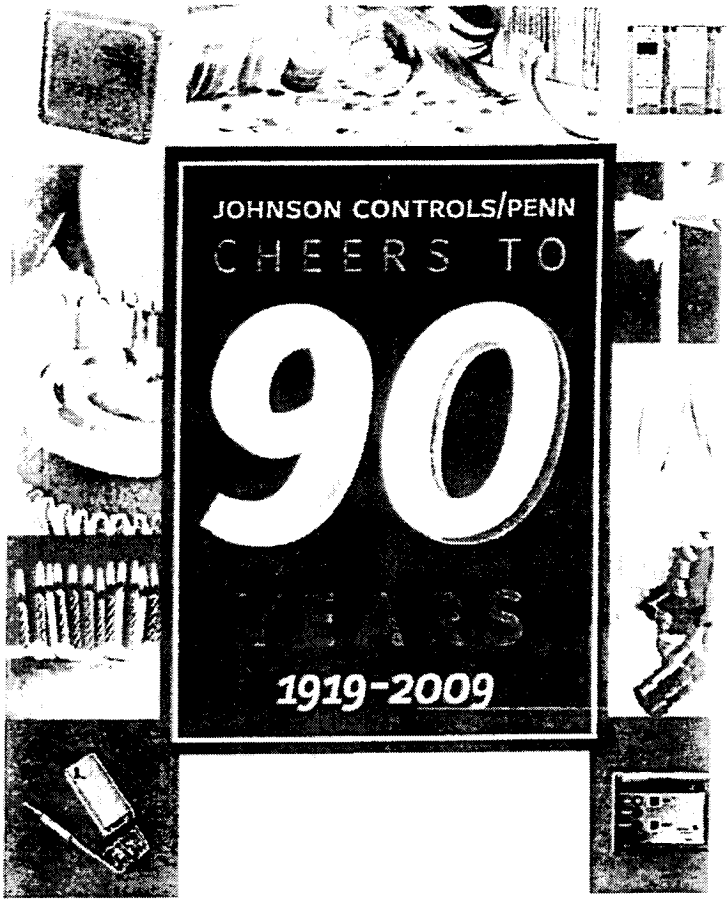
Our 90-year celebration will feature a 90-day long distributor and customer promotion. To motivate counter personnel to sell and customers to buy, they will be given the opportunity to win one of 90 total prizes. To add to the excitement, each region will feature a grand prize that is sure to make everyone celebrate.

To order in the U.S.
call: 1-800-275-5676
fax: 1-800-356-1191

To order in Canada
call: 1-800-321-4023
fax: 1-800-321-4024

Johnson Controls

P.O. Box 423, Milwaukee, WI 53201
www.johnsoncontrols.com
© 2009 Johnson Controls, Inc.
Printed in USA on recycled paper.



Johnson Controls

When your 90-day promotion ends, please send all entry forms to:

Cheers to 90 Years – M19
Johnson Controls, Inc.
507 E. Michigan Street
Milwaukee, WI 53202

If you need additional quantities of any of the items in this brochure, please contact your Johnson Controls sales representative.

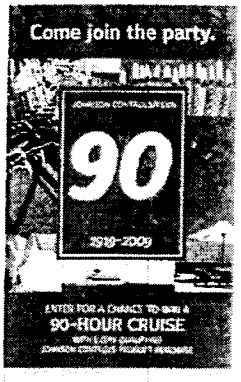
© 2009 Johnson Controls, Inc. P.O. Box 423, Milwaukee, WI 53201 Printed in USA
www.johnsoncontrols.com

Johnson Controls

Brochure

Quantity: 50

All details regarding the "Cheers to 90 Years" contest can be found in this brochure, including the official rules. Place these brochures on the counter for your customers.



Bill Stuffer

Quantity: 100

Include the bill stuffer in monthly statements to let your customers know about their opportunity to participate in the "Cheers to 90 Years" contest at your store. There's room on the back for your company's name, address and phone number.

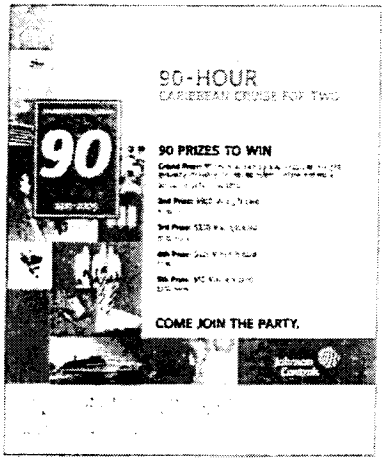
Electronic Flyer

Quantity: Unlimited

Send this electronic flyer to your contractor customers to let them know about their opportunity to win one of 90 prizes when they enter the "Cheers to 90 Years" contest at your store.

You received this electronic flyer, along with the contest registration information.

This electronic flyer is also available from your Johnson Controls sales representative.

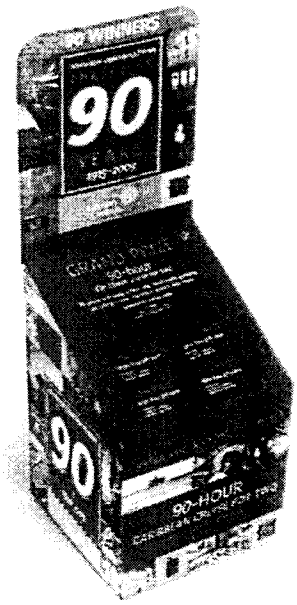


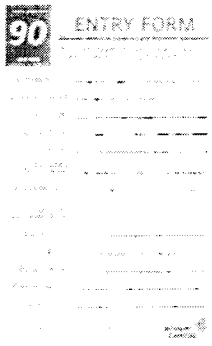
Counter Display

Quantity = 1

The "Cheers to 90 Years" contest centers around the counter display, which lists the official rules. Follow the assembly instructions included, and then place the display on your counter for the next 90 days.

This counter display provides every detail about the contest. Information on the front panel is directed at the contractor customer. Information on the back panel is directed at the distribution sales team. Both have a chance to win the grand prize – a four-day, four-night Caribbean cruise for two. Or the $500 second prize. Or the $250 third prize. Don't forget there are even more prizes this year – a $125 fourth prize and $90 fifth prize. There are 90 prizes overall, which gives everyone a better chance to win. So set up the counter display and start selling Johnson Controls products.





Entry Form

Quantity: 5 pads (50 entries per pad)

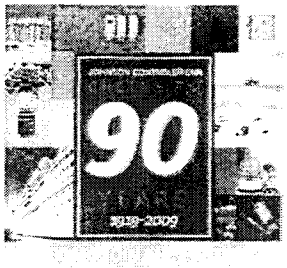
Place the entry forms near the counter display. Every time a contractor customer purchases a qualifying* Johnson Controls or Johnson Controls/PENN brand product, the customer and the distributor salesperson can complete the entry form together for a chance to win one of 90 prizes. Remember only completed, legible entries are eligible.

* Qualifying Johnson Controls Product Purchase:
The "Cheers to 90 Years" contest includes ALL Johnson Controls and Johnson Controls/PENN product purchases EXCEPT repair parts, Metasys® and Facility Explorer building management system products.

Poster

Quantity: 1

Place the "Cheers to 90 Years" poster in a prominent position in your store, so it's on display for all to see. This poster is designed to capture customers' attention and direct them to the counter for more information.



To order in the US:
1-800-275-5676
fax 1-800-356-1191

To order in Canada:
1-800-321-4023
fax 1-800-321-4024

JOHNSON CONTROLS

P.O. Box 423, Milwaukee, WI 53201
www.johnsoncontrols.com
© 2007 Johnson Controls, Inc. Printed in U.S.A.

GET DEEP DISCOUNTS ON JOHNSON CONTROLS PRODUCTS

The more you order the more you save.

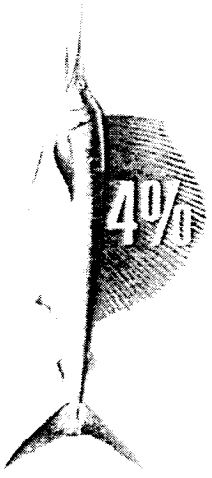
Get the Johnson Controls refrigeration and HVAC products you need now, before the season hits. The more you order between now and March 1, 2007, the more you'll save. And the better prepared you'll be to reel in the profits.

A chance to win a deep sea fishing trip.

The Blue Water 8 challenge will also feature a distributor and customer promotion this summer that will help you move product and give you the chance to win a deep sea fishing trip at a resort location.

LIMIT-OUT ON BIG DISCOUNTS

on Johnson Controls and Johnson Controls/PENN brand product orders of $20,000 to $59,999



on Johnson Controls and Johnson Controls/PENN brand product orders of $60,000 to $159,999

on Johnson Controls and Johnson Controls/PENN brand product orders of $160,000 and up

SAVE ON THESE JOHNSON CONTROLS PRODUCTS:

- Damper Products
  - Curtain Fire
  - Damper Kits
  - Round
- Direct Mount M9000 Series Actuators
- T-600 Series Thermostats
- T-4000 Series Pneumatic Thermostats
- T-5800 Pneumatic Receiver Controllers
- TE Series Sensors
- VA9104 Series Valve Actuators
- VB-9000 Ball Valves
- VG7000 Globe Valves
- VS Series Variable Frequency Drives
  - Micro Drives from 1-10HP
  - VS Open Drives 1-20HP

SAVE ON THESE JOHNSON CONTROLS/PENN PRODUCTS:

- A19 Temperature Controls
- A419 Electronic Temperature Controls
- P66 Series Electronic Fan Speed Controls
- P70 Pressure Controls
- P470 Electronic Pressure Controls
- P541 Electronic Lube Oil Controls
- System 350™ Modular Electronic Controls
- VFD66 Fan Speed Controls
- Plus all other Johnson Controls/PENN brand products

Discount only applies to Johnson Controls and Johnson Controls/PENN products listed here. Place one order for maximum discount and up to 4 releases, based on order value. Discount level determined by original order value of the Johnson Controls and Johnson Controls/PENN products.

SHIPPING INFORMATION:

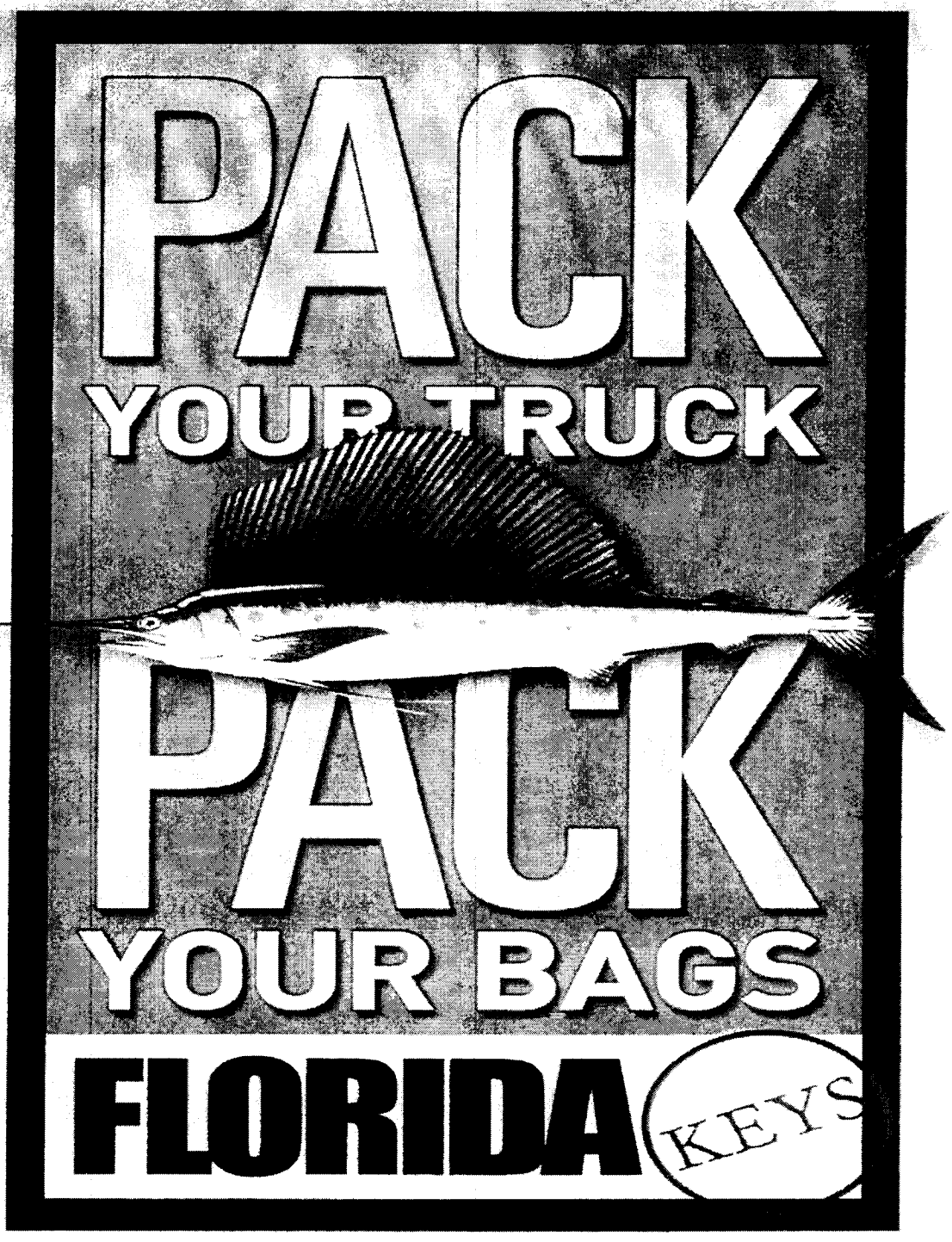
Order Value	Number of rel
$20,000 - $59,999	2
$60,000 - $159,999	3
$160,000 and up	4

Releases must ship to your account loca
and payment terms apply. Requested D
be between March 15 and May 15, 200

Orders must be received by March 1, 20
CHALLENGE and your P.O. number to
electronic order, fax or phone. All electro
accompanied by a fax confirmation sen
within one hour of transmission.

And look for our summer Bluewater Sh
help move inventory off your shelf and
pocket. Details coming soon.

No product returns allowed for products ord



JOHNSON

ENTER THE

CONTEST

Every time you pack your truck with Johnson Controls or Johnson Controls/PENN brand products, you can enter for a chance to win a deep sea fishing trip for two to the Florida Keys.

So get ready to pack your bags next February!

Play the Bluewater Challenge contest from Johnson Controls and you're destined to be a winner. You already know about the quality and reliability of all Johnson Controls products. Now, every time you buy one of our proven products, you're getting closer to a top prize.

How to Play the Bluewater Challenge contest:

1) Buy any Johnson Controls or Johnson Controls/PENN brand product and you'll get an entry form. See official rules for entry without purchase.

   (Excludes repair parts, Metasys® and Facility Explorer building management system products.)

2) Complete the Bluewater Challenge entry form with your distributor salesperson and drop it in the counter display. Now you both have a chance to win the grand prize – a 4-day, 3-night fishing trip for two to the Florida Keys. Or the $400 second prize. Or the $200 third prize.

3) Repeat steps 1 and 2 above. The more you buy, the better chance you and your distributor salesperson have to win.

Best of all, Grand, Second and Third prizes will be awarded to a contractor customer and a distributor salesperson in each of nine


Lodging • Airfare • Deep Sea Fishing • Prizes • Meals


GRAND PRIZE
Deep sea fishing trip for two to the Florida Keys. Includes air, hotel, fishing excursion, meals, and more. The 4-day, 3-night trip at an oceanfront resort is scheduled for February 2008.
18 winners
9 contractor customers + guest
9 distributor salespeople + guest
2ND PRIZE
$400 gift card to an outdoor adventure store
18 winners
9 contractor customers
9 distributor salespeople
3RD PRIZE
$200 gift card to an outdoor adventure store
18 winners
9 contractor customers
9 distributor salespeople
54 WINNERS

The Bluewater Challenge Contest Official Rules

1. Entry. NO PURCHASE NECESSARY. Only completed, legible entries are eligible. Complete and deposit printed entry with purchase of Johnson Controls or Johnson Controls/PENN product by Aug. 31, 2007, or for entry without purchase, hand write name, address, phone, employer and the words: "Bluewater Challenge" on a 3x5 card and send postmarked by Aug. 31, 2007, to: "Bluewater Challenge," Johnson Controls, Inc., M19, 507 E. Michigan Street, Milwaukee, WI 53202, received by September 15, 2007. Sponsor not responsible for lost, late, illegible or misdirected entries or award notifications. Entry constitutes acceptance of all rules.

2. Eligibility. You must be at least 21 years old and a legal resident of the 50 United States (includes D.C.) or Canada to enter and win. Void where prohibited or restricted. All federal, state, provincial and local laws and regulations apply. Contest runs in designated 60-day period (varies by locale) between May 1, 2007 and August 31, 2007. All entries must be received by September 15, 2007. Employees (and immediate families and households) of Johnson Controls, Inc., its subsidiaries and affiliates are not eligible to enter or win. Winning names will be posted.

3. Contest Prizes. A Grand, Second and Third prize will be awarded to one contractor and one distributor's inside salesperson in each of nine regions. (See No. 6, below.) Eighteen Grand Prize Winners will receive a deep sea fishing trip for two (one adult guest), including travel, accommodations, meals, fishing charter fees, taxes and gratuities, all as determined by Sponsor. The 4-day, 3-night fishing trip to the Florida Keys is scheduled for February 2008 and valued between $5,000 and $6,000 (US), depending on airfare. Restrictions and conditions apply. No cash in lieu of prize. No transfers. Trip must be taken. Florida residents may, at Sponsor's option, be provided with ground travel stipend rather than airfare. If the winner can't go, the prize will be forfeited and a new winner will be randomly selected. Winner must agree to participate in publicity as arranged by Sponsor, or prize will be forfeited, except where prohibited. Grand Prize in the eight U.S. regions only also includes a $1,500 cash payment to help offset tax obligation or other expenses. Sponsor's decisions final in all matters.

Eighteen Second Prizes, a $400 (US) value gift card to a major outdoor equipment store.
Eighteen Third Prizes, a $200 (US) value gift card to a major outdoor equipment store.
(Sponsor reserves right to substitute like prize of equal or greater value for Second and Third Prizes due to availability.
Second and Third Prizes will be shipped to winners within four to six weeks of validation of eligibility.)

Total value of all 54 Contest Prizes to be awarded estimated between $100,800 and $118,800, depending on airfare. Total value of all Contest Prizes in each U.S. region estimated between $7,700 and $8,700, depending on airfare; estimated value in Canadian region, $7,200.

4. Prize Drawing. Potential Grand, Second and Third Prize winners in each region will be selected by Sponsor in a random drawing from among all eligible entries in each region, to be held on or about September 30, 2007. Potential winners will be notified the first week of October 2007 by phone or by express delivery at the address listed on the entry form. To become prize recipient, potential Grand Prize winner will be required to execute and return an affidavit of eligibility, publicity release, and mutually acceptable release of liability within 20 days of notification, or an alternate winner may be selected, chosen by random drawing. Prize will be awarded to the prize recipient only. Second and Third Prize winners may be required to provide affidavit of eligibility and liability release or other evidence of eligibility. Transfer, cash redemption, exchange or substitution of prize is not allowed, except at the sole discretion of Sponsor, whose decisions are final. Except where prohibited, acceptance of prize constitutes recipient's consent to the use of his or her name, likeness and biographical data for advertising and promotional purposes without additional compensation. Chance of winning depends on the number of entries received.

Potential prize winners in Canada must complete an appropriate mathematical test of skill before claiming prize, or alternate winner will be chosen. As to Quebec: Any litigation respecting the conduct or organization of a publicity contest may be submitted to the Regie des alcohols, des courses et des jeux for a ruling. Any litigation respecting the awarding of a prize may be submitted to the Regie only for the purpose of helping the parties reach settlement.

5. Qualifying products for entry with purchase include all Johnson Controls and Johnson Controls/PENN brand products, but excludes all repair parts as well as Metasys® and Facility Explorer building management systems products.

6. Johnson Controls, Inc. has divided the U.S. and Canada into nine regions. A Grandprize, Second prize and Third prize will be awarded to a distributor's contractor customer and an inside salesperson in each of these nine regions:
- Northwest Region: Washington, Oregon, Montana, Idaho, Wyoming, Utah, Colorado, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, Alaska, Minnesota
- West Region: California, Arizona, Nevada, Hawaii
- South Region: New Mexico, Texas, Louisiana, Mississippi, Arkansas
- Southeast Region: Georgia, South Carolina, North Carolina, Alabama, Florida
- Central Region: Wisconsin, Illinois, Michigan, Iowa, Missouri
- East Central Region: Indiana, Ohio, Kentucky, Tennessee, West Virginia
- Northeast Region: Maine, New Hampshire, Vermont, New York, Massachusetts, Connecticut, Rhode Island
- Mid-Atlantic Region: Pennsylvania, Maryland, Delaware, Virginia, D.C., New Jersey
- Canadian Region: All of Canada.

Mailed entries will be designated by Sponsor into the proper regional drawing.

7. Additional rules. By participating, participants release and hold harmless Sponsor and its parents, subsidiaries, affiliates, directors, officers, employees, and agents from any and all liability for any injuries, including but not limited to, personal injury or death, loss or damage of any kind arising from or in connection with the contest or any prize won. Sponsor's decisions in all contest matters are final. Sponsor reserves the right to alter or terminate this program at its sole discretion in the event of extreme, unexpected or unusual circumstances that compromise the integrity or intended play of the contest. Sponsor not responsible for printing, typographical, mechanical, validation or other errors, including such errors that may lead to erroneous appearance of qualification for a prize or premium. Winners are responsible for all fees, costs or expenses associated with receipt of prize, including all federal, state, provincial and local taxes. Sponsor will comply with all tax reporting obligations.

Metasys® is a registered trademark of Johnson Controls, Inc.

JOHNSON CONTROLS

P.O. Box 423, Milwaukee, WI 53201

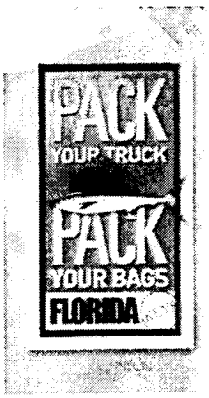
HOW TO SET UP YOUR PROMOTION

JOHNSON CONTROLS

Counter Display

Quantity = 1

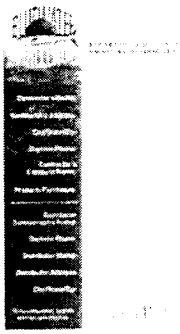
The Bluewater Challenge Promotion centers around the display, which includes the official rules. Follow the assembly instructions included and then place the display on your counter for the next 60 days. It provides every detail – information on the front panel is directed at the contractor customer; information on the back panel is directed at the distribution sales team. Both have a chance to win the grand prize – a 4-day, 3-night fishing trip for two to the Florida Keys. Or the $400 second prize. Or the $200 third prize. So set up the display and start selling Johnson Controls products.



Brochure

Quantity = 50

The Bluewater Challenge brochure provides all the details for this contest, including the official rules. Place these brochures on the counter for your customers.



Entry Form

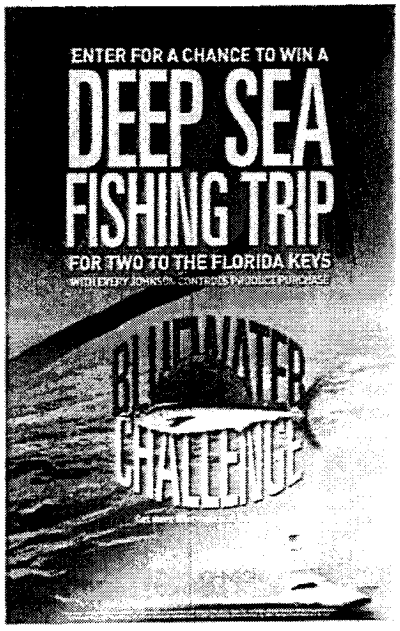
Quantity = 5 pads (50 entries per pad)

Place the entry forms near the counter display. Every time your customer purchases any Johnson Controls or Johnson Controls/PENN brand product, the customer and the distribution salesperson can complete the entry form together and drop it in the display. Remember only completed, legible entries are eligible.

Bill Stuffer

Quantity = 100

Include the bill stuffer in monthly statements to let your customers know about their opportunity to participate in the Bluewater Challenge at your store. There's room on the back for your company's name, address and phone number.



Poster

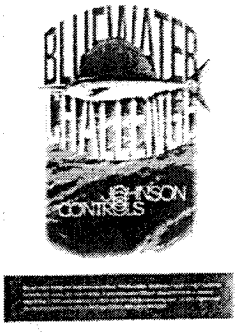
Quantity = 1

The Bluewater Challenge poster is designed to capture customers' attention and direct them to the counter for more information. Hang this poster in a prominent position in your store, where everyone can see it.

Pen

Quantity = 5

To get you started, we've included a few pens to complete the entry form every time a Johnson Controls or Johnson Controls/PENN brand product is purchased.



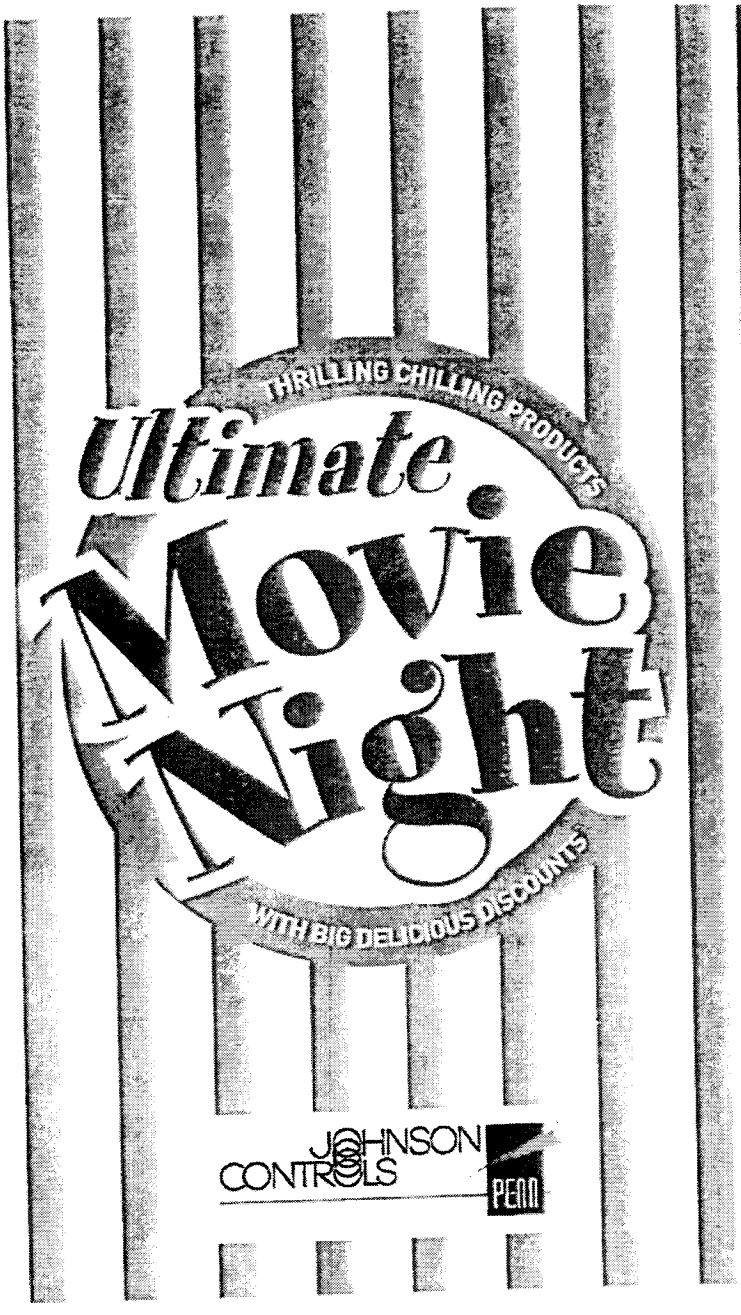
Window Decal

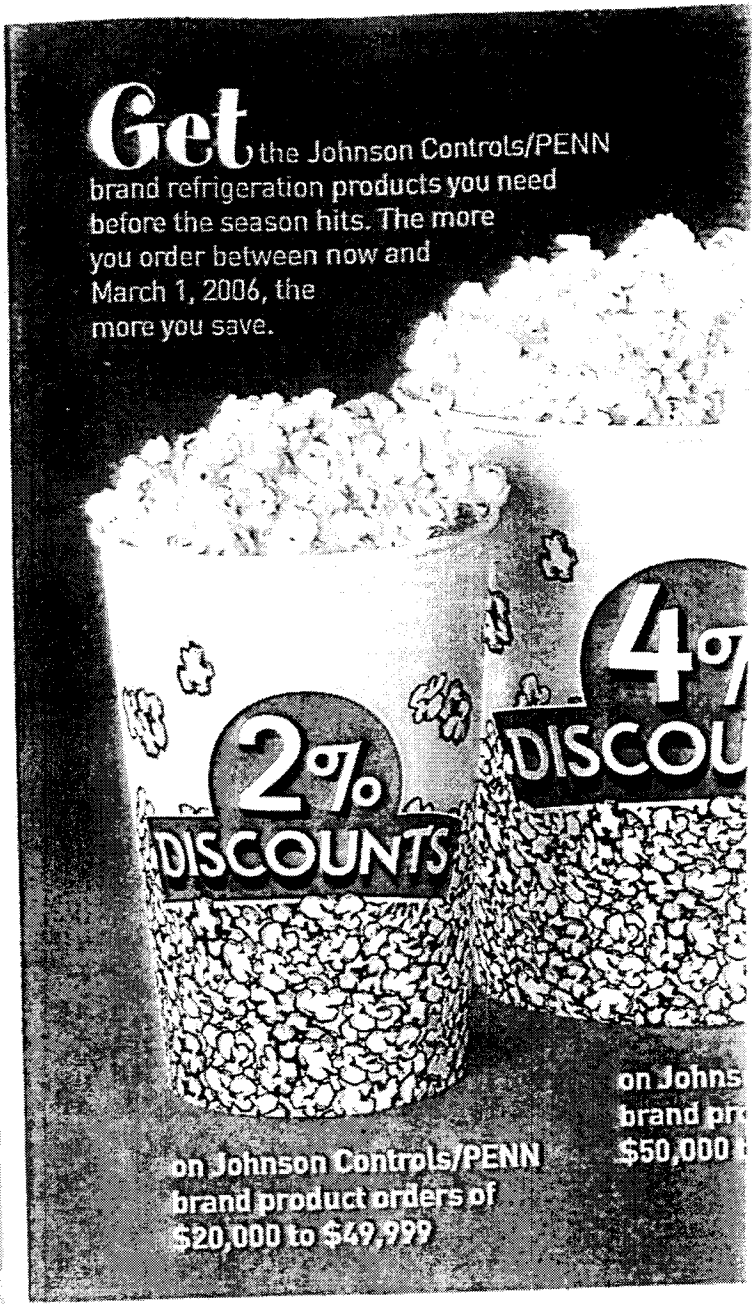
Quantity = 1

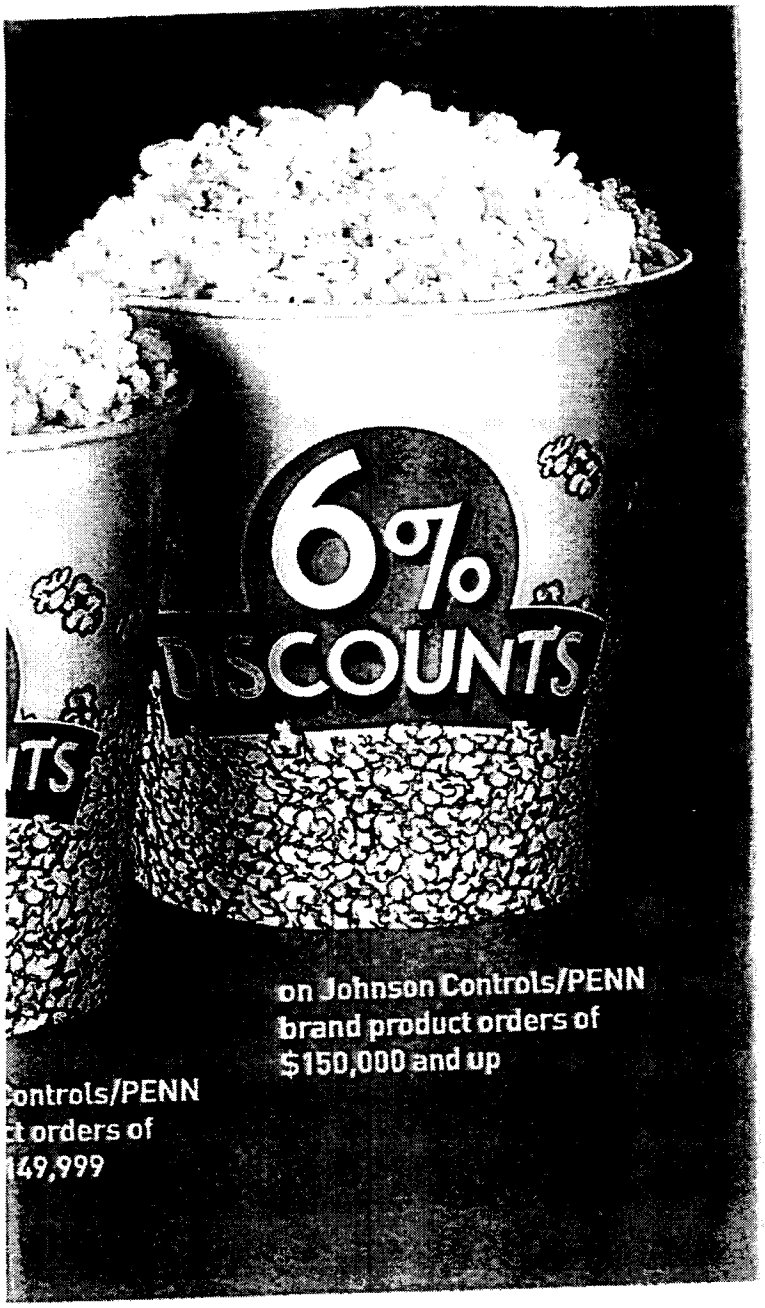
Place the window decal on your door or the nearest window to announce the Bluewater Challenge Promotion to customers before they even enter your store. The decal is double-sided, so it will look great when viewed from either side.

If you need additional quantities of any of the items above, please contact your Johnson Controls sales representative.

JOHNSON CONTROLS


THRILLING CHILLING PRODUCTS
Ultimate
Movie
Night
WITH BIG DELICIOUS DISCOUNTS
JOHNSON CONTROLS
PENN


Get the Johnson Controls/PENN brand refrigeration products you need before the season hits. The more you order between now and March 1, 2006, the more you save.
2% DISCOUNTS
on Johnson Controls/PENN brand product orders of $20,000 to $49,999
4%
DISCOU
on Johns
brand pr
$50,000



Save on these Johnson Controls/PENN products:

- A19
- A419
- P66
- P470
- P70
- System 350
- VFD
- P545
- Plus all other Johnson Controls/PENN brand products.

Discount only applies to Johnson Controls/PENN brand refrigeration products. Place one order for maximum discount and up to 4 releases, based on order value. Discount level determined by original order value of the Johnson Controls/PENN brand products.

Shipping Information:

Order value:	Number of releases:
$20,000 - $49,999	2
$50,000 - $149,999	3
$150,000 and up	4

Releases must ship to your account location. Standard shipping and payment terms apply. Requested dock date for releases must be between **March 15** and **May 15, 2006**.

Orders must be received by **March 1, 2006**. Mention code MOVIE and your P.O. number to receive your discount via electronic order, fax or phone. All electronic orders must be accompanied by a fax confirmation sent to Tamara at 414-524-7074 within one hour of transmission.

JOHNSON CONTROLS PENN

P.O. Box 423, Milwaukee, WI 53201
www.johnsoncontrols.com
© 2006 Johnson Controls, Inc. Printed in USA

Johnson Controls reserves the right to cancel or modify this program at any time.

Ultimate Movie Night

JOHNSON CONTROLS PENN

P.O. Box 423, Milwaukee, WI 53201
© 2006 Johnson Controls, Inc. Printed in USA
www.johnsoncontrols.com

Need more thrills and chills?

Play "The Coolest Garage Contest" from Johnson Controls/PENN and **you're destined to be a winner. You already know about the quality and reliability of all Johnson Controls/PENN brand products.** Now every time **you buy one of our proven products** you're getting closer to a top prize **and a cash card.**

How to play "The Coolest Garage Contest"

1. **With every Johnson Controls/PENN** brand product you purchase **from your distributor,** you'll receive an entry form for a chance to win a $10,000 garage makeover, a $2,000 lawn tractor or a $500 tool cart. **If you purchase** two Johnson Controls/PENN brand products, you'll receive two entry forms. If you purchase three products, you'll receive three entry forms, and so on. The more you buy, the better chance you have to win.

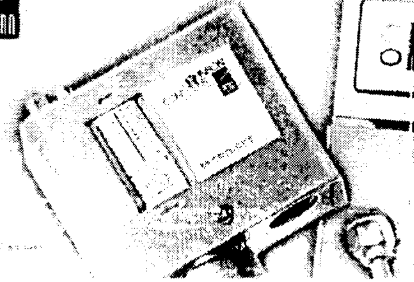
2. For every $50 in Johnson Controls/PENN brand products you purchase **you'll receive a stamp on your frequent buyer card. Each frequent buyer card requires ten $50 stamps. Fill this card up (with product purchases that total $500) and you'll receive a $25 cash card to use anywhere.***

Eligible Products

A11, A19, A25, A28, A319, A36, A419, A70, A72, A74, A99, F59, F61, F62, F63, F92, F93, MR/MS, P100, P10, P128, P12, P145, P170, P20, P21, P28, P29, P300, P32, P399, P400, P445, P45, P470, P47, P545, P61, P66, P67, P70, P72, P74, R310, RLD, System 350, S66, SEC99, V43, V46, V48, V146, V148, V47 and VFD66.

With Johnson Controls/PENN everybody wins!

JOHNSON CONTROLS PENN



The Coolest Garage Makeover Contest Official Rules:

1. **Entry. NO PURCHASE NECESSARY.** Only completed, legible entries are eligible. Complete printed entry with purchase of Johnson Controls/PENN product, or for entry without purchase, hand write name, address, phone, employer and the words "Coolest Garage Makeover" on a 3x5 card and send to "Coolest Garage Makeover," Johnson Controls, Inc., M19, 507 E. Michigan Street, Milwaukee, WI 53202 by September 15, 2005. Sponsor not responsible for lost, late, illegible or misdirected entries or award notifications. Entry constitutes acceptance of all rules.

2. **Eligibility.** You must be at least 21 years old and a legal resident of the 50 United States (includes D.C.) or Canada to enter and win. Void where prohibited or restricted. All federal, state, provincial and local laws and regulations apply. Contest runs in designated 60-day period (varies by locale) between May 1, 2005 and August [illegible] 2005. All entries must be received by September 15, 2005. Employees (and immediate families and households) of Johnson Controls, Inc., this distributor, its subsidiaries and affiliates are not eligible to enter or win. Winning names will be posted.

3. **Contest Prizes. One Grand Prize,** a $10,000 (US) garage makeover. Prize includes $10,000 retail value merchandise and labor cost for an interior garage makeover, purchased by winner at home improvement center as agreed by winner and Sponsor. Sponsor representative will participate in and have approval rights, reasonably exercised, over purchases and makeover. The Grand Prize is intended to provide the winner with an improved or remodeled garage interior and to provide items normally found in a garage. Makeover may include but is not limited to items such as shelving and storage containers for the garage, lawn tractors, power tools, hand tools, tool chests or carts, lawn & garden equipment, patio furniture, grill. Products shown in photography are representative of the prizes the winner(s) may select. This Grand Prize is intended to include improvements normally made to the inside of a garage and such items as may normally be purchased at a home improvement center, and is not intended to include items such as a car, motorcycle, boat, bicycle, RV, camper, or trailer or to apply to the exterior of the garage. Winner must agree to participate in "before-and-after" publicity as arranged by Sponsor, or prize will be forfeited. All decisions, purchases and remodeling related to the Grand Prize are subject to the approval of Sponsor, which shall not be unreasonably withheld. In the event that, in Sponsor's sole discretion, the Grand Prize winner does not have a garage suitable for makeover, Sponsor and winner shall work cooperatively to arrange a comparable alternate prize of the same value, subject to Sponsor's final approval. Sponsor's decisions final in all matters.

One Second Prize, a $2,000 (US) value lawn tractor, to be purchased by winner with Sponsor's approval. Sponsor's decisions final in all matters.
One Third Prize, a $500 (US) value tool cart, to be purchased by winner with Sponsor's approval. Sponsor's decisions final in all matters.
One Distributor Prize, a $2,500 (US) cash card or credit to distributorship where the Grand Prize winner entered contest.
Total value of all Contest Prizes to be awarded: $15,000 (US).

4. **Prize Drawing.** Potential Grand, Second and Third Prize winners will be selected by Sponsor in a random drawing from among all eligible entries received, to be held on or about September 20, 2005. Potential winners will be notified the first week of October 2005 by phone or by express delivery at the address listed on the entry form. To become prize recipient, potential winner will be required to execute and return an affidavit of eligibility, publicity release, and mutually acceptable release of liability within 20 days of notification, or an alternate winner may be selected, chosen by random drawing. Title will be conveyed to the prize recipient. Transfer, cash redemption, exchange or substitution of prize is not allowed, except at the sole discretion of Sponsor, whose decisions are final. Except where prohibited, acceptance of prize constitutes recipient's consent to the use of his or her name, likeness and biographical data for advertising and promotional purposes without additional compensation. Chance of winning depends on the number of entries received. Any potential prize winner in Canada must complete an appropriate mathematical test of skill before claiming prize, or alternate winner will be chosen. As to Quebec: Any litigation respecting the conduct or organization of a publicity contest may be submitted to the Régie des alcools, des courses et des jeux for a ruling. Any litigation respecting the awarding of a prize may be submitted to the Régie only for the purpose of helping the parties reach settlement.

5. **Frequent buyer $25 cash card premium.** For each $50 (US or CAN) in qualifying Johnson Controls/PENN products purchased during promotion period, distributors will use official "Coolest Garage" stamp to cancel one of 10 areas on premium card. Qualifying products include all Johnson Controls/PENN brand products and System 350, but excludes all repair parts. Products eligible for this premium include the following series: A11, A19, A25, A28, A319, A36, A419, A70, A72, A74, A99, F59, F61, F62, F63, F92, F93, MR/MS, P100, P10, P128, P12, P145, P170, P20, P21, P28, P29, P300, P32, P399, P400, P445, P45, P470, P47, P545, P61, P66, P67, P70, P72, P74, R310, RLD, System 350, S66, SEC99, V43, V46, V48, V146, V148, V47 and VFD66. When premium card is full (i.e., $500 (US or CAN) in purchases), purchaser will receive a $25 (US or CAN) cash card. Submit premium card to distributor or mail to Garage Promotion, P.O. Box 14377, Milwaukee, WI 53215. Maximum two cards per individual or household. Allow 4 to 6 weeks for delivery. Proof of purchase may be required. Audits may be conducted to validate number of Johnson Controls/PENN purchases. Each cash card will be sent by registered mail and each requires recipient's authorized signature. No cash cards will be mailed to distributor locations. Filled premium cards must be received at fulfillment center no later than September 15, 2005, or will be void. **Offer good only while supplies last;** 10,000 cash cards available.

6. **Additional rules.** By participating, participants release and hold harmless Sponsor and its parents, subsidiaries, affiliates, directors, officers, employees, and agents from any and all liability for any injuries, including but not limited to, personal injury or death, loss or damage of any kind arising from or in connection with the contest or any prize won. Sponsor's decisions in all contest matters are final. Sponsor reserves the right to alter or terminate this program at its sole discretion in the event of extreme, unexpected or unusual circumstances that compromise the integrity or intended play of the contest or of the frequent buyer program. Sponsor not responsible for printing, typographical, mechanical, validation or other errors, including such errors that may lead to erroneous appearances of qualification for a prize or premium. Winners are responsible for all fees, costs or expenses associated with receipt of prize, including all federal, state, provincial and local taxes. Sponsor will comply with all tax reporting obligations.

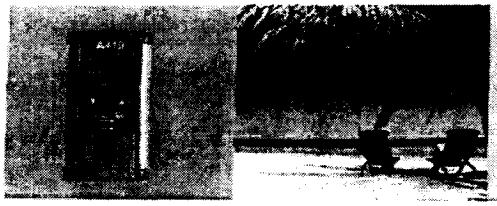
Sponsored by Johnson Controls, Inc., 507 E. Michigan Street, Milwaukee, WI 53202.

COME JOIN THE PARTY

ENTER FOR A CHANCE TO WIN A 90-HOUR CARIBBEAN CRUISE FOR TWO

with every qualifying Johnson Controls product purchase

No purchase necessary. Void where prohibited. The "Cheers to 90 Years" promotion is open to legal residents of the 50 U.S. states, D.C. and Canada, 21 years and older. Official rules at distributors. Contest begins April 1, 2009 and ends September 30, 2009; entries must be received by October 15, 2009. Sponsored by Johnson Controls, Inc., 507 E. Michigan Street, Milwaukee, WI 53202.



Johnson Controls

world's refrigeration needs seriously.

Maybe too seriously.

...rch Manager, 1960s

Dir. Product Development, 1970s

Sr. Engineering Manager, 1980s

Global Product Manager, 1990s

For us, designing and manufacturing refrigeration controls isn't just an occupation, it's our calling. We're continually coming up with new technology, from traditional electromechanical products to sophisticated integrated control systems. Refrigeration, HVAC and lighting Controls that save on installation costs, maintain product integrity and help save energy. No one offers a more complete line of solutions for all refrigeration control needs. It's our idea of serious fun. To learn more about specific Johnson Controls/PENN products, contact your local representative. Or call 1-800-972-8040 ext. 415.

JOHNSON CONTROLS

PENN

Master Catalog 125
Temperature Controls Section A
Product Bulletin A19
Issue Date 0579

A19 Series Utility Thermostats for Farm, Industrial and Commercial Use

Application

These temperature controls are designed to cover a broad range of uses for heating and general purpose requirements. See "Application" column, "Specifications" Page 2, for typical uses. Controls have SPST contacts which open on temperature increase or they may be supplied in single-pole, double-throw contact action.

Various control ranges are available to cover working temperatures from -30 to 550° F (-34 to 288° C). Closed tank fittings and bulb wells are available for immersion applications.

These controls are designed for open low and open high applications. Where critical or high value products are to be maintained within a specific temperature differential, a single control should not be applied to function as both an open low and open high control. In these applications, a separate back-up control with alarm contacts should be wired to indicate when the back-up control operates.

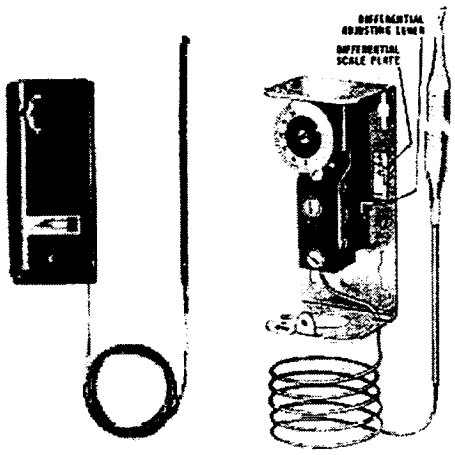


Fig. 1: (Left) Control with external range scale, knob adjustment. (Right) Interior of model with adjustable differential.

Fig. 2: Space thermostat with Style 3 coiled bulb and finger-tip adjusting knob.

Features

- Dependability -- precision snap-acting dusttight contacts.
- Dependability -- low volume, responsive liquid filled sensing elements.
- Wide choice of temperature control functions with a minimum number of models.
- Precision "repeat" accuracy which is unaffected by barometric pressure and cross ambient problems.
- Special close differential models available.

General Description

The Series A19 is a small, compact control with adjustable or fixed differential. Controls supplied with adjustable differential have an internal scale plate indicating increments of differential. The controls are supplied with adjusting lever at minimum differential stamped on the control. To adjust move the lever to the differential required. Models are available with or without external range adjustment and visible scale. External range adjustment may be by screwdriver slot or range adjusting knob (Fig. 2).

© 1979 Johnson Controls, Inc.
Code No. LIT-125030

A built-in high cutout stop is an integral part of these controls and may be adjusted quickly and easily in the field. Product Number A19BAG-1 is especially designed for portable heaters. It is supplied with a 6 ft cord, 120 V.A.C. polarized plug, and a chain hanger kit.

Optional Constructions

Note: For most prompt service, select controls listed under "Specifications," below. If these are not entirely suitable for your application, then the following variations are available.

Adjustable Differential: Available at extra cost.

Armored Capillary: Single braided copper armor may be supplied at extra cost.

Capillary Tube: Additional length of capillary over 6 ft available at extra cost. Extra length in 2 ft increments from 6 ft to 10 ft; over 10 ft in 5 ft increments.

Contact Unit: Close differential or special close differential may be supplied.

Mounting Bracket: Optional at extra cost.

Types A19AAB, A19AAC, A19BAB, A19BAC

Volts AC	120	208	240
Full Load Amps.	16.0	9.2	8.0
Locked Rotor Amps.	96.0	55.2	48.0
Non-inductive or Resistance Load Amps. (Not Lamp Load)	* 22 Amps. 120 to 277 VAC		
Pilot Duty - 125 VA @ 24 to 600 VAC			

* SPST Rating

Types A19AAE

Volts AC	120	208	240
Full Load Amps.	6.0	3.4	3.0
Locked Rotor Amps.	36.0	20.4	18.0
Non-inductive or Resistance Load Amps. (Not Lamp Load)	10 Amps. 120 to 277 VAC		
Pilot Duty - 125 VA @ 24 to 277 VAC			

Types A19AAB, A19AAC, A19ADB (Hot Water Models)

Volts AC	120	240
Full Load Amps.	10.0	6.0
Locked Rotor Amps.	60.0	36.0
Non-inductive or Resistance Load Amps.	10.0	6.0
Pilot Duty - 125 VA @ 24 to 600 VAC		

Specifications

Product Number	Appl.	Action	Range °F (°C)	Diff. °F (°C)	*Max. Bulb Temp. °F (°C)	Bulb Style	Bulb Size (in.)	Bulb Well	Cap. Length (ft.)	Bulb Support (in.)	Cover		Range Adjuster	
											Plain	Scale	Screw-driver	Knob
A19AAB-4	Fluid Cutout	Opens on rise	30 to 110 (-1 to 43)	3 (1.7)	140 (60)	1	3/8 x 4-15/16	WEL14A-602R	6	3		X	X	
A19AAB-7	Industrial Oven	Opens on rise	100 to 300 (38 to 149)	7 (3.9)	350 (177)	1	3/16 x 10-1/8		6			X		X
A19AAB-10	Industrial Oven	Opens on rise	200 to 550 (93 to 288)	10 (5.6)	620 (327)	1	3/16 x 5-5/8		6			X		X
A19AAC-1	Dual Fuel Changeover	SPDT	-30 to 50 (-34 to 10)	5 (2.8)	140 (60)	1	3/8 x 4-1/16	Outdoor Shield Supplied	6	3	X		X	
A19AAC-9	Fluid Cutout	SPDT	100 to 240 (38 to 121)	6 (3.3)	290 (143)	1	3/8 x 3-9/16	WEL14A-602R	6	3		X	X	
A19AAE-3	Crop Drying	Opens on rise	80 to 180 (27 to 82)	2 (1.1)	200 (93)	7	1-1/8 x 1-1/4 Copper Coil		10			X		X
A19ADB-2	Hot Water Cutout; Manual Reset	Opens on rise	100 to 240 (38 to 121)	Lockout	290 (143)	2	0.290 x 2-11/16	Direct Immersion 1/2 in. NPT Conn.	None			X		X
A19ADN-1	Warm Air; Manual Reset	Opens on rise	100 to 240 (38 to 121)	Lockout	290 (143)	1	3/8 x 3	WEL14A-602R	6	3		X	X	
A19ADP-1	Warm Air; Manual Reset	SPDT	100 to 240 (38 to 121)	Lockout	290 (143)	1	3/8 x 3	WEL14A-602R	6	3		X	X	
A19BAB-3	Heating	Opens on rise	30 to 95 (0 to 35)	3 (1.7)	140 (60)	3	Coil		None			X		X
A19BAC-1	Farm Thermostat Heat or Ventilate	SPDT	30 to 110 (0 to 43)	3 (1.7)	140 (60)	3	Coil		None			X		X
A19BAG-1	Portable Heater	Opens on rise	35 to 95 (0 to 35)	3 (1.7)	140 (60)	3	Coil		None			X		X

* Maximum bulb temperature which the element can withstand at infrequent intervals during life of control, such as shipping conditions. This is not the temperature at which the control can withstand on repeat cycles.

Packing Nut: Part No. FTG13A-600R is available for closed tank applications where the temperature does not fall below -35°F (-37°C) or exceed +250°F (121°C). Maximum liquid pressure limit is 150 psig (1034 kPa). For applications where the temperature or liquid pressure exceeds these limits specify Style 4 element with all metal packing nut as an integral part of the control.

Range Adjustments: Concealed dial with screwdriver slot (plain cover), exposed dial with screwdriver slot, dial and knob adjustment or models with factory sealed setting may be supplied.

Ranges: For ranges other than those shown in "Specifications" table, contact Customer Service.

Sealed Stop: Available at extra cost.

Miscellaneous Specifications

Case: .062 in. cold rolled steel. Gray baked enamel finish.

Cover: .025 in. cold rolled steel. Gray baked enamel finish.

Contact Unit: Precision Pennswitch. Snap acting dust-tight contacts.

Shipping Weights

Shipping weights shown below are approximate. Weights vary depending upon construction. Generally, overpack will contain 25 individually packed controls.

Individual pack: 1.0 lb.

Overpack containing 25 individually packed units: 26.0 lbs.

Ordering Information

1. Specify Product Number only, if available (see the "Specifications" chart).
2. If Product Number is not available specify Type Number.
   a. Capillary length.
   b. Range.
   c. Bulb style.
   d. Bulb well, if required.
   e. Packing nut, if required.
   f. Any other miscellaneous specifications.

Repairs and Replacement

Repairs must not be made in the field other than replacement of the cover, well assembly and packing nut assembly. When ordering replacement parts, give Product and Serial Numbers. Controls requiring attention should be returned to the factory or nearest Johnson Controls representative for inspection and service.

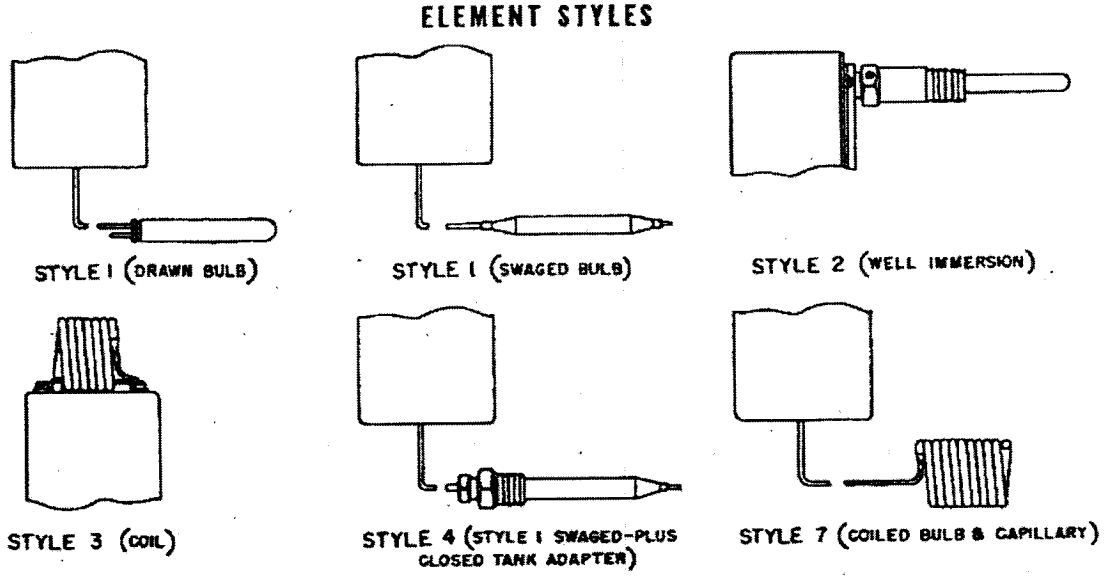
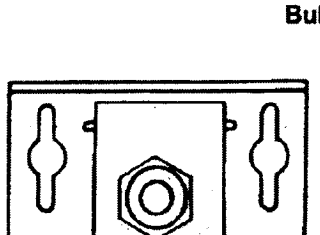
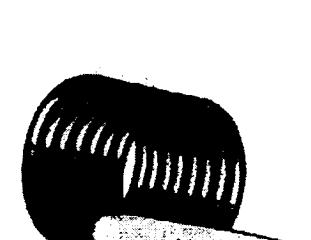


Fig. 3: Element Styles available on Series A19

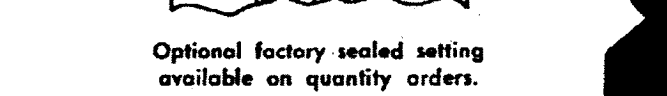
Bulb and Bulb Accessories



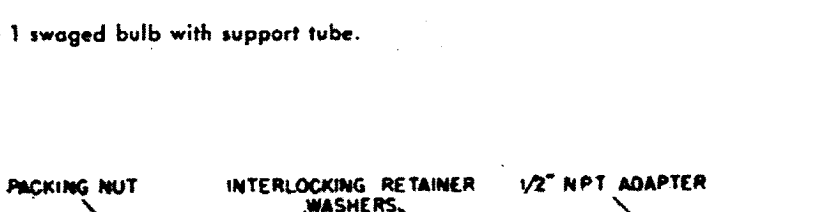
Optional factory sealed setting available on quantity orders.



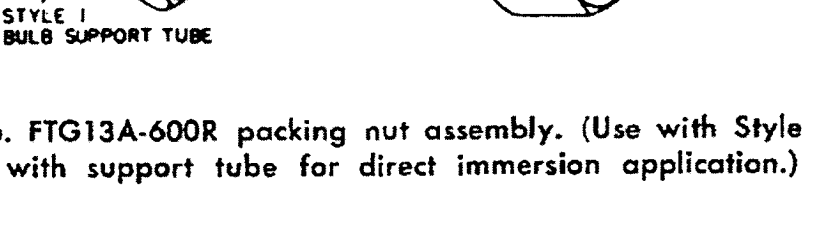
Style 3 element attached to the case.



Style 1 swaged bulb with support tube.

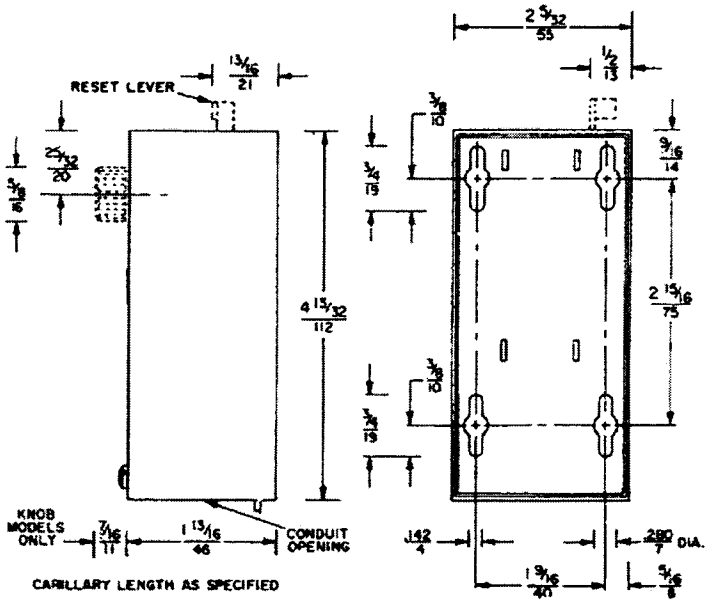


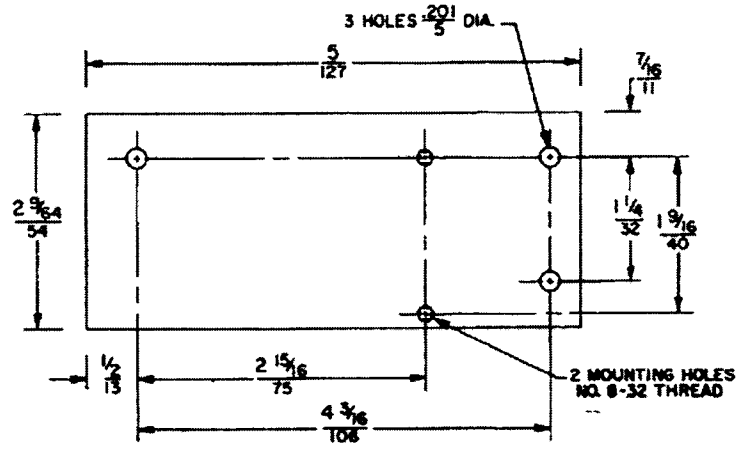
Part No. FTG13A-600R packing nut assembly. (Use with Style 1 bulb with support tube for direct immersion application.)



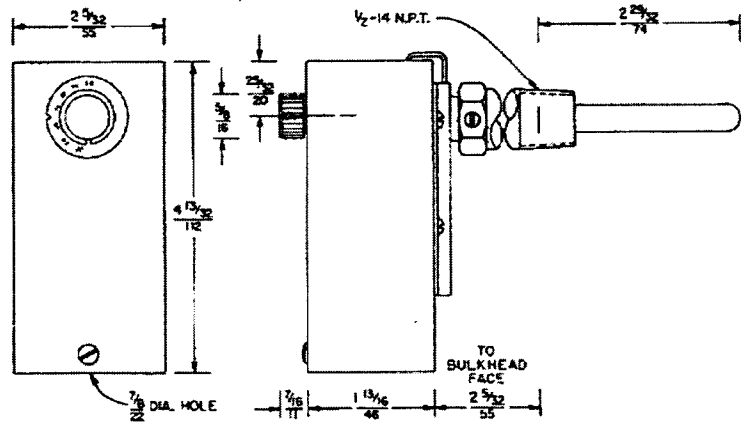
BULB WELL ASSEMBLY	DIMENSION "A"
PART NO. WELI4A-600R (MONEL)	4 3/4 (121mm)
PART NO. WELI4A-602R	4 15/16 (125mm)
PART NO. WELI4A-603R	5 13/16 (148mm)
PART NO. WELI6A-601R	2 13/16 (71mm)

Bulb well dimensions.





Optional mounting bracket.



Dimensions in. / mm

Performance specifications appearing herein are nominal and are subject to accepted manufacturing tolerances and application variables.

Notes

Notes

JOHNSON CONTROLS

Master Catalog 125
Temperature Controls Section A
Product Bulletin A19
Issue Date 1291

A19 Series Temperature Controls For Low Energy Circuits

Application

These temperature controls are used for low energy electrical loads to operate small relays, solenoid valves, and electronic control circuits. The controls have special "dry circuit" switches with gold plated contacts for improved contact characteristics required in low voltage, low current circuits.

Various control ranges are available to cover sensed temperatures from -30 to 225°F (-35 to 105°C). Closed tank fittings and bulb wells are available for immersion applications. Controls are also available without an enclosure. For further information, contact the nearest Johnson Controls field sales office or contact Customer Service.

All Series A19 controls are designed for use *only* as operating controls. Where an operating control failure would result in personal injury and/or loss of property, it is the responsibility of the installer to add devices (safety, limit controls) or systems (alarm, supervisory systems) that protect against, or warn of, control failure.

Features

- Compact, general purpose temperature controls with a wide selection of models.
- Dependability . . . precision enclosed snap-acting contacts and liquid filled sensing element are field proven.
- Precision "repeat" accuracy which is unaffected by barometric pressure and cross ambient temperature problems.
- Concealed differential adjustment discourages unauthorized adjustment changes.
- "Trip-free" manual reset . . . reset must be pressed and released before operation will resume. Contacts cannot be blocked in the closed position.

General Description

These compact controls are supplied with fixed or adjustable differential. Controls supplied with adjustable differential have an internal scale plate indicating the differential in Fahrenheit degrees.

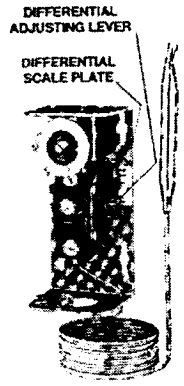


Fig. 1 – Interior of an A19 with differential adjustment. Differential adjustment is concealed when cover is on control.

Ranges of 20 to 80°F (-5 to 28°C), -30 to 50°F (-35 to 10°C), or -30 to 100°F (-35 to 40°C) have direct reading differential scale plate. Other ranges require a scale plate with multiplier. Example: X2 setting means when minimum differential is 5°F (2.8°C) then X2 differential is 10°F (5.6°C). Knob range adjustment and visible scale are standard.

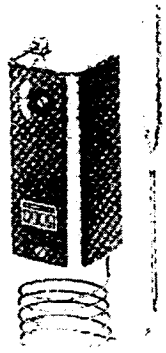


Fig. 2 – The A19ACA with external range adjustment and manual reset.

Specifications

Type Number	**A19AAJ**	Remote Bulb, Open Low, Fixed Differential
	A19AAK	Remote Bulb, Open High, Fixed Differential
	A19AAL	Remote Bulb, SPDT, Fixed Differential
	A19ABL	Remote Bulb, SPDT, Adjustable Differential
	A19BBL	Style 3 Bulb, SPDT, Adjustable Differential
Material	**Case**	.062" (1.6 mm) Cold Rolled Steel
	Cover	.025" (0.6 mm) Cold Rolled Steel
Conduit Opening		⅞" Diameter Hole for ½" Conduit
Contact Unit		Enclosed Snap-Acting Pennswitch
Enclosure		NEMA 1
Finish		Gray Baked
Shipping Weight	**Individual Pack**	1 lb (0.45 kg)
	Overpack of 50	55 lb (25 kg)
Terminal Screws		8-32 x ¼" Binder Head with Cup Washers

© 1991 Johnson Controls, Inc.

Code No. LIT-125040

Ordering Information

1. To order, specify Product Number if available.
2. When the Product Number is not available, specify Type Number and the following:
   a. Range required.
   b. Style of element.
   c. Manual reset, if needed.
   d. Length of capillary, 6 ft. (1.8 m) is standard.
   e. Ambient compensation, if required.
   f. Type of adjustment; knob, screwdriver slot, concealed or factory sealed.
   g. Fixed or adjustable differential.
3. Specify bulb well, if required, by Part Number.
4. Specify packing nut, Part Number FTG13A-600R, if required for Style 1 bulb with support tube. (See Figs. 9 and 11.)

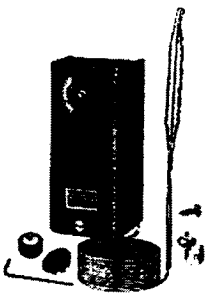


Fig. 4 – The A19 with remote bulb and convertible adjustment has a snap-in plug in the cover, a knob for field installation, and a bulb mounting clip with sheet metal screw.

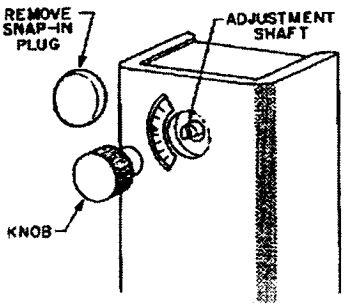


Fig. 5 — Drawing showing snap-in plug removed and the knob in line to assemble. Press the knob onto the slotted shaft.

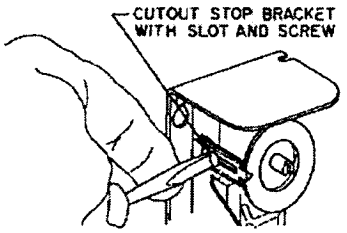


Fig. 6 — The convertible adjustment controls have a screw type cutout stop. The stop screw must be loosened and moved to the stop setting desired. Tighten screw after setting is made.

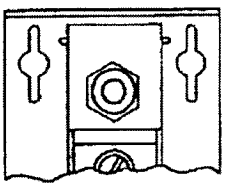


Fig. 7 — Factory sealed setting — optional at no extra cost on quantity orders.

Fig. 8 — Style 1 drawn bulb.

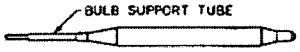


Fig. 9 — Style 1 swaged bulb with support tube. (Add FTG13A-600R packing nut to Style 1 swaged bulb when used in closed tank.)

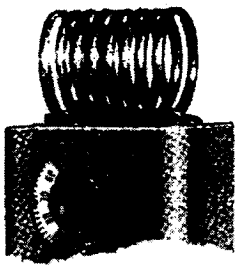


Fig. 10 – Style 3 element attached to the case.

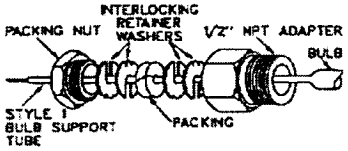
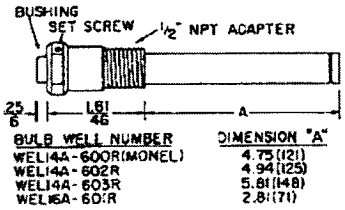
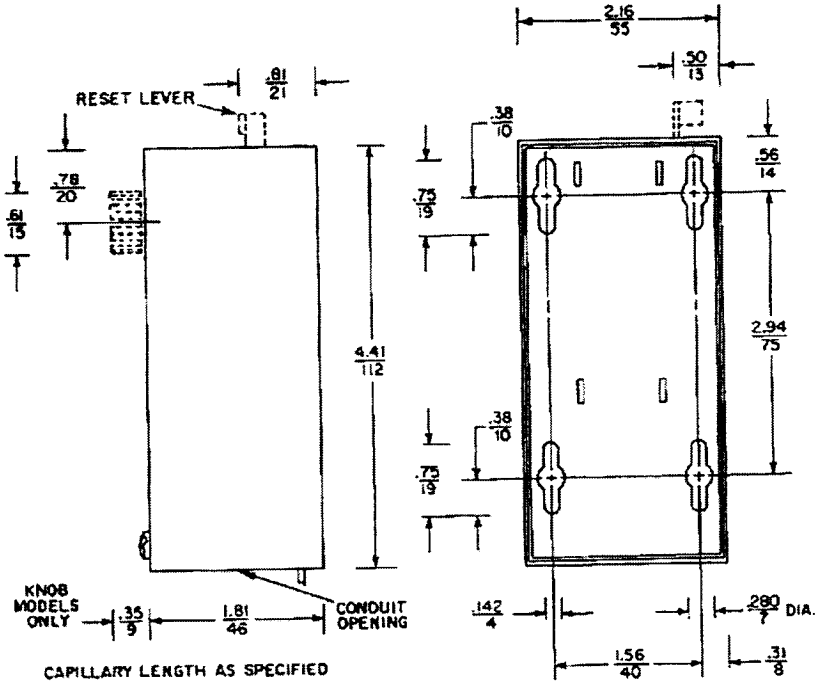


Fig. 11 — Part No. FTG13A-600R packing nut assembly. (Use with Style 1 bulb with support tube for direct immersion application.

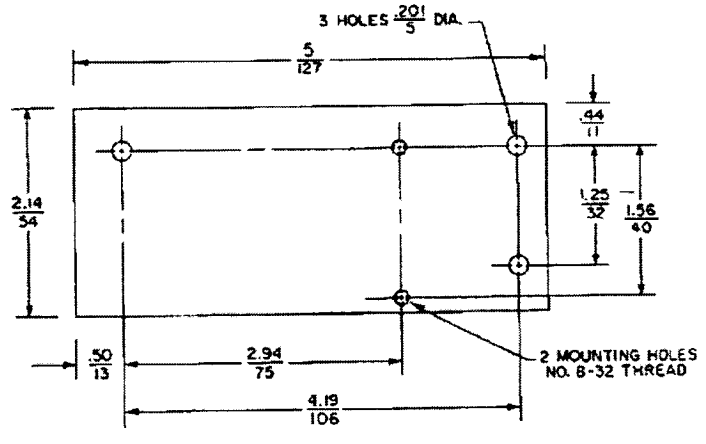


BULB WELL NUMBER	DIMENSION "A"
WELI4A-600R(MONEL)	4.75 (121)
WELI4A-602R	4.94 (125)
WELI4A-603R	5.81 (148)
WELI6A-601R	2.81 (71)

Fig. 12 — Bulb well for liquid immersion applications where a temperature bulb may be removed without draining tank.



A19 Dimensions $\frac{\text{in.}}{\text{mm}}$



Optional Mounting Bracket Dimensions $\frac{\text{in.}}{\text{mm}}$

Performance specifications appearing herein are nominal and are subject to accepted manufacturing tolerances and application variables.

UL Guide No. XAPX
File E6688

JOHNSON CONTROLS

Controls Group
507 E. Michigan Street
P.O. Box 423
Milwaukee, WI 53201

Printed in U.S.A.

A19 Series Hot Water Heating Controls Well Immersion

Application

Johnson Controls hot water immersion controls provide various control functions for hydronic heating systems. These include high temperature cutout, operating, circulator or low temperature cutout.

All Series A19 temperature controls are designed for use *only* as operating controls. Where an operating control failure would result in personal injury and/or loss of property, it is the responsibility of the installer to add devices (safety, limit controls) or systems (alarm, supervisory systems) that protect against, or warn of, control failure.

Features

- Sealed, dusttight Pennswitch contact unit.
- Matching drawn bulb and well for rapid, efficient heat transfer.
- Manual reset, when supplied, is "Trip-Free." Reset must be pressed and released before operation will resume.
- Concealed dial stop permits control within maximum temperature selected or specified.
- Direct reading scales provide fast, easy "on-the-job" adjustment.

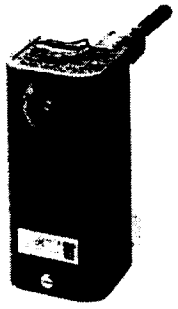


Fig. 1 -- The A19 Direct Mounting Control.

General Description

A liquid expansion temperature element with copper bulb well gives fast control response.

The control can be easily removed from the bulb well by loosening the set screws and withdrawing the sensing bulb from the well. The control can be mounted in any position around the axis of the bulb well without changing the operating characteristics.

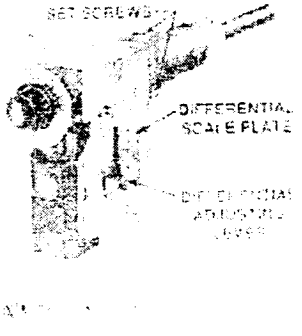


Fig. 2 -- Illustrated is the A19 with adjustable differential. Note the complete accessibility of the well assembly set screw. After loosening these screws, the control can be quickly removed from the well.

Specifications

Type Number	**A19AAB**	Open on Rise, Fixed Differential
	A19AAC	SPDT, Fixed Differential
	A19ABA	Close on Rise, Adjustable Differential
	A19ABB	Open on Rise, Adjustable Differential
	A19ABC	SPDT, Adjustable Differential
	A19ADB	Open on Rise, Lockout with Manual Reset
	A19ADC	SPDT, Lockout with Manual Reset
Temperature Range		100 to 240°F (40 to 120° C)
Differential	**Fixed**	6 F° (3.3 C°)
	Adjustable	6 F° (3.3 C°) Min.; 24 F° (13 C°) Max.
Maximum Temperature	**At Case**	140°F (60°C)
	At Bulb	290°F (143°C)
Contact Action		Red to Yellow Closes on Temperature Rise Red to Blue Opens on Temperature Rise
Contact Units		Snap Acting, Enclosed Dusttight Pennswitch
Conduit Openings		One 7/8" (22 mm) Diameter Hole for 1/2" Conduit
Enclosure		NEMA Type 1 General Purpose
Finish		Gray Baked Enamel
Material	**Case**	.062" (1.57 mm) Cold Rolled Steel
	Cover	.025" (0.64 mm) Cold Rolled Steel
Mounting		Immersion Well Mounts Directly in Boiler Tapping. Case of Remote Bulb Models Mounts to Flat Surface
Shipping Weight	**Individual Pack**	1.5 lb (0.7 kg)
	Overpack of 25 Units	37.5 lb (17 kg)
Terminal Screws		No. 8—32 x 1/4" Binder Head With Cup Washers

© 1988 Johnson Controls, Inc.
Code No. LIT-125025

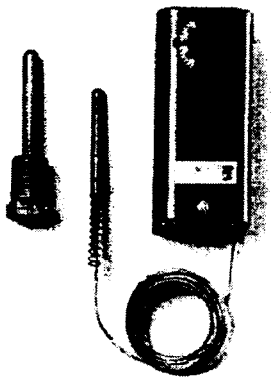


Fig. 3 – The A19 with convertible adjustment has a snap-in plug in the cover and a knob for field installation.

The range scale, visible through the cover opening, shows the range setting. An adjustable differential or lockout with manual reset is also available.

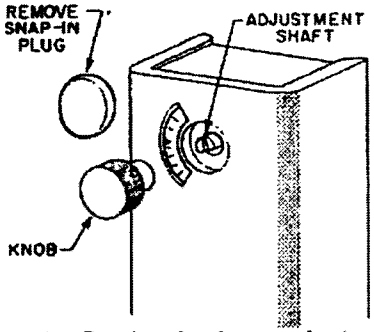


Fig. 4 — Drawing showing snap-in plug removed and the knob in line to assemble. Press the knob onto the slotted shaft.

On open high and SPDT models, the range dial pointer indicates the temperature at which the normally closed contacts open on a temperature rise. On the open low models, the dial pointer indicates the temperature at which the contacts open on drop.

Knob range adjustment and visible scale are standard. Models are available with a knob assembly for field convertible adjustment. These models are supplied with a snap-in plug in the cover for concealed screwdriver slot adjustment.

Electrical Ratings

Motor Ratings	120 V	240 V
AC Full Load Amps.	10.0	6.0
AC Locked Rotor Amps.	60.0	36.0
AC Non-Inductive Amps.	10.0	6.0
Pilot Duty — 125 VA, 24 to 600 VAC		

Optional Constructions

Immersion Style

Direct mounting or remote mounting with a 6 foot capillary and bulb well are standard. Capillary lengths of 10 or 20 ft are available at extra cost. Consult Customer Service.

Well Thread Size

1/2 in. NPT standard; 3/4 in. NPT available on request.

Range Adjuster

A screwdriver slot with visible scale or a screwdriver slot with internal scale and solid cover are optional at no extra cost (quantity orders only). Models are available with a knob for field convertible adjustment. This provides conversion to knob, concealed screwdriver slot or external screwdriver slot adjustment.

Repairs and Replacement

Field repairs must not be made. For a replacement control contact the nearest Johnson Controls wholesaler.

Ordering Information

1. Specify complete Product Number, if established.
2. If Product Number is not available, specify Type Number and the following:
   a. Well thread size – 1/2 in. or 3/4 in. NPT.
   b. Remote well mounting, if required.
   c. If remote mounting is required, specify length of capillary if other than 6 ft. Available on quantity orders only.
   d. Stop settings, if required. Available on quantity orders only.

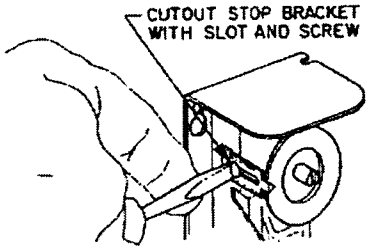
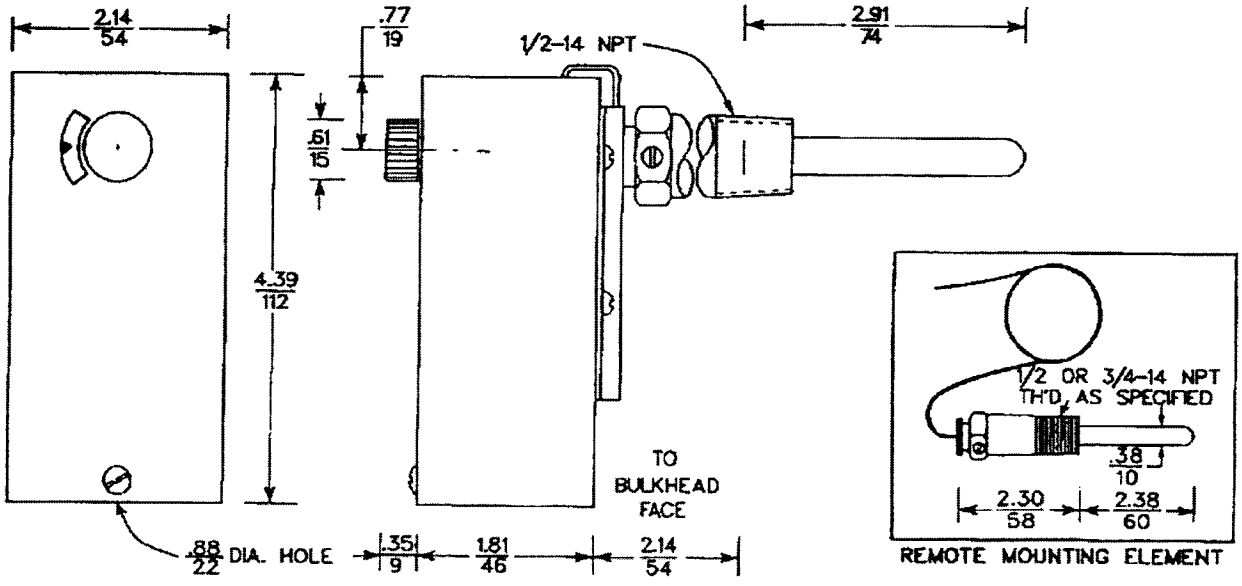


Fig. 5 — The controls have a screw type cutout stop. The stop screw must be loosened and moved to the stop setting desired. Tighten screw after setting is made.



Performance specifications appearing herein are nominal and are subject to accepted manufacturing tolerances and application variables.

U.L. Guide No. XAPX
File E6688

Notes

JOHNSON CONTROLS

Controls Group
507 E. Michigan Street
P.O. Box 423
Milwaukee, WI 53202

Printed in U.S.A.

Master Catalog 125
Temperature Controls Section A
Product Bulletin A19
Issue Date 1088

A19 Series Temperature Controls with Stainless Steel Elements for Industrial and Commercial Use

Application

These temperature controls are designed for hearing, refrigeration, and general purpose applications where stainless steel bulb and capillary are required. Models are available with SPST switches that open high or open low. Models are also available with SPDT switches that have color coded terminals and can be wired for open high or open low applications. The controls are available with fixed (factory set) or adjustable differential.

Various control ranges are available to cover working temperatures from -30 to 550°F (-35 to 228°C).

All Series A19 temperature controls are designed for use *only* as operating controls. Where an operating control failure would result in personal injury and/or loss of property, it is the responsibility of the installer to add devices (safety, limit controls) or systems (alarm, supervisory systems) that protect against, or warn of, control failure.

Features

- Dependability . . . snap-acting contacts in a dust protected enclosure and liquid filled sensing element are field proven.
- "Repeat" accuracy which is unaffected by barometric pressure and cross ambient temperature problems.
- Concealed differential adjustment discourages unauthorized adjustment changes.
- Close differential . . . fixed or adjustable.
- "Trip-free" manual reset . . . the reset must be pressed and released before operation will resume. Contacts cannot be blocked in the closed position.

General Description

These compact controls are supplied with a fixed or adjustable differential. The controls supplied with an adjustable differential have an internal scale plate indicating the differential in degrees Fahrenheit.

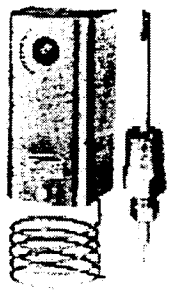


Fig. 1 – A19 Temperature Control with a Style 4 sensing element.

Ranges of 20/80°F (-5/28°C), -30/50°F (-35/10°C) or -30/100°F (-35/40°C) have a direct reading scale plate. Other ranges require a scale plate with multiplier. Example: x2 setting means when the minimum differential is 5F° (2.8C°) then 2x differential is 10F° (5.6C°).

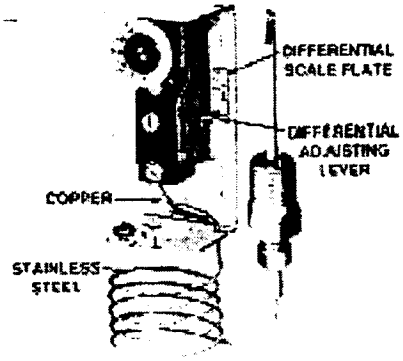


Fig. 2 – Interior of an A19 with adjustable differential. The differential adjustment is concealed when cover is on the control.

Specifications

Product	A19	Temperature Control
Range and Differential		See Range and Differential Specification Table
Switch		Sealed Dust Protected Pennswitch
Contact Action	SPDT	Red to Yellow Closes on Temperature Increase Red to Blue Opens on Temperature Increase
Sensing Element Material	Capillary	Type 304 Stainless Steel, .060" (1.52 mm) OD (Internal Connection to Diaphragm is Copper)
	Bulb	Type 316L Stainless Steel, .200" (5.08 mm) OD
	Packing Nut	Style 4, Type 303 Stainless Steel
Enclosure	Case	.062" (1.6 mm) Cold Rolled Steel
	Cover	.025" (0.6 mm) Cold Rolled Steel
Finish		Gray Baked Enamel
Conduit Opening		7/8" (22 mm) Diameter Hole for 1/2" Conduit
Wiring Connections		Screw Type Terminals, 8-32 x 1/4" Binder Head Screws with Cup Washers
Shipping Weight	Individual Pack	1.0 lb (.45 kg)
	Overpack of 25	26.5 lb (12 kg)

© 1988 Johnson Controls, Inc.
Code No. LIT-125035

Ordering Information

1. To order, specify Product Number if available.
2. Where Product Number is not available, specify Type Number and the following:
   a. Range required.
   b. Style 1 or Style 4 stainless steel elements. (See Fig. 5.)
   c. Length of capillary, 6 feet (1.8 m) is standard.
   d. Ambient compensation, if required.
   e. Type of adjustment, knob, screwdriver slot or concealed.

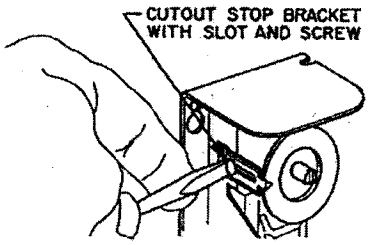


Fig. 4 — The controls have a screw type cutout stop. The stop screw must be loosened and moved to the stop setting desired. Tighten the screw after the setting is made.

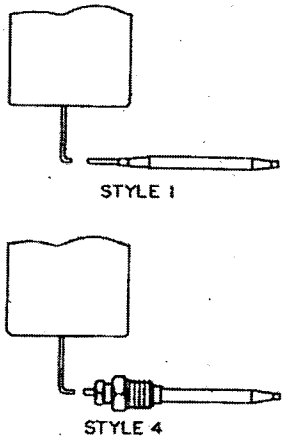
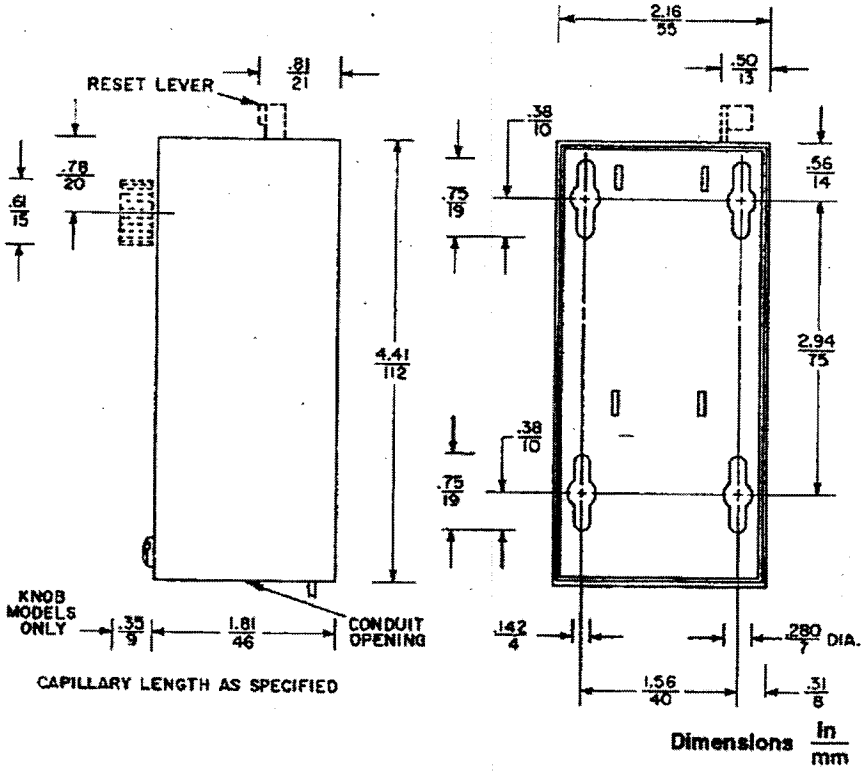


Fig. 5 — Element styles that are available with stainless steel capillary and packing nut.



Performance specifications appearing herein are nominal and are subject to accepted manufacturing tolerances and application variables.

UL Guide No. XAPX
File E6688

Notes

JOHNSON CONTROLS

Controls Group
507 E. Michigan Street
P.O. Box 423
Milwaukee, WI 53202

Printed in U.S.A.

Master Catalog 125
Temperature Controls Section A
Product Bulletin A19
Issue Date 0588

A19 Series Temperature Controls For Refrigeration With NEMA 1 Enclosure

Application

These controls are designed to cover a broad range of general purpose operating temperature control applications in the refrigeration, air conditioning and heating field with a minimum number of models. Typical applications are: frozen food cases, display cases, beverage coolers, milk coolers, walk-in boxes, water chillers, etc.

Various control ranges are available to cover working temperatures from -30 to 225°F (-35 to 105°C). Closed tank fittings and bulb wells are available for immersion applications.

Single-stage controls less enclosure and two-stage controls with or without enclosure also are available. Contact the nearest Johnson Controls office or contact Customer Service.

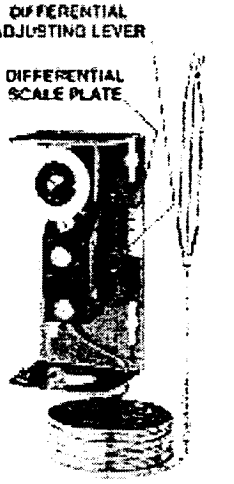


Fig. 1: Interior of an A19 with differential adjustment. Differential adjustment is concealed when cover is on control.

Specifications

Case Material		.062" (1.6mm) Cold Rolled Steel
Conduit Opening		7/8" Diameter Hole for 1/2" Conduit
Contact Unit		Snap-Acting Contacts in Dustlight Enclosure
Cover Material		.025" (0.6mm) Cold Rolled Steel
Finish		Gray Baked Enamel
Shipping Weight	Individual Pack	1 lb (0.45 kg)
	Overpack of 50	55 lb (25 kg)
Terminal Screws		No. 8-32 x 1/4" Binder Head with Cup Washers

Range and Differential Specifications

Range °F / °C	Differential °F / °C			Bulb Size in. / mm	Max. Ambient °F / °C (1)
	Adjustable	Standard (Fixed)	Close (Fixed)		
-30 to 50	5 to 20	5	2.5	.375 x 4	140
-35 to 10	2.8 to 11.1	2.8	1.4	9.5 x 102	60
-30 to 100	3 to 12	3	1.5	.375 x 4	140
-35 to 40	1.7 to 6.7	1.7	0.8	9.5 x 102	60
-20 to 60	5 to 20	5	2.5	.375 x 4	140
-6 to 15	2.8 to 11.2	2.8	1.4	9.4 x 102	60
20 to 80	3.5 to 14	3.5	1.75	.375 x 5	140
-5 to 28	1.9 to 7.8	1.9	0.97	9.5 x 127	60
25 to 225	7 to 28	7	3.5	.375 x 3	275
-3 to 105	3.9 to 15.6	3.9	1.9	9.5 x 76	135
30 to 50	4 to 16	4	2	.375 x 2.625	190
0 to 10	2.2 to 8.9	2.2	1.1	9.5 x 67	88
30 to 110	3.5 to 14	3.5	1.75	.375 x 5	140
0 to 43	1.9 to 7.8	1.9	0.97	9.5 x 127	60
40 to 90	3.5 to 14	3.5	1.75	.375 x 6	140
5 to 32	1.9 to 7.8	1.9	0.97	9.5 x 152	60
50 to 130	3.5 to 14	3.5	1.75	.375 x 5	170
10 to 55	1.9 to 7.8	1.9	0.97	9.5 x 127	77

(1) Maximum bulb temperature which the element can withstand at infrequent intervals during life of control, such as shipping conditions. This is not the temperature which the control can withstand on repeat cycles. Maximum ambient temperature around control case is 140°F (60°C).

All Series A19 temperature controls are designed for use *only* as operating controls. Where an operating control failure would result in personal injury and/or loss of property, it is the responsibility of the installer to add devices (safety, limit controls) or systems (alarm, supervisory systems) that protect against, or warn of, control failure.

© 1988 Johnson Controls, Inc.
Code No. LIT-125020

Features

- Compact general purpose temperature controls with a wide selection of models.
- Dependability – precision snap-acting contacts in dusttight enclosure and liquid filled sensing element are field proven.
- Precision "repeat" accuracy which is unaffected by barometric pressure and cross ambient temperature problems.
- Concealed differential adjustment discourages unauthorized adjustment changes.
- Extremely close differentials – fixed or adjustable.
- "Trip-free" manual reset – reset must be *pressed and released* before operation will resume. Contacts cannot be blocked in the closed position.

General Description

These compact controls are supplied with fixed or adjustable differential. Controls supplied with adjustable differential have an internal scale plate indicating increments of differential.

Knob range adjustment and visible scale are standard. Models are available with a knob for field convertible adjustment. These models are supplied with a snap-in plug in the cover for concealed screwdriver slot adjustment. A bulb mounting clip with sheet metal screw is supplied with remote bulb models. A special designed, field-proven liquid filled sensing element provides precision "repeat" accuracy which is unaffected by barometric pressure and cross ambient temperature problems.

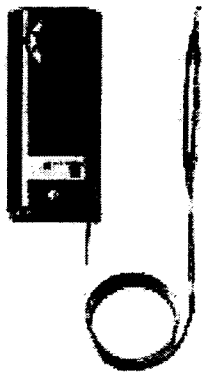


Fig. 2: The A19 with external range adjustment.

The A19ACA and A19ADB controls lockout requiring that reset be pressed and released before operation will resume. All other controls in the series are automatic recycling.

Optional Constructions

Ambient Compensation

Available on fixed differential and manual reset models at extra cost, if required.

Capillary Length

Standard is 6 feet (1.8 m). Optional lengths are 10 feet (3m), 15 feet (4.6 m) and 20 feet (6.1m). Quantity orders.

Mounting Brackets

Optional at extra cost.

Electrical Rating Tables

Standard Differential

Volts, AC	120	208	240
Full Load Amps.	16.0	9.2	8.0
Locked Rotor Amps	96.0	55.2	48.0
Non-Inductive or Resistance Load Amps. † (Not Lamp Loads)	22 Amps. 120 to 277 VAC		
Pilot Duty — 125 VA, 24 to 600 VAC			

†SPST rating

Standard Differential With Lockout

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

Close Differential

Volts, AC	120	208	240
Full Load Amps.	6.0	3.4	3.0
Locked Rotor Amps.	36.0	20.4	18.0
Non-Inductive or Resistance Load Amps. (Not Lamp Loads)	10 Amps. 24 to 277 VAC		
Pilot Duty — 125 VA, 24 to 277 VAC			

A19 Series

High Range Temperature Control

Description

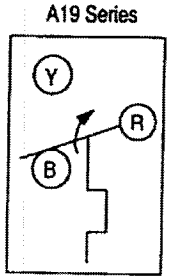
The A19 Series controls are single stage temperature controls that incorporate liquid-filled sensing elements.

Features

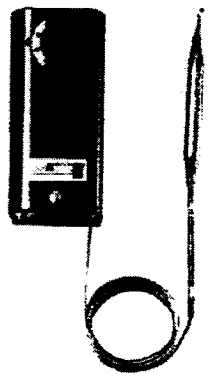
- wide temperature ranges available
- constant differential throughout the entire range
- SPST or SPDT snap-acting switches
- fixed or adjustable differential available
- unaffected by barometric pressure changes
- unaffected by cross-ambient conditions
- compact enclosure
- variety of sensing element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

Applications

The A19s are suitable for temperature control in heating, ventilating, air conditioning, and refrigeration applications.



A19 Series
Terminal Arrangement for SPDT



A19AAB

Selection Charts

A19 Series High Range Temperature Control

Code Number[1]	Switch Action	Range °F (°C)	Diff F° (C°) (Factory Set)	Bulb and Capillary	Bulb Well No. (order separately)	Range Adjuster	Max Bulb Temp °F (°C)
A19AAB-4C	SPST, Open High Remote Bulb Thermostat	30 to 110 (-1 to 43)	3 1/2 (1.9)	3/8 in. x 5 in. copper 6 ft. Cap.[2]	WEL14A-602R	Screwdriver slot Visible scale	140 (60)
A19AAB-7C	SPST, Open High Oven Thermostat	100 to 300 (38 to 149)	7 (3.9)	3/16 in. x 9-1/2 in. copper 6 ft. Cap.	–	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. Cap.	–	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. Cap.[2]	WEL14A-602R	Screwdriver slot Visible Scale	290 (143)
A19ABB-2C	SPST, Open High Remote Bulb Thermostat	50 to 200 (10 to 93)	Adj. 6 to 24 (3 to 13)	0.290 in. x 2-1/2 in. copper 10 ft. Cap.	–	Knob Visible Scale	240 (116)
A19ABB-7C		50 to 201 (10 to 94)		7.4 x 64 mm copper 3m Cap.			240 (116)

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

Replacement Parts

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

Technical Specifications

Electrical Ratings

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

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

The performance specifications are nominal and conform to acceptable industry standards. For applications at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products. © 2009 Johnson Controls, Inc.

A19 Series

Remote Bulb Control

Description

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

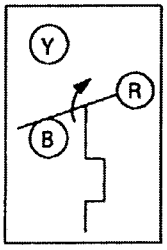
Features

- 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 heating, ventilating, air conditioning, and refrigeration.

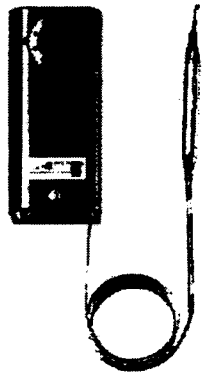
A19 Series



Action on Increase of Temperature

a19.eps

A19 Series Terminal Arrangement for SPDT



A19ABC-24

Selection Charts

A19 Series Remote Bulb Control[1]

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)
Adjustable Differential (Wide Range)							
A19ABA-40C [2]	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. Cap.	WEL14A-602R	Screwdriver Slot	140 (60)
A19ABC-4C	SPDT	50 to 130 (10 to 55)	3 1/2 to 14 (1.9 to 8)	3/8 in. x 5 in., 8 ft. Cap.	WEL14A-603R	Knob	170 (77)
A19ABC-24C [3]	SPDT	-30 to 100 (-34 to 38)	3 to 12 (1.7 to 6.7)	3/8 in. x 4 in., 8 ft. Cap.	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. Cap.	WEL14A-602R	Convertible	140 (60)
A19ABC-37C	SPDT	-30 to 100 (-34 to 38)	3 to 12 (1.7 to 6.7)	3/8 in. x 4 in., 10 ft. Cap.	WEL14A-602R	Screwdriver slot	140 (60)
A19ABC-74C	SPDT	-30 to 100 (-34 to 38)	3 to 12 (1.7 to 6.7)	3/8 in. x 4 in., 6 ft. Cap.	WEL14A-602R	Screwdriver slot	140 (60)
Fixed Differential							
A19AAF-12C	SPDT	25 to 225 (-4 to 107)	3 1/2 (1.9)	3/8 in. x 3 in., 10 ft. Cap.	WEL14A-602R	Screwdriver slot	275 (135)
Fixed Differential (Case Compensated)							
A19AAC-4C	SPDT	0 to 80 (-18 to 27)	5 (2.8)	3/8 in. x 4 in., 6 ft. Cap.	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. Cap.	WEL14A-602R	Screwdriver slot	140 (60)
Fixed Differential (Close)							
A19AAD-5C [4]	SPST Open Low	30 to 50 (-1 to 10) (Bulk Milk Cooler)	2 1/2 (1.4)	3/8 in. x 2 5/8 in., 6 ft. Cap.	WEL16A-601R	Screwdriver slot	190 (88)
A19AAF-20C	SPDT	-30 to 100 (-34 to 38)	2 1/2 (1.4)	3/8 in. x 4 in., 6 ft. Cap.	WEL14A-602R	Screwdriver slot	140 (60)
A19AAF-21C	SPDT	40 to 90 (4 to 32)	1 1/2 (0.8)	3/8 in. x 5 3/4 in., 6 ft. Cap.	WEL14A-603R	Screwdriver slot	140 (60)
Manual Reset							
A19ACA-14C	SPST Open Low	-30 to 100 (-34 to 38)	Manual Reset	3/8 in. x 4 in. 6 ft .Cap.	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. Cap.	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. Cap.	WEL14A-602R	Knob	290 (143)
A19ADN-1C	SPST Open High	100 to 240 (38 to 116)	Manual Reset	3/8 in. x 4 in. 6 ft. Cap.	WEL14A-602R	Screwdriver slot	290 (143)

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

The performance specifications are nominal and conform to acceptable industry standards. For applications at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products. © 2009 Johnson Controls, Inc

Remote Bulb Control (Continued)

Selection Charts (Continued)

Replacement Parts

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 part number **FTG13A-600R**.

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

Technical Specifications

Electrical Ratings

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

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

The performance specifications are nominal and conform to acceptable industry standards. For applications at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products. © 2009 Johnson Controls, Inc. www.johnsoncontrols.com

A19 Series
Temperature Controls Less Enclosure

Application

These "open" type temperature controls are designed for mounting in cases or enclosures that are part of the units on which they are installed. Controls are designed to cover a broad range of general purpose operating temperature control applications in the refrigeration, air conditioning and heating field. Models are available with open on rise action, close on rise action or SPDT action.

All Series A19 temperature controls are designed for use *only* as operating controls. Where an operating control failure would result in personal injury and/or loss of property, it is the responsibility of the installer to add devices (safety, limit controls) or systems (alarm, supervisory systems) that protect against, or warn of, control failure.

Features

- Dependability--precision snap-acting contacts in a dust protected enclosure.
- Flexibility--wide choice of ranges, mounting and element styles.
- Precision repeat accuracy which is unaffected by barometric pressure and cross ambient problems.

General Description

This group of controls is available with adjustable or nonadjustable differential.

Available with 1/4 in. (6 mm) shaft and choice of 0.156 in. (3.96 mm) or 0.187 in. (4.75 mm) flat for knob mounting (knob not supplied), screwdriver adjustment or factory sealed setting on quantity orders (see Optional Constructions).

Standard shaft rotation is clockwise for warmer when facing adjusting shaft. Also available with calibrated dial and pointer.

> ⚠ CAUTION: Do not dent or deform the sensitive bulb of this control. A dent or deformation will change the calibration and cause the control to cycle at a temperature lower than the dial setting.

Optional Constructions

Adjustment Options

Set point adjustment changes cut-in and cut-out points alike. Adjustment options are:

1. 1/4 in. (6.4 mm) shaft with 0.156 in. (3.96 mm) or 0.187 in. (4.75 mm) milled flat for buyers' knobs (Fig. 5).

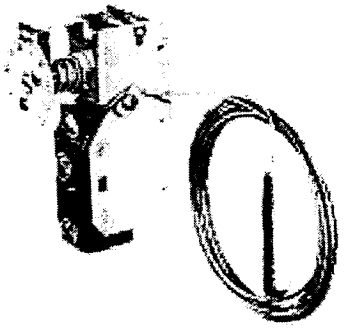


Fig. 1 -- A19 Temperature Control

2. Screwdriver slot with stops, colder-warmer dial (Fig. 3).
3. Factory sealed setting (Fig. 4).
4. Calibrated dial and pointer, with factory adjustable (not field) low cutout or high cutout stops when specified (Figs. 1 and 2).

Example: Low temperature thermostat may have a low cutout stop set from -10 to -30°F (-23 to -34°C). High cutout stop may be set from +30 to +50°F (-1.1 to 10°C)

Ambient Compensation

At extra cost, if required.

Specifications

Type Number	**A19AGA**	Open Low (Cooling), Standard Differential
	A19AGB	Open High (Heating), Standard Differential
	A19AGC	SPDT (Cooling-Heating), Standard Differential
	A19AGD	Open Low (Cooling), Close Differential
	A19AGE	Open High (Heating), Close Differential
	A19AGF	SPDT (Cooling-Heating), Close Differential
Switch		Snap-Acting Contacts in Dust Protected Enclosure
Finish		Zinc Plate
Material	**Base Plate**	0.063" (1.6 mm) Cold Rolled Steel
	Frame	0.050" (1.3 mm) Cold Rolled Steel
Shipping Weight	**Individual Pack**	0.7 lb (0.3 kg)
	Bulk Pack of 50 Units	41 lb (19 kg)

© 1991 Johnson Controls, Inc.
Code No. LIT-125045

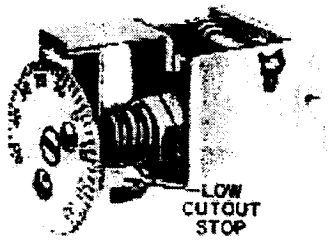


Fig. 2 -- Calibrated dial and pointer with factory adjustable low cutout stop.

Mounting

Standard back mounting plate illustrated in dimension drawing (Fig. 5) is regularly supplied. Front mounting and special brackets to customers' specifications which attach to this plate are available at extra cost.

Packaging

Bulk pack is standard. Orders for a single shipment of less than 50 controls will be individually packaged. Individual packaging charges will apply.

Packing Nut

Part No. FTG13A-600R is available for closed tank applications where the temperature is within -35 to +250°F (-37 to 121°C). Maximum liquid pressure limit is 150 PSIG (1034 kPa).

For applications where the temperature or liquid pressure exceeds these limits specify Style 4 element with all metal packing nut as an integral part of the control.

Sensing Elements

3/8 in. (9.5 mm) diameter bulb and 6 ft. (1.8 m) capillary are standard.

Optional constructions at extra cost on quantity orders include:

1. Capillary longer than 6 ft.
2. Bulbs 3/16 in. (4.8 mm), 1/4 in. (6.4 mm) or 5/16 in. (7.9 mm) O.D.
3. Coil bulbs for low movement air applications.

Terminals and Terminal Insulation

1. Number 8-32 binder head screw terminals, standard.
2. 1/4 in. × 0.032 in. male quick-connect terminals on models without calibrated dial, at extra cost.
3. Clip-on bakelite terminal cover (Fig. 9).

Repairs and Replacement

Field repairs must not be made. Controls requiring attention should be returned to the factory. When ordering a replacement control specify Product and Serial Number as shown on the control.

Electrical Ratings

A19AGA through A19AGC

Volts, AC	120	208	240
Full Load Amp	16.0	9.2	8.0
Locked Rotor Amp	96.0	55.2	48.0
Non-Inductive or Resistance Load Amp	22 Amp, 120 to 240 VAC*		
Pilot Duty — 125 VA, 24 to 600 VAC			

*SPST Rating. SPDT is 16 amp, 120 to 240 VAC.

A19AGD through A19AGF

Volts, AC	120	208	240
Full Load Amp	6.0	3.4	3.0
Locked Rotor Amp	36.0	20.4	18.0
Non-Inductive or Resistance Load Amp	10 Amp, 120 to 277 VAC		
Pilot Duty — 125 VA, 24 to 277 VAC			

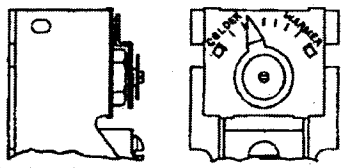


Fig. 3 — Drawing showing screwdriver slot range adjustment with stops.

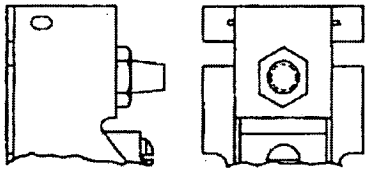


Fig. 4 — Drawing showing factory sealed setting.

Standard Refrigeration Application

Type Number	Typical Application	Adjustable Range °F / °C	Minimum Differential F° / C°	Maximum Bulb Temperature* °F / °C	Standard Bulb Size in. / mm
A19AGA	Low Temperature	-30 to +50 / -35 to +10	5 / 2.8	140 / 60	.375 x 4 / 9.5 x 102
A19AGA	Commercial Temperature	20 to 90 / -5 to +30	3.5 / 1.9	140 / 60	.375 x 5 / 9.5 x 127
A19AGA	Air Conditioning	60 to 80 / 15 to 35	2.5 / 1.4	140 / 60	.375 x 7 / 9.5 x 178
A19AGD	Milk Cooler	30 to 50 / 0 to 10	2 / 1.1	190 / 88	.366 x 2.50 / 9.3 x 64
A19AGD	Special Close Differential	40 to 90 / 5 to 30	1.5 / 0.8	140 / 60	.375 x 6 / 9.5 x 152

Above are typical cooling, or close high applications. These ranges will give same differentials in open high action.
*Maximum bulb temperature which the element can withstand at infrequent intervals during life of control, such as shipping conditions. This is not the temperature which the control can withstand on repeat cycles.

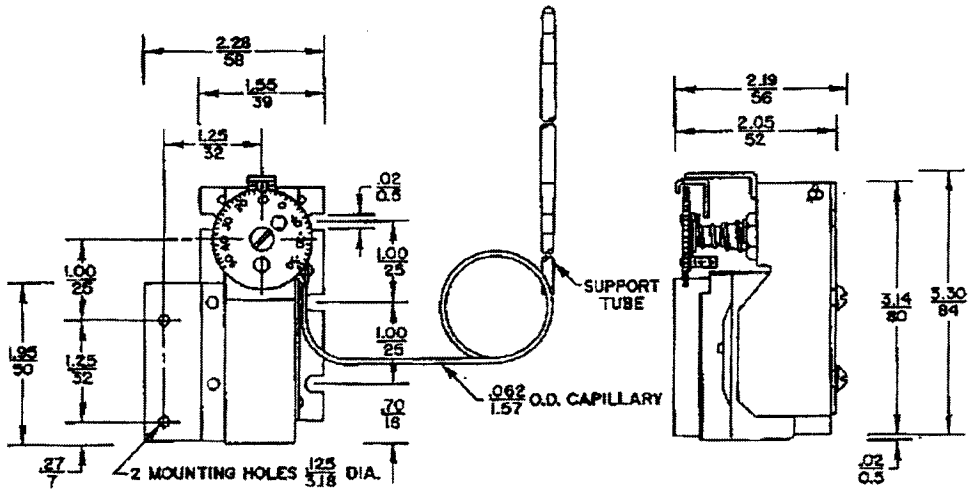


Fig. 6 — Side support, front mounting bracket, optional at extra cost.

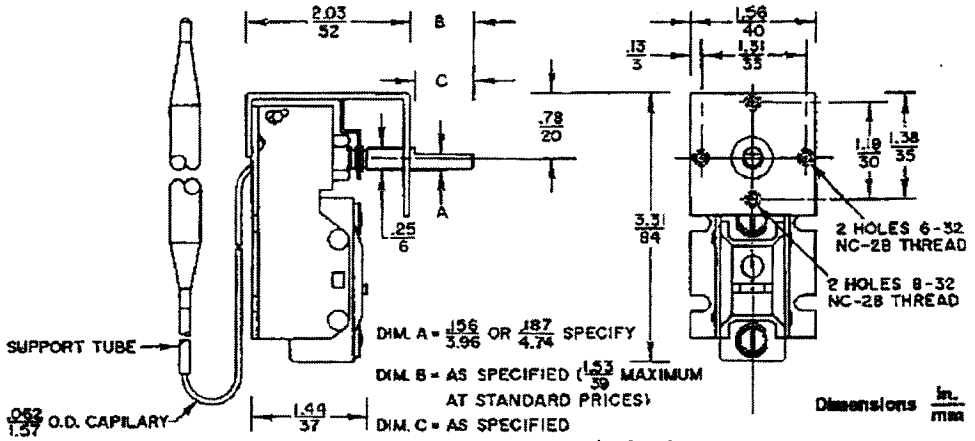


Fig. 7 — Center support, front mounting bracket, optional at extra cost.

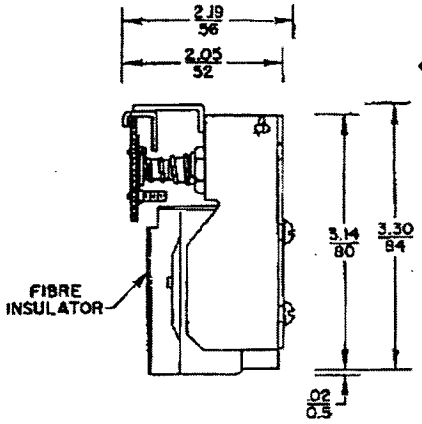


Fig. 8 (left) — Fibre insulator supplied as standard on all controls less enclosure except when clip-on terminal insulator is required. (See Fig. 9).

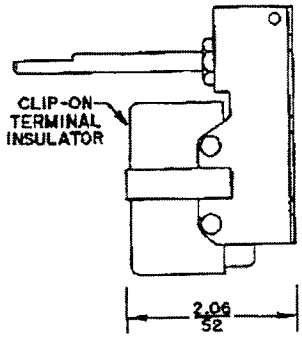


Fig. 9 (right) — Clip-on terminal insulator, optional at extra cost on models specifying adjustments shown in Figs. 3, 4 and 5, but without center support mounting (Fig. 7).

Performance specifications appearing herein are nominal and are subject to accepted manufacturing tolerances and application variables.

UL Guide No. XAPX2
File E6688
CSA Class 4813 02
File LR948

JOHNSON CONTROLS

Controls Group
507 E. Michigan Street
P.O. Box 423
Milwaukee, WI 53202

Printed in U.S.A.

JOHNSON CONTROLS

FANs 121, 125
Temperature Controls Section A
Technical Bulletin A19, A28
Issue Date 0983

A19 and A28 Series Control Point Deviation Remote Bulb, Non-Compensated, Liquid Filled Thermostats

Controls incorporating liquid filled sensing elements operate by the expansion and contraction of the fill, resulting from changes in its temperature. A change in temperature of any part of the fill (in bulb, capillary, or cup) will produce a change in fill volume which will be directly proportional to the temperature change and to the portion of total fill affected. Since the bulb contains the major portion of the total fill, it retains principal control of the operating point of any remote bulb thermostat. The capillary and cup affect the operating point only slightly, due to the small amount of fill they contain.

Ambient induced control point shift in a line of controls is affected by:

1. The difference between the ambient temperature at which the control was factory calibrated (75°F, standard) and the ambient temperatures to which the case and capillary will be exposed in the application;
2. The setting (operating control point) of the control; and,
3. The operating range of the particular control.

By choosing the optimum range for the specific application of a Johnson Controls A19 or A28 remote bulb thermostat, the shift due to wide ambient fluctuations can be kept to a low value.

For extremely critical applications operating under severe ambient conditions, Johnson Controls offers special construction with case compensation for such conditions at an added cost. Consult Customer Service or the nearest Johnson Controls field sales office.

Note that cross ambient conditions do not make Johnson Controls liquid filled, remote bulb temperature controls inoperative. Likewise, these controls are unaffected by barometric or altitude variations.

▲ CAUTION: Although all brands of non-compensated, liquid filled, remote bulb temperature controls have characteristics similar to those discussed in this bulletin, these curves cannot be used to calculate ambient deviation in other manufacturers' controls.

This data applies only to single bulb Johnson Controls A19 and A28 controls and only for the ranges shown. If information is required on ambient deviation characteristics for other ranges or controls, consult the nearest Johnson Controls field sales office.

Ambient Variation at Control

To determine control point shift due to wide changes in ambient temperature at the control case and/or capillary, compute as follows:

S_t = Total control point shift

S_1 = Cup induced shift

S_2 = Capillary induced shift

D_1 = Deviation factor of cup

D_2 = Deviation factor of capillary

A_1 = Anticipated extreme ambient temperature at cup

A_2 = Anticipated extreme ambient temperature at capillary.

The total shift in control point will be the sum of the shift due to the cup and the shift due to the capillary.

To compute S_1:

1. Find the curve on graph one or two for the particular range involved.
2. Locate the control point setting applicable and the intersection of the vertical line from the setting with the range curve.
3. Follow the horizontal line to the left from the intersection point and determine the cup deviation factor, D_1.
4. Estimate the anticipated extreme ambient temperature the case may be subjected to in the application, A_1.
5. $S_1 = D_1 \times (75-A_1)$.

To compute S_2:

1. Locate the range of the control on Table 1.
2. Read the capillary deviation factor, D_2.
3. Estimate the extreme average ambient temperature in which the capillary will operate, A_2.

© 1983 Johnson Controls, Inc.

Code No. LIT-121075

4. Determine the length of capillary, L.

5. $S_2 = D_2 \times (75-A_1) \times L$.

Total shift in control operating point is: $S_t = S_1 + S_2$.

A **negative value** indicates a **lowered control point.**

A **positive value** indicates a **raised control point.**

Example

Assume a control is required to maintain -5°F with a 115°F extreme ambient temperature of capillary and case, and that a 6 ft. capillary length is required.

On Graph 1, we find ranges of -20 to 10°F, -30 to 50°F.

A. Select range -20 to 10°F.

1. Calculate cup shift, S_1

   a) On Graph 1, our required control set point of -5°F intercepts the -20 to 10°F curve at a D_1 of **.055°F.**

   b) A_1 (case ambient) is **115°F.**

   c) $S_1 = D_1 \times (75-A_1)$

   $= .055 \times (75-115)$

   $S_1 = -2.2°F.$

2. Calculate capillary shift, S_2

   a) Table 1 tells us that range -20 to 10°F has a D_2 of **.0075.**

   b) A_1 (capillary ambient) is **115°F.**

   c) L (capillary length) is 6 ft.

   d) $S_2 = D_2 \times (75-A_2) \times L$

   $= .0075 \times (75-115) \times 6$

   $S_2 = -1.80°F.$

3. The total shift in set point

   a) $S_t = S_1+S_2$

   $= (-2.2) + (-1.8)$

   $S_t = -4.0°F.$

   b) Since S_t is negative, the control point will shift **down** 4°F.

B. Select range -30 to 50°F.

1. Calculate cup shift, S_1

   a) On Graph 1, our set point of -5°F intercepts the -30 to 50°F curve at a D_1 of .043°F.

   b) A_1 is **115°F.**

   c) $S_1 = D_1 \times (75-A_1)$

   $= .043 \times (75-115)$

   $S_1 = -1.72°F.$

2. Calculate capillary shift, S_2

   a) Table 1 gives a D_2 of .005 for the range -30 to 50°F.

   b) A_2 is 115°F.

   c) L is 6 ft.

   d) $S_2 = D_2 \times (75-A_2) \times L$

   $= .005 \times (75-115) \times 6$

   $S_2 = 1.2°F.$

3. The total shift in set point

   a) $S_t = D_1 + S_2$

   $= (-1.72) + (-1.2)$

   $S_t = -2.92°F.$

   b) The control point will shift **down** 2.92°F.

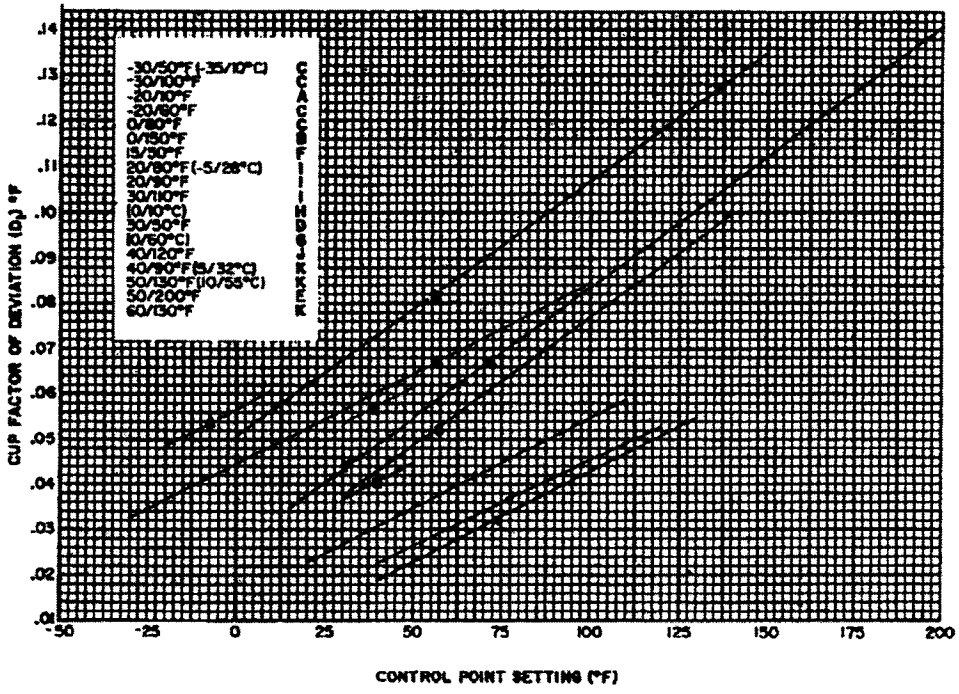
For the least amount of ambient shift, it is obvious that the -30 to 50°F range is the correct selection.

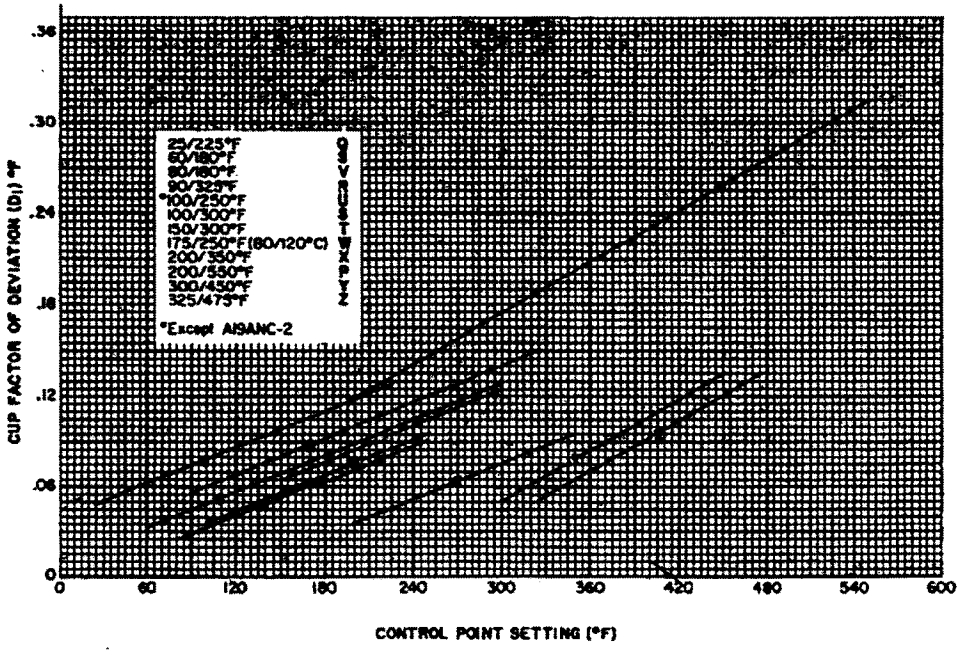
Table 1

Capillary Ambient Deviation

Range	Deviation Factor (D_2) °F/ft.
–30/50°F (–35/10°C)	.0050
–30/100°F	.0050
–20/10°F	.0075
–20/60°F	.0050
0/80°F	.0050
0/150°F	.0078
15/50°F	.0054
20/80°F (–5/26°C)	.0035
20/90°F	.0035
25/225°F	.0075
(0/10°C)	.0050
30/50°F	.0057
30/110°F	.0035
(0/80°C)	.0057
40/90°F	.0029
40/120°F	.0032
50/130°F (10/55°C)	.0036
50/200°F	.0078
60/130°F	.0042
60/180°F	.0050
80/160°F	.0038
90/325°F	.0068
*100/250°F	.0056
100/300°F	.0075
150/300°F	.0095
175/250°F (80/120°C)	.0094
200/350°F	.0056
200/550°F	.0180
300/450°F	.0078
325/475°F	.0078

*Except A19ANC-2 D_2=.0078


CUP FACTOR OF DEVIATION (D1) °F
.14
.13
.12
.11
.10
.09
.08
.07
.06
.05
.04
.03
.02
.01
-50
-25
0
25
50
75
100
125
150
175
200
CONTROL POINT SETTING (°F)
-30/50°F(-35/10°C)
-30/100°F
-20/10°F
-20/80°F
0/80°F
0/150°F
15/30°F
20/80°F(-5/28°C)
20/90°F
30/110°F
(0/10°C)
30/50°F
(0/60°C)
40/120°F
40/90°F(5/32°C)
50/130°F(10/55°C)
50/200°F
60/150°F


CUP FACTOR OF DEVIATION (D1) °F
.36
.30
.24
.18
.12
.06
0
0
60
120
180
240
300
360
420
480
540
600
CONTROL POINT SETTING (°F)
25/225°F
50/180°F
80/180°F
90/325°F
*100/250°F
100/300°F
150/300°F
175/250°F(80/120°C)
200/350°F
200/550°F
300/450°F
325/475°F
*Except AISANC-2

Notes

JOHNSON CONTROLS

Controls Group
507 E. Michigan Street
P.O. Box 423
Milwaukee, WI 53202

Printed in U.S.A.

A19 Series Temperature Controls – Single-Pole, Single-Throw and Single-Pole, Double-Throw Models with NEMA 1 Enclosure

Application

These controls are designed to cover a broad range of general purpose operating temperature control applications in the refrigeration, air conditioning and heating field with a minimum number of models. Typical applications are: frozen food cases, display cases, beverage coolers, milk coolers, etc. Various control ranges are available.

Controls are supplied with an adjustable range (except models with factory sealed settings) and adjustable or nonadjustable differential.

All Series A19 temperature controls are designed for use *only* as operating controls. Where an operating control failure would result in personal injury and/or loss of property, it is the responsibility of the installer to add devices (safety, limit controls) or systems (alarm, supervisory systems) that protect against, or warn of, control failure.

Installation

Follow equipment manufacturer's instructions if provided. If instructions are not provided proceed as follows:

Mounting

Controls are normally mounted to a surface through holes in back of case.

▲ CAUTION: On rough mounting surfaces use the top two mounting holes only. When these controls are mounted on an uneven surface using screws in all four holes, the case can be twisted enough to affect the control's calibration and operation.

For closed tank applications without well assembly Part No. FTG13A-600R packing nut assembly may be supplied. See Fig. 2 for sequence of installation. Put parts over support tube section of element, placing bulb into tank. Tighten 1/2 in. NPT adapter. Screw packing nut into adapter with the retaining washers and packing in place as shown.

To install models supplied with bulb well, first install bulb well into tank. Remove bushing from bulb well and slide bushing over capillary. Replace bushing into bulb well. Push bulb into position in bottom of well. Tighten set screw in end of adapter to hold bulb in position. See Fig. 3 for bulb well illustration.

▲ CAUTION: Do not dent or deform the sensitive bulb of this control. A dent or deformation will change the calibration and cause the control to cycle at a temperature lower than the dial setting. When the bulb mounting clip is used to mount the bulb near the refrigerant tubing, be sure the sheet metal screw does not pierce the tubing.

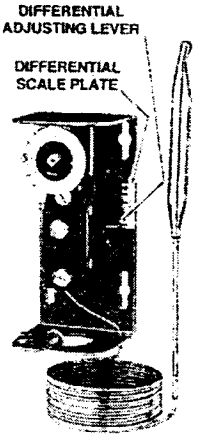


Fig. 1 – An A19 with external range adjustment and screwdriver slot.

Adjustments

The A19 temperature controls may be supplied with an external range adjustment and screwdriver slot as shown in Fig. 1, range adjustment knob or solid cover. Solid cover models with calibrated dial are adjusted by removing the cover and moving dial so the desired setting is in line with the dial pointer on the stop bracket. (See Fig. 5.) Convertible adjustment models can be field converted from concealed screwdriver slot adjustment to knob adjustment or external screwdriver slot adjustment. They are supplied with a snap-in plug in the cover to provide concealed screwdriver slot adjustment. For knob adjustment remove the snap-in plug and press the knob onto the slotted shaft. For external screwdriver slot adjustment remove the snap-in plug. The convertible adjustment models with remote bulb include a bulb mounting clip.

© 1988 Johnson Controls, Inc.

Code No. LIT-121015
Part No. 997-349

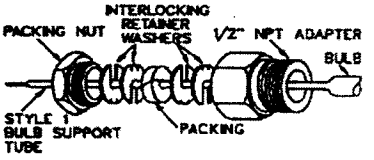
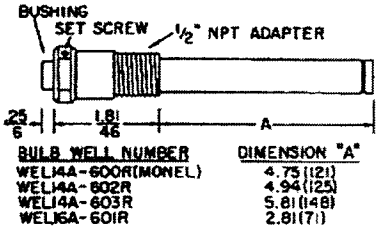


Fig. 2 – Part No. FTG13A-600R packing nut assembly. (Used with swaged bulb with support tube for direct immersion application.)



BULB WELL NUMBER	DIMENSION "A"
WELI4A-600R(MONEL)	4.75 (121)
WELI4A-602R	4.94 (125)
WELI4A-603R	5.81 (148)
WELI6A-601R	2.81 (71)

Fig. 3 – Bulb well for liquid immersion applications where a temperature bulb may be removed without draining tank.

Dial settings normally indicate the cutout setting unless otherwise specified by the equipment manufacturer. Models with SPDT contacts are normally set so the red (common) to yellow contacts open at the dial setting.

Models with adjustable differential and ranges of 20/80°F (-5/28°C), -30/50°F (-35/10°C) and -30/100°F (-35/40°C) have a differential scale plate showing increments of differential. Other ranges have a scale plate with a multiplier. For example when "MIN" differential is 5F° (2.8C°) then x2 is 10F° (5.6C°), x3 is 15F° (8.3C°), etc. The controls are supplied with adjusting lever at minimum differential stamped on the control. To adjust move the lever to the differential required.

Low cutout or high cutout stop supplied on certain models (specified by the equipment manufacturer).

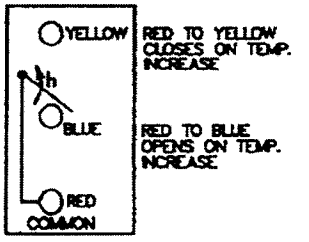


Fig. 4 – Terminal arrangement of SPDT models.

If high or low cutout stop adjustment is required proceed as follows:

1. Set dial to temperature at which stop is desired.
2. Remove cover of the control.
3. Loosen the cutout stop screw, slide the screw to the front of the temperature control against the plastic step behind the dial and tighten the screw. (See Fig. 5.) Sometimes an exact stop setting is not possible and stop must be set to the closest stop corresponding to dial setting required.
4. Replace cover.

Wiring

▲ CAUTION: Disconnect power supply before wiring connections are made to avoid possible electrical shock or damage to equipment.

All wiring should conform to the National Electrical Code and local codes. Single-pole, double-throw models should be wired as shown in Fig. 4. Use copper conductor only.

▲ CAUTION: Use terminal screws furnished (8-32 x 1/4 in. binder head). Substitution of other screws may cause problems in making proper connections.

Checkout Procedure

Before applying power, make sure installation and wiring connections are according to job specifications. After the necessary mechanical adjustment and electrical connections have been made, an operational checkout is recommended.

Adjust the control setpoint to put the system in operation and observe at least three complete operating cycles to be sure that all components are functioning correctly.

If the system fails to operate, recheck the wiring and components.

Repairs and Replacement

Field repairs must not be made. For a replacement control contact the nearest Johnson Controls representative.

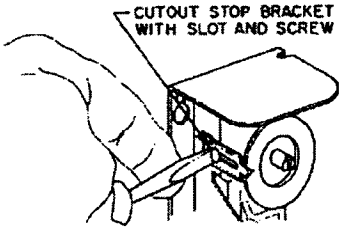


Fig. 5 – All models have a screw type cutout stop. The stop screw must be loosened and moved to the stop setting desired. Tighten screw after setting is made.

JOHNSON CONTROLS

Controls Group
507 E. Michigan Street
P.O. Box 423
Milwaukee, WI 53202

Printed in U.S.A.

JOHNSON CONTROLS

A19 Series Immersion Hot Water Controls -- SPST and SPDT

Application

These controls are used on hot water boiler systems. Typical applications include:

- high temperature cutout control
- operating control to maintain hot water supply
- circulator or unit heater control
- combined operating and circulator control

The controls have an adjustable range and adjustable or fixed differential. They are also available with lockout that requires manual reset.

All Series A19 temperature controls are designed for use only as operating controls. Where an operating control failure would result in personal injury and/or loss of property, it is the responsibility of the installer to add devices (safety, limit controls) or systems (alarm, supervisory systems) that protect against, or warn of, control failure.

Installation

Follow equipment manufacturers' instructions, if provided. Mount the control in top or side boiler tappings.

▲ CAUTION: Do not dent or deform the sensitive bulb of this control. A dent or deformation will change the calibration and cause the control to cycle at a temperature lower than the dial setting.

To install:

1. Drain the system to a level below tapping.
2. Remove bulb well from the control by loosening set screws in the hex nut.
3. Place a small amount of pipe dope on the bulb well threads to prevent leakage.
4. Turn bulb well securely into the boiler tapping.

▲ CAUTION: Be sure that unobstructed depth is sufficient so bulb well will not make metal-to-metal contact. The bulb well must be completely submerged--avoid mounting where it might be partly above the operating liquid level or surrounded by an air pocket.

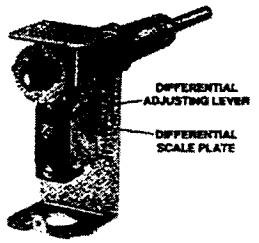


Fig. 1 -- An A19 Hot Water Control less cover with adjustable differential.

5. Insert the bulb into well applying a firm pressure to be sure the bulb is at bottom of well. Tighten set screws.
   a. On remote bulb models, remove bushing from the bulb well. Insert bulb into well. Slide bushing over capillary and push into bulb well. Tighten set screws.

▲ CAUTION: For Remote Mounting Models Only. On rough mounting surfaces use the top two mounting holes only. When these controls are mounted on an uneven surface using screws in all four holes, the case can be twisted enough to affect the control's calibration and operation.

Specifications

Type Number	Action	Range °F / °C Min.	Range °F / °C Max.	Diff. °F / °C Fixed	Diff. °F / °C Adj.	Maximum Allowable Bulb Temp. °F / °C
A19AAB	Open on Rise	100	240	6	—	290
A19AAC	SPDT	40	120	3.3		143
A19ABA	Close on Rise	100	240	—	6 / 3.3 Min.	290
A19ABB	Open on Rise	40	120			143
A19ABC	SPDT				24 / 13 Max	
A19ADB	Open on Rise	100	240	Manual Reset		290
A19ADC	SPDT	40	120			143

Wiring

▲ CAUTION: Disconnect power supply before wiring connections are made to avoid possible electrical shock or damage to equipment.

© 1988 Johnson Controls, Inc.

Form 997-529-7
Code No. LIT-121020

All wiring should conform to the National Electrical Code and local codes. Single-pole, double-throw models should be wired as shown in Fig. 3. Red is the common terminal. Use copper conductors only.

▲ CAUTION: Use terminal screws furnished (8-32 × 1/4 in. binder head). Substitution of other screws may cause problems in making proper connections.

Adjustments

Dial settings normally indicate the cutout setting unless otherwise specified by the equipment manufacturer. Models with SPDT contacts are normally set so the red (common) to blue contacts open at the dial setting on a rise in temperature.

Rotate adjusting knob to raise or lower both the cutout and cut-in settings.

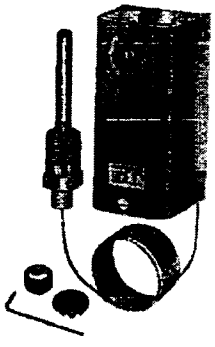


Fig. 2 – An A19 with convertible adjustment has a snap-in plug in the cover and a knob for field installation.

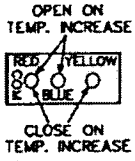


Fig. 3 — Terminal arrangement of SPDT models.

Convertible adjustment models can be field converted from concealed screwdriver slot adjustment to knob adjustment or external screwdriver slot adjustment. They are supplied with a snap-in plug in the cover to provide concealed screwdriver slot adjustment. For knob adjustment remove the snap-in plug and press the knob onto the slotted shaft. For external screwdriver slot adjustment remove the snap-in plug.

Models with adjustable differential have a differential scale plate (see Fig. 1) with a multiplier shown. For example, when "MIN." differential is 6F° (3.3C°), then x2 is 12F° (6.6C°), x3 is 18F° (9.9C°), etc. The controls are supplied with adjusting lever at minimum differential stamped on the control. To adjust, move the lever to the differential required.

High Temperature Cutout Stop

The high temperature cutout stop is an integral part of these hot water controls and can be field adjusted. To set high temperature cutout stop, proceed as follows:

1. Set dial to temperature at which stop is desired.
2. Remove control cover.
3. Loosen the cutout stop screw, slide the screw to the front of the temperature control against the plastic step behind the dial and tighten the screw. (See Fig. 4.)

   Note: Sometimes an exact stop setting is not possible and the stop must be set to the closest step corresponding to the dial setting.

Checkout Procedure

Before applying power, make sure installation and wiring connections are according to job specifications.

Before leaving the installation, observe at least three complete operating cycles to be sure that all components are functioning correctly.

Repairs and Replacement

Field repairs must not be made. For a replacement control contact the nearest Johnson Controls wholesaler.

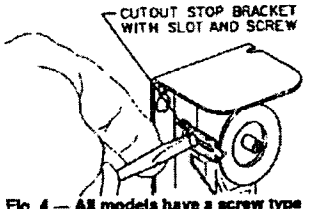


Fig. 4 — All models have a screw type cutout stop. The stop screw must be loosened and moved to the stop setting desired. Tighten screw after setting is made.

JOHNSON CONTROLS

Controls Group
507 E. Michigan Street
P.O. Box 423
Milwaukee, WI 53201

Printed in U.S.A.

A19 Series

Automatic Changeover with Strap-On Mounting

Description

This is a changeover control for use with combination heating and cooling thermostats.

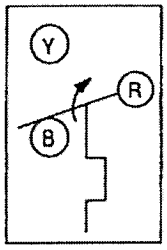
Features

This control automatically selects the correct thermostat function.

Applications

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

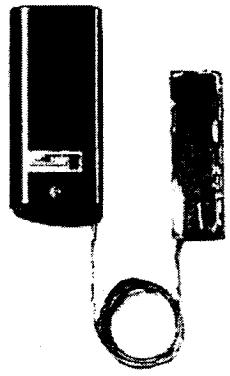
A19 Series



Action on Increase of Temperature

a19.eps

A19 Series
Terminal Arrangement for SPDT



A19CAC-1 (Remote Bulb Model)

Selection Charts

A19 Series Automatic Changeover with Strap-on Mounting

Code Number	Switch Action	Range °F (°C)	Diff F°(C°)	Mounting
A19CAC-1C	SPDT	60 to 90 (16 to 32)	10 (5.6)	42 in. cap.
A19CAC-2C	SPDT	60 to 90 (16 to 32)	10 (5.6)	Direct

Replacement Parts

Code Number	Description
CVR28A-617R	Concealed adjustment cover

Technical Specifications

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

Electrical Ratings

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

The performance specifications are nominal and conform to acceptable industry standards. For applications at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products. © 2009 Johnson Controls, Inc.

A19 Series

Coiled Bulb Space Thermostat

Description

Wide range temperature control with air coil sensing element.

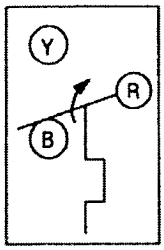
Features

- wide temperature range
- NEMA 1 enclosure

Applications

Use for return air or space temperature sensing.

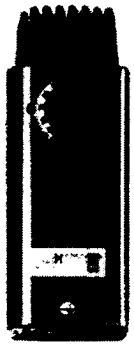
A19 Series



Action on Increase of Temperature

a19.eps

A19 Series
Terminal Arrangement for SPDT



A19BAC

Selection Charts

A19 Series Coiled Bulb Space Thermostat

Code Number	Switch Action	Range °F (°C)	Diff F° (C°)	Bulb and Capillary	Range Adjuster	Max. Bulb Temp °F (°C)
VENTILATING, HEATING						
A19BAB-3C	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	SPDT	30 to 110 (-1 to 43)	3 1/2 (1.9) Fixed	1 3/8 in. x 2 1/4 in. Coiled	Convertible	
A19BAF-1C	SPDT	30 to 110 (-1 to 43)	1 1/2 (0.9) Fixed	1 3/8 in. x 2 1/4 in. Coiled	Knob	
COOLING						
A19BBC-2C [1]	SPDT	-30 to 100 (-34 to 38)	3 to 12 (1.7 to 7)	1 3/8 in. x 2 1/4 in. Coiled	Convertible	140 (60)

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

Replacement Parts

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

Technical Specifications

Electrical Ratings

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

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

The performance specifications are nominal and conform to acceptable industry standards. For applications at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products. © 2009 Johnson Controls, Inc.

A19

Temperature Control Less Enclosure (SPDT, Close Differential)

Description

Open-type temperature control for mounting in cases or enclosures.

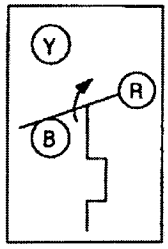
Features

This control is designed with SPDT contacts for open high or open low applications.

Applications

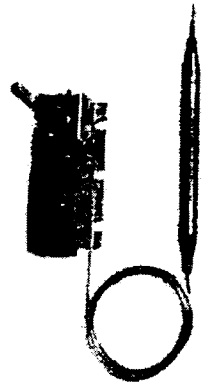
Use for panel-mounted temperature control for a packaged terminal air conditioner or for self-contained HVAC equipment.

A19 Series



Action on Increase of Temperature

A19 Series
Terminal Arrangement for SPDT



A19AGF-31

Selection Charts

A19 Temperature Control Less Enclosure (SPDT, Close Differential)

Code Number	Switch Action	Range °F (°C)	Diff F° (C°)	Bulb and Capillary	Range Adjuster	Max. Bulb Temp. °F (°C)
A19AGF-31C	SPDT	40 to 90 (4 to 32)	1 1/2 (0.8)	3/8 x 5 in.; 5 ft Cap	Shaft	140 (60)

Replacement Parts

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

Technical Specifications

- back mounting
- knob supplied by the customer

Electrical Ratings

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

The performance specifications are nominal and conform to acceptable industry standards. For applications at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products. © 2009 Johnson Controls, Inc.

A19BAC, A28AA Single and Two-Stage Space Thermostats For Farm and General Purpose Applications

Application

The single-stage A19BAC and the two-stage A28AA thermostats incorporate single-pole double-throw (SPDT) switches for controlling automatic ventilation or heating in livestock barns, poultry houses, milk houses, brooder houses and other buildings. The 30 to 110°F (0 to 43°C) and 0 to 140°F (-15 to 60°C) temperature ranges permit use for many space applications.

IMPORTANT: The single-stage A19 and A28 thermostats are intended to control equipment under normal operating conditions. Where failure or malfunction of an A19 or A28 thermostat 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) intended to warn of or protect against failure or malfunction of the A19 or A28 thermostat must be incorporated into and maintained as part of the control system.

⚠ CAUTION: **Risk of Property Damage.** Do not install A19 or A28 space thermostats with general purpose enclosures in any type of agricultural environment defined in NEC Art. 547 where dust or dust with water may accumulate or where corrosive atmospheres exist. Doing so may cause the A19 or A28 thermostat to fail and result in the loss of temperature regulation and damage to other property.

Operation

Figs. 4 and 5 illustrate the operation of the A19. On a temperature increase, the circuit between R and Y closes. Simultaneously the R and B circuit opens.

Figure 6 illustrates the operation of the A28AA. On a temperature increase, the circuit between R and Y of the low stage switch (RY_L) closes. Simultaneously, the circuit between R and B (RB_L) opens.

On a further increase in temperature, the high stage switch operates and closes RY_H while simultaneously opening RB_H.

The reverse sequencing takes place on a temperature fall.

Installation

Mounting

Mount control to a flat surface with screws through holes provided in back of frame.

IMPORTANT: On rough mounting surfaces use the top two mounting holes only. When these controls are mounted on an uneven surface using screws in all four holes, the case can be twisted enough to affect the thermostat's calibration and operation.

Mount the control where it is exposed to the average temperature of the controlled space. Do not mount where it will be affected by unusual heat or cold, such as directly over an animal stall, in sunlight, or on an outside wall. Avoid locations near a door, window or hay chute.

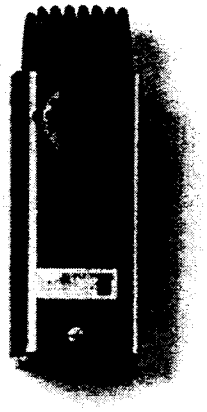


Fig. 1 – Exterior view of Space Thermostat

IMPORTANT: Do not dent or deform the sensitive bulb of this thermostat. A dent or deformation will change the calibration and cause the thermostat to cycle at a temperature lower than the dial setting.

Adjustment

Knob adjustment or screwdriver slot is supplied on the range screw. Dial pointer is located on adjustment stop bracket on knob and screwdriver adjustment models.

Before removing the cover, verify that all power to the thermostat and associated equipment is turned off.

⚠ WARNING: **Risk of Electrical Shock.** Disconnect the power supply before mounting and wiring to prevent possible electrical shock. On multiple circuit units, more than one circuit may have to be disconnected.

© 2003 Johnson Controls, Inc.
Part No. 996-238, Rev. C

Solid cover models are adjusted by removing cover and moving dial so that the setpoint is in line with the dial pointer on the stop bracket. (See Fig. 3.)

Convertible adjustment models can be field converted from concealed screwdriver slot adjustment to knob adjustment or external screwdriver slot adjustment. They are supplied with a snap-in plug in the cover to provide concealed screwdriver slot adjustment. For knob adjustment remove the snap-in plug and press the knob onto the slotted shaft. For external screwdriver slot adjustment remove the snap-in plug.

The A28AA switch is stamped to indicate the HI-TEMP switch and the LO-TEMP switch.

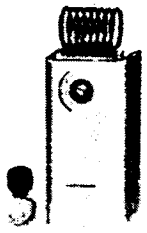


Fig. 2 – The Space Thermostats with convertible adjustment have a snap-in plug in the cover, built-in screwdriver slot and a knob for field installation.

A high temperature adjustment stop is supplied on the thermostats. (See Fig. 3.) If adjustment stop is required:

1. Set dial to temperature at which stop is desired.
2. Remove cover from thermostat.
3. Loosen the adjustment stop screw, slide the screw to the front of the thermostat against the plastic stop cam behind the dial and tighten the screw. (See Fig. 3.)

   Sometimes an exact stop setting is not possible and stop must be set to the closest step corresponding to dial setting required.
4. Turn dial to setpoint desired.
5. Replace cover.

Wiring

> ⚠ WARNING: **Risk of Electrical Shock.** Disconnect the power supply before mounting and wiring to prevent possible electrical shock. On multiple circuit units, more than one circuit may have to be disconnected.

All wiring should conform to local, national, and regional codes. Use copper conductors only. Do not use on applications where electrical ratings exceed ratings shown on the thermostat's cover label.

See Figs. 4 through 11 for typical wiring applications.

Note: Use terminal screws furnished (8-32 x 1/4 in. binder head). Substitution of other screws may cause problems in making proper connections.

Checkout Procedure

Before leaving the installation, observe at least three complete operating cycles to be sure that all components are functioning correctly.

Check for correct operation in the following manner.

1. *A19BAC – Ventilating or Cooling*: Turn dial clockwise to a setting above space temperature. Fan or cooling system should be off. When you turn the dial counterclockwise, the fan or cooling system should turn on approximately at the dial setting.

   A19BAC – Heating: Turn dial clockwise above the space temperature; the heating unit should be on. When you turn the dial counterclockwise, the heating unit should turn off approximately at the dial setting.
2. *A28AA* – If wiring is similar to Fig. 8, fan should start at approximately space temperature and should change to high speed as the dial is turned counterclockwise to a lower temperature setting.

   If similar to Fig. 9, the damper should open as the dial is turned counterclockwise. The devices should act in reverse sequence when the dial is turned clockwise to a higher setting.
3. If control devices do not operate in the manner described above, check all wiring for short circuits and tightness of wiring connections. If controlled devices operate in reverse (start in high or fully open position), check wiring.

Repairs and Replacement

Field repairs must not be made. For replacement thermostat contact the nearest Johnson Controls distributor.

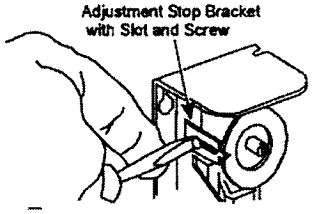
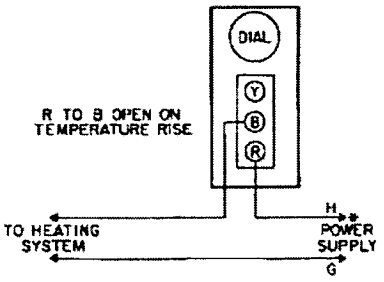


Fig. 3 – All models have a screw type adjustment stop. Loosen and move stop screw to the stop setting desired. Tighten screw after setting is made.

Electrical Ratings

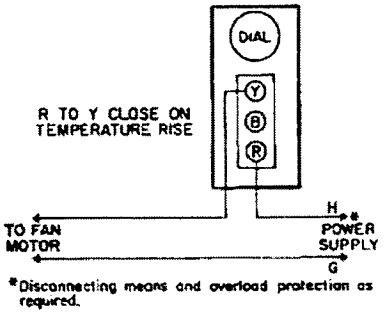
	A28AA*				A19BAC			
Volts, AC	**120**	**208**	**240**	**277**	**120**	**208**	**240**	**277**
Full Load Amp	16.0	9.2	8.0	--	16.0	9.2	8.0	--
Locked Rotor Amp	96.0	55.2	48.0	--	96.0	55.2	48.0	--
Non-Inductive Amp								
SPDT	16.0	9.2	8.0	7.2	16.0	16.0	16.0	16.0
SPST	16.0	9.2	8.0	7.2	22.0	22.0	22.0	22.0
Pilot Duty	125 VA, 24 to 277 VAC				125VA, 24 to 600 VAC			

* Max connected load not to exceed 2000 VA.



*Disconnecting means and overload protection as required.

Fig. 4 – A19BAC typical heating control circuit.



*Disconnecting means and overload protection as required.

Fig. 5 – A19BAC typical ventilating or cooling control circuit.

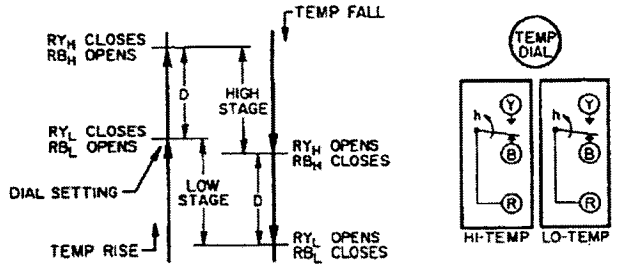
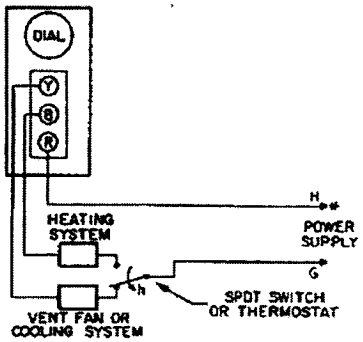
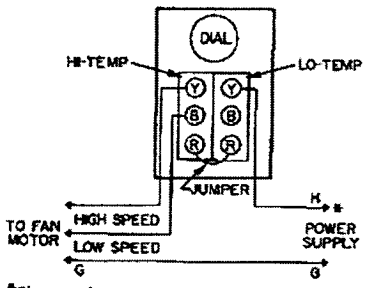


Fig. 6 – Switch action of the A28AA two-stage control. RB_H, RY_H indicate HI-TEMP. RB_L, RY_L indicate LO-TEMP. D is the differential between stages.



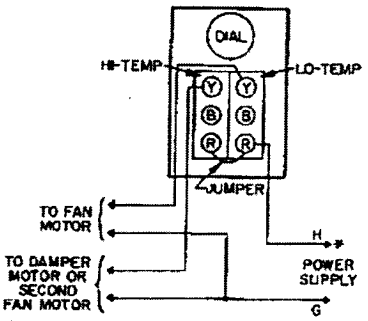
*Disconnecting means and overload protection as required.

Fig. 7 — An A19BAC in control of heating and ventilating systems.



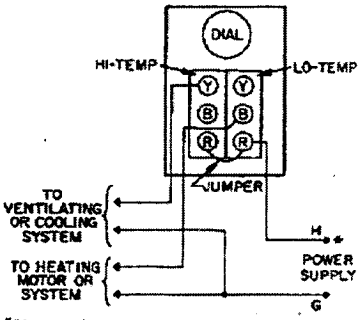
*Disconnecting means and overload protection as required.

Fig. 8 — An A28AA shows typical wiring for the control of a two speed ventilating fan. When control temperature reaches the dial setting, the low temperature switch starts the fan on low speed. If the space temperature continues to rise, the high temperature switch supplies power to the high speed motor winding while disconnecting the low speed winding.



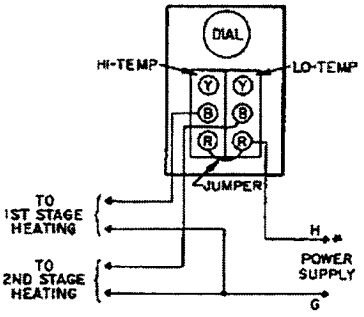
*Disconnecting means and overload protection as required.

Fig. 9 — Typical hookup for a two speed volume fan application. Fan starts when the temperature reaches the dial setting. If the temperature continues to rise, the damper motor is energized by the high temperature switch.



*Disconnecting means and overload protection as required.

Fig. 10 — Typical wiring for a combination heating and cooling system automatic changeover. A temperature increase to dial setting turns off the heating system when the R–B low temperature switch contacts open. An increase of approximately 3F° (1.7C°) turns on the fan or cooling system through the R–Y contacts of the high temperature switch.



*Disconnecting means and overload protection as required.

Fig. 11 — Typical hookup for two stage heating. On a temperature drop to dial setting the first stage heating turns on. If the temperature continues to drop about 3F° (1.7C°) the second heating stage turns on.

JOHNSON CONTROLS

Controls Group
507 E. Michigan Street
P.O. Box 423
Milwaukee, WI 53202

Published in U.S.A.
www.johnsoncontrols.com

JOHNSON CONTROLS

Installation Instructions
Issue Date January 9, 2003

A19PRC Type Temperature Controls with NEMA 4X Raintight Enclosures

Application

IMPORTANT: The A19PRC Type Temperature Controls are intended to control equipment under normal operating conditions. Where failure or malfunction of an A19PRC control 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) intended to warn of or protect against failure or malfunction of the A19PRC control must be incorporated into and maintained as part of the control system.

The A19PRC type electromechanical temperature controls are designed for use in many agricultural applications. The A19PRC controls have rugged Noryl® plastic enclosures and are UL Listed as NEMA Type 4X and for use in National Electrical Code (NEC) Article 547 Agricultural Environments (ANSI/NFPA 70). See Figure 1 and *Technical Specifications*.

The adjustable A19PRC type temperature controls have O-ring sealed external setpoint adjustment knobs and range scales with oversized markings for easy readability in low light. The exposed portion of the liquid expansion sensing elements has been tested per Article 547 of the NEC.

IMPORTANT: Do not dent, bend, uncoil, or otherwise alter the position of the sensing element (coil) mounted on the base of the A19PRC type controls. Damaging the sensing element (coil) may change the control calibration and voids any warranties on the control.

Operation

When the temperature at the sensing element rises to the setpoint (dial setting), the switch between R and Y closes, and the switch between R and B opens on Single Pole, Double Throw (SPDT) models. See Figures 2, 3, and 4.

Installation

Dimensions

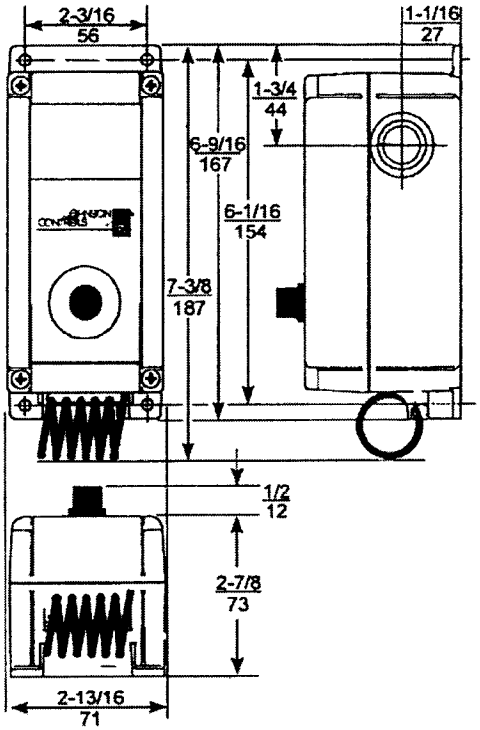


Figure 1: Dimensions for A19PRC Temperature Controls with NEMA 4X Enclosures, in./mm

Mounting

Mount the temperature control on a wall where it is exposed to the average temperature of the controlled space. Do not mount where it may be affected by unusual heat or cold, such as directly over an animal stall or in sunlight. Avoid locations near a door, window, or other sources of non-ambient air drafts. Do not mount on an outside wall or where temperature at the bulb (coil) exceeds 140°F (60°C).

- Mount the temperature control to a flat surface with screws through the holes in the mounting ears on the back of the case. See Figure 1.

© 2003 Johnson Controls, Inc.
Part No. 996-551, Rev. A

Wiring

WARNING: Risk of Electrical Shock.
To avoid the risk of electrical shock, disconnect all power sources to the control before wiring any connections. More than one disconnect may be required to completely de-energize the control and equipment.

IMPORTANT: All wiring must conform to all local, national and regional regulations. Use copper conductors only for all wire connections.

IMPORTANT: Do not use A19 temperature controls on applications where the electrical load across the control's switch may exceed the electrical ratings shown on the temperature control's label.

IMPORTANT: Use only the terminal screws furnished with the switch. Using other screws in the switch voids the warranty, may damage the switch, and cause problems in making secure connections.

There are three 1/2 in. (Trade-size) conduit knockouts on the A19PRC NEMA 4X enclosure. To make wiring connections, proceed as follows:

1. Loosen the four cover screws and remove the cover and knob assembly. The knob is secured in the cover and must not be removed. Do not damage the O-ring seal.
2. Select the knockout to be removed. Place a screwdriver blade on the knockout near the edge. Apply a sharp blow to the screwdriver handle to loosen the knockout.

Note: For watertight connection to rigid conduit, connect an approved watertight conduit fitting to the conduit first, and then connect the fitting to the A19P control enclosure.

3. Insert wire through conduit opening.
4. Make wiring connections to the screw terminals. See Figures 2, 3, and 4.
5. Ensure that the O-ring seal is properly seated. Replace cover and knob assembly. Check the alignment of the range adjustment knob.

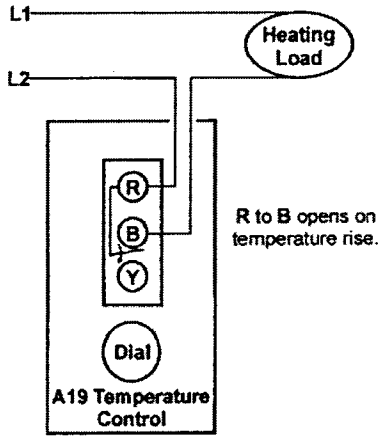


Figure 2: Typical Wiring for Heating Applications

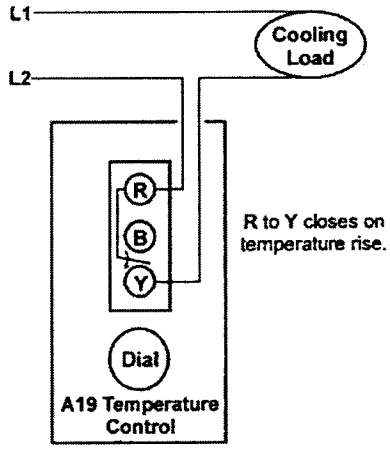


Figure 3: Typical Wiring for Cooling Applications

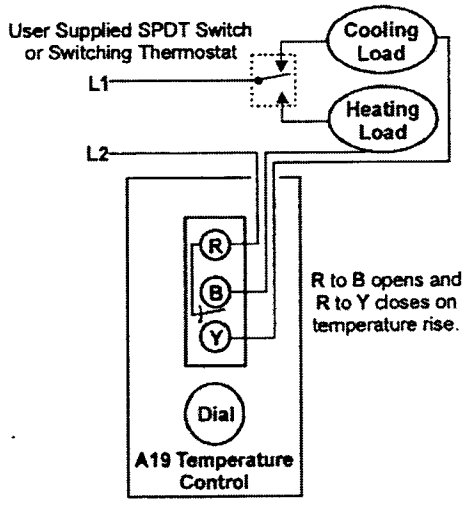


Figure 4: Typical Wiring for Combination Heating and Cooling Applications

Setup and Adjustments

Turn the knob on the front of the temperature control to change the control temperature setpoint.

Checkout

Before leaving the installation, observe at least three complete operating cycles of the controlled equipment to ensure that all components are functioning correctly.

Follow the guidelines below to check for proper A19PRC temperature control operation.

For Heating applications: turn the dial clockwise to a setpoint greater than the space temperature, and the heating system should cycle on. Turn the dial counterclockwise to a setpoint less than the space temperature, and the heating system should cycle off.

For Cooling or Ventilating applications: turn the dial clockwise to a setpoint greater than the space temperature, and the ventilating or cooling system should cycle off. Turn the dial counterclockwise to a setpoint less than the space temperature, and the ventilating or cooling system should cycle on.

If the temperature control does not operate in the manner described above, check the wiring for short circuits and tightness of wiring connections.

Repairs and Replacement

The A19PRC controls are not field reparable; do not attempt to repair a control that is not functioning properly. Contact your Johnson Contols/PENN sales representative or authorized distributor for a replacement control.

Technical Specifications

Product	A19PRC Type Temperature Controls with NEMA 4X Raintight Enclosures						
Switch Contact Ratings	**Applied VAC**	**24**	**120**	**208**	**240**	**277**	**600**
	Motor, Full Load Amperes	-	16	9.2	8	-	-
	Motor, Locked Rotor Amperes	-	96	55.2	48	-	-
	Non-inductive, SPST Amperes	-	22	22	22	22	-
	Non-inductive, SPDT Amperes	-	16	16	16	16	-
	Pilot Duty Volt-Amperes	125	125	125	125	125	125
Ambient Operating Conditions	-26 to 140°F; (-32 to 60°C)						
Ambient Storage Conditions	-40 to 140°F; (-40 to 60°C)						
Shipping Weight	1.2 lb (0.54 kg)						
Agency Listings	UL Listed; File E6688, CCN XAPX (US) and XAPX7 (Canada) UL Listed as Type 4X and for NEC Article 547 Agricultural Environments						

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

JOHNSON CONTROLS

Controls Group
507 E. Michigan Street
P.O. Box 423
Milwaukee, WI 53201

Published in U.S.A.
www.johnsoncontrols.com

A19QSC Type Temperature Controls with NEMA 4X Raintight Enclosures

Installation Instructions

Part No. 24-7664-2667, Rev. —
Issued August 23, 2006

Application Requirements

IMPORTANT: The A19QSC Type Temperature Controls are intended to control equipment under normal operating conditions. Where failure or malfunction of an A19QSC control 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) intended to warn of or protect against failure or malfunction of an A19QSC control must be incorporated into and maintained as part of the control system.

The A19QSC type electromechanical temperature controls are designed for use in many agricultural applications. For installations that require National Electrical Code (NEC) Article 547 compliance, use a series A19P or T19P control. The A19QSC controls have rugged Noryl plastic enclosures and are UL Listed as Type 4X. See Figure 1 and the *Technical Specifications* section for additional information.

The adjustable A19QSC type temperature controls have internal setpoint adjustment dials and range scales.

IMPORTANT: Do not dent, bend, or otherwise alter the sensing element bulb of the A19QSC controls. Damaging the sensing element bulb may change the control calibration and voids any warranties on the control.

Dimensions

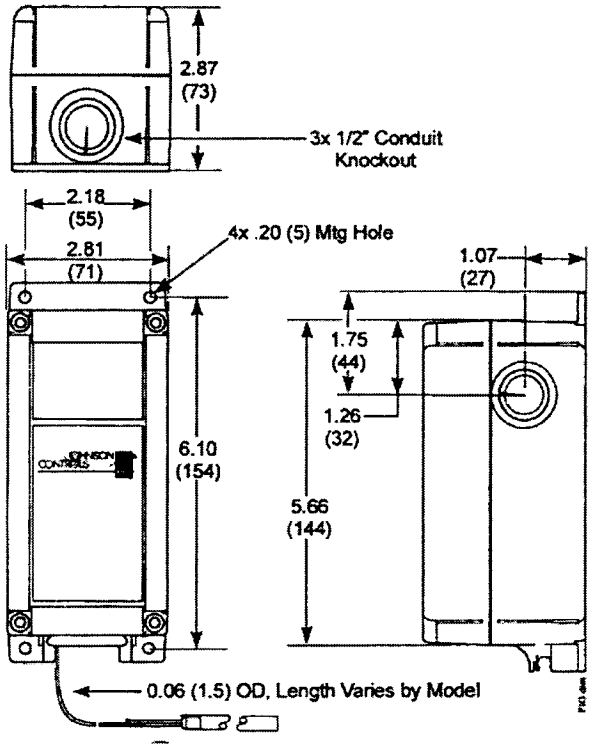


Figure 1: Dimensions for A19QSC Temperature Controls with NEMA 4X Enclosures, in. (mm)

Mounting

Mount the temperature control to a flat surface with screws through the holes in the mounting ears on the back of the case. See Figure 1.

Do not mount on an outside wall or where the temperature at the enclosure exceeds 140°F (60°C).

Wiring

WARNING: Risk of Electric Shock. Disconnect each of multiple power supplies before making electrical connections. More than one disconnect may be required to completely de-energize equipment. Contact with components carrying hazardous voltage can cause electric shock and may result in personal injury or death.

IMPORTANT: All wiring must conform to all local, national, and regional regulations. Use copper conductors only for all wire connections.

IMPORTANT: Do not use A19 temperature controls on applications where the electrical load across the control's switch may exceed the electrical ratings shown on the temperature control's label.

IMPORTANT: Use only the terminal screws furnished with the switch. Using other screws in the switch voids the warranty, may damage the switch, and can cause problems with making secure connections.

There are three 1/2 in. (trade-size) conduit knockouts on the A19QSC NEMA 4X enclosure. To make wiring connections, proceed as follows:

1. Loosen the four cover screws and remove the cover. Do not damage the O-ring seal.
2. Select the knockout to be removed. Place a screwdriver blade on the knockout near the edge. Apply a sharp blow to the screwdriver handle to loosen the knockout.
3. For watertight connection to rigid conduit, connect an approved watertight conduit fitting to the conduit first, and then connect the fitting to the A19QC control enclosure.
4. Insert wire through conduit opening.
5. Make wiring connections to the screw terminals. See Figure 2, Figure 3, and Figure 4.
6. Verify the O-ring seal is properly seated.
7. Replace the cover.

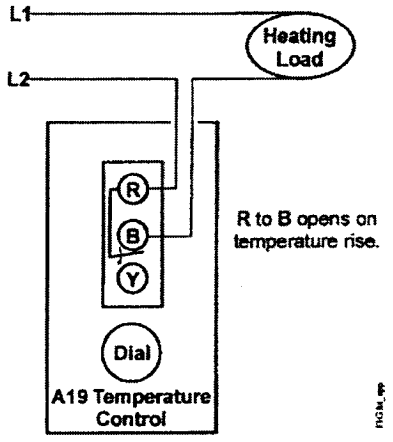


Figure 2: Typical Wiring for Heating Applications

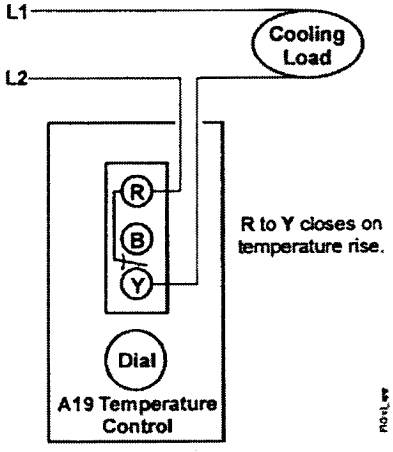


Figure 3: Typical Wiring for Cooling Applications

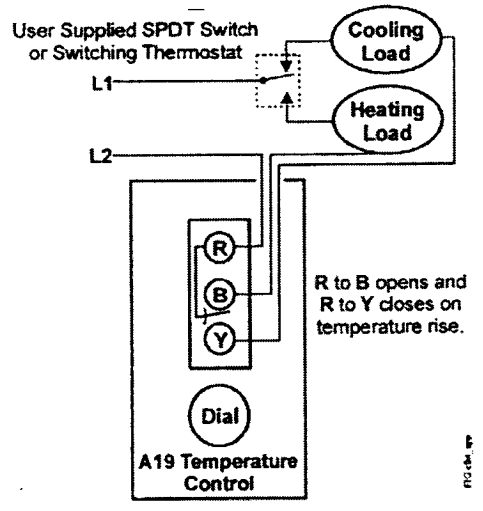


Figure 4: Typical Wiring for Combination Heating and Cooling Applications

Setup and Adjustments

Turn the knob inside the temperature control to change the control temperature setpoint.

Before leaving the installation, observe at least three complete operating cycles of the controlled equipment to ensure that all components are functioning correctly.

Follow the *Operation* guidelines to check for proper A19QSC temperature control operation.

For heating applications:

1. Turn the dial clockwise to a setpoint greater than the sensed temperature. The heating system should cycle on.
2. Turn the dial counterclockwise to a setpoint less than the sensed temperature and the heating system should cycle off.

For cooling or ventilating applications:

1. Turn the dial clockwise to a setpoint greater than the sensed temperature and the ventilating or cooling system should cycle off.
2. Turn the dial counterclockwise to a setpoint less than the sensed temperature and the ventilating or cooling system should cycle on.

If the temperature does not operate in the manner described previously, check the wiring and tightness of wiring connections.

Operation

When the temperature at the sensing element rises to the setpoint (dial setting), the switch between R and Y closes and the switch between R and B opens on SPDT models. See Figure 2, Figure 3, and Figure 4.

Repair Information

If the A19QSC type electromechanical temperature control fails to operate within its specifications, replace the unit. For a replacement A19QSC control, contact the nearest Johnson Controls/PENN® representative.

Technical Specifications

A19QSC Type Temperature Controls with NEMA 4X Raintight Enclosures

Switch Contact Ratings	**Applied VAC**	**24**	**120**	**208**	**240**	**277**	**600**
	Motor, Full Load Amperes	-	16	9.2	12	-	-
	Motor, Locked Rotor Amperes	-	96	55.2	72	-	-
	Non-inductive, Single-Pole, Single-Throw (SPST) Amperes	-	22	22	22	22	-
	Non-inductive, Single-Pole, Double-Throw (SPDT) Amperes	-	16	16	16	16	-
	Pilot Duty Volt-Amperes	125	125	125	125	125	125
Ambient Operating Conditions	-26 to 140°F (-32 to 60°C)						
Ambient Storage Conditions	-40 to 140°F (-40 to 60°C)						
Shipping Weight	1.2 lb (0.54 kg)						
Compliance	UL Listed; File E6688, CCN XAPX (US) and XAPX7 (Canada) UL Listed as Type 4X						

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

JOHNSON CONTROLS

Controls Group
507 E. Michigan Street
Milwaukee, WI 53202

All other marks herein are the marks of their respective owners.
© 2006 Johnson Controls, Inc.

Published in U.S.A.

www.johnsoncontrols.com

A19 Series

Fan or Cutout Control (Liquid Expansion Bulb)

Description

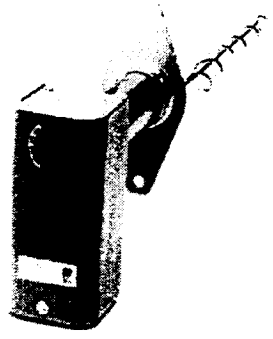
Wide range temperature control with adjustable dial stops and mounting flange.

Features

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

Applications

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



A19EBA, A19EBB, A19EBC
A19EDB
(A19EDB not for use as limit control)

Selection Chart

A19 Series Fan or Cutout Control (Liquid Expansion Bulb)

Code Number	Application	Switch Action	Range °F (°C)	Diff F° (C°)		Adj. Stop °F (°C)		Bulb Length	Max. Bulb Temp °F (°C)
				Min	Max	Min	Max		
A19EBA-1C	Furnace Fan Control	Close High SPST	50 to 250 (10 to 121)	9 (5)	36 (20)	145 (63)	250 (121)	6 in.	290 (143)
A19EBB-1C	Warm Air	Open High SPST	100 to 350 (38 to 177)	9 (5)	36 (20)	240 (116)	350 (177)	6 in.	375 (191)
A19EBC-1C	Counter-Flow Warm Air Furnace	SPDT	100 to 350 (38 to 177)	9 (5)	36 (20)	240 (116)	350 (177)	6 in.	375 (191)
A19EDB-1C[1]	Warm Air With Lock Out	Open High SPST	100 to 350 (38 to 177)	Manual Reset		240 (116)	350 (177)	6 in.	375 (191)

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

Replacement Parts

Code Number	Description
CVR28A-618R	Visible scale cover

Technical Specifications

Electrical Ratings

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

The performance specifications are nominal and conform to acceptable industry standards. For applications at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products. © 2009 Johnson Controls, Inc.

A19

Flange Mounted Duct Thermostat

Description

This is a wide-range temperature control with a special air coil sensing element and an adjustable mounting flange.

Applications

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

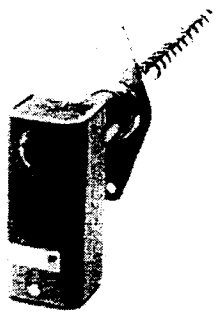
Features

- 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

Technical Specifications

Electrical Ratings

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



A19EAF

Selection Charts

A19 Flange Mounted Duct Thermostat

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

Replacement Parts

Code Number	Description
CVR28A-618R	Visible scale cover

The performance specifications are nominal and conform to acceptable industry standards. For applications at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products. © 2009 Johnson Controls, Inc.

A19 Series

Hot Water Temperature Control (Well Immersion)

Description

This is a universal replacement control for open high or SPDT applications. The control is furnished with a well assembly for 1/2 inch tapping.

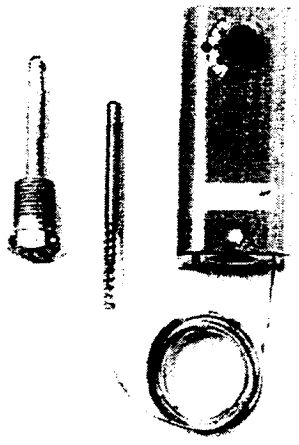
Features

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

Applications

This operating control is ideal for hot water boilers.

A19ABC-11



A19ABC-12

Selection Charts

A19 Series Hot Water Temperature Control (Well Immersion)

Code Number	Application	Switch Action	Range °F (°C)	Diff F° (C°)	Well Conn. Size–NPT	Range Adjuster	Max. Bulb Temp. °F (°C)
A19ABC-11C	Open High (R-B) Open Low (R-Y)	SPDT	100 to 240 (38 to 116)	6 to 24 (3 to 13)	1/2 in.	Convertible	250 (121)
A19ABC-12C					1/2 in., 8 ft. Cap.		290 (143)
A19ADB-2C	High Temp. Lockout	SPST Open High with Lockout	100 to 240 (38 to 116)	Manual Reset (locks out high)	1/2 in.	Knob	250 (121)

Replacement Parts

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

Technical Specifications

Electrical Ratings

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

The performance specifications are nominal and conform to acceptable industry standards. For applications at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products. © 2009 Johnson Controls, Inc.

A19 Series

Special Purpose Thermostat (Rubber-Coated Bulb and Capillary)

Description

This thermostat's rubber-coated bulb is designed for direct immersion.

Features

The rubber-coated bulb and capillary provide corrosion resistance.

Applications

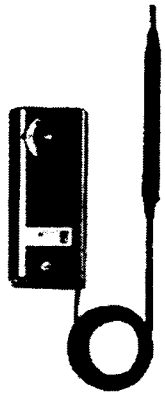
This control is designed for use in cooling towers.

Technical Specifications

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

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 or Resistance Load A (not lamp loads)	10 A, 120 to 277 VAC		
Pilot Duty – 125 VA, 24 to 277 VAC			



A19AAF-4

Selection Charts

A19 Series Special Purpose Thermostat (Rubber-Coated Bulb and Capillary)

Code Number	Switch Action	Range °F (°C)	Diff F° (C°)	Bulb and Capillary	Range Adjuster	Max. Bulb Temp. °F (°C)
A19AAF-4C	SPDT	40 to 90 (4 to 32)	1-1/2 (0.8)	3/8 in. x 5-3/4 in. Rubber-coated 6 ft. Cap.	Screwdriver slot	140 (60)

Replacement Parts

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

The performance specifications are nominal and conform to acceptable industry standards. For applications at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products. © 2009 Johnson Controls, Inc.

Show Details

N50-2 Tech meeting, B7F3 South Team room

Thu 02/11/2010 9:00 AM - 10:00 AM (Repeats)

Attendance is **required** for Douglas J Hoeffel

Chair: **Alan Bronikowski/CORP/Johnson_Controls**

No Location Information

Required:	Douglas J Hoeffel/NA/Johnson_Controls@Johnson_Controls, Eric A Beales/EXT/Johnson_Controls@Johnson_Controls
Repeats:	This entry repeats ⊞ View Dates

Description

Discuss software technical issues on the N50-2 project

Personal Notes

A19 Series

Thermostat for Crop Drying

Description

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

Technical Specifications

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

Electrical Rating 120 VAC

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

Features

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

Applications

Crop drying thermostat energizes gas valve to maintain temperature.

A19AAE-3

Selection Chart

Code Number	Switch Action	Range °F (°C)	Diff F°(C°)	Bulb and Capillary	Range Adjuster	Max. Bulb Temp °F (°C)
A19AAE-3C	SPST Open High	80 to 180 (27 to 82)	2 (1.1) Fixed	1/8 in. x 1 1/4 in. Copper-coiled 10 ft Cap.	Knob Ext. Scale	200 (93)
A19ABB-2C	SPST Open High	50 to 200 (10 to 93)	6 to 24 (3 to 13) Adjustable	0.290 in. x 2 1/2 in. 10 ft Cap.	Knob Ext. Scale	240 (116)

The performance specifications are nominal and conform to acceptable industry standards. For applications at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products. © 2009 Johnson Controls, Inc.