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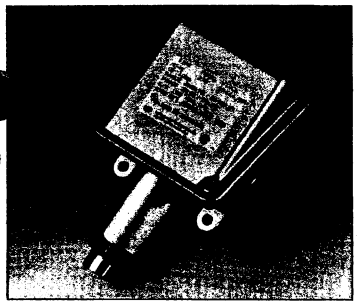
APPENDIX D-4 PRESSURE SWITCH

- United Controls Series 100
- NOSHOCK Series 300
- AllenBradley Bulletin 836



100 Series Pressure Switch

Types H100, H100K (Differential Pressure)

UNITED ELECTRIC CONTROLS

Installation and Maintenance Instructions

Please read all instructional literature carefully and thoroughly before starting. Refer to the final page for the listing of Recommended Practices, Liabilities and Warranties.

GENERAL

The H100 and H100K differential pressure switches are activated when bellows, diaphragm or piston sensor responds to a pressure change. This response, at a pre-determined set point, actuates a single snap-acting switch, converting the pressure signal into an electrical signal. Control set point may be varied by turning the internal adjustment hex. (See Adjustment -PART II).

Part I - Installation

Tools Needed
Adjustable Wrench
Screwdriver
Hammer (for alternate wire knockouts)

INSTALL UNIT WHERE SHOCK, VIBRATION AND TEMPERATURE FLUCTUATIONS ARE MINIMAL. ORIENT UNIT SO THAT MOISTURE IS PREVENTED FROM ENTERING THE ENCLOSURE. IF UNIT IS BEING INSTALLED WHERE HEAVY CONDENSATION IS EXPECTED, VERTICAL MOUNTING (PRESSURE CONNECTION DOWN) IS REQUIRED. DO NOT MOUNT IN AMBIENT TEMPERATURES EXCEEDING PUBLISHED LIMITS.

Controls may be mounted and operated in any position. They may be surface mounted via the two mounting ears on either side of the enclosure, or directly to a rigid pipe by using the pressure connection. Low pressure and differential pressure units, models 520-535, 540-543, 544-548, are also available with an optional surface mounting bracket. Should the control be installed where condensation is expected, vertical mounting is recommended as a means or keeping water away from switch terminals.

Never use the enclosure for leverage to hand tighten the pressure connection. Always use a wrench to tighten the pressure connection to the pipe.To prevent damaging the pressure sensor, use a back-up wrench to hold the hex nut in place when surface mounting.

On models supplied with an external manual reset button, be sure to leave sufficient finger space over the reset button for the operator to reset the control. See Mounting Diagram.

DISCONNECT ALL SUPPLY CIRCUITS BEFORE WIRING.

ELECTRICAL RATINGS STATED IN LITERATURE AND ON NAMEPLATES SHOULD NEVER BE EXCEEDED. OVERLOAD ON A SWITCH CAN CAUSE FAILURE ON THE FIRST CYCLE.

WIRE UNITS ACCORDING TO NATIONAL AND LOCAL ELECTRICAL CODES. MAXIMUM RECOMMENDED WIRE SIZE IS14 AWG.

Remove the two screws retaining the cover and cover gasket. Two cast-in knockouts for 1/2" conduit are located on the side and back of enclosure. These can easily be knocked out by placing the blade of a screwdriver in the groove and rapping sharply with a hammer. A 1/2" NPT conduit connection is also provided on the left hand side of the enclosure. The three switch terminals are clearly labeled "common", "normally open" and "normally closed". For switches supplied with leadwires, the following color coding applies:

	Man. Res. SPDT	DPDT (Option 1010) SWT1	SWT2
Common	Violet	Violet	Yellow
Normally Open	Blue	Blue	Orange
Normally Closed	Black	Black	Red

Grounding screw and clamp (cast in symbol) is provided. Keep the wire as short as possible to prevent interface with the plunger and the adjustable differential switch wheel, if applicable.

art II - Adjustments

Tools Needed
5/8" Open End Wrench

SOME MODELS HAVE A TWO-PIECE, ADJUSTABLE PLUNGER. THIS FEATURE IS CHARACTERIZED BY A 3/16" HEX HEAD SCREW INSTALLED IN THE 1/4" HEX PLUNGER. THE LENGTH OF THIS ASSEMBLY IS ADJUSTED AT THE FACTORY AND IS CRITICAL TO THE FUNCTION OF THE CONTROL.

DURING NORMAL CALIBRATION, THIS ADJUSTMENT SHOULD NOT BE DISTURBED. HOWEVER WHEN REPLACING THE ELECTRICAL SWITCH, IT MAY BE NECESSARY TO ADJUST THE PLUNGER LENGTH IN ORDER TO "RE-GAP" THE SWITCH. REFER TO INSTRUCTIONS IN "PART III-REPLACEMENTS" TO DETERMINE IF REGAPPING IS NECESSARY.

For set point adjustments and recalibration, connect control to a calibrated pressure source.

H100 and H100K

Remove pressure switch cover. Adjust set point by turning 5/8" hex adjustment screw clockwise (in) to raise set point, or counter clockwise (out) to lower set point. Tension on adjustment screw can be increased by tightening adjustment lock onto it. (See diagrams). Controls include uncalibrated reference scales for high, low or mid range settings.

Note: Models 190-193 (welded stainless steel diaphragms with NACE option, M411). These models are applications sensitive. For rising pressure applications, set point should be adjusted from low pressure up to set point. For falling pressure applications set point should be adjusted from high pressure down to set point. Wide pressure cycling above and below set point can cause control band shift.

Adjustable Differential Models

Control types with option code 1519 incorporate a snap switch with internal adjustment wheel. Turning this wheel raises or lowers the pressure rise set point. The fall set point remains constant. Consult factory for additional information.

Manual Reset Button

Control types with option code 1530 incorporate a snap switch which when actuated, remains actuated until the pressure drops sufficiently to allow the reset button (located on top of the control) to be manually depressed to reset the switch.

Part III - Replacements

Tools Needed
Screwdriver
Adjustable Wrench

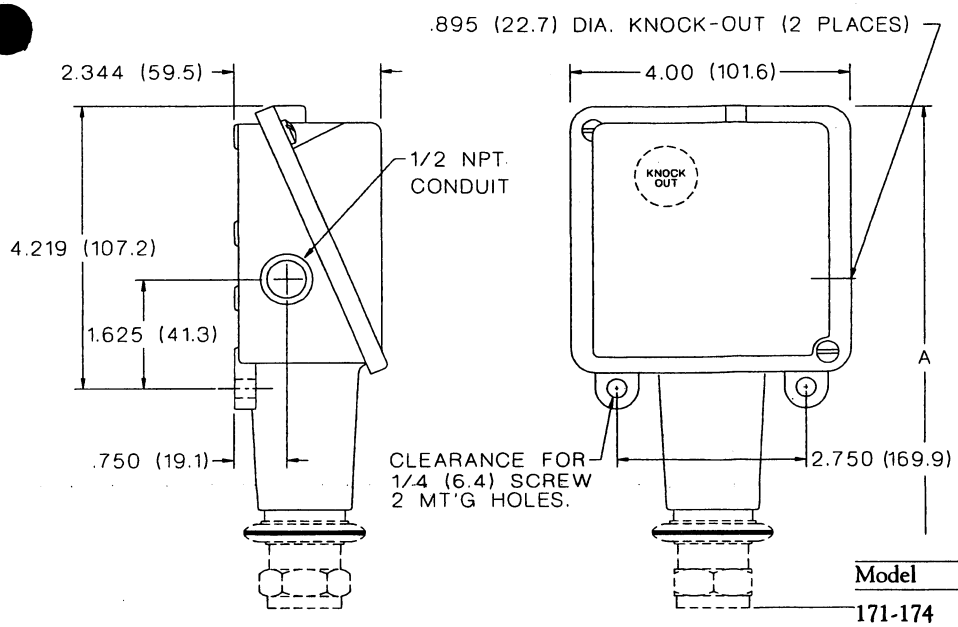
USE ONLY FACTORY AUTHORIZED REPLACEMENT PARTS AND PROCEDURES. COMPONENTS AVAILABLE FOR REPLACEMENT ARE THE SWITCHES. OTHER COMPONENTS FACTORY REPLACEABLE ONLY. DISCONNECT LIVE CIRCUITS BEFORE REPLACING THE SWITCH.

Switch Replacement (all models)

1. Disconnect lead wires from the terminals.
2. Remove switch mounting screws (2) and take out the switch and insulator.
3. Insert insulator and replacement switch. Orient switch plunger over the adjustment screw; tighten switch mounting screws securely.

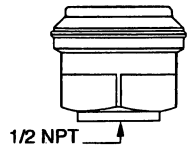
   Gapping
   Turn 5/8" hex adjustment screw in approximately mid range. This puts a load on the plunger sensor. Using a 1/4" wrench on the plunger and a 3/16" wrench on the plunger hex screw, turn hex screw out from plunger until switch actuates. (If switch is already actuated proceed to the next step.) Turn plunger hex screws in, until switch just transfers. Turn hex screw in a additional 2 - 2 1/2 flats from this point (approximately 1/3 turn). This will provide a 9-11 Mil gap. Follow set point adjustment procedure. Exceptions to the 2 - 2 1/2 flat gap: Model 194: gapped only 1 (one) flat; models 610-616: gapped 4 flats.
4. Check set point according to PART II.
5. Connect wires and replace cover securely.

Dimensions

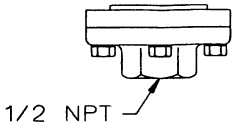


Dimension A

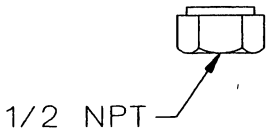
Model	Inches	mm	NPT
171-174	7.50	190,57	1/2
183-186	7.56	192,07	1/2
188,189	6.62	168,27	1/2
190-194	6.63	168,27	1/2
218-274	6.56	166,67	1/4
358-376	7.03	176,99	1/4
483-486	7.56	192,07	1/2
488,489	6.62	168,27	1/2
490-494	6.63	168,27	1/2
520-525	8.44	214,30	1/2
530-535	8.00	203,20	1/2
540-543	8.63	219,10	1/8
544-548	8.69	220,70	1/8
560-564	6.62	168,3	2 Sanitary fitting
565-567	6.62	168,3	1 1/2 Sanitary fitting
610-616	7.00	177,80	1/4
680	6.97	177,04	1/4
701-713	6.57	166,67	1/4



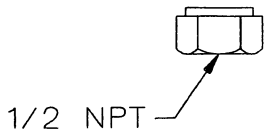
Models 171-174, 471-474



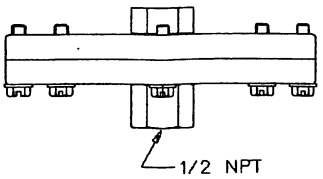
Models 183-189, 483-489



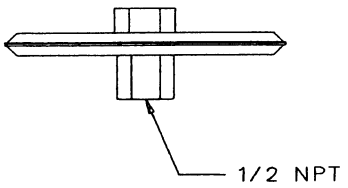
Models 190-194. 490-494



Models 218-376, 610-713

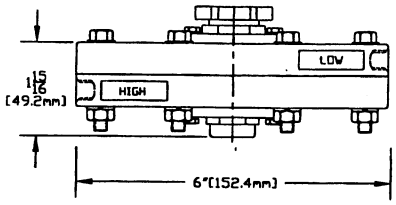


Models 520-525

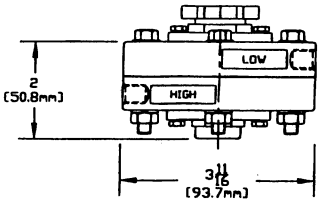


Models 530-535

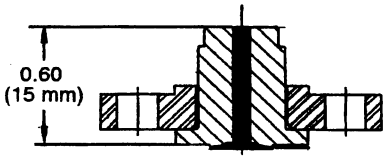
Dimensions



Model 540-543

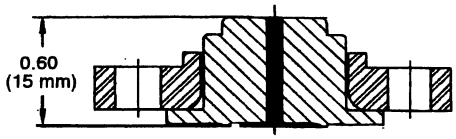


Models 544-548



1 1/2" Sanitary Fitting

Models 560-564



2" Sanitary Fitting

Models 565-567

UNITED ELECTRIC CONTROLS
180 Dexter Avenue, P.O. Box 9143
Watertown, MA 02272-9143 USA
Phone: 617 926-1000 Fax: 617 926-2568

RECOMMENDED PRACTICES

United Electric Controls Company recommends careful consideration of the following factors when specifying and installing UE pressure and temperature units. Before installing a unit, the Installation and Maintenance instructions provided with unit must be read and understood.

- To avoid damaging unit, proof pressure and max temperature limits stated in literature and on nameplates must never be exceeded, even by surges in the system. Operation of the unit up to proof pressure or max temperature is acceptable on a limited basis (i.e.start-up, testing) but continuous operation must be restricted to the designated adjustable range. Excessive cycling at proof pressure or maximum temperature limits could reduce sensor life.
- A back-up unit is necessary for applications where damage to a primary unit could endanger life, limb or property. A high or low limit switch is necessary for applications where dangerous runaway condition could result.
- The adjustable range must be selected so that incorrect, inadvertent or malicious setting at any range point can not result in an unsafe system condition.
- Install unit where shock, vibration and ambient temperature fluctuations will not damage unit or affect operation. Orient unit so that moisture does not enter the enclosure via the electrical connection.
- Unit must not be altered or modified after shipment. Consult UE if modification is necessary.
- Monitor operation to observe warning signs of possible damage to unit, such as drift in set point. Check unit immediately.
- Preventative maintenance/periodic testing is necessary for critical applications where damage could endanger property/ personnel.
- For all applications, a factory set unit should be tested before use.

Electrical ratings stated in literature and on nameplate must not be exceeded. Overload on a switch can cause damage, possible on the first cycle. Wire unit according to local and national electrical codes, using wire size recommended in installation sheet.

- Use only factory authorized replacement parts and procedures.
- Do not mount unit in ambient temp. exceeding published limits.
- For remote mounted temperature units, capillary lengths beyond 10 feet can increase chance of error, and may require re-calibration of set point and indication.

LIMIT WARRANTY

UE warrants that the product thereby purchased is, upon delivery, free from defects in material and workmanship and that any such product which is found to be defective in such workmanship or material will be repaired or replaced by UE (F.O.B. UE); provided, however, that this warranty applies only to equipment found to be so defective within a period of 12 months after installation by buyer but not to exceed 18 months after delivery by the seller. **Except for the limited warranty of repair and replacement stated above, UE disclaims all warranties whatsoever with respect to the product, including all implied warranties of merchantability or fitness for any particular purpose.**

LIABILITY LIMITATION

The sole and exclusive remedy of buyer for any liability or seller for any claim, including incurred in connection with (I) breach of any warranty whatsoever expressed or implied, (II) a breach of contract, (III) a negligent act or acts (or negligent failure to act) committed by seller, or (IV) an act for which strict liability will be imputed to seller, is limited to the limited warranty or repair and replacement stated herein. **In no event shall the seller be liable for any special, indirect, consequential or other damages or like general nature, including, without limitation, loss of profits or production, or loss or expenses of any nature, incurred by the buyer or any third party.**

IKON5M0898

Mechanical Compact SPDT with Adjustable Hysteresis

300 SERIES

- Switch adjustment ranges from 3 psig to 30 psig through 450 psig to 4,600 psig
- Standard zinc-plated steel with NBR diaphragm (< 225 psig); steel piston with NBR seal (> 225 psig) wetted parts
- SPDT single changeover contact configuration
- RoHS compliant

APPLICATIONS

- Hydraulics & pneumatics
- Pumps & compressors
- Tank monitoring
- Leak detection
- Water management

SPECIFICATIONS

Switching parameters	
Number	1
Function	SPDT, micro switch
Contact rating	Up to 28 Vdc 2A Up to 125 Vac 4A Up to 250 Vac 4A
Non-repeatability	±2% of full scale adjustment range
Contact material	Silver-plated
Frequency	Max. 100 cycles/min
Media	Diaphragm type, compressed air or not corrosive liquids Piston type, self lubricating fluids such as hydraulic oil or grease
Pressure ranges	3 psig to 30 psig through 450 psig to 4,600 psig Diaphragm type: 870 psi max.; Piston type: 5,000 psi max.
Switch adjustment	
Switch point	Full scale
Hysteresis	Adjustable, 10-30% depending on switch point
Durability	>1,000,000 cycles
Temperature ranges	Media -4 °F to 176 °F (-20 °C to 80 °C) Ambient -4 °F to 176 °F (-20 °C to 80 °C) Storage -4 °F to 176 °F (-20 °C to 80 °C)
Proof pressure	870 psig or 5,000 psig depending on adjustment range
Measuring element	NBR diaphragm < 225 psig; steel piston with NBR seal > 225 psig 1/4″ NPT zinc-plated steel standard connection, others available on request
Housing material	Zinc-plated steel
Environmental rating	IP65
Weight	Approximately 0.2 lb.

ORDERING INFORMATION				
SERIES	**300**			
SWITCH FUNCTION	**1**	Single changeover contact, SPDT		
PROCESS CONNECTION	**2**	1/4″ NPT male		
SWITCH ADJUSTMENT RANGES *(Max. working pressure)*	**3/30**	3 psig to 30 psig (870 psig)	**150/1700**	150 psig to 1,700 psig (5,000 psig)
	7/115	7 psig to 115 psig (870 psig)	**150/2300**	150 psig to 2,300 psig (5,000 psig)
	15/225	15 psig to 225 psig (870 psig)	**300/2900**	300 psig to 2,900 psig (5,000 psig)
	150/425	150 psig to 425 psig (5,000 psig)	**300/3600**	300 psig to 3,600 psig (5,000 psig)
	150/1150	150 psig to 1,150 psig (5,000 psig)	**450/4600**	450 psig to 4,600 psig (5,000 psig)
ELECTRICAL CONNECTIONS	**1**	36″ Cable (connected to option 8)	**8**	Hirschmann (DIN EN 175301-803 form A)

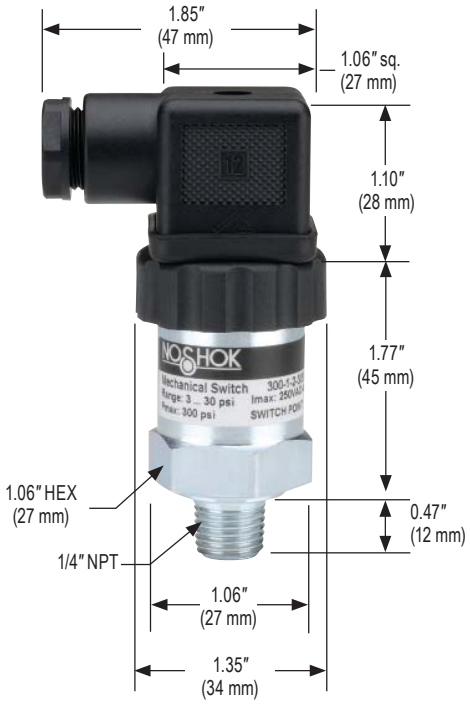
Please consult your local NOSHOK Distributor or NOSHOK, Inc. for availability and delivery information.

EXAMPLE

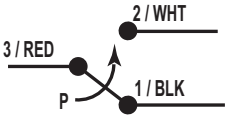
300 – 1 – 2 – 15/225 – 8

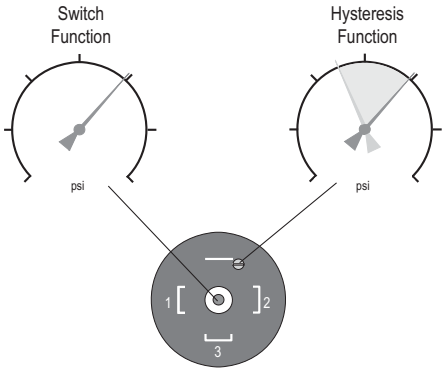
Series .....300 Series
Switch function.....Single changeover contact
Process connection .....1/4" NPT Male
Adjustable range .....15 psig to 225 psig
Electrical connection .....Hirschmann

Additional Ordering Information
Switch Set Point(s) (please specify)



Switching Output Schematic





Allen-Bradley

Condition Sensing Specifications

Bulletin Number 808, 836, 836T, 837, 840

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, http://www.ab.com	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at http://www.rockwellautomation.com/literature/. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

Technical Data

Technical Terms

Tank Operation — When the liquid in a tank reaches a preset low level, the float switch will start a pump to begin filling the tank. When the liquid level reaches a preset high level, the float switch will stop the pump.

Sump Operation — Liquid is being collected in a sump. When the liquid reaches a preset high level, the float switch will start a pump to empty the sump. When the liquid reaches a preset low level, the float switch will stop the pump.

Operating Force — Contact force required to trip the float switch. Operation depends on the type of switch, liquid, float, and float operator assembly.

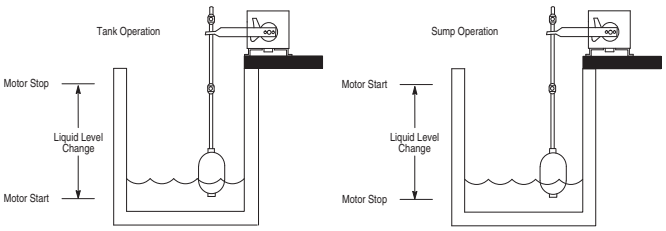
Turbulence — Waves or agitation in the liquid. Excessive turbulence may cause improper switch operation — for example, early switching or switching between operating points.

Buoyancy — Force supporting the float equal in magnitude to the weight of the displaced liquid.

Theory of Operation

Bulletin 840 Float Switches provide automatic control for motors that pump liquids from a sump or into a tank. The switch must be installed above the tank or sump, and the float must be in the liquid for the float switch to operate. **Tank Operation:** A float operator assembly is attached to the float switch by a rod, chain or cable. The float switch is actuated based on the location of the float in the liquid. The float switch contacts are open when the float forces the operating lever to the UP position. As the liquid level falls, the float and operating lever move downward. When the float reaches a preset low level, the float switch contacts close, activating the circuit and starting the motor. The contacts can directly activate a motor or provide input for a logic system to fill the tank. As the liquid level rises, the float and operating lever move upward. When the float reaches a preset high level, the float switch contacts open, deactivating the circuit and stopping the motor. **Sump Operation:** Sump operation is opposite tank operation.

Figure 1
Tank and Sump Operation



Temperature Range (Switch)

The temperature range for the switch mechanism at +32 °F (0 °C) or below is based on the absence of freezing moisture, water, or other fluids that may solidify and impede the operation of the control. Temperature ratings are as follows:

Operating: –22…+150 °F (–30…+66 °C)

Storage: –22…+200 °F (–30…+93 °C)

Temperature Range (Float)

The temperature range for the float mechanism at +32 °F (0 °C) or below is based on the absence of freezing moisture, water, or other fluids that may solidify and impede the operation of the control. Temperature ratings are as follows:

Operating and Storage:
–22…+200 °F (–30…+93 °C)

Conversions

Bulletin 840 **Styles A and B** Float Switches are assembled for tank operation but can be easily converted to sump operation. **Style A** switches can be changed from tank to sump operation by moving the float rod to the opposite end of the double arm lever.

Styles B switches can be converted in either of the following ways:

- Remove the lever, turn the shaft 90° counterclockwise and replace the lever in its original position.
- Remove the lever and replace 180° from the original position.

Style D is for tank operation only. **Style DS** is for sump operation only. These switches cannot be converted.

Contacts

Bulletin 840 Float Switches have a snap action mechanism for quick-make and quick-break contact operation. This feature provides high snap-through forces once the mechanism has traveled the required distance. See table below.

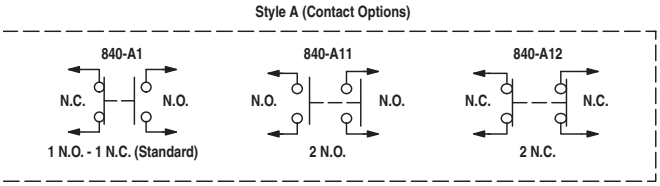
Maximum Contact Rating per Pole

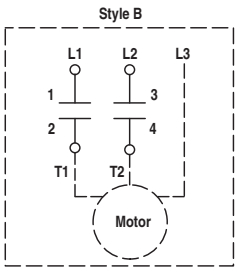
AC — NEMA A600					DC — NEMA N300		
Max. V AC	Make	Break	Make	Break	Max. V DC	Make	Break
120	60 A	6.0 A	7200V A	720V A	—	—	—
240	30 A	3.0 A	7200V A	720V A	125	2.2 A	2.2 A
480	15 A	1.5 A	7200V A	720V A	250	1.1 A	1.1 A
600	12 A	1.2 A	7200V A	720V A	—	—	—

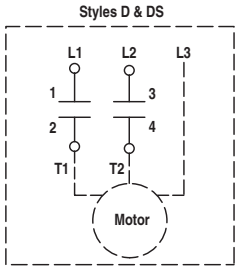
Maximum Horsepower Ratings

	Single-Phase AC		2- or 3-Phase AC		DC		
Style	115V	230V	115V	230-460-575V	32V	115V	230V
A — Tank or Sump	1	1	—	—	.025	0.25	0.125
B — Tank or Sump	1.5	3	—	2	—	1	1
D — Tank	1.5	2	2	3	0.25	0.5	0.5
DS — Sump	1.5	2	2	3	0.25	0.5	0.5

Contact Wiring Configurations





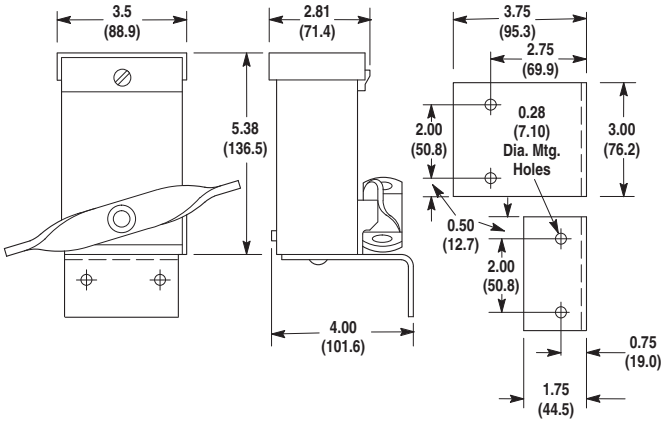


Approximate Dimensions

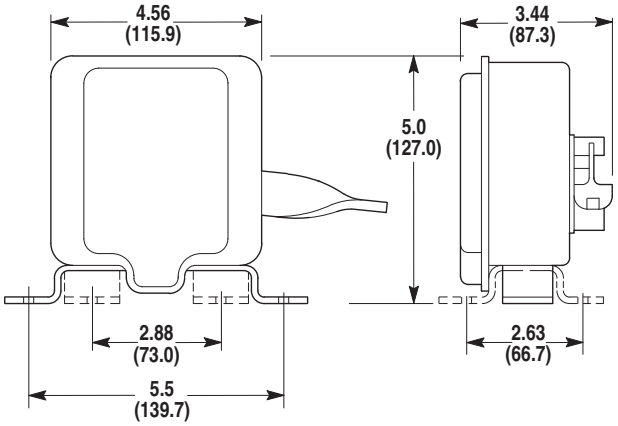
Approximate Dimensions and Shipping Weights

Dimensions in inches (millimeters). Dimensions are not intended to be used for manufacturing purposes.

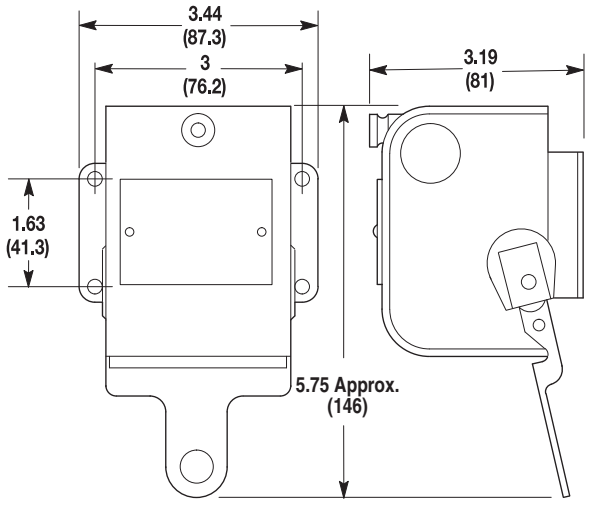
Type 1
Mounting Bracket



Style A —
Approximate Shipping Weight 4 lbs (1.8 kg)

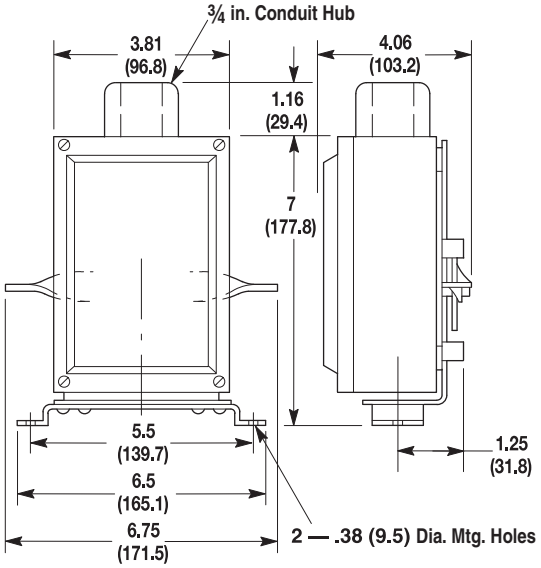


Style B —
Approximate Shipping Weight 3 lbs (1.4 kg)



Styles D and DS —
Approximate Shipping Weight 2 lbs (0.9 kg)

Type 4



Styles A and B —
Approximate Shipping Weight 4 lbs (1.8 kg)

Technical Data

Technical Terms

Adjustable operating range — Total span within which the contacts can be adjusted to trip and reset.

Trip setting — Higher pressure setting at which value the contacts transfer from their normal state to a changed state.

Reset setting — Lower pressure setting at which value the contacts return to their normal state.

Adjustable differential — Difference between the trip and reset values.

Minimum differential — When the differential is set to the lowest pressure difference between trip and reset.

Maximum differential — When the differential is set to the widest pressure difference between trip and reset.

Maximum occasional surge pressure — Maximum surge pressure that can be applied to the actuator. Surges or transients can occur during startup and shutdown of a machine or system. Expressed in milliseconds, complex electronic instrumentation is required to measure the varying amplitude, frequency, and duration of this wave form. Extreme surges that occur approximately eight times in a 24-hour period are negligible.

Maximum line pressure — Maximum sustained pressure that can be applied to the bellows without permanent damage. The control should not be cycled at this pressure.

Positive pressure — Any pressure more than 0 psi. See Figure 2.

- **Trip setting —** Increasing pressure setting when contacts change state.
- **Reset setting —** Decreasing pressure setting when contacts return to their normal state.

Vacuum (negative pressure) — Any pressure less than 0 psi, inches of Hg vacuum. See Figure 2.

- **Trip setting —** Decreasing vacuum setting when contacts change state.
- **Reset setting —** Increasing vacuum setting when contacts return to their normal state.

psi — Pounds per square inch. Devices listed are in gauge pressure units which use atmospheric pressure as a reference. Atmospheric pressure at sea level is approximately 14.7 psi or 30 in. Hg.

Operating range adjustment acrew — This screw is used to adjust the trip setting by varying the force of the main spring.

Differential adjustment screw — This screw is used to adjust reset setting by varying the force of the differential blade spring.

Pressure media — There are many types of pressure media that are controlled. Examples include air, water, hydraulic fluids and other types of gases and liquids. The type of media and maximum system pressure will determine the type of actuator used for the pressure control application. See page 13-9.

Pressure connection — Common types of pressure connections used in control systems are 1/4 in. and 3/8 in. female pipe threads, and 7/16 in. — 20 SAE copper tubing.

Contact configuration — There are many types of contact configurations available. Bulletin 836 Style A and C pressure controls offer a wide variety of contact configurations for both automatic operation and manual reset. See page 13-14.

Figure 1
Graphics to illustrate technical terms

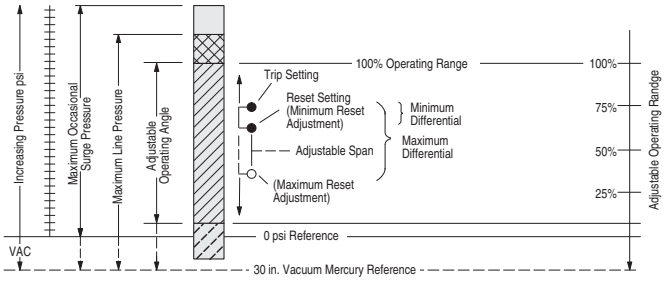
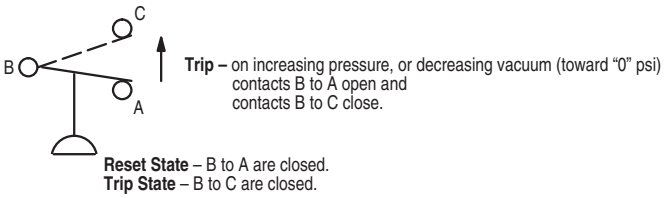


Figure 2
Positive pressure or vacuum



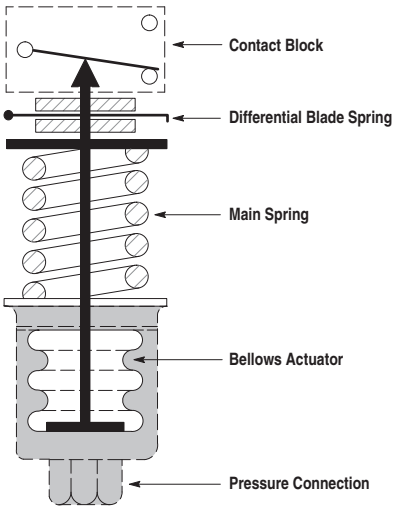
Theory of Operation

Bulletin 836 Pressure Controls are designed to open or close electrical circuits in response to changes in pneumatic (air or gas) or hydraulic (water or oil) pressure. Figure 3 is a simplified drawing of a pressure control.

The system pressure is connected to the control at the pressure connection. The system pressure is applied directly to the bellows. As pressure rises, the bellows exerts force on the main spring. When the threshold force of the main spring is overcome, it transfers the motion to the contact block, causing the contacts to actuate — this is referred to as the trip setting. As pressure decreases, the main spring will retract, causing the secondary differential blade spring to activate
and return the contacts to their normal state — this is referred to as reset setting.

Varying the force of the main spring (by turning the operating range adjustment screw) determines where the contacts will trip. Varying the force of the secondary differential blade spring (by turning the differential adjustment screw) determines where the contacts will reset.

Figure 3
Basic mechanical structure



Applications for Control

Pressure controls can be used to either control or monitor a machine or process. Figure 4 shows a typical control application. Here, pressure is controlled within predetermined high and low values. Figure 5 shows a typical monitoring application. Here, pressure is monitored between a high and low value, signaling when a preset limit has been exceeded.

Figure 4
Typical control application

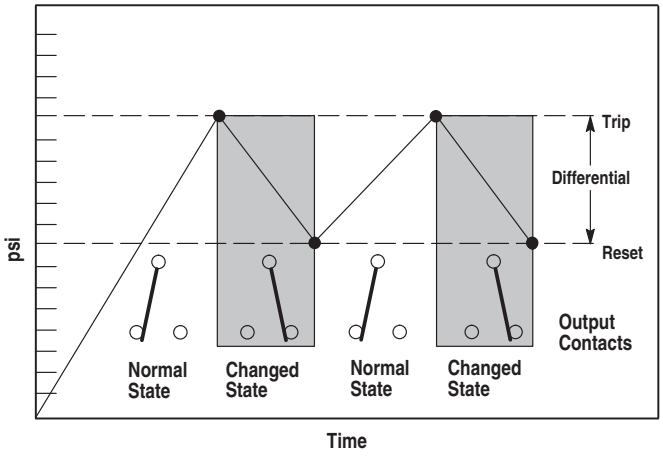
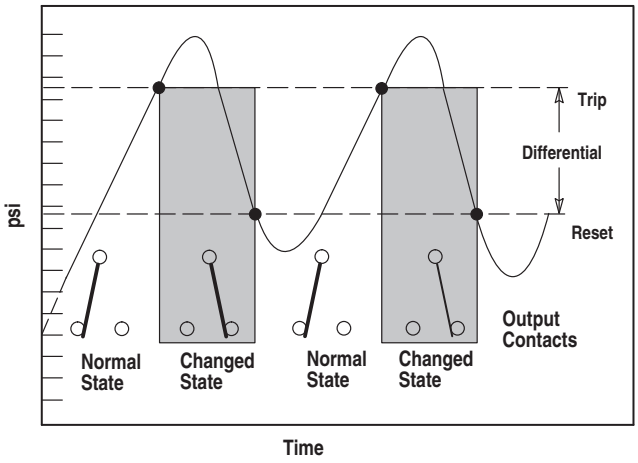


Figure 5
Typical monitoring application



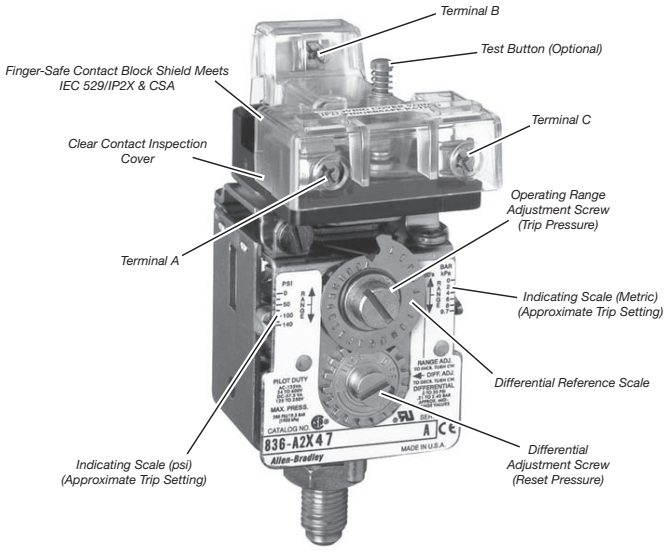
Control Settings

Allen-Bradley controls are designed for ease of setting to help minimize installation time. Standard controls shipped from the factory are set at the maximum operating range and minimum differential. By following this simple two-step process, the control can be set to the specific requirements for each application. See Figure 6.

Step 1 — Adjust trip setting
The trip setting is achieved by turning the operating range adjustment screw. Turn the range screw counterclockwise to lower the trip setting, or clockwise to raise the trip setting. The approximate trip setting is shown on the indicating scale.
Note: Turning the operating range adjustment screw will change both the trip and reset settings in virtually equal increments.

Step 2 — Adjust reset setting
The reset setting is achieved by turning the differential adjustment screw counterclockwise to increase the differential, or clockwise to decrease the differential.
Note: Adjusting the differential has little or no affect upon the trip setting.

Figure 6
Trip and reset adjustment

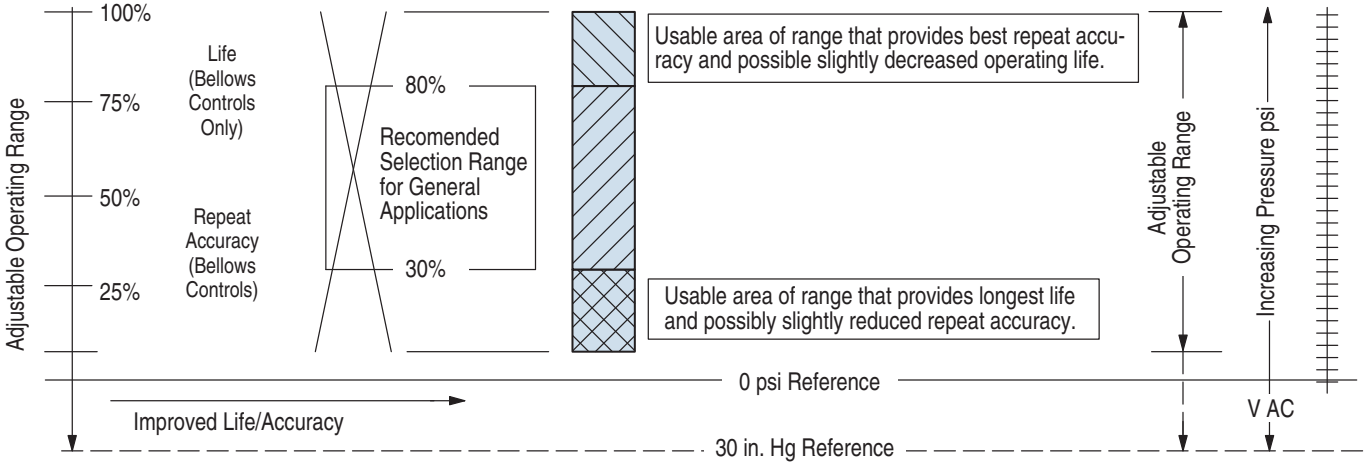


Repeat Accuracy and Mechanical Life

The design and construction of Bulletin 836 Styles A and C controls provide a typical repeat accuracy of + 0.5% or better. Repeat accuracy is based on percent of maximum range, evaluated from test data and calculated using the formula per ICS 2-225 standards.

Repeat accuracy and mechanical life of bellows type controls is graphically illustrated in Figure 7. For general applications, controls selected where the contacts operate between 30…80% of the operating range and where the maximum line and surge pressures do not exceed the specified values will provide excellent life and repeat accuracy. For more specific applications, it is important to note that the controls are designed to operate **below** or **above** these values. However, there may be a small trade-off between the factors of repeat accuracy and mechanical life.

Figure 7
Repeat accuracy versus mechanical life graph



Standard Contacts

Snap-action contact operation
Contact blocks are single-pole, double-throw and can be wired to open or close on increasing or decreasing pressures.

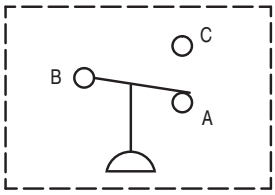
Non-inductive ratings
5 A, 240V
3 A, 600V

Control circuit ratings
AC - 125 VA, 24…600V
DC - 57.5 VA, 115…230V

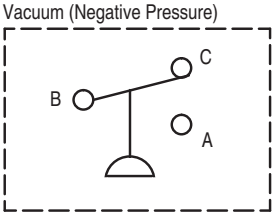
Standard Contact Wiring Configurations

Single-pole double throw

Positive Pressure



Vacuum (Negative Pressure)



Note: NEMA does not rate contacts to switch low voltage and current.
Bulletin 836 Styles A and C Pressure Controls are supplied with silver contacts. The devices are designed to deliver high-force snap action to the contacts. This provides exceptional contact fidelity at 24V DC I/O card current level entry when the control is protected in a suitable enclosure for the surrounding environment.

Special Controls

A large number of unlisted catalog modifications and complete devices are available for specific and OEM applications.

Special controls and modification service is available to meet many applications unique to the OEM market.

Please contact your local Rockwell Automation sales office or Allen-Bradley distributor for assistance with specific modified controls and accessories.

Temperature Range

Temperature range at +32 °F (0 °C) or below is based on the absence of freezing moisture, water, or other fluids that may solidify and impede operation of the control. Temperature ratings are as follows:

Operating:	–22… +150 °F (–30…+66 °C)
Storage:	–22…+200 °F (–30…+93 °C)

Factory-Set Pressure Controls

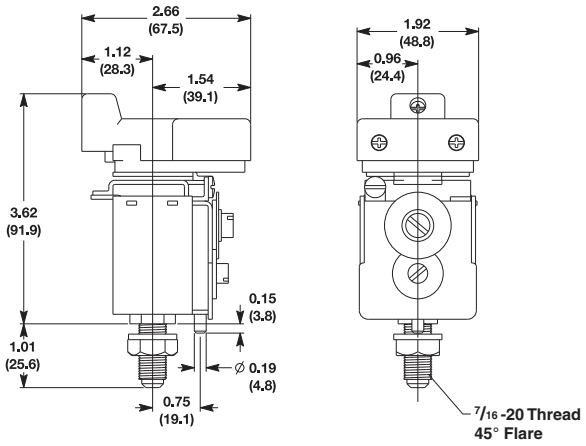
Rockwell Automation will factory set pressure control values to customer-specified values only if a Cat. No. 836-_C device is ordered. Catalog numbers ordered without the "C" suffix are set at the maximum operating range and minimum differential. See Factory Options.

Pressure Control Selection

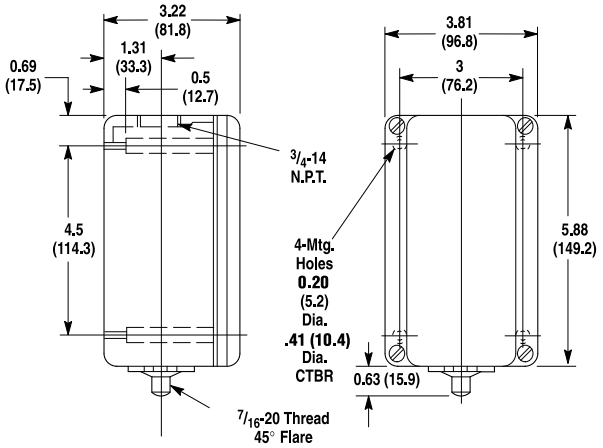
The selection table below is an overview of the three types of Allen-Bradley Bulletin 836 Pressure Controls. Each type of control is suitable for use on many types of applications. Pressure ranges, pressure connections, enclosure types, and the compatibility of the actuator with different types of pressure media are given to assist in the selection of which type of control to use.

	836 Style A	836 Style C	836 Style C
Actuator Type	Internal Bellows, Copper Alloy	External Bellows, Copper Alloy	External Bellows, Stainless Steel Type 316
Adjustable Operating Ranges	30 in. Hg Vacuum…375 psi	30 in. Hg Vacuum…900 psi	30 in. Hg Vacuum…375 psi
Adjustable Differentials	2…95 psi	0.2…125 psi	0.4…80 psi
Maximum Line Pressures	up to 750 psi	up to 1300 psi	up to 650 psi
Occasional Surge Pressures	up to 850 psi	up to 1600 psi	up to 650 psi
Pressure Media			
Air	•	•	•
Water	•	•	•
Hydraulic Fluids	•	•	•
Liquids: Corrosive★			•
Non-Corrosive	•	•	•
Gases: Corrosive★			•
Non-Corrosive	•	•	•
Enclosures			
Open Type	•	•	•
Type 1	•	•	•
Type 4 & 13	•	•	•
Type 4X		•	•
Type 7 & 9 and 4 & 13	•	•	•
Pipe Connections			
Pressure Connection	7/16 in.-20 SAE Flare for 1/4 in. Copper Tubing	1/4 in. N.P.T.F. Internal Pipe Thread or 3/8 in. N.P.S.F. Internal Pipe connection (**836-C1** and **836-C1A** only)	1/4 in. N.P.T.F. Internal Pipe Thread

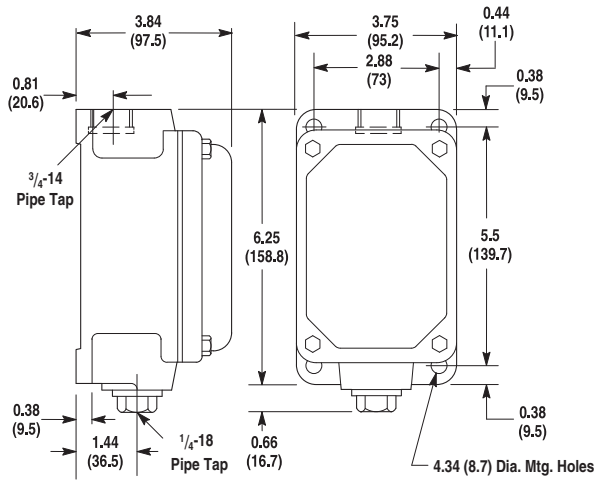
★ Corrosive liquids and gases compatible with Type 316 Stainless Steel.



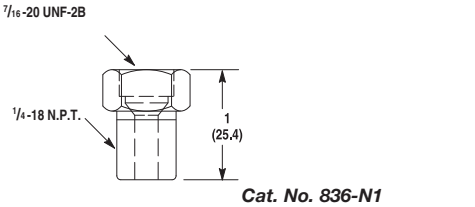
Open Type
Approximate Shipping Weight 1 lb. (0.45 kg)



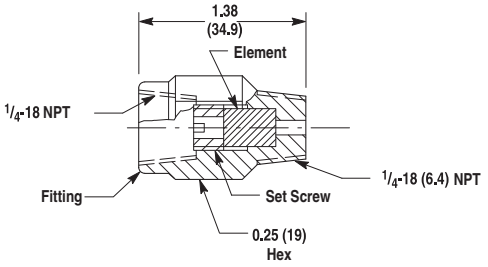
Type 4 & 13
Approximate Shipping Weight 3 lbs (1.4 kg)



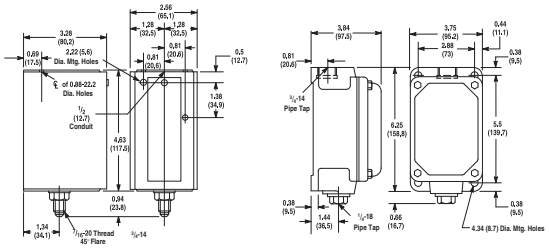
Type 7 & 9 and 4 & 13
Approximate Shipping Weight 9 lbs (4.1 kg)



Cat. No. 836-N1
Approximate Shipping Weight 1/4 lb (0.1 kg)



Cat. No. 836-N40
Approximate Shipping Weight 1/4 lb (0.1 kg)

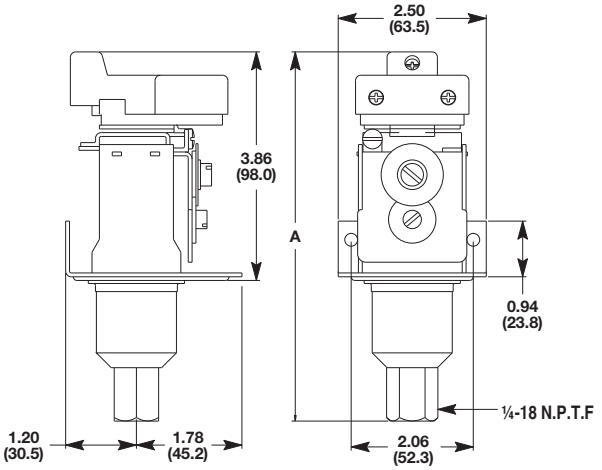


Type 1
Approximate Shipping Weight 2 lbs (0.91 kg)

Approximate Dimensions and Shipping Weights

Dimensions in inches (millimeters). Dimensions are not intended to be used for manufacturing purposes.

Style C



Open Type
Approximate Shipping Weight 1.3 lbs. (.60 kg)★

Pressure Controls

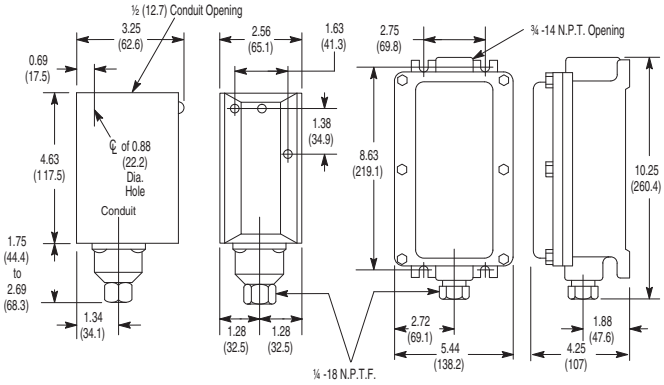
Approximate Dimensions

Approximate Dimensions and Shipping Weights

Dimensions in inches (millimeters). Dimensions are not intended to be used for manufacturing purposes.

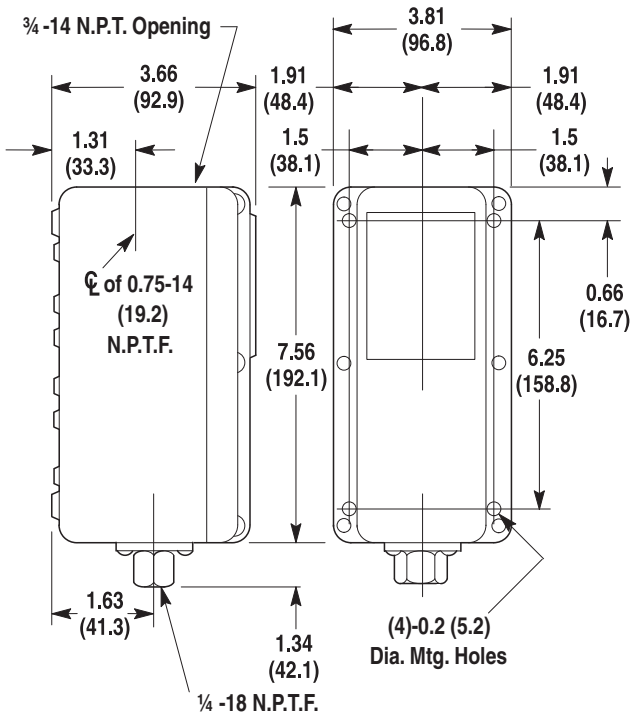
Style A

Cat. No.	Dimension A
C2, C3, C60, C61	6.11 (155)
C4	5.99 (152)
C5, C64	5.94 (151)
C6, C62	6.29 (160)
C7, C63	6.24 (158)
C8, C9	5.56 (141)
C10, C11, C12, C65	5.78 (147)

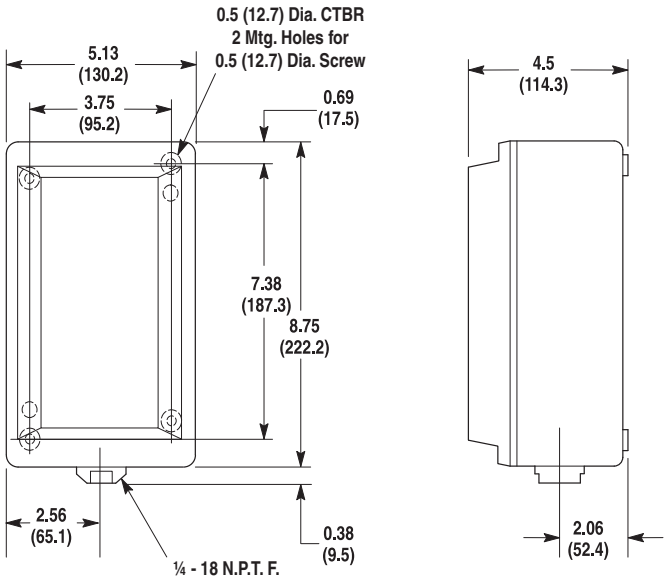


Type 1
Approximate Shipping Weight 2.0 (.9 kg)

Type 7&9 and 4&13
Approximate Shipping Weight 10 lbs. (4.5 kg)



Type 4 & 13
Approximate Shipping Weight 5 lbs (2.3 kg)



Type 4X
Approximate Shipping Weight 6 lbs (2.7 kg)

★ Cat. No.s **836-C1** and **836-C1A:**
Require a 2 in. swing radius from centerline of pressure connection. Mount control on 7/8 in. minimum spacers
Have a 3/8-18 N.P.S.F. internal pipe connection

Technical Data

Technical Terms

Adjustable operating range — Total span within which the contacts can be adjusted to trip and reset.

Trip setting — Higher pressure setting at which value the contacts transfer from their normal state to a change state.

Reset setting — Lower pressure setting at which value the contacts return to their normal state.

Adjustable differential — Difference between the trip and reset values

Minimum differential — When the differential is set to the lowest possible difference between trip and reset.

Maximum differential — When the differential is set to the highest possible difference between trip and reset.

Max. occasional surge pressure — Maximum surge pressure that can be applied to the actuator. Surges or ransients can occur during start-up and shut-down of a machine or system. Expressed in milliseconds, complex electronic instrumentation is required to measure the varying amplitude, frequency, and duration of this wave form. Extreme surges that occur approximately 8 times in a 24-hour period are negligible.

Maximum line pressure — Maximum sustained pressure that can be applied to the actuator without permanent damage. The control should not be cycled at this pressure. **Note:** Does not apply to piston type controls.

psi — Pounds per square inch gauge (positive pressure). Devices listed are in gauge pressure units which use atmospheric pressure as a reference. Atmospheric pressure at sea level is approximately 14.7 psi or 30 in. Hg.

Vacuum — Inches of mercury (in. Hg) vacuum (negative pressure).

Operating range adjustment screw — This screw is used to adjust the trip setting by varying the force of the main spring.

Differential adjustment screw — This screw is used to adjust reset setting by varying the force of the differential blade spring.

Pressure media — There are many types of pressure media that can be controlled. Examples include air, water, hydraulic fluids, and other types of gases and liquids. The type of media and the maximum system pressure will determine the type of actuator used for the pressure control application. See page 13-32.

Pressure connection — Common standard types of pressure connections used in control systems are 1/4 in. and 3/8 in. N.P.T.F. female pipe threads. SAE 7/16 and SAE 9/16 O-ring boss seals are also available (piston versions only).

Contact configuration — Bulletin 836T controls are available with either a 2-circuit or 4-circuit contact block. See Contacts.

Style D

Style D — pressure difference controls adjustable system difference range — The adjustable operating range for a pressure difference control.

System difference pressure bushing — This bushing is used to adjust the trip setting by varying the force on the main spring.

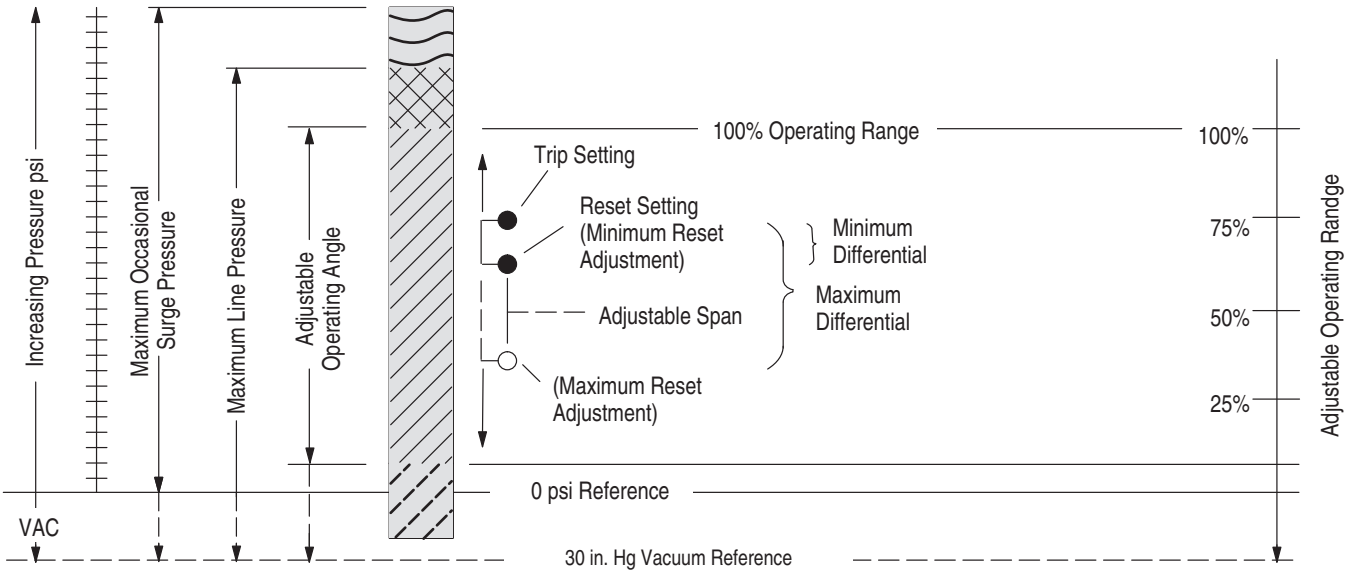
Trip setting — Desired difference in pressure between the two bellows at which value the contacts transfer from their normal state to a changed state. This occurs in one of the following conditions:

- The pressure in the bottom bellows is higher than the pressure in the top bellows by a value equal to the trip setting.
- The pressure in the bottom bellows remains constant and the pressure in the top bellows decreases by a value equal to the trip setting.

Reset setting — Predetermined normal difference in pressure between the two bellows, at which value the contacts return to their normal state. This occurs in one of the following conditions:

- The pressure in the bottom bellows is lower than the top bellows.
- The pressure in the bottom bellows remains constant and the pressure in the top bellows increases.

Figure 1
Graphics to illustrate technical terms



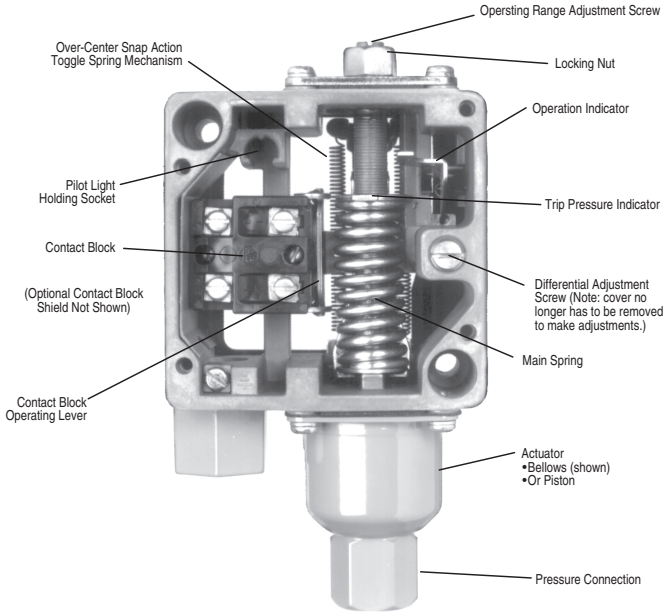
Theory of Operation

Bulletin 836T Pressure Controls are designed to open or close electrical circuits in response to changes in pneumatic (air or gas) or hydraulic (oil or non-corrosive liquids) pressure. Piston controls are not intended for use with air or water. Figure 2 shows the basic operating mechanism.

Pressure is applied to the actuator which can be either a bellows or piston type. As pressure rises, the actuator exerts force on the main spring. When the threshold force of the main spring is overcome, levers transfer the motion to the contact block, displacing the contacts — this is referred to as the trip setting. The unique lever design amplifies the actuator motion, providing shorter stroke, which results in maximizing bellows life.

The lever assembly also includes a virtually friction-free over-center toggle arrangement, providing positive snap action to the contact block for long contact life. As pressure falls, force on the differential spring increases and contacts return to their normal state — this is referred to as reset setting. Varying the force of the main spring (by turning the operating range adjustment screw) determines when the contacts will trip. Varying the force of the differential spring (by turning the differential adjustment screw) determines when the contacts will reset. Setting trip and reset values determines the operating parameters of the application.

Figure 2
Basic mechanical structure



Applications for Control

Pressure controls can be used to either control or monitor a machine or process. Figure 3 shows a typical control application. Here, pressure is controlled within predetermined high and low values. Figure 4 shows a typical monitoring application. Here, pressure is monitored between a high and low value, signaling when a preset limit has been exceeded.

Figure 3
Typical control application

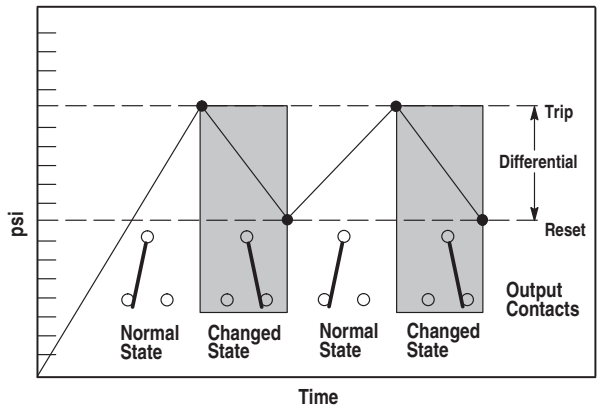
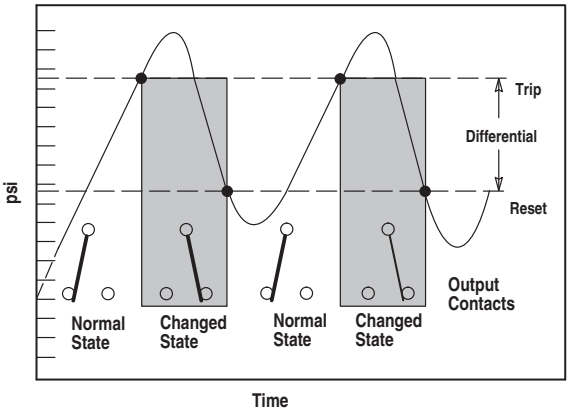


Figure 4
Typical monitoring application



Control Setting — Style T Pressure Controls

Allen-Bradley controls are designed for ease of setting to help minimize installation time. Standard pressure controls shipped from the factory are set at the maximum operating range and minimum differential. By using a pressure gauge and following these simple directions, the control can be set to the specific requirements for each application. See Figure 5.

Step 1 — Adjust trip setting

The trip setting is controlled by the operating range adjustment screw and is adjusted externally. After loosening the lock nut, the trip setting is set by turning the operating range adjustment screw counterclockwise to lower the trip setting or clockwise to raise the trip setting. The approximate trip setting is shown on the indicating scale. When the proper setting is reached, simply tighten the lock nut.

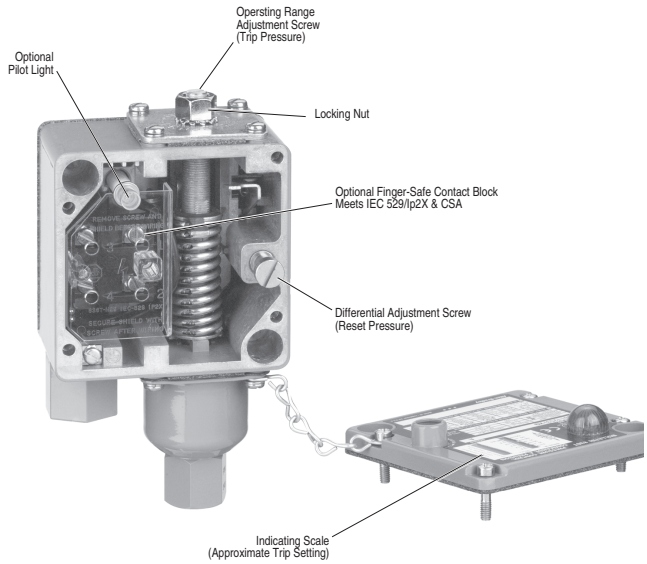
Note: Turning the operating range adjustment screw will cause both the trip and reset settings to change in virtually equal increments.

Step 2 — Adjust reset setting

The reset setting is controlled by an external differential adjustment screw. The reset setting is set by turning the differential adjustment screw clockwise to increase the differential or counterclockwise to decrease the differential.

Note: Adjusting the differential has little or no affect on the trip setting.

Figure 5
Trip and reset adjustment for pressure controls



Control Setting — Style D Pressure Difference Controls

Standard pressure difference controls shipped from the factory are set at the maximum adjustable difference range and minimum differential. Remove the front cover and use a pressure gauge to make the following adjustments. See Figure 6.

Step 1 — Adjust trip setting (difference pressure)

The trip setting is controlled by the system difference pressure bushing and is adjusted internally. With no pressure (open to atmosphere) applied to top bellows, apply a constant pressure to bottom bellows equal to the desired difference in pressure at which the contacts are to trip. Insert a 1/8 in. diameter rod into a hole in the bushing and turn bushing to the left. Continue to turn bushing until the mechanism trips; circuit 1-2 will open. At this value, the trip setting is set at the pressure which is being applied to the bottom bellows.

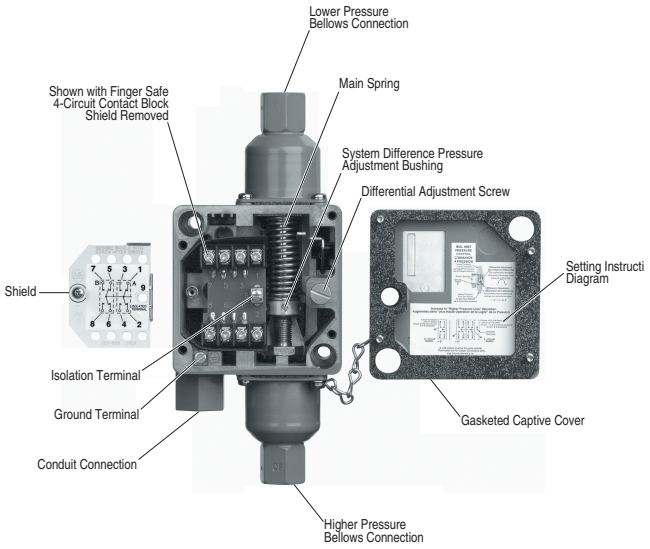
Note: Turning the system difference pressure bushing will cause both the trip and reset settings to change in virtually equal increments.

Step 2 — Adjust reset setting (differential pressure)

The reset setting is controlled by differential adjustment screw (this adjustment can be made with the cover on). The reset setting is adjusted by turning the differential adjustment screw clockwise to increase the differential or counterclockwise to decrease the differential.

Note: Adjusting the differential has little or no affect upon the trip setting (difference pressure).

Figure 6
Trip and reset adjustment for pressure difference controls — 4-circuit contact block



Repeat Accuracy and Mechanical Life

The design and construction of Bulletin 836T Pressure Controls provide a typical repeat accuracy equal to or better than the values shown in the repeat accuracy table below. Repeat accuracy is based on percent of maximum range, evaluated from test data and calculated using the formula per ICS 2-225 standards. Repeat accuracy and mechanical life of bellows type controls is graphically illustrated in Figure 7. The life curve does not apply to piston type controls.

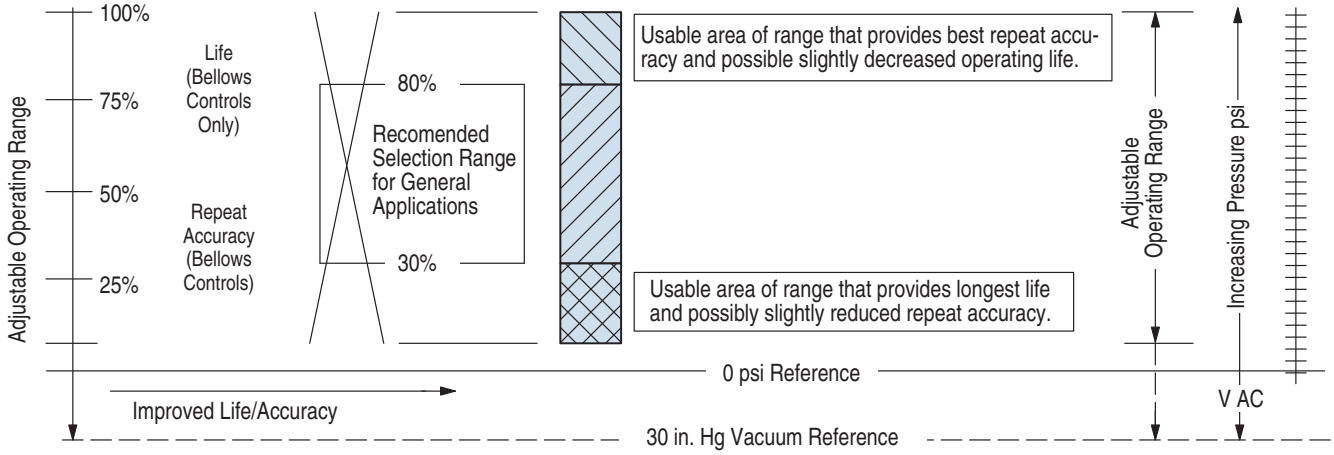
For general applications, controls selected where the contacts operate between 30% and 80% of the operating range and where the maximum line and surge pressures do not exceed the specified values will provide excellent life and repeat accuracy. For more specific applications, it is important to note that the controls are designed to operate below or above these values. However, there may be a small trade-off between the factors of repeat accuracy and mechanical life.

Type	Typical Characteristics (% of Maximum Range) ★
Bellows	± 1%
Piston with seal	± 5% ‡
Piston without seal	± 3%

★ Evaluation made from test data and calculated using formula per ICS 2-225 standards.

‡ Seal adds additional friction and value shown takes into consideration initial breakaway frictional force incurred during start-up or infrequent cycle operation. On continual cycle operation the repeat accuracy approaches ±3%.

Figure 7
Repeat accuracy versus mechanical life graph



Conversion Factors (Rounded)

psi x 703.1 = mm/H_2O
psi x 27.68 = in. H_2O
psi x 51.71 = mm/Hg
psi x 2.036 = in. Hg
psi x 0.0703 = kg/cm^2
psi x 0.0689 = bar
psi x 68.95 = mbar
psi x 6895 = Pa
psi x 6.895 = kPa

Note:
psi - pounds per square inch (gauge).
H_2O at 39.2 °F
Hg at 32 °F

Mounting without Removing Cover

Bulletin 836T controls can be mounted without removing the front cover. This helps prevent foreign materials from entering the opened enclosure during the interval between mounting and wiring of the control.

Factory Set Pressure Controls

Rockwell Automation will factory set pressure controls to customer specified values only if a Cat. No. 836T-__C device is selected. Unspecified pressure controls (cat. nos. without the "C" suffix) shipped from the factory are set at the maximum operating range and minimum differential. See Factory-Set Pressure Controls, page 13-43.

Temperature Range

The temperature range at +32 °F (0 °C) or below is based on the absence of freezing moisture, water, or other fluids that may solidify and impede the operation of the control. Temperature ratings:

Operating: –22… +150 °F (–30…+66 °C)
Storage: –22…+200 °F (–30…+93 °C)

Contacts

Bulletin 836T controls feature 2- and 4-circuit contact blocks for added control circuit flexibility. Two-circuit contact blocks have one normally open contact and one normally closed contact and may be arranged for single-pole double-throw operation or separate circuit operation having the same polarity. Four-circuit contact blocks may be arranged for double-pole double-throw operation or separate circuit operation having the same polarity.

2 Circuit Contact Ratings

Maximum Operational Volts Ue	Utilization Category		Rated Operational Currents		
	IEC	NEMA	Volts Ue	Make	Break
AC 600	AC-15	A600	120…600	7200 VA	720 VA
			72…120	60 A	720 VA
			24…72	60 A	10 A
DC 600	DC-13	-	115…600	50 VA	50 VA

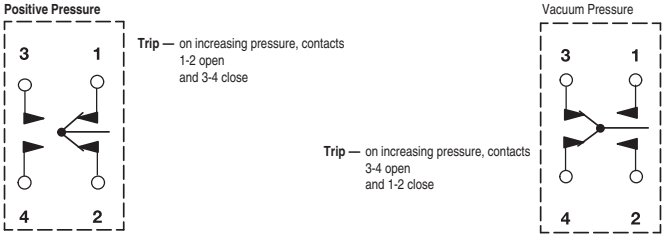
4 Circuit Contact Ratings

Maximum Operational Volts Ue	Utilization Category		Rated Operational Currents		
	IEC	NEMA	Volts Ue	Make	Break
AC 240	AC-15	B300	120…240	3600 VA	360 VA
DC 250	DC-13	R300	125…250	28 VA	28 VA

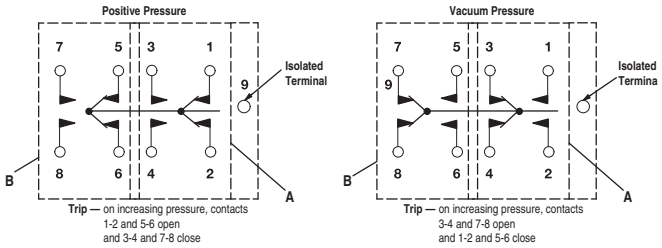
Note: NEMA does not rate contacts to switch low voltage and current. Bulletin 836T Styles T and D Pressure Controls are supplied with silver contacts. The devices are designed to deliver high force snap action to the contacts. This provides exceptional contact fidelity at 24V DC I/O card current level entry when the integrity of the enclosure is maintained.

Contact Wiring Configurations

2-Circuit Contact Blocks



4-Circuit Contact Blocks



Note: Cicuits A and B are electrically isolated from one another.
A or C circuits must be the same polarity.

Figure 8
Removable paint mask

Cover with Transparent Mask and Instruction Label in Place

Cover with Mask Partially Removed

Nameplate with Removable Paint Mask

The masks are convenient for the many users who repaint controls to match the machine or color code equipment. Saves costly time-consuming hand masking necessary so as not to conceal product functional specifications and approval listings. This feature is standard on most controls at no additional cost. The paint mask feature cannot be supplied on controls with pilot lights. They are also not available on those devices where it is necessary to remove the mask and add suffix modifications to the catalog number or specific customer identification in the space provided.

Pressure Control Selection

The selection table below is an overview of the five types of Bulletin 836T Pressure Controls Rockwell Automation offers. Each type of control is suitable for use on many types of applications. Pressure ranges, pressure connections, enclosure types, and the compatibility of the actulator with different types of pressure media are given to assist in the selection of which type of control to use.

836T				
Actuator Type	Copper Alloy Bellows	Type 316 Stainless Steel Bellows	Piston Type Without Seal	Piston Type With Seal
Adjustable operating ranges	30 in. Hg vacuum…650 psi	30 in. Hg vacuum…375 psi	40…5000 psi	80…5000 psi
Adjustable differentials	2…125 psi	2…90 psi	20…650 psi	40…650 psi
Maximum line pressures	up to 1300 psi	up to 600 psi	—	—
Occasional surge pressures	up to 1600 psi	up to 600 psi	up to 15 000 psi	up to 15 000 psi
Pressure Media				
Air	•	•		
Water	•	•	•	•
Hydraulic fluids	•	•	•	•
Corrosive liquids ★		•		
Non-corrosive liquids	•	•	•	•
Corrosive gases ★		•		
Non-corrosive gases	•	•		
Enclosures				
Type 1, 4 & 13	•	•	•	•
Type 7 & 9 and 4 & 13, IP66	•	•	•	•
Pipe Connections				
Standard pressure connection	1/4 in. N.P.T.F. female pipe thread	1/4 in. N.P.T.F. female pipe thread	3/8 in. N.P.T.F. female pipe thread SAE 7/16-20 UNF-2B thread O-ring boss seal SAE 9/16-18 UNF-2B thread O-ring boss seal	3/8 in. N.P.T.F. female pipe thread SAE 7/16-20 UNF-2B thread O-ring boss seal SAE 9/16-18 UNF-2B thread O-ring boss seal

★ Corrosive liquids and gases must be compatible with Type 316 Stainless Steel Bellows.

Note: Pressure difference controls are supplied with either copper alloy or stainless steel bellows. See Product Selection on page 13-38 and page 13-39 for details.

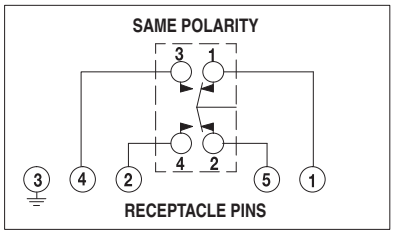
Wiring Diagrams

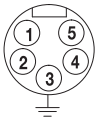
Bulletin 836T 5-Pin Mini-Type Receptacle Option Wiring Reference (J1 Wiring)

(See applicable codes and laws)

Without Pilot Light

Suffix X19





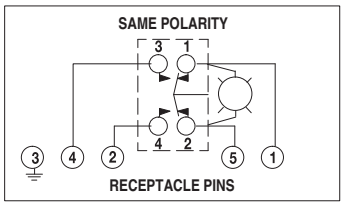
PIN/WIRE CODE
1= White
2= Red
3= Green
4= Orange
5= Black

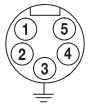
PRESSURE: CIRCUIT 1-2 (PINS 1&5)
OPENS ON RISING PRESSURE
VACUUM: CIRCUIT 3-4 (PINS 4 & 2)
OPENS ON INCREASING VACUUM
(TOWARD 30 in. HG)

With Pilot Light★

Suffix X21X9

WITH NEON GLOW PILOT LIGHT 120V AC ONLY
PILOT LIGHT WIRED ACROSS CIRCUIT
1-2 (PINS 1 & 5)



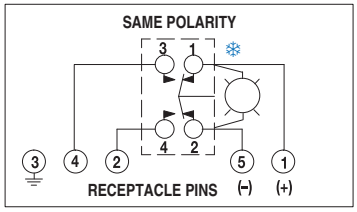


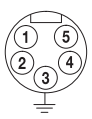
PIN/WIRE CODE
1= White
2= Red
3= Green
4= Orange
5= Black

PRESSURE: CIRCUIT 1-2 (PINS 1&5)
OPENS ON RISING PRESSURE
VACUUM: CIRCUIT 3-4 (PINS 4 & 2)
OPENS ON INCREASING VACUUM
(TOWARD 30 in. HG)

Suffix X21X15

WITH LED PILOT LIGHT 24V DC ONLY
PILOT LIGHT WIRED ACROSS CIRCUIT
1-2 (PINS 1 & 5)



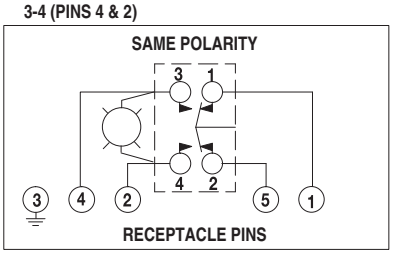


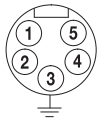
PIN/WIRE CODE
1= White
2= Red
3= Green
4= Orange
5= Black

PRESSURE: CIRCUIT 1-2 (PINS 1 & 5)
OPENS ON RISING PRESSURE
VACUUM: CIRCUIT 3-4 (PINS 4 & 2)
OPENS ON INCREASING VACUUM
(TOWARD 30 in. HG)

Suffix X22X9 ‡

WITH NEON GLOW PILOT LIGHT 120V AC ONLY
PILOT LIGHT WIRED ACROSS CIRCUIT
3-4 (PINS 4 & 2)



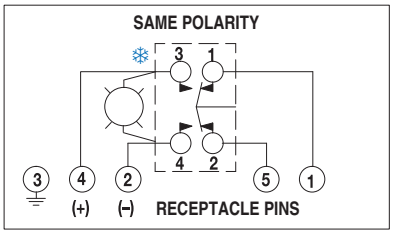


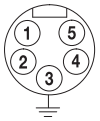
PIN/WIRE CODE
1= White
2= Red
3= Green
4= Orange
5= Black

PRESSURE: CIRCUIT 1-2 (PINS 1 & 5)
OPENS ON RISING PRESSURE
VACUUM: CIRCUIT 3-4 (PINS 4 & 2)
OPENS ON INCREASING VACUUM
(TOWARD 30 in. HG)

Suffix X22X15 ‡

WITH LED PILOT LIGHT 24V DC ONLY
PILOT LIGHT WIRED ACROSS CIRCUIT
3–4 (PINS 4 & 2)





PIN/WIRE CODE
1= White
2= Red
3= Green
4= Orange
5= Black

PRESSURE: CIRCUIT 1-2 (PINS 1 & 5)
OPENS ON RISING PRESSURE
VACUUM: CIRCUIT 3-4 (PINS 4 & 2)
OPENS ON INCREASING VACUUM
(TOWARD 30 in. HG)

★ The pilot lights shown in these diagrams are wired across the terminals and in series with the load. Pilot light is OFF when the load is energized, ON when the load is de-energized. For simultaneous energization of the load and pilot light, or other optional wiring configurations, consult your local Rockwell Automation sales office or Allen-Bradley distributor. You may only select ONE wiring configuration per device.

‡ **Note pilot light polarity**.

§ X22 not available with 4-circuit pressure controls.

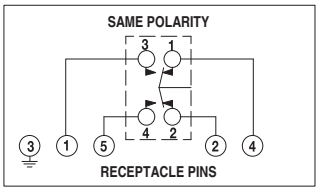
Bulletin 836T 5-Pin Mini-Type Receptacle Option Wiring Reference

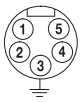
(J9 Wiring)

(See applicable codes and laws)

Without Pilot Light

Suffix X20





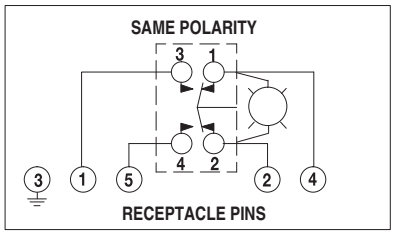
PIN/WIRE CODE
1= White
2= Red
3= Green
4= Orange
5= Black

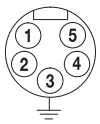
PRESSURE: CIRCUIT 1–2 (PINS 4 & 2)
OPENS ON RISING PRESSURE
VACUUM: CIRCUIT 3–4 (PINS 1 & 5)
OPENS ON INCREASING VACUUM
(TOWARD 30 in. HG)

With Pilot Light★

Suffix X23X9

WITH NEON GLOW PILOT LIGHT 120V AC ONLY
PILOT LIGHT WIRED ACROSS CIRCUIT
1–2 (PINS 4 & 2)



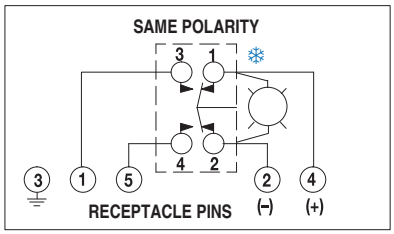


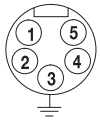
PIN/WIRE CODE
1= White
2= Red
3= Green
4= Orange
5= Black

PRESSURE: CIRCUIT 1–2 (PINS 4 & 2)
OPENS ON RISING PRESSURE
VACUUM: CIRCUIT 3–4 (PINS 1 & 5)
OPENS ON INCREASING VACUUM
(TOWARD 30 in. HG)

Suffix X23X15

WITH LED PILOT LIGHT 24V DC ONLY
PILOT LIGHT WIRED ACROSS CIRCUIT
1–2 (PINS 4 & 2)



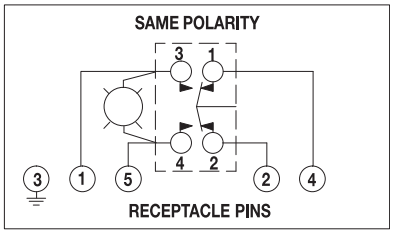


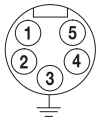
PIN/WIRE CODE
1= White
2= Red
3= Green
4= Orange
5= Black

PRESSURE: CIRCUIT 1–2 (PINS 4 & 2)
OPENS ON RISING PRESSURE
VACUUM: CIRCUIT 3–4 (PINS 1 & 5)
OPENS ON INCREASING VACUUM
(TOWARD 30 in. HG)

Suffix X24X9

WITH NEON GLOW LIGHT 120V AC ONLY
PILOT LIGHT WIRED ACROSS CIRCUIT
3–4 (PINS 1 & 5)



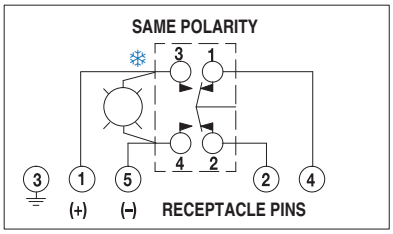


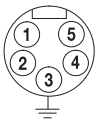
PIN/WIRE CODE
1= White
2= Red
3= Green
4= Orange
5= Black

PRESSURE: CIRCUIT 1–2 (PINS 4 & 2)
OPENS ON RISING PRESSURE
VACUUM: CIRCUIT 3–4 (PINS 1 & 5)
OPENS ON INCREASING VACUUM
(TOWARD 30 in. HG)

Suffix X24X15

WITH LED PILOT LIGHT 24V DC ONLY
PILOT LIGHT WIRED ACROSS CIRCUIT
3–4 (PINS 1 & 5)





PIN/WIRE CODE
1= White
2= Red
3= Green
4= Orange
5= Black

PRESSURE: CIRCUIT 1–2 (PINS 4 & 2)
OPENS ON RISING PRESSURE
VACUUM: CIRCUIT 3–4 (PINS 1 & 5)
OPENS ON INCREASING VACUUM
(TOWARD 30 in. HG)

★ The pilot lights shown in these diagrams are wired across the terminals and in series with the load. Pilot light is OFF when the load is energized, ON when the load is de-energized. For simultaneous energization of the load and pilot light, or other optional wiring configurations, consult your local Rockwell Automation sales office or Allen-Bradley distributor.

‡ **Note pilot light polarity**.

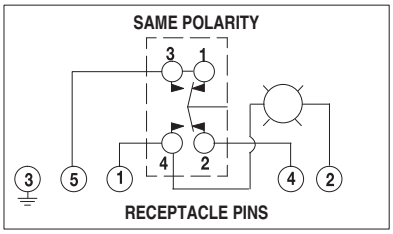
Bulletin 836T 5-Pin Mini-Type Receptacle Option Wiring Reference

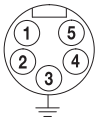
(See applicable codes and laws)

With Pilot Light

Suffix X81X9

WITH NEON GLOW LIGHT 120V AC ONLY
RATED 600V 8 AMPS



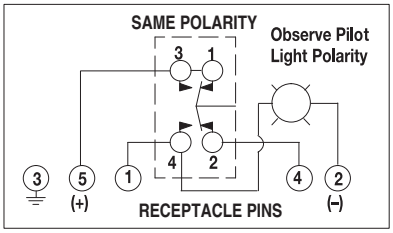


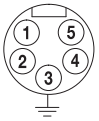
PIN/WIRE CODE
1= White
2= Red
3= Green
4= Orange
5= Black

PRESSURE: CIRCUIT 1–2 (PINS 5 & 4)
OPENS ON RISING PRESSURE
VACUUM: CIRCUIT 3–4 (PINS 5 & 1)
OPENS ON INCREASING VACUUM
(TOWARD 30 in. HG)

Suffix X81X15

WITH LED PILOT LIGHT 24V DC ONLY
RATED 600V 8 AMPS





PIN/WIRE CODE
1= White
2= Red
3= Green
4= Orange
5= Black

PRESSURE: CIRCUIT 1–2 (PINS 5 & 4)
OPENS ON RISING PRESSURE
VACUUM: CIRCUIT 3–4 (PINS 5 & 1)
OPENS ON INCREASING VACUUM
(TOWARD 30 in. HG)

Note: Bulletin 836T Suffix “X81” Wiring — load and pilot light simultaneously energize when contacts displace (contact terminals 3 and 4 close) at a predetermined pressure setting.

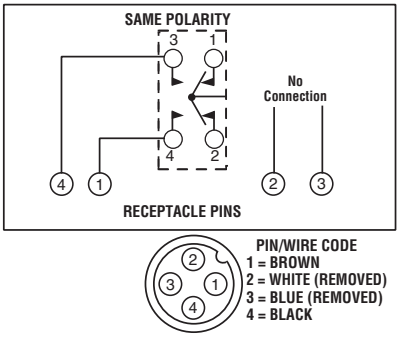
Bulletin 836T 4-Pin Micro-Type Receptacle Option Wiring Reference

(See applicable codes and laws)

Without Pilot Light

Suffix X136

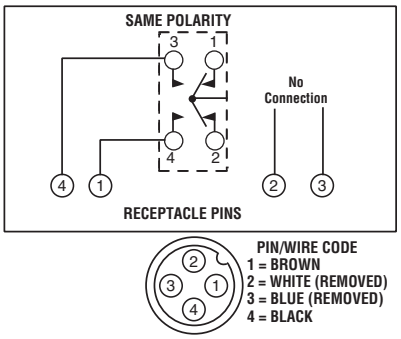
4-PIN MICRO-TYPE RECEPTACLE VERSION RATED 250V 4 AMPS



PRESSURE: CIRCUIT 3-4 (PINS 1 & 4)
CLOSES ON RISING PRESSURE
VACUUM: CIRCUIT 1-2
CLOSES ON INCREASING VACUUM
(TOWARD 30" HG)

Suffix X136

4-PIN MICRO-TYPE RECEPTACLE VERSION RATED 250V 4 AMPS

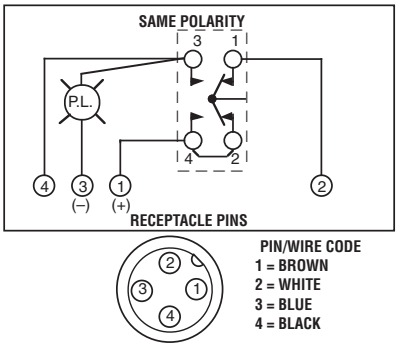


PRESSURE: CIRCUIT 3-4 (PINS 1 & 4)
CLOSES ON RISING PRESSURE
VACUUM: CIRCUIT 1-2
CLOSES ON INCREASING VACUUM
(TOWARD 30" HG)

With Pilot Light★

Suffix X130X15

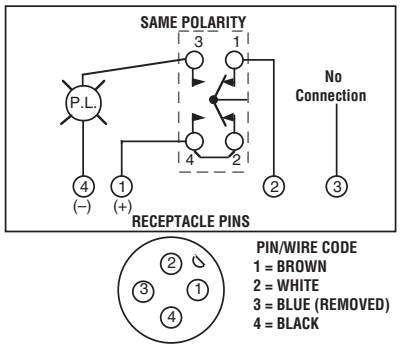
4-PIN MICRO-TYPE RECEPTACLE VERSION RATED 250V 4 AMPS WITH LED PILOT LIGHT 24V DC ONLY



PRESSURE: CIRCUIT 3-4 (PINS 1 & 4)
CLOSES ON RISING PRESSURE
VACUUM: CIRCUIT 1-2
CLOSES ON INCREASING VACUUM
(TOWARD 30" HG.)

Suffix X135X15

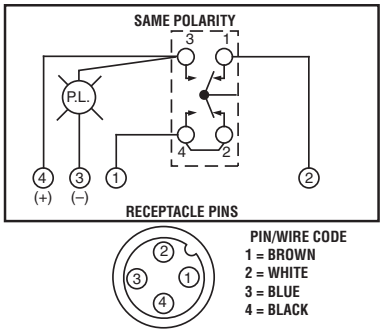
4-PIN MICRO-TYPE RECEPTACLE VERSION RATED 250V 4 AMPS WITH LED PILOT LIGHT 24 VDC ONLY



PRESSURE: CIRCUIT 3-4 (PINS 1 & 4)
CLOSES ON RISING PRESSURE
VACUUM: CIRCUIT 1-2
CLOSES ON INCREASING VACUUM
(TOWARD 30" HG.)

Suffix X137X15, X137X18

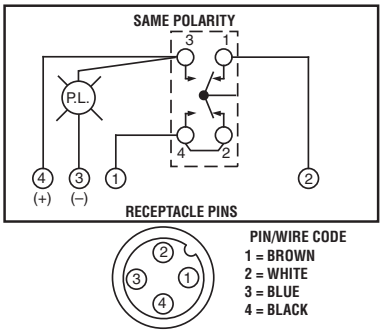
4-PIN MICRO-TYPE RECEPTACLE VERSION RATED 250V 4 AMPS WITH LED PILOT LIGHT 24 VDC ONLY



PRESSURE: CIRCUIT 3-4 (PINS 1 & 4)
CLOSES ON RISING PRESSURE
VACUUM: CIRCUIT 1-2
CLOSES ON INCREASING VACUUM
(TOWARD 30" HG.)

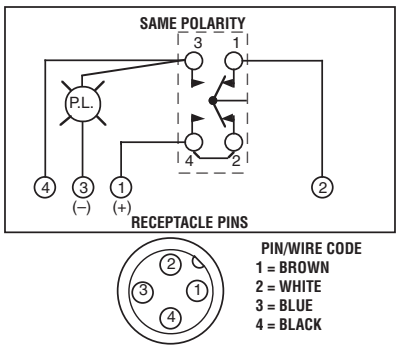
Suffix X139X15

4-PIN MICRO-TYPE RECEPTACLE VERSION RATED 250V 4 AMPS WITH LED PILOT LIGHT 24 VDC ONLY WITH 10 kΩ RESISTOR, 4-CIRCUIT APPLICATIONS



PRESSURE: CIRCUIT 3-4 (PINS 1 & 4)
CLOSES ON RISING PRESSURE
VACUUM: CIRCUIT 1-2
CLOSES ON INCREASING VACUUM
(TOWARD 30" HG.)

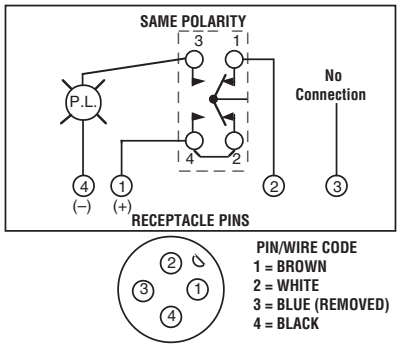
Suffix X130X15
4-PIN MICRO-TYPE RECEPTACLE VERSION
RATED 250V 4 AMPS
WITH LED PILOT LIGHT 24V DC ONLY



PIN/WIRE CODE
1 = BROWN
2 = WHITE
3 = BLUE
4 = BLACK

PRESSURE: CIRCUIT 3-4 (PINS 1 & 4)
CLOSES ON RISING PRESSURE
VACUUM: CIRCUIT 1-2
CLOSES ON INCREASING VACUUM
(TOWARD 30" HG.)

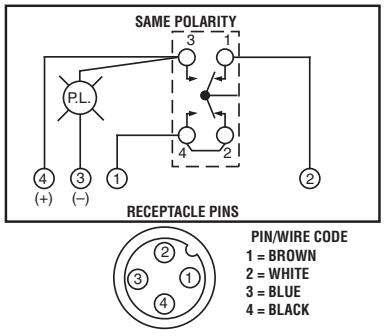
Suffix X135X15
4-PIN MICRO-TYPE RECEPTACLE VERSION
RATED 250V 4 AMPS
WITH LED PILOT LIGHT 24 VDC ONLY



PIN/WIRE CODE
1 = BROWN
2 = WHITE
3 = BLUE (REMOVED)
4 = BLACK

PRESSURE: CIRCUIT 3-4 (PINS 1 & 4)
CLOSES ON RISING PRESSURE
VACUUM: CIRCUIT 1-2
CLOSES ON INCREASING VACUUM
(TOWARD 30" HG.)

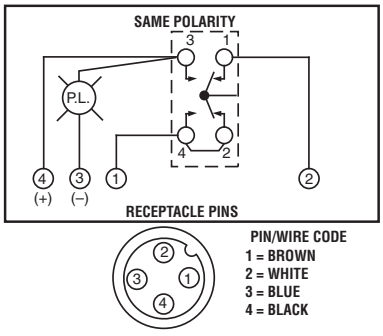
Suffix X137X15, X137X18
4-PIN MICRO-TYPE RECEPTACLE VERSION RATED
250V 4 AMPS
WITH LED PILOT LIGHT 24 VDC ONLY



PIN/WIRE CODE
1 = BROWN
2 = WHITE
3 = BLUE
4 = BLACK

PRESSURE: CIRCUIT 3-4 (PINS 1 & 4)
CLOSES ON RISING PRESSURE
VACUUM: CIRCUIT 1-2
CLOSES ON INCREASING VACUUM
(TOWARD 30" HG.)

Suffix X139X15
4-PIN MICRO-TYPE RECEPTACLE VERSION RATED
250V 4 AMPS
WITH LED PILOT LIGHT 24 VDC ONLY
WITH 10 kΩ RESISTOR, 4-CIRCUIT APPLICATIONS



PIN/WIRE CODE
1 = BROWN
2 = WHITE
3 = BLUE
4 = BLACK

PRESSURE: CIRCUIT 3-4 (PINS 1 & 4)
CLOSES ON RISING PRESSURE
VACUUM: CIRCUIT 1-2
CLOSES ON INCREASING VACUUM
(TOWARD 30" HG.)

★ The pilot lights shown in these diagrams are wired across the terminals and in series with the load. Pilot light is OFF when the load is energized, ON when the load is de-energized. For simultaneous energization of the load and pilot light, or other optional wiring configurations, consult your local Rockwell Automation sales office or Allen-Bradley distributor. You may only select ONE wiring configuration per device.

‡ **Note pilot light polarity**.

§ X22 not available with 4-circuit pressure controls.

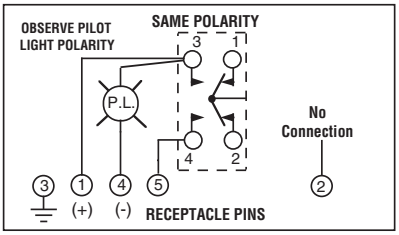
Bulletin 836T 5-Pin Micro-Type Receptacle Option Wiring Reference

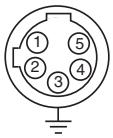
(See applicable codes and laws)

With Pilot Light★

Suffix X145X9 (120V AC), X145X15 (24V DC), X145X18 (24V DC)

5-PIN MICRO-TYPE RECEPTACLE VERSION
RATED 300V 3 AMPS
WITH LED PILOT LIGHT 24VDC ONLY



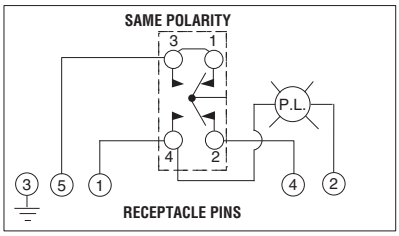


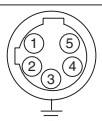
PIN/WIRE CODE
1 = RED-WHT. TR.
2 = RED (REMOVED)
3 = GREEN
4 = RED-YEL. TR.
5 = RED-BLK. TR.

PRESSURE: CIRCUIT 3-4 (PINS 1&5)
CLOSES ON RISING PRESSURE
VACUUM: CIRCUIT 1-2
CLOSES ON INCREASING VACUUM
(TOWARD 30" HG.)

Suffix X181X9, X181X15, X181X18

5-PIN MICRO-TYPE RECEPTACLE VERSION
RATED 300V 3 AMPS
WITH NEON GLOW PILOT LIGHT 120VAC ONLY





PIN/WIRE CODE
1 = RED-WHITE TR.
2 = RED
3 = GREEN
4 = RED-YEL. TR.
5 = RED-BLACK TR.

PRESSURE: CIRCUIT 1-2 (PINS 5 & 4)
OPENS ON RISING PRESSURE
VACUUM: CIRCUIT 3-4 (PINS 5 & 1)
OPENS ON INCREASING VACUUM
(TOWARD 30" HG.)

★ The pilot lights shown in these diagrams are wired across the terminals and in series with the load. Pilot light is OFF when the load is energized, ON when the load is de-energized. For simultaneous energization of the load and pilot light, or other optional wiring configurations, consult your local Rockwell Automation sales office or Allen-Bradley distributor. You may only select ONE wiring configuration per device.

‡ **Note pilot light polarity**.

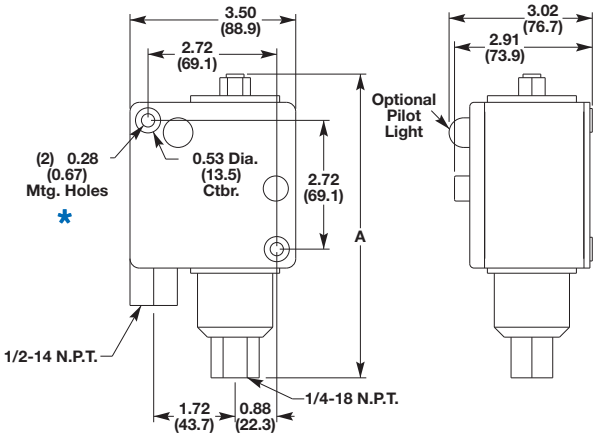
§ X22 not available with 4-circuit pressure controls.

Approximate Dimensions

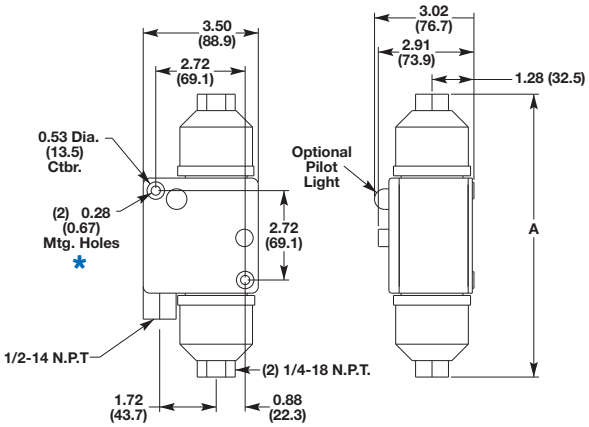
Approximate Dimensions and Shipping Weights

Dimensions in inches (millimeters). Dimensions are not intended to be used for manufacturing purposes.

Type 4 & 13 (Bellows)



Approximate Shipping Weight 3-1/2 lbs. (1.6 kg)



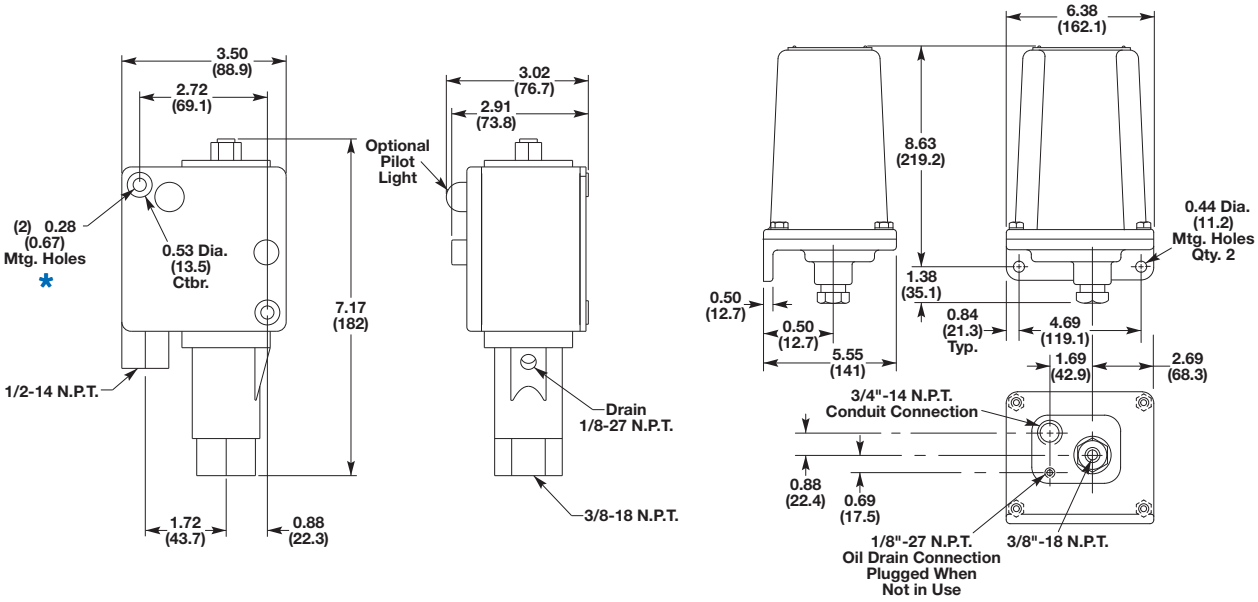
Approximate Shipping Weight 4 lbs. (1.8 kg)

Cat. No.	A Dimensions	Cat. No.	A Dimensions	Cat. No.	A Dimensions	Cat. No.	A Dimensions
836T-T251J	6.65 (169)	**836T-T254J**	6.95 (176)	**836T-D450J**	8.60 (218)	836T-D460J	8.60 (218)
836T-T260J		**836T-T255J**					
—	—	**836T-T256J**	7.09 (180)	**836T-D451J**	8.14 (207)		
836T-T252J	6.41(163)	**836T-T262J**	7.33 (186)	**836T-D452J**		**836T-T252J**	8.5 (216)
836T-T253J		**836T-T263J**	7.25 (184)			836T-D463J	10.06 (256)
836T-T261J				**836T-D453J**	9.5 (241)		

Type 4 & 13 (Piston)

Type 4 & 13 and 7 & 9 Bellows and Piston Type

(Does not include Dual Bellows Devices)



Approximate Shipping Weight 4.5 lbs. (2.0 kg)

Approximate Shipping Weight 10 lbs. (4.5 kg)

★ (2) mounting screws are required: 3/16 x 20 x 2 in. Counterbore depth is 1-1/8 in. Overall depth of mtg hole (front to back) is 2-1/4 in.

Technical Data

Theory of Operation

When the shaft of a speed switch is rotated, a magnetic induction linkage operates a contact. One contact is provided for clockwise operation, and one contact for counterclockwise operation. See Figure 1 for a simplified view of the operating mechanism of a Speed Switch with normally open contacts. Operation of a device with normally closed contacts is similar.

When the shaft (1) rotates, the field of the magnet (2) induces eddy currents in the copper cup (3). These currents produce an electromagnetic torque proportional to the shaft speed, which produces a rotational torque on the cup in the same direction as the shaft rotation. The cup engages a contact operating lever (4) to activate the contacts.

As the shaft speed increases, the operating torque will also increase. When the torque has increased enough to overcome an opposing adjustable spring force (5), the moveable contact (6) is forced against the stationary contact (7). The contacts close and will remain closed as the shaft speed increases to its normal value.

Similarly, as the shaft speed is decreased, a speed is reached where the spring force again exceeds the operating torque and the contacts return to their normal position.

As the shaft speed increases, the contact set speed (the speed at which the contacts operate) will be at a higher RPM than the speed where the contacts reset (return to their normal position) on decreasing RPM. The difference in these contact operating values is called the differential.

Ambient Temperature Range

Temperatures below 32°F (0°C) are based on the absence of freezing moisture, water, or other fluids that may solidify and impede contact operation of the control. Temperature ranges are as follows:

Operating: –22…150°F (–30…66°C)
Storage: –22…200°F (–30…93°C)

Typical Control Circuits

Forward Plugging — Circuit shown in Figure 2 is a typical control circuit for forward direction plugging with optional lockout protection. Operation is as follows:

Pushing START energizes the forward coil and closes normally open contact F1; the motor runs forward. Normally closed contact F2 opens the circuit so the reverse coil does not energize. The forward contact on the speed switch closes. Pushing STOP drops out the forward contact. Then the reverse contactor or starter is energized and the motor is plugged. When the motor speed decreases to the preset speed setting of the speed switch, the contact opens and drops out the reverse contactor.

Conveyor Sequencing — Circuit shown in Figure 2 is a control circuit for conveyor sequencing. Operation is as follows:

Pushing START energizes coil M1 to start the first conveyor and closes the normally open contact. When the first conveyor reaches the preset speed setting of the speed switch, the speed switch contact closes, energizing coil M2 to start the second conveyor. Pushing STOP drops out coils M1 and M2, stopping the conveyors.

Anti-Plugging — Circuit shown in Figure 2 is a typical anti-plugging control circuit. The circuit is used where damage would result from a sudden reversal of power. Bulletin 808 contacts keep the reverse circuit open until the motor has coasted to a preset speed.

Figure 1
Operating Mechanism

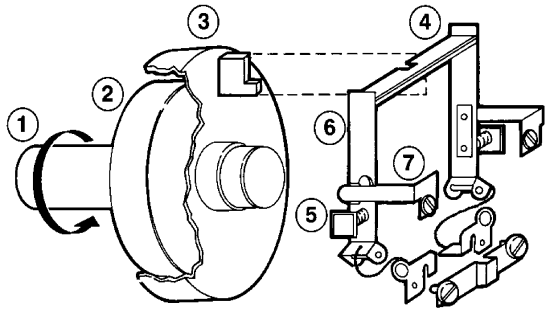
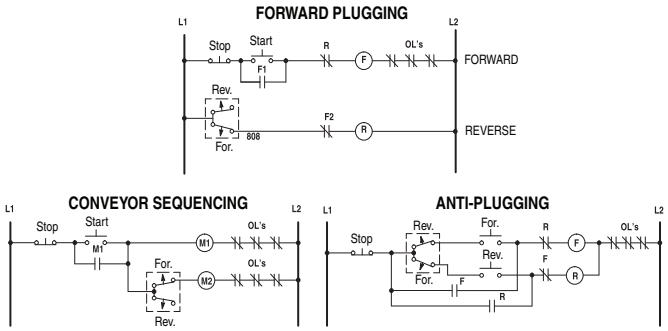


Figure 2
Typical Control Circuits



Lockout Solenoid

In some applications, an accidental turn of the shaft may close the Bulletin 808 contacts that jog or start the motor. To guard against this, the Bulletin 808 can be equipped with a lockout solenoid, which mechanically restrains the contacts from operating unless the lockout coil is energized. This feature is available in kit form.

Mounting

The Type 1, 4 & 13 enclosure is available in three types of mounting brackets. They are base mounting, 3-point flange mounting and 4-point flange mounting. These devices are also available without mounting bracket for direct mounting. The Type 7 & 9 enclosure is available with base mounting only. Mounting brackets can be assembled at the factory, or ordered separately as accessories.

Installation

For greatest accuracy, the Bulletin 808 shaft should be driven at the highest available speed within its maximum operating speed. It is recommended that the continuous driven speed be at least two times the speed at which the contacts are set to operate. This will provide the torque to hold the contacts in the desired position, reducing false contact operation under severe shock and vibration. The driven speed can be higher than the adjustable range speed, but must not exceed the maximum shaft operating speed. There must be a positive coupling between the Bulletin 808 and machine. A rigid coupling should not be used. However, flexible couplings are recommended and available from local Power Transmission Equipment Distributors. Gears, chains, or timing belts can be used if it is not possible to mount a flexible coupling. A V-belt is not recommended for plugging applications.

Adjustment

The contact operating speed is easily adjusted with two external adjustment screws, one for each set of contacts. After the speed switch has reached normal operating temperature, the screw is turned to adjust the contact operating speed. Changes in inertia (WR^2) of moving equipment may require readjustment of the set points.

Shaft Loading

If the radial and axial shaft loading values are exceeded, shortened bearing life may result. The maximum values are listed in the Maximum Shaft Loading table below. In speed sensing or direction of motion applications, a timing belt may be used. A V-belt is not recommended. Proper belt tension must be maintained to keep slippage at a minimum.

Maximum Shaft Loading

Enclosure	Maximum Radial Loads	Maximum Axial Loads (Thrust Loads)
Type 1, 4 & 13	50 lbs. (222 Newtons)	20 lbs. (89 Newtons)
Type 7 & 9	25 lbs. (111 Newtons)	20 lbs. (89 Newtons)

Note: Timing belt tension must not exceed 25 lbs. (111 Newtons).

Typical Torque and Temperature Rise Characteristics

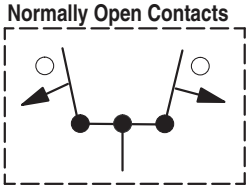
Contact Operating Range RPM	Shaft Operating Speed Maximum RPM	Driving Torque Maximum lb•in	Temperature Rise (Maximum RPM) °F
15…80	1200	6 (.68 N•m)	120 °F (49 °C)
50…1000	2000	6 (.68 N•m)	140 °F (60 °C)

Contact Ratings — NEMA B600

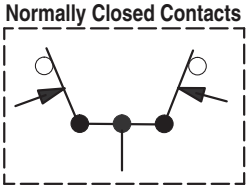
AC						DC	
	Amperes		Continuous Carrying Current	Voltamperes			
Maximum AC Voltage	Make	Break		Make	Break	Maximum Voltage	Ampere
120	30	3.00	5	3600	360	115…125	0.12
240	15	1.50	5	3600	360	230…250	0.08
480	7.5	0.75	5	3600	360		
600	6	0.6	5	3600	360	—	—

Contact Wiring Configurations

Normally Open Contacts



Normally Closed Contacts

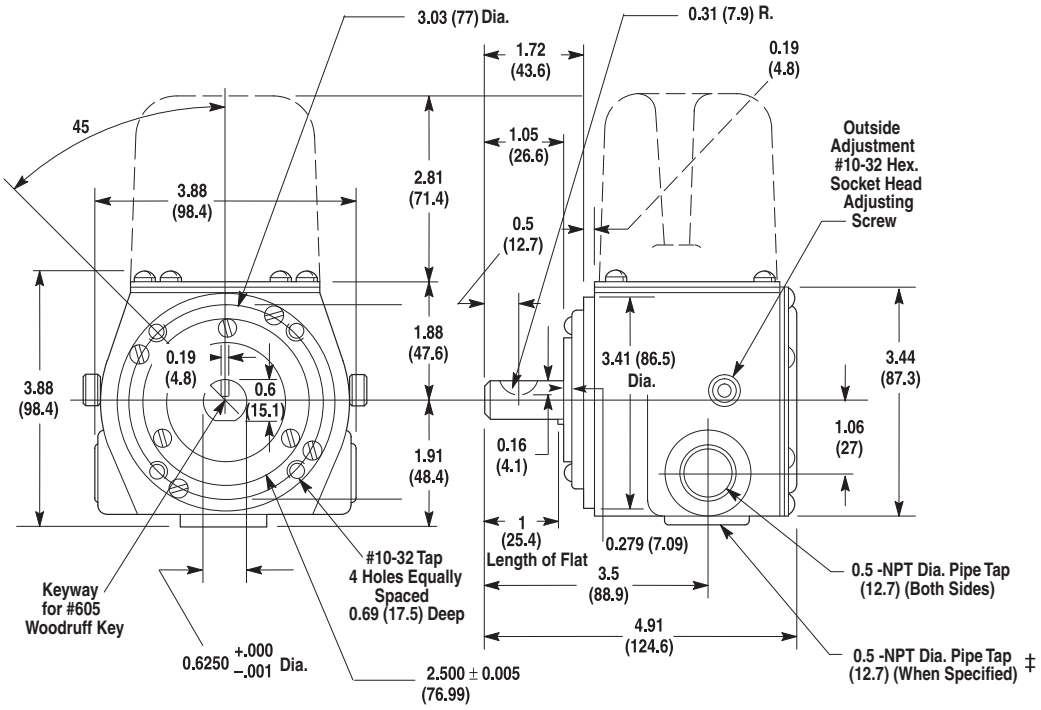


Approximate Dimensions

Dimensions in inches (millimeters). Dimensions are not intended to be used for manufacturing purposes.

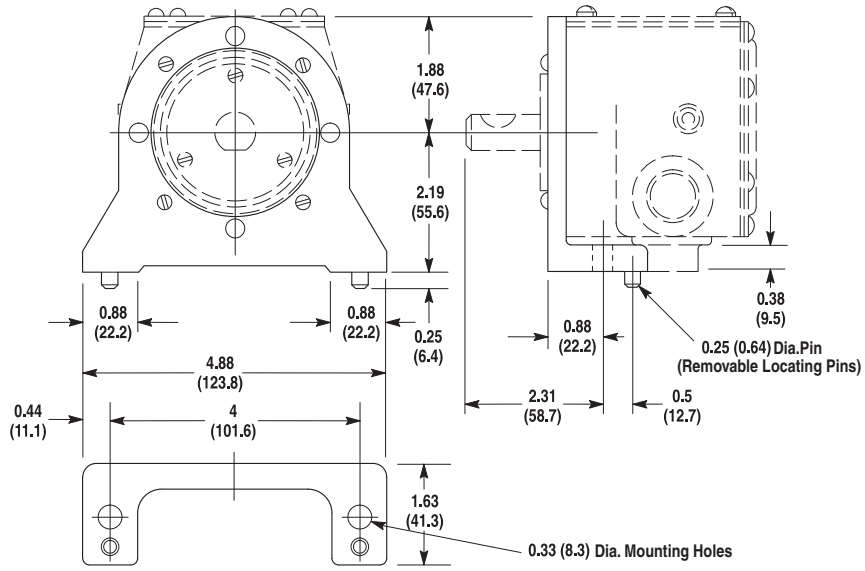
Type 1, 4, & 13

Figure 1 — Less Mounting Bracket



Less Mounting Bracket
Cat. No. ★
808-J4
808-K4
808-M4
808-R4

Figure 2 — Base Mounting



Base Mounting
Cat. No. ★
808-J1
808-K1
808-M1
808-R1

★ If lockout solenoid is used, see dotted portion of Figure 1 for dimensions.
§ Bulletin 808 Speed Switches with a suffix **X1** added to the catalog number are equipped with a 1/2 (12.7) pipe tap in the center of the enclosure bottom on the same center line as the pipe tap at the side.

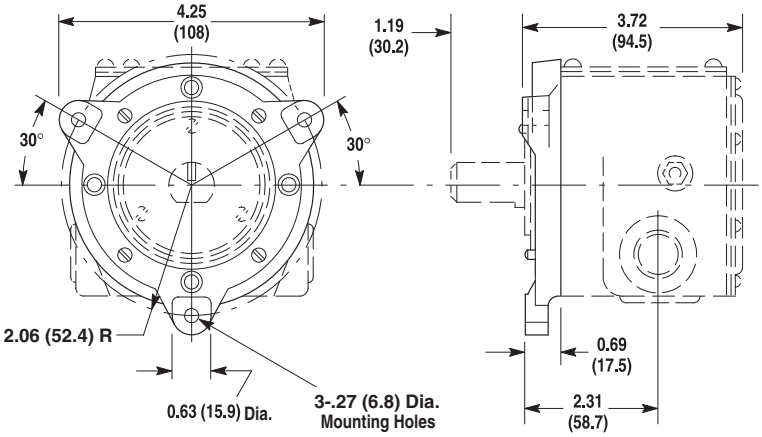
Approximate Shipping Weight

• Type 1, 4 & 13: 6 lbs (2.7 kg); Type 7 & 9: 10 lbs (4.5 kg)

Dimensions in inches (millimeters). Dimensions are not intended to be used for manufacturing purposes.

Type 1, 4, & 13 (continued)

Figure 3 — Flange Mounting (Three-Point)

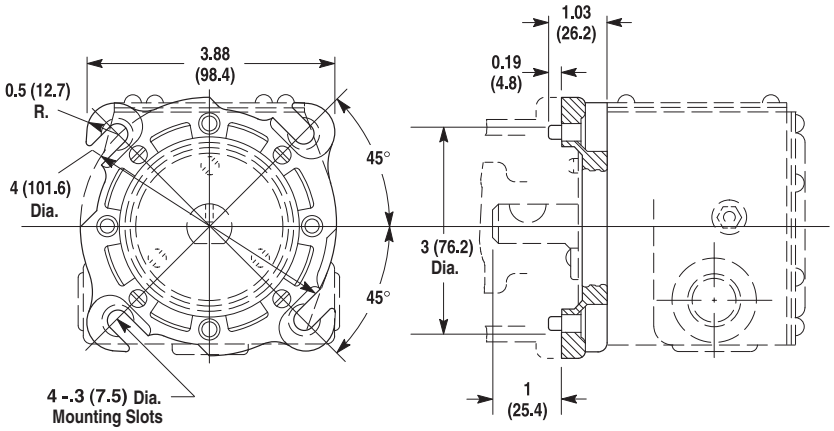


Flange Mounting (Three Point)
Cat. No. ★
808-J2
808-K2
808-M2
808-R2

Approximate Shipping Weight

6 lbs (2.7 kg)

Figure 4 — Flange Mounting (Four-Point)



Flange Mounting (Four Point)
Cat. No. ★
808-J3
808-K3
808-M3
808-R3

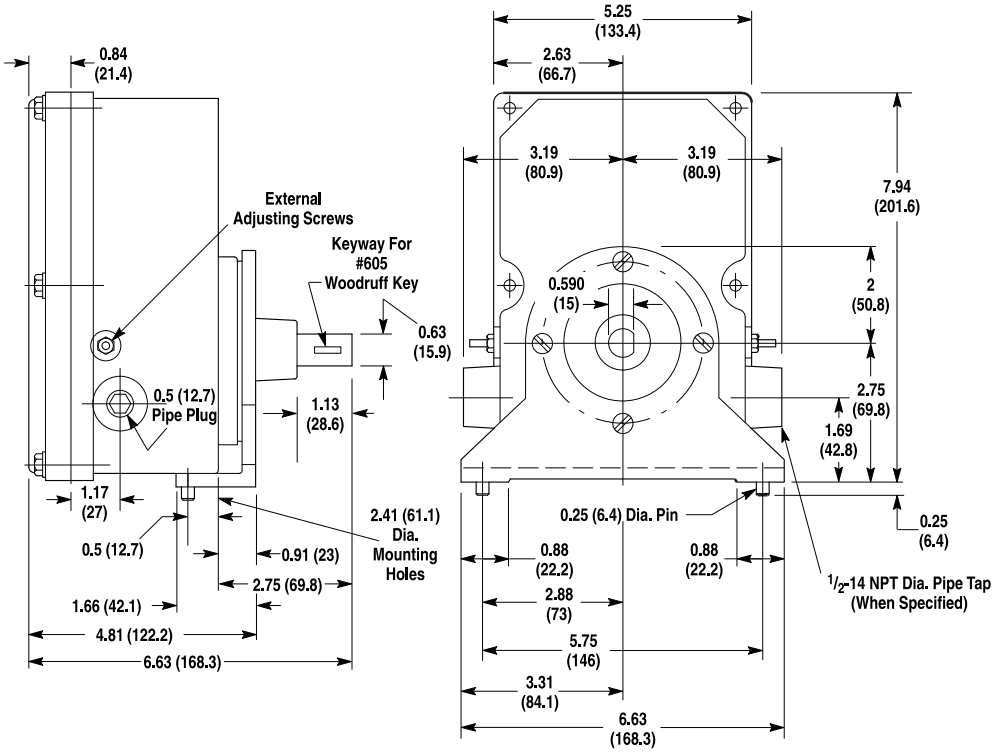
★ If lockout solenoid is used, see dotted portion of Figure 1 (on previous page) for dimensions.

Approximate Shipping Weight

6 lbs (2.7 kg)

Type 7 & 9

Figure 5 — Base Mounting



Base Mounting
Cat. No.
808-J17
808-K17
808-M17
808-R17

Approximate Shipping Weight

10 lbs (4.6 kg)

Technical Data

Technical Terms

Adjustable operating range — Total span within which the contacts can be adjusted to trip and reset.

Trip setting — Higher temperature setting when the contacts transfer from their normal state to a changed state.

Reset setting — Lower temperature setting when the contacts return to their normal state.

Adjustable differential — Difference between the trip and reset values.

Minimum differential — When the differential is set to the lowest temperature difference between trip and reset.

Maximum differential — When the differential is set to the highest temperature difference between trip and reset.

Maximum temperature — The maximum temperature that can be applied to the bulb. This includes temperature override that may occur in the system. **This rating must NOT be exceeded.**

Operating range adjustment screw — This screw is used to adjust the trip setting by varying the force of the main spring.

Differential adjustment screw — This screw is used to adjust reset setting by varying the force of the differential blade spring.

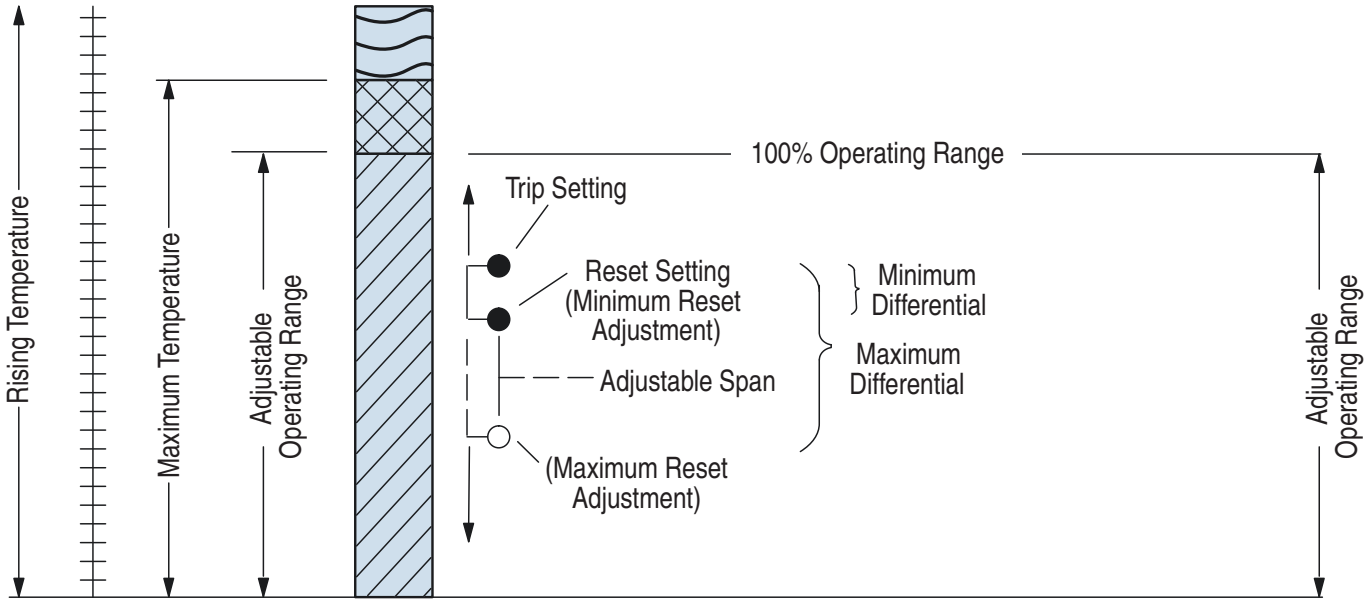
Contact configuration — There are many types of contact configurations available. Bulletin 837 Temperature Controls are offered in a wide variety of contact configurations for both automatic operation and manual reset. See page 13-57.

Mounting — There are two methods of mounting temperature controls: remote or direct immersion.

- Remote Method — A bulb and capillary system is used for mounting the control away from the machine or process.
- Direct Immersion — The control is mounted directly on the machine or process. Rockwell Automation offers both horizontal and vertical immersion types.

Conversion factor — Temperatures given in Fahrenheit can be converted to Celsius using this equation: °C = 0.56 (°F –32°) Temperatures given in Celsius can be converted to Fahrenheit using this equation: °F = (1.8 x °C) +32°

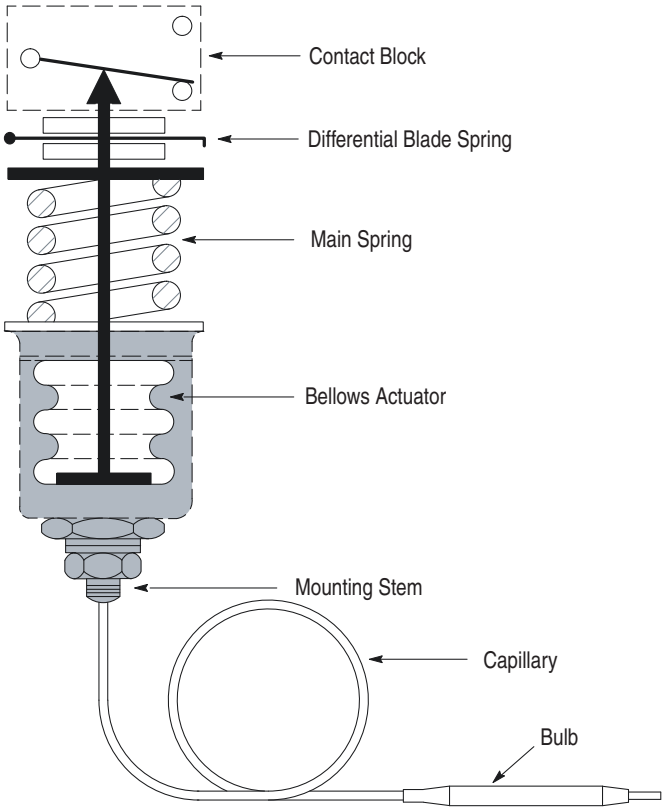
Figure 1
Graphics to illustrate technical terms



Bulletin 837 Temperature Controls are designed to open or close electrical circuits in response to changes in temperature. Figure 2 is a simplified drawing of a temperature control. The bellows, bulb, and capillary are filled with a temperature-responsive liquid. The vapor pressure of the liquid increases as the temperature of the bulb increases. System temperature is converted to pressure through the bulb and capillary, which are connected to the control at the mounting stem. Pressure applied to the actuator changes in proportion to the temperature of the bulb. As temperature rises, the bellows exerts force on the main spring. When the threshold force of the main spring is overcome, it transfers the motion to the contact block and actuates the contacts — this is referred to as the trip setting. As temperature decreases, the main spring will retract. When the threshold force on the differential blade spring is overcome, the contacts will return to their normal state —this is referred to as reset setting. Varying the force of the main spring (by turning the operating range adjustment screw) determines when the contacts will trip. Varying the force on the secondary differential blade spring (by turning the differential adjustment screw) determines when the contacts will reset. Setting trip and reset determines control operation.

Theory of Operation

Figure 2
Basic mechanical structure



Applications for Control

Temperature controls can be used to either control or monitor a machine or process. Figure 3 shows a typical control application. Here, temperature is controlled within predetermined high and low values. Figure 4 shows a typical monitoring application. Here, temperature is monitored between a high and low value, signaling when a preset limit has been exceeded.

Figure 3
Typical control application

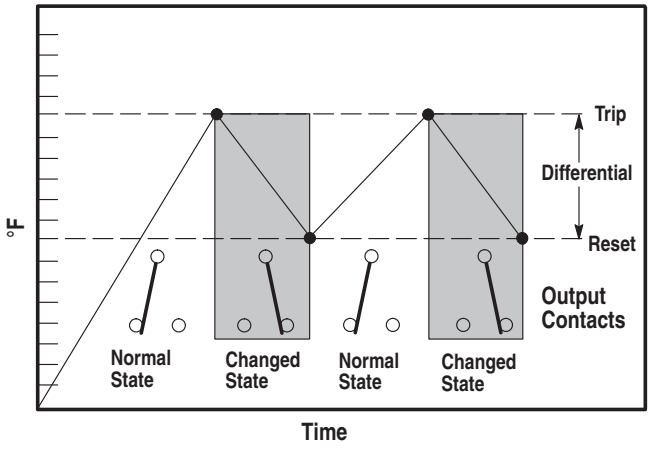
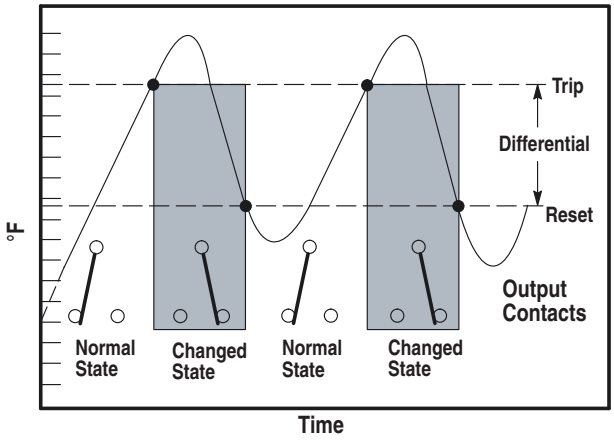


Figure 4
Typical monitoring application



Control Settings

Allen-Bradley Temperature Controls are designed for ease of setting to help minimize installation time. Standard controls shipped from the factory are set at the maximum operating range and minimum differential. By following this simple two step process, the control can be set to the specific requirements for each application. See Figure 5.

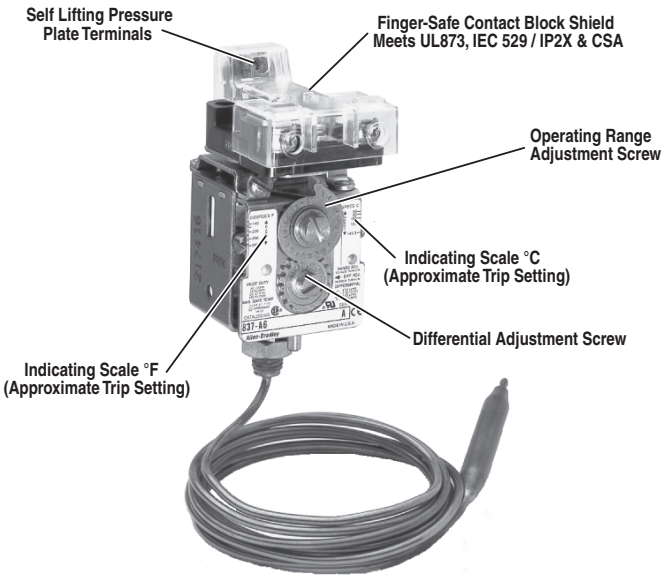
Step 1 — Adjust trip setting

The trip setting is achieved by turning the operating range adjustment screw. Turn the screw counterclockwise to lower the trip setting or clockwise to raise the trip setting. The approximate trip setting is shown on the indicating scale.

Step 2 — Adjust reset setting

The reset setting is achieved by turning the differential adjustment screw counterclockwise to increase the differential or clockwise to decrease the differential.

Figure 5
Trip and reset adjustment

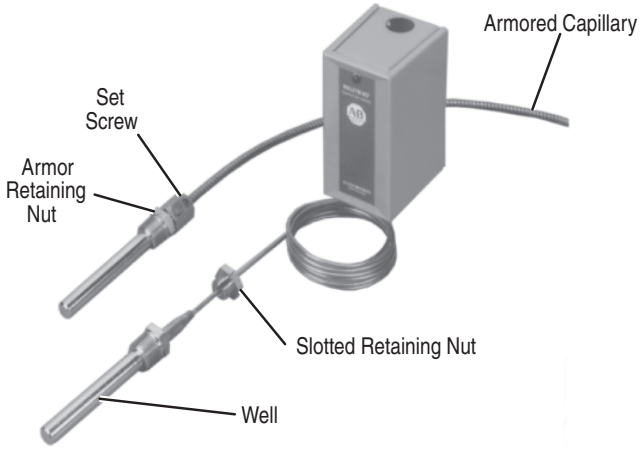


Thermostat Wells

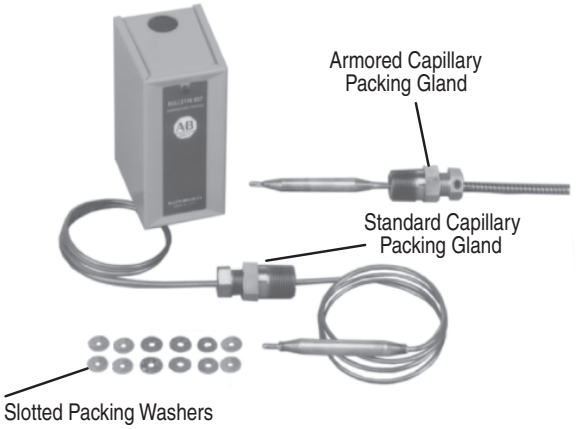
Thermostat wells are basically sealed tubes on one end with threads on the other that allow mounting directly into a system. Thermostat wells protect the bulbs and allow installing or removing controls for calibration without discharging or draining an entire system. The bulb of a temperature control is inserted into the well which is secured with a locking nut for standard bulb and capillary devices. Bulbs for armored capillary devices are secured with a sleeve nut and set screw to prevent the armor from sliding back exposing the capillary. The bulbs of direct immersion devices are secured with a set screw which is also used to mount the control. Thermostat wells are rated for 1000 psi at 600 °F. Thermostat wells used when mounting direct horizontal immersion controls will allow mounting the control in a confined space. These devices otherwise require an 11 in. swing diameter to secure the bulb into the system. See page 13-58.

Packing Glands

Packing glands are used when the application requires the bulb to be located deeper into a process than would be possible with a thermostat well. The glands provide a seal at any desired length along a standard capillary device. The bulb must be supported to resist damage from flow or turbulence within the system. The capillary of armored capillary devices can only be sealed at the small exposed section of capillary located at the bulb. Packing glands are not intended to seal around the armor. They are designed to withstand sealing pressures up to 50 psi. The packing gland cannot be assembled into a thermostat well. See page 13-58.



Thermostat Wells



Packing Glands

Bulb and Capillaries

Copper bulbs and capillaries are supplied for lower temperature ranges. Stainless steel is used for temperatures above 260 °F. Stainless steel is also available on lower ranges for more corrosive applications. Capillary lengths of 3, 6, 12, 20, and 30 feet are available for all styles of temperature control devices.

Armor

Bronze or stainless steel armor is available for added protection of the capillary. See Modifications on page 13-57 for ordering instructions.

Capillary Bending Radius

Copper and Stainless Steel —
0.5 in. (12.7 mm) minimum
with Bronze and Stainless Steel Armor —
2 in. (50.8 mm) minimum

Direct Immersion

Horizontal and vertical immersion devices are used when the controls are required to be mounted directly on the machine or in a process.

Standard Contact★

Contact Operation

Contact blocks are single-pole, double-throw and can be wired to open or close on increasing or decreasing temperature.

Non-Inductive Ratings

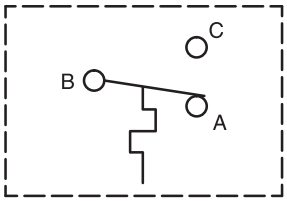
5 A, 240V
3 A, 600V

Control Circuit Ratings

AC — 125 VA, 24…600V
DC — 57.5 VA, 115…230V

Standard Contact Wiring Configuration

Single-pole Double-throw



Repeat Accuracy

The vapor pressure technology used in Bulletin 837 controls to sense temperature provides an exceptionally long operating life. High quality chemicals and rigid control during manufacturing provide a typical repeat accuracy of ±2 °F. Repeat accuracy is based on percent of maximum range, evaluated from test data and calculated using the formula per ICS 2-225 standards.

Special Controls

A large number of unlisted catalog modifications and complete devices are available for specific and OEM applications. Special controls and modification service is available to meet many applications unique to the OEM market.

Please consult your local Rockwell Automation sales office or Allen-Bradley distributor for assistance with specific modified controls and accessories.

Temperature Range

The temperature range for the mechanism at +32 °F (0 °C) or below is based on the absence of freezing moisture, water or other fluids that may solidify and impede the operation of the control. Temperature ratings are as follows:

Operating:	–22… +150 °F (–30…+66 °C)
Storage:	–22…+200 °F (–30…+93 °C)

Factory-Set Temperature Controls

Rockwell Automation will factory set temperature controls to customer-specified values if a Cat. No. 837-_C device is ordered. Unspecified temperature controls (cat. nos. without the "C" suffix) shipped from the factory are set at the maximum operating range and minimum differential. See Factory Options, page 13-59.

Application Note

When the ambient temperature surrounding the mechanism of the temperature control approaches 30 °F (-1.1 °C) on either side of the setting, a cross-ambient type control should be used. This will protect against false temperature-sensing, as the bellows within the mechanism may otherwise respond to changes in temperature. Cat. Nos. **837-A3** and **837-A4** bulb and capillary Types, all **837-V** direct vertical immersion, and all **837-H** direct horizontal immersion devices are cross-ambient.

When the bulb of cross-ambient bulb and capillary controls **837-A3** and **837-A4** is to be mounted vertically, the capillary end of the bulb should always be positioned higher than the termination end of the bulb.

When mounting the bulb horizontally, the word “**TOP**” stamped near the capillary of the bulb should be positioned upward toward the 12 o' clock position. The capillary end of the bulb should never be higher than the termination end of the bulb. The direct vertical immersion devices in the catalog series **837-V** are conventionally mounted with the bulb downward, below the mechanism.

They must not be mounted with the bulb up. Since the horizontal immersion device is not available in a Type 4 & 13 enclosure, the corresponding vertical immersion device can be used. When the vertical immersion device is mounted horizontally, the word “TOP” stamped on the mounting thread “hex” should point upward toward the 12 o' clock position.

The direct horizontal Immersion devices, in catalog series **837-H** should always be mounted with the mechanism above the bulb. The word “TOP” stamped on the mounting thread “hex” should point upward toward the 12 o' clock position. Cat. No. **837-A2** is not cross-ambient and should not be used if the ambient temperature approaches or crosses over the set point as false temperature may occur.

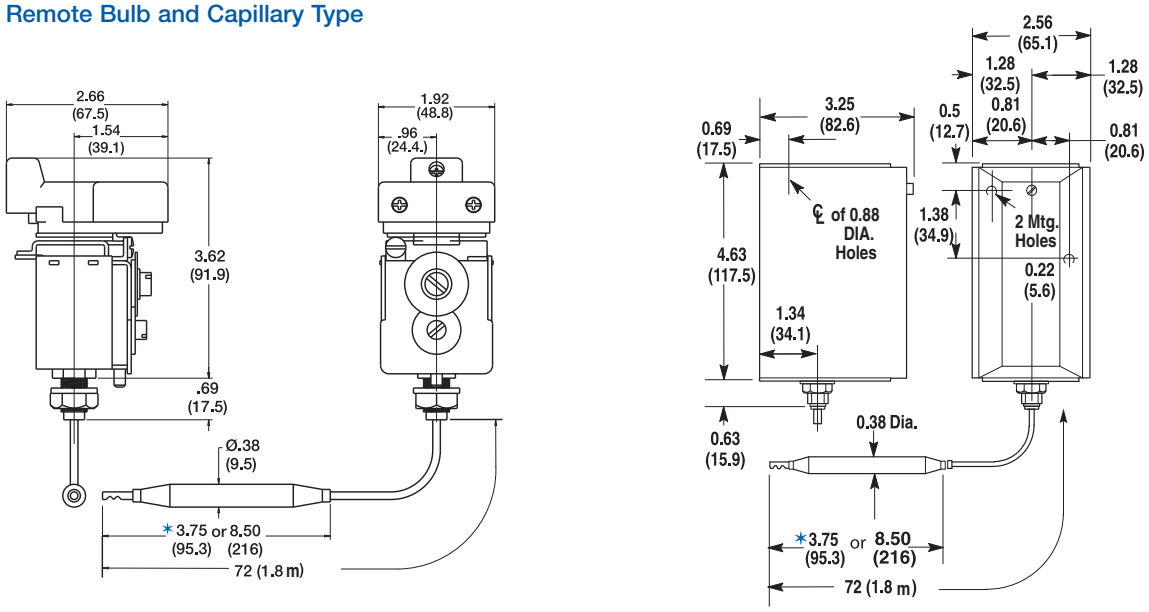
Consult your local Rockwell Automation sales office or Allen-Bradley distributor for assistance on special applications.

★ NEMA does not rate contacts to switch low-voltage and current. Bulletin 837 Styles A, H and V Temperature Controls are supplied with silver contacts. The devices are designed to deliver high force snap action to the contacts. This provides exceptional contact fidelity at 24V DC I/O card current level entry when the integrity of the enclosure is maintained.

Approximate Dimensions

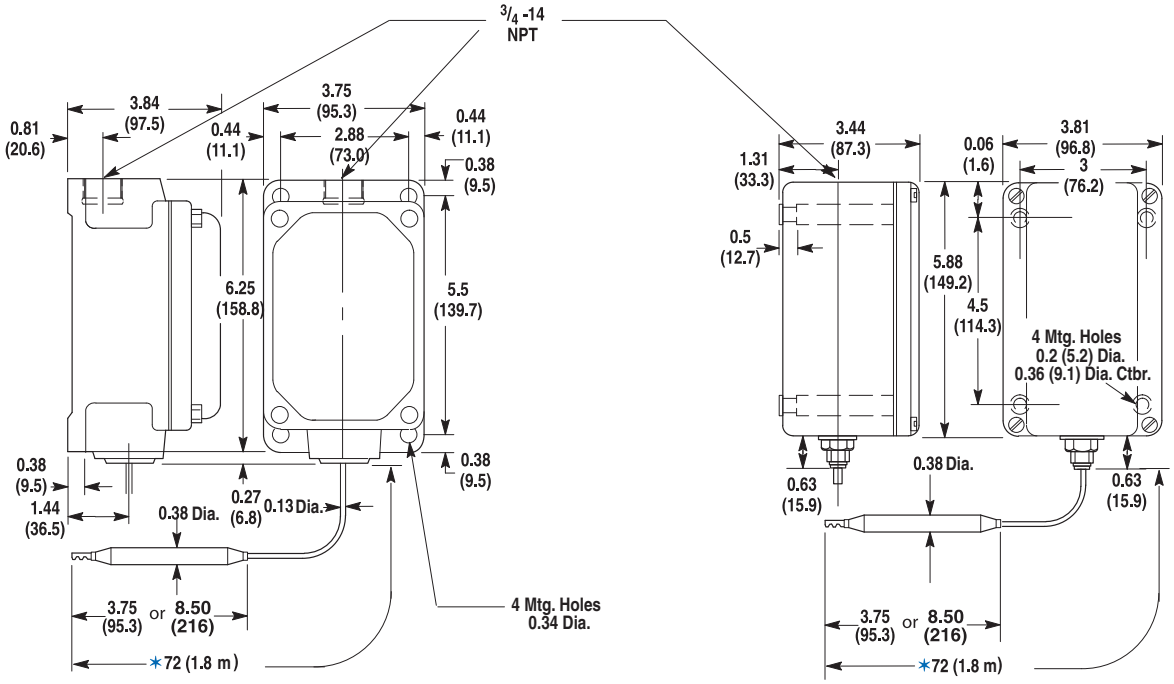
Dimensions in inches (millimeters). Dimensions are not intended to be used for manufacturing purposes.

Remote Bulb and Capillary Type



Open Type
Approximate shipping weight 2-1/2 lb (1.1 kg)

Type 1
Approximate shipping weight 3 lb (1.4 kg)



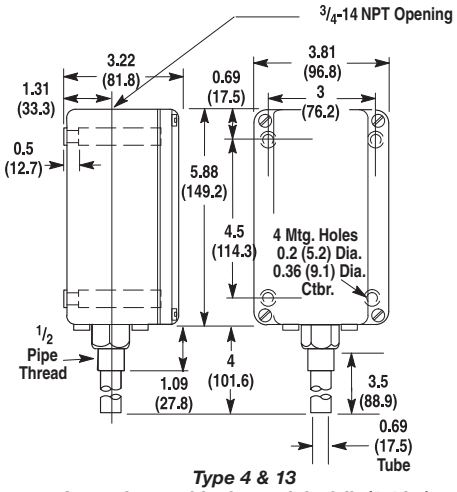
Types 7 & 9 and 4 & 13 combined
Approximate shipping weight 9 lb (4.1 kg)

Type 4 & 13
Approximate shipping weight 3 lb (1.4 kg)

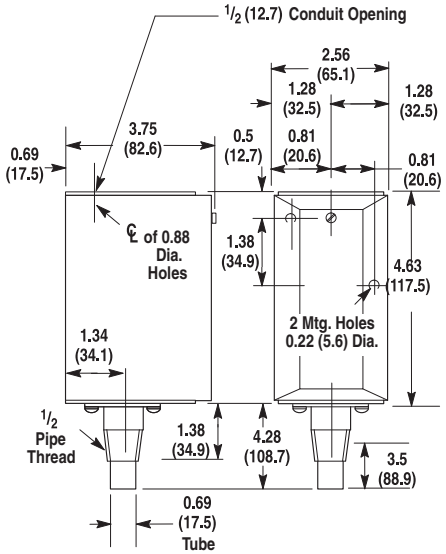
★ Dimension is 8.5 in. for Cat. Nos. 837-A3 and 837-A4 controls.

Dimensions in inches (millimeters). Dimensions are not intended to be used for manufacturing purposes.

Direct Vertical Immersion Type

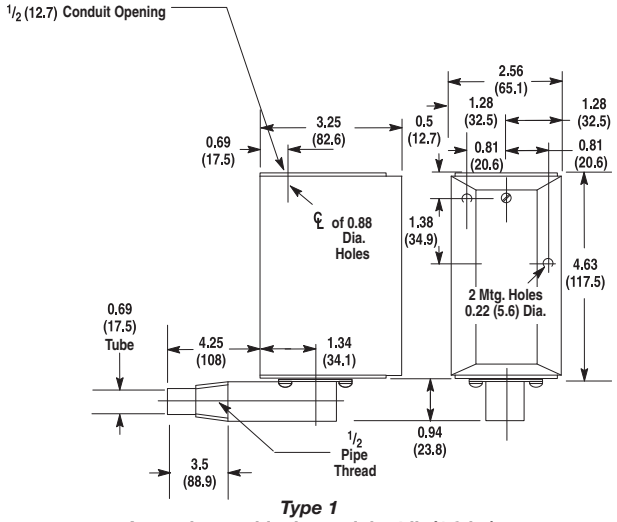


Type 4 & 13
Approximate shipping weight 3 lb (1.4 kg)



Type 1
Approximate shipping weight 3 lb (1.4 kg)

Direct Horizontal Immersion Type



Type 1
Approximate shipping weight 4 lb (1.8 kg)

Dimensions in inches (millimeters). Dimensions are not intended to be used for manufacturing purposes.

Thermostat Wells and Packing Glands

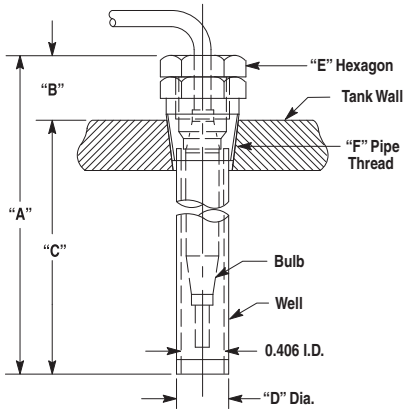


Figure A

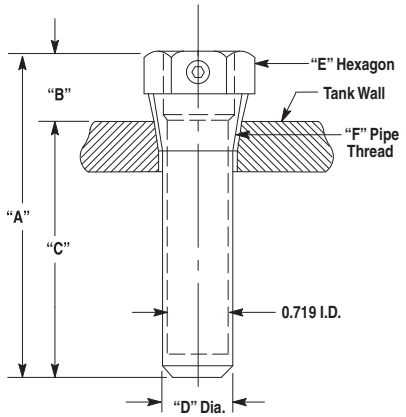


Figure B

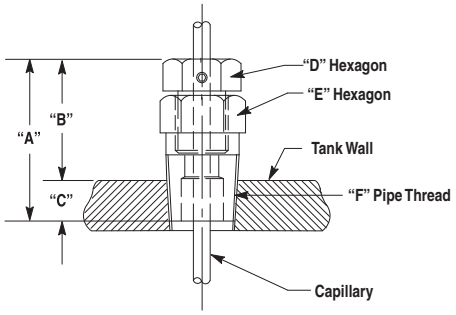


Figure C

Note: Packing gland can be used to form a seal anywhere along length of capillary.

Cat. No.	Figure	A	B	C	D	E	F
837-N1	A	4-5/8 (117.6)	23/32 (18.3)	3-29/32 (99.2)	17/32 (13.5)	7/8 (22.2)	1/2 NPT
837-N2	B	3-27/32 (97.6)	27/32 (21.4)	3 (76.2)	27/32 (21.4)	1-1/8 (28.6)	3/4 NPT
837-N3	A	5-13/32 (137.3)	1-1/2 (38.1)	3-29/32 (99.2)	17/32 (13.5)	7/8 (22.2)	1/2 NPT
837-N4	C	2-5/32 (54.8)	1-21/32 (42.1)	7/16 (11.1)	3/4 (19.1)	7/8 (22.2)	1/2 NPT
837-N5	C	2-5/32 (54.8)	1-21/32 (42.1)	7/16 (11.1)	3/4 (19.1)	7/8 (22.2)	1/2 NPT
837-N6	A	9-5/8 (244.5)	13/16 (20.6)	8-13/16 (223.8)	5/8 (15.9)	7/8 (22.2)	1/2 NPT
837-N7	A	10-5/32 (258)	1-1/2 (38.1)	8-13/16 (223.8)	5/8 (15.9)	7/8 (22.2)	1/2 NPT
837-N12	A	4-5/8 (117.6)	23/32 (18.3)	3-29/32 (99.2)	17/32 (13.5)	7/8 (22.2)	1/2 NPT
837-N13	A	9-5/8 (244.6)	13/16 (20.6)	8-13/16 (223.8)	5/8 (15.9)	7/8 (22.2)	1/2 NPT
837-N14	A	5-13/32 (137.3)	1-1/2 (38.1)	3-29/32 (99.2)	17/32 (13.5)	7/8 (22.2)	1/2 NPT
837-N15	A	10-5/16 (262)	1-1/2 (38.1)	8-13/16 (223.8)	5/8 (15.9)	7/8 (22.2)	1/2 NPT
837-N16	B	3-27/32 (97.6)	27/32 (21.4)	3 (76.2)	27/32 (21.4)	1-1/8 (28.6)	3/4 NPT

Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

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Rockwell Otomasyon Ticaret A.Ş., Kar Plaza İş Merkezi E Blok Kat:6 34752 İçerenköy, İstanbul, Tel: +90 (216) 5698400

www.rockwellautomation.com

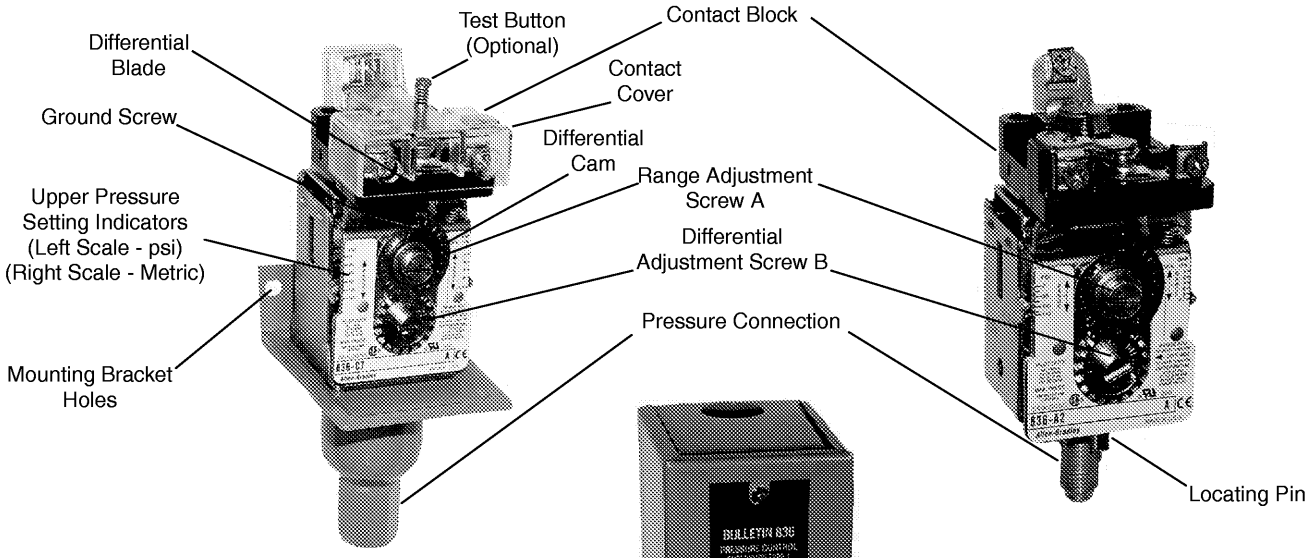
Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444
Europe/Middle East/Africa: Rockwell Automation NV, Pegasus Park, De Kleetlaan 12a, 1831 Diegem, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640
Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

Publication 836-TD001A-EN-P - September 2014

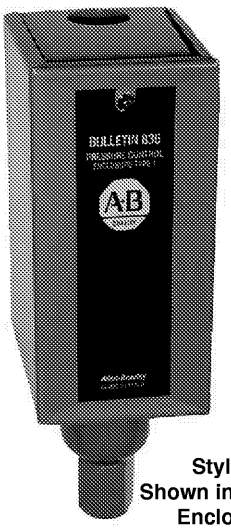
BULLETIN 836
INSTRUCTIONS

Pressure Controls



Style C Shown Without Enclosure

Style A Shown Without Enclosure



Style C Shown in Type 1 Enclosure

DESCRIPTION - Bulletin 836 Pressure Controls are designed for use with air, water, oil and other noncorrosive liquids, vapors, and gasses. (Type 316 stainless steel bellows are available for more corrosive liquids or gasses in pressure ranges to 375 psi.)

Bulletin 836 Controls are available in Type 1, 4 & 13, 4X, 7 & 9, 4 &13 combination enclosures in addition to open type. The operating range pressure and differential are adjustable. Fixed differential versions are also available. Pressure ranges available from 30 in. Hg vacuum to 900 psi.

The standard contact block is single pole, double throw and can be wired to open or close on increasing or decreasing pressure.

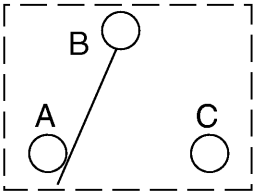
CONTACT RATINGS

Non-Inductive Ratings	Control Circuit Ratings
5 Amperes, 250 Volts	AC-125 VA 24 to 600 Volts
3 Amperes, 600 Volts	DC-57.5 VA 115 to 230 Volts

Manual reset, horsepower rated and other contact block modifications are also available on devices manufactured at the factory.

OPERATION - A low friction, straight in-line mechanism operates a snap action switch at a predetermined pressure setting. An increase in pressure causes the normally closed circuit A-B to open and normally open circuit B-C to close. This is known as the "Trip" pressure. When the pressure returns to a lower predetermined setting, the circuit A-B will close and circuit B-C will open. This is known as the "Reset" pressure. The difference between the "Trip" and "Reset" pressure is the differential.

For controls which operate in a vacuum, the following sequence occurs: 1) an increase in vacuum (lower pressure toward 30 in Hg) causes circuit A-B to close and B-C to open. This is the "Trip" setting. 2) when the pressure returns to a predetermined lower vacuum (higher pressure toward 0 psi.), circuit A-B will open and B-C will close. This is the "Reset" point. The difference between the "Trip" and "Reset" setting is the differential.



Standard Contact Arrangement For Positive Pressure

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Printed in U.S.A.

ADJUSTMENT - Generally, unless otherwise specified, controls shipped from the factory are set at the maximum operating range pressure and minimum differential.

The following procedure should be used to set the control to a particular requirement:

OPERATING RANGE ADJUSTMENT: Turn range adjustment Screw "A" counterclockwise to lower the upper and lower pressure settings. To increase the upper and lower settings, turn Screw "A" clockwise. The approximate upper pressure setting is shown by indicators on the outer edges of the nameplate.

DIFFERENTIAL ADJUSTMENT: When the differential blade is at the low point of the differential cam the control will function at minimum differential. To increase the differential, turn adjustment Screw "B" counterclockwise. This will decrease the lower pressure setting only. To decrease the differential, turn differential adjustment Screw "B" clockwise. This will raise the lower setting only.

Condensed instructions are supplied with open style controls and are on the inside of the cover of enclosed devices.

NOTE: The use of a pressure gauge is desirable when setting the control.

CAUTION: The range adjustment Screw "A" should not be adjusted beyond the pressure indicated on the pressure scale as this may cause the control to malfunction.

It is recommended that a periodic inspection of gauge pressure be made and the pressure control adjusted to compensate for application variables.

BELLOWS LIFE: The pressure applied to a bellows in a normal cycle of operation should not exceed the maximum rated Range Pressure. The bellows will withstand the rated Maximum Line Pressure but should not be cycled at this pressure. The control is designed to operate within published rated Range Pressure. For general applications a control used within 30% to 80% of Range Pressure will provide optimum bellows life and repeatability.

IMPORTANT: Bulletin 836 Style A pressure controls are normally supplied with a built in pulsation snubber. Bulletin 836 Style C devices are supplied with a removable snubber. The snubber can be removed for inspection, cleaning, or when using the control with high viscosity fluids. The snubber can be removed with a 1/4 inch nut wrench, or equivalent.

The pulsation snubber is designed to help reduce pressure transients. Transients can vary in amplitude, frequency, and duration and if not controlled with a snubber can reduce bellows life.

Pressure systems and lines must be maintained and kept free of foreign particles in air lines and sludge in fluid lines. A restricted or clogged pulsation snubber can cause the pressure control to become inoperative.

MOUNTING: The pressure control should be mounted securely to a firm base using two mounting screws. The mounting holes are provided either in the base of the enclosure or in a convenient mounting bracket which is provided as part of the open Style C control. Mounting brackets are available for the open type Style A control.

CAUTION: The control should not be supported by the electrical and pressure connections only. A support wrench should be used when tightening the electrical hub and pressure connections. The enclosed device or open type control using a mounting bracket is not intended to support connecting equipment. This equipment must be secured to support weight and to reduce vibration.

CAUTION: If a liquid thread sealant is used on the pressure connection, care must be taken to avoid excess sealant from getting into bellows orifice.

PILOT LIGHT OPTION - A high intensity neon glow pilot light is available for 120 volt, 60 hertz applications. A 24 volt DC LED pilot light is also available. The pilot light is factory wired across the N.C. contacts, circuit A-B and can easily be converted to the N.O. contacts, circuit B-C, on the standard contact block .

Unless a third wire is made available, the pilot light is connected across the load contacts which can be either the N.O. or N.C. contacts. The pilot light is on until the load is energized.

Current rating:

120 VAC high intensity neon glow . . . . . 4 mA
24 VDC high intensity LED . . . . . 22 mA

ATTENTION - To prevent electrical shock, disconnect from power source before installing or servicing.

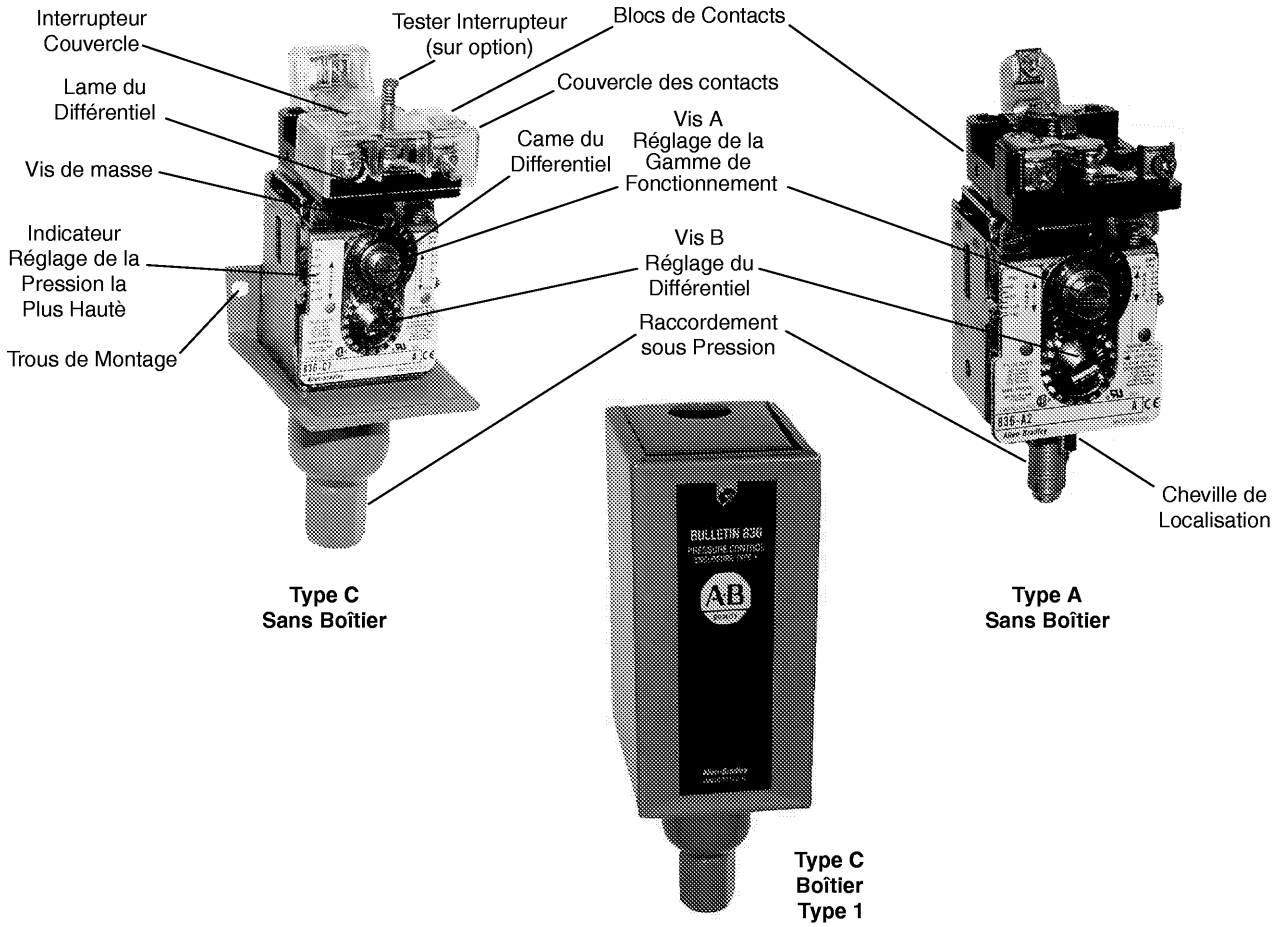
CAUTION - For 24 VDC LED pilot lights, polarity must be observed. Red (+) lead of pilot light should always be connected to rear terminal (B)

To order pilot light version add X9 (120VAC), X15 (24VDC) or X18 (24VDC) to catalog number of the selected control.

REPAIRS - Due to the integral construction of the Bulletin 836 Pressure Control, only limited repairs can be made in the field. If returned to the factory for repairs, the condition of the control will be evaluated to determine economic feasibility. When practical, the control will be repaired, factory adjustments made for optimum performance and tested to specifications.

CONTACT BLOCK REPLACEMENT - To order the Bulletin 836 Contact Block replacement Kit, specify Catalog Number 836-N2.

Commandes à Pression



DESCRIPTION - Les commandes à pression du Bulletin 836 sont conçues pour usage avec l'air, l'eau, l'huile, les liquides non corrosifs, les vapeurs et du gaz. (Des soufflets en acier inoxidable Type 316 existent pour un usage avec de nombreux autres liquides ou gaz corrosifs dans gammes de la pression à 375 psi.)

Les commandes du Bulletin 836 sont disponibles avec boîtiers Type 1, 4 & 13, 4X, 7 & 9, 4 & 13 la combinaison et sans boîtier.

La pression de fonctionnement est réglable soit le différentiel. Des interrupteurs avec un différentiel fixe sont aussi disponibles.

La gamme de pression disponible est de 30" Hg. vacuum jusqu' à 900 lbs/po. carré.

Le bloc de contacts est monopolaire, bidirectionnel et peut être câblé pour s'ouvrir ou se fermer sur des augmentations ou diminutions de pression.

VALEURS NOMINALES DES CONTACTS

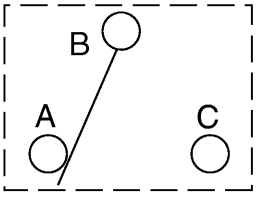
Valeurs nominales non inductives	Valeurs nominales circuit de commande
5 Amps, 250 Volts	CA-125 VA 24 à 600 Volts
3 Amps, 600 Volts	CC-57.5 VA 115 à 230 Volts

D'autres modifications des blocs de contacts sont aussi disponibles, tel que:
Réarmement manuel
Valeur nominale en HP

FONCTIONNEMENT - Un mécanisme à basse friction en ligne directe fait fonctionner un interrupteur à rupture brusque à une valeur de pression pré-réglée. Sous la pression de declenchement le circuit normalement fermé A-B s'ouvre et le circuit normalement ouvert B-C se ferme. Quand la pression retourne à une valeur plus base pré-réglée, le circuit A-B se ferme et le circuit B-C s'ouvre.

On appelle ceci la pression de réarmement. La différence entre le déclenchement et la pression de réarmement est le différentiel.

Pour les commandes qui fonctionnent dans un vacuum, les séquences suivantes surviennent: 1) Une augmentation de vacuum (pression plus basse vers 30" Hg) cause le circuit A-B de se fermer et le circuit B-C de s'ouvrir. Ceci est le réglage de déclenchement. 2) Quand la pression retourne à un vacuum plus bas pré-réglé (pression plus élevée vers 0 lbs/po. carré) le circuit A-B s'ouvre et le circuit B-C se ferme. Ceci est le point de réarmement. La différence entre le déclenchement et le point de réarmement est le différentiel



Arrangement du Contact Standard Pour Pression Positive

40060-217-01 (5)
Printed in U.S.A.

ADJUSTEMENT - Toutes les commandes expédiées de l'usine sont réglées au maximum de la gamme de pression, et au différentiel minimum, néanmoins un client peut commander un réglage spécifique. Les types de réglages sont décrits ci-dessous.

RÉGLAGE GAMME DE PRESSION: Tourner la vis "A" en sens horologique pour augmenter la valeur de pression la plus haute et la plus basse.

Tourner la vis "A" en sens antihorologique pour diminuer la valeur de pression la plus haute et la plus basse.

La valeur approximative de la pression la plus haute est démontrée par des indicateurs sur les côtés extérieurs de la plaque signalétique.

RÉGLAGE DIFFÉRENTIEL: Quand la lame du différentiel est au point bas ede la came du différentiel la commande fonctionne au différentiel minimum.

Pour augmenter le différentiel, tourner la vis de réglage "B" en sens anti-horologique. Ceci diminuera la valeur de la plus basse pression seulement.

Pour augmenter le différentiel, tourner la vis de réglage "B" en sens horologique. Ceci augmentera la valeur de la plus basse pression seulement.

À NOTER: Voir aussi les renseignements sur le réglage fournis avec tourtes les commandes avec ou sans boitier.
Pour un réglage exact, toujours utiliser un jauge de pression.

ATTENTION: Pour éviter un mauvais fonctionnement de la commande ne jamais tourner la vis de réglage "A" au-delà de la position indiquée sur l'échelle étalonnée.

LONGÉVITÉ DES SOUFFLETS: La pression appliquée à un soufflet dans un cycle normal de fonctionnement devrait être inférieure à la gamme nominale maximum. La pression maximum dans le cycle plus le changement de pression dans le cycle doivent être inférierus à la pression de la ligne maximum permise. Pour obtenir une plus longue durée du soufflet nous vous recommandons de faire fonctionner la commande à une valeur de pression approximativement au milieu de la gamme de fonctionnement.

IMPORTANT : Les régulateurs de pression type A du Bulletin 836 sont normalement fournis avec un limiteur de pulsations. Les régulateurs type C du Bulletin 836 sont équipés d'un limiteur amovible. Ce limiteur peut être retiré pour l'inspection et le nettoyage ou lorsque le régulateur est utilisé avec des fluides à haute viscosité. Le limiteur peut être retiré avec une clé de 1/4 po ou un outil équivalent.

Le limiteur de pulsation est conçu pour réduire les transitoires de pression. L'amplitude, la fréquence et la durée des transitoires pouvant varier, ils peuvent réduire la durée de vie utile des soufflets s'ils ne sont pas contrôlés par un limiteur.

Les systèmes sous pression doivent être entretenus de façon à ce que les conduites d'air soient toujours exemptes de particules étrangères et les conduites de fluides, exemptes de boue. Un limiteur de pulsation obstrué ou colmaté peut empêcher le fonctionnement du régulateur de pression.

MONTAGE: La commande de pression devrait être montée solidement à une base ferme en utilisant deux vis de montage. Les trous de montage sont fournis soit à la base du boîtier ou sur un support de montage qui est fourni avec la commande du Type C sans boîtier. Bien que des supports de montage sont disponibles pour une commande Type A sans boîtier ils sont normalement montés sur un panneau avec la connexion de pression à l'exteriur du panneau.

ATTENTION: La commande ne doit pas être supportée seulement par les connexions électriques et de pression. On doit utiliser une clé anglaise de support quand on reserre le raccord du conduit électrique et le raccord de pression.

ATTENTION: Si on utilise un scellage liquide sur le raccord de pression s'assurer que l'excès ne coule pas dans l'orifice du soufflet.

OPTION DE TÉMOIN LUMINEUX - Un témoin lumineux au néon haute intensité est offert pour les applications 20 volts, 60 hertz. Un témoin DEL 24 volts c.c. est également disponible. Le témoin est câblé en usine entre les contacts N.F. du circuit A-B et peut facilement être reconnecté entre les contacts N.O. du circuit B-C, sur le bloc de contacts standard.

À moins qu'un troisième fil soit disponible, le témoin est connecté sur les contacts de charge, lesquels peuvent être soit N.O., soit N.F. Le témoin reste allumé jusqu'à ce que la charge soit activée.

Intensité nominale :
Témoin néon 120 V c.a. haute intensité . . . . . 4 mA
Témoin DEL 24 V c.c. haute intensité . . . . . 22 mA

ATTENTION - Pour éviter un choc électrique, débrancher de la source d'alimentation avant installation ou entretien.

CAUTION - Avec les témoins DEL 24 V c.c., la polarité doit être respectée. Le fil rouge (+) du témoin doit toujours être branché sur la borne arrière (B).

Lors de la commande du témoin lumineux, ajouter X9 (120 V c.a.) X15 (24 V c.c.) ou X18 (24Vc.c.) au numéro de catalogue, selon le modèle désiré.

RÉPARATIONS - Dû à la construction intégrale de la commande à pression du Bulletin 836, elle doit être retournée à l'usine pour réparations. La commande sera réglée pour un rendement optimum et elle sera essayée selon les spécifications.

REMPLACEMENT DU BLOC DE CONTACTS - Pour commander le jeu de remplacement du bloc de contacts Type C Bulletin 836 spécifier le numéro de catalogue 836-N2.

Rockwell Automation