

Condition Sensing Specifications

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

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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.

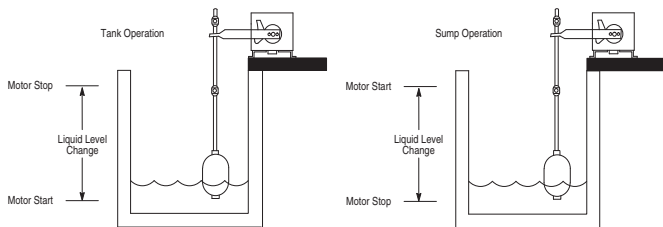
Turbulence — Waves or agitation in the liquid. Excessive turbulence may cause improper switch operation — for example, early switching or switching between operating points.

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.

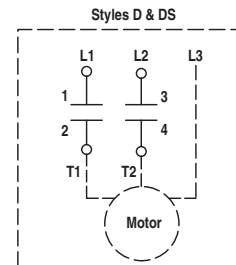
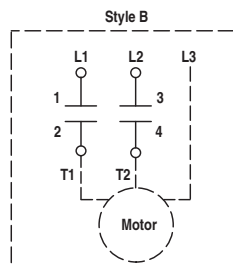
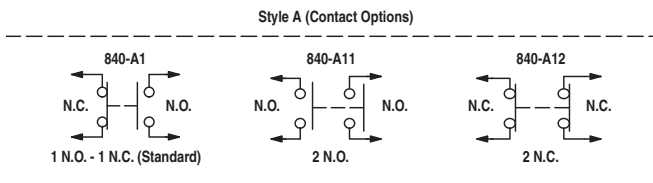
Maximum Contact Rating per Pole

Max. V AC	AC — NEMA A600				DC — NEMA N300		
	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

Style	Single-Phase AC		2- or 3-Phase AC		DC		
	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



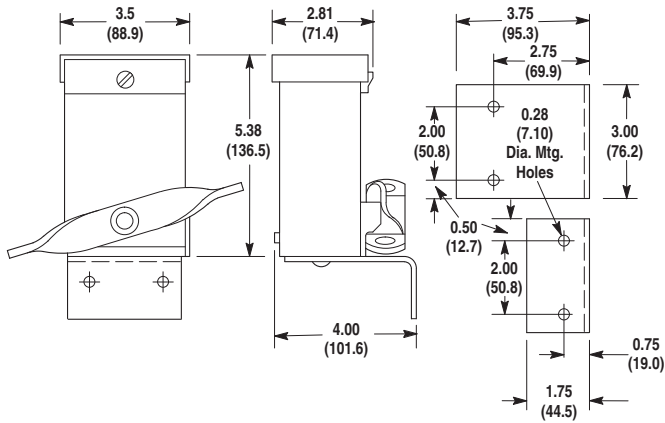
Approximate Dimensions

Approximate Dimensions and Shipping Weights

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

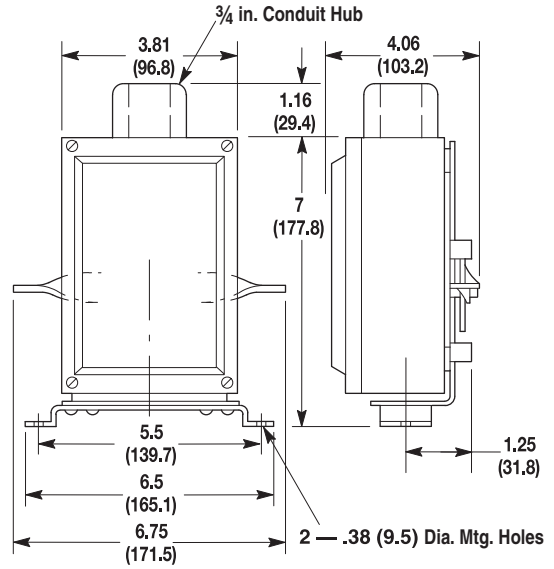
Type 1

Mounting Bracket

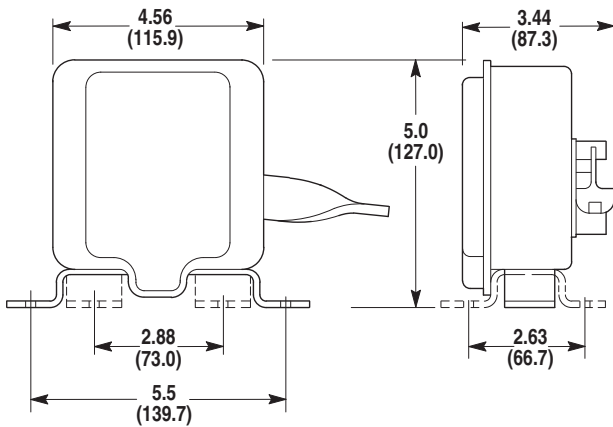


Style A —
Approximate Shipping Weight 4 lbs (1.8 kg)

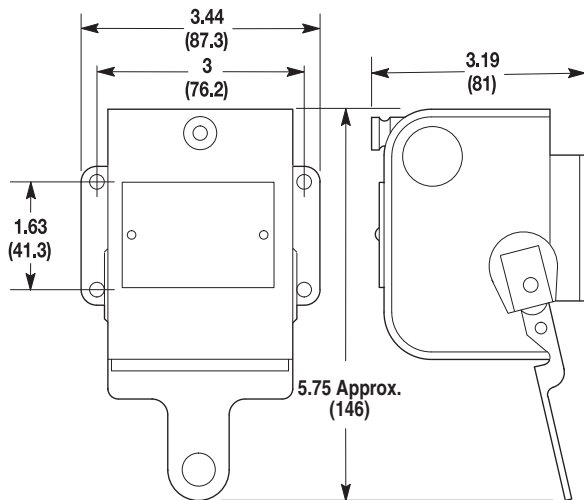
Type 4



Styles A and B —
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)

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 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 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

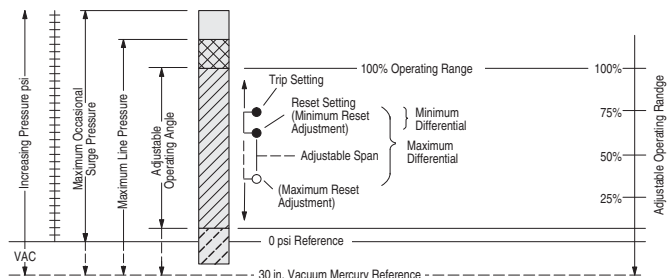
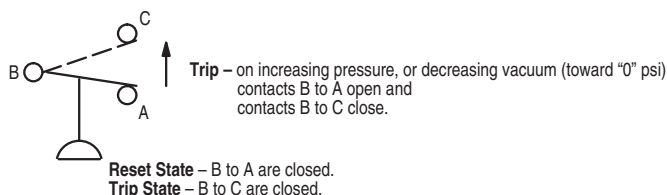


Figure 2
Positive pressure or vacuum



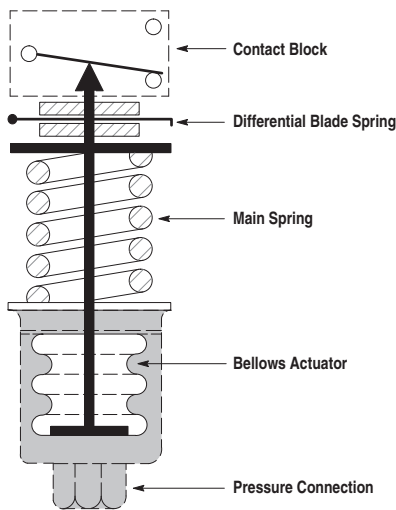
Theory of Operation

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 the 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

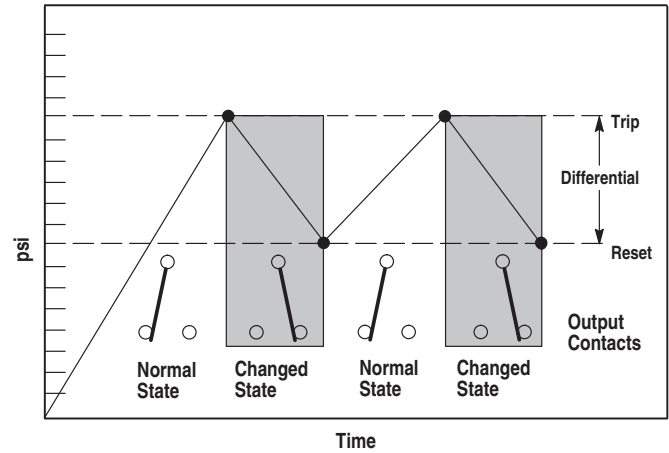
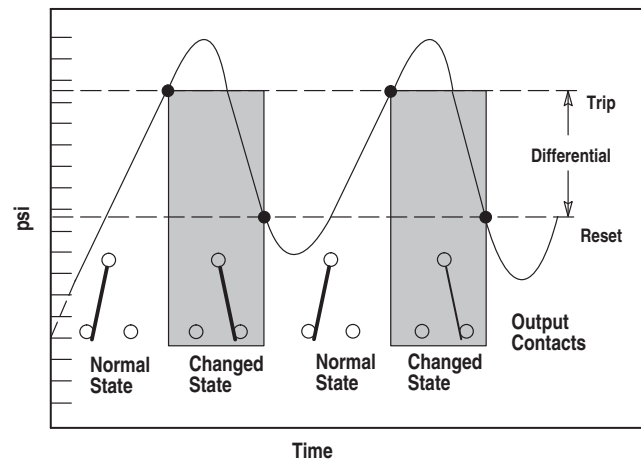


Figure 5
Typical monitoring application



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.

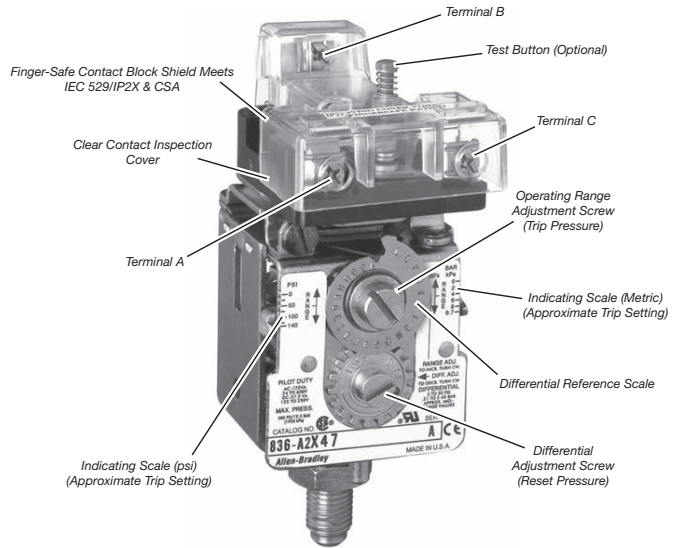
Note: Turning the operating range adjustment screw will change both the trip and reset settings in virtually equal increments.

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



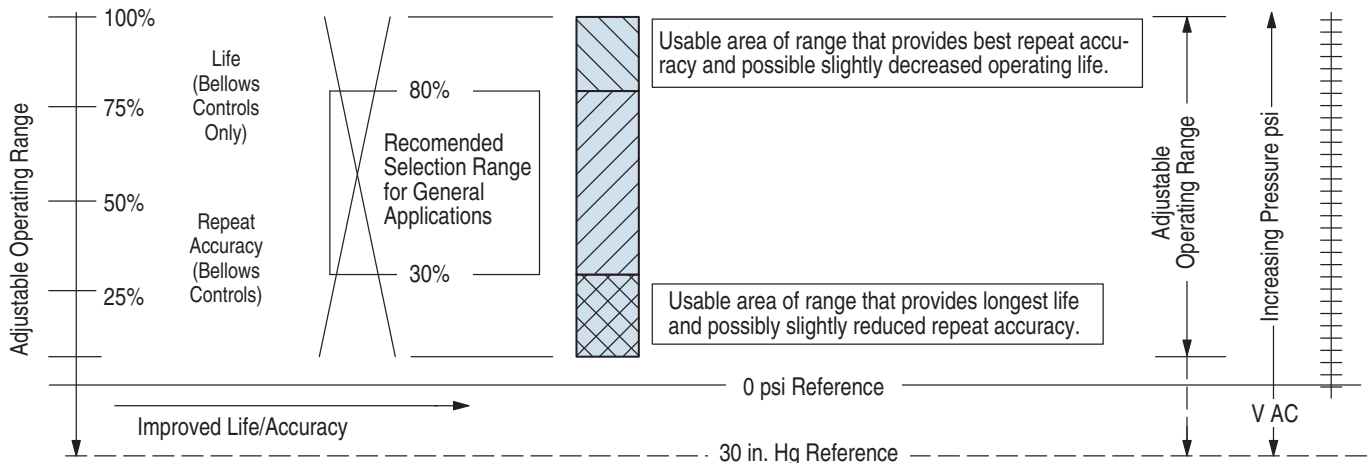
Repeat Accuracy and Mechanical Life

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

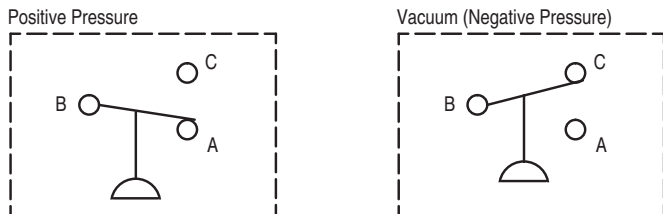
5 A, 240V
3 A, 600V

Control circuit ratings

AC - 125 VA, 24...600V
DC - 57.5 VA, 115...230V

Standard Contact Wiring Configurations

Single-pole double throw



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

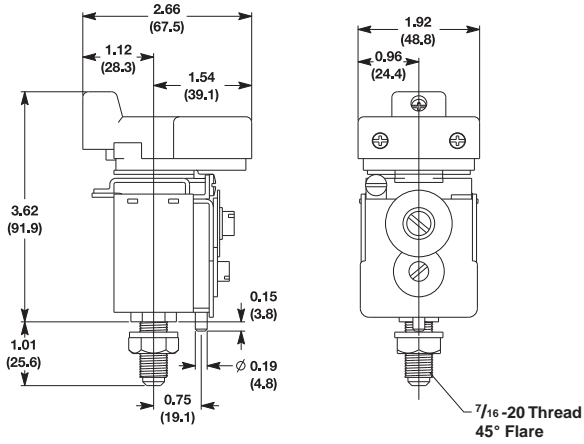
Rockwell Automation will factory set pressure control values to customer-specified values only if a Cat. No. 836-C device is ordered. Catalog numbers ordered without the "C" suffix are set at the maximum operating range and minimum differential. See Factory Options.

Pressure Control Selection

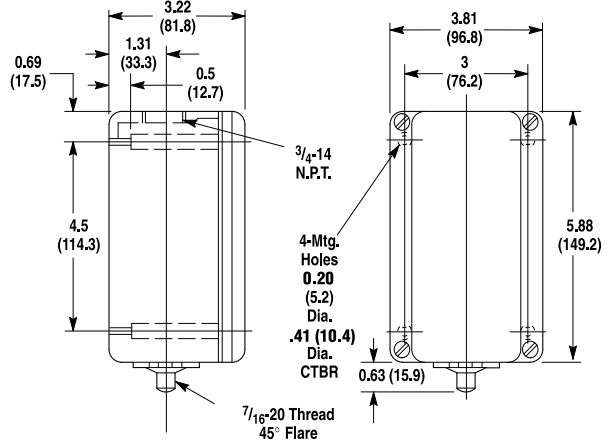
The selection table below is an overview of the three types of Allen-Bradley Bulletin 836 Pressure Controls. Each type of control is suitable for use on many types of applications. Pressure ranges, pressure connections, enclosure types, and the compatibility of the actuator with different types of pressure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

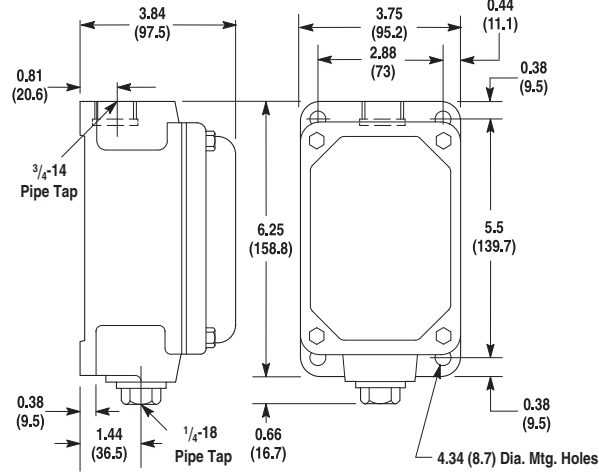
★ Corrosive liquids and gases compatible with Type 316 Stainless Steel.



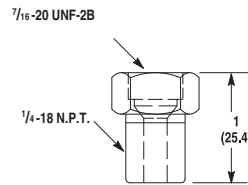
Open Type
Approximate Shipping Weight 1 lb. (0.45 kg)



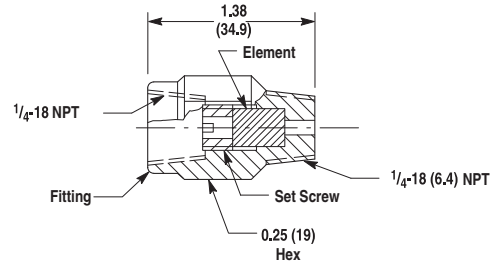
Type 4 & 13
Approximate Shipping Weight 3 lbs (1.4 kg)



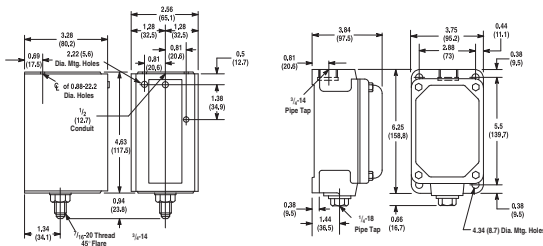
Type 7 & 9 and 4 & 13
Approximate Shipping Weight 9 lbs (4.1 kg)



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)

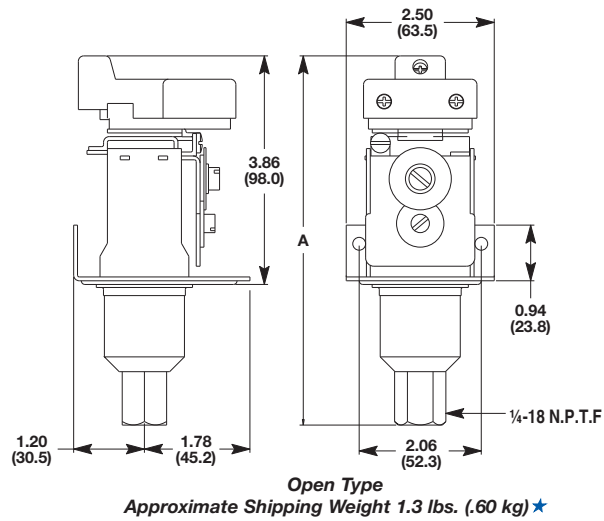


Type 1
Approximate Shipping Weight 2 lbs (0.91 kg)

Approximate Dimensions and Shipping Weights

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

Style C



Pressure Controls

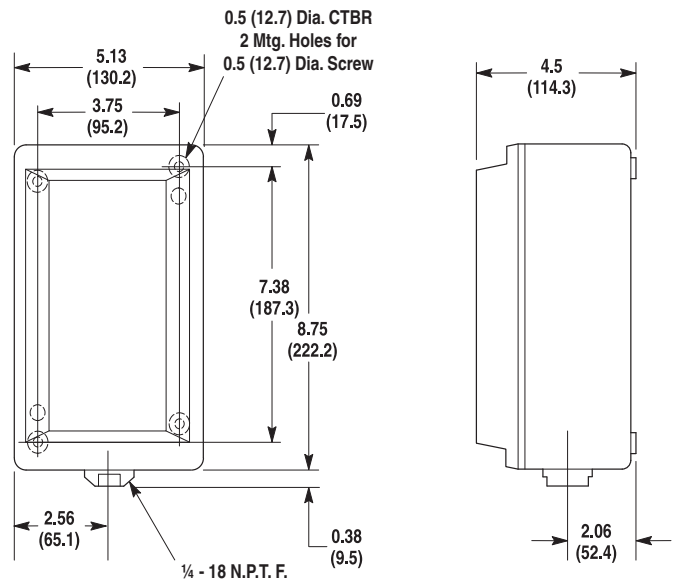
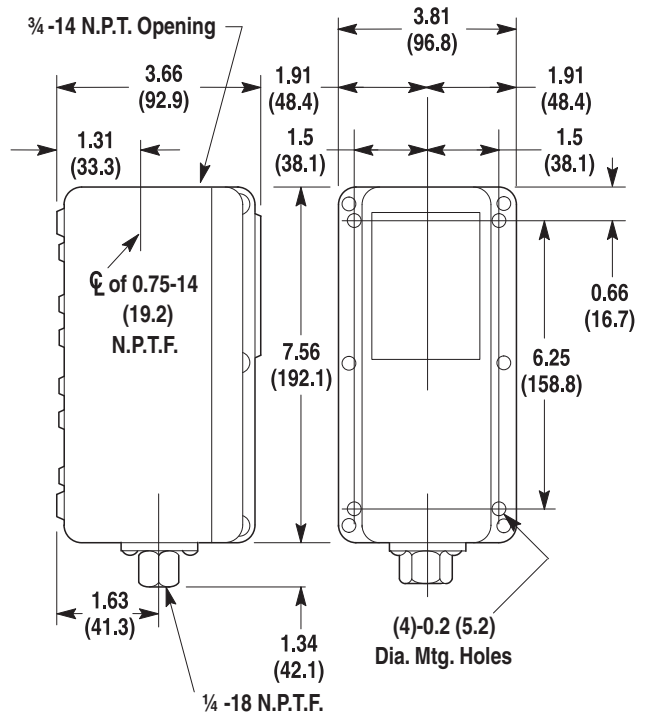
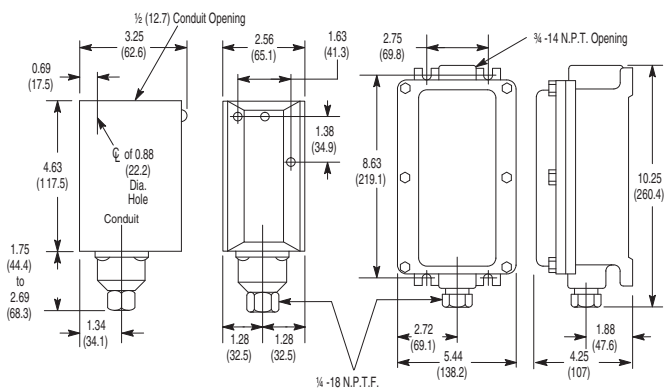
Approximate Dimensions

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)



★ 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.

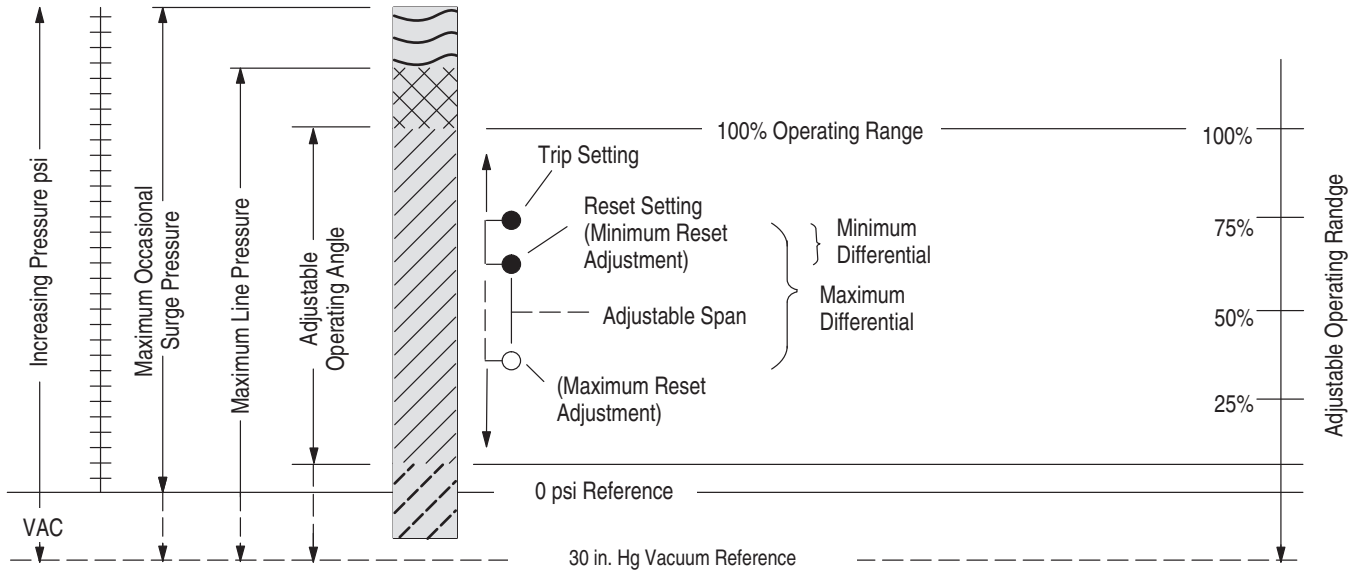
Trip setting — Desired difference in pressure between the two bellows at which value the contacts transfer from their normal state to a changed state. This occurs in one of the following conditions:

- 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



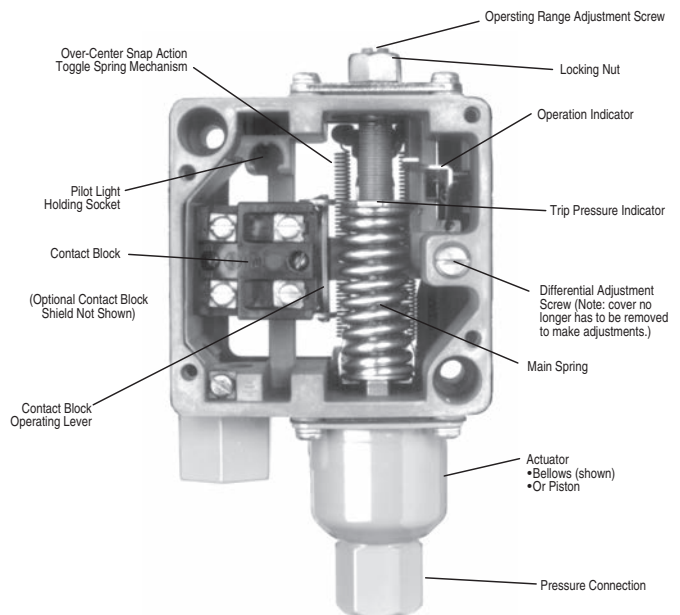
Theory of Operation

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

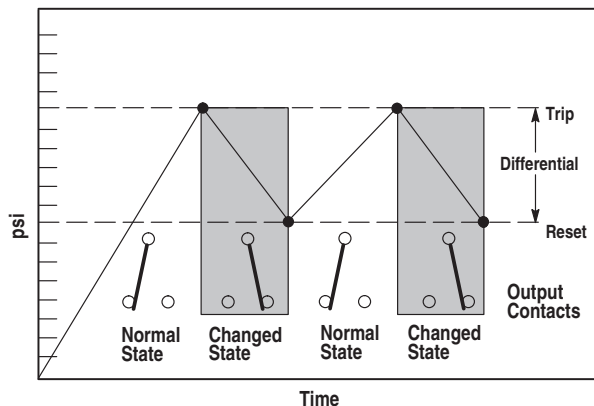
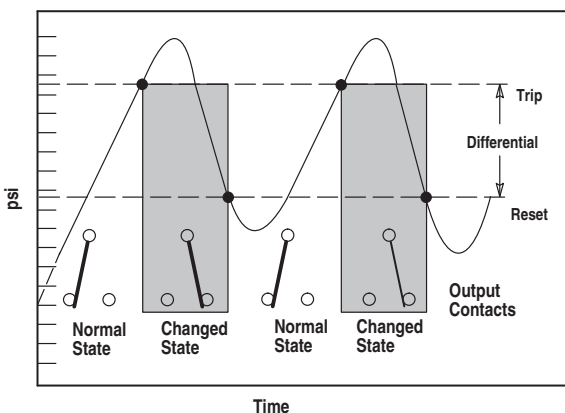


Figure 4
Typical monitoring application



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.

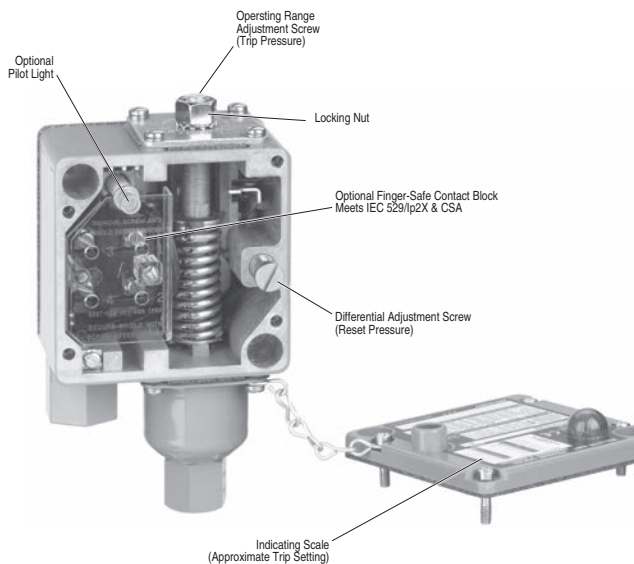
Note: Turning the operating range adjustment screw will cause both the trip and reset settings to change in virtually equal increments.

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.

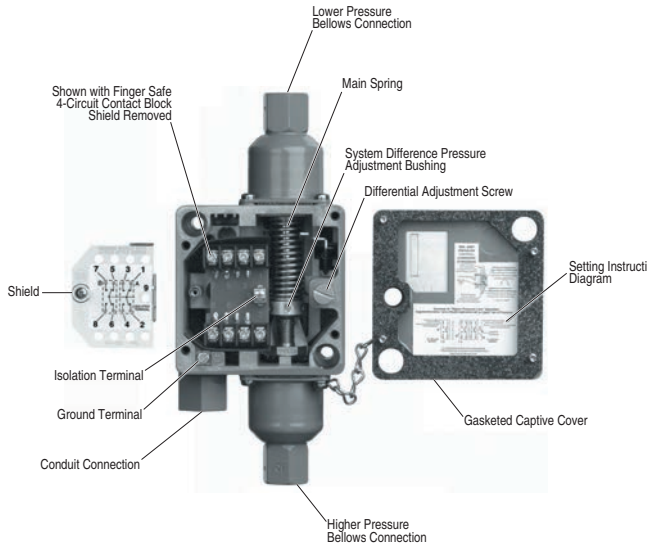
Note: Turning the system difference pressure bushing will cause both the trip and reset settings to change in virtually equal increments.

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.

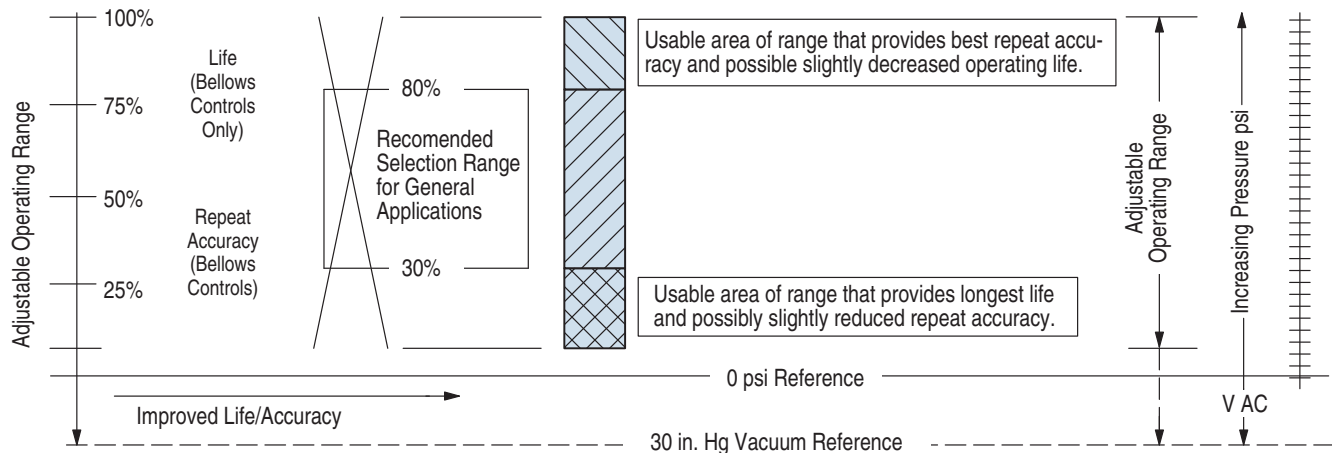
For general applications, controls selected where the contacts operate between 30% and 80% of the operating range and where the maximum line and surge pressures do not exceed the specified values will provide excellent life and repeat accuracy. For more specific applications, it is important to note 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 ₂ O
psi x 27.68 = in. H ₂ O
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).
- H₂O 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

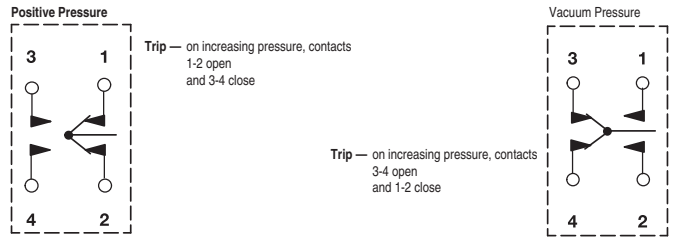
4 Circuit Contact Ratings

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

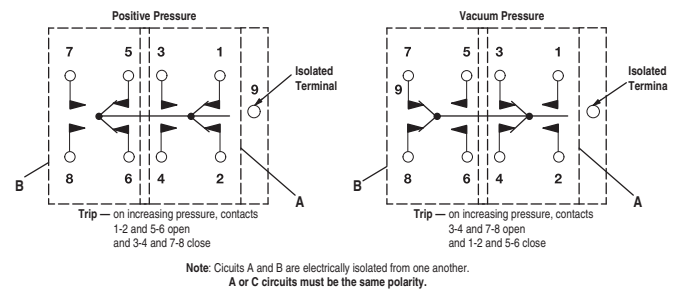
Note: NEMA does not rate contacts to switch low voltage and current. Bulletin 836T Styles T and D Pressure Controls are supplied with silver contacts. The devices are designed to deliver high force snap action to the contacts. This provides exceptional contact fidelity at 24V DC I/O card current level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

Contact Wiring Configurations

2-Circuit Contact Blocks



4-Circuit Contact Blocks

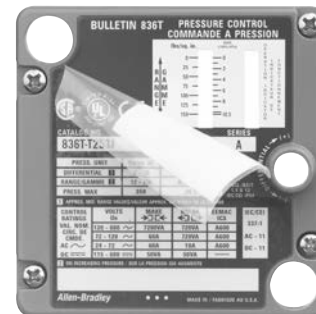


Note: Circuits A and B are electrically isolated from one another. A or C circuits must be the same polarity.

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 actuator 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.

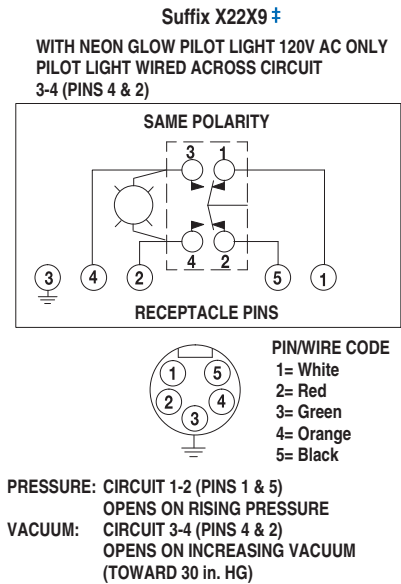
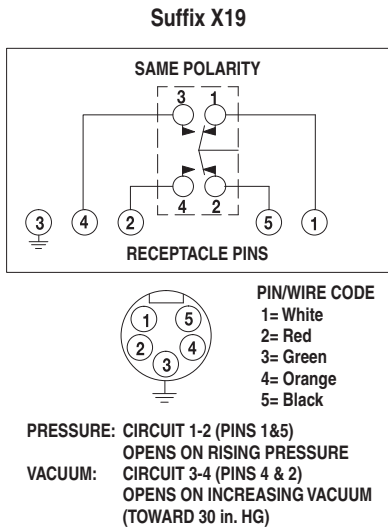
Note: Pressure difference controls are supplied with either copper alloy or stainless steel bellows. See Product Selection on page 13-38 and page 13-39 for details.

Wiring Diagrams

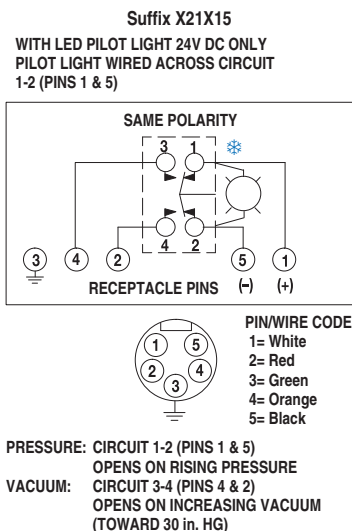
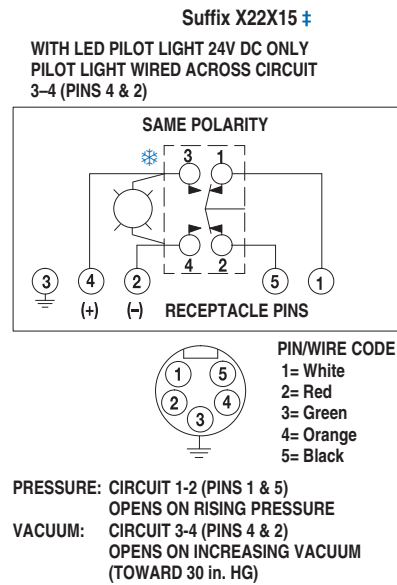
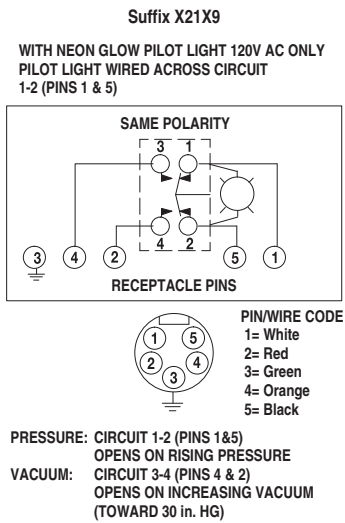
Bulletin 836T 5-Pin Mini-Type Receptacle Option Wiring Reference (J1 Wiring)

(See applicable codes and laws)

Without Pilot Light



With Pilot Light★



★ 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.

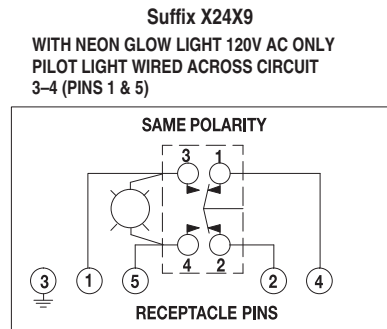
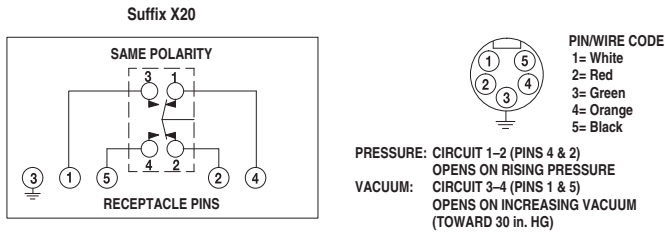
‡ Note pilot light polarity.

§ X22 not available with 4-circuit pressure controls.

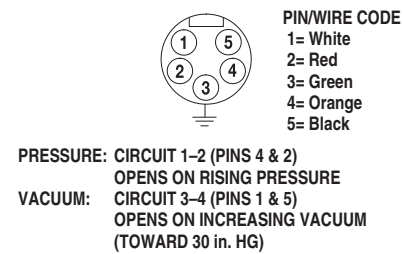
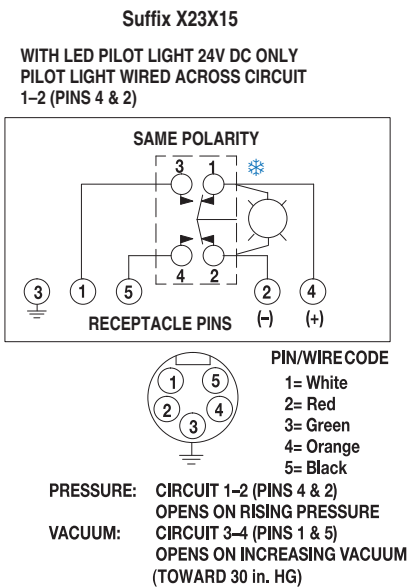
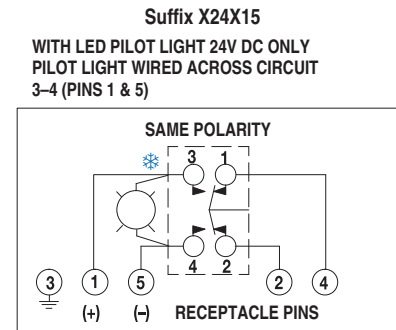
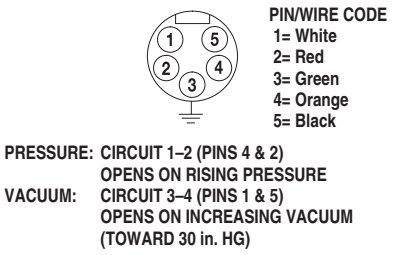
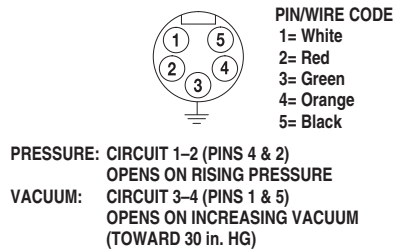
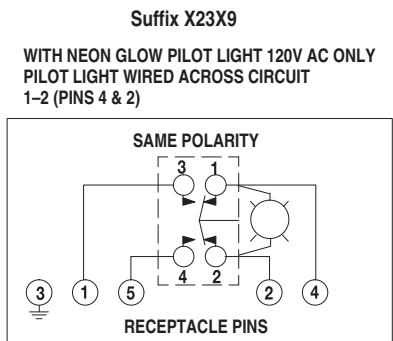
Bulletin 836T 5-Pin Mini-Type Receptacle Option Wiring Reference (J9 Wiring)

(See applicable codes and laws)

Without Pilot Light



With Pilot Light★



★ 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.

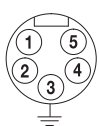
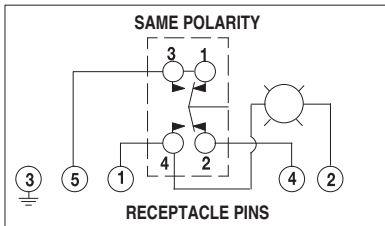
Bulletin 836T 5-Pin Mini-Type Receptacle Option Wiring Reference

(See applicable codes and laws)

With Pilot Light

Suffix X81X9

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

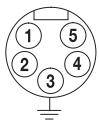
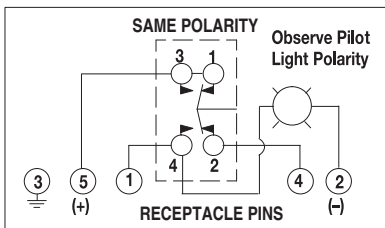


PIN/WIRE CODE
1= White
2= Red
3= Green
4= Orange
5= Black

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

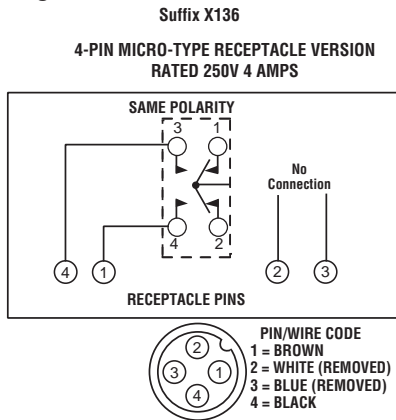
PRESSURE: CIRCUIT 1-2 (PINS 5 & 4)
OPENS ON RISING PRESSURE
VACUUM: CIRCUIT 3-4 (PINS 5 & 1)
OPENS ON INCREASING VACUUM
(TOWARD 30 in. HG)

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.

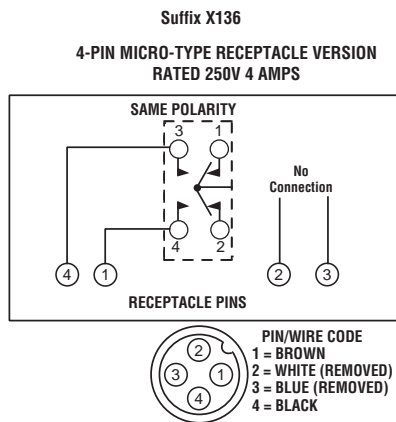
Bulletin 836T 4-Pin Micro-Type Receptacle Option Wiring Reference

(See applicable codes and laws)

Without Pilot Light

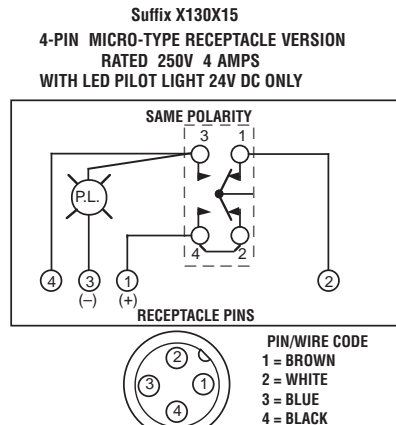


PRESSURE: CIRCUIT 3-4 (PINS 1 & 4)
CLOSES ON RISING PRESSURE
VACUUM: CIRCUIT 1-2
CLOSES ON INCREASING VACUUM
(TOWARD 30" HG)

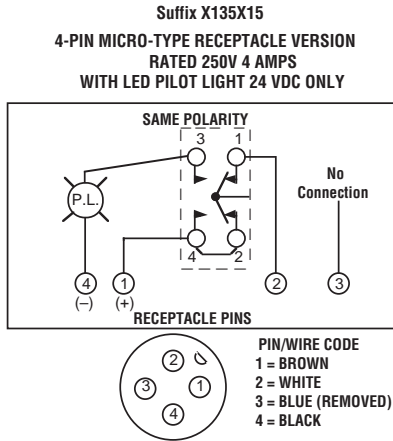


PRESSURE: CIRCUIT 3-4 (PINS 1 & 4)
CLOSES ON RISING PRESSURE
VACUUM: CIRCUIT 1-2
CLOSES ON INCREASING VACUUM
(TOWARD 30" HG)

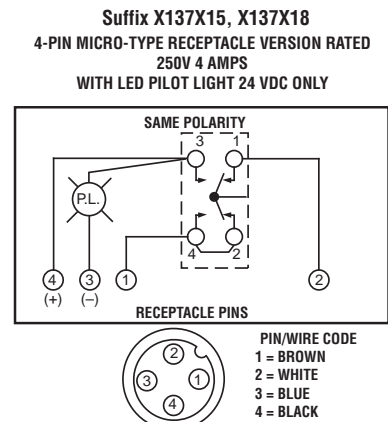
With Pilot Light★



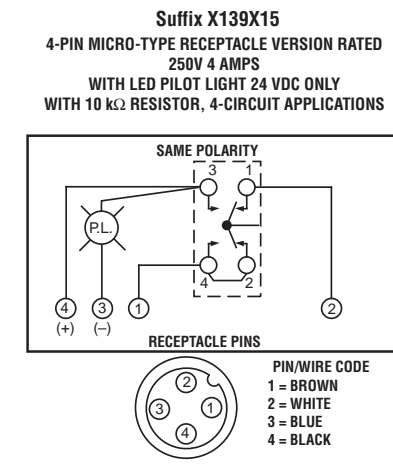
PRESSURE: CIRCUIT 3-4 (PINS 1 & 4)
CLOSES ON RISING PRESSURE
VACUUM: CIRCUIT 1-2
CLOSES ON INCREASING VACUUM
(TOWARD 30" HG.)



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

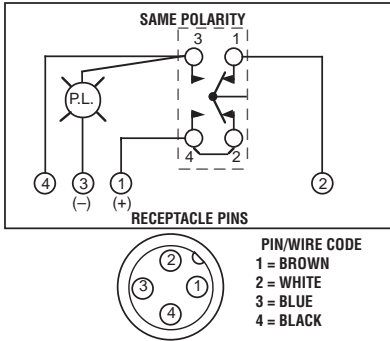


PRESSURE: CIRCUIT 3-4 (PINS 1 & 4)
CLOSES ON RISING PRESSURE
VACUUM: CIRCUIT 1-2
CLOSES ON INCREASING VACUUM
(TOWARD 30" HG.)



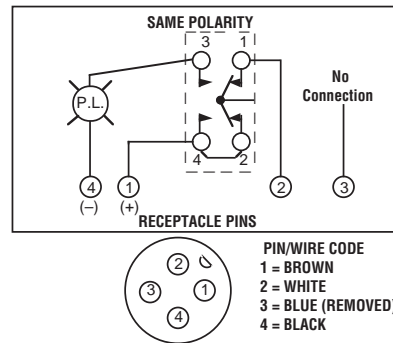
PRESSURE: CIRCUIT 3-4 (PINS 1 & 4)
CLOSES ON RISING PRESSURE
VACUUM: CIRCUIT 1-2
CLOSES ON INCREASING VACUUM
(TOWARD 30" HG.)

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



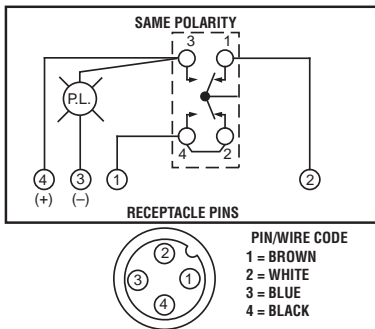
PRESSURE: CIRCUIT 3-4 (PINS 1 & 4)
CLOSES ON RISING PRESSURE
VACUUM: CIRCUIT 1-2
CLOSES ON INCREASING VACUUM
(TOWARD 30" HG.)

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



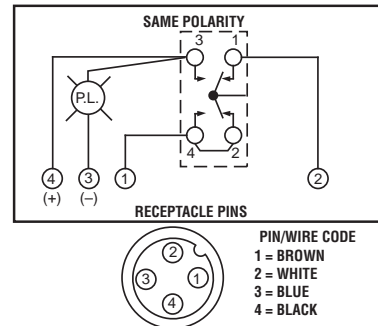
PRESSURE: CIRCUIT 3-4 (PINS 1 & 4)
CLOSES ON RISING PRESSURE
VACUUM: CIRCUIT 1-2
CLOSES ON INCREASING VACUUM
(TOWARD 30" HG.)

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.)

★ 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.

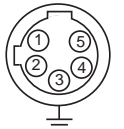
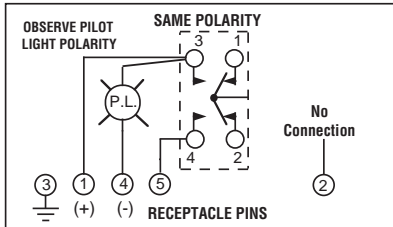
Bulletin 836T 5-Pin Micro-Type Receptacle Option Wiring Reference

(See applicable codes and laws)

With Pilot Light★

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

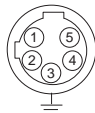
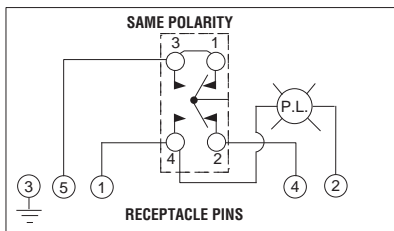
**5-PIN MICRO-TYPE RECEPTACLE VERSION
RATED 300V 3 AMPS
WITH LED PILOT LIGHT 24VDC ONLY**



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.**

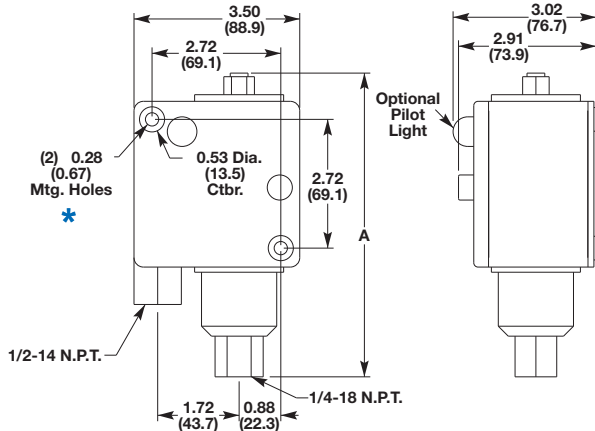
§ X22 not available with 4-circuit pressure controls.

Approximate Dimensions

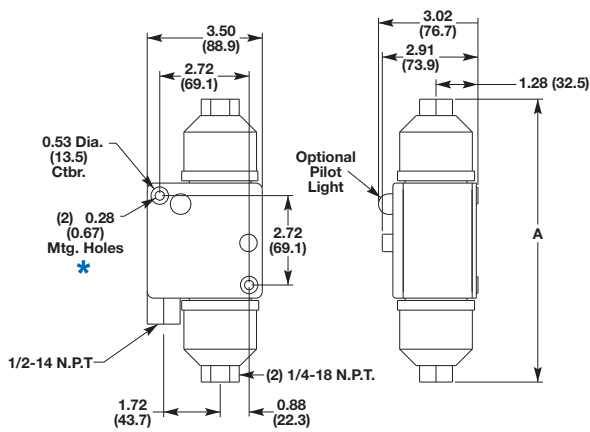
Approximate Dimensions and Shipping Weights

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)



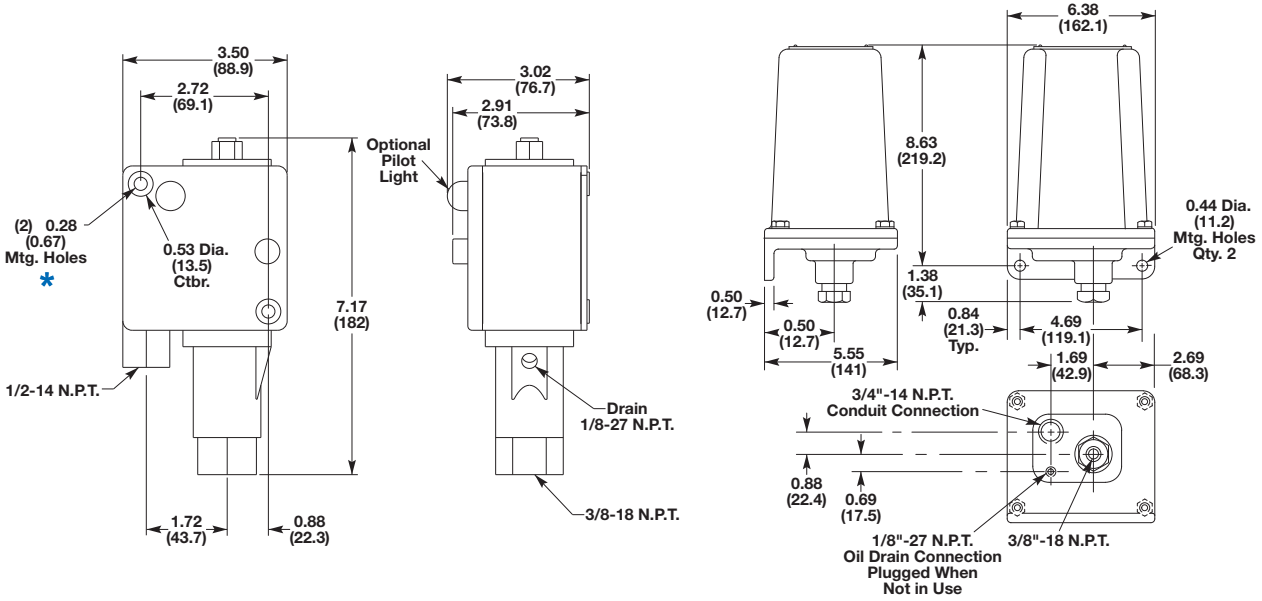
Approximate Shipping Weight 4 lbs. (1.8 kg)

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	8.5 (216)
836T-T252J	6.41(163)	836T-T262J	7.33 (186)	836T-D452J			
836T-T253J		836T-T263J	7.25 (184)	836T-D453J	836T-D463J	10.06 (256)	
836T-T261J							

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

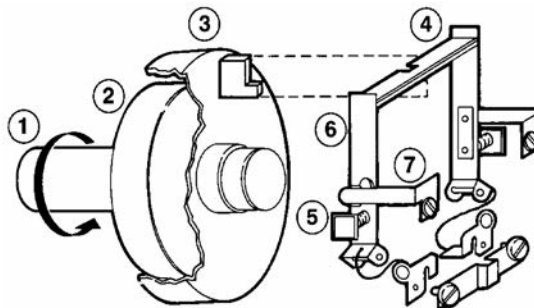
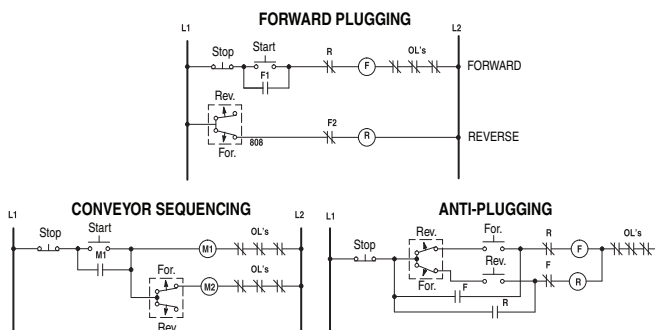


Figure 2
Typical Control Circuits



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 (WR²) 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

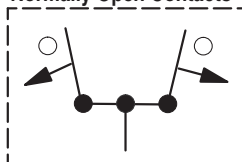
Contact Operating Range RPM	Shaft Operating Speed Maximum RPM	Driving Torque Maximum lb•in	Temperature Rise (Maximum RPM) °F
15...80	1200	6 (.68 N•m)	120 °F (49 °C)
50...1000	2000	6 (.68 N•m)	140 °F (60 °C)

Contact Ratings — NEMA B600

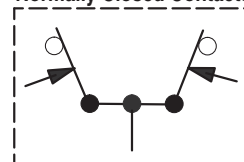
Maximum AC Voltage	AC				DC		
	Amperes		Continuous Carrying Current	Voltamperes		Maximum Voltage	Ampere
	Make	Break		Make	Break		
120	30	3.00	5	3600	360	115...125	0.12 0.08
240	15	1.50	5	3600	360	230...250	
480	7.5	0.75	5	3600	360	—	—
600	6	0.6	5	3600	360	—	—

Contact Wiring Configurations

Normally Open Contacts



Normally Closed Contacts

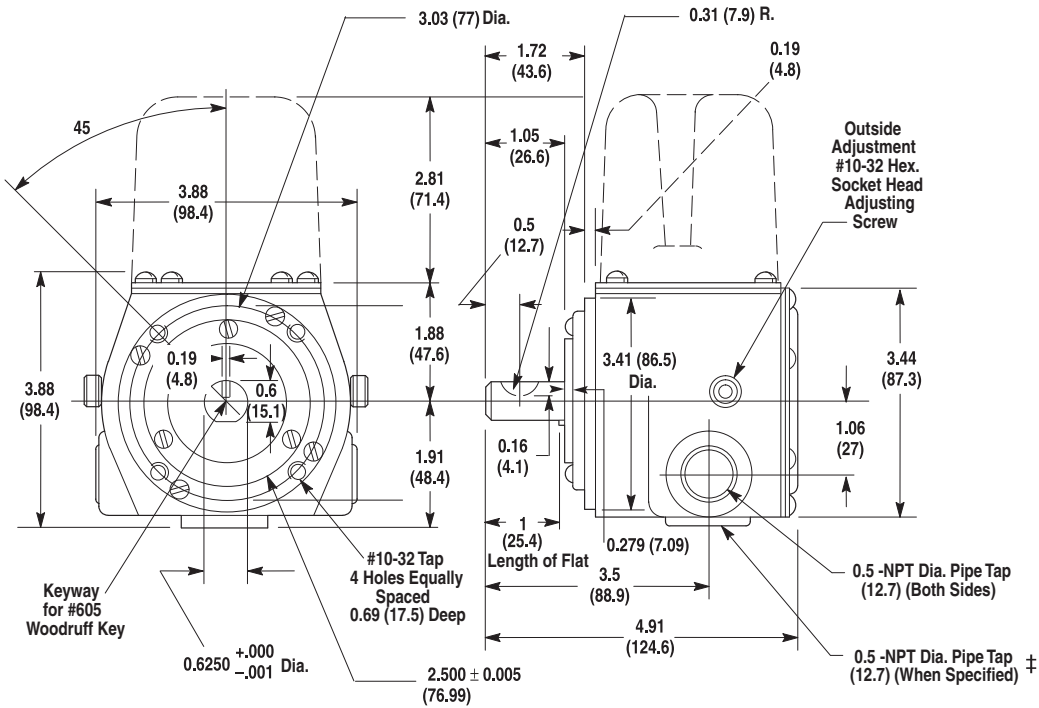


Approximate Dimensions

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

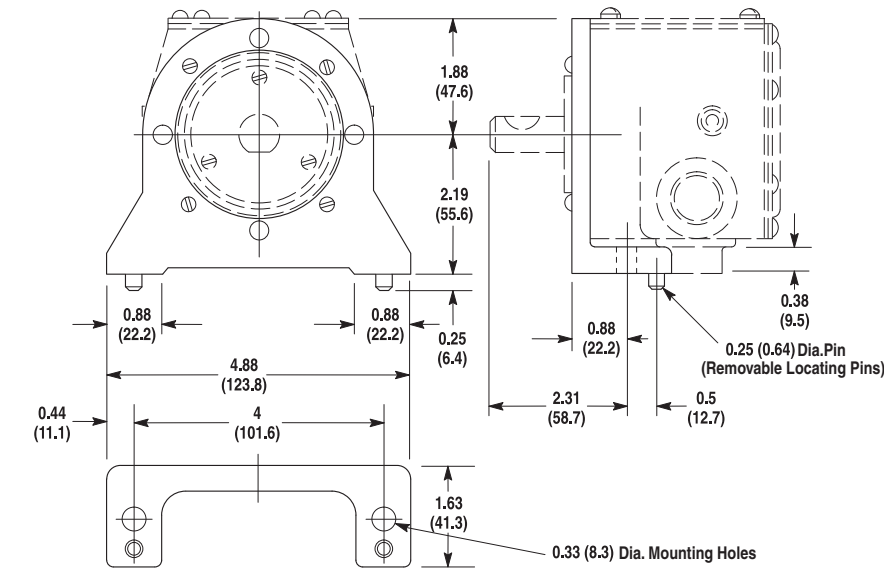
Type 1, 4, & 13

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.

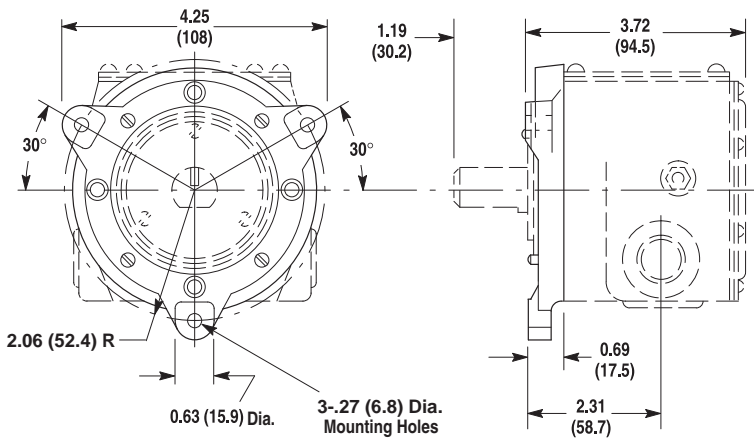
Approximate Shipping Weight

- 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)



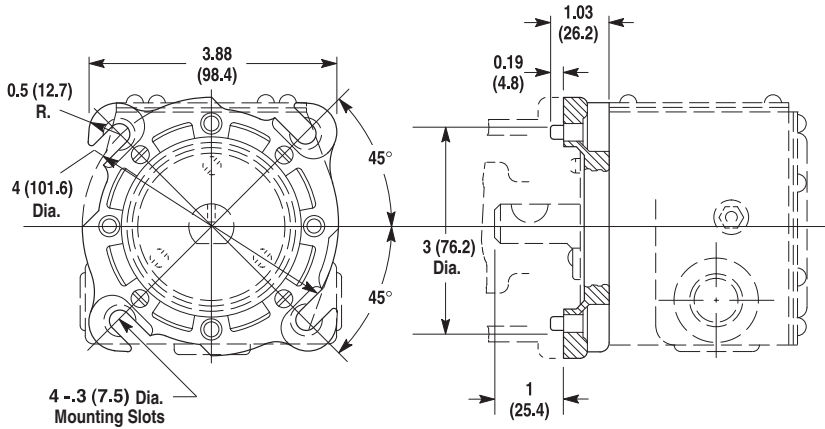
Flange Mounting (Three Point)

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

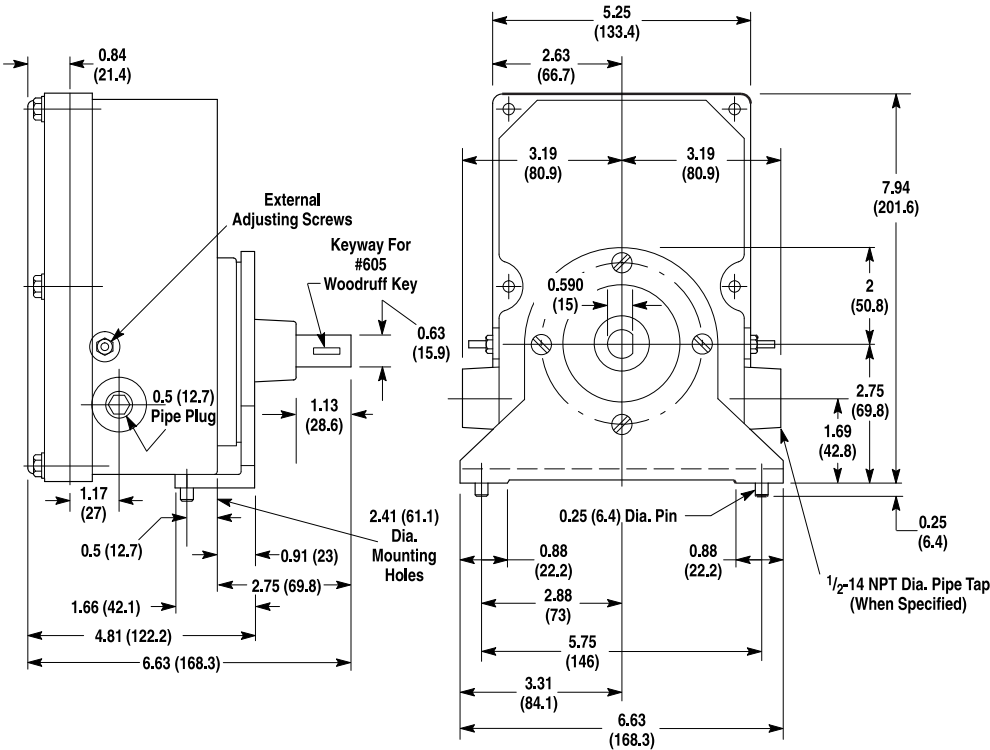
★ If lockout solenoid is used, see dotted portion of Figure 1 (on previous page) for dimensions.

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.

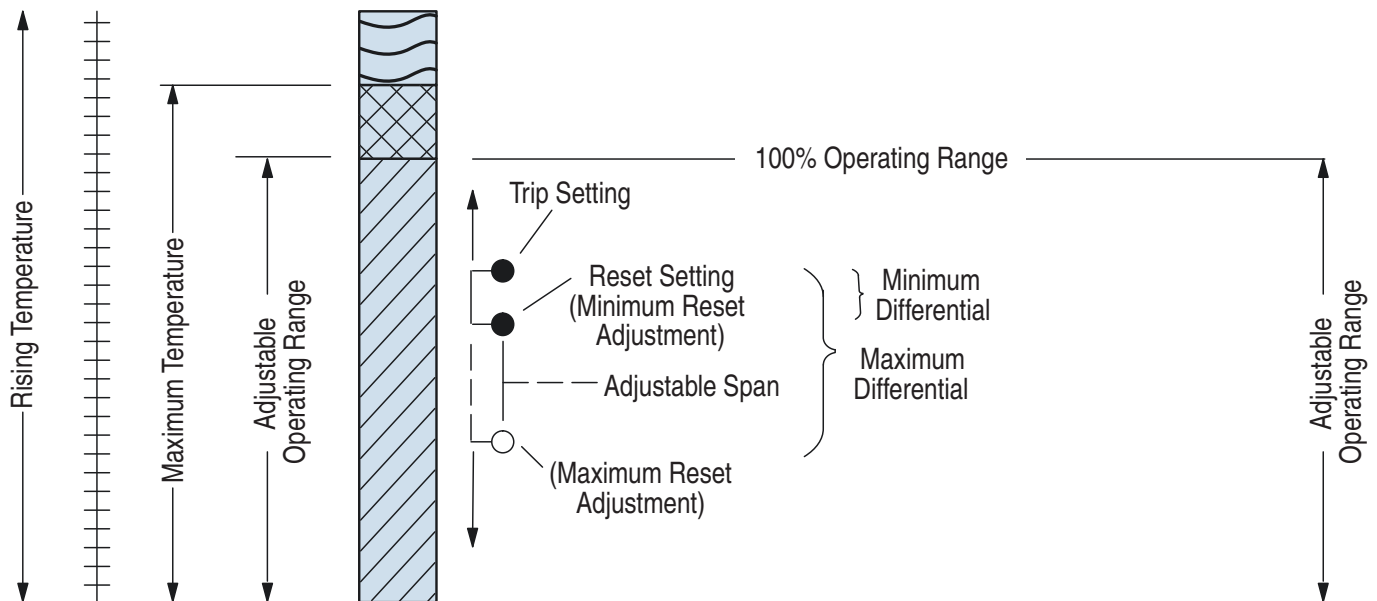
Mounting — There are two methods of mounting temperature controls: remote or direct immersion.

- 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: $^{\circ}\text{C} = 0.56 (^{\circ}\text{F} - 32^{\circ})$
 Temperatures given in Celsius can be converted to Fahrenheit using this equation: $^{\circ}\text{F} = (1.8 \times ^{\circ}\text{C}) + 32^{\circ}$

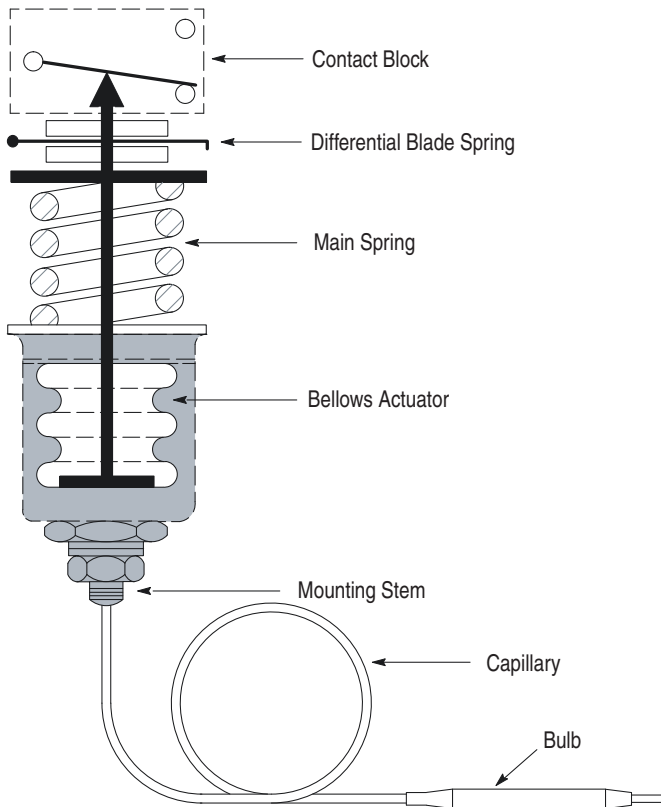
Bulletin 837 Temperature Controls are designed to open or close electrical circuits in response to changes in temperature. Figure 2 is a simplified drawing of a temperature control. The bellows, bulb, and capillary are filled with a temperature-responsive liquid. The vapor pressure of the liquid increases 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.

Figure 1
 Graphics to illustrate technical terms



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

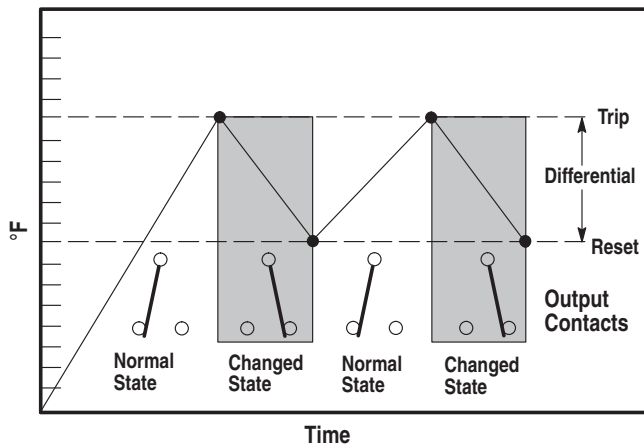
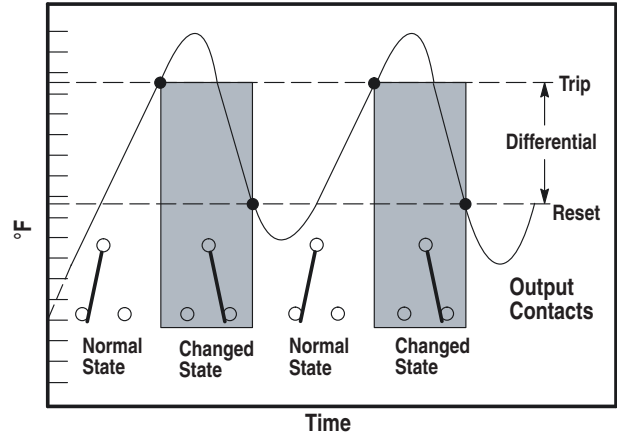


Figure 4
Typical monitoring application



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.

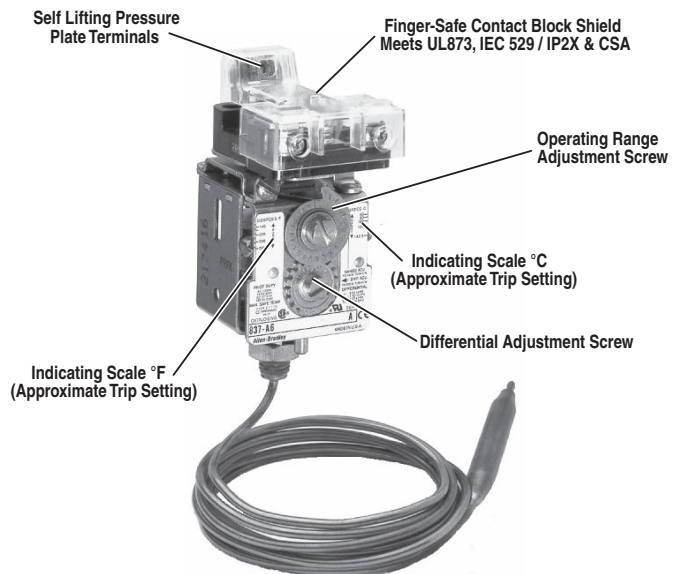
Step 1 — Adjust trip setting

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

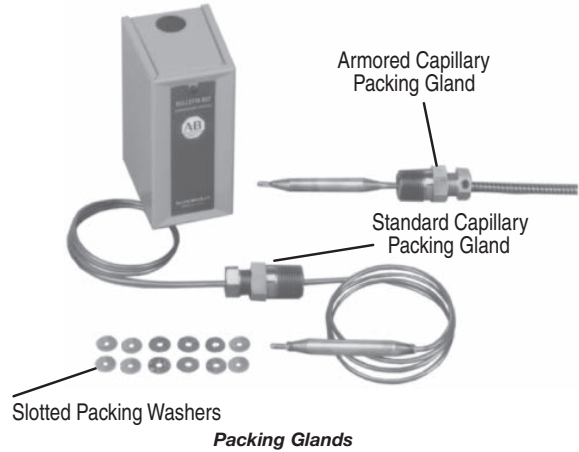
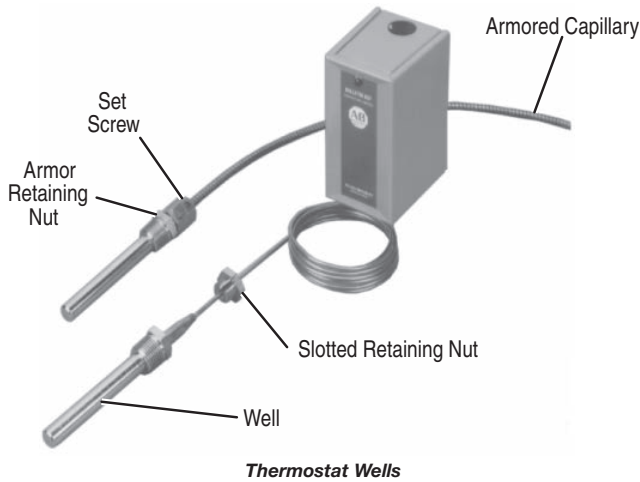


Thermostat Wells

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.



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.

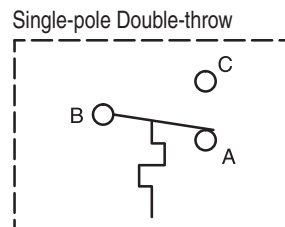
Non-Inductive Ratings

5 A, 240V
3 A, 600V

Control Circuit Ratings

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

Standard Contact Wiring Configuration



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.

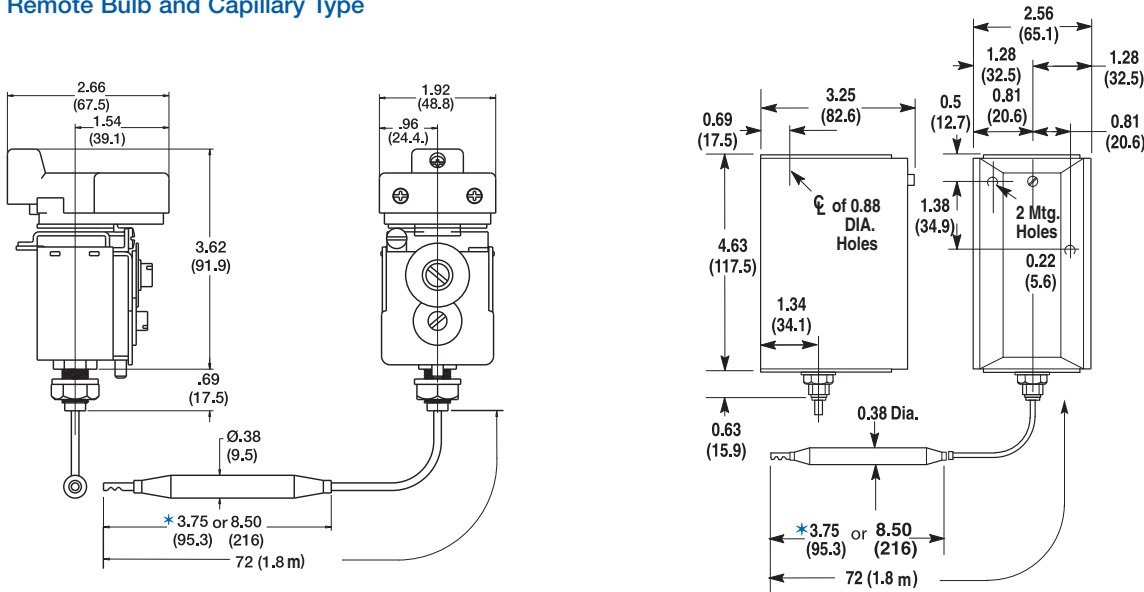
Consult your local Rockwell Automation sales office or Allen-Bradley distributor for assistance on special applications.

★ 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

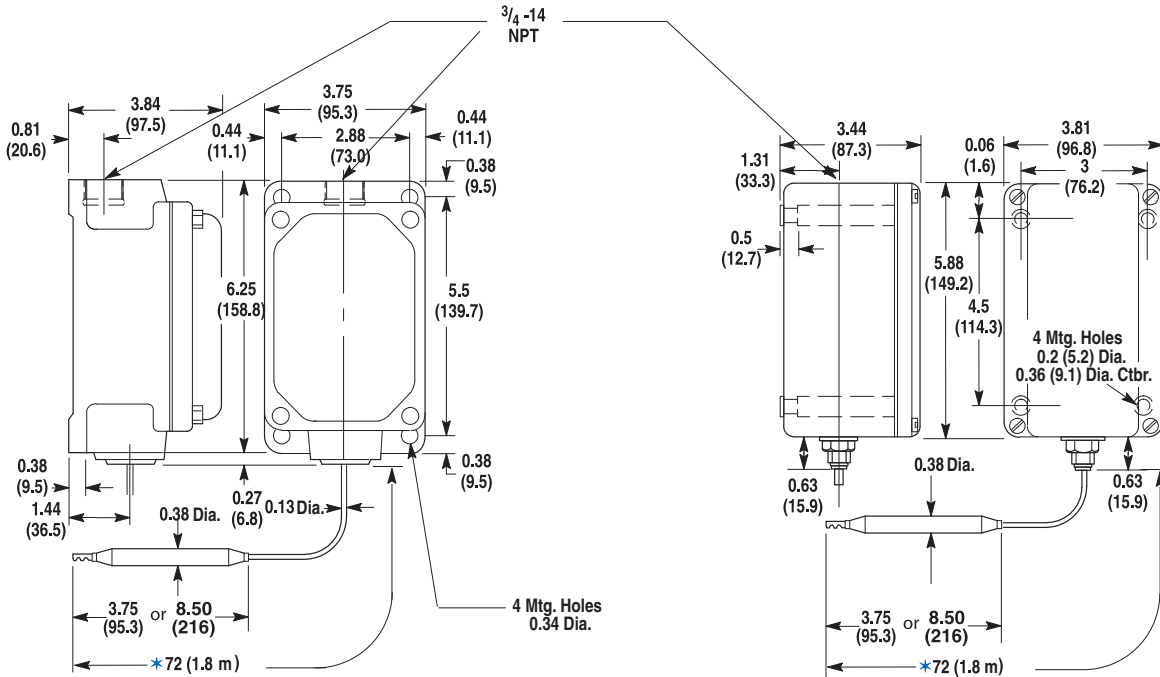
Dimensions in inches (millimeters). Dimensions are not intended to be used for manufacturing purposes.

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)



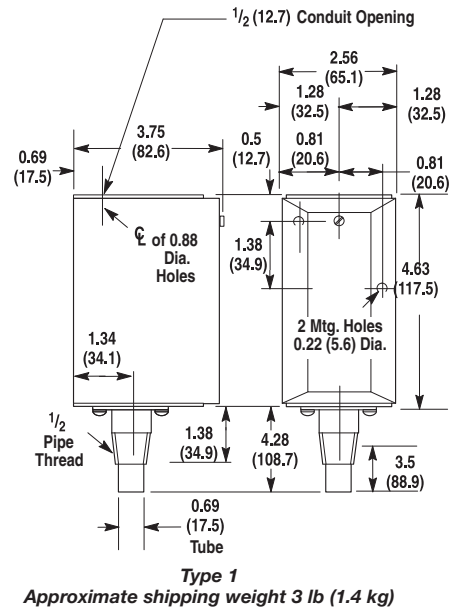
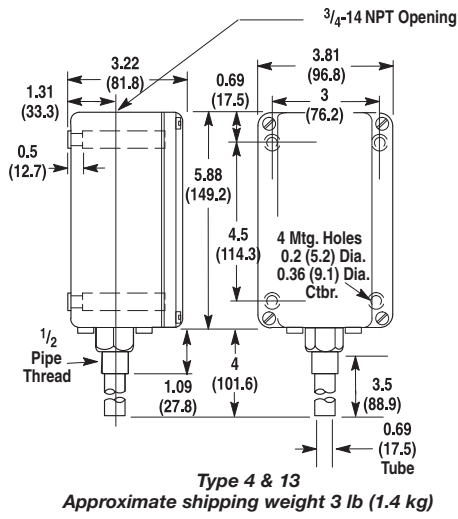
Types 7 & 9 and 4 & 13 combined
Approximate shipping weight 9 lb (4.1 kg)

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

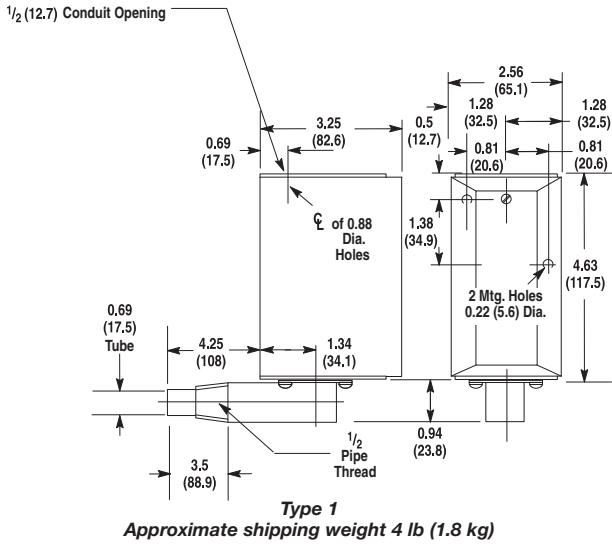
★ Dimension is 8.5 in. for Cat. Nos. 837-A3 and 837-A4 controls.

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

Direct Vertical Immersion Type



Direct Horizontal Immersion Type



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

Thermostat Wells and Packing Glands

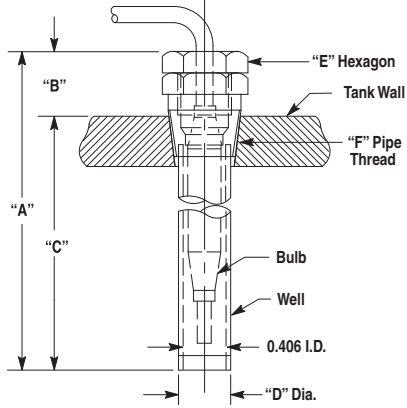


Figure A

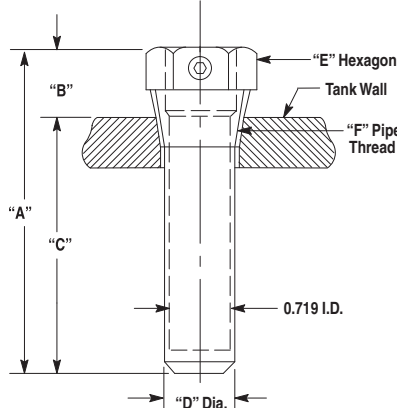


Figure B

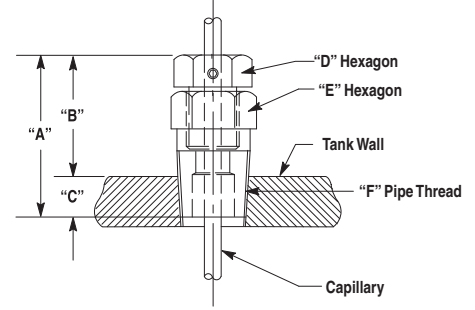


Figure C

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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