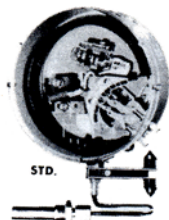


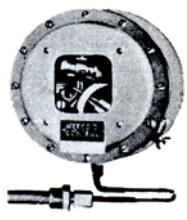


# **Installation Instructions (Preliminary)** **Series D-7000-(N) Remote Bulb Temperature Controls**

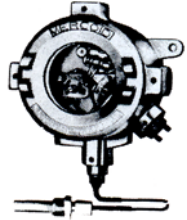
## **ENCLOSURES – TYPE NO. PREFIX**



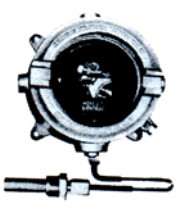
**GENERAL PURPOSE**  
 Prefixed by  
 DA, DL, DR, DS



**WEATHER-RESISTANT**  
 Prefixed by  
 DAW, DLW, DRW, DSW



**EXPLOSION PROOF**  
 Prefixed by  
 DAH, DLH, DRH, DSH



**EXPLOSION PROOF**  
 Prefixed by  
 DAE, DLE, DRE, DSE

### **CONTROL NUMBERS**

Part of the control number following Type No. Prefix identifies the style of the control case.  
 The digit 5 of 7035 denotes a plain case with bottom connection.  
 The digit 8 of 7038 denotes a flanged case with bottom connection.  
 The digit 9 of 7039 denotes a flanged case with back connection.

### **CIRCUITS (SWITCH OPERATION)**

Suffix number after control number denotes number of circuits and circuit operation.  
 Suffix -153 designates SPDT - one circuit closes as other circuit opens.  
 Suffix - 804 designates 2 ea. SPDT switches - two circuits close as two circuits open.

### **LOCATION AND MOUNTING OF CONTROL CASE**

Follow equipment manufacturer's instructions or proceed as follows:  
 Vibration causes erratic operation of any instrument and shortens its life. It is important to select a location that is reasonably free of vibration. All controls must be mounted vertical and level. Delrin bushed movements prolong control life by alleviating excessive wear of metal surfaces due to vibration and/or pulsation. It is identified by the letter "B" after the suffix number. Example: -2B, -3B, -804B, etc.

**General Purpose Types - DA, DS, DL, DR** - These controls without a flange plate are mounted by means of a bracket supplied with the control. For panel mounted use the holes provided on the flanged case. See drawing 1000F on page 4.

**Weather Resistant Types - DAW, DSW, DRW, DLW** - For surface mounting only. Has flanged case with bottom connection. See drawing 1062 on page 4.

**Explosion-Proof Types - DAE, DSE, DLE, DRE, DLH, DAH, DSH, DRH** - Secure with the mounting lugs provided on the housing. See drawings 98D and 1350 on page 4.

### **LOCATION OF REMOTE BULB**

#### **To Insure Proper Control Operation:**

1. The temperature bulb should be completely immersed in the medium being controlled.
2. BULB MUST BE CORRECTLY LOCATED AND PROPERLY INSTALLED so that the temperature changes at the bulb reflect actual temperature changes of the medium being controlled.
3. Be sure the bulb will not be affected by external temperatures.
4. Bulb may be installed vertically or horizontally. The following precautions should be taken:
  - (a) Do not install bulb in dead end of pipe, tank, etc., where it would not be subject to free circulation of the medium being controlled. See illustration No. 5.
  - (b) If bulb No. 2 is located in a pipe or duct with diameter larger than the bulb length, the bulb can be installed perpendicular to the pipe if protected from possible damage due to flow velocity.
  - (c) If bulb No. 2 is to be inserted into a pipe with a diameter smaller than the bulb length (ex. a 2-7/8" long bulb in a 1" pipe) the bulb should be located longitudinally in the pipe so that the entire length is exposed to the flowing medium (ex. replace an elbow in the pipe with a tee and install bulb as shown in illustration No. 6 and 7. If pipe is 1" diameter or less, provide an enlarged section around the bulb so that it does not restrict flow.
  - (d) When bulb No. 2 is to be inserted in a rapidly flowing stream of fluid in a pipe or duct, make sure that it is mechanically protected against the velocity in order to prevent the bulb from breaking off at the capillary.
  5. Gas activated bulbs, unlike vapor pressure bulbs, do not have any elevation effects. Therefore, no compensation is required.

### **BULB PROTECTION**

- There are three ways to protect bulb No. 2:
1. Before tightening packing gland, pull bulb back into union as far as possible (standard No. 2 bulb with 3/4" union only). The union is recessed to provide some support.
  2. Where insertion depth is greater than bulb length, use extension sleeve "B". See illustration Nos. 8, 9, and 10.
  3. Separable Wells (see drawing No. 10): wells slow down heat transfer of temperature changes to the bulb and consequently increase response time of control the union will slide back on capillary allowing complete immersion of bulb in any depth of well.

### **FOR DIMENSIONS OF BULBS, SEE CHART - PAGE 3**

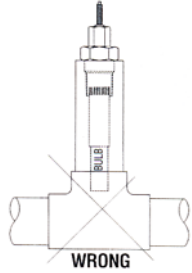
Caution: When installing bulbs with union connections, be careful not to twist the flexible tubing. Loosen packing nut or union so that the union can turn freely around tubing. After union is firmly secured to the pipe or tank, position bulb by sliding tubing through union and then tighten the packing gland nut.

### **CROSS AMBIENT TEMPERATURE EFFECTS**

There are no cross ambient effects associated with these gas actuated units which are designed with a range number ending with "n", i.e. -5N.

### **WHERE TURBULENT OR FAST FLOWING LIQUIDS PREVAIL**

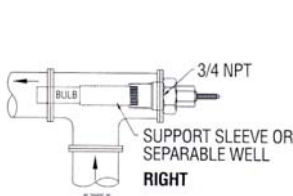
Bulb supports for bulb No. 2 are used where the bulb is mounted in turbulent or fast flowing liquids or where it is desired to insert the remote bulb at some distance within a vessel, pipe, or tank. See "B" in illustration Nos. 8, 9 and 10. The remote bulb should be positioned so that at least one inch of the bulb is within the extension sleeve "B" (dimension "B") in order to insure firm support. No. 2 bulb union is threaded to receive extension sleeve "B". Extension addition "A" permits extending the mounting through insulation.



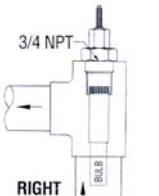
**ILLUSTRATION NO. 5**

#### **INCORRECT INSTALLATION**

Note that a very small portion of the bulb is exposed to the direct path of medium being controlled. section containing bulb has no flow so its temperature is affected by radiation to or from the surrounding air.



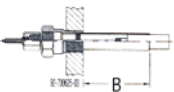
**ILLUSTRATION NO. 6**



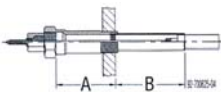
**ILLUSTRATION NO. 7**

#### **RECOMMENDED INSTALLATION**

These two illustrations indicate the bulb is completely exposed (in direct path) of medium being controlled.



**ILLUSTRATION NO. 8**



**ILLUSTRATION NO. 9**

## WELLS

Wells (with dimensions "A" and "C" in illustration 10) are used to protect the remote bulb from physical damage or to permit removal of the bulb without draining the system.

The use of a well will increase the time lag of the control since the temperature change of the controlled medium must be transmitted through the wall of the well and then the bulb. Thus when wells are used, it is important that the well dimension "C" be greater than or equal to the bulb length "B" to insure that all of the temperature sensitive portion of the bulb is within the liquid area.

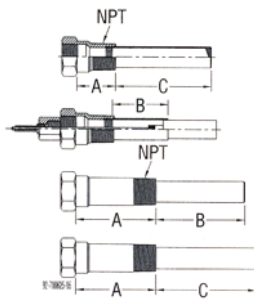


ILLUSTRATION  
NO. 10

## WIRING

Wire in accordance with local electrical codes or follow equipment manufacturer's recommendations. On general purpose controls, do not attach ridged conduit to case. Use a short strip of BX to relieve conduit expansion and contraction strains.

Where a control is connected directly into the load circuit, it must be connected into the hot side of line.

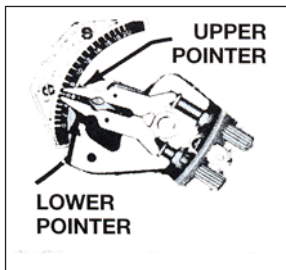
Do not overload electrically - see nameplate attached to control for electrical rating.

## ADJUSTMENTS

### How to Set Operating Point of Control

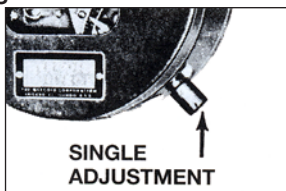
#### DA - DOUBLE ADJUSTMENT TYPES - FULLY AUTOMATIC

Prefixed by DA, DAE, DAH, DAW - Provided with double adjustments. Adjust the upper pointer to set the "high" temperature point for switch operation. Adjust the lower pointer to set the "low" temperature operating point. The difference between the upper and lower pointers is the operating differential between "on-off" switch operation. Minimum differential for each range is shown on Page 3.



#### DS - SINGLE ADJUSTMENT TYPES - FULLY AUTOMATIC

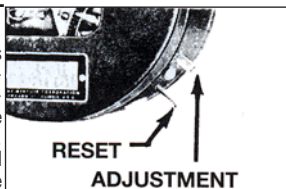
Prefixed by DS, DSE, DSH, DSW - Equipped with a single adjustment. The single pointer on the scale sets the temperature where switch operation occurs. Differential is fixed (not adjustable). For fixed differential of each respective range, see Page 3.



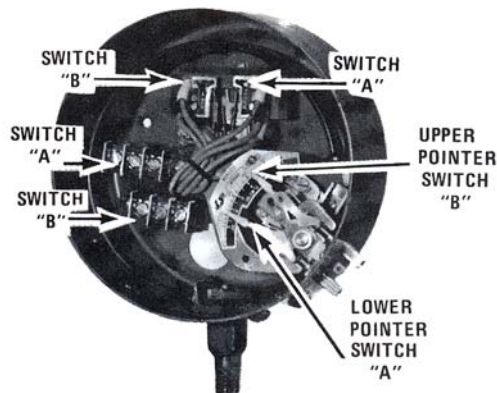
#### DR - SEMI-AUTOMATIC CONTROL WITH MANUAL RESET

DR-7035-153U. A single adjustment sets the operating point for automatic operation. A push button reset must be operated manually to restore the circuit to the original position after automatic operation. Example - Type DR-7035-153L: circuit will open automatically on a temperature rise to the temperature indicated by the pointer on the scale - no matter how much the temperature drops, the circuit will not reclose until the reset button is operated.

Suffix -L denotes control will operate automatically on an increase. Suffix -U denotes control will operate automatically on a decrease.



## TWO-STAGE TEMPERATURE CONTROL SERIES D-7435



TYPES DA-7435, DAW-7438, DAH-7435, DAE-7435 - This series incorporates two single pole, double throw snap switches, actuated by the same Bourdon Tube. The operating point of each switch is adjustable through an outside knob. The change in temperature which opens and closes each switch at its respective setting is the "fixed differential" (sensitivity) of the switch. The temperature represented by the difference between the two adjustment points is the temperature "spread" between operation of the two switches. Upper pointer indicates the operating point of the "high" temperature circuit. Lower pointer indicates the operating point of the "low" temperature circuit.

### OPERATING RANGES/SERIES D-7435 With Snap-Action Contacts

| Range No. | Scale Range                 | Max. Temperature Not To Exceed | Min. Spread Between Switches | Fixed Deadband Each Switch |
|-----------|-----------------------------|--------------------------------|------------------------------|----------------------------|
| 1N        | -60 to 30°F (-50 to 0°C)    | 150°F (65°C)                   | 12°F (7°C)                   | 4°F (2°C)                  |
| 3N        | 0 to 100°F (-18 to 40°C)    | 240°F (115°C)                  | 13°F (8°C)                   | 4°F (2.5°C)                |
| 4N        | 50 to 150°F (10 to 65°C)    | 250°F (120°C)                  | 13°F (8°C)                   | 4°F (2.5°C)                |
| 5N        | 100 to 200°F (40 to 95°C)   | 300°F (150°C)                  | 12°F (7°C)                   | 4°F (2.5°C)                |
| 7N        | 140 to 300°F (60 to 150°C)  | 500°F (260°C)                  | 18°F (10°C)                  | 6.5°F (4°C)                |
| 8N        | 250 to 415°F (120 to 215°C) | 550°F (290°C)                  | 18°F (10°C)                  | 7°F (4°C)                  |
| 9N        | 350 to 550°F (175 to 290°C) | 600°F (315°C)                  | 22°F (13°C)                  | 8°F (4.5°C)                |
| 10N       | 100 to 300°F (40 to 150°C)  | 500°F (260°C)                  | 22°F (13°C)                  | 8°F (4.5°C)                |
| 11N       | 100 to 500°F (40 to 260°C)  | 600°F (315°C)                  | 46°F (26°C)                  | 16°F (9°C)                 |

### ELECTRICAL RATING

AC capacities: 5A @ 120 V, 5A @ 240 V. (Not available for 440 V).  
DC capacity: 5A, 30 V resistive.

**OPERATING RANGES/SERIES D-7000**  
**With Snap-Action Contacts Types: DA-7035, DA-7235-153 & DA-7235-804**

| Adjustable Operating Range  | Range No. | Max. Process Temp. Not To Exceed | Adjustable Deadband | Adjustable Deadband | Fixed Deadband       | Bulb Furnished With 6" Capillary Unless Otherwise Specified (1) | Bulb Min. Insertion Depth (2) |
|-----------------------------|-----------|----------------------------------|---------------------|---------------------|----------------------|-----------------------------------------------------------------|-------------------------------|
|                             |           |                                  | DS-7035-153         | DS-7235-153         | DS-7235-804 (2) SPDT |                                                                 |                               |
|                             |           |                                  | Minimum Deadband    | Fixed Deadband      | Fixed Deadband       | Bulb No./Cap. Mat'l.                                            |                               |
| -60 to 30°F (-50 to 0°C)    | 1N        | 150°F (65°C)                     | 23°F (13°C)         | 5°F (3°C)           | 5°F (3°C)            | No. 2 SS/Copper                                                 | 2-7/8" (73 mm)                |
| 0 to 100°F (-18 to 40°C)    | 3N        | 240°F (115°C)                    | 25°F (14°C)         | 5°F (3°C)           | 5°F (3°C)            | No. 2 SS/Copper                                                 | 2-7/8" (73 mm)                |
| 50 to 150°F (10 to 65°C)    | 4N        | 250°F (120°C)                    | 25°F (14°C)         | 5°F (3°C)           | 5°F (3°C)            | No. 2 SS/Copper                                                 | 2-7/8" (73 mm)                |
| 100 to 200°F (40 to 95°C)   | 5N        | 300°F (150°C)                    | 25°F (14°C)         | 5°F (3°C)           | 5°F (3°C)            | No. 2 SS/Copper                                                 | 2-7/8" (73 mm)                |
| 140 to 300°F (60 to 150°C)  | 7N        | 500°F (260°C)                    | 41°F (23°C)         | 8°F (4.5°C)         | 8°F (4.5°C)          | No. 2 SS/Copper                                                 | 2-7/8" (73 mm)                |
| 250 to 415°F (120 to 215°C) | 8N        | 550°F (290°C)                    | 42°F (23°C)         | 9°F (5°C)           | 9°F (5°C)            | No. 2 SS/SS                                                     | 2-7/8" (73 mm)                |
| 350 to 550°F (175 to 290°C) | 9N        | 600°F (315°C)                    | 50°F (28°C)         | 10°F (6°C)          | 10°F (6°C)           | No. 2 SS/SS                                                     | 4-7/8" (124 mm)               |
| 100 to 300°F (40 to 150°C)  | 10N       | 500°F (260°C)                    | 50°F (28°C)         | 10°F (6°C)          | 10°F (6°C)           | No. 2 SS/Copper                                                 | 2-7/8" (73 mm)                |
| 100 to 500°F (40 to 260°C)  | 11N       | 600°F (315°C)                    | 100°F (56°C)        | 20°F (12°C)         | 20°F (12°C)          | No. 2 SS/SS                                                     | 2-7/8" (73 mm)                |
| ELECTRICAL RATINGS          |           |                                  | See Code D          | See Code E          | See Code G           |                                                                 |                               |

(1) All bulbs, including those with a copper capillary, are made of Type 304 Stainless Steel  
(2) Insertion depth may be increased through use of bulb supports or wells.

Repeatability: ±1% of full scale.

| Circuit Suffix No. | Switch Action                                                                               |
|--------------------|---------------------------------------------------------------------------------------------|
| -153               | SPDT one circuit OPENS as other CLOSES                                                      |
| -804               | Two SPDT operate simultaneously in one direction upon increase (or decrease when specified) |

| Circuit Code | Circuit Suffix No. | AC Capacity |      |         | DC Resistive |      | Horsepower |    |
|--------------|--------------------|-------------|------|---------|--------------|------|------------|----|
|              |                    | 120V        | 240V | 440V    | 120V         | 240V | AC         | DC |
| D            | -153               | 15A         | 15A  | 15@480V | 1/2A         | 1/4A | 1/8        | NA |
| E            | -153               | 15A         | 15A  | NA      | ②            | ②    | ①          | NA |
| G            | -804               | 5A          | 5A   | NA      | ③            | ③    | NA         | NA |

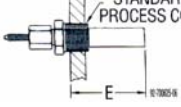
① 1/4 HP at 120V AC, 1/2 HP at 240V AC.  
② DC rated controls (up to 10A), consult factory.  
③ 5A, 30V DC resistive.

**GENERAL BULB INFORMATION**

All bulbs are made of 304 stainless steel; capillary material is either copper or 316 stainless steel, as shown in the range table. The maximum pressure of bulbs with a process connection is 300 psi. Other bulbs are for non-pressurized (e.g., open tank) use only. Consult the factory for higher pressure applications.

**RANGE TABLE – NO. 2 BULB**

**Standard 11/16" Diameter Series D Bulb & 3/4" NPT Connection**

| See Note for "E" & "B" Dims.<br>Standard 3/4" NPT Process Connection<br> | Bulb (1)/ 6 ft. Cap. Tubing | Range Numbers              |                            |                            | Optional 11/16" Bulb with 1/2" NPT Process Conn. | Range Numbers           |                   |                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|----------------------------|----------------------------|----------------------------|--------------------------------------------------|-------------------------|-------------------|-------------------|
|                                                                                                                                                            |                             | 1N, 3N, 4N, 5N, 7N, 10N    | 8N, 11N                    | 9N                         |                                                  | 1N, 3N, 4N, 5N, 7N, 10N | 8N, 11N           | 9N                |
|                                                                                                                                                            | SS Bulb/ Copper Capillary   | E=2-7/8" B=2-7/8" Standard | N.A.                       | N.A.                       |                                                  | E=3-1/2" B=2-7/8"       | N.A.              | N.A.              |
|                                                                                                                                                            | SS Bulb/ SS Cap.            | E=2-7/8" B=2-7/8" Option   | E=2-7/8" B=2-7/8" Standard | E=4-7/8" B=4-7/8" Standard |                                                  | E=3-1/2" B=2-7/8"       | E=3-1/2" B=2-7/8" | E=5-1/2" B=4-7/8" |

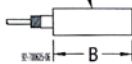
**RANGE TABLE – NO. 2 BULB**

**Optional 1/2" & 3/8" Diameter Bulbs with 3/4" NPT Connection**

|                                                              | Bulb (1)/ 6 ft. Cap. Tubing | Range Numbers           |                     |                     | Optional 1/2" Bulb with 1/2" NPT | Range Numbers           |                     |                     |
|--------------------------------------------------------------|-----------------------------|-------------------------|---------------------|---------------------|----------------------------------|-------------------------|---------------------|---------------------|
|                                                              |                             | 1N, 3N, 4N, 5N, 7N, 10N | 8N, 11N             | 9N                  |                                  | 1N, 3N, 4N, 5N, 7N, 10N | 8N, 11N             | 9N                  |
| Optional 1/2" Diameter Bulb with 3/4" NPT Process Connection | SS Bulb/ Copper             | E=5-3/4" B=5-3/4"       | N.A.                | N.A.                |                                  | E=6-3/8" B=5-3/4"       | N.A.                | N.A.                |
|                                                              | SS Bulb/ SS Cap.            | E=5-3/4" B=5-3/4"       | E=5-3/4" B=5-3/4"   | E=10" B=10"         |                                  | E=6-3/8" B=5-3/4"       | E=6-3/8" B=5-3/4"   | E=10-5/8" B=10"     |
| Optional 3/8" Diameter Bulb with 3/4" NPT Process Connection | SS Bulb/ Copper             | E=11-3/8" B=11-3/8"     | N.A.                | N.A.                | Optional 3/8" Bulb with 1/2" NPT | E=11-3/8" B=11-3/8"     | N.A.                | N.A.                |
|                                                              | SS Bulb/ SS Cap.            | E=11-3/8" B=11-3/8"     | E=11-3/8" B=11-3/8" | E=19-7/8" B=19-7/8" |                                  | E=11-3/8" B=11-3/8"     | E=11-3/8" B=11-3/8" | E=19-7/8" B=19-7/8" |

**RANGE TABLE – NO. 1 BULB**

**11/16" Diameter Series D Bulb for Open Tank Use**

| See Note for "B" Dims. (No process connection)<br>BULB<br> | Bulb (1)/ 6 ft. Cap. Tubing | Range Numbers           |                   |                   |
|-----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-------------------------|-------------------|-------------------|
|                                                                                                                                               |                             | 1N, 3N, 4N, 5N, 7N, 10N | 8N, 11N           | 9N                |
|                                                                                                                                               | SS Bulb/ Copper             | B=2-7/8" Standard       | N.A.              | N.A.              |
|                                                                                                                                               | SS Bulb/ SS Cap.            | B=2-7/8" Option         | B=2-7/8" Standard | B=4-7/8" Standard |

**NOTES:**

Dim. "E" = MINIMUM INSERTION DEPTH  
Minimum clearance distance for bulb insertion: measured from the top outside surface of female NPT.

Dim. "B" = ACTIVE BULB LENGTH  
Length of bulb that responds to temperature change: measured from the free end. Process fluid must have good contact with the bulb over this length.

(1) All bulbs, including those with a copper capillary are made of Type 304 Stainless Steel

**Well Pressure Ratings**

| Temp.         | Brass             | SS                 |
|---------------|-------------------|--------------------|
| 70°F (21°C)   | 1000 psi 6890 kPa | 2400 psi 16500 kPa |
| 200°F (95°C)  | 900 psi 6200 kPa  | 2250 psi 15500 kPa |
| 300°F (150°C) | 500 psi 3440 kPa  | 2150 psi 14800 kPa |
| 400°F (205°C) | 160 psi 1100 kPa  | -                  |
| 550°F (285°C) | Do Not Use        | 2000 psi 13700 kPa |

**Protective Well Assemblies**

**For Series D. No. 2 Bulb, (Standard 11/16" Diameter)**

| Range                   | Bulb Ass'y Well Dim. |               | Well Ass'y # |            |
|-------------------------|----------------------|---------------|--------------|------------|
|                         | E (Min.)             | C             | Brass        | S.S.       |
| 1N, 3N, 4N, 5N, 7N, 10N | 2-7/8" 73 mm         | 3-1/4" 83 mm  | 49-543       | 49-251SS-1 |
| 8N, 11N                 | 2-7/8" 73 mm         | 3-1/4" 83 mm  | N/A          | 49-251SS-1 |
| 9N                      | 4-7/8" 124 mm        | 5-1/4" 134 mm | N/A          | 49-253SS-1 |

**CAUTIONS**

Control movement must not be oiled.

Do not overload – note electrical rating on nameplate and be sure total current passing through switch is within specified rating.

**WARNING:** A failure resulting in injury or damage may be caused by over-pressures, excessive vibration or pressure pulsation, excessive temperature, corrosion of pressure containing parts and movement assembly, electrical overload, or other misuse. Do not tamper with switch wires. Position of these wires is essential to proper operation. Tampering with these wires will void warranty.

### LOCKING DEVICE

When the control has been adjusted to desired range, the locking bar may be inserted between the adjustment screws with slot passing over the projecting lug. By placing a sealing wire between the locking bar and the hole in the lug protruding from adjustment assembly, adjustments cannot be tampered with.

For DAH and DSH, sealing wire may pass through locking bar and hole in hub above adjusting knobs.

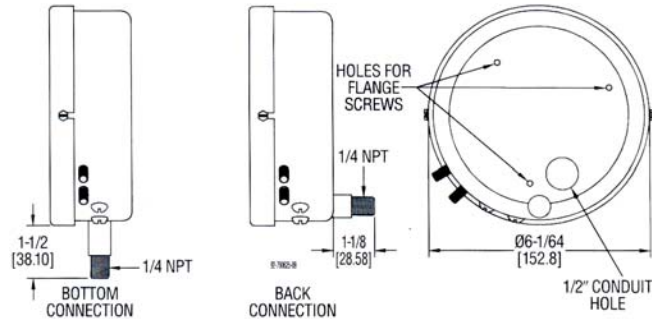
DAW, DRW, DSW, adjusting knob cover may be sealed in place with sealing wire through cover bolt hole.

### CONTROL DIMENSIONS

Note: Dimensional drawings shown are for general reference only. Comprehensive drawings are available from factory upon request.

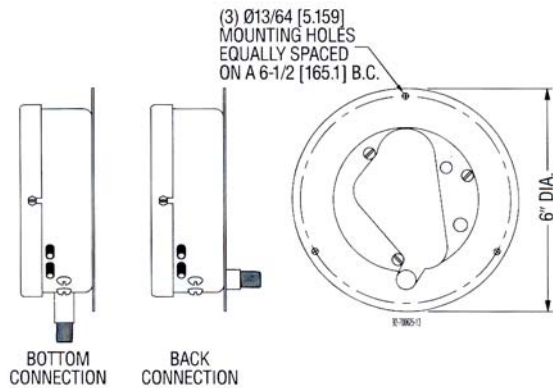
### General Purpose

Types DA, DS, DR, DL  
Drawing No. 1000B



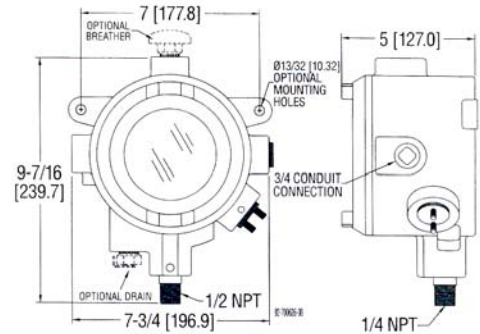
### Flange for Surface Mounting

Drawing No. 1000F



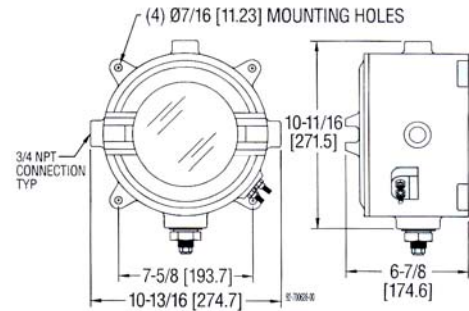
### Explosion-Proof

Types DAH, DRH, DSH, DLH  
Drawing No. 1350



### Explosion-Proof

Types DAE, DRE, DSE, DLE  
Drawing No. 98D



### Weather-Proof

Types DAW, DSW, DRW, DLW  
Drawing No. 1062

