

# POWERS™ Controls

## HU 186 Room And Duct Hygrostats

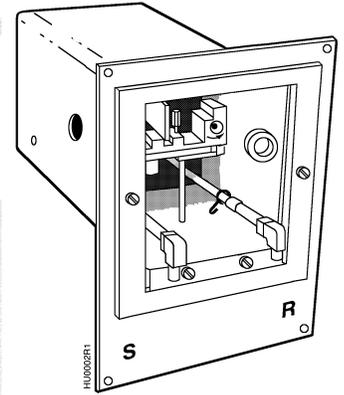
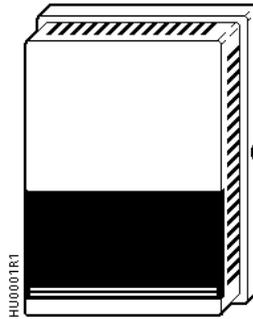


Figure 1. Room Hygrostat.

Figure 2. Duct Hygrostat.

### Description

The HU 186 Room and Duct Hygrostats are pneumatic instruments sensitive to slight changes in relative humidity. They feature adjustable sensitivity and bimetal temperature compensation to minimize temperature effects. The room hygrostat comes complete with standard cover and wall plate. The duct hygrostat is shipped inside the duct mounting box.

### Product Numbers

See Table 1.

### Application

The sensing element of the HU 186 hygrostat consists of a highly sensitive hygroscopic membrane. Typical applications include comfort control of hospitals, schools, and office buildings. More critical applications include the control of humidity in museums or computer rooms.

Figure 3 shows a typical application of a room type hygrostat. The duct hygrostat would be used when humidity sensing is to be done with a duct sensor. For most applications, the best location for a duct sensor is in the return air duct.

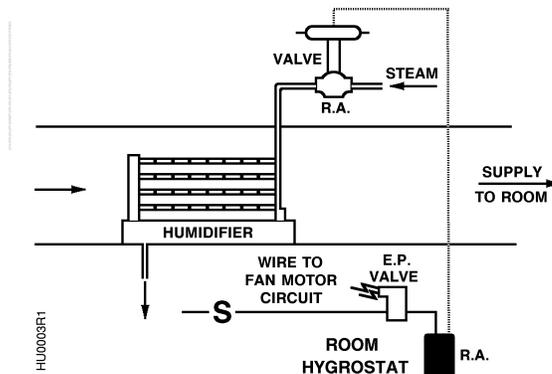


Figure 3. Application of Room Hygrostat.

**Table 1. Product Numbers.**

Product Numbers		Model	Maximum Dry Bulb Temp.	Control Range (rh)
Direct Action	Reverse Action			
186-0013	186-0019	Room	135°F	20 to 90%
186-0087	186-0088	Duct		
-	186-0090		140°F	55 to 95%
-	186-0091			25 to 65%

<b>Specifications</b>	Direct or Reverse Acting Range	See Table 1
	Maximum Operating Temperature	See Table 1
<b>Operating</b>	Sensitivity (adjustable)	1/4 to 4 psi per 1% rh (1.7 to 28 kPa per 1% rh)
	Normal Supply Pressure	15 to 25 psig (103 to 172 kPa)
<b>Physical</b>	Maximum Supply Pressure	30 psig (207 kPa)
	Air Consumption	20 scim (5.5 ml/s)
	Effect of 10° F Temperature Change	Shift of 1% rh
	Effect of 5 psi Supply Pressure Change (mid-sensitivity)	Shift of 1% rh
	Air Capacity (time rating per 155-202P25 (TB-113))	0.7 min/vol unit
	Dimensions, Room Type	See Figure 9
	Standard Room Cover Finish	Desert Beige
	Dimensions, Duct Type	See Figure 10
	Air Connections	Barb fitting for 1/4-inch (6.4 mm) OD Poly Tubing
	<b>Accessories</b>	Membrane Element Kit
Restrictor Plate Kit (Pkg. of 10)		180-893
Calibration Tool (Pkg. of 5)		192-632

**Operation**

The action consists of a combination of force-balance and flapper-nozzle characteristics with internal feedback.

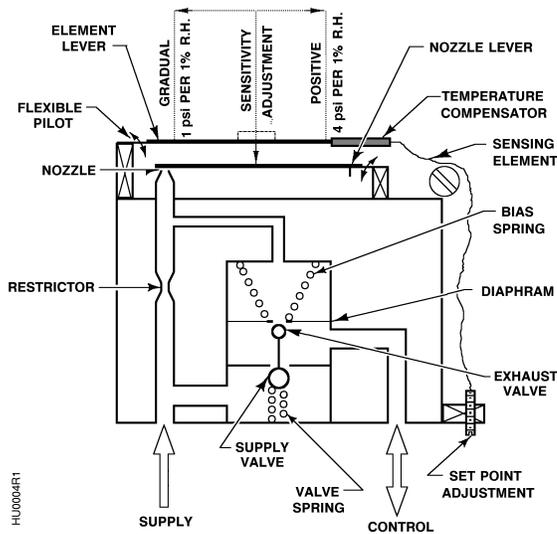
**Reverse Acting**

A decrease in humidity causes the membrane sensing element to shrink. The contracting element, which is attached to the element lever, exerts greater force on the nozzle lever through the sensitivity adjustment assembly. The nozzle lever closes off the nozzle, building up pressure above the relay diaphragm. Movement of the diaphragm closes the exhaust valve and opens the supply valve ball. Supply pressure passes into the control pressure chamber below the diaphragm. The control pressure increases until its upward force on the diaphragm is balanced by the pressure in the chamber above the diaphragm plus the bias spring. The valve spring then closes the supply valve and a new balance point is reached until a humidity change upsets it. Because of the bias spring, the minimum control pressure is about 1/2 psig.

**Direct Acting**

Here the basic sensing and lever movement is the same as described above. See Figure 4. However, the nozzle is in a different location; it's on the opposite side of the nozzle lever. Thus a decrease in humidity results in the flapper pulling away from the nozzle and decreasing the control pressure.

The element and nozzle levers pivot on flexure pivots to minimize hysteresis. A bimetal link on the element lever compensates for ambient temperature changes.



**Figure 4. Hygrostat Operation.**

**Calibration**

The hygrostat is factory calibrated to pass a control pressure of  $9 \pm 4$  psig at approximately 40% rh. The factory sensitivity setting is centered to give approximately 2 psig per 1% rh. Item numbers shown in parentheses are called out in Figure 5.

## Calibration, continued

### Room Type

1. Remove the cover using the calibration tool.
2. Loosen the test screw (2) 1/2 turn. Slide the rubber tubing of a pressure gauge over the test port to measure the control pressure.
3. Measure the relative humidity near the hygrostat. See the *Use of Psychrometric Chart* section.
4. If the room humidity is higher than desired, use the calibration tool to turn the adjustment screw (1) counterclockwise to lower the humidity. A 1/4 turn of the adjustment screw will change the set point about 10% rh
5. Cam post (4) is a coarse adjustment and should only be used if the desired set point cannot be obtained by the adjustment in Step 4. It is primarily a factory adjustment to obtain a parallel relationship between the nozzle lever (7) and the element lever (6).

### Duct Type

1. Connect pressure gauge to control connection on duct box.
2. Measure relative humidity in duct.
3. Remove cap plug on duct cover and insert calibration tool to make adjustments given in Step 4 above. See Figure 6.
4. Replace cap plug.

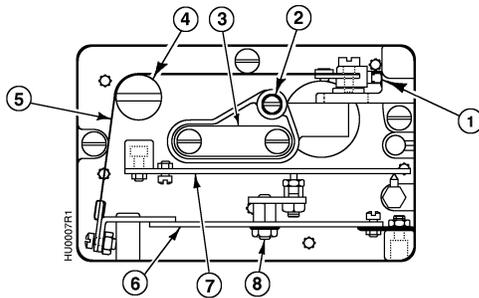


Figure 5. Hygrostat Assembly.

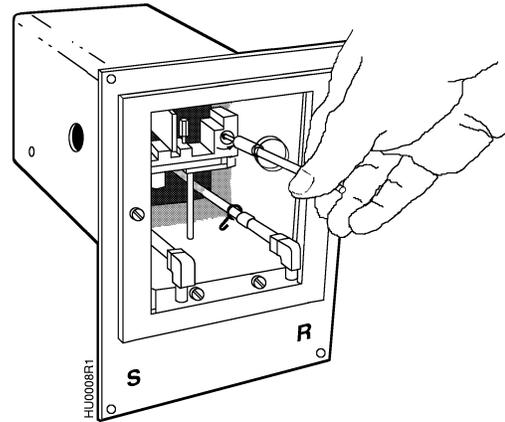


Figure 6. Hygrostat Calibration.

## Sensitivity Adjustment

Item numbers shown in parentheses are called out in Figure 5.

1. Carefully loosen sensitivity adjustment (8) using a 3/16-inch wrench.
2. Slide the sensitivity adjustment (8) to desired position on the element lever (6).

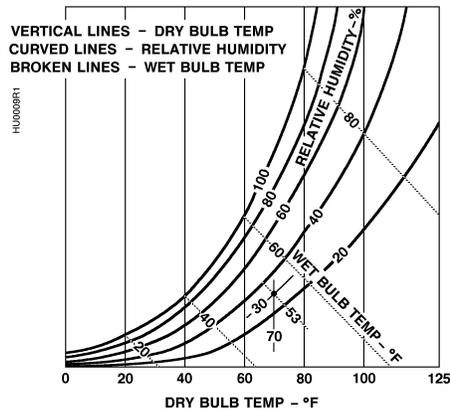
Sensitivity will be 4 psi per 1% rh at the end nearest the element, down to 1/4 psi per 1% rh at the end attached to the flexure pivot. See Figure 4. An overtravel spring on the sensitivity adjustment assembly prevents damage to the nozzle on a reverse acting hygrostat.

**NOTE:** When the sensitivity is changed, the element must be recalibrated for set point.

**Use of Psychrometric Chart**

A sling psychrometer is probably the most readily available humidity measuring device. Plotting the wet and dry bulb temperature readings from it on a psychrometric chart determines the relative humidity.

As an example, assume a dry bulb temperature of 70°F, and a wet bulb temperature of 53°F, measured with a sling psychrometer. Using the psychrometric chart illustrated in Figure 7, follow the 70° dry bulb temperature line vertically until it intersects the 53°F wet bulb temperature line. This determines the relative humidity point. In this case, the 30% relative humidity line goes through the point; therefore, the relative humidity is 30%.



**Figure 7. Psychrometric Chart.**

**Installation**

See *Technical Bulletin 155-210P25 (TB-145)* for instructions covering terminal roughing-in through the wall plate stage. HU 186 plugs into the terminal connector through two holes in the wall plate. When facing the wall, the supply connection will be on the left for a horizontal installation and on the bottom for a vertical installation. Two captive mounting screws fasten the hygrostat body assembly to the wall plate. The cover is held in place by two button head cover screws which are tightened with the calibration tool. Wall Plate Kit No. 180-443 is included with the room hygrostat.

**Room Type**

**Duct Type**

Cut an opening in the air duct. See Figure 10 for dimensions. Fasten the duct box flange to the duct using four No. 8 sheet metal screws.

**Maintenance**

Item numbers in parentheses are called out in Figure 8 and Table 2. Clean the membrane element (13) with a soft, dry brush when dirt or dust accumulates. The hygrostat should not be totally disassembled in the field. The only parts which should be replaced are items (5) through (7), (10) through (13), and (16) in Table 2 and Figure 8. As an initial check, make certain that there is 15 to 25 psig of **clean, dry** supply air. Use a pressure gauge and rubber tubing to measure control pressure at the test screw (15).

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## Troubleshooting

Troubleshooting contains the most common problems and solutions.

### Control Pressure Remains at 1/2 psig

1. Remove the cover and connect a pressure gauge.
2. Gently press the nozzle lever against nozzle. The control pressure should increase. If not, the restrictor hole in the restrictor plate (6) is clogged.
3. Replace the restrictor plate using the replacement parts in the Restrictor Plate Kit. See Table 2.
4. Remove the old gaskets (5 and 7) and restrictor plate (6). Reassemble with the new kit parts, putting them in the same relative positions as the original parts. Make sure that the gasket connecting the two holes is between the restrictor plate and the cover.

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### Control Pressure Remains at Maximum (15—25 psig)

1. Gently push the nozzle lever (2) away from nozzle (17).
2. If the control pressure does not drop to approximately 1/2 psig, check for a clogged nozzle.
3. Carefully clean the tip of the nozzle. Also clean the nozzle lever where it contacts the nozzle, as dirt will accumulate and clog the nozzle opening.

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### Excessive Air Leakage from Nozzle-Control Pressure Does Not Drop

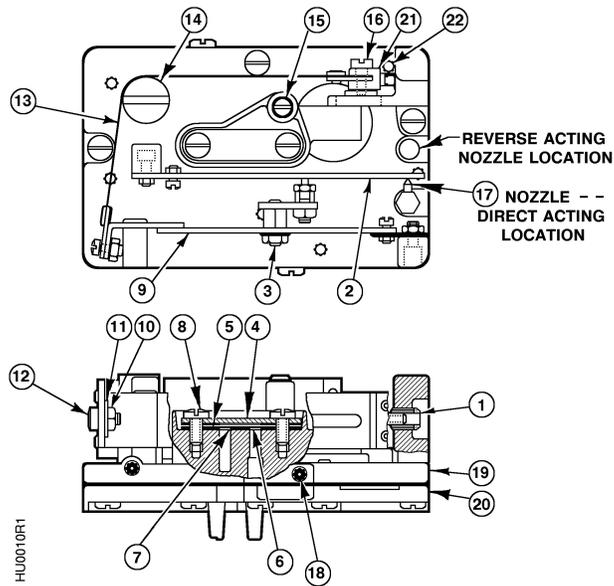
1. If excessive air leakage occurs and the control pressure does not drop to 1/2 psig when the nozzle lever is pulled away from the nozzle, then there is dirt on one of the relay ball valves. See Figure 4 in the *Operation* section.
2. The dirt particle on either the supply or the exhaust balls can usually be removed by moving the lever so that it alternately opens and closes the nozzle. This fluttering action will usually dislodge dirt from the ball valves.
3. Disassembly of the body (19) and base (20) to access the relay is not recommended.

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### Replacement of Membrane Element

1. If the membrane element (13) is damaged and becomes cracked or torn, replace it with parts in the Membrane Element Kit. See Table 2.
  2. Disconnect the old element by removing screws (12) and (16).
  3. Attach the new element.
  4. Recalibrate using the procedure in the Calibration section.
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**Hygrostat Components**

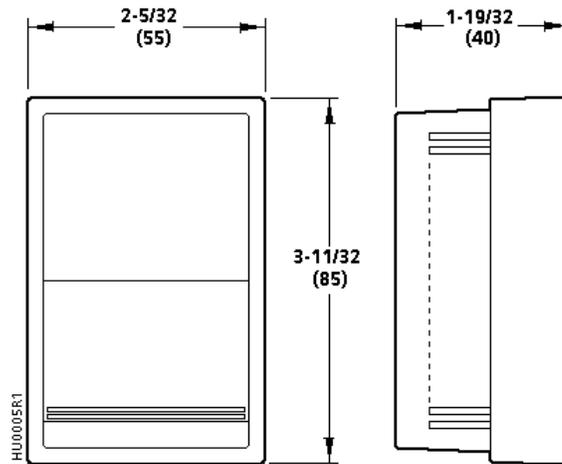


**Figure 8. Hygrostat Construction.**

**Table 2. Parts List for Hygrostat (Item Numbers See Figure 8).**

Item	Part No.	Part Name	Qty.	Material	Item	Part No.	Part Name	Qty.	Material
1	-	Adjusting Screw	1	Brass	13	See 24	Membrane Element Assembly	1	-
2	-	Nozzle Lever	1	Stainless Steel	14	-	Cam Post	1	Brass with Teflon®
3	-	Sensitivity Adj. Assem. (RA) Sensitivity Screw (DA)	1	-	15	833-009	Test Screw	1	Bronze
4	-	Restrictor Cover	1	Brass	16	See 24	Long Element Screw	-	Brass
5	See 23	Upper Gasket	1	Neoprene	17	186-162	Nozzle Assembly Nozzle Assem. Mod 5 to 7	1 1	Brass Brass
6	See 23	Restrictor Plate	1	Brass	18	-	Cover Screw	2	Stainless Steel
7	See 23	Lower Gasket	1	Neoprene	19	-	Body Assembly	-	-
8	-	Restrictor Cover Screws	2	Brass	20	-	Base	-	-
9	-	Element Lever Assembly	1	-	21	-	Lockwasher No. 8	1	Steel
10	See 24	2-56 Hex Nut	1	Brass	22	-	Adjustment Screw Spring	1	Bronze
11	See 24	Lock Washer	1	Steel	23	180-893	Restrictor Plate Kit	-	Incl. Items 5, 6, 7
12	See 24	Short Element Screw	1	Brass	24	186-062	Membrane Element Kit	-	Incl. Items 10, 11, 12, 13, 16

## Dimensions



DIMENSIONS IN PARENTHESES ARE IN MILLIMETERS

Figure 9. Room Hygrostat Dimensions.

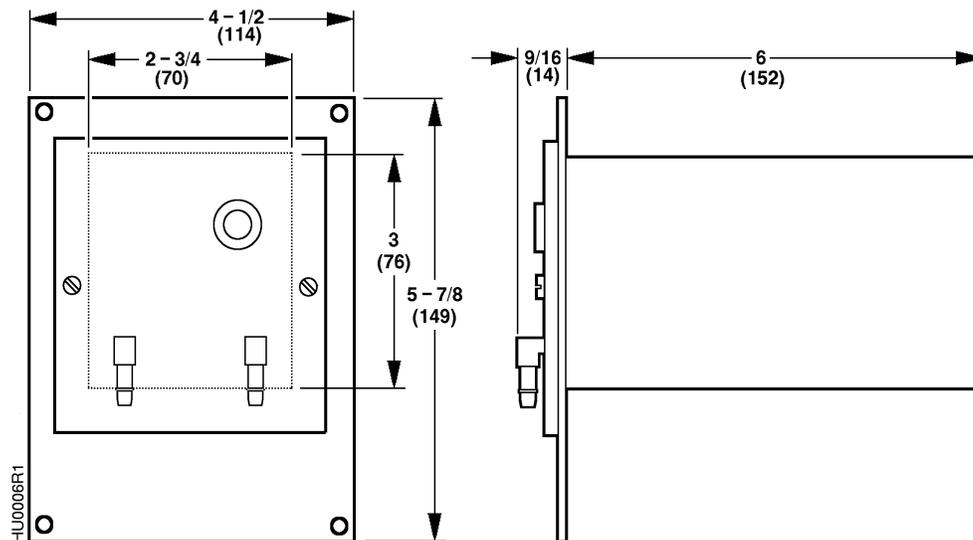


Figure 10. Duct Hygrostat Dimensions.

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