

# CP980B, C, D, E, and F Velocitrol Velocity Sensor/Controller

**PRODUCT DATA**

### DESCRIPTION

The CP980 Velocitrol Velocity Sensor/Controller is a control system combining an ultra sensitive air velocity sensor with a pneumatic controller to detect and control air flow in air terminal units, independent of system static pressure.

Two Sensor models are currently available, a reverse acting (RA) Sensor for normally closed dampers and a direct acting (DA) Sensor for normally open dampers. Two earlier Sensor models were both reverse acting, one for low velocities and one for high velocities. Each Sensor's velocity rating is determined through the use of an orifice to limit the flow.

Two Controller models are currently available and will be referred to as a B-type or C-type Controller corresponding to two of the three previous models. The B-type models work in conjunction with a one-pipe thermostat to provide high and low air volume limits. The C-type models work with a two-pipe thermostat to provide high and low air volume limits and sequencing for reheating. The A-type models provided only a fixed high air volume limit. The A-type models have no MIN or MAX dials.

Adding a bypass port to the B-type or C-type allows bypassing the minimum setting to provide the cooling control with no minimum setting.



SENSOR



CONTROLLER

M31414

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NEW VELOCITROLS CP980C/D/E/F (SENSOR/CONTROLLER)

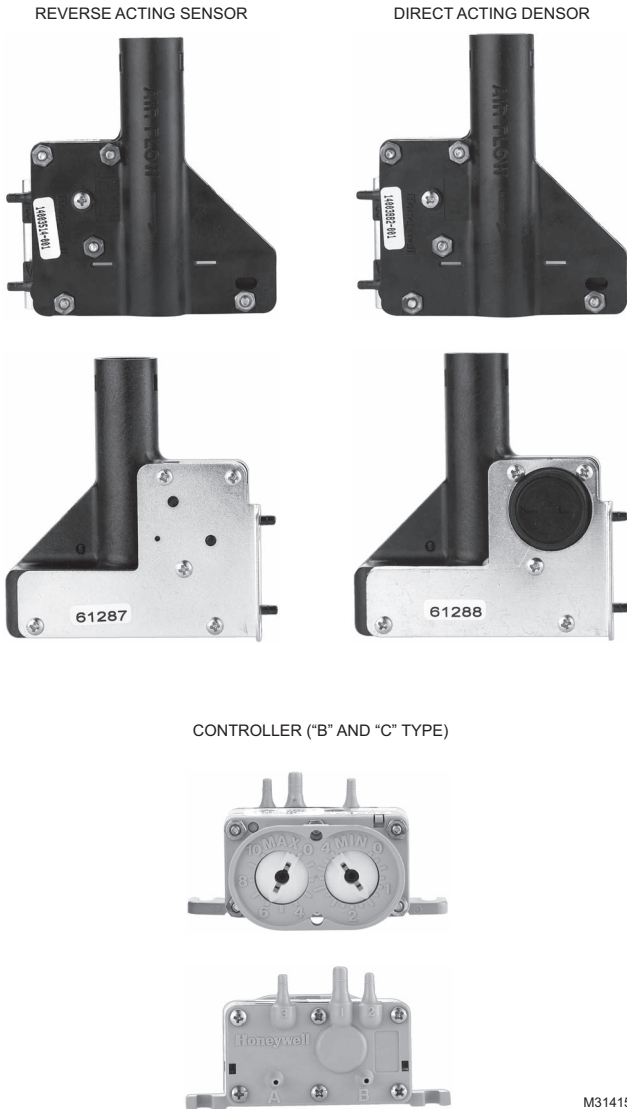


Fig. 1. Velocitrol Velocity Sensor/Controller components.

## APPLICATIONS

The applications following may be either high- or low-velocity; they are theoretical and not necessarily typical examples.

Systems above 100 ft./min. are high velocity systems. High-velocity systems in high-rise buildings may be captured by a fire management system to help control smoke in the fire area. Any fire management system will determine normally open and normally closed configuration of the dampers.

### Single-Duct, Constant Volume Reheat System

The thermostat in Fig. 2 modulates the reheat coil valve in response to load. Although inlet static pressure may vary, the Sensor/Controller maintains a constant volume by sensing air velocity changes and adjusting the damper accordingly.

### Single-Duct, Variable Constant Volume System

The thermostat in Fig. 3 senses room temperature and resets the control point of the velocity Sensor/Controller. This repositions the damper to increase or decrease airflow accordingly. If a change in static pressure modifies flow, the Sensor repositions the actuator to maintain flow as directed by the thermostat.

If the thermostat calls for airflow greater or less than the Controller maximum and minimum settings, these adjustments take precedence over thermostat control and maintain the specified air volume as shown in Fig. 4.

Use of a C-type Controller makes sequencing of reheat possible. The thermostat output is connected to the reheat coil valve whose operating range is 9 to 15 lb/in<sup>2</sup> (62 to 103 kPa).

## ORDERING INFORMATION

When purchasing replacement and modernization products from your TRADELINE® wholesaler or distributor, refer to the TRADELINE® Catalog or price sheets for complete ordering number.

If you have additional questions, need further information, or would like to comment on our products or services, please write or phone:

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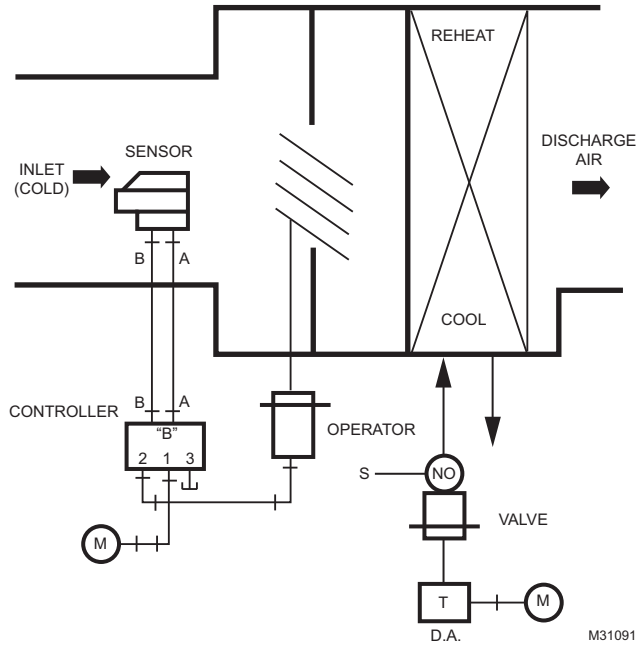


Fig. 2. Single-Duct, Constant Volume Reheat Application.

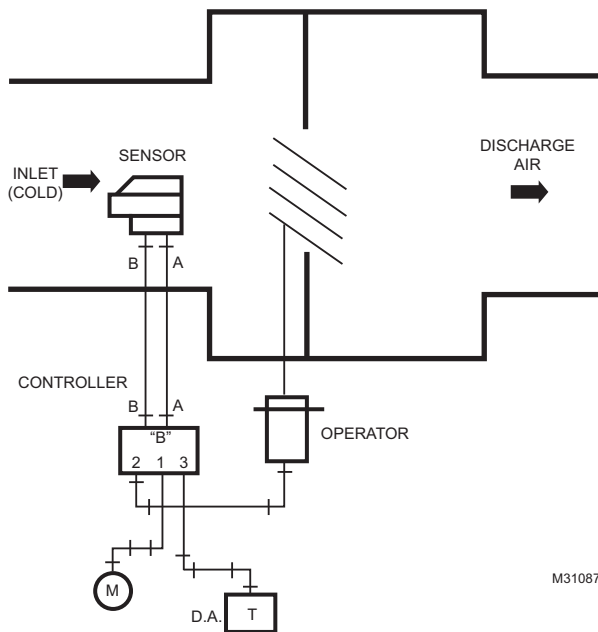


Fig. 3. Single-Duct, Variable Constant Volume Application.

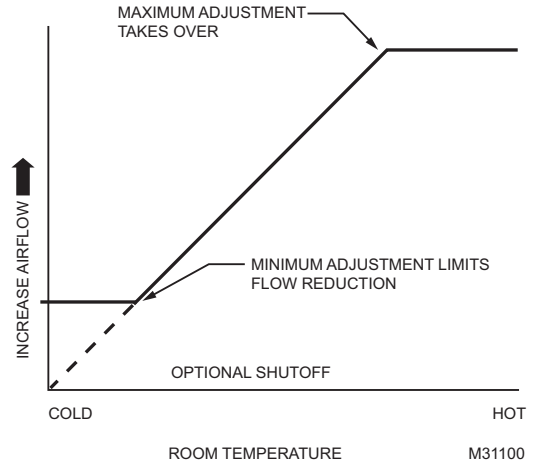


Fig. 4. Airflow Control in Single-Duct, Variable Constant Volume Application.

### Dual-Duct, Variable Constant Volume System

The minimum airflow limit is set equal to the minimum airflow required from the heating duct (see Fig. 5 and Fig. 6 on page 4). A C-type Controller maintains airflow at the minimum limit setting until the thermostat modulates the mixing dampers to full cooling and reaches a branch line pressure of 9 lb/in<sup>2</sup> (62 kPa). A further increase in branch line pressure increases airflow to the maximum limit setting while the cold damper is fully open and the hot air damper is fully closed.

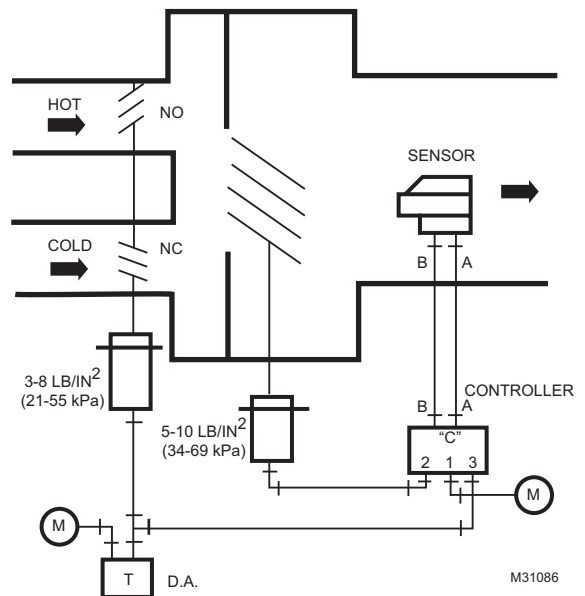


Fig. 5. Dual-Duct, Variable Constant Volume Application.

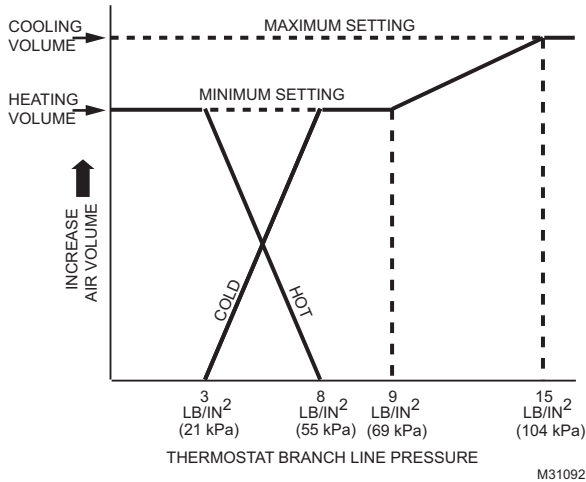


Fig. 6. Air Volume Control in Alternate Dual-Duct, Variable Constant Volume Application.

### Dual-Duct, Dual Variable Constant Volume System

When the room temperature (Fig. 7 and Fig. 8 on page 5) is below the control range of the direct-acting thermostat (2 lb/in<sup>2</sup>), the volume damper and the hot duct damper are fully open while the cold duct damper is fully closed. With less than 2 lb/in<sup>2</sup> branch line pressure (BLP) from the thermostat, the RP972 reversing relay outputs a maximum signal. For this application, the RP972 is set on A and calibrated to 14 lb/in<sup>2</sup> instead of 13 lb/in<sup>2</sup>, which is the factory calibration.

The RP470A higher-of-two-pressure selector relay compares the output of the RP972 with the output of the thermostat and transmits the higher pressure to port 3 of C-type Controller, in this case the full 14 lb/in<sup>2</sup>.

As the room temperature rises, the BLP of the thermostat increases. When the thermostat BLP reaches 5 lb/in<sup>2</sup>, the output for the RP972 drops to 9 lb/in<sup>2</sup>. The RP470 selects the 9 lb/in<sup>2</sup> as the higher and transmits it to the Controller. The drop in pressure to port 3 causes the Controller to modulate the volume damper to its minimum position as dictated by 9 lb/in<sup>2</sup> internal biasing of the C-type Controller.

As the thermostat BLP increases from 6.5 to 8 lb/in<sup>2</sup>, the Controller bias holds the volume damper at minimum while the RP971 converts the BLP signal into a 5 to 10 lb/in<sup>2</sup> signal. The hot and cold air duct damper operator then modulates the hot duct damper closed and the cold duct damper open.

With a continued rise in space temperature, the thermostat BLP continues to increase and since the BLP is now higher than the RP972 output, the RP470 selects the thermostat BLP to be transmitted to the Controller. A BLP increase from 9 to 11.5 lb/in<sup>2</sup> modulates the volume damper from minimum to maximum airflow.

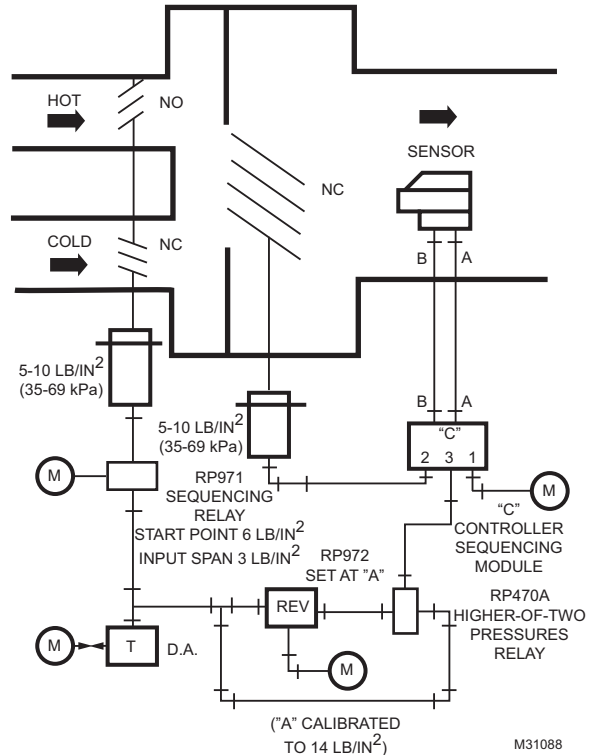
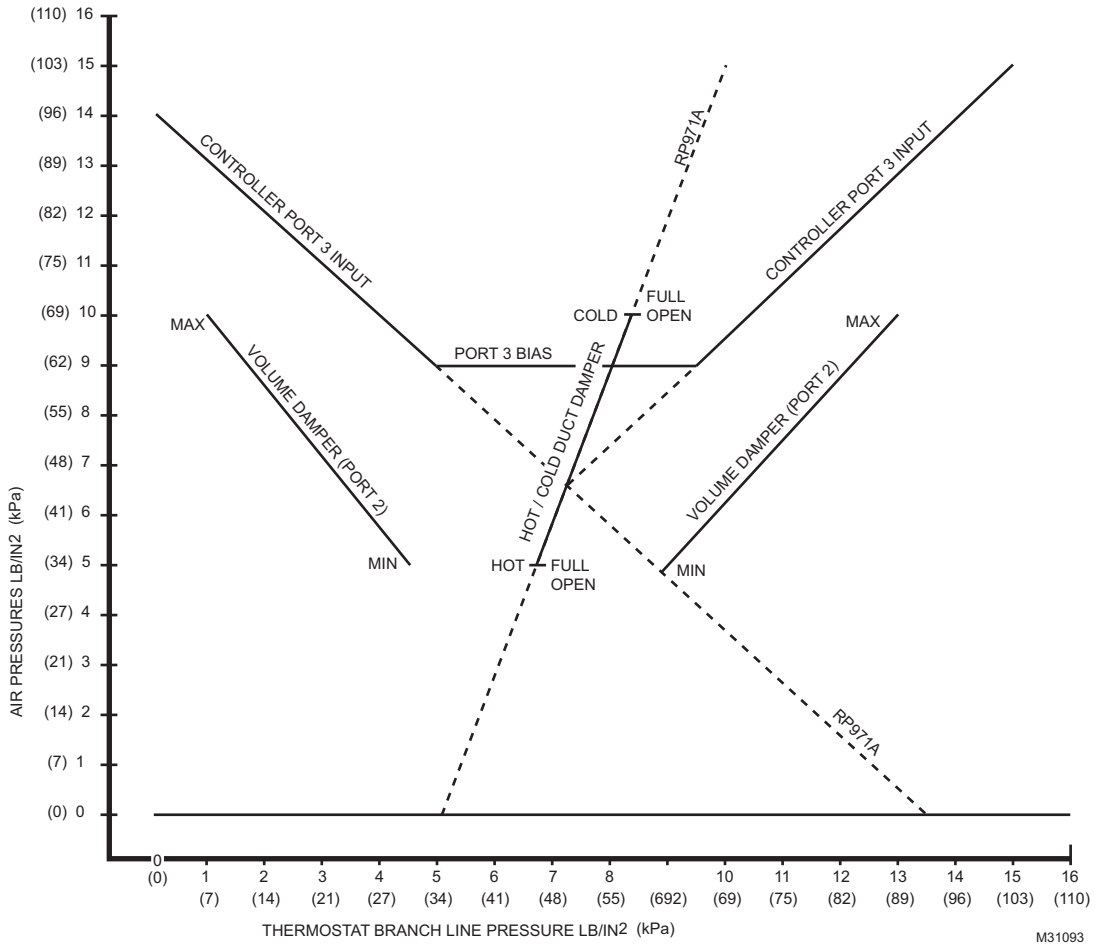


Fig. 7. Dual-Duct, Dual Variable Constant Volume Application.



**Fig. 8. Air Volume Control in Dual-Duct, Dual Variable Constant Volume Application.**

# SPECIFICATIONS

## Devices

Both active and inactive devices increase the air velocity with an increase in thermostat branch line pressure (BLP).

## Models

1. CP980B1000 (Low Velocity) and CP980B1034 (High Velocity)
  - Consisting of CP980A and RP980A (inactive); R.A. (normally closed damper) adjustable maximum velocity limit only.
2. CP980B1018 (Low Velocity), CP980B1042 (High Velocity), and CP980B1067 (High Velocity Carrier Special)
  - Consisting of CP980A and RP980B (inactive); R.A. (normally closed damper) adjustable maximum and minimum velocity limits.
3. CP980B1026 (Low Velocity) and CP980B1059 (High Velocity)
  - Consisting of CP980A and RP980C (inactive); R.A. (normally closed damper) adjustable maximum and minimum velocity limits with sequencing.

NOTE: The old/obsolete Sensor was available in two ranges (see Table 1 on page 12 in the “Repair” section):

- CP980A1002 Low Velocity
  - CP980A1010 High Velocity
4. CP980C: D.A. (normally open damper) with B-type Controller (1-pipe thermostat).
  5. CP980D: R.A. (normally closed damper) with B-type Controller (1-pipe thermostat).
  6. CP980E: D.A. (normally open damper) with C-type Controller (2-pipe thermostat).
  7. CP980F: R.A. (normally closed damper) with C-type Controller (2-pipe thermostat).

## Adjustment Range

### Maximum limit:

**CP980B:** 25 to 100% of velocity range.

**CP980C, D, E, and F:** 40 to 100% of velocity range (see Fig. 9 on page 7).

### Minimum limit:

**CP980B:** 0 to 75% of velocity range.

**CP980C, D, E, and F:** 0 to 50% of velocity rating (see Fig. 10 on page 7).

## Air Consumption

**CP980B:** 0.04 SCFM (1133 SCCM).

**CP980C, D, E, and F:** 0.029 SCFM (821 SCCM).

Air consumption for a bleed type thermostat is included with the B-type Controller but not for the C-type Controller.

## Ambient Operating Limits

**Temperature:** 40 to 130 °F (5 to 55 °C).

**Humidity:** 5 to 95% Relative Humidity (Non-condensing?)

## Maximum Safe Air Pressure

- 30 lb/in<sup>2</sup> (207 kPa).

## Normal Operating Air Pressure

**Nominal Main Supply:** 20 lb/in<sup>2</sup> (138 kPa).

**Minimum:** 18 lb/in<sup>2</sup> (124 kPa).

## Nominal Thermostat Branch Line

**B-type Controller:** 1 to 1.5 lb/in<sup>2</sup> (7 to 103 kPa).

**C-type Controller:** 9 to 15 lb/in<sup>2</sup> (62 to 103 kPa).

## Maximum Control Point Variation Due To Static Pressure Changes

- ± 5 percent: 0 to 4 in. WC (0 to 1 kPa).
- ± 10 percent: 0 to 6 in. WC (0 to 1.5 kPa).

## Sensitivity

Velocity change required for control action is less than 5 ft./min. (0.025 m/s) maximum (no orifice).

## Capacity (Branch Line)

**CP980B:** 0.022 SCFM (623 SCCM) maximum. Equivalent to 0.007 in. (0.2 mm) restriction.

**CP980C, D, E, and F:** 0.011 SCFM (312 SCCM). Equivalent to 0.005 in. (0.13 mm) restriction.

## Sensor Velocity Rating

Sensor velocity rating is dependent upon the orifice used and corresponds to a setting of 10 on the Controller's MAX dial (Fig. 16 on page 12). See Table 1 on page 12 in the “Repair” section.

# OPERATION

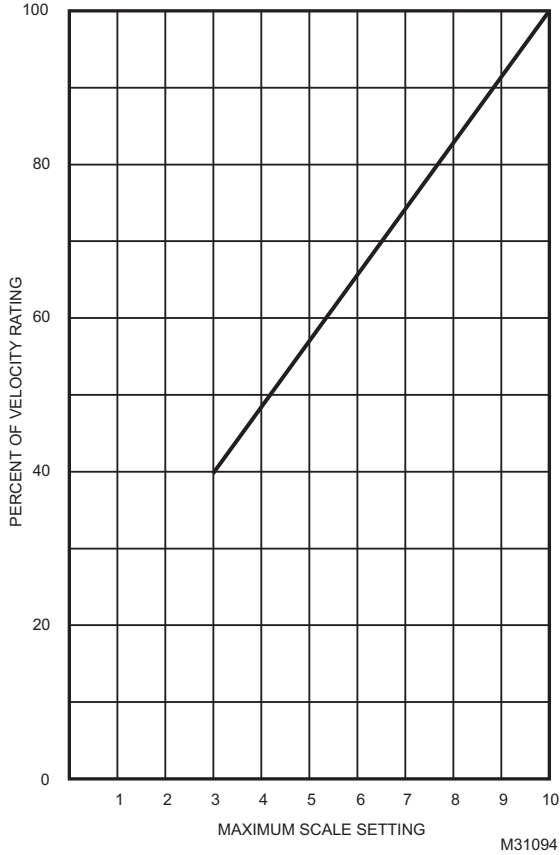
The Velocitrol Velocity Sensor/Controller takes main air and passes some through the primary jet restriction and some through the primary amplifier restrictions.

To control the pressure drop across the secondary jet restriction, the pressure downstream of the primary jet restriction is adjusted by the thermostat minimum setting, the maximum setting, or the optional minimum flow bypass. This pressure drop is the determining factor in the flow through the emitter tube (jet velocity).

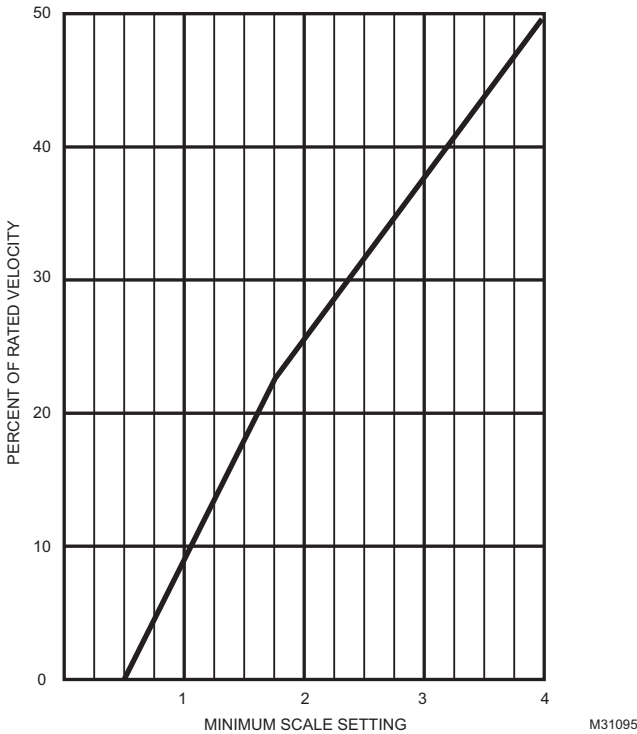
The air jet is recovered by the collector tube, The amount of air recaptured and therefore, the recovery pressure, is directly related to the velocity of the jet and inversely related to the duct air velocity (increased duct velocity deflects the jet further from the center of the collector tube).

The recovery pressure is amplified by the primary amplifier and fed through the BLP restriction to the branch line and the damper operator. The amplifier provides either a DA or RA signal depending upon the amplifier (Sensor) type.

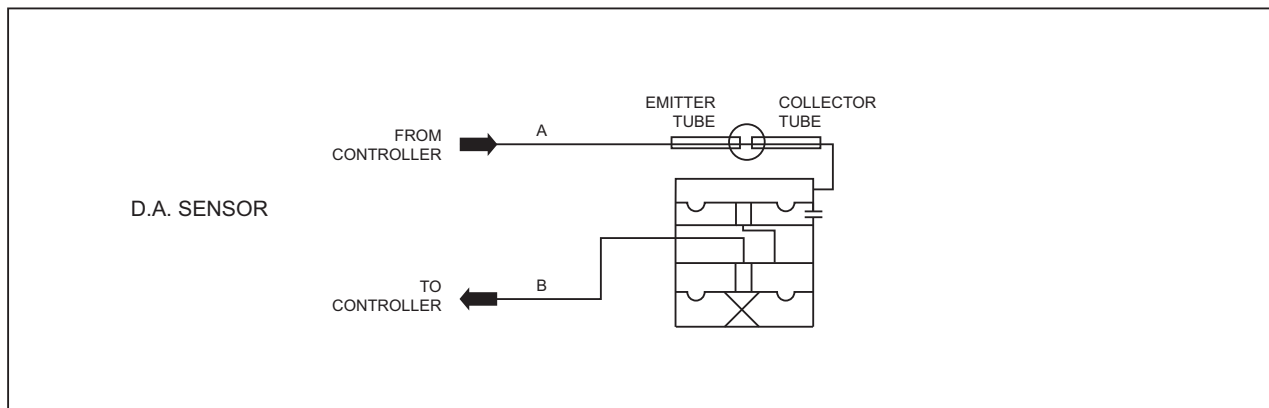
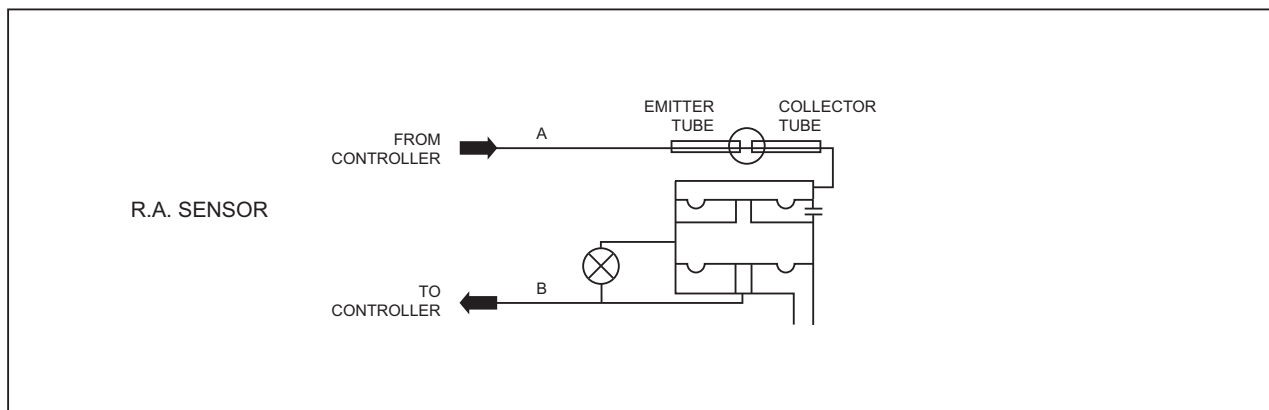
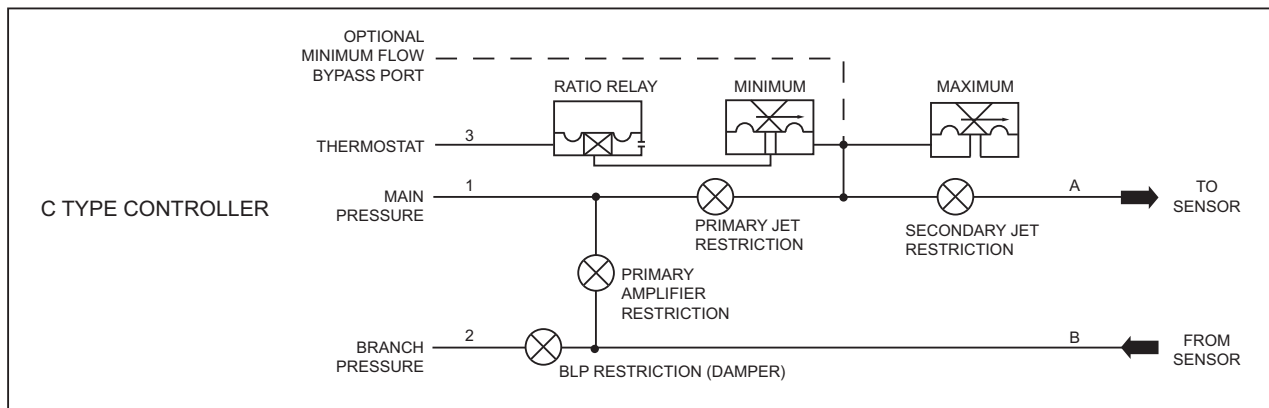
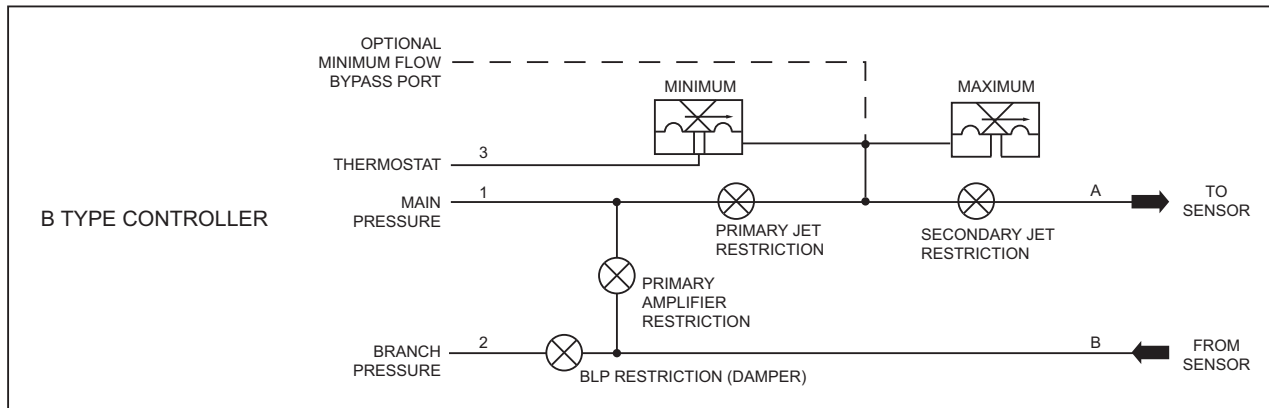
With an established velocity control point, any change in duct velocity gives an appropriate change in the Controller branch line signal to return the duct velocity to the control point. A change in temperature at the thermostat changes the signal to the Controller changing the setpoint of the Controller.



**Fig. 9. Velocitrol Sensor/Controller Maximum Scale Calibration.**



**Fig. 10. Velocitrol Sensor/Controller Minimum Scale Calibration.**



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**Fig. 11. Sensor and Controller Schematic Diagrams.**



# MAINTENANCE

## General

The CP980 requires only a 0 to 30 lb/in<sup>2</sup> (0 to 207 kPa) air pressure gauge to check its operation.

## Visual Inspection Procedure

1. Check tubing connections for leaks.
2. Inspect the terminal unit dampers. They should not be operating continuously at one extreme or the other, and they should be correctly linked to the damper operator.
3. Look for clogged filters in the air handling unit (low static pressure to the terminal unit).

## Air Pressure Measurement

The main air pressure at the Controller must be no less than 18 lb/in<sup>2</sup>.

## Calibration and Adjustment

### Adjustments

The maximum velocity limit is adjustable from 100 percent down to 40 percent of the range. A minimum velocity limit is adjustable from zero up to 50 percent of the range. The maximum adjustment provides the controlling limit in this overlap.

### Calibration

Sensor/Controllers ordered from the factory as a matched set come factory calibrated. This calibration is accomplished using laboratory type instruments and procedures, which are much more accurate than using field procedures. When both units are replaced, minimum and maximum flow calibrations are maintained.

Refer to Fig. 16 on page 12 for the following calibration procedures and port locations on the Controller.

### Maximum Flow (Terminal Unit Calibration)

1. For B-type Controller, cap thermostat port 3 on the Controller.  
For C-type Controller, connect main air to port 3 on the Controller.
2. Install flow measuring test equipment.
3. Measure actual flow in ft<sup>3</sup>/min (m<sup>3</sup>/s).
4. Adjust or calibrate the MAX dial to the desired flow level using flow measuring equipment. Write the new dial setting and air flow on a tag or on the unit for future reference.

### Minimum Flow (Terminal Unit Calibration)

1. Vent port 3 on the Controller.
2. Turn MAX dial above 10.
3. Install flow measuring test equipment.
4. Measure actual flow in ft<sup>3</sup>/min (m<sup>3</sup>/s).

5. Adjust or calibrate the MIN dial to the desired flow level using flow measuring equipment. For future reference, write the new dial setting and airflow on a tag or on the unit.

## Operational Checks

1. Note the maximum and minimum Controller scale settings. Reset the maximum to 10 and the minimum to zero.
2. With main air applied to the Controller, vary the thermostat setting. The operator/damper should vary the air flow to the dictates of the thermostat.
3. In a constant volume application (C-type Controller), uncap port 3. The flow should drop to shut-off.
4. With a signal applied (or port 3 capped), shut off duct air flow (shut off fan or block diffusers). The damper should be wide open attempting to maintain flow.
5. With a B-type Controller with port 3 temporarily disconnected, the terminal unit should go to full volume when port 3 is blocked (capped). The unit should shut off with port 3 vented.  
With a C-type Controller, the unit should go to full volume with main air supplied to port 3. The unit should shut off with port 3 vented.
6. If these actions do not occur, replacement of the complete Sensor/Controller model is recommended.
7. Reconnect the thermostat and reset the Controller to its original scale settings.

# TROUBLESHOOTING

## General

Make note of Controller settings so the Controller can be set back to the original settings when finished troubleshooting. The troubleshooting procedures assume that the system operated correctly in the past and that both the visual inspection and operational check have been done.

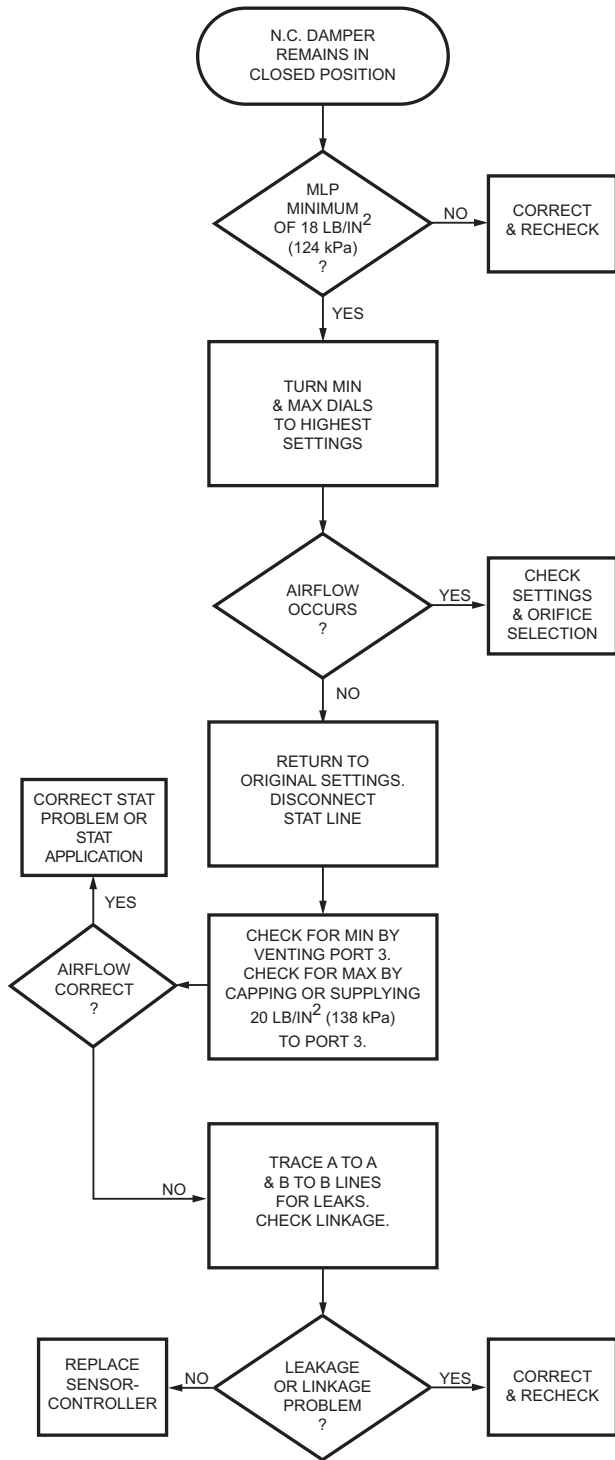
**NOTE:** If the pneumatic air supply has been contaminated with water or oil and symptoms develop similar to Fig. 12 and Fig. 13 on page 10 (low main air pressure), then replace the filter (Fig. 16 on page 12).

The equipment required is:

1. A means of measuring airflow from the terminal unit
2. A pressure gauge with a range of 0 to 30 lb/in<sup>2</sup> (0 to 207 kPa) for measuring main pressure at terminal unit.

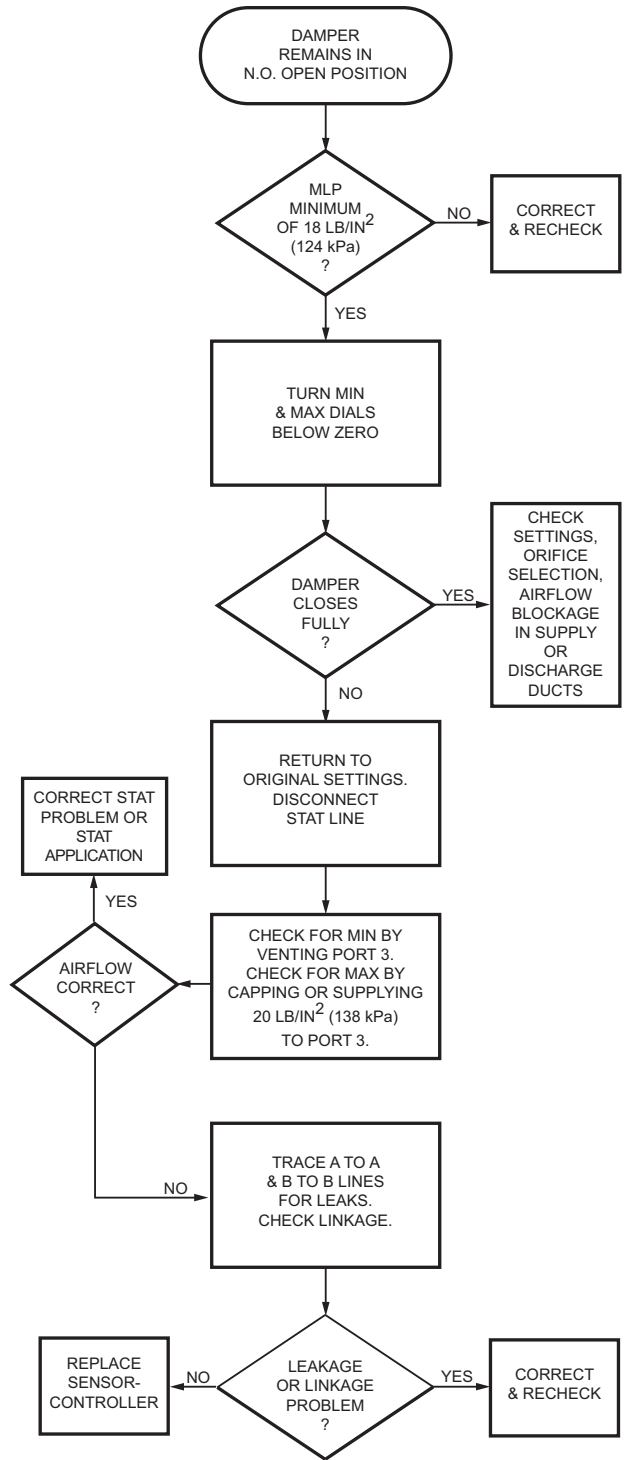
A series of flow diagrams are provided for troubleshooting the CP980B/C/D/E/F models. The titles and possible conditions are:

1. Damper Remains in Normally Closed Position (Fig. 12 on page 10).
2. Damper Remains in Normally Open Position (Fig. 13 on page 10).
3. Unit Controls at Constant Volume Maximum Flow (Fig. 14 on page 11).
4. Unit Controls at Constant Volume Minimum Flow (Fig. 15 on page 11).



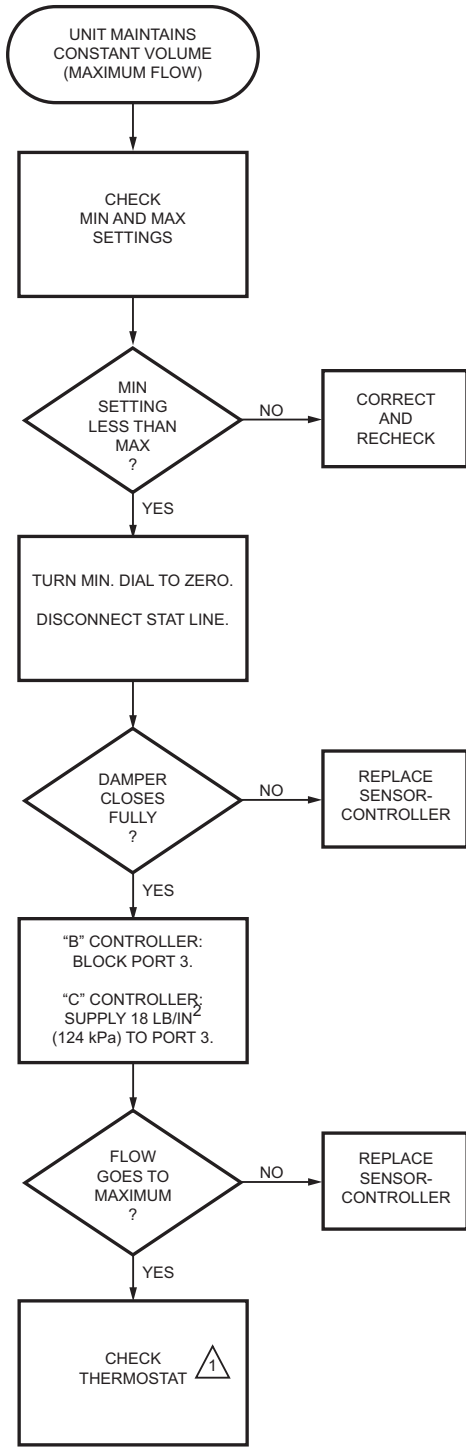
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Fig. 12. Damper Remains in Normally Closed Position.



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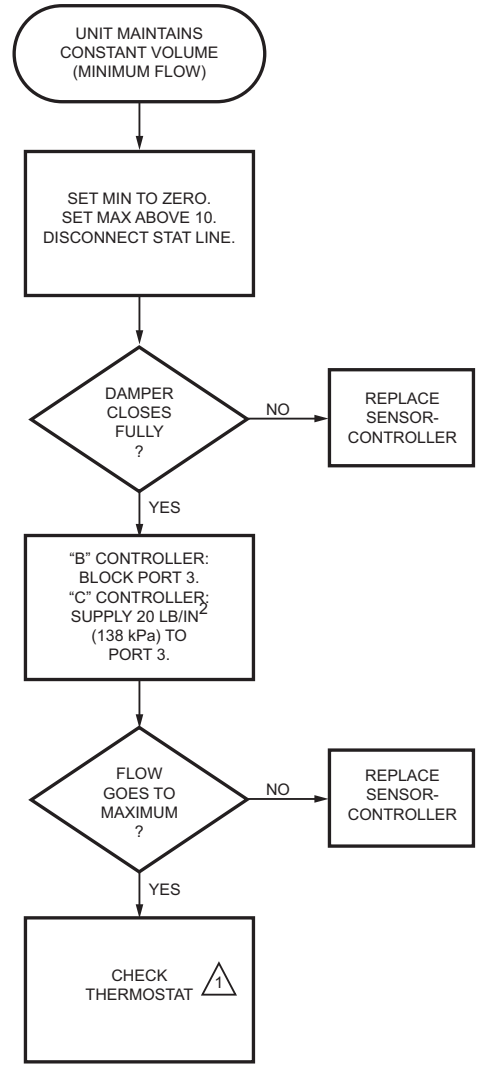
Fig. 13. Damper Remains in Normally Open Position.



1. B-TYPE CONTROLLER REQUIRES BLEED STAT. NO MAIN AIR SUPPLY TO STAT NECESSARY.  
 2. C-TYPE CONTROLLER REQUIRES EXTERNAL AIR SUPPLY TO STAT.  
 3. ALL MODELS REQUIRE DIRECT-ACTING THERMOSTATS FOR COOLING APPLICATIONS.

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**Fig. 14. Unit Controls at Constant Volume Maximum Flow.**



1. B-TYPE CONTROLLER REQUIRES BLEED STAT. NO MAIN AIR SUPPLY TO STAT NECESSARY.  
 2. C-TYPE CONTROLLER REQUIRES EXTERNAL AIR SUPPLY TO STAT.  
 3. ALL MODELS REQUIRE DIRECT-ACTING THERMOSTATS FOR COOLING APPLICATIONS.

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**Fig. 15. Unit Continually Controls at Constant Volume Minimum Flow.**

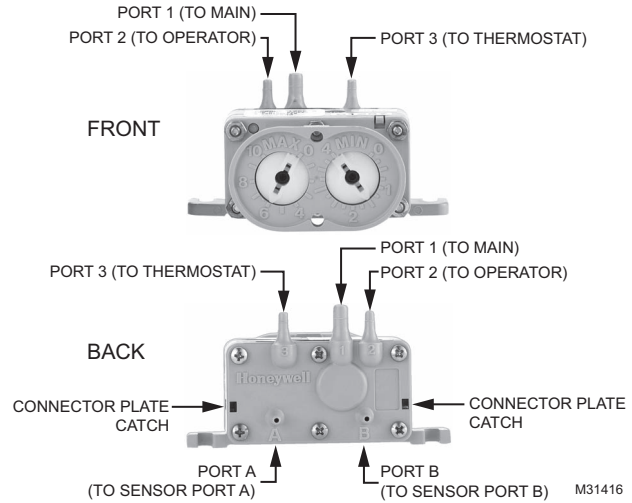
# REPAIR

**NOTE:** The Barb Cap 14003567-001 and Filter 14001865-001 are available as service repair parts. If parts other than these two are required, replacing the Sensor and Controller as a matched set is recommended.

## Controller Filter Replacement

Refer to Fig. 16 for this procedure.

1. Remove the main air line from port 1.
2. Remove the six screws holding the unit together.
3. Carefully unfasten the catch on either side of the connector plate and remove slowly. On C-type Controllers take care not to lose the piston and spring behind the diaphragm. Hold the spring and the piston down with a small nail file or straightedge.
4. Remove the filter.
5. Replace with a new filter (14001865-001).
6. Replace the connector plate and reinstall the six screws.
7. Reconnect the main air line.



**Fig. 16. Controller View.**

## Orifice Replacement

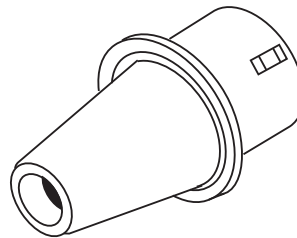
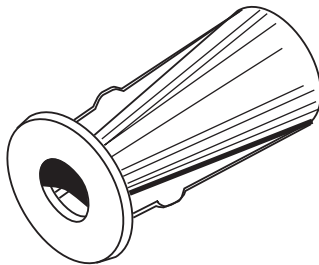
Replace lost or damaged orifices by reordering. Refer to Table 1 for orifice part numbers.

**Table 1. Orifices vs. Velocity Ratings.**

| Orifice Part Number.<br>(see Fig. 17) | Color | Controller and Velocity Rating ft/min (m/s) |                          |                   |
|---------------------------------------|-------|---|--------------------------|-------------------|
|                                       |       | CP980A1002<br>(obsolete)                    | CP980A1010<br>(obsolete) | CP980C, D, E, & F |
| None                                  | n/a   | 500 (2.5)                                   | n/a                      | 500 (2.5)         |
| 14003642-002                          | Green | 750 (3.7)                                   | 1500 (7.6)               | 750 (3.7)         |
| 14003642-003                          | White | 1500 (7.6)                                  | 3500 (17.7)              | 1500 (7.6)        |
| 14003642-004                          | Blue  | 2000 (10.1)                                 | 4250 (21.5)              | 2000 (10.1)       |
| 14003749-001                          | Black | 2500 (12.6)                                 | n/a                      | 2500 (12.6)       |
| 14003749-002                          | Gray  | 3500 (17.7)                                 | n/a                      | 3500 (17.7)       |

Part Nbr. 14003642-

Part Nbr. 14003749-



M31089

**Fig. 17. Orifices by Part Number (see Table 1).**

### Automation and Control Solutions

Honeywell International Inc.  
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Golden Valley, MN 55422

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Toronto, Ontario M1V 4Z9  
customer.honeywell.com

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