



# Installation, Service and Troubleshooting Instructions

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### GENERAL

This manual provides detailed explanations of the operation of the Carrier Comfort System bypass controller and each configurable function. The configurable functions allow the operation of the bypass controller to be adjusted to match specific user needs and system requirements.

The bypass controller is the pressure moderator of the VVT system. The pressure moderation ability of the bypass controller makes a zoning system with a constant volume HVAC unit possible. The bypass controller maintains system static pressure based on the used-configured set point. The bypass controller regulates system static pressure by opening its damper when it measures a pressure above the system set point and closing its damper when it measures a system pressure below the system set point. If the system static pressure is within 3% of the system set point, the damper will remain at its present position.

The bypass controller will receive the system mode from the monitor thermostat and will modulate its damper according to user-configured settings, system mode, and sensor information. Only one bypass controller should be used per one monitor thermostat.

NOTE: The 33CSBC--00 bypass controller will only work with 33CSPS--01 and 33CSPS--02 pressure sensors.

NOTE: The Comfort System (33CS) bypass controller is not compatible with a VVT Generation II Enhanced or Pre-Enhanced device. The Carrier 33CS VVT system will not support Enhanced or Pre-Enhanced devices.

## INSTALLATION

The bypass controller receives power from the bypass damper actuator. The bypass damper actuator contains the wiring harness and wire nut connections for the bypass controller and the bypass controller sensors (pressure sensor and indoor-air quality [IAQ] sensor). All wiring connections must be made correctly before the bypass controller will function.

**Bypass Controller Placement** — Begin the bypass controller installation by determining where the bypass controller will be located. In most cases, this will be predetermined by the building plans and the location of the bypass damper actuator. See Fig. 1.

The bypass controller should be located on an interior wall, about 5 ft from the ground, near the bypass damper. The bypass controller can be placed in a remote location if used in conjunction with a remote room sensor.

**Mounting Bypass Damper Actuator to Duct** — The bypass damper should already be installed in the bypass ductwork. The bypass damper actuator is mounted on the duct at the damper location.

**Wiring Requirements** — The wiring requirements for the VVT System bypass controller are:

**BYPASS CONTROLLER TO THERMOSTAT (NETWORK)** — Wiring shall be 18 gage, 3-conductor, shielded, stranded wire, color coded (RED, BLACK, GREEN), plenum rated if required, and long enough to run from bypass controller to thermostat in daisy-chain configuration. A T-tap wiring configuration is not acceptable. The bypass controller does not have to be below the monitor thermostat.

**BYPASS CONTROLLER TO DAMPER ACTUATOR** — Wiring shall be 18 gage, 5-conductor, shielded, stranded wire, color coded (RED, WHITE, BLUE, YELLOW, GREEN), plenum rated if required, and long enough to run from bypass controller to damper actuator. Do not run wire longer than 500 ft.

NOTE: Do not run the network and the control wire in the same conduit for more than 5 ft. Never run wires near any cable carrying AC voltage. For further wiring information, consult the local Carrier distributor.

Power required to the damper actuator is 24 vac/30 va. Typical wiring is 18 gage thermostat wire (standard or plenum cable). The maximum load of a relay contact is 24 vac, 1 amp. A short in the field wiring will cause non-warranty damage to the bypass controller. Test before attaching to bypass controller.

Call the local Carrier representative if more information is needed about wiring the VVT System or the bypass controller.

## Wiring Connections

### ⚠ WARNING

Electric shock can cause injury or death. Ensure power to the HVAC unit has been disconnected before wiring.

**WIRE BYPASS CONTROLLER TO NETWORK** — Wire the bypass controller to the network as shown in Fig. 2. All wiring should be kept a minimum of 12 in. away from any cables carrying AC current. For more information refer to the installation instructions included with each relay pack. Red, black, and green network wires should be connected to the bypass controller connector board. The shielding on the cables should be wrenutted together.

### ⚠ CAUTION

Three-wire network shielding must be connected to earth ground at one location only. Network communications will not be transmitted properly.

**WIRE BYPASS CONTROLLER TO DAMPER BOARD** — The damper board thermostat wiring bundle contains the wires required to connect the bypass controller to the damper actuator. See Fig. 2. Wire nut the RED, WHITE, BLUE, YELLOW, and GREEN wires of the bypass controller to the damper board wiring bundle.

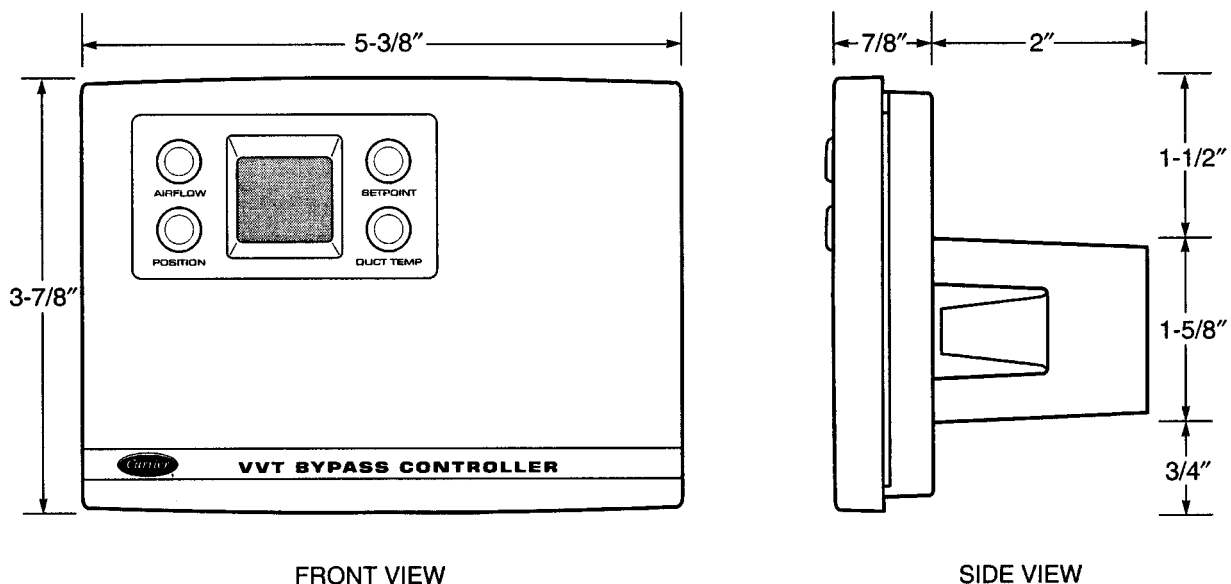


Fig. 1 — Bypass Controller Dimensions

**WIRE SENSORS TO DAMPER BOARD** — The damper board sensor wiring bundle contains the wires required to connect the sensors. The duct temperature sensor and wiring is part of the damper actuator. No wiring is required.

**NOTE:** For IAQ and pressure sensor wiring and installation, see sections below.

**INDOOR-AIR QUALITY SENSOR INSTALLATION** — An indoor-air quality sensor is designed for use with the Carrier Comfort system. The sensor has a range of 0 to 5000 ppm of CO<sub>2</sub>. The factory setting is 1000 ppm. This set point is adjustable only through software. An isolated power supply of 16 to 24 vac is required and supplied with the sensor, with a 300 mA average and a 500 mA peak. The IAQ sensors are available in 3 models: Wall Mount with LED (light-emitting diode), Wall Mount, and Duct Mount.

The duct-mounted sensor is mounted in the duct (typically the return air duct). It reads the level of CO<sub>2</sub> at its location. The sensor is shipped mounted in an aspirator box for mounting to the ductwork. A 1½-in. hole is required for the sensor sampling tube. This is a typical VVT system application.

When the IAQ sensor is used in Monitor-Only applications, it is usually duct-mounted and wired to a zone controller relay pack (local IAQ). When the IAQ sensor is used in VVT Monitor applications, it is usually duct-mounted and wired to the bypass damper (system IAQ).

To wire the IAQ sensor, perform the following:

1. Wire the dry contact relay output from the sensor (connections 3 and 4) to the red and black wires of the "O" section of the PS sensor harness of the bypass controller damper. The PS sensor harness is supplied with a pressure sensor for use with the bypass damper. Recommended gage of wire is 14, stranded. See Fig. 3.
2. Wire the 2 wires from the isolated 24 vac power supply to the power input side of the sensor (connections 1 and 5). Recommended gage of wire is 14, stranded. The green/red LED on the sensor shows steady green during normal operation.

Configure the options associated with the sensor. Refer to the Indoor-Air Quality Sensor section on page 12.

**PRESSURE SENSOR INSTALLATION** — The 33CS pressure sensor must be interfaced to the bypass controller master bypass damper using the factory supplied 8 wire harness. Three wires are for the pressure sensor and the 2 wires marked "O" are for an optional IAQ sensor. See Fig. 3. Refer to the pressure sensor installation instruction for more information. See Fig. 4.

**CONNECT POWER TO DAMPER ACTUATOR** — After the wiring has been completed, provide power to the damper actuator by connecting the power wiring bundle to a 24 vac transformer. Power required to the damper actuator is 24 vac/30 va. Typical wiring is 18 gage thermostat wire (standard or plenum cable). The maximum load of a relay contact is 24 vac, 1 amp. A short in the field wiring will cause non-warranty damage to the bypass controller. Test before attaching to bypass controller. Once power has been provided, the damper actuator will provide power to the bypass controller. The bypass controller display will appear on the screen. If the display is blank or blinking, recheck the wiring connections between the bypass controller and damper actuator.

**Sensor Adjustment** — To regulate the Carrier VVT system external static pressure, the bypass controller must be interfaced to a 33CS pressure sensor. The pressure sensor measures actual system static pressure.

**Pressure Sensors** — There are two different pressure sensors available. Depending on the static pressure the system will operate at, choose the correct pressure sensor. The 33CSPS-01 has an operating range from 0.05 to 0.5 in. wg. The 33CSPS-02 has an operating range from 0.2 to 2.0 in. wg.

The pressure sensor measures the system static pressure through one or multiple PSP (static pressure pickups) that are mounted downstream of the bypass damper in the system duct. When the system duct layout makes it impossible to locate the PSP in an area of laminar flow, multiple PSPs may be installed and then connected to calculate an average system pressure. See Fig. 5.

When calibrated, the pressure sensor is highly accurate and capable of measuring static pressure with a resolution of 0.01 in. wg. The bypass controller displays the system static pressure in inches wg.

**EQUIPMENT SET UP FOR PRESSURE SENSOR CALIBRATION** — The following equipment is needed for pressure sensor calibration:

- accurate manometer or Magnehelic pressure gage
- 1/4 in. (OD) tee fitting with 3 ports
- 1 ft length of 1/4 in. (ID) flexible tubing to run from the pressure sensor to one port of the tee fitting
- sufficient length of 1/4 in. (ID) flexible tubing to run from one of the tee fitting ports (located near pressure sensor) to the manometer or Magnehelic (located near the bypass controller).

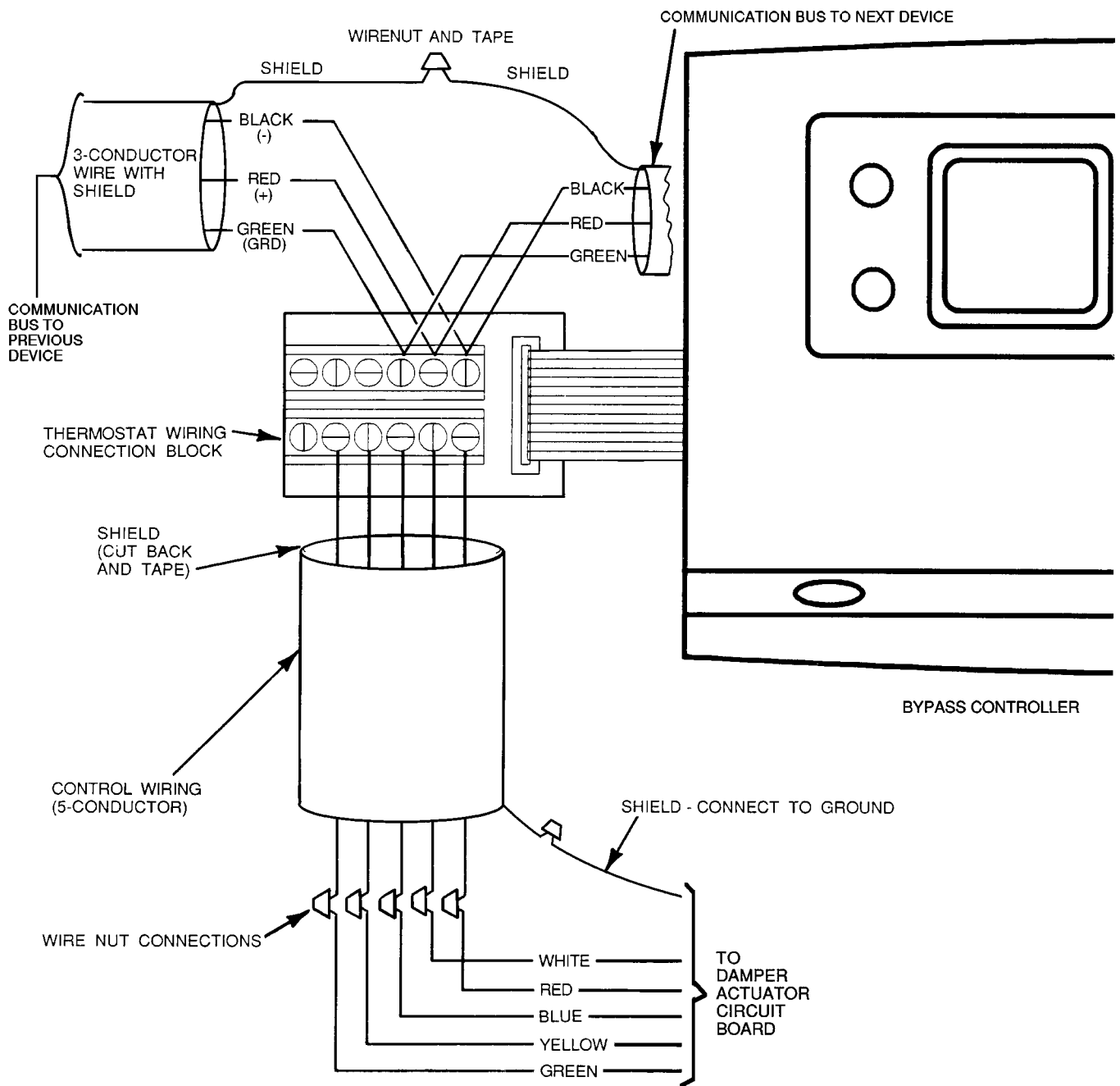
For the manometer or Magnehelic gage to measure the correct pressure, a 1/4 (OD) tee fitting must be temporarily installed as a pressure tap in the flexible tubing running between the pressure sensor and the PSP pressure pickup.

**NOTE:** The pressure sensor and PSP pressure pickup must be installed according to the installation instructions packaged with each component.

Perform the following procedure to set up the pressure sensor and manometer or Magnehelic gage:

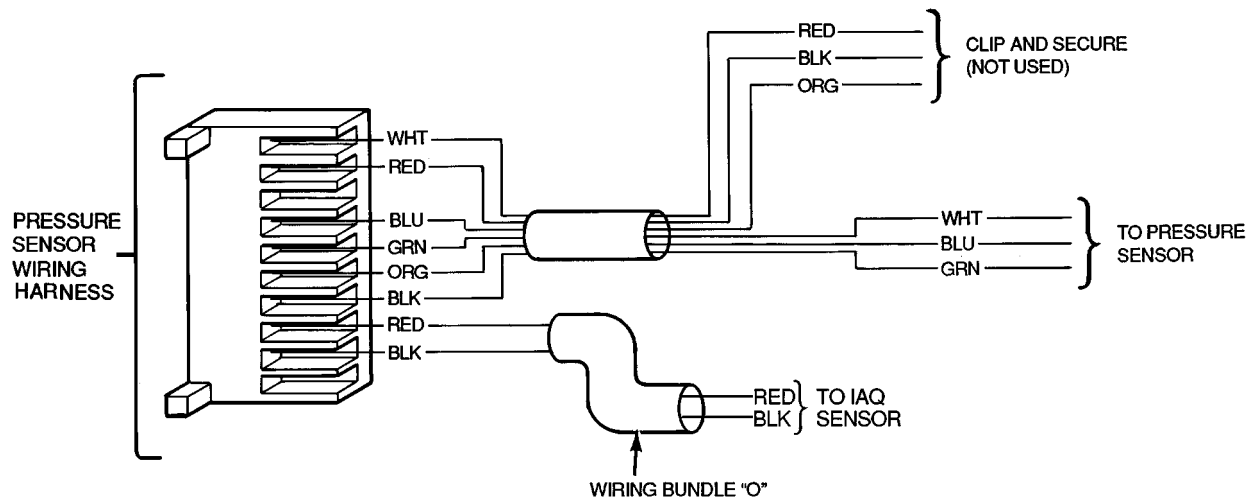
1. Locate the manometer or Magnehelic gage so the static pressure readings can be easily viewed from the bypass controller location.
2. At the pressure sensor, remove the flexible tube connected to the high-pressure port.
3. Install one port of the tee fitting into the end of the flexible tube that was disconnected from the pressure sensor in step 2.
4. Using 1 ft length of flexible tubing, connect the second port of the tee fitting to the pressure sensor high-pressure port.
5. Using the remaining length of flexible tubing, connect the third port of the tee fitting to the high-pressure inlet of the manometer or Magnehelic gage.

**NOTE:** The low-pressure port on both the pressure sensor and manometer or Magnehelic gage must be open to the atmosphere.



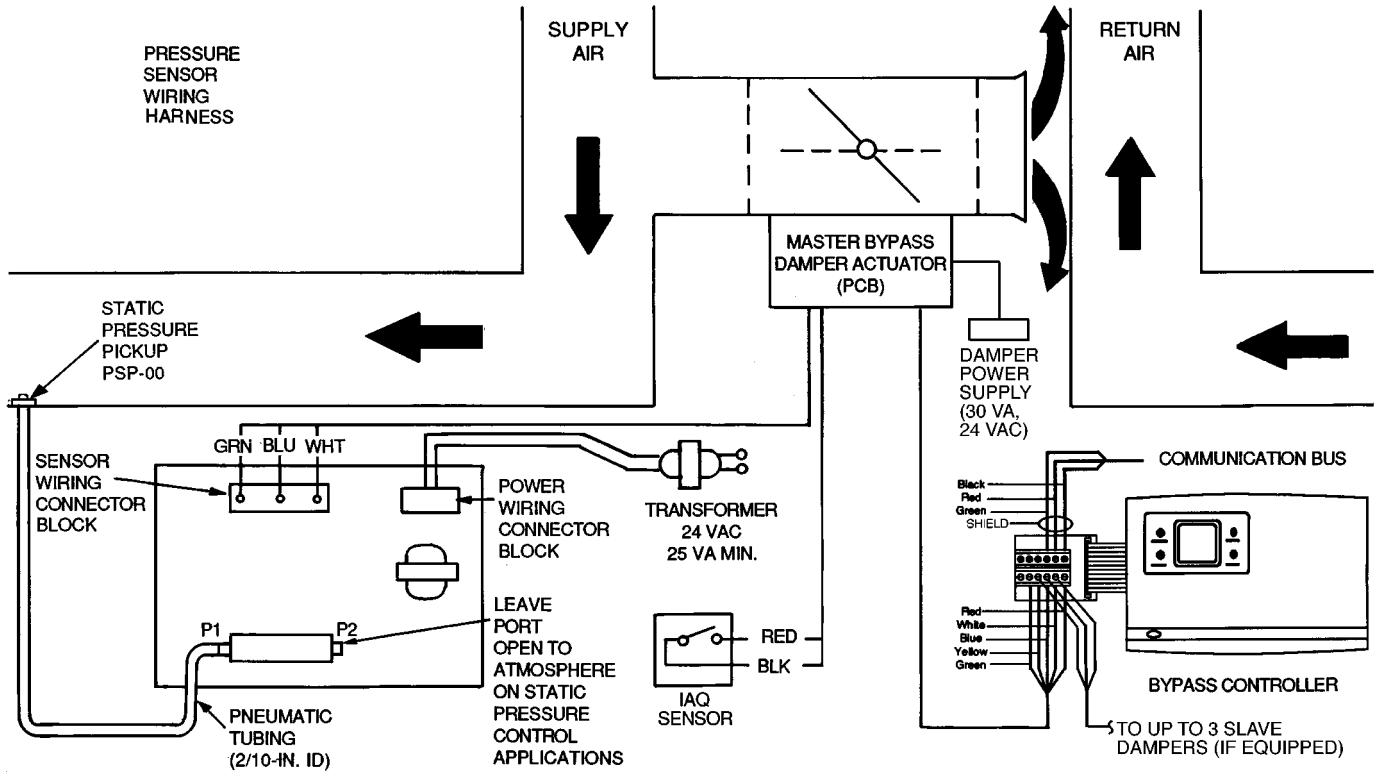
NOTE: All wiring is field-supplied.

→ **Fig. 2 — Bypass Controller Wiring Connections**



IAQ — Indoor-Air Quality

Fig. 3 — Damper Actuator Sensor Wiring

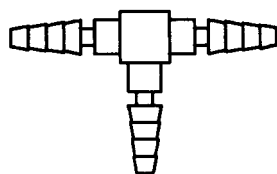


LEGEND

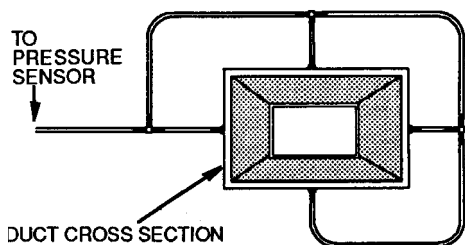
- PCB — Printed Circuit Board
- PSP — Pressure Static Pickup



Fig. 4 — Bypass Damper and Pressure Sensor Installation



CONNECTING TEE



**Fig. 5 — Pressure Sensor Average Flow Locations**

**PRESSURE SENSOR RE-ZEROING PROCEDURE FOR THE BYPASS CONTROLLER** — To re-zero the pressure sensor perform the following:

1. Power the pressure sensor.
2. Configure the Pressure Sensor Range, category 5, option 5. If using a pressure sensor pick-up (33CSPS-02), set the value to 2.0 in. wg. If using a velocity pressure probe (33CSPS-01), set the value to 0.5 in. wg.
3. Select the Auto-Zero Enable function in category 5, option 6. Set the option to ON. The bypass controller will automatically deenergize the equipment supply air fan. The bypass controller will wait until the fan-off time has expired before the Auto-Zero function is started. The pressure sensor Auto-Zero Enable function will automatically calibrate the pressure sensor to zero. After the Auto-Zero Enable function completes the pressure sensor re-zeroing, the bypass controller display will return the Auto-Zero Enable function to OFF.

NOTE: For bypass controller stand-alone operation, the Auto-Zero Enable function will not be available. To zero the pressure sensor, turn off the system fan and allow the pressure to dissipate. Enter category 5, option 8 for pressure sensor calibration. Press the left upper and lower information buttons simultaneously. The current pressure reading will be saved as the zero pressure reading.

### **Calibration of Pressure Sensor (with Pressure Pick-Up) and Selection of System Pressure Set Point**

— This section explains how to configure the system pressure set point for the bypass controller when using a pressure pick-up.

NOTE: Before performing this procedure, re-zero the pressure sensor of the bypass controller.

To configure the system pressure set point, perform the following procedure:

1. Set the System Setup Enable function (category 5, option 7) to ON. The bypass controller deenergizes the system heating/cooling equipment, closes the bypass damper(s), and opens all the zone dampers in the VVT system to their Maximum Damper Position. The bypass controller also energizes the system supply air fan relay. This option forces the system into a static condition so that a

stable system pressure can be obtained. By adjusting the minimum and maximum damper positions at individual zones, the system can be adjusted to balance airflow and obtain an acceptable noise level. The bypass damper will display the highest address found in its scan.

2. Use the Zone Damper Control function to close, one at a time, the zone dampers farthest away from the equipment supply air fan. Each time a zone damper is closed, check the noise level and objectionable drafts in the zones that remain open. Check the ability of the system supply air fan to maintain supply airflow above the minimum required supply airflow. Refer to the Zone Damper Control section on page 7 for more information on Zone Damper Control.

Continue closing individual zone dampers until the noise or drafts, due to increased supply airflow, becomes objectionable in any zone or until the equipment supply air fan cannot maintain the minimum cfm requirements of the unit.

NOTE: For systems utilizing temperature diversity, close dampers at an opposing solar exposure while leaving the other dampers open. Perform Step 2. The system should be balanced while performing this task to assure designed airflow.

3. When either noise level and/or drafts, due to supply airflow, becomes objectionable or the system static pressure approaches the upper static pressure limit, use Zone Damper Control to reopen the last zone damper that was closed. Open zone dampers until the noise level and/or drafts in every zone is acceptable or the unit supply air fan is able to exceed the minimum airflow requirements. This determines the maximum supply air static pressure the bypass controller should allow for the system.
4. Calibrate the pressure sensor. To calibrate the pressure sensor, select category 5, option 8. The current pressure reading will be displayed on the bypass controller screen. Use the left information buttons to adjust the value until the pressure matches the system pressure on the manometer or Magnehelic gage.
5. Press the select button to modify the Auto Pressure Set Point option (category 5, option 9). The current system pressure will blink. Press the select button again. System Setup Enable will end and the new system pressure set point will be stored.
6. From the system balance report, determine the equipment supply air fan operating rpm. From the equipment application information, determine the minimum operating cfm for both the cooling and heating cycles. These quantities are typically 300 to 350 cfm/ton.

From the equipment fan performance curve or table, determine the maximum static pressure the fan can overcome at its fixed operating rpm. Verify the fan can deliver the minimum operating cfm required by the equipment cooling and heating cycles.

If the external static pressure value determined for the equipment maximum operating static pressure approaches or exceeds the System Pressure Set Point of the bypass controller, the System Pressure Set Point must be reduced.

NOTE: The bypass controller cannot use a velocity pressure probe.

**Zone Damper Control** — Zone damper control allows the bypass controller to position each zone damper associated with its system. Each zone damper can be independently programmed full-open or full-closed. The System Setup Enable option is used to control the system dampers.

The full-open or full-closed position of each zone damper associated with the bypass controller is maintained while system setup is enabled. The bypass controller automatically modulates its own bypass damper full closed and each zone damper full open.

During zone damper control operation, equipment heating and cooling is deenergized, the system supply air fan is energized, all zone dampers are at the maximum open position, and the bypass damper is in the minimum open position.

To activate the System Setup Enable option (zone damper control), set category 5, option 7 to ON.

NOTE: During System Setup Enable, the bypass controller will disable the operation of every device on its network. The bypass controller will only control the damper position of the monitor thermostat and zone controllers associated with its system.

**SYSTEM SETUP ENABLE DISPLAY** — The bypass controller indicates the device address of the zone it is currently communicating with in the upper left part of the display. All zone dampers are set to the maximum open position upon activating System Setup Enable.

During System Setup Enable, zone damper information is displayed by the bypass controller based on the following annunciators:

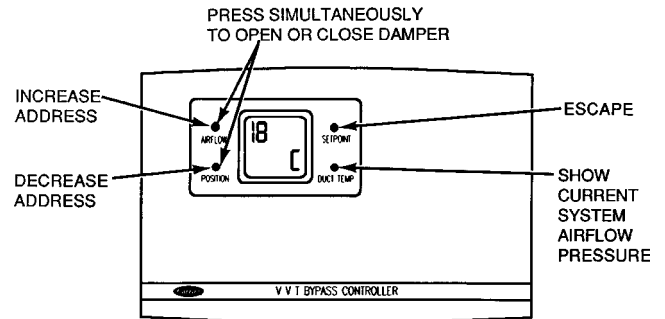
- A flashing "O" annunciator indicates the damper is modulating open. A continuous "O" annunciator indicates the damper is at its maximum open or maximum airflow position.
- A flashing "C" annunciator indicates the damper is modulating closed. A continuous "C" annunciator indicates the damper is at its full closed or minimum airflow position.

NOTE: For pressure independent thermostat operation, the "O" or "C" annunciator may not stop flashing because the thermostat will continuously modulate its damper to maintain the airflow set point. If the device does not control a damper, the bypass controller continuously indicates an "O" annunciator.

- A "CE" indicates that there is a communication problem between the bypass controller and the device at the address shown.
- A "dE" indicates that there is a damper error at the displayed zone.

**SELECTING ZONE CONFIGURATION** — Press the Increase Address button if the desired device address is greater than the device address currently displayed. See Fig. 6. Press the Decrease Address button if the desired device address is less than the device address currently displayed.

NOTE: When zone damper control is activated, it will initially display the highest address scanned. The bypass controller will not display its own device address.



**Fig. 6 — Zone Damper Control Programming Buttons**

**POSITIONING A ZONE DAMPER** — To position a closed zone damper open or an open zone damper closed, press both left information buttons simultaneously.

**DEACTIVATING ZONE DAMPER CONTROL** — Zone Damper Control is deactivated by pressing the lower right information button while the current system pressure is being displayed.

NOTE: When Zone Damper Control is deactivated it releases control of each zone damper. The monitor thermostat is allowed to energize the fan relay, but must wait 5 minutes before selecting a system mode.

## BYPASS CONTROLLER STAND-ALONE OPERATION

When the bypass controller is operated in the Stand-Alone mode, communications with a monitor thermostat is not required. The bypass controller should be addressed outside the scanning range of the monitor thermostat. During Stand-Alone mode, the bypass controller operates in Bypass Damper Pressure mode. The following features are disabled in Stand-Alone operation: System Setup, Changeover Cycle, Indoor-Air Quality support, and Pressure Sensor Auto Zero.

## BYPASS CONTROLLER CONFIGURATION

Configuration can be done manually with the information buttons on the bypass controller, or by computer with the system network software. Refer to each specific section in this manual for detailed instructions on configuring the bypass controller options.

A special start-up category of options (category 8.0) has been designated as the start-up category. This category contains options that must be configured correctly before the bypass controller will operate correctly. After installation, configure the start-up (8.0) category first. The start-up category will automatically be displayed when entering programming mode after the bypass controller is powered up for the first time (or when the bus and element addresses are set to 0).

**Manual Configuration** — To manually configure the bypass controller, press both upper or both lower information buttons simultaneously. See Fig. 7 and 8. The configuration screen will display the word "category" and the current category number is displayed in the lower right corner (numbered from 1 to 14). Press the left upper or lower information buttons to access the different configuration categories. Press the select (right lower information) button to accept the current category for modification. The word "option" will be displayed and the current option number and configuration of the option are shown. The escape (right upper information) button can be used to return to the category screen. The categories will loop around when scrolling from 14 back to 1.

The left upper and lower information buttons are used to toggle through the options of each category. The option number is displayed in the lower right corner of the screen. See Table 1 for categories and options. When the desired option is shown on the screen, press the select button. The configurable data will flash. The left information buttons are used to toggle the data values. When the desired setting is shown press the select button to store the change. To exit without saving changes, press both upper or both lower information buttons or press the escape button. If the bypass controller is in programming mode for 3 minutes without any user input, the bypass controller reverts back to normal display operation.

Each option is discussed in detail in this manual. Refer to the appropriate section for more information.

**Computer Configuration** — To configure the bypass controller on the network, Carrier network software must be running.

## BYPASS CONTROLLER DISPLAY

This section describes those functions that relate to information displayed by the bypass controller. To configure the bypass controller the installer utilizes the information buttons.

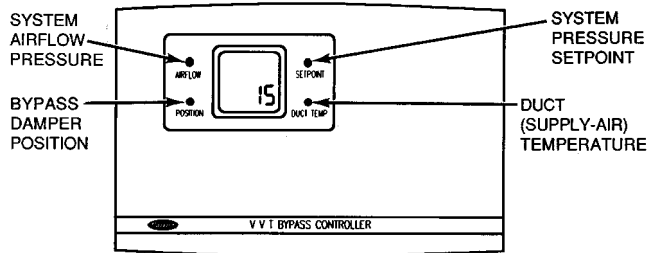


Fig. 7 — Bypass Controller

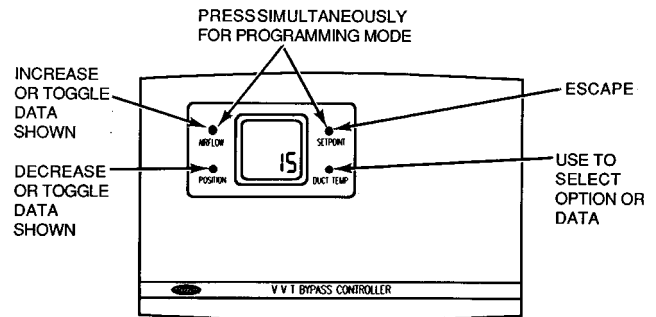


Fig. 8 — Bypass Controller Programming Buttons

Table 1 — VVT Bypass Controller Categories and Options

OPTION	DESCRIPTION	DEFAULT	MINIMUM	MAXIMUM
<b>CATEGORY 1.0 SET POINTS</b>				
1.1	Cool-Down Set Point (F)	80	72	87
1.2	Warm-Up Set Point (F)	60	55	70
1.3	Fahrenheit Temperature Display	ON	OFF	ON
<b>CATEGORY 2.0 OCCUPANCY SCHEDULE</b>				
No configuration required.				
<b>CATEGORY 3.0 DAMPER</b>				
3.1	Maximum Damper Position	15	8	15
3.2	Minimum Damper Position	0	0	7
3.3	Pressure Sensor Error Damper Position	5	2	13
3.4	System Pressure Set Point (in. wg)	1.0	0.0	5.0
3.5	Stand Alone Operation	OFF	OFF	ON
3.6	Changeover Cycle	ON	OFF	ON
3.7	ZD/RD Actuator	ON	OFF	ON
3.8	Counterclockwise Open	ON	OFF	ON
3.9	Fan On Delay (sec)	120	0	600
3.10	Fan Off Delay (sec)	120	0	600
<b>CATEGORY 4.0 HVAC EQUIPMENT</b>				
No configuration required.				
<b>CATEGORY 5.0 SENSORS</b>				
5.1	Room Sensor	1	1	3
5.2	Room Temperature Sensor Calibration (F)	Zone Temp.	—	—
5.3	Remote Room Sensor Calibration (F)	Room Temp.	—	—
5.4	Duct Temperature Sensor Calibration (F)	Duct Temp.	—	—
5.5	Pressure Sensor Range (F)	2.0	0.0	5.0
5.6	Auto-Zero Enable	OFF	OFF	ON
5.7	System Setup Enable	OFF	OFF	ON
5.8	Pressure Sensor Calibration (in. wg)	Duct Press.	—	—
5.9	Auto-Pressure Set Point	OFF	OFF	ON
<b>CATEGORY 6.0 SUPPLEMENTAL HEAT</b>				
No configuration required.				
<b>CATEGORY 7.0 DIAGNOSTICS/METERING</b>				
7.1	Error Code Display	OFF	OFF	ON
7.2	Alternate Information	OFF	OFF	ON
7.3	Unit Reset	OFF	OFF	ON
<b>CATEGORY 8.0 START-UP</b>				
8.1	Device Element Address	0	0	239
8.2	Security Level	1	1	4
8.3	Device Bus Number	0	0	239
<b>CATEGORY 9.0 BROADCAST / DAYLIGHT SAVINGS TIME</b>				
No configuration required.				
<b>CATEGORY 10.0 HOLIDAY SCHEDULES</b>				
No configuration required.				
<b>CATEGORY 11.0 ALARM</b>				
11.1	Equipment Priority	7	0	7
11.2	Communication Failure Retry Time (Minutes)	10	1	240
11.3	Re-Alarm Time (Minutes)	30	1	255
<b>CATEGORY 12.0 OPTIMAL START</b>				
No configuration required.				
<b>CATEGORY 13.0 LOADSHED</b>				
No configuration required.				
<b>CATEGORY 14.0 INDOOR-AIR QUALITY (IAQ)</b>				
14.1	Indoor-Air Quality Sensor	OFF	OFF	ON
14.2	Indoor-Air Quality Pressure Set Point (in. wg)	0.0	0.0	5.0
14.3	Indoor-Air Quality Delay (min)	0	0	240

**Information Display** – The information buttons allow the bypass controller to display:

- supply airflow pressure
- bypass damper position
- system pressure set point
- duct temperature

The bypass controller continuously displays the system information corresponding to the last information button that was pressed. After a bypass controller reset, the information display indicates the bypass damper position.

NOTE: If the information being shown has been forced by network software, an "F" will be shown on the display screen when the data is shown.

NOTE: If the bypass controller is participating in IAQ mode operation, "IA9" will be displayed on the screen.

**INFORMATION BUTTONS** — The bypass controller is equipped with 4 information buttons which are used to select the system information to be displayed and to configure the installer programmable functions of the bypass controller. See Fig. 7. The information buttons display supply airflow pressure, bypass damper position, system pressure set point, and duct temperature.

**TEMPERATURE SCALE DISPLAY** — Temperature sensor information is displayed by the bypass controller in increments of 0.1 degree Celsius or Fahrenheit when the DUCT TEMP information button is pressed.

**FAHRENHEIT TEMPERATURE DISPLAY** — The Fahrenheit Temperature Display Option determines whether temperatures are displayed in Celsius or Fahrenheit. The default is ON. The Fahrenheit Temperature Display Option can be configured at category 1, option 3.

If the Fahrenheit Temperature Display option is set to OFF, the bypass controller displays temperature information in the Celsius scale. If the Fahrenheit Temperature Display is set to ON, the bypass controller displays temperature information in the Fahrenheit scale.

**PRESSURE SENSOR DISPLAY** — The bypass controller will display pressure sensor information in increments of 0.01 in. wg.

**DAMPER POSITION DISPLAY** — To display damper position, the bypass controller divides the position of the bypass damper into 16 increments. Full-open is designated as position 15. Full-closed is designated as position 00.

**Bypass Controller Initialization Display** — The bypass controller activates the bypass controller initialization display when it initially receives power and after reset is initiated.

The bypass controller will display the rotating lines while it establishes the bypass damper actuator home position. The bypass controller will then begin system operation and will display the bypass damper position.

**Alternate Information Display** — Allows the bypass controller to display additional information. Simultaneously press both right or left information buttons, and the bypass controller will display a sequence of information. The information displayed is determined by the configuration setting of Alternate Information. The display can be frozen by pushing any information button during the display sequence.

→ The Alternate Information option can be set to ON or OFF. To configure, set category to 7 and option to 2. Use the left information buttons to toggle the option ON or OFF. The default is OFF.

When Alternate Information is ON and the Information Display mode is activated, the bypass controller will display the following information (if available) in this order:

- (1) zone temperature
- (2) time of day
- (3) security level
- (4) IAQ switch status (digital input)

The information is shown on the top half of the display screen. The number of the sequence (1 to 4) is shown in the bottom right corner to help distinguish which piece of information is being displayed. The numbering is not shown when the Alternate Information option is turned OFF. To speed up the display sequence, press an information button to toggle through the sequence quickly.

When Alternate Information is OFF and the Information Display mode is activated, the bypass controller will display the following information (if available) in this order:

- zone temperature
- time of day
- security level

**Display Freeze** — The Display Freeze function is enabled when the Alternate Information option is ON. After Information Display is activated, press any information button to continuously display the data shown when the information button was pressed. Press a information button to resume the Information Display sequence.

NOTE: Normal operation of the bypass controller is not affected by the Display Freeze or Information Display operations.

## COMMUNICATION

This section describes those functions of the bypass controller that relate to communication and start up. The bypass controller is part of a VVT system which is part of a communication network. This allows devices on the network to communicate with each other. Communication is utilized by the bypass controller to receive additional information necessary to control the bypass damper and to distribute information to the associated system controller (monitor thermostat). These options are located in the Start-Up (8.0) category.

NOTE: The Start-Up category will automatically be displayed upon entering programming mode after initial power up of the bypass controller or if it does not have an address.

**Communication Interface** — For communication the bypass controller is interfaced to the network. The bypass controller is interfaced to the network through the wiring connector board. For the bypass controller to communicate on the network, it must have an address consisting of two components, the device (or element) address and the bus number or address. Any device which does not have an address will not operate.

**Device Address** — Communication with the bypass controller is accomplished via the network. The Device Address option allows the bypass controller to establish an identity on the Carrier network for transmitting and receiving information. The device address is set in category 8, option 1. The factory setting is 0. Use the left information buttons to raise and lower the device address until the correct address is shown on the bypass controller. The thermostat will not run without a device address. The address must be unique to this device on its bus.

**Device Bus Number** — There can be different communication buses connected in a single system. There is one primary bus and there can be 239 secondary buses attached to the primary bus. The primary bus address is always 0. Each secondary bus has a device address. When the bypass controller resides on a secondary bus, the bus address must be entered into the Device Bus Number configuration. The default is 0. Acceptable values range from 0 to 239. The Device Bus Number is set in category 8, option 3.

The primary network device bus number is always 0. Secondary network buses can be added by using a network bridge module. This secondary bus has a bus number equal to the device address of the bridge module. Any devices (monitor, zone controller, bypass controller) on this secondary bus must have their device bus number set equal to the device address of the bridge module.

**Device Access Security Level** — The device access security level is used to limit access to the bypass controller functions by unauthorized personnel. The access security level is configured in category 8, option 2. The factory setting is 1. The range of acceptable access security levels is 1 to 4.

Access security level 1 allows full programming of the bypass controller. Security levels 2, 3, and 4 allow no programming.

### **▲ CAUTION**

Do not leave access security level option at 1 after configuration is complete. Untrained or unauthorized users may change set points or other important information.

If the access security level is changed to 2, 3, or 4, the access security level cannot be changed back in the normal method because programming is not allowed. To reconfigure the access security level of the bypass controller, activate the information display (simultaneously press both left or right information buttons). When the information display shows the security level (display number 3), press any button to freeze the display. Then press both upper or both lower information buttons to enter the programming mode. Reconfigure category 8, option 2 to the desired access security level.

## **SENSORS**

This section describes those functions that relate to the different sensors that can be interfaced to the bypass controller. The bypass controller utilizes information from the following sensors to operate the bypass damper and control system static pressure: zone temperature sensor, IAQ sensor, duct temperature sensor, and system pressure sensor.

When necessary, sensor calibration can be performed at the bypass controller.

**Bypass Damper Duct Temperature Sensor** — The bypass controller measures duct temperature at the bypass damper through a solid state temperature sensor from 30 to 180 F (in 0.1° F increments) and up to 500 ft from the bypass controller. The bypass damper duct temperature sensor is connected to the printed circuit board in the bypass damper actuator. No wiring is required. See Fig. 9.

**DUCT TEMPERATURE SENSOR CALIBRATION** — The Duct Temperature Sensor Calibration function allows the user to calibrate the sensor. The factory setting is computer calibrated. The range of values is 30 to 180 F in 0.1° F increments.

To access the Duct Temperature Sensor Calibration function, set category 5, option 4. The current duct temperature is displayed. Use the left upper and lower information buttons to raise or lower the calibration value to the desired setting.

**Pressure Sensor** — The bypass controller measures pressure in its system through a pressure sensor.

**PRESSURE SENSOR RE-ZERO** — To assure that the bypass controller is able to maintain proper static pressure levels during normal operation, the bypass controller will automatically re-zero when the Auto-Zero Enable option is selected.

To auto-zero the pressure sensor, select category 5, option 6 (Auto-Zero Enable). Set the option to ON. The bypass controller will turn off the system fan and allow time for the pressure to settle. If a Fan-Off Delay has been programmed into the bypass controller, this time period must expire before the sensor can be zeroed. Once this time period expires, the bypass controller will automatically zero the pressure sensor and reset the option to OFF.

**PRESSURE SENSOR CALIBRATION** — To calibrate the pressure sensor manually, select category 5, option 8. The current pressure reading will be displayed on the bypass controller screen. Compare the pressure reading to the pressure measured by a Magnehelic gage or manometer. Use the left information buttons to adjust the value until the desired pressure is shown.

**Zone Temperature Monitoring** — The bypass controller can use sensors to monitor the temperature in the zone.

The zone controller can do one of the following:

- use the local zone temperature sensor for temperature information
- use its remote room sensor(s) (field installed) for temperature information
- average the temperatures it receives from its local room temperature and remote room sensors for temperature information.

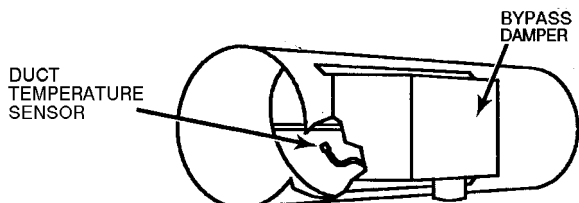
To configure the room sensor, set category 5, option 1. When the Room Sensor option is set to 1, the bypass controller will use the local zone temperature sensor for temperature information. When the Room Sensor option is set to 2, the bypass controller uses its remote room sensor(s) (field installed) for temperature information. When the Room Sensor option is set to 3, the bypass controller averages the temperatures it receives from its local room temperature and remote room sensors for temperature information.

**Zone Temperature Sensor** — The bypass controller can measure zone temperature through a solid-state temperature sensor which is field-installed in the zone where the bypass controller is located. See Fig. 10. The sensor has a range of 30 to 180 F with 1/10 degree resolution.

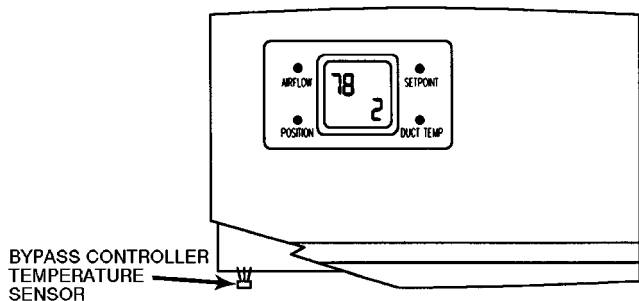
**ZONE TEMPERATURE SENSOR CALIBRATION** — To calibrate the zone temperature sensor, configure category 5, option 2. The temperature reading of the sensor will be displayed. Compare the reading to an accurate thermometer. Use the left upper or lower information buttons to raise or lower the temperature reading (by tenths of a degree) until the desired calibrated temperature is shown. The range of possible temperatures is 30 to 180 F.

**Remote Room Temperature Sensor** — The bypass controller can measure zone temperature through a solid-state temperature sensor located at a remote location up to 1000 ft from the bypass controller. The sensor has a range of 30 to 180 F in 1/10 degree increments. The remote room temperature sensor is connected to the bypass controller through the wiring connector board. See Fig. 11. Up to 4 remote room sensors can be used. When more than one remote room sensor is used, the temperatures are averaged.

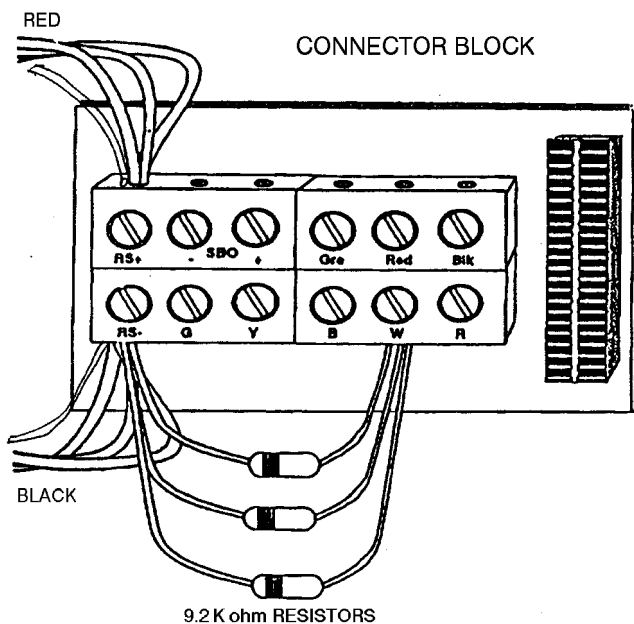
All sensors must be wired in parallel. When adding remote room sensors, a field-supplied 9.2 K ohm resistor must be added to the connector block for each sensor. See Fig. 11.



**Fig. 9 — Duct Temperature Sensor**



**Fig. 10 — Zone Temperature Sensor**



**NOTE:** For each additional sensor (2 or more total) a resistor must be added. Resistors are wired in parallel between terminals RS- and W on the thermostat terminal block.

Example shown is for 4 Remote Room Sensors.

**Fig. 11 — Remote Room Sensor Wiring**

**REMOTE ROOM TEMPERATURE SENSOR CALIBRATION** — To calibrate the remote room temperature sensor, configure category 5, option 3. The temperature reading of the sensor will be displayed. Compare the reading to an accurate thermometer placed in the approximate center of the space (or measure temperature at each sensor and manually compute the average). Use the left upper or lower information buttons to raise or lower the temperature reading (by tenths of a degree) until the desired calibrated temperature is shown. The range of possible temperatures is 30 to 180 F.

**Indoor-Air Quality Sensor** — The Comfort IAQ feature allows the Carrier Comfort system to interface with the economizer (if available) on the HVAC equipment and maintain the quality of indoor air within acceptable limits. An IAQ sensor (CO<sub>2</sub>) is used to monitor the IAQ levels in a zone or in the return air duct. On bypass controllers, the bypass controller is configured to either participate in the IAQ system, or to ignore IAQ commands. The bypass controller will not participate in IAQ mode when a local IAQ mode occurs on a zone controller.

When the CO<sub>2</sub> level exceeds the preset level (factory configuration is 1000 ppm and special software is required to modify this value), the sensor signals the indoor fan motor to run for 5 to 30 minutes (field-configured). The indoor fan circulates the air throughout the occupied space. At the end of the 5 to 30 minutes, if the CO<sub>2</sub> level still exceeds the set point, the system will enter IAQ mode.

When the system is bringing in additional outside air (in IAQ mode), the bypass controller will modulate its damper to keep system static pressure at the IAQ Pressure Set Point to allow the outside air to circulate. A set of contacts are also available on the relay pack which can be used to start a local exhaust fan when the system is bringing in additional outside air. The bypass controller will display status when the system is in this mode. When the IAQ level drops below the IAQ set point, the bypass damper returns to its standard operating mode. Sensor contacts open for 4½ minutes to end IAQ mode.

To configure the IAQ sensor option, set category 14, option 1. When the option is configured ON, the bypass controller will modulate during IAQ fan operation. When the option is configured OFF, the IAQ commands are not used. The default is OFF.

**IAQ PRESSURE SET POINT** — When the IAQ mode brings in fresh outdoor air, the system static pressure will rise or drop depending on the amount of air needed and the number of zones participating in the IAQ mode. The IAQ Pressure Set Point option will keep the system static pressure at the defined value to allow the necessary airflow through the system. The option is configured in category 14, option 2. The set point can be configured from 0.0 to 5.0 in. wg. The default value is 0.0 in. wg.

**IAQ ALARM DELAY** — The IAQ Alarm Delay option controls how long the bypass controller will wait before issuing an IAQ alarm. To configure the IAQ Alarm Delay option, set category 14, option 3. The number of minutes will be shown. The range of acceptable values is 0 to 240 minutes in 1 minute increments. Use the left set point buttons to set the time limit to the desired value. The default value is 0 minutes.

## BYPASS DAMPER MODULATION

This section describes the functions of the bypass controller that relate to control of the bypass damper and the operation of the bypass damper as a member of a Carrier system.

By modulating the bypass damper, the bypass controller provides sufficient airflow through the heating/cooling equipment and maintains proper static pressure levels in the duct system.

The bypass controller is capable of controlling dampers equipped with model ZD(ENC), RD(ENC), MA-08, and HTA actuators.

The bypass controller modulates the bypass damper depending on the bypass damper mode it has selected. The two bypass damper operating modes are bypass damper pressure mode and bypass damper open mode.

Based on the system mode selected, the bypass controller uses the bypass damper modulation function to determine proper damper position. When a bypass damper has been slightly oversized, the Damper Maximum Open Position function allows the capacity of a bypass damper to be reduced.

As part of a VVT system, the changeover cycle of the bypass controller minimizes zone usage of supply air when air temperatures are counterproductive to zone comfort needs.

The Zone Damper Control function allows the damper position at each zone damper associated with the bypass controller to be held constant for system balancing of supply airflow and to establish the correct system pressure set point.

**Damper Interface** — The bypass controller is interfaced to the bypass damper actuator through its wiring connector board. The bypass controller can be used to control up to 4 bypass dampers, including one master damper and 3 slave dampers.

**NOTE:** The bypass controller receives information from and directly controls only the master damper. Each slave damper receives and follows the damper position commands sent to the master damper, but does not send information to the bypass controller.

**Bypass Damper Mode** — The bypass controller modulates the bypass damper based on the bypass damper mode it has selected. The two bypass damper operating modes are bypass damper pressure mode and bypass damper open mode.

If the bypass controller is a member of a zoning system, it has an associated system controller (monitor thermostat) that determines the operation of the system heating/cooling equipment based on zone demand. The associated system controller of the bypass controller also determines the operating status of the supply air fan. When the equipment heating stages are needed, the system mode is heating. When the equipment cooling stages are needed, the system mode is cooling.

**BYPASS DAMPER PRESSURE MODE SELECTION** — The bypass controller selects the bypass damper pressure mode during system heating mode, system cooling mode, or when the supply-air fan is energized.

**BYPASS DAMPER OPEN MODE SELECTION** — The bypass controller selects the bypass damper open mode when a system mode has not been chosen and the supply air fan is deenergized, and during changeover.

**Bypass Damper Modulation** — The bypass controller continuously monitors system static pressure through the pressure sensor.

**DAMPER MODULATION DURING THE BYPASS DAMPER PRESSURE MODE** — The bypass controller determines the bypass damper modulation by comparing system static pressure to the system pressure set point.

If the system pressure is greater than the system pressure set point, the bypass damper is modulated open until the damper maximum open position is reached or pressure drops to within 3% of the system pressure set point.

If system static pressure is within 3% of the system pressure set points, the bypass damper position does not change.

If the system pressure is less than the system pressure set point, the bypass damper is modulated closed until the damper minimum open position is reached or pressure rises to within 3% of the system pressure set point.

When the Change-Over Cycle option is enabled, the bypass controller will select a damper mode based on duct air temperature when entering a system heating or cooling mode.

If the Stand-Alone Operation option is set to ON, the bypass controller will operate the bypass damper continuously in system pressure mode.

**DAMPER MODULATION DURING THE BYPASS DAMPER OPEN MODE** — The bypass controller modulates the bypass damper open until the damper maximum open position is reached.

**SYSTEM PRESSURE SET POINT** — The System Pressure Set Point function establishes the supply air static pressure which is to be maintained by the bypass controller. The factory setting is 1.0 in. wg. The range of available values is 0.0 to 5.0 in. wg in 0.1 in. wg increments.

To configure the System Pressure Set Point, set category 3, option 4. Use the left upper and lower information buttons to raise or lower the set point.

**DAMPER MAXIMUM OPEN POSITION** — The Damper Maximum Open Position function specifies the maximum open position for the bypass damper(s). The factory setting is 15. The range of values is 15 (full open) to 08 (50% open).

To configure the Damper Maximum Open Position function, set category 3, option 1. Use the left information buttons to raise or lower the position setting.

**DAMPER MINIMUM OPEN POSITION** — The Damper Minimum Open Position function specifies the minimum open position for the bypass damper(s). The factory setting is 00. The range of values is 00 (full closed) to 07 (50% open).

To configure the Damper Minimum Open Position function, set category 3, option 2. Use the left information buttons to raise or lower the position setting.

**Changeover Cycle** — The Changeover Cycle function is used to regulate the supply-air temperature delivered to zones when the system changes from one mode to another (i.e., heating to cooling). During a changeover, the bypass controller and the monitor thermostat work together to moderate the temperature of the supply air from the system heating/cooling equipment before it is delivered to the zones. To determine when the changeover cycle is complete, the bypass controller compares the supply air temperature to the changeover set points. The factory setting is ON.

If the Changeover Cycle function is set to ON, the bypass controller utilizes the Changeover Cycle function system operation.

**NOTE:** If the Stand-Alone Operation function is ON, the Changeover Cycle function is disabled.

If the Changeover Cycle function is set to OFF, the Changeover Cycle is not used during system operation.

To configure the Changeover Cycle option, set category 3, option 6. Use the left information buttons to toggle the display to ON or OFF. The default is ON.

**SYSTEM MODE SELECTION** — System mode is selected by the associated system controller (monitor thermostat) of the bypass controller, to control operation of the system heating/cooling equipment. System Heating Mode is selected when the equipment heating stages are needed. System Cooling Mode is selected when the equipment cooling stages are needed.

When the system mode is selected the associated system controller energizes the corresponding equipment stages and the bypass controller operates in the bypass damper open mode.

**NOTE:** Until the changeover cycle is completed, all zone dampers modulate based on supply-air temperature.

To determine when the changeover cycle is completed, the bypass controller compares the bypass damper supply-air temperature to the changeover set points.

During a system cooling mode, the changeover cycle is completed when the bypass damper supply-air temperature is below the changeover cool-down set point.

During a system heating mode, the changeover cycle is completed when the bypass damper supply-air temperature is above the changeover warm-up set point.

When the changeover cycle is completed, all zone dampers modulate based on the system mode selected and the bypass controller operates in the bypass damper pressure mode.

**CHANGEOVER COOL-DOWN SET POINT** — The Cool-Down Set Point function establishes the maximum acceptable duct temperature that can be sent to the zones during the changeover cycle when the system is in cooling mode. The factory setting is 80. The range of acceptable values is 72 to 87.

The Changeover Cool-Down Set Point is the supply-air temperature that ends the changeover cycle when the system cooling mode is selected. The bypass damper then assumes pressure mode operation.

To configure the Cool-Down Set Point, set category 1, option 1. Use the left information buttons to configure the Cool-Down Set Point.

**CHANGEOVER WARM-UP SET POINT** — The Warm-Up Set Point function establishes the minimum acceptable duct temperature limit that can be sent to the zones during the changeover cycle when the system is in heating mode. The factory setting is 60. The range of acceptable values is 55 to 70.

The Changeover Warm-Up Set Point is the supply-air temperature that ends the changeover cycle when the system heating mode is selected.

To configure the Warm-Up Set Point, set category 1, option 2. Use the left information buttons to configure the Warm-Up Set Point.

**Counterclockwise Open Damper Modulation** — The Counterclockwise Open Damper Modulation function configures the direction that the bypass controller modulates the bypass damper.

If the Counterclockwise Open Damper Modulation function is set to ON, the bypass controller modulates the damper counterclockwise to the open position. The factory setting is ON.

If the Counterclockwise Open Damper Modulation function is set to OFF, the bypass controller modulates the damper clockwise to the open position.

**NOTE:** The Model ZD (zone circular damper) and Model RD (rectangular damper) actuators require counterclockwise rotation to modulate their dampers to the open position.

To configure the Clockwise Open Damper Modulation option, set category 3, option 8. Use the left information buttons to set the option ON or OFF.

**ZD/RD Actuator** — The ZD/RD Actuator option configures the bypass controller to work with a ZD/RD actuator or a high torque actuator. When the option is set to ON, the bypass controller will operate the bypass damper with a ZD/RD actuator. When the option is set to OFF, the bypass controller will operate the bypass damper with a high torque actuator. The default is ON. A high torque actuator will handle higher static pressures and comes in two types, an HTA-02 (60 degree actuator) and an HTA-03 (90 degree actuator).

To configure the ZD/RD Actuator option, set category 3, option 7. Use left information buttons to toggle the option ON or OFF.

**PS (Pressure Sensor) Error Damper Position** — The PS Error Damper Position function establishes the position to which the bypass controller will modulate its damper(s) during an error condition associated with the pressure sensor. During the pressure sensor error condition, the bypass controller will hold the damper position to maintain system static pressure. The factory setting is 5. The range of acceptable values is 2 to 13.

To configure the PS Error Damper Position function, set category 3, option 3. Use the left upper and lower information buttons to set the position value.

**Fan On Delay** — The Fan On Delay option is used by the bypass controller to enhance the operation of the system when the HVAC equipment controls the indoor fan during system heating modes. The Fan On Delay option defines how long the HVAC equipment will delay energizing the indoor fan after the first stage of heating is energized. The default is 120 seconds. The range is 0 to 600 seconds.

To configure the Fan On Delay option, set category 3, option 9. Use the left information buttons to increase or decrease the value.

**Fan Off Delay** — The Fan Off Delay option is used by the bypass controller to enhance the operation of the system when the HVAC equipment controls the indoor fan during system heating modes. The Fan Off Delay option defines how long the HVAC equipment will energize the indoor fan after the first stage of heating is deenergized. The default is 120 seconds. The range is 0 to 600 seconds.

To configure the Fan Off Delay option, set category 3, option 10. Use the left information buttons to increase or decrease the value.

**NOTE:** The Fan Off Delay function is also used by the Auto-Zero function.

## DIAGNOSTICS

The bypass controller has diagnostic capabilities for components, information, zone comfort, and usage.

Diagnostic problems, called errors, are divided into 3 categories: Hardware Failure (HF) errors, Storage Failure (SF) errors, and System Errors (SE).

**Error Code Display** — An error code representing the SF, SE, and HF diagnostic functions can be displayed to indicate which error has been declared. The 2 letters located in the left of the display represent the type of error. The numbers located in the right of the display identify the specific error.

When the Error Code Display option is ON, an error code will be displayed when the associated error occurs. Any previous error codes that occurred when the Error Code Display was configured OFF will also be displayed.

NOTE: When an error is cleared, any errors remaining in the bypass controller will be displayed sequentially until all errors are cleared.

When the Error Code Display option is set to OFF, no error codes will be displayed by the bypass controller. Having the Error Code Display turned OFF will not stop the errors (alarms) from being communicated on the network. See the Alarm Options section on page 18 for more information pertaining to network alarms.

→ To configure the Error Code Display option, set category 7, option 1. Use the left set point buttons to toggle the setting to ON or OFF. The default is OFF.

**System Errors (SE)** — System Errors occur when the zone controller detects a zone operating problem or system operating problem. See Table 2 for System Errors.

**Table 2 — System Errors**

ERROR CODE	SYSTEM ERROR DESCRIPTION	ALARM PRIORITY LEVEL
SE10	IAQ Exceeded Limit	2

**IAQ EXCEEDED LIMIT ERROR** — The bypass controller can interface to an indoor air quality switch. If the CO<sub>2</sub> level exceeds the configurable set point for the configured amount of time, the bypass controller will issue an SE10. An IAQ input is considered active only after the contact has been closed for 2 minutes. Once an IAQ sensor goes active, it is only considered inactive after the contact has remained open for 4 minutes and 15 seconds to ensure air quality.

**Storage Failure (SF) Errors** — A Storage Failure error is an indication that the bypass controller has invalid information in its memory.

When an SF Error occurs, the bypass controller replaces the invalid data in memory with factory selected default values and the invalid information is not used by the associated system control.

To clear an SF Error, enter correct data at the bypass controller. See Table 3 for a description of Storage Failure Errors.

→ **Table 3 — Storage Failure (SF) Errors**

ERROR	INFORMATION AFFECTED	DEFAULT VALUE(S)
SF08	Fahrenheit Temperature Display	ON
SF19	Maximum Damper Position	15
SF20	Minimum Damper Position	0
SF23	ZD/RD Actuator	ON
SF24	Counterclockwise Open	ON
SF46	Zone Temperature Sensor Calibration	Factory Calibrated
SF47	Remote Room Sensor Calibration	Factory Calibrated
SF48	Duct Temperature Sensor Calibration	Factory Calibrated
SF49	Pressure Sensor Calibration	Field Calibrated
SF51	Room Sensor	1
SF61	Alarm System Name	Network Configured
SF65	Error Code Display	OFF
SF67	Alternate Information	OFF
SF75	Device Element Address	0
SF76	Security Level	1
SF77	Device Bus Number	0
SF86	Equipment Priority	7
SF87	Communication Failure Retry Time	10
SF88	Re-Alarm Time	30
SF93	Local IAQ Sensor	OFF
SF98	Alarm Routing Control	Network Configured
SF99	Pressure Sensor Offset	0
SF105	Warm Up Set Point	60
SF106	Cool Down Set Point	80
SF109	System Pressure Set Point	1.0
SF110	Pressure Sensor Range	2.0
SF111	IAQ Pressure Set Point	0.0
SF112	PS Error Damper Position	5
SF113	Fan On Delay	120
SF114	Fan Off Delay	120
SF117	Changeover Cycle	ON
SF118	Stand Alone Operation	OFF

**EXAMPLE OF CLEARING AN SF ERROR** — The zone controller displays a SF20 error. Look up SF20 in Table 3. The affected configuration is Minimum Damper Position. The default value is 5. The desired setting is 3.

To clear the SF20 error manually, reconfigure the Minimum Damper Position option to 3. The SF20 error should be cleared.

**NOTE:** If the SF error cannot be cleared, replace the bypass controller and configure the new bypass controller to match desired settings.

**Hardware Failure (HF) Errors** — A Hardware Failure (HF) error is an error that corresponds to a hardware failure at the bypass controller, associated sensors, or zone damper.

To clear a HF Error, the component responsible for initiating the HF Error must be adjusted, repaired, or replaced. See Table 4 for a description of HF errors.

**Table 4 – Hardware Failure Errors**

ERROR	ERROR DESCRIPTION	ALARM PRIORITY
HF01	Cannot Detect Closed Damper	2
HF02	Cannot Detect Open Damper	2
HF03	Zone Temperature Sensor Out of Range	2
HF04	Remote Room Sensor Out of Range	2
HF05	Duct Temperature Sensor Out of Range	2
HF06	Hardware NOVRAM Failure	2
HF07	Hardware Analog/Digital Failure	2
HF08	Pressure Sensor Out of Range	2

**CANNOT DETECT CLOSED DAMPER** — An HF01 error is issued when the bypass controller attempts to close the damper, but the position sensor indicates the damper is not at the fully closed position.

To clear the error, correct the damper problem and use the Unit Reset function. The Unit Reset function is in category 7, option 3. The default is OFF. Use the left set point buttons to set the option to ON. The bypass controller will reset all errors.

To correct the damper problem:

1. Check the damper for mechanical binding. An obstruction in the damper or a bent damper blade can prohibit the damper from modulating closed. Remove the source of binding.
2. Check the actuator-to-damper alignment. If the damper shaft is out of alignment with the actuator crank arm position, the damper may reach the fully closed position before the actuator.

Align the damper and the actuator so both fully closed positions coincide. Prior to alignment, the Minimum Damper Position (category 3, option 2) setting should be configured to zero. This will ensure the actuator will be in the fully closed position when the zone controller demand is zero.

3. Check the damper actuator position to see if the traveler arm has moved past the position sensor. If the traveler arm is stuck at fully open or fully closed position, use the following steps to correct the problem:
  - a. Disconnect the bypass controller ribbon cable from the wiring connector board.
  - b. At the damper, using a flat head screw driver, turn the traveler screw (located on the stepper motor) until the traveler arm is midway between the fully closed and fully open positions.
  - c. Reconnect the bypass controller.

4. Check for excessive inlet static pressure beyond the rated ability of the damper actuator.
  - ZD and RD zone dampers are rated for 18 in.-lb.
  - The MA-08 actuator is rated for 18 in.-lb.
  - The HTA-02 actuator is rated for 80 in.-lb.
  - The HTA-03 actuator is rated for 45 in.-lb.

5. Check the configuration of the zone controller Counterclockwise Open option (category 3, option 8). For Carrier ZD and RD dampers the damper blade modulates counterclockwise to open. Ensure this option is configured correctly.

6. Check the wiring between the damper actuator and bypass controller. If the green wire between the damper actuator and the bypass controller has lost continuity, the bypass controller will constantly receive the indication that the damper is fully closed.

To check the wiring, disconnect the bypass controller and wiring connector board. Connect the bypass controller and wiring connector board directly at the damper board. If the error disappears, the field wiring or the connections should be checked. Check the continuity of the green wire.

If the error is still present, the bypass controller circuit board, the wiring connector board, or the damper actuator circuit board is bad. To isolate the defective component, replace components, one at a time, until the error disappears.

**CANNOT DETECT OPEN DAMPER** — An HF02 error is issued when the bypass controller attempts to open the damper, but the position sensor indicates the damper is at the fully closed position.

To clear the error, correct the damper problem and use the Unit Reset function. The Unit Reset function is in category 7, option 3. The default is OFF. Use the left set point buttons to set the option to ON. The bypass controller will reset all errors.

To correct the damper problem:

1. Check the damper for mechanical binding. An obstruction in the damper or a bent damper blade can prohibit the damper from modulating open. Remove the source of binding.
2. Check the damper actuator position to see if the traveler arm has moved past the position sensor. If the traveler arm is stuck at fully open or fully closed position, use the following steps to correct the problem:
  - a. Disconnect the bypass controller ribbon strip from the wiring connector board.
  - b. At the damper, using a flat head screw driver, turn the traveler screw (located on the stepper motor) until the traveler arm is midway between the fully closed and fully open positions.
  - c. Reconnect the bypass controller.
3. Check for excessive inlet static pressure beyond the rated ability of the damper actuator.
  - ZD and RD zone dampers are rated for 18 in.-lb.
  - The MA-08 actuator is rated for 18 in.-lb.
  - The HTA-02 actuator is rated for 80 in.-lb.
  - The HTA-03 actuator is rated for 45 in.-lb.
4. Check the wiring between the damper actuator and bypass controller. If the green wire between the damper actuator and the bypass controller has lost continuity, the bypass controller will constantly receive the indication that the damper is fully closed.

To check the wiring, disconnect the bypass controller and wiring connector board. Connect the bypass controller and wiring connector board directly at the damper board. If the error disappears, the field wiring or the connections should be checked.

If the error is still present, the bypass controller circuit board, the wiring connector board, or the damper actuator circuit board is bad. To isolate the defective component, replace components, one at a time, until the error disappears.

**ZONE TEMPERATURE SENSOR OUT OF RANGE** — An HF03 error is issued when the zone temperature sensor is open or shorted. The HF03 error will automatically clear when the sensor reading is back within the allowable range. The zone temperature sensor can be recalibrated.

To check the zone temperature sensor:

1. Ensure the Room Sensor option (category 5, option 1) has been configured correctly. Check for other wiring running parallel to and less than 12 in. from the remote room sensor wiring. Avoid running AC, control, or communication bus wiring near the remote room sensor wiring. Maintain a minimum separation of 12 in. or more between other wiring and remote room sensor wiring. Make sure that the legs zone temperature sensor are not shorted out.
2. Check the zone temperature sensor calibration. Calibrate the sensor by manual calibration at the bypass controller using the Zone Temperature Sensor Calibration function (category 5, option 2) and an accurate thermometer. Measure the temperature at the bypass controller zone temperature sensor location using the accurate thermometer. Wait for the reading to stabilize. Using the set point buttons, increase or decrease the temperature display to match the reading of the thermometer.

**REMOTE ROOM SENSOR OUT OF RANGE** — An HF04 error is issued when the remote room temperature sensor is open or shorted. The HF04 error will automatically clear when the sensor reading is back within the allowable range. The remote room temperature sensor can be recalibrated.

To check the remote room sensor:

1. If using a remote room temperature sensor, check for proper wiring connections (red to +, black to -). Check if the remote room sensor wiring and connections to the circuit board are physically intact. Maintain a minimum separation of 12 in. or more between other wiring and remote room sensor wiring.
2. Check the remote room sensor calibration. Calibrate the sensor by manual calibration at the bypass controller using the Remote Room Sensor Calibration function (category 5, option 3) and an accurate thermometer. Measure the temperature at the remote room temperature sensor location using the accurate thermometer. Wait for the reading to stabilize. Using the set point buttons, increase or decrease the temperature display to match the reading of the thermometer.
3. Check the configuration of the remote room sensor.

**DUCT TEMPERATURE SENSOR OUT OF RANGE** — An HF05 error is issued when the duct temperature sensor is open or shorted. The HF05 error will automatically clear when the sensor reading is back within the allowable range. The duct temperature sensor can be recalibrated.

To check the duct temperature sensor:

1. Check that the duct temperature sensor wiring and connections to the damper actuator circuit board are physically intact. Ensure the 5-conductor control wiring running between the damper actuator and the zone controller is not run near AC, control, or communication bus wiring. Maintain a minimum separation of 12 in. or more between other wiring and remote room sensor wiring.
2. Check the duct temperature sensor calibration. Calibrate the sensor by manual calibration at the bypass controller using the Duct Temperature Sensor Calibration function (category 5, option 4) and an accurate thermometer. Measure the temperature at the duct temperature sensor location using the accurate thermometer. Wait for the reading to stabilize. Using the set point buttons, increase or decrease the temperature display to match the reading of the thermometer.

**HARDWARE NOVDRAM FAILURE** — An HF06 error is issued when the bypass controller detects a problem in its non-volatile memory. If the bypass controller is able to correct the problem, the error will clear in approximately 10 minutes. If the condition persists, the bypass controller must be replaced.

**HARDWARE A/D FAILURE** — An HF07 error is issued when the bypass controller detects a problem with its analog/digital converter circuitry. If the bypass controller is able to correct the problem, the error will clear in approximately 10 minutes. If the condition persists, the bypass controller must be replaced.

**PRESSURE SENSOR OUT OF RANGE** — An HF08 error is issued when the pressure sensor is open or shorted. The pressure sensor can be recalibrated. The HF08 error will automatically clear when the sensor reading is back within the allowable range.

To clear the HF08 error:

1. Check for excessive static pressure or excessive differential pressure at the PS sensor pressure pickup. The 33CSPS-01 is rated for a maximum of 0.5 in. wg. The 33CSPS-02 is rated for a maximum of 2.0 in. wg. When the pressure sensor is operating at or above the rated pressure, the sensor readings will be unstable, causing an HF08 error.
2. Check the connection of hoses running from the PSP pressure pickup and the PS pressure sensor. Incorrect or faulty connections with the PSP pressure pickup can result in an HF08 error.
3. Check to ensure the PS pressure sensor wiring connection to the damper actuator is complete and well connected. Ensure the connections labeled "O" on the PS pressure sensor wiring harness are not used or shorted to ground. For the bypass controller, the two wires marked "O" on the PS pressure sensor wiring harness are not used and can be clipped to prevent possible connection to ground.

4. Check the wiring from the PS pressure sensor to the damper actuator printed circuit board. If improperly wired the bypass controller will be unable to communicate with the PS pressure sensor. This will result in an HF08 error. To check the wiring:
  - a. Remove the PS pressure sensor from location and wire it directly to the factory supplied 6-wire harness. The harness should be connected to the damper actuator printed circuit board.
  - b. If the HF08 error disappears, then the field-wiring or connections should be checked.
  - c. If the HF08 error still appears, the damper circuit board or the PS pressure sensor may have failed.
  - d. To determine the defective component, replace the components one at a time until the problem is isolated.

**Bypass Controller Reset** — The bypass controller constantly verifies operation and the information it utilizes. When it finds a fault in a specified area, the bypass controller resets using the bypass controller initialization display.

The bypass controller will reset when it finds fault in the following areas:

- The ability of the microprocessor to properly operate the programs used by the bypass controller is verified to prevent improper response to zone and system conditions.
- The level of power used by the bypass damper (24 vac) and by the bypass controller (10 vdc) is checked to prevent improper operation by micro-electronic components during low power conditions.
- The ability of the bypass controller to communicate with the bypass damper to prevent incorrect operation of the bypass damper.

The bypass controller also monitors the following:

- Each piece of information received by the bypass controller is verified to eliminate the use of incorrect data.
- Each portion of information stored by the bypass controller is verified to eliminate the use of incorrect data.

When possible, system communication and data storage faults are corrected by the bypass controller. When corrections cannot be made the information is regarded as invalid and not utilized.

## ALARM OPTIONS

The alarms options of the bypass controller are responsible for detecting alarms and transmitting them to the CCN (Carrier Comfort Network). A specified device (such as the Building Supervisor) on the CCN records the alarm messages from all other devices and uses this data to produce alarm messages. The bypass controller detects successful transmission of the alarm and will retry if there is a communication failure. If the alarm is successfully transmitted, the bypass controller will reset the alarm.

**Equipment Priority** — The Equipment Priority function tells the error recording device the priority of the device that is sending the alarm. The priority determines which alarms are shown first and which alarms are deleted when the alarm memory is full. To set the option, configure category 11, option 1. The range is 0 to 7, where 7 is the highest priority. The default value is 7 (bypass controller priority). It is recommended not to change this value.

**Communication Failure Retry Time** — The Communication Failure Retry Time option configures how long the bypass controller will wait before re-sending an alarm that was not received by a device configured as an acknowledge. The option is configured in category 11, option 2. The range of acceptable values is 1 to 240 minutes. The default is 10 minutes.

**Re-Alarm Time** — The Re-Alarm Time option configures how long the bypass controller will wait before re-sending an alarm after the alarm message has been received by a device and the alarm persists. When the condition returns to normal, the alarm will no longer be sent. The option is configured in category 11, option 3. The range of acceptable values is 1 to 255 minutes. The default is 30 minutes. A value of 255 disables this feature.

**Alarm Routing Control** — The Alarm Routing Control option determines which devices on the CCN will receive and process the alarm information. This option cannot be configured from the bypass controller. The default value is 11000000. This value sends/marks alarms for the CCN. A value of 10000000 sends alarms to the Building Supervisor. A value of 01000000 sends alarms to the Auto-Dial gateway. A value of 00010000 sends alarms to the printer interface. A value of 00000000 disables all alarms going out on the CCN. The option is configured through Carrier network access software.

**Alarm System Name** — The Alarm System Name option identifies the alarm system on the CCN. This option cannot be configured from the bypass controller. The default name is 33CSBC. The option is configured through Carrier network access software.

## ALARM DESCRIPTION

This section describes the major alarm types that are available within the system.

The section describes each alarm in detail: what controllers it works with; the sensors required for the alarm to be activated; and how the alarm is configured, disabled, and normalized. The description provides information on how the alarm is applied and the necessary hardware required for proper operation.

**Indoor-Air Quality Status Alarm** — Refer to Table 5 for IAQ alarm specifications.

**Table 5 — IAQ (Indoor-Air Quality) Status Alarm**

FUNCTION	DESCRIPTION
<b>Controllers</b>	Monitor Thermostat, Zone Controller, Bypass Controller
<b>Sensor Required</b>	IAQ (CO <sub>2</sub> ) Sensor
<b>Sensor Wiring</b>	Pins 6 and 7 of Relay Board or Wire to Damper Board
<b>Input</b>	Closed contact when level exceeded.
<b>Output</b>	SE10
<b>Category/Option</b>	14.1 System IAQ Sensor 14.2 IAQ Pressure Set Point 14.3 IAQ Alarm Delay
<b>Configuration Values</b>	14.1 — ON 14.2 — 0.0 in. wg 14.3 — 0 minutes
<b>Configuration Increments</b>	14.2 — 0.1 in. wg 14.3 — 1 minute
<b>Associated Functions</b>	None

### LEGEND

IAQ — Indoor Air Quality  
SE — System Error

**OPERATION** — When the CO<sub>2</sub> level exceeds the preset level, the sensor signals the bypass controller. The bypass controller will wait until the IAQ Alarm Delay option (category 14, option 3) has expired, then it will issue an SE10. The system (if configured) will bring in fresh outdoor air to meet IAQ requirements.

If the CO<sub>2</sub> level still exceeds the preset level (factory configuration is 1000 ppm and cannot be changed without optional software) after the IAQ Alarm Delay, the alarm is sent. The monitor thermostat energizes the indoor fan motor (if not already running) for 5 to 30 minutes (field-configured). If the Auxiliary Relay has been configured for IAQ operation, the bypass controller energizes the relay. This is intended for use with an economizer, but can be wired to an exhaust fan or HRV. If used with an economizer, the economizer moves to the minimum position and the indoor fan circulates the air throughout the occupied space.

The monitor thermostat that controls the bypass controller has 3 lockout features which will prevent IAQ mode if the outdoor humidity is too high or the outdoor temperature is too high or too low.

When the monitor thermostat receives an IAQ alarm from a bypass controller (or itself in monitor-only mode), it sends all the zone controllers and the bypass controller the system IAQ alarm.

At the end of the 5 to 30 minutes, if the CO<sub>2</sub> level still exceeds the set point, the indoor fan will stay energized. The bypass damper modulates according to the IAQ Pressure Set Point. This forces fresh outside air to enter the zone with deficient IAQ. When the IAQ level drops below the IAQ set point, the bypass damper return to its standard operating mode.

**CLEARING THE ALARM** — To clear a system error, use the Unit Reset function. The Unit Reset function is in category 7, option 3. The default is OFF. Use the left set point buttons to set the option to ON. The bypass controller will reset all errors.

## NETWORK ACCESSIBLE VARIABLES

When using network access software, the set point and operation tables can be accessed. The variables in the tables can be read, written, or forced to a certain value. The bypass controller point display table is shown in Table 6. Other network software access tables are shown in Table 7.

**Table 6 — Bypass Controller Point Display Table**

VARIABLE DESCRIPTION	POINT NAME	READ/WRITE CAPABILITY
Duct Temperature	DT	Yes
Room Temperature	ZT	Yes
Damper Position	DPOS	Yes
System Pressure	SYS PRESS	Yes
System IAQ Status	IAQ	Yes

**Table 7 — CCN Bypass Controller Data Tables**

TABLE NAME	TABLE DESCRIPTION
33CSBC	Device ID Table
CONFIG1	Configuration Table
BYPSSTAT	Points Display Table
ALARMLOG	Maintenance Table
SERVICE1	Service Table
SETPPOINT	Setpoint Table
ALARMDEF	Alarm POC Table
ALARMSO1	Alarm Text Table
TIME	Time/Date Table

## BYPASS CONTROLLER TROUBLESHOOTING

The most common operating problems and errors associated with the bypass controller are:

- **Operating Problems.** No display and flashing displays occur when the bypass controller is not receiving rated power or has miswired connections.
- **Bypass Communication Problems.** The bypass controller is not displaying correct system mode, or its device address is not displayed during a communication check.
- **Hardware Failure (HF) Errors.** These errors occur when the bypass controller detects a problem with one of its own components or that of an associated device.
- **Storage Failure (SF) Errors.** These errors occur when the bypass controller detects and replaces faulty data contained within its memory with factory selected default values.
- **System Errors (SE).** System errors occur when the bypass controller detects a IAQ airflow problem.

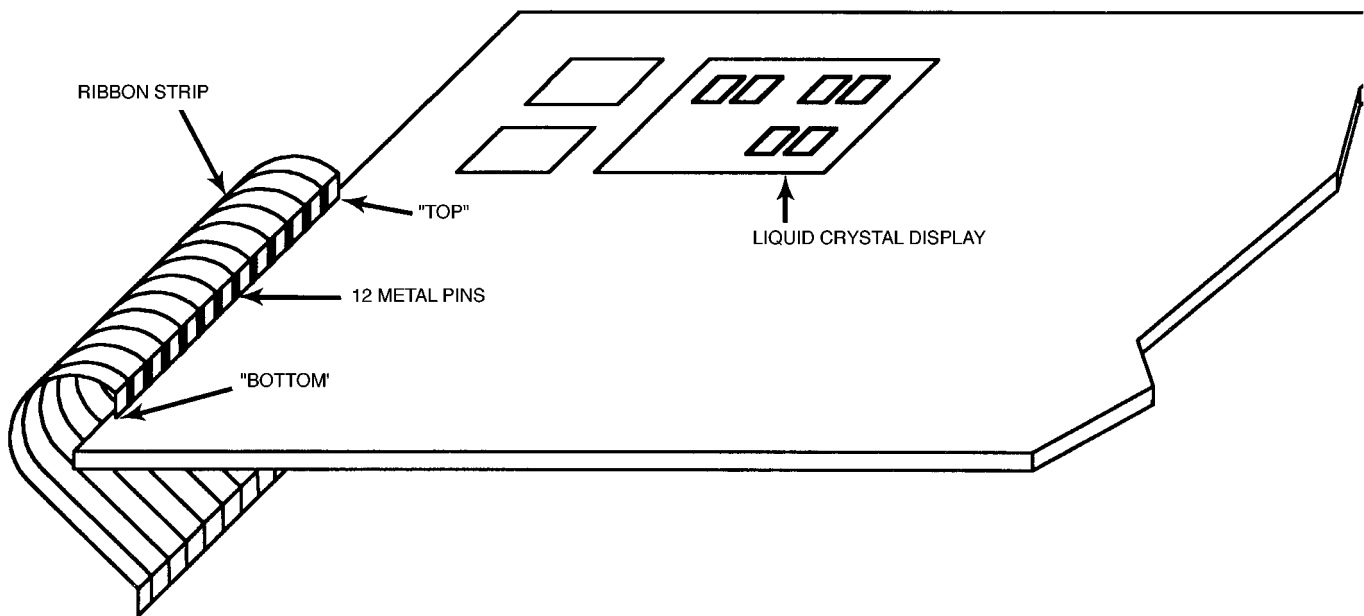
Operating problems other than listed may be related to the network connections.

### General Operating Problems

**NO DISPLAY** — If the bypass controller display remains blank after 24 vac power has been applied to its damper actuator, it is an indication that power is not reaching the bypass controller.

To troubleshoot the problem, perform the following procedure:

1. At the damper actuator, check that 24 vac/20 va (25 va for dampers interfaced to a pressure sensor) is being supplied from the power transformer. Acceptable voltage range is 21 to 30 vac. If the power is not being supplied, check the wiring between the 24 vac transformer and the damper actuator for shorts or faulty connections. Replace the transformer as necessary.
2. At the bypass controller wiring connector board, with the bypass controller connected, check for approximately 10 vdc (steady) across the red and white wires from the damper actuator. If the correct voltage is not read, check the continuity of the 5-conductor wire from the bypass controller wiring connector board to the damper actuator.
3. Check that the bypass controller ribbon cable is properly seated in the wiring connector board. Use the ribbon cable and wiring connector block diagram to check for continuity between the bypass controller ribbon cable termination and the corresponding wiring connector block terminal. See Fig. 12.
4. At the damper actuator, with the bypass controller connected, check for approximately 10 vdc (steady) across the red and white wires to the bypass controller. If the correct voltage is not read, replace the damper actuator.



Ribbon Strip Metal Pins (See diagram)	Corresponding wire connected to Terminal Block	
"TOP" 1st Pin	SBO +	} 3-Wire Cable Communication Bus
2nd Pin	Red (+ )	
3rd Pin	Black (- )	
4th Pin	Green (Gnd)	
5th Pin	SBO-	} 5 Wire Cable to Damper or Single Zone Relay Pack
6th Pin	White	
7th Pin	Red	
8th Pin	Blue	
9th Pin	Yellow	
10th Pin	Green	} Not Used
11th Pin	Red	
"BOTTOM" 12th Pin	Black	

**NOTES:**

1. To troubleshoot continuous or intermittent problems with the connector block (bad or cracked solder joints or tracings), check continuity on ribbon strip pins.
2. To troubleshoot the TVA (Transient Voltage Arrestor) of the wiring connector block, check continuity between the communication bus red and black wiring connector block terminals and the ribbon strip SBO- termination. If there is continuity, the TVA has failed.

**Fig. 12 — Ribbon Strip (Wall Mounted Device)**

**CONTINUOUSLY RESETTING DISPLAY** — If the bypass controller display continuously resets (zeros rotate), it is an indication that the bypass controller is continuously going through the power-up sequence and cannot proceed into its normal operating mode.

Check for any of the following conditions that would cause the display to blink or constantly display 4 zeros:

- Low voltage from the 24 vac/20 va (25 va for pressure sensor) transformer. Acceptable voltage range is 21 to 30 vac.
- Unsteady 10 vdc across the red and white wires from the damper board to the bypass controller.
- The yellow or blue wire from the damper actuator to the bypass controller wiring connector board is broken or disconnected. Try a different bypass controller to see if the same problem occurs.
- The bypass controller ribbon cable is improperly installed or defective. See Fig. 12 for troubleshooting information.
- The bypass controller wiring connector board is defective.
- The bypass controller or damper actuator is defective.

### **Bypass Controller Communication Problems** —

Most communication problems are associated with improper configuration of the system devices, faulty wiring, or a failure of a single device connected to the communication bus. The following is a brief communication bus troubleshooting procedure.

If one or more devices are experiencing any of the following communication problems perform the troubleshooting procedure below:

- The bypass controller or zone controller does not correctly indicate equipment fan operation or the current system mode.
- During the Communication Check, the monitor thermostat of the bypass controller fails to verify communications with the bypass controller.

**NOTE:** The nature of the communication bus is such that one item can cause multiple problems or one error can cover up several problems. If a problem is found, correct it and check the communication bus for other communication problems that may appear.

1. Check the device address of the bypass controller. If the bypass controller is configured to communicate in a VVT system, it must be addressed within the scanning range of its monitor thermostat. Check the device bus configuration and make sure the bypass controller is on the same bus as the monitor thermostat.

2. Check the configuration of the communication related options of the monitor thermostat and each device in the VVT system. Each device has one or more communication related options that could be misconfigured.
3. Check the mounting and cover plates of the bypass controller for protruding screw heads or bent interior standoffs.

Protruding screw heads on the rear mounting plate can cause a short between the rear pins of the set point buttons. The bypass controller cannot communicate with the monitor thermostat when its set point buttons are depressed. Bent interior standoffs can be constantly depressing the set point buttons and prevent the device from communicating.

4. Check the bypass controller wiring connector board for the correct communication bus wire connections. The red, green, and black wires must be in their proper locations. The wiring connector board is labeled to indicate the correct wiring connections. See Fig. 12 and check for a faulty ribbon cable, wiring connector board or failed TVA (Transient Voltage Arrestor).
5. Check the communication bus voltages. Check the voltage between the green and red and the black and green wires. There should never be any AC voltage measured on the communication bus. AC voltage of any level can cause communication problems. If AC voltage is measured, the source must be located and removed.

On the communication bus, the following voltages should be measured: red to green 3.1 to 3.6 vdc, black to green 1.4 to 1.9 vdc. If the correct voltage is not measured, the communication bus may have a device with weak I/O driver or faulty wiring connections.

If the communication problem still exists, a device on the communication bus could be defective or the communication bus wiring may be faulty.

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