



Installation, Start-Up and Configuration Instructions

Part Number 33ZCBC-01

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SAFETY CONSIDERATIONS

SAFETY NOTE

Air-conditioning equipment will provide safe and reliable service when operated within design specifications. The equipment should be operated and serviced only by authorized personnel who have a thorough knowledge of system operation, safety devices and emergency procedures.

Good judgement should be used in applying any manufacturer's instructions to avoid injury to personnel or damage to equipment and property.

⚠ WARNING

Disconnect all power to the unit before performing maintenance or service. Unit may automatically start if power is not disconnected. Electrical shock and personal injury could result.

GENERAL

The 3V control system VVT bypass controller (33ZCBC-01) is a system static pressure controller that operates to maintain the desired system duct pressure based on the system pressure set point. The VVT bypass controller is used with a system of VVT zone controllers. Zone controllers maintain precise temperature control in the space by regulating the flow of conditioned air into the space and operating an optional terminal fan.

As part of the 3V control system, the bypass controller is designed to communicate using a Carrier protocol with a Linkage Coordinator zone controller. One Linkage Coordinator zone controller can coordinate up to 31 additional zone controllers. The purpose of the Linkage Coordinator/zone relationship is to provide an efficient data path for communication between the zone controllers, bypass controller, and associated Carrier network air source. This arrangement makes up the 3V control system.

A user interface is not required for everyday operation of the bypass controller. A service person or building owner can configure or operate the bypass controller through a Carrier network user interface such as the System Pilot or Carrier software.

INSTALLATION

General — The bypass controller is used to control the bypass damper actuator in the 3V control system. The purpose of the bypass damper is to account for fluctuations in the supply air pressure caused by the zone dampers modulating to satisfy individual set points. The bypass system allows a constant volume HVAC (heating, ventilation and air conditioning) unit to supply variable volumes of air to the building. The system bypasses air from the supply side to the return side of the unit.

Determining the proper size for the bypass damper is critical for the operation of the VVT (variable volume/variable temperature) system. If the damper selected is too large, it may have to modulate more than necessary to react to system pressure changes. The ability of the system to stay within a pressure range is compromised. When the damper is undersized, the capability of the damper to control the pressure may be compromised due to the inability to bypass enough air volume. An undersized damper also creates higher airflow velocities which add to the noise generated by the system.

This book will discuss installation and wiring of the bypass controller and bypass actuator. The bypass damper and duct system should already be correctly sized and installed. The bypass actuator should be sized to match the bypass damper. Carrier provides system software that can be used to design the system and choose the correct dampers and actuators based on the application.

Bypass Controller Hardware — The bypass controller consists of the following hardware:

- control module
- plastic enclosure with integrated actuator
- one no. 8 x 3/4-in. self-drilling sheet metal screw

Figure 1 shows the bypass controller physical details.

Field-Supplied Hardware — Each bypass controller requires the following field-supplied components to complete its installation:

- damper
- damper actuator (if high-torque actuator is required)
- transformer — 24 vac, 40 va (standard applications)
- duct temperature sensor (33ZCSENDAT) with grommet (to secure DAT sensor to duct)

DUCT TEMPERATURE SENSOR (DAT) — The bypass controller must be connected to a field-supplied duct temperature sensor (part number 33ZCSENDAT) to monitor the temperature of the air delivered by the air source.

Mount Bypass Controller

LOCATION — The bypass controller should be located on or near the bypass damper in a ceiling area where accessible. When an external high-torque actuator is used, the bypass controller is mounted on the shaft of the damper. Select a location which will be safe from water damage and allow sufficient access for service and wiring. For service access, there should be at least 6 in. of clearance between the front of the bypass controller and adjacent surfaces. Refer to Fig. 1-3.

MOUNTING — Perform the following steps to mount the bypass controller:

1. Visually inspect the damper and determine the direction in which the damper shaft moves to open the damper — clockwise (CW) or counterclockwise (CCW).

If the damper rotates CCW to open, it does not require any configuration changes.

If the damper rotates CW to open, then the damper actuator logic must be reversed. This is done in the software when performing system start-up and damper calibration test. Do not attempt to change damper rotation by changing wiring. This will upset the damper position feedback potentiometer readings.

2. Rotate the damper shaft to the fully closed position.
3. Press the release button on the actuator and rotate the clamp in the same direction that was required to close the damper in Step 2.
4. Press the actuator release button and rotate the actuator back one-position of graduation. Release the button and lock the actuator in this position.
5. Mount the bypass controller to the terminal by sliding the damper shaft through the actuator clamp assembly. See Fig. 2 for details. Remove the controller wiring

access cover. Secure the controller by installing the screw provided through the grommet in the anti-rotation slot. Detach the grommet from the slot so it can slide from side to side. Be sure the floating grommet is in the center of the slot. **FAILURE TO CENTER THE GROMMET MAY CAUSE THE ACTUATOR TO STICK OR BIND.**

6. Tighten the actuator clamp assembly to the damper shaft. Secure by tightening the two 8-mm nuts.
7. If the damper has less than 90 degrees of travel between the fully open and fully closed positions, then a mechanical stop must be set on the actuator. The mechanical stop prevents the damper from opening past the maximum damper position. To set the mechanical stop, perform the following procedure:
 - a. Press the actuator release button and rotate the damper to the fully open position.
 - b. Using a No. 1 Phillips screwdriver, loosen the appropriate stop clamp screw and move the stop clamp so that it contacts the edge of the cam on the actuator.
 - c. Secure the stop clamp in this position by tightening the screw.
8. Verify that the damper opens and closes. Press the actuator release button and rotate the damper. Verify that the damper does not rotate past the fully open position. Release the button and lock the damper in the fully open position.
9. Replace wiring access cover.

Connect the Power Transformer — An individual, field-supplied, 24-vac power transformer is required for each bypass controller. Transformers must be UL (Underwriters' Laboratories) Class 2 rated. Standard applications require a 24 vac transformer, rated at 40 va minimum. All transformer secondaries are required to be grounded. Use only stranded copper conductors for all wiring to the bypass controller. Wiring connections must be made in accordance with NEC (National Electrical Code) and local codes. Ground one side of the transformer secondary at the transformer location. Connect the grounded side of the transformer to J1-2. Connect the live side of the transformer secondary to J1-1. Connect an 18-gage, green ground wire from terminal J1-3 to the metal chassis of the unit.

The power supply is 24 vac ± 10% at 40 va (50/60 Hz).

For bypass controllers, the power requirement sizing allows for the bypass actuator. The bypass damper actuator is limited to 20 va.

NOTE: Do not run sensor or communication wiring in the same conduit with line-voltage wiring.

Perform the following steps to connect the power transformer:

1. Install the field-supplied transformer in an electrical enclosure that conforms to NEC and local codes.
2. Connect 24 vac from the transformer as shown in the applicable wiring diagram (Fig. 4). Be sure to observe polarity when connecting the transformer power. The grounded terminal must be connected to the transformer ground terminal as shown.

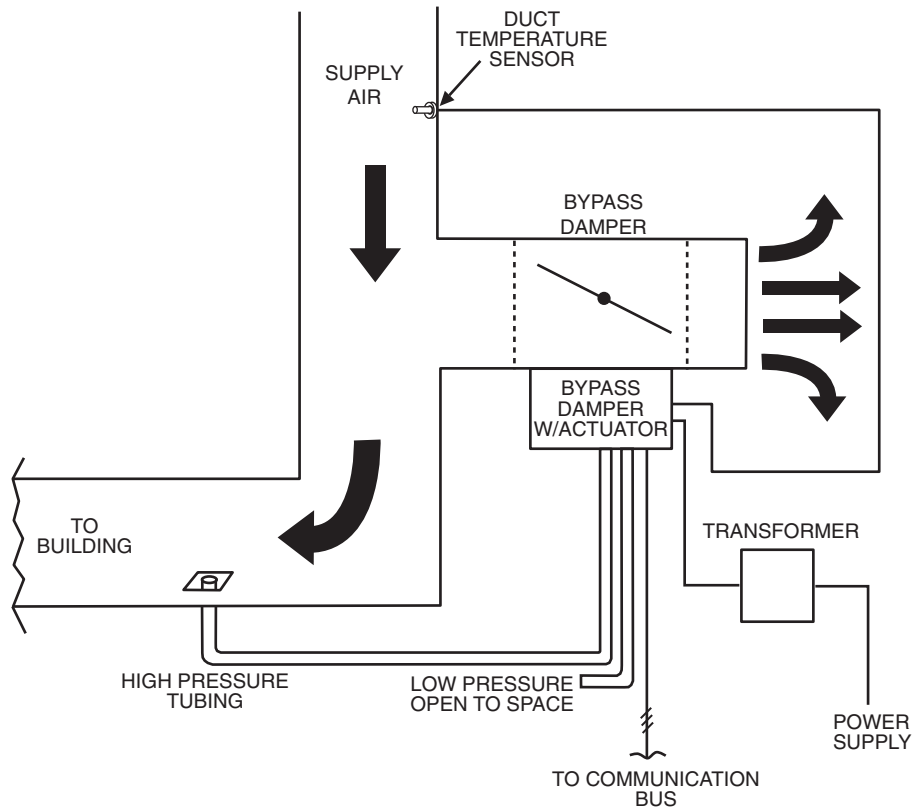


Fig. 3 — Bypass Controller Installation

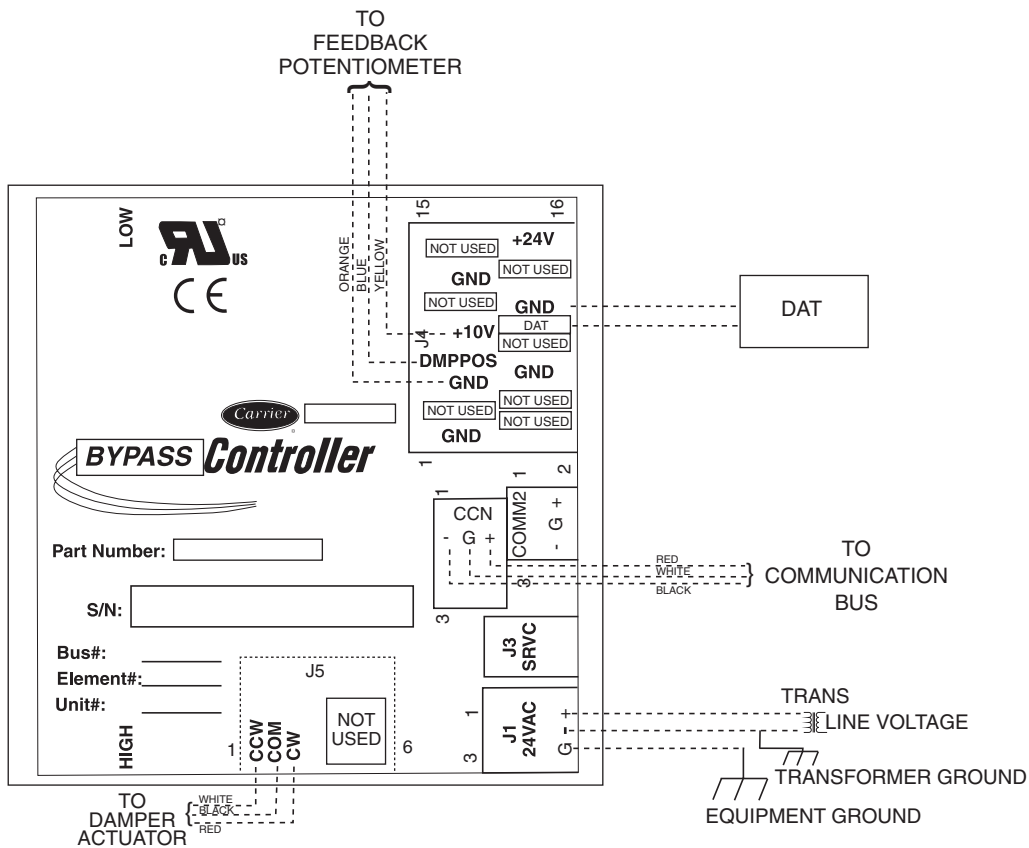


Fig. 4 — Bypass Controller Wiring

Bypass Controller Inputs and Outputs — The bypass controller inputs and outputs are shown in Tables 1 and 2.

Table 1 — Bypass Controller Inputs

CHANNEL	J4 TERMINATIONS	DESCRIPTION	CONTROL DEVICE
DUCT_TMP	10, 12	Duct Temperature	10K Thermistor
DMP_POS	9 (10 v), 7 (W+), 5 (-)	Damper Position	0-10 VDC
SP_SENSR	3, 1	System Pressure	0-5 VDC

Table 2 — Bypass Controller Outputs

CHANNEL	J5 TERMINATIONS	DESCRIPTION	CONTROL DEVICE
DMPR_CCW	1 (24 VAC), 2	Damper CCW	24 VAC
DMPR_CW	3 (24 VAC), 2	Damper CW	24 VAC

Install Duct Temperature Sensor — The duct temperature sensor is required. The duct temperature sensor must be installed in the supply air duct. The 33ZCSENDAT is the recommended sensor. See Fig. 5 for sensor details.

For bypass systems, the duct temperature sensor should be moved to a location which will provide the best sensing of the supply-air temperature during heating and cooling.

For bypass systems using a ducted supply, the duct temperature sensor should be located in the main supply duct downstream of the discharge of the air source and before the bypass damper to allow good mixing of the supply airstream.

The 33ZCSENDAT duct sensor is a small epoxy sensor that is 1 1/4-in. long. A grommet is provided for filling the hole around the sensor cable after the sensor is located in the duct.

See Fig. 3 and 6 for mounting location.

⚠ WARNING

Disconnect electrical power before wiring the bypass controller. Electrical shock, personal injury, or damage to the fan coil controller can result.

Do not run sensor or relay wires in the same conduit or raceway with Class 1 AC service wiring. Do not abrade, cut, or nick the outer jacket of the cable. Do not pull or draw cable with a force that may harm the physical or electrical properties. Avoid splices in any control wiring.

Perform the following steps to connect the duct temperature sensor to the bypass controller:

1. Drill or punch a 1/4-in. hole in the supply duct. See Fig. 6. Duct sensor can be installed to hang from top of duct or from the sides. Sensor probe can touch side of duct.
2. Push sensor through hole in the supply duct. Snap the grommet into the hole until it is secure. Pull on the leads of the duct sensor until the sensor is snug against the grommet.
3. Connect the sensor leads to the bypass controller's terminal board at the terminals labeled DAT (J4-10) and GND (J4-12). See Fig. 4 for wiring. If extending cable length beyond 8 ft, use plenum rated, 20 AWG (American Wire Gage), twisted pair wire. Sensor wiring does not have polarity. Either lead can be wired to either terminal.
4. Neatly bundle and secure excess wire.
5. Using electrical tape, insulate any exposed lead to prevent shorting.
6. Connect shield to earth ground (if shielded wire is used).

Install Pressure Tubing — The static pressure pick up should be located in the main supply duct before the first branching of ductwork. Run the tubing from the bypass controller to the installation location. For stable airflow measurement, the recommended minimum length of tubing is 2 ft. Connect the tubing to the high side of the pressure sensor marked P1. Make sure the low side of the pressure sensor (P2) is open to the atmosphere. See Fig. 3.

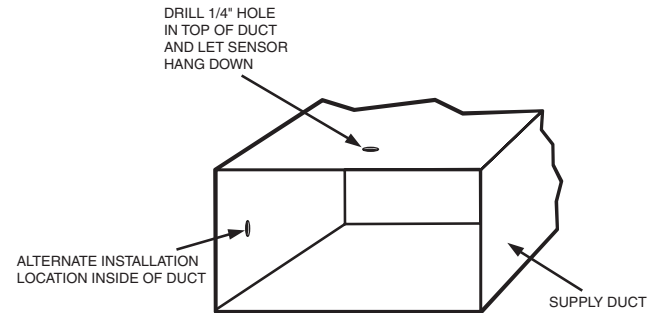
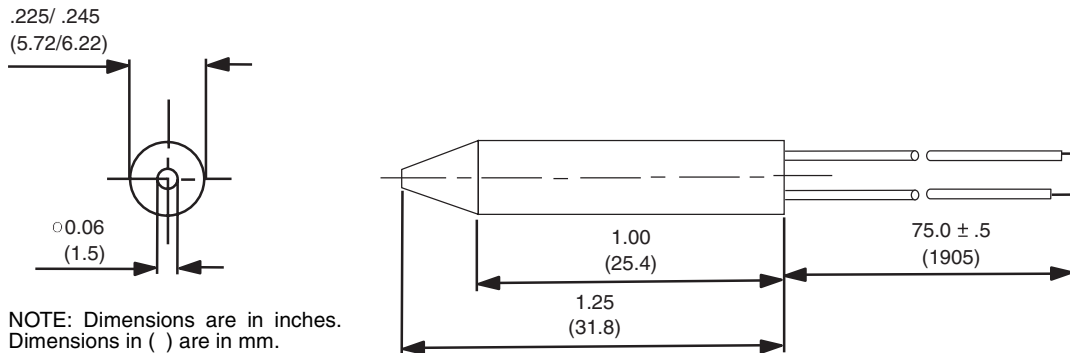


Fig. 6 — DAT Installation Location



NOTE: Dimensions are in inches. Dimensions in () are in mm.

Fig. 5 — 33ZCSENDAT Duct Sensor

Install Field-Supplied Actuators — Follow the damper manufacturers recommended installation instructions with the following recommendations.

Belimo Multi-Function technology actuators may be ordered direct from Belimo. The following accessory actuators may be used instead of the integrated actuator:

- NM24-MFT US P-30002 — 70 in.-lb actuators with floating point control and 0 to 10 vdc feedback.
- AM24-MFT US P-30002 — 160 in.-lb actuators with floating point control and 0 to 10 vdc feedback.

The following actuators may be used as linked actuators. Up to four actuators may be linked to the main actuator:

- LM24-MFT US P-10002 — 35 in.-lb actuators with 0 to 10 vdc control and 0 to 10 vdc feedback.
- NM24-MFT US P-10002 — 70 in.-lb actuators with 0 to 10 vdc control and 0 to 10 vdc feedback.
- AM24-MFT US P-10002 — 160 in.-lb actuators with 0 to 10 vdc control and 0 to 10 vdc feedback.

FLOATING POINT HIGH-TORQUE ACTUATORS — The field-supplied floating point high-torque actuators are multi-function technology actuators intended for applications where higher torque is needed for bypass operation. These actuators would replace the integrated actuator on the bypass controller. The actuators have three wires for power and control and one 0-10VDC feedback wire to send a signal to the bypass controller and any linked actuators. The three control wires are 1(BLK), 2(RED), and 3(WHT). The 1(BLK) and 2 (RED) wires provide power to the actuator. These should be wired to the same power source as the bypass controller making sure wire 2 (RED) connects to J1-1 on the power plug of the Bypass controller and wire 1 (BLK) connects to J5-2 the common of the Bypass Controller power. See Fig. 7 and 8 for wiring.

Polarity of the actuator and bypass controller power must be the same for proper operation and to prevent damage to the devices. A 1N4004 or 1N4007 diode must be placed across the CCW and CW terminals of the bypass controller. The end of the diode with the silver band tip (positive end) should be placed in the CCW terminal along with Wire 3(WHT). The other end of the diode should be placed in the CW terminal with the actuator switch in the CW or default position. This will make the damper rotate CCW when the CCW terminal is energized and CW when the CW terminal is energized. For reverse rotation the actuator switch may be changed to the CCW position.

LINKED ACTUATORS — Field-supplied linked actuators may be used to link to the bypass controller actuator. Install the actuators per the manufacturer's directions. Provide power for the linked actuators by wiring 24 vac to the 1(BLK) and 2 (RED) wires. Maintain polarity if more than one actuator is powered by the same power supply. Make sure the direction rotation switches on the linked actuators are set to CW. Wire the wire 3 (WHT) of the linked actuator(s) to the wire 5 (GRN) of the controlling actuator. The linked actuator will then track to the same damper position as the controlling actuator. See Fig. 8-10 for wiring.

Linked actuators may be used to control off the integrated actuator of the bypass controller actuator. Install the actuators per the manufacturer's directions. Provide power for the linked actuators by wiring 24 vac to the 1 (BLK) and 2 (RED) wires. Maintain polarity if more than one actuator is powered by the same power supply. Make sure the direction rotation switches on the linked actuators are set to CW. Connect wire 3 (WHT) of the linked actuator to J4-7(DMPPOS).

Damper Stops — For clockwise closed installations the damper stop on the right side of the damper shaft is left at the full clockwise position. The stop on the left side of the shaft must be moved to stop the actuator at the full open position for the damper. For example the Carrier round dampers rotate 45 degrees. Slide the left stop up to the 45 degree mark. Press the actuator release button and rotate the damper CCW all the way to the stop. The damper blade indicator should indicate the damper is full open. Wire 5 (white) should be wired to J4-7(DMPPOS). See Fig. 2.

NOTE: The rotation switch should be in the CW position for correct feedback for this application. Reverse the rotation by configuring the bypass controller for clockwise open and do not change the switch from the CW position.

Connect the Carrier Network Communication Bus — The bypass controllers connect to the bus in a daisy chain arrangement. The bypass controller may be installed on a primary bus or on a secondary bus from the primary bus. Connecting to a secondary bus is recommended.

At any baud (9600, 19200, 38400 baud), the number of controllers is limited to 239 zones maximum. Bus length may not exceed 4000 ft, with no more than 60 total devices on any 1000-ft section. Optically isolated RS-485 repeaters are required every 1000 ft.

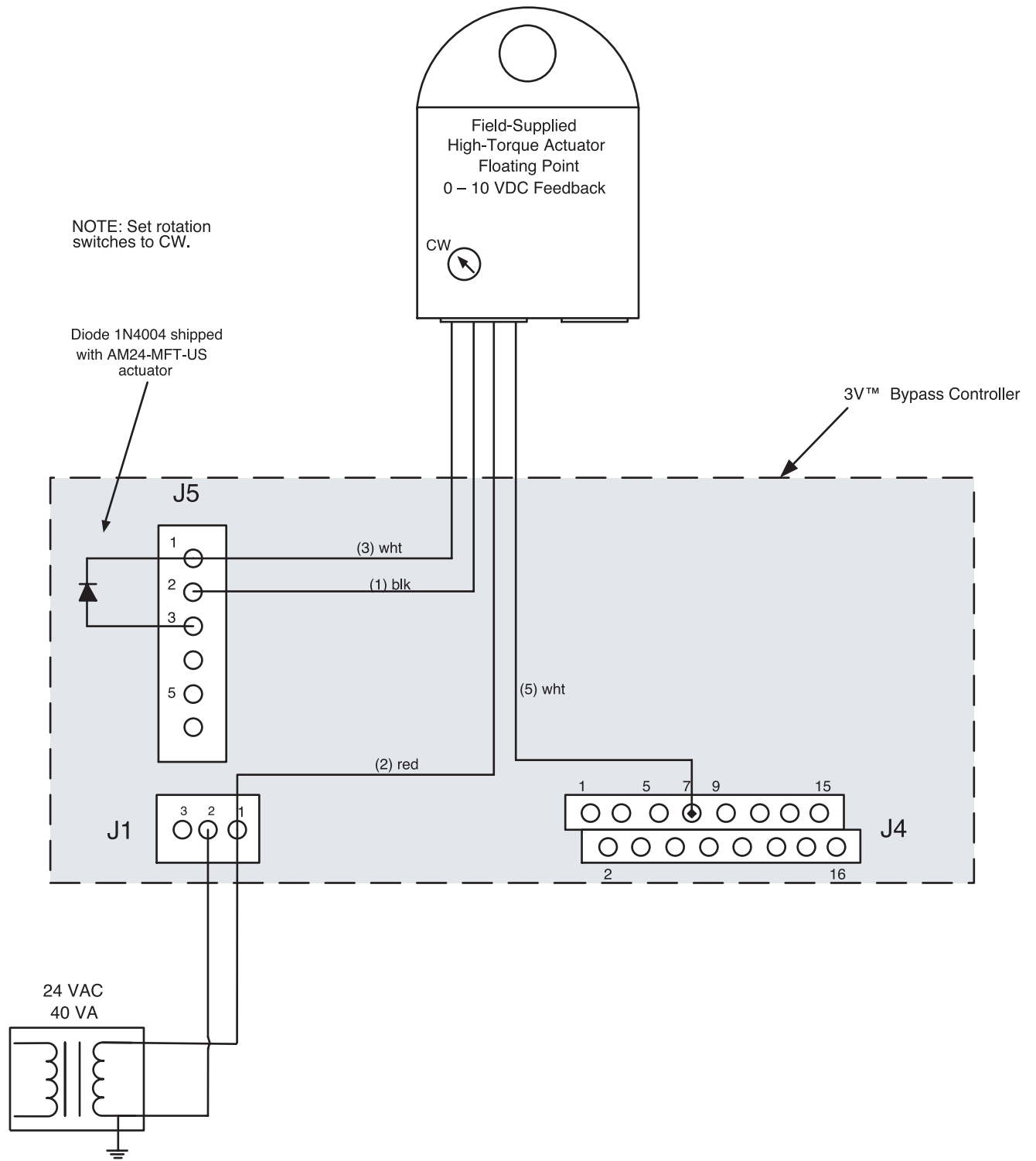


Fig. 7 — High-Torque Actuator Wiring

NOTE: Set rotation switches to CW.

3V™ Bypass Controller

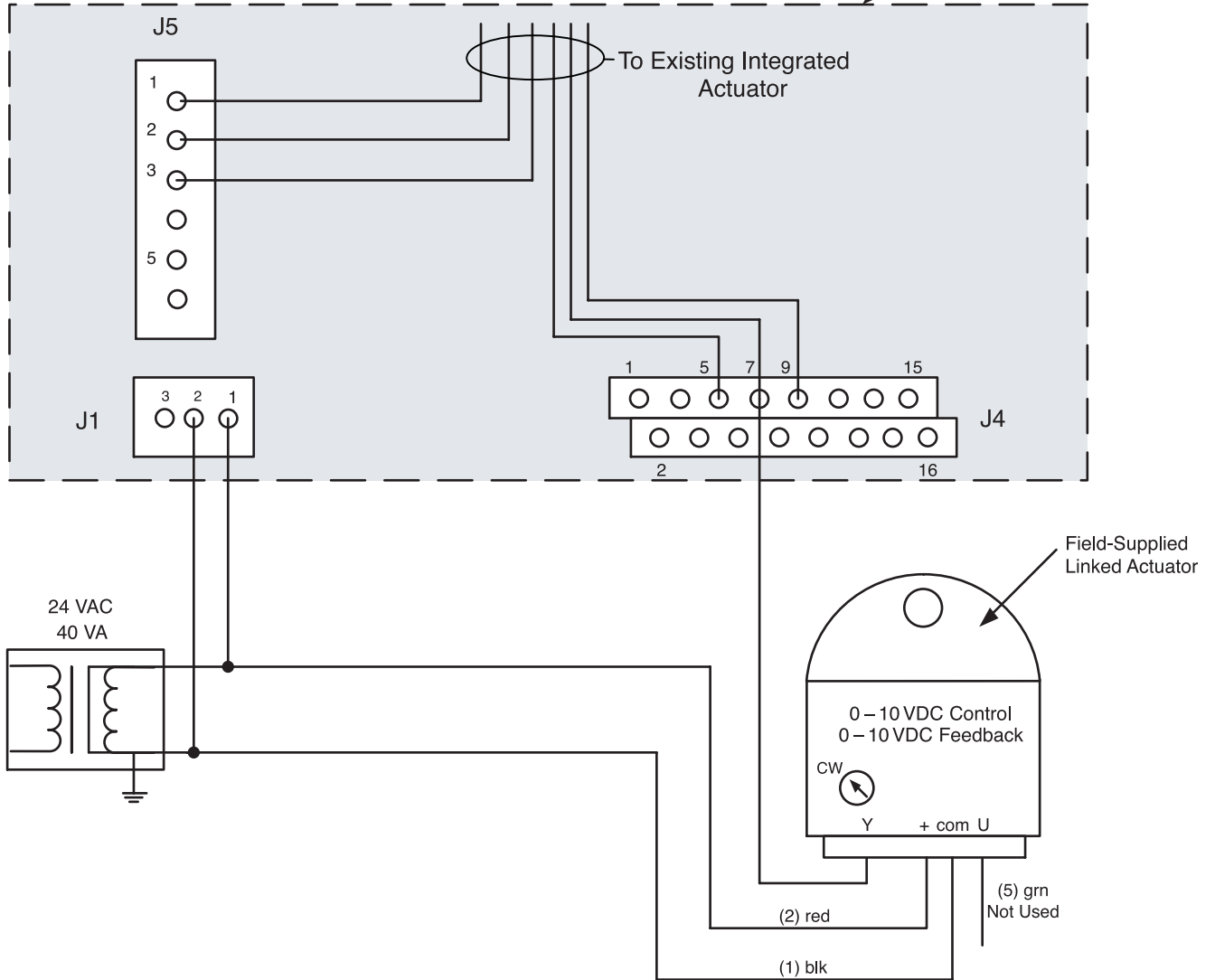


Fig. 9 — Field-Supplied Linked Damper Wiring

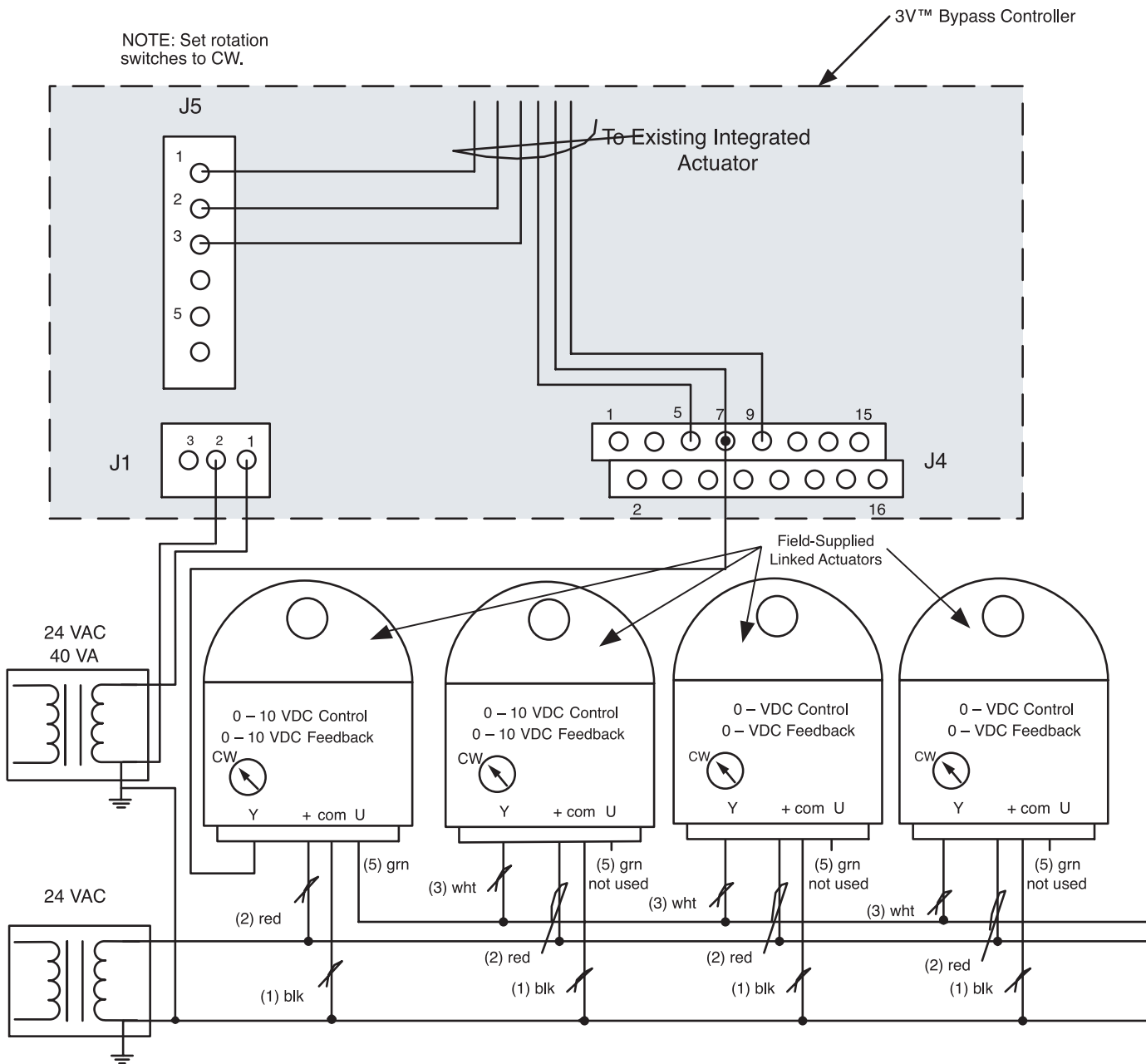


Fig. 10 — Multiple Field-Supplied Linked Damper Wiring

The first device in a network connects directly to the bridge and the others are wired sequentially in a daisy chain fashion. Refer to Fig. 11 for an illustration of communication bus wiring.

COMMUNICATION BUS WIRE SPECIFICATIONS — The communication bus wiring is field-supplied and field-installed. It consists of shielded three-conductor cable with drain (ground) wire. The cable selected must be identical to the Carrier Network communication bus wire used for the entire network. See Table 3 for recommended cable.

Table 3 — Recommended Cables

MANUFACTURER	CABLE PART NO.
Alpha	2413 or 5463
American	A22503
Belden	8772
Columbia	02525

NOTE: Conductors and drain wire must be at least 20 AWG (American Wire Gage), stranded, and tinned copper. Individual conductors must be insulated with PVC, PVC/nylon, vinyl, Teflon, or polyethylene. An aluminum/polyester 100% foil shield and an outer jacket of PVC, PVC/nylon, chrome vinyl, or Teflon with a minimum operating temperature range of -20 C to 60 C is required.

CONNECTION TO THE COMMUNICATION BUS

1. Strip the ends of the red, white, and black conductors of the communication bus cable.
2. Connect one end of the communication bus cable to the bridge communication port labeled COMM2 (if connecting on a secondary bus).

When connecting the communication bus cable, a color code system for the entire network is recommended to simplify installation and checkout. See Table 4 for the recommended color code.

Table 4 — Color Code Recommendations

SIGNAL TYPE	COMMUNICATION BUS WIRE COLOR	PLUG PIN NUMBER
+	Red	1
Ground	White	2
-	Black	3

3. Connect the other end of the communication bus cable to the terminal block labeled CCN in the bypass controller. Following the color code in Table 4, connect the Red (+) wire to Terminal 1. Connect the White (ground) wire to Terminal 2. Connect the Black (-) wire to Terminal 3.
4. Connect additional devices in a daisy chain fashion, following the color coded wiring scheme in Table 4. Refer to Fig. 11.

NOTE: The communication bus drain wires (shield) must be tied together at each device. If the communication bus is entirely within one building, the resulting continuous shield must be connected to ground at only one single point. If the communication bus cable exits from one building and enters another building, connect the shields to ground at a lightning suppressor in each building where the cable enters or exits (one point only).

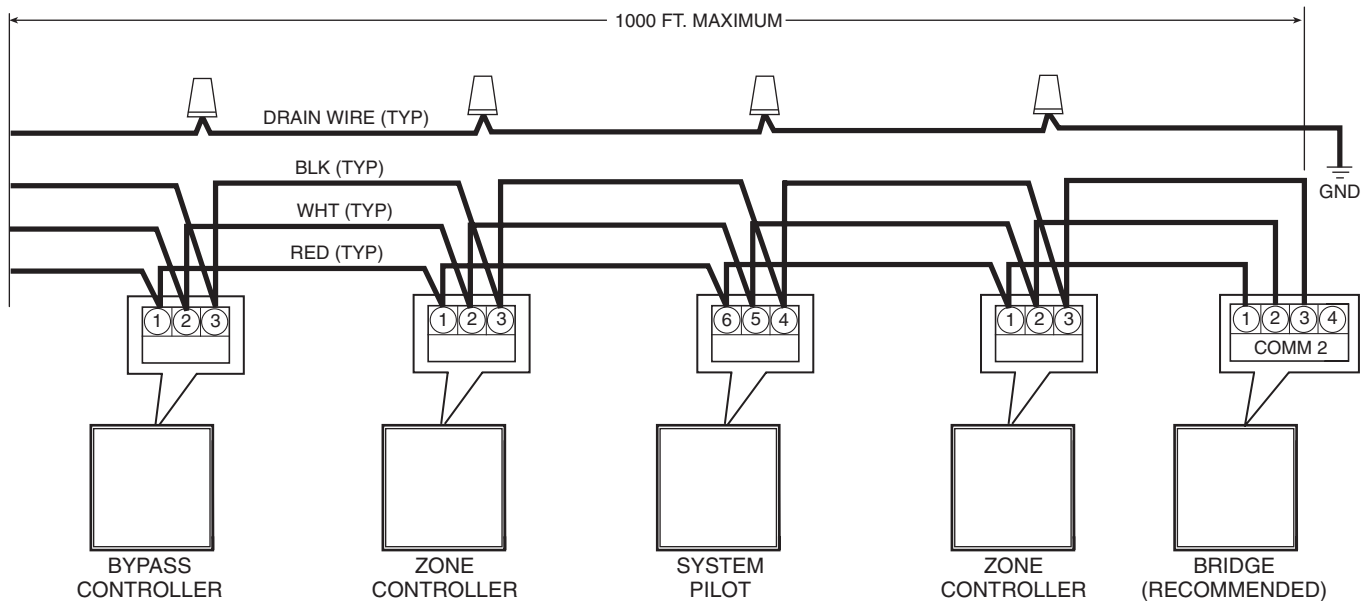


Fig. 11 — Communication Bus Wiring

START-UP

Use the Carrier network communication software to start up and configure the bypass coil controller.

All set-up and set point configurations are factory-set and field-adjustable.

Changes can be made using the System Pilot or Carrier software. During start-up, the System Pilot or Carrier software can also be used to verify communication with the bypass controller.

For specific operating instructions, refer to the literature provided with the System Pilot or Carrier software.

Perform System Checkout — To check out the system, perform the following:

1. Apply 24 vac power to the bypass controller.
2. Using the System Pilot, upload the controller from address 0,141 (default address). The address may be set at this time. The address should be set to 1 higher than the monitor or the linkage coordinator.
3. Access the bypass controller commissioning and maintenance tables.
4. If the terminal damper closes in the clockwise direction, then no adjustment is required. If the terminal damper opens in the clockwise direction, set the CW Rotation point to OPEN.
5. Force the Bypass Commis point to Enable.
6. Force the Damper Calibration point to Enable. The automatic bypass damper calibration process will begin. The bypass controller will verify that the air source fan is off. Communication with the linkage coordinator is required. Make sure the linkage coordinator and the Bypass Controller are addressed correctly.

NOTE: If the Bypass Controller is in local mode (stand alone), the user must make sure the duct static pressure is 0 to enable damper calibration.

If the fan is turned on, the Damper Calibration process will be aborted. The bypass damper will travel to its minimum and maximum positions. The damper positions will be saved and used by the bypass controller. When the damper calibration process is complete, the bypass controller will automatically return the point to Disable.

7. Force the Zero Pressure Sensor Cal point to Enable. The bypass controller verify that the air source fan is off. If the fan is turned on, the Zero Pressure Sensor Calibration process will be aborted. The bypass controller will automatically calibrate the zero value of the pressure sensor. When the calibration process is complete, the bypass controller will automatically return the point to Disable.
8. Set up all zone controllers and perform system commissioning at the linkage coordinator before adjusting the System Pressure Set Point.
9. Adjust the System Pressure Set Point by forcing the point to the desired value. The bypass controller will write the forced value to the set point table and will begin to control to the new bypass pressure set point.
10. Read the airflow with a measuring device. If the reading varies from the screen value, force the value to the measured value. Once the pressure sensor is forced, the controller will automatically calibrate the pressure sensor (as long as the bypass damper is not >95% open). Repeat as needed.

CONFIGURATION

The following sections describe the computer configuration screens which are used to configure the bypass controller. The screens shown may be displayed differently when using different Carrier software.

Status Display Table — The status display table is used to show status of different functions of the bypass controller. The values displayed in this table are read-only values. See Table 5.

SYSTEM MODE — The System Mode variable displays the Linkage Coordinator zone controller's system mode as the bypass controller's system mode except when the bypass controller is in its commissioning mode or the network communication fails. In bypass commissioning mode, the system mode will display *BPCOMMIS* to indicate the bypass controller is in its own commissioning mode. If the network communication between the bypass controller and the linkage coordinator fails, the system mode will display *LOCAL*.

System Mode:	Display Units	ASCII
	Display Range	HEATING, COOLING, FREE COOL, PRESSURE, EVAC, ZONE_BAL, OFF, BPCOMMIS, LOCAL
	Network Access	Read only

DAMPER POSITION — This variable displays the damper position percent range of rotation determined by the damper feedback potentiometer. The bypass controller is designed for use on dampers with a range of rotation up to 90 degrees.

Damper Position:	Display Units	% open
	Display Range	0 to 100
	Network Access	Read only

SYSTEM PRESSURE SETPT — This variable displays the supply air static pressure set point that is to be maintained by the bypass controller. The bypass controller determines the damper position by comparing the system static pressure to this set point.

System Pressure Setpoint:	Display Units	in. wg
	Display Range	0.10 to 1.80
	Network Access	Read only

SYSTEM PRESSURE — This variable displays the static system pressure through an integrated pressure sensor in increments of 0.1 in. wg.

System Pressure:	Display Units	in. wg
	Display Range	0.00 to 2.00
	Network Access	Read only

DUCT TEMPERATURE — This variable displays the duct temperature at the bypass damper through a 10K thermistor with a measurement range from -40 to 245 F in 0.1° F increments.

Duct Temperature:	Display Units	F (C)
	Display Range	-40.0 to 245.0
	Network Access	Read/Write

Table 5 — Status Display

DESCRIPTION	VALUE	UNITS	STATUS	FORCE	NAME
System Mode	BPCOMMIS		Comm failure		SYS_MODE
Damper Position	0	%OPEN	Comm failure		DMP_POS
System Pressure Setpt	1.50	in H2O	Comm failure		SP_SETPT
System Pressure	0.00	in H2O	Comm failure		SP_SENSR
Duct Temperature	73.8	dF	Comm failure		DUCT_TMP

Maintenance Tables — The bypass controller contains the following maintenance tables, Bypass Controller Maintenance Table (BP_MAINT), Bypass Controller Commissioning Maintenance Table (BPCOMMIS), and Bypass Controller System Pilot Default Maintenance (SP_MAINT).

BYPASS CONTROLLER MAINTENANCE TABLE — See Table 6 for Bypass Controller Maintenance Table (BP_MAINT).

System Mode — This variable displays the master zone controller's system mode as the bypass controller's system mode except when the bypass controller is in its commissioning mode or the network communication fails. In bypass commissioning mode, the system mode will display *BPCOMMIS* to indicate the bypass controller is in its own commissioning mode. If the network communication between the bypass controller and the master zone controller fails, the system mode will display *LOCAL*.

System Mode:	Display Units	ASCII
	Display Range	HEATING, COOLING, FREE COOL, PRESSURE, EVAC, ZONE_BAL, OFF, BPCOMMIS, LOCAL
	Forcible	No

Damper Position — This variable displays the damper position percent range of rotation determined by the damper feedback potentiometer. The bypass controller is designed for use on dampers with a range of rotation up to 90 degrees.

Damper Position:	Display Units	% open
	Display Range	0 to 100
	Forcible	No

System Pressure Setpt — This variable displays the supply air static pressure set point that is to be maintained by the bypass controller. The bypass controller determines the damper position by comparing the system static pressure to this set point.

System Pressure Setpoint:	Display Units	in. wg
	Display Range	0.10 to 1.80
	Forcible	No

LAT Exceeds Limit — This variable displays whether the leaving air temperature exceeds the heating or cooling limit configured in the Bypass Controller Service Configuration Table. If *Yes* is displayed, the System Pressure Set Point is increased by the value in LAT Pressure Delta. This will cause the amount of bypassed air to be reduced, thus protecting the air source from receiving air that is too hot or too cool. If *No* is displayed, then no LAT protection is in effect.

LAT Exceeds Limit:	Default Value	No
	Display Range	Yes/No
	Forcible	No

LAT Pressure Delta — This variable displays the amount of in. wg by which the System Pressure Set Point will be increased if LAT Exceeds Limit displays *Yes*.

LAT Pressure Delta:	Display Units	in. wg
	Display Range	0.00 to 1.00
	Forcible	No

System Pressure — This variable displays the static system pressure through an integrated pressure sensor in increments of 0.1 in. wg.

System Pressure:	Display Units	in. wg
	Display Range	0.00 to 2.00
	Forcible	No

Duct Temperature — This variable displays the duct temperature at the bypass damper through a 10K thermistor with a measurement range from -40 to 245 F in 0.1° F increments.

Duct Temperature:	Display Units	F (C)
	Display Range	-40.0 to 245.0
	Forcible	Yes

Clear Alarms — This variable displays the commanded state of the Clear Alarms function. If this decision is forced to *Yes*, all alarms in the Alarm History Table will be cleared and this decision will automatically be set back to *No*.

Clear Alarms:	Default Value	No
	Display Range	Yes/No
	Forcible	Yes

Table 6 — Maintenance

DESCRIPTION	VALUE	UNITS	STATUS	FORCE	NAME
System Mode	BPCOMMIS				SYS_MODE
Damper Position	58	%OPEN			DMP_POS
System Pressure Setpt	1.50	in H2O			SP_SETPT
LAT Exceeds Limit	No				LAT_ALRM
LAT Pressure Delta	0.00	in H2O			DELTA_SP
System Pressure	0.00	in H2O			SP_SENSR
Duct Temperature	73.8	dF			DUCT_TMP
Clear Alarms	No				CLR_ALRM

BYPASS CONTROLLER COMMISSIONING MAINTENANCE TABLE — See Table 7 for Bypass Controller Commissioning Maintenance Table (BPCOMMIS).

Bypass Commis (60 min) — This variable displays whether the bypass commissioning function has been enabled. The bypass commissioning function permits the user to calibrate the bypass damper and the system pressure sensor. All calibration decisions will remain disabled until the user forces Bypass Commissioning to *Enable*. When the user forces this decision to *Enable*, System Mode will be updated to *BPCOMMIS* to indicate that bypass commissioning is in effect.

Bypass controller commissioning will automatically be disabled if no activity is detected in the commissioning maintenance table (for example, if none of the calibration decisions are forced or if communication with the zone controller is lost) for one hour.

Bypass		
Commiss:	Default Value	Disable
	Display Range	Enable/Disable
	Forcible	Yes

Damper Calibration — This variable displays whether the damper calibration process has been enabled. When the user forces this decision to *Enable* after Bypass Commissioning has also been forced to *Enable*, the bypass damper is calibrated.

If the system fan is on, the bypass controller sends a request to the Linkage Coordinator zone controller to turn the system fan off. If the communication fails, the damper calibration process will be terminated and this decision will be *Disabled*.

When the fan is off, the zone controller will drive the damper to the full closed position.

After completing the closed position calibration, the zone controller will drive the damper to the full open position.

If there was an error during the closed or open position calibration, an alarm will be generated and Damper Cal Alarm will display *Alarm* until a successful damper calibration takes place.

When calibration is completed, the force will be removed from Damper Calibration decision, and the bypass controller will send a request to the Linkage Coordinator zone controller to return the system fan to normal operation. The damper will remain fully open.

NOTE: Bypass controller commissioning will automatically be disabled if no activity is detected in this maintenance table for one hour.

Damper		
Calibration:	Default Value	Disable
	Display Range	Enable/Disable
	Forcible	Yes

Zero Pressure Cal — This variable displays whether the pressure transducer zero calibration process has been enabled. When the user forces this decision to *Enable* after Bypass Commissioning has also been set to *Enable*, the pressure transducer is calibrated.

If the system fan is on, the zone controller will send a request to the Linkage Coordinator zone controller to turn the

system fan off. If the communication fails, the damper calibration process will be terminated and this decision will be *Disabled*.

When the fan is off, the zone controller will drive the damper to the full open position.

The bypass controller will measure the output voltage of the pressure sensor and verify that the output voltage is within the tolerance of zero pressure voltage of the sensor (1.0 ± 0.1 vdc).

If the pressure sensor voltage failed to decrease to within the zero pressure tolerance (1.0 ± 0.1 vdc), a Press Sensr Cal Alarm will be displayed until a successful calibration takes place.

When calibration is completed, the force is removed from Zero Pressure Cal decision, and the bypass controller will send a request to the Linkage Coordinator zone controller to return the system fan to normal operation. The damper will remain fully open.

NOTE: This value cannot be forced if Auto Press Cal is set to *Enable* in the Sensor Service Configuration Table.

NOTE: Bypass Controller Commissioning will automatically be disabled if no activity is detected in this maintenance table for one hour.

Zero Pressure		
Cal:	Default Value	Disable
	Display Range	Enable/Disable
	Forcible	Yes

Pressure Sensor Cal — This variable displays whether the high-end pressure transducer calibration process has been enabled. The purpose of this process is to correctly calibrate the pressure transducer. When the user forces this decision to *Enable* after Bypass Commissioning has also been set to *Enable*, the user may then force the System Pressure to the correct reading as measured with calibrated test equipment. From the forced value, the bypass controller calculates a calibration multiplier that will always be applied to the System Pressure sensor reading. Once the multiplier is calculated, the force is removed and the multiplier is applied to the System Pressure sensor reading.

NOTE: Bypass controller commissioning will automatically be disabled if no activity is detected in this maintenance table for one hour.

Pressure		
Sensor Cal:	Default Value	Disable
	Display Range	Enable/Disable
	Forcible	Yes

Damper Position — This variable displays the damper position percent range of rotation determined by the damper feedback potentiometer. The bypass controller is designed for use on dampers with a range of rotation up to 90 degrees.

Damper		
Position:	Display Units	% open
	Default Value	0
	Display Range	0 to 100
	Forcible	No

Table 7 — Commissioning Maintenance

DESCRIPTION	VALUE	UNITS	STATUS	FORCE	NAME
Bypass Commis (60 min)	Enable			Service	COMMISS
Damper Calibration	Disable				DMP_CAL
Zero Pressure Cal	Disable				ZR_PSCAL
Pressure Sensor Cal	Disable				PS_CAL
Damper Position	42	%OPEN			DMP_POS
System Pressure	0.00	in H2O			SP_SENSR
System Pressure Setpt	1.50	in H2O			SP_SETPT
Damper Cal Alarm	Normal				DAMP_CAL
Press Sensr Cal Alarm	Normal				SP_CAL

System Pressure — This variable displays the static system pressure through an integrated pressure sensor in increments of 0.1 in. wg. When Bypass Commissioning and Pressure Sensor Cal are *Enabled*, the user may force this value to the correct reading of the System Pressure as measured with calibrated test equipment. From the forced value, the bypass controller calculates a calibration multiplier that will always be applied to the System Pressure sensor reading. Once the multiplier is calculated, the force is removed and the multiplier is applied to the System Pressure sensor reading.

System Pressure: Display Units in. wg
 Default Value 0.00
 Display Range 0.00 to 2.00
 Forcible Yes

System Pressure Setpt — This variable displays the supply air static pressure set point that is to be maintained by the bypass controller. The bypass controller determines the damper position by comparing the system static pressure to this set point. When the user forces the System Pressure Setpt from this table, the bypass controller automatically updates the System Pressure Setpt configuration value in the Pressure Setpoint Service Configuration Table.

System Pressure Setpoint: Display Units in. wg
 Default Value 0.50
 Display Range 0.10 to 1.80
 Forcible Yes

Damper Cal Alarm — This variable displays *Alarm* if the damper calibration process failed because there was an error during the closed or open position calibration of the damper. *Normal* is displayed when a successful damper calibration takes place.

Damper Cal Alarm: Default Value Normal
 Display Range Normal/Alarm
 Forcible No

Press Sensr Cal Alarm — This variable displays *Alarm* if the pressure transducer zero calibration process failed because the pressure sensor voltage did not decrease to within the zero pressure tolerance (1.0 ± 0.1 vdc). *Normal* will be displayed when a successful pressure transducer zero calibration takes place.

Press Sensr Cal Alarm: Default Value Normal
 Display Range Normal/Alarm
 Forcible No

BYPASS CONTROLLER SYSTEM PILOT DEFAULT MAINTENANCE TABLE — See Table 8 for Bypass Controller System Pilot Default Maintenance (SP_MAINT).

Duct Temperature — This variable displays the duct temperature at the bypass damper through a 10K thermistor with a measurement range from -40 to 245 F in 0.1° F increments.

Duct Temperature: Display Units F (C)
 Default Value -40.0
 Display Range -40.0 to 245.0
 Forcible Yes

Damper Position — This variable displays the damper position percent range of rotation determined by the damper feedback potentiometer. The bypass controller is designed for use on dampers with a range of rotation up to 90 degrees.

Damper Position: Display Units % open
 Default Value 0
 Display Range 0 to 100
 Forcible No

System Pressure — This variable displays the static system pressure through an integrated pressure sensor in increments of 0.1 in. wg.

System Pressure: Display Units in. wg
 Default Value 0.00
 Display Range 0.00 to 2.00
 Forcible No

System Mode — This variable displays the master zone controller's system mode as the bypass controller's system mode except when the bypass controller is in its commissioning mode or the network communication fails. In bypass commissioning mode, the system mode will display *BPCOMMIS* to indicate the bypass controller is in its own commissioning mode. If the network communication between the bypass controller and the Linkage Coordinator zone controller fails, the system mode will display *LOCAL*.

System Mode: Display Units ASCII
 Display Range HEATING, COOLING, FREE COOL, PRESSURE, EVAC, ZONE_BAL, OFF, BPCOMMIS, LOCAL
 Forcible No

Configuration Tables — The bypass controller contains the following configuration tables: Alarm Configuration (ALMCONF), Bypass Controller Configuration (BP_SERV), Device Configuration (BYPASS), Language Configuration (LNGCONF), Duct Sensor Configuration (SEN_SERV), and Set Point Configuration (SETPOINT).

ALARM CONFIGURATION TABLE — The Alarm Configuration Table (ALMCONF) contains decisions used to configure the alarm settings for the zone controller. This includes realarm time and routing of alarms. See Table 9.

Table 8 — System Pilot Default Maintenance

DESCRIPTION	VALUE	UNITS	STATUS	FORCE	NAME
Bypass Controller					
Duct Temperature	73.8	dF			DUCT_TMP
Damper Position	0	%OPEN			DMP_POS
System Pressure	0.00	in H2O			SP_SENSR
System Mode	BPCOMMIS				SYS_MODE

Table 9 — Alarm Configuration

DESCRIPTION	VALUE	UNITS	NAME
Alarm Routing Control	11010000		ROUTING
Re-alarm Time	10	min	RETIME

OPERATION

System Pressure Operation

NORMAL OPERATION — The bypass controller will modulate its damper to maintain the proper system static pressure set point. The bypass controller does this by comparing its pressure sensor input reading to the configured system static pressure set point and determining the error (sensor reading — set point). The bypass controller then compares the calculated error to the configured deadband value. If the error is greater than 1/4 of the deadband value (configured deadband times a constant of 0.05), then the bypass controller commands the damper to open or close (depending on the positive or negative value of the error). If the error is less than 1/4 of the deadband value, the bypass controller holds the damper position. If the pressure sensor fails, the bypass controller will move the damper to the configured Pressure Sensor Error Damper Position. See Fig. 12 for an operation flow chart.

LEAVING AIR TEMPERATURE (LAT) MODE — The bypass controller will provide LAT protection by controlling the system pressure based on its duct temperature. If the duct temperature goes above the configured heating LAT limit or below the cooling LAT limit, the bypass controller will increase the pressure set point by the configured LAT Pressure Delta value. This will cause the amount of bypassed air going back to the air source to be reduced. If the LAT Pressure Delta decision is configured for zero, the LAT protection function will be disabled. The bypass controller will control to the normal system pressure set point again at the end of the current heating or cooling cycle, or when its duct temperature sensor reads greater than the Cooling LAT limit plus five degrees or less than the Heating LAT limit minus ten degrees. This temperature swing would indicate that the air source cycled the heating or cooling as part of its LAT protection, or because the system conditions are close to satisfying the mode.

NOTE: Bypass LAT protection is disabled during Bypass Commissioning mode, or if the duct temperature sensor fails.

Bypass Controller Calibration — The bypass controller allows calibration of the damper and pressure sensor from the Bypass Commissioning Maintenance screen. Refer to the System Check-Out section for the step-by-step procedure.

DAMPER CALIBRATION — If the bypass controller is not operating in stand-alone mode, it will verify the system fan status with its associated Linkage Controller. If the fan is on, the bypass will request its Linkage Controller to turn the fan off.

NOTE: If the bypass controller is in stand-alone mode (not communicating with a Linkage Coordinator) the user must ensure the pressure reading is zero before performing calibration. The bypass controller will not be allowed to enter calibration mode if the fan is on.

In either case, the bypass will check to ensure the fan is off by reading its pressure sensor and damper position. If the pressure reading is less than 10% of the static pressure set point and the bypass damper position is less than 25% of the resistance of the feedback potentiometer for greater than 60 seconds, then the bypass controller assumes the fan is off. When the fan is off, the bypass controller will drive its damper to the fully closed position. The bypass controller will read the value of the actuator's feedback potentiometer until the value stops changing. This indicates the damper is fully closed. If

the feedback resistance value meets the Damper Closed Criteria in Table 15, the bypass controller will store the value in non-volatile memory as the resistance at fully closed. The bypass controller will then position the damper fully open. When the feedback resistance value stops changing, the bypass controller reads the value and if the feedback resistance value meets the Damper Open Criteria in Table 15, the bypass controller stores the value as the resistance at fully open. The bypass controller will use the following formula to determine damper position:

For damper rotation configured as Open:

$$\text{Damper Position (\% open)} = \frac{(\text{Feedback Resistance} - \text{Resistance at Full Closed})}{(\text{Resistance at Full Open} - \text{Resistance at Full Closed})} * 100.$$

For damper rotation configured as Closed:

$$\text{Damper Position (\% open)} = 100 - \frac{(\text{Feedback Resistance} - \text{Resistance at Full Closed})}{(\text{Resistance at Full Open} - \text{Resistance at Full Closed})} * 100.$$

Table 15 — Damper Position Criteria

DAMPER ROTATION	CLOCKWISE	COUNTER CLOCKWISE
Damper Open Criteria	The resistance value is greater than 75% of the full range of the potentiometer	The resistance value is less than 25% of the full range of the potentiometer
Damper Closed Criteria	The resistance value is less than 25% of the full range of the potentiometer	The resistance value is greater than 75% of the full range of the potentiometer

If an invalid resistance value is read, the bypass controller will not store or use the value, and will issue a Damper Calibration Alarm. If the bypass controller loses communication with its associated Linkage Coordinator, the damper calibration process will be terminated. When the damper calibration is completed, the bypass controller will signal the Linkage Coordinator to return the fan to normal operation.

PRESSURE TRANSDUCER ZERO CALIBRATION — Pressure transducer calibration will occur under two conditions if it is not operating in stand-alone mode. The first condition is when it is forced by the user in the BPCOMMIS maintenance table to perform this operation. The second condition is when the system goes in to the unoccupied mode for at least 5 minutes or 168 hours (7 days) since the last calibration, whichever comes first. If the bypass controller is not operating in stand-alone mode, it will verify the system fan status with its associated Linkage Coordinator. If the fan is on, the bypass controller will send a high priority request to its Linkage Coordinator to turn the fan off. If the fan is already off, the bypass controller will send the same priority request to ensure that the fan stays off during the calibration procedure. If for some reason the bypass controller loses communication with its Linkage Coordinator for more the 60 minutes or the procedure takes longer the 60 minutes, the Linkage Coordinator will return the fan and system to normal operation and the bypass controller will terminate the calibration procedure and return to normal operation.

NOTE: If the bypass is in stand-alone mode (not communicating with a Linkage Controller), the user must ensure the pressure reading is zero before performing calibration.

In either case, the bypass controller will check to ensure the fan is off by reading its pressure sensor and damper position. If the pressure reading is less than 10% of the static pressure set point and the bypass damper position is less than 25% of the resistance of the feedback potentiometer for greater than 60 seconds, then the bypass controller assumes the fan is off. When the fan is off, the bypass controller will drive its damper to the fully open position. If an invalid feedback resistance value is detected, the bypass controller will terminate the calibration. Once at the fully open damper position, the bypass controller will read the output voltage of the pressure sensor. If

the voltage reads within the range of 1.0 vdc \pm 0.1 volt, it calculates the offset voltage based on the difference between the output voltage reading and the nominal zero pressure reading of 1.0 vdc. This value is then stored in non-volatile memory. If the voltage reading is outside of the tolerance range, the bypass controller will display "Alarm" in the commissioning screen. The screen will display "Alarm" until a successful calibration of the pressure sensor is performed. When the calibration is completed, the bypass controller will signal the Linkage Coordinator to return the fan to normal operation.

- LEGEND**
- BP — Bypass
 - BP_SETPT — System Pressure Setpoint
 - DAT — Duct Air Temperature
 - DMP_POS — Damper Position
 - LAT — Leaving Air Temperature
 - LAT_ALARM — Leaving Air Temperature Alarm
 - LAT_HYST — Leaving Air Temperature Setpoint Hysteresis
 - LC — Linkage Coordinator
 - PS_error — Static Pressure Sensor error
 - SP_SENSR — Static Pressure Sensor
 - SP_SET — Static Pressure Setpoint

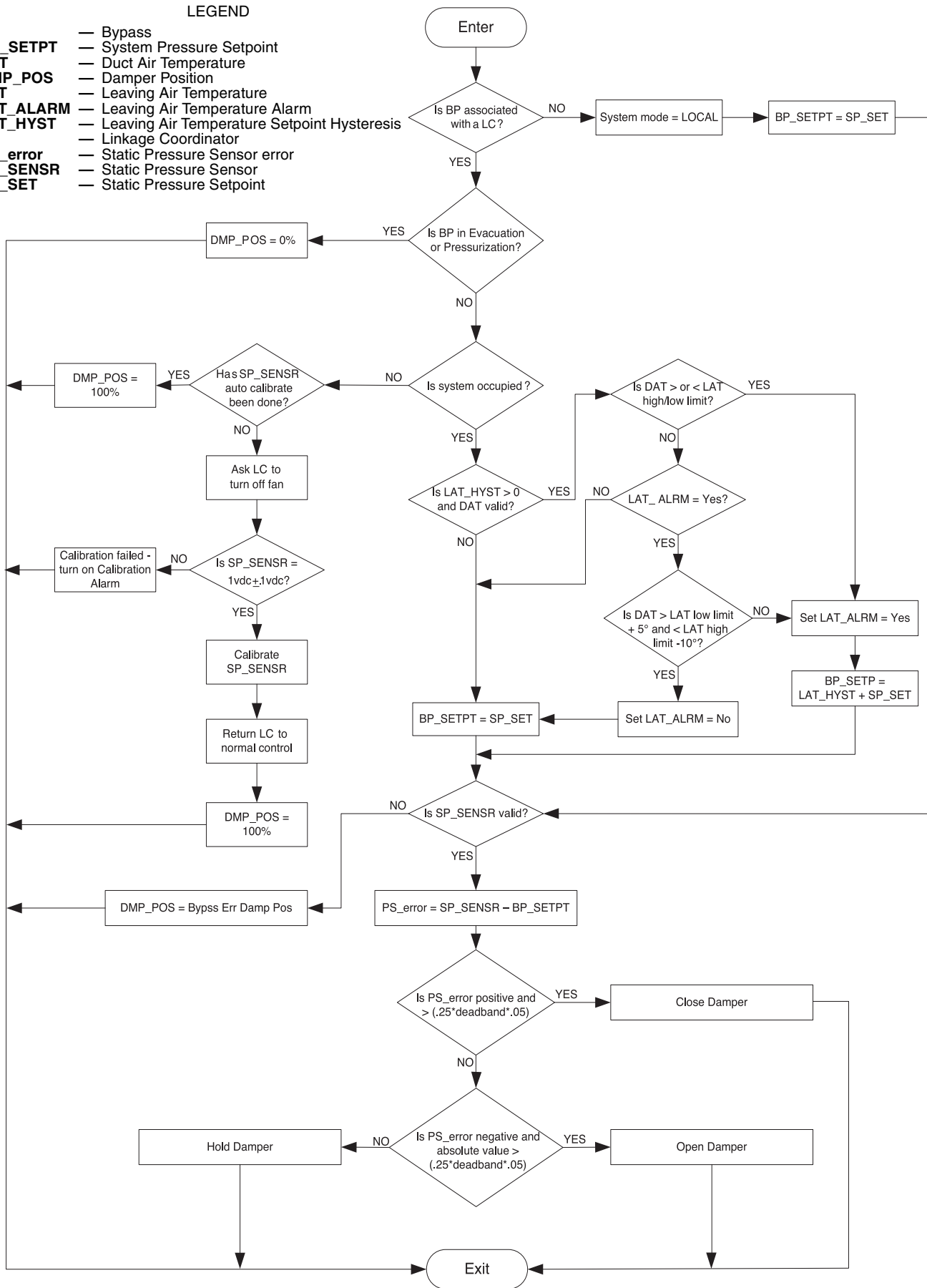


Fig. 12 — Bypass Controller Operation Flow Chart