

## Excel 10 W7751B,D,F,H VAVII Controllers



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## INTRODUCTION

### Description of Devices

The W7751B,D,F,H Excel 10 VAV II Box Controllers provide enhanced control solutions for single duct, dual duct and constant volume air terminal units. They feature preprogrammed heating/cooling or reheat control algorithms for standard VAV Box control applications that are selected through the E-Vision software configuration tool. They use Echelon® LonWorks® communication technology and the new Free Topology Transceiver (FTT) for greater installation flexibility. In addition, they are the first VAV Box Controllers in the marketplace from any manufacturer that use the LonMark® VAV Controller compliance profile for true openness and interoperability with third party LonMark® devices. They can be used in stand-alone applications or be used in combination with Excel 10 Zone Manager (FTT), other Excel Controllers, and the Excel Building Supervisor, to provide a complete and low cost control solution for small to large commercial buildings.

The W7751B,D,F,H Excel 10 VAV Box Controllers are configurable direct digital controllers designed for pressure independent or pressure dependent single duct VAV, dual duct VAV and constant volume air terminal unit control solutions. Four models are available including a low cost circuit board version (W7751B) for internal panel mounting, two plenum mounted controllers complete with a wiring subbase for easy field installation (W7751D and F) and the low cost W7751H Smart VAV Actuator consisting of the Excel 10 Controller that is factory mounted and wired to a 90 second ML6161B Actuator. All four of the Excel 10 VAV Box Controllers contain an integral microbridge air flow sensor that provides flow measurement for pressure independent applications. The controller configuration is selected using a personal computer and the E-Vision and CARE software configuration tools. The Excel 10 VAV Box Controllers offer many features required in today's commercial buildings including energy saving setpoint reset for electrical demand limit control, standby setpoints for setpoint reset in the occupied mode and unoccupied setpoints for both heating and cooling. The control solutions are scaleable from stand-alone installations, to a networked system using a Zone Manager as the network master or they can be fully integrated into the complete Excel 5000 system with Excel 80, 100, 500 and 600 controllers and Excel Building Supervisor. In addition, they

provide true open communication with the use of the LonMark® Controller compliance profile and the FTT for greater flexibility in network wiring and integration with third party LonMark® devices.

The T7770 are direct-wired wall modules used in conjunction with W7751B,D,F,H Controllers. The zone controlled by the W7751 Controllers will typically use a T7770 Wall Module with a temperature sensor for space temperature measurement in a minimum system configuration. Additional features available in the T7770 model include analog setpoint input, override digital input pushbutton, override status LED and E-Bus network access jack.

The T7780 Digital Display Wall Module (DDWM) has all of the features of the T7770 Wall Modules but communicates via the E-Bus.

The C7770A Air Temperature Sensor is a direct wired temperature sensor that is used to sense discharge or return air in a duct controlled by a W7751 Controller.

The Q7750A Excel 10 Zone Manager is a communications interface that allows devices on the E-Bus network to communicate with devices on the EXCEL 5000® System C-Bus. Fig. 1 shows an overview of a typical system layout. The Q7750A also provides some control and monitoring functions.

### Control Application

VAV systems in commercial buildings typically incorporate a central air handler that delivers a modulated volume of air at a preconditioned temperature to multiple zones. Each zone is serviced by a VAV terminal box unit. Each box incorporates an air flow pickup assembly and motorized damper with optional fan and/or reheat coil. The controller determines and regulates the air flow of conditioned air to the space. The zone being fed by the terminal box will use a T7770 Wall Module or a T7780 DDWM for space temperature determination and access to the E-Bus network for operators. Fig. 2 shows a typical VAV box control application for the W7751B,D,F Controllers. Fig. 3 shows a typical VAV box control application for the W7751H Smart VAV Actuator. Table 1 shows the capabilities of the Excel 10 VAV Box Controllers.

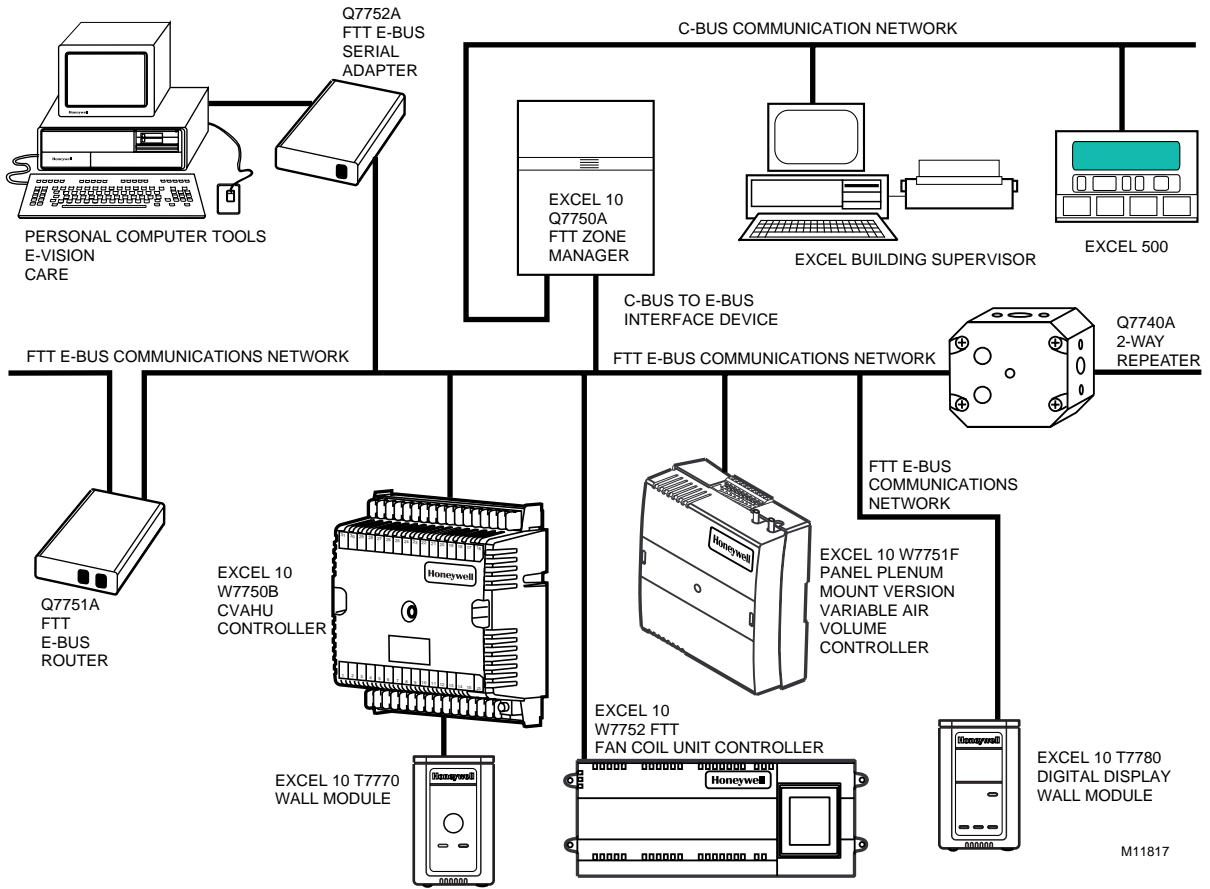


Fig. 1. Typical system overview.

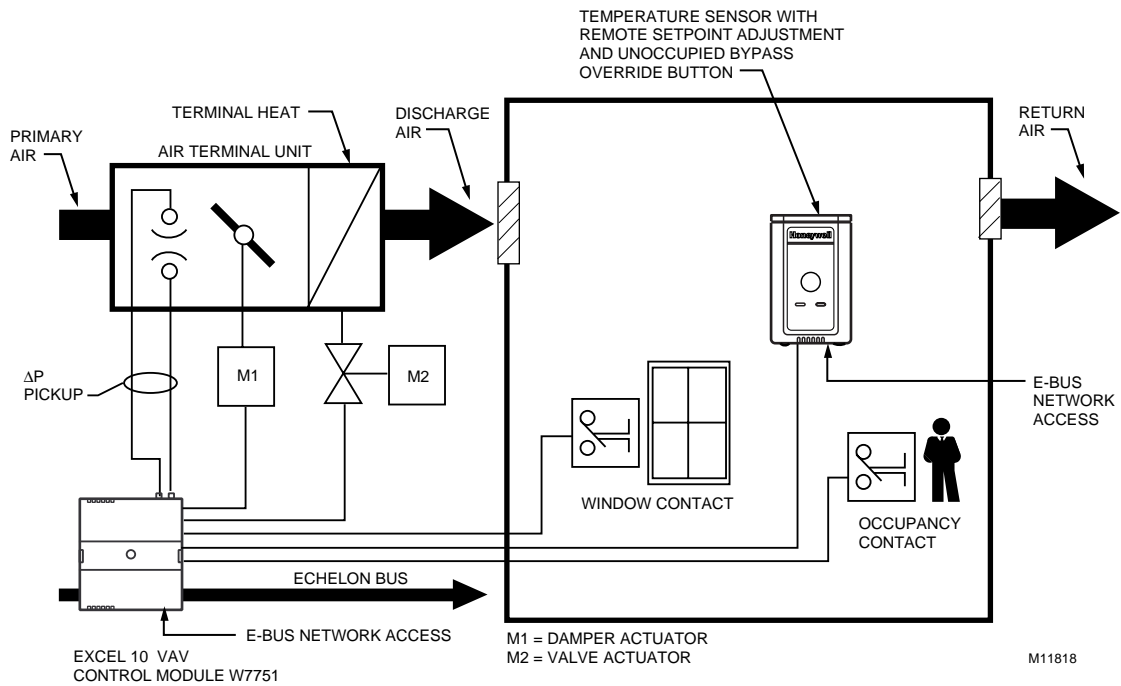
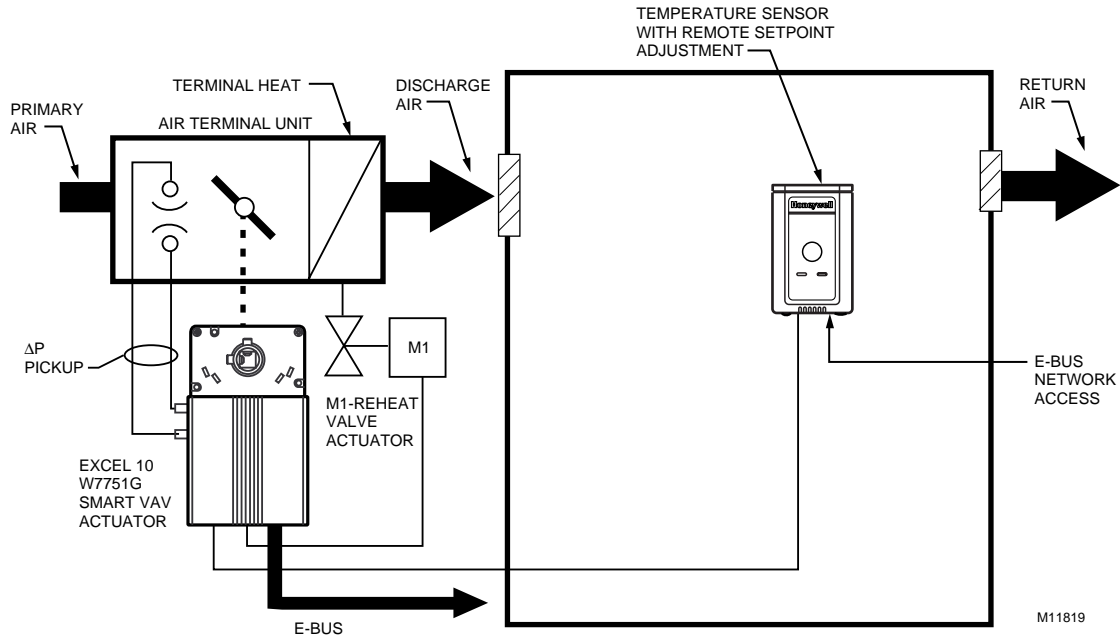


Fig. 2. Typical W7751B,D,F VAV box control application.



**Fig. 3. Typical W7751H Smart VAV Actuator box control application (Smart VAV Actuator mounts directly on the damper shaft as represented by the dotted line). (The W7751H does not include a window contact or occupancy sensor contact terminals, which are available via the network only.)**

**Table 1. Excel 10 VAV Box Controller Capability.**

Excel 10 VAV Box Controller Capability	W7751B,D,F	W7751H
<b>Fan</b>		
None	X	X
Series	X	X
Parallel - Temp	X	X
Parallel - Flow	X	X
Parallel - PWM	X	X
<b>Reheat</b>		
None	X	X
One Stage Reheat	X	X**
Two Stages Reheat	X	X**
Three Stages Reheat	X	—
One Stage Periph	X	X**
Floating Reheat (Two outputs)	X	X**
Floating Periph (Two outputs)	X	X**
Floating Reheat then Periph (Four outputs)	X	—
Floating Periph then Reheat (Four outputs)	X	—
PWM Reheat (One output)	X	X**
PWM Periph (One output)	X	X**
PWM Reheat then Periph (Two outputs)	X	X**
PWM Periph then Reheat (Two outputs)	X	X**

Excel 10 VAV Box Controller Capability	W7751B,D,F	W7751H
<b>Exhaust Tracking</b>		
Disabled	X	X
Enabled	X	X
<b>Occupancy Sensor</b>		
None	X	X
Connected	X	—*
<b>Window Contact</b>		
None	X	X
Connected	X	—*
<b>Wall Module Configuration</b>		
Local	X	X
Shared	X	X
<b>Wall Module Type</b>		
Sensor Only	X	X
Sensor and Setpoint	X	X
Sensor, Setpoint and Bypass	X	X
Sensor and Bypass	X	X

(continued)

**Table 1. Excel 10 VAV Box Controller Capability (Continued).**

Excel 10 VAV Box Controller Capability	W7751B,D,F	W7751H
<b>Air Temperature Sensor</b>		
20 K ohm air temperature sensors can be used in conjunction with wall modules (Either a wall module or an air temperature sensor can be used with the W7751H, but not both.)	X	X
<b>Dual Duct Pressure Independent</b>		
<b>Flow mixing</b> Cold and hot duct flow pickups	X***	X***
<b>Without flow mixing</b> Cold and hot duct flow pickups	X***	X***
<b>Constant volume</b> Cold and hot duct flow pickups	X***	X***
With cold duct pickup only	X	X
Constant volume with discharge pickup only	X****	X****
<b>Dual Duct Pressure Dependent</b>		
With flow mixing	X	X
Without flow mixing	X	X

\* Available only via the network for the W7751H.

\*\* The W7751H Smart VAV Actuator provides damper control and two configurable outputs available for two stages of reheat, floating reheat (requires two outputs), PWM Reheat or Periph (one output required), PWM Reheat and Periph (two outputs required) or one stage of reheat or Periph (can be PWM also) and a serial or parallel fan.

\*\*\* These applications require two W7751 Excel 10 controllers per zone.

\*\*\*\* Flow sensor in discharge air. The temperature control loop controls the cool damper position and the flow controls adjust the heating damper position.

## Control Provided

The W7751B,D,F,H Controllers are primarily intended for pressure independent, single or dual-duct VAV box control. Pressure independent control specifies that the individual zone terminal unit has a means for maintaining a consistent volume of air into the zone regardless of the input static pressure. The controller modulates the air flow into the zone to satisfy the Zone Temperature Setpoint. Minimum Air Flows are maintained except during emergency strategy periods or during building Unoccupied periods if using physical position stops, a MIN/MAX air flow is always maintained (see Table 2).

Pressure dependent control specifies that the damper position is controlled by space temperature only and not by a measurement of air flow volume. The amount of air delivered to the zone at any given damper position is dependent on the static pressure in the supply air duct (physical position stops, range stop pins, are used to keep the damper at a fixed position).

VAV systems generally only provide cool air to the zones; therefore, the W7751 Controller provides additional outputs for control of heating systems such as reheat coils for Heat mode or Morning warm-up mode operation. The heating equipment can be staged-resistive heating, staged 2-position (solenoid) valve, or modulated steam or hot water valve.

The possible modes of operation are listed in Table 2.

**Table 2. Modes Of Operation For Excel 10 VAV Controller.**

Mode	Description	Events Causing a Controller to Switch to This Mode
<b>Effective Occupancy (User Address: StatusOcc)</b>		
OCCUPIED*	Controller is in Occupied mode.	Any of the following: Network input (DestSchedOcc) containing time-of-day schedule flag from either the Excel 10 Zone Manager, a C-Bus controller, an Occupancy Sensor Digital Input, or from Network input (DestManMode) for manual override to OCCUPIED mode.
STANDBY*	Controller is in Standby mode.	Network input (DestSchedOcc) containing time-of-day schedule flag from the Excel 10 Zone Manager must be OCCUPIED and the Occupancy Sensor Digital Input must be UNOCCUPIED.
UNOCCUPIED	Controller is in Unoccupied mode.	Network input (DestSchedOcc) containing time-of-day schedule flag from the Excel 10 Zone Manager, the C-Bus, or the network input CmdManOcc has a value of UNOCCUPIED.
<b>Override Modes (User Address: StatusOverride)</b>		
OCCUPIED*	Controller is in Occupied mode.	Network input (DestSchedOcc) containing time-of-day schedule flag from the Excel 10 Zone Manager, the C-Bus, the Occupancy Sensor Digital Input or from the Network input (DestManMode) for manual override to OCCUPIED mode.
UNOCCUPIED	Controller is in Unoccupied mode.	Network input (DestSchedOcc) containing time-of-day schedule flag from the Excel 10 Zone Manager, the C-Bus, or the network input DestManualOcc has a value of UNOCCUPIED.
BYPASS	User-initiated Bypass of the Unoccupied mode.	Digital input (Bypass pushbutton) has been pressed, and the Bypass duration timer has not yet expired, or the network input DestManualOcc has a value of BypassTime.
NOT ASSIGNED	No Bypass action.	No Override input received.
<b>Operational Modes (User Address: StatusMode)</b>		
START-UP AND WAIT (followed by) FLOAT_OUT_SYNC	Flow Diversity on power-up provides a staggered start sequence to evenly apply the load to the supply fan and electrical system.	These modes occur on controller power-up, and after downloading to the controller from E-Vision or going to auto mode to manual mode (DestManMode). Temperature and flow control loops are disabled.
COOLING	The Excel 10 VAV Controller is controlling the Cooling mode.	Network input (DestHvacMode) containing AHU operational mode information from other E-Bus controllers that have the value of COOL/AUTO.
HEATING	The Excel 10 VAV Controller is controlling the Heating mode.	Network input (DestHvacMode) containing AHU operational mode information from other E-Bus controllers that have the value of HEAT/AUTO.
REHEAT	The Excel 10 VAV Controller is controlling the Reheating mode.	Network input (DestHvacMode) has the value of AUTO, so that when cool air is supplied to the box and the space temperature is below the Heating Setpoint, causes the Excel 10 VAV Controller control algorithm to energize the Reheat coil(s).
MORNING WARM-UP	The main AHU is supplying warm air, and the box damper is set at (WarmupDmprPos).	Network input (DestHvacMode) containing AHU operational mode information from E-Bus controllers that have the value of MORNING WARM-UP.
NIGHT PURGE	The main AHU is supplying fresh (100 percent outdoor) air, and the box damper is set at (PurgeDmprPos).	Network input (DestHvacMode) containing AHU operational mode information from E-Bus controllers that have the value of NIGHT PURGE.
PRESSURIZE	The box damper is set at (PressDmprPos).	Network input (DestHvacMode) containing smoke control signal from E-Bus controllers that have the value of PRESSURIZE.
DEPRESSURIZE	The box damper is set at (DepressDmprPos).	Network input (DestHvacMode) containing smoke control signal from E-Bus controllers that have the value of DEPRESSURIZE.
FLOW TRACKING	Temperature control is turned off. The box maintains a Flow Setpoint based on the sum of all of the controllers supplying the zone (the SrcBoxFlow controller provides other controllers with DestFlowTrack input).	Configuration parameter is box type (Flow_Tracking). NOTE: See Fig. 45. FlowTrackOfst (Flow Offset) determines the differential between the boxes that are the supply air flow and the exhaust air flow.

\*Available only via the network for the W7751H.

(continued)



Table 2. Modes Of Operation For Excel 10 VAV Controller (Continued).

Mode	Description	Events Causing a Controller to Switch to This Mode
MANUAL POSITION	Box damper is set to (ManDamp).	Typically this is done through E-Vision or XBS by setting the point DamperPos to Manual mode.
<b>Operational Modes (User Address: StatusMode)</b>		
MANUAL FLOW	Air Flow Setpoint is set to (DestManFlowSpt).	Typically this is done through E-Vision or XBS by setting the point SupplyFlow to Manual mode.
MANUAL	See comments for FlowManState in Appendix D, Table D7. LonMark®.	—
CLOSED*	Indicates a window is open; box damper is set to (WinOpnDmprPos).	The (Window) Digital Input contacts are open and the controller is configured for a window sensor.
SELF TEST	Control algorithm is disabled; various hardware tests can be performed.	The variable (TestMode) was set to TESTING. NOTE: This mode is available in Excel 10 VAV Controller versions and also include the W7751H Smart VAV Actuator.
I/O TEST	Control algorithm is disabled, various hardware tests can be performed (see I/O Test Mode, Application Step 7. Troubleshooting).	The I/O test pin/pad is shorted (see the I/O Test Mode, Application Step 7. Troubleshooting). NOTE: The I/O Test Mode is not available on the W7751H Smart VAV Actuator.
FLOAT_OUT_SYNC	Controller is synchronizing actuators.	Control loops are temporarily suspended. NOTE: For controllers that enter the Unoccupied mode, its actuators are controlled and resynchronize during a time frame of 125 percent of the actuators motor speed; for example, if an actuators motor speed is 90 seconds, the actuator would resynchronize after 112 seconds once its controller entered the Unoccupied mode.  If a controller remains in continuous Occupied mode, the actuators that it controls resynchronize approximately once every 24 hours based on the CPU clock of the controller. If a controller remains in continuous Occupied mode it resynchronizes randomly during this time period of one hour.
DISABLED	Shutoff control algorithm	Network input (DestManMode) containing AHU operational mode information from other E-Bus controllers that have the value of DISABLED.

\*Available only via the network for the W7751H.

## Products Covered

This System Engineering Guide describes how to apply the Excel 10 family of W7751 VAV Controllers and related accessories to typical applications. The specific devices covered include:

- W7751B,D,F,H Controllers.
- T7770A through D Wall Modules.
- T7780 Digital Display Wall Module.
- Q7750A Excel 10 Zone Manager.
- Q7751A,B Bus Router.
- Q7752A Serial Adapter.
- Q7740A,B FTT Repeaters.
- 209541B FTT Termination Module.

## Organization of Manual

This manual is divided into three basic parts: the Introduction, the Application Steps, and the Appendices that provide supporting information. The Introduction and Application Steps 1 through 5 provide the information needed to make accurate material ordering decisions. Application Step 6 and the Appendices include configuration engineering that can be started using Excel E-Vision PC Software after the devices and accessories are ordered. Application Step 7 is troubleshooting. The organization of the manual assumes a project is being engineered from start to finish. If an operator is adding to, or is changing an existing system, the Table of Contents can provide the relevant information.

## Applicable Literature

The following list of documents contains information related to the Excel 10 family of VAV Box Controllers and the EXCEL 5000® System in general.

Form No.	Title
74-2076C	Excel 10 Technical Literature Collation
74-2942	Excel 10 W7751B,D,F Controller Specification Data
74-2953	Excel 10 W7751H Smart VAV Actuator Specification Data
74-2697	T7770A through G Wall Module Specification Data
74-2955	T7780 Digital Display Wall Module Specification Data
74-2868	Excel 10 C7770A Air Temperature Sensor Specification Data
74-2950	Excel 10 Q7750A, Zone Manager Specification Data
74-2952-1	Excel 10 Q7751A,B Router Specification Data
74-2954-1	Excel 10 Q7752A Serial Interface Specification Data
74-2858	Excel 10 Q7740A,B FTT Repeaters Specification Data
74-2951	Excel 10 Q7750A Zone Manager Checkout and Test Manual
95-7504	Excel 10 W7751B,D,F Controller Installation Instructions
95-7538	T7770A,B,C,D,E,F,G Wall Module Installation Instructions
95-7558	T7780 Digital Display Wall Module Installation Instructions
95-7509	Excel 10 Q7750A Zone Manager Installation Instructions.
95-7510	Excel 10 Q7751A,B Router Installation Instructions
95-7511	Excel 10 Q7752A Serial Interface Installation Instructions
95-7516	Excel 10 SLTA Connector Cable Installation Instructions
95-7555	Excel 10 Q7740A,B FTT Repeaters Installation Instructions
95-7554	Excel 10 209541B Termination Module Installation Instructions
74-2588	Excel E-Vision User's Guide
74-5587	CARE User's Manual
74-1392	CARE Excel 10 Zone Manager User's Guide
74-5577	CARE Icon Guide
74-2039	XBS User's Manual
74-5018	XBS Application Guide

## Product Names

The W7751 Controller is available in four models:

- W7751B VAV Box Controller for OEM mounting on a VAV box.
- W7751D VAV Box Controller mounts on either a standard 4 in. by 4 in. electrical junction box or a standard 5 in. by 5 in. electrical junction box (wire passes through junction box to wiring subbase). It can also be snapped onto standard EN 50 022 DIN rail 35 mm by 7.5 mm (1-3/8 in. by 5/16 in.).
- W7751F VAV Box Controller mounts into either a panel with screws or snaps onto standard EN 50 022 DIN rail 35 mm by 7.5 mm (1-3/8 in. by 5/16 in.). Wires are terminated externally to wiring subbase.
- W7751H Smart VAV Actuator is a VAV controller that is factory mounted to an ML6161B1000 Actuator. The actuator/controller assembly is field mounted to the VAV box damper shaft similar to the mounting of a standard actuator, and the controller wiring is terminated to the screw terminals that are located under a snap-on cover.

The T7770 Wall Module is available in five models:

- T7770A1006 Wall Module with temperature sensor. Use with Excel 5000 or Excel 10 Controllers.
- T7770A2004 Wall Module with temperature sensor and E-Bus network connection. Use with Excel 5000 or Excel 10 Controllers.
- T7770B Wall Module with temperature sensor, setpoint, and E-Bus network connection. Use with Excel 5000 or Excel 10 Controllers.
- T7770C Wall Module with temperature sensor, setpoint, Bypass button and LED, and E-Bus network connection. Use with Excel 5000 or Excel 10 Controllers.
- T7770D Wall Module with temperature sensor, Bypass button and LED, and E-Bus network connection. Use with Excel 5000 or Excel 10 Controllers.

NOTE: The T7770B,C Models are available with a relative scale plate adjustable in E-Vision °F (± 5°C).

The T7780 DDWM is available in four models:

- T7780 DDWM displays and provides space temperature, setpoint, Occ/Unocc override, Application Mode, and Fan mode/speed selection for all Excel 10 controllers (except W7751A,C,E,G).

Other products:

- Q7750A Excel 10 Zone Manager.
- Q7751A,B Bus Router.
- Q7752A Serial Adapter.
- Q7740A,B FTT Repeaters
- 209541B FTT Termination Module
- ML6161 Series 60 Damper Actuator.
- M6410A Series 60 Valve Actuator (use with V5812 or V5813 Valves).
- ML684A Series 60 Versadrive Valve Actuator (use with V5011 and V5013 Valves).
- MMC325-010 Transducer, Series 60 to pneumatic 0 to 10 psi.
- MMC325-020 Transducer, Series 60 to pneumatic 0 to 20 psi.
- ML6464A Direct Coupled Damper Actuator, 66 lb.-in. torque, Series 60.
- ML6474 Direct Coupled Damper Actuator, 132 lb.-in. torque, Series 60.
- ML6185A Direct Coupled Damper Actuator, Spring Return, Series 60.

- ML7984B Direct Coupled Valve Actuator, PWM (use with V5011 or V5013F,G Valves).
- EL7680A1008 Wall Module Infrared Occupancy Sensor.
- EL7628A1007 Ceiling Mounted Infrared Occupancy Sensor.
- EL7611A1003 Ultrasonic Occupancy Sensor.
- EL7612A1001 Ultrasonic Occupancy Sensor.
- AK3781 E-Bus (non-plenum): 22 AWG (0.325 mm<sup>2</sup>) twisted pair solid conductor, non-shielded wire (one twisted pair).
- AK3782 E-Bus (non-plenum): 22 AWG (0.325 mm<sup>2</sup>) twisted pair solid conductor, non-shielded wire (two twisted pairs).

- AK3791 E-Bus (plenum): 22 AWG (0.325 mm<sup>2</sup>) twisted pair solid conductor, non-shielded wire (one twisted pair).
- AK3792 E-Bus (plenum): 22 AWG (0.325 mm<sup>2</sup>) twisted pair solid conductor, non-shielded wire (two twisted pairs).

Refer to Table 10 in Application Step 5. Order Equipment for a complete listing of all available part numbers.

NOTE: The Q7750A Zone Manager is referred to as (E-Link) in internal software and CARE.

## Agency Listings

Table 3 provides information on agency listings for Excel 10 products.

**Table 3. Agency Listings.**

Device	Agency	Comments
<b>W7751B,D,F Controllers</b>	UL	Tested and listed under UL916 (file number E87741).
	CSA	Listed (LR95329-3).
	FCC	Complies with requirements in FCC Part 15 rules for a Class A Computing Device. Operation in a residential area may cause interference to radio or TV reception and require the operator to take steps necessary to correct the interference.
	FCC	Complies with requirements in FCC Part 15 rules for a Class B Computing Device. Operation in a residential area can cause interference to radio or TV reception and require the operator to take steps necessary to correct the interference.
<b>W7751H Smart VAV Actuator</b>	UL	Tested and listed under UL916 (file number E87741).
	cUL	Tested and listed under UL916 (file number E87741).
	CE	General Immunity per European Consortium standards EN50081-1 (CISPR 22 Class B) and EN 50082-1:1992 (based on Residential, Commercial, and Light Industrial). EN 61000-4-2 IEC 1000-4-2 (IEC 801-2) Electromagnetic Discharge. EN 50140, EN 50204 IEC 1000-4-3 (IEC 801-3) Radiated Electromagnetic Field. EN 61000-4-4 IEC 1000-4-4 (IEC 801-4) Electrical Fast Transient (Burst).  Radiated Emissions and Conducted Emissions. EN 55022:1987 Class B. CISPR-22: 1985.
	FCC	Complies with requirements in FCC Part 15 rules for a Class B Computing Device. Operation in a residential area may cause interference to radio or TV reception and require the operator to take steps necessary to correct the interference.
<b>T7770A through D Wall Modules</b>	UL	(Not applicable.)
	CSA	(Not applicable.)
	FCC	(Not applicable.)
<b>T7780 DDWM</b>	CE	Emissions; EN50081-1, EN55022 (CISPR 22 Class B), Immunity 50082-1
	UL &cUL	Tested and listed under UL916, S8L9 Energy Management Equipment.
	FCC	Complies with requirements in FCC Part 15 rules for a Class B Computing Device.

(continued)

Table 3. Agency Listings (Continued).

Device	Agency	Comments
<b>Q7750A Excel 10 Zone Manager</b>	UL	Tested and listed under UL916, file number S4804 (QVAX, PAZY).
	CSA	Listing pending.
	FCC	Complies with requirements in FCC Part 15 rules for a Class A Computing Device. Operation in a residential area can cause interference to radio or TV reception and require the operator to take steps necessary to correct the interference.
<b>Q7751A,B Router, Q7752A Serial Adapter</b>	UL	UL1784.
	CSA	Listed.
	FCC	Complies with requirements in FCC Part 15 rules for a Class B Computing Device.

## Abbreviations and Definitions

**AHU** - Air Handling Unit; the central fan system that includes the blower, heating equipment, cooling equipment, ventilation air equipment, and other related equipment.

**Box** - A VAV terminal unit box.

**CAV** - Constant Air Volume; a TUC that maintains a fixed air flow through the box.

**CO** - Carbon Monoxide. Occasionally used as a measure of indoor air quality.

**CO<sub>2</sub>** - Carbon Dioxide. Often used as a measure of indoor air quality.

**CARE** - Computer Aided Regulation Engineering; the PC based tool used to configure C-Bus and E-Bus devices.

**C-Bus** - Honeywell proprietary Control Bus for communications between EXCEL 5000® System controllers and components.

**CPU** - Central Processing Unit; an EXCEL 5000® System controller module.

**cUL** - Underwriters Laboratories Canada.

**CVAHU** - Constant Volume AHU; refers to a type of air handler with a single-speed fan that provides a constant amount of supply air to the space it serves.

**DDF** - Delta Degrees Fahrenheit.

**DDWM** - Digital Display Wall Module.

**D/X** - Direct Expansion; refers to a type of mechanical cooling where refrigerant is (expanded) to its cold state, within a heat-exchanging coil that is mounted in the air stream supplied to the conditioned space.

**E-Bus** - Honeywell implementation of Echelon® LonWorks® network for communication among Excel 10 Controllers.

**E-Bus Segment** - An E-Bus section containing no more than 60 Excel 10s. Two segments can be joined together using a router.

**Echelon®** - The company that developed the LON® bus and the Neuron® chips used to communicate on the E-Bus.

**Economizer** - Refers to the mixed-air dampers that regulate the quantity of outdoor air that enters the building. In cool outdoor conditions, fresh air can be used to supplement the mechanical cooling equipment. Because this action saves energy, the dampers are often referred to as *economizer dampers*.

**EMI** - Electromagnetic Interference; electrical noise that can cause problems with communications signals.

**E-Link** - Refers to the Q7750A Zone Manager. This name is used in internal software and in CARE software.

**EMS** - Energy Management System; refers to the controllers and algorithms responsible for calculating optimum operational parameters for maximum energy savings in the building.

**EEPROM** - Electrically Erasable Programmable Read Only Memory; the variable storage area for saving user setpoint values and factory calibration information.

**EPROM** - Erasable Programmable Read Only Memory; the firmware that contains the control algorithms for the Excel 10 Controller.

**Excel 10 Zone Manager** - A controller that is used to interface between the C-Bus and the E-Bus. The Excel 10 Zone Manager also has the functionality of an Excel 100 Controller, but has no physical I/O points.

**NOTE:** The Q7750A Zone Manager can be referred to as E-Link in the internal software, CARE.

**Firmware** - Software stored in a nonvolatile memory medium such as an EPROM.

**Floating Control** - Refers to Series 60 Modulating Control of a valve or damper. Floating Control utilizes one digital output to pulse the actuator open, and another digital output to pulse it closed.

**IAQ** - Indoor Air Quality. Refers to the quality of the air in the conditioned space, as it relates to occupant health and comfort.

**I/O** - Input/Output; the physical sensors and actuators connected to a controller.

**I x R** - I times R or current times resistance; refers to Ohm's Law:  $V = I \times R$ .

**K** - Degrees Kelvin.

**Level IV** - Refers to a classification of digital communication wire. Formerly known as UL Level IV, but *not* equivalent to Category IV cable. If there is any question about wire compatibility, use Honeywell-approved cables (see Step 5 Order Equipment section).

**OEM** - Original Equipment Manufacturer; the company that builds the VAV boxes.

- NEC** - National Electrical Code; the body of standards for safe field-wiring practices.
- NEMA** - National Electrical Manufacturers Association; the standards developed by an organization of companies for safe field wiring practices.
- Node** - A Communications Connection on a network; an Excel 10 Controller is one node on the E-Bus network.
- NV** - Network Variable; an Excel 10 parameter that can be viewed or modified over the E-Bus network.
- PC** - An IBM compatible Personal Computer with 386 or higher processor and capable of running Microsoft® Windows™ Version 3.1.
- Pot** - Potentiometer. A variable resistance electronic component located on the T7770B,C Wall Module; used to allow user-adjusted setpoints to be input into the Excel 10 Controller.
- PWM** - Pulse Width Modulated output; allows analog modulating control of equipment using a digital output on the controller.
- RTD** - Resistance Temperature Detector; refers to a type of temperature sensor whose resistance output changes according to the temperature change of the sensing element.
- Subnet** - An E-Bus segment that is separated by a router from its Q7750A Zone Manager.
- TOD** - Time-Of-Day; the scheduling of Occupied and Unoccupied times of operation.
- TCU** - Terminal Control Unit; industry can refer to VAV box controllers such as the Excel 10 VAV Controller as TCUs.
- TUC** - Terminal Unit Controller; industry can refer to VAV box controllers such as the Excel 10 VAV Controller as TUCs.
- VA** - Volt Amperes; a measure of electrical power output or consumption as applies to an ac device.
- Vac** - Voltage alternating current; ac voltage rather than dc voltage.
- VAV** - Variable Air Volume; refers to either a type of air distribution system, or to the W7751 Excel 10 VAV Box Controller that controls a single zone in a variable air volume delivery system.
- VOC** - Volatile Organic Compound; refers to a class of common pollutants sometimes found in buildings. Sources include out-gassing of construction materials, production-line by-products, and general cleaning solvents. A VOC is occasionally used as a measure of indoor air quality.
- W7751** - The model number of the Excel 10 VAV Box Controllers (also see VAV).
- Wall Module** - The Space Temperature Sensor and other optional controller inputs are contained in the T7770 or T7780 Wall Modules. See Application Step 5. Order Equipment for details on the various models of Wall Modules.
- XBS** - Excel Building Supervisor; a PC based tool for monitoring and changing parameters in C-Bus devices.

## Zone Control Definitions

### Variable Air Volume ATUs

Variable air volume (VAV) ATUs are commonly called VAV boxes. Each VAV box has a controller that controls the temperature of a room or zone by modulating a damper in the VAV box to vary the amount of conditioned air supplied to the zone rather than changing the temperature of the conditioned air. They are used in larger buildings that have many zones along with a central air handling fan that supplies conditioned air via a pressurized main air duct system. The central air handling fan has a separate equipment controller that controls discharge air temperature, humidity, and supply duct static pressure.

### Air Terminal Unit Control

Air terminal units (ATUs) regulate the amount of conditioned air delivered to satisfy the temperature requirements of a room or space. ATUs are classified by air handling system design and are available in several configurations. ATUs may be of variable air volume or constant volume design, and may be used in single-duct or dual-duct air handling systems. ATU controls can be as basic as a room thermostat controlling a damper or a more complex direct digital controller operating a damper, a terminal fan and enabling a reheat coil. In all cases, each ATU has a controller that is used to control the environment of the room or space.

### Pressure - Dependent And Pressure - Independent Control

Static pressure variations in an air handling system can affect terminal unit operation. Pressure-dependent terminal units are affected by changing duct static pressures because their damper position is determined by space temperature only. They may have mechanical or electric minimum and maximum air flow limits. Pressure-independent terminal units can automatically adjust to duct pressure changes because they contain air flow sensors and the controllers compensate for pressure changes in the main air distribution system. The damper position in pressure independent terminal units is determined by both space temperature and air flow volume.

### Variable Air Volume ATUs (VAV)

Variable air volume (VAV) ATUs are commonly called VAV boxes. Each VAV box has a controller that controls the temperature of a room or zone by modulating a damper in the VAV box to vary the amount of conditioned air supplied to the zone rather than changing the temperature of the conditioned air. They are used in larger buildings that have many zones along with a central air handling Unit (AHU) that supplies conditioned air via a pressurized main air duct system.

## Single Duct Variable Air Volume (VAV) Systems

Single duct VAV systems are used in over 80 percent of the VAV applications and employ one main supply air duct from the central air handling system. The air handling unit supplies cool air virtually one hundred percent of the time, with the only exception being a morning warm-up cycle that is used in buildings that are not continuously occupied, that temporarily raises the discharge air temperature of the central air handling system to quickly warm the building from its unoccupied zone temperatures to the occupied zone temperatures. Since the central air handling system is usually supplying cool air, single or multiple electric reheat coils or a modulating hot water (hydronic) reheat coil are often added in the VAV box discharge air duct to reheat the cool air when the zone becomes too cold. VAV boxes with reheat coils typically have a series or parallel fan in the VAV box to ensure air flow across the coil in the heating mode.

### Pressure Dependent Throttling VAV Boxes

Pressure dependent throttling VAV boxes are the simplest and least expensive ATU. A controller modulates a damper actuator according to the temperature in the zone. The pressure dependent VAV box usually has minimum and/or maximum damper position setpoint stops in the controller for limiting air volume. Because the unit is pressure dependent, the volume of air distributed to the zone at any given space temperature varies with the supply duct static pressure at the inlet of the VAV box. Maintaining a stable duct static pressure is important for proper operation and proper setting of the minimum damper position setpoint stop is essential for adequate circulation. When reheat coils and/or finned tube radiation are used the controller will set the damper position at a minimum position during the heating mode to ensure some air flow into the space and optimize heat transfer from the reheat coil. Pressure dependent VAV boxes are used in smaller buildings or in areas of larger buildings where the supply duct static pressure is low and stable.

### Pressure Independent VAV Boxes

Pressure-independent or variable constant-volume VAV boxes are essentially air flow control devices that deliver a constant volume of air to a conditioned space at a given temperature despite a varying supply duct static pressure. An air flow sensor in the inlet of the VAV box is used to measure the volume of air and the *VAV box controller resets the air flow volume setpoint as the thermal load changes in the space*. Therefore, a pressure independent VAV box controller provides two control sequences; zone temperature control and terminal unit air flow control. The controller usually has a minimum air flow setpoint to maintain air flow at light load conditions and a maximum air flow setpoint to limit the air flow to meet the design conditions for the zone. A single zone sensor can be used to control multiple VAV boxes with differing volume ratings. When reheat coils and/or finned tube radiation are used with this unit the controller will lower the air flow setpoint during the heating mode to ensure air flow into the room and optimize heat transfer from the reheat coil. Pressure independent VAV boxes are used in buildings with larger air handling systems that have constant duct static pressure fluctuations due to the large number of zones.

## Series Fan Powered VAV Boxes

Series Fan-powered VAV boxes are similar to pressure dependent and/or pressure independent VAV boxes, except they include an integral fan in series with the VAV box discharge duct that recirculates space air at constant volume and enhances the air distribution in the zone. Primary air is modulated by the VAV box damper to meet space demand for cooling and as primary air modulates down, more plenum air is drawn in by the fan to maintain a constant discharge volume to the zone. Typically the series fan is on continuously during occupied hours, or it can be programmed to be activated as primary air decreases to ensure adequate air circulation. In addition to enhancing air distribution, the units serving the perimeter area of a building usually include a reheat coil that is sequenced with the primary air damper to supply heat when required. When the primary air system is not operating (nighttime or unoccupied control mode), the night operating mode of the controller enables the fan and the reheat coil to maintain the lower unoccupied temperature setpoint in the space. Series Fan Powered VAV boxes can be pressure independent or pressure dependent.

### Parallel Fan Powered VAV boxes

Parallel Fan Powered VAV boxes or Bypass Fan Induction Terminal Units are similar to Series Fan-powered VAV terminal units, except the fan is located in the return plenum and does not run continuously during occupied hours. When the zone temperature is low and the need for primary air decreases, the controller modulates the primary air damper to a minimum and enables the fan, which recirculates warm air from the return plenum into the zone acting as the first stage of reheat. If a reheat coil is used the fan is cycled on when the reheat coil is enabled. As the space warms, the reheat valve closes and the fan cycles off as the primary air damper opens to allow delivery of conditioned air from the air handling system. When heating is required in the unoccupied mode, the fan at the central air handling system remains off, the VAV box fan and the reheat coil are enabled and the zone is heated to a reduced night setback temperature using air from the return air plenum. Parallel Fan Powered VAV boxes can be pressure independent or pressure dependent.

### Induction VAV Boxes

Induction VAV boxes use induced return air as the reheat medium which means no parallel fan is present in the VAV box. Induction VAV boxes are usually installed above the ceiling and draw return air from the plenum created by a false ceiling. The VAV box controller uses an air flow sensor for controlling air flow and a room sensor for controlling room temperature similar to pressure independent VAV boxes. The volume of air coming through the primary damper is controlled by positioning both dampers simultaneously so that as the primary air damper closes, the return air damper opens. Return air is thus drawn into the unit and recirculated into the space. Like pressure independent VAV boxes the controller resets the air flow setpoint of the controller as the thermal load changes in the conditioned space. For extremely cold design conditions, a reheat coil can be added.

The induction VAV ATU maintains satisfactory air motion at lower loads than a throttling VAV box can, however, the wide use of Parallel Fan Powered VAV boxes has now limited the use of Induction VAV boxes.

## Single-Duct Constant Volume Zone Reheat Air Terminal Units

Single-Duct Constant Volume Zone Reheat Systems are used in low static pressure systems and have a heating coil (hot water, steam, or electric) in the branch supply duct to each zone. The central air-handling unit supplies constant temperature air and a manual balancing damper in each zone is set in a fixed position to determine the amount of air delivered to that zone. The volume of air delivered to each zone will change as the static pressure of the supply duct changes, however, in low static pressure systems the changes in the supply duct static pressure are small and do not have a dramatic effect on the amount air delivered to the zone. The control strategy used in single zone reheat systems is simple and involves activating electric heat or positioning a valve in conjunction to the zone temperature. In most cases this is accomplished using a simple space thermostat. However, direct digital controllers can be used in these cases to control multiple zone valve positions the reheat coil valve (or electric heating elements) as required to maintain space condition.

## Dual Duct Air Handling Systems

In a dual-duct air handling system, supply air is divided at the central fan and hot air and cold air flow through separate ducts to the perimeter zones in the building. Dual-duct terminal units are essentially mixing boxes with two supply inlets and one discharge outlet. The air is allowed to mix in the mixing box section and is discharged out of a single duct into the zone. Since a source of heating is available reheat coils are not used in the zone. Basic dual-duct mixing systems were not economical because supply air was cooled and heated year round and modern energy codes prohibited their use in many cities in the U.S. except in critical applications like hospitals, nursing homes, etc. However, with direct digital controllers and networked systems the individual zone data can be used to reset hot and cold duct temperatures as needed, allowing dual duct systems to be used more often in today's applications. Dual duct systems are often used in conjunction with single duct systems in the same building.

## Variable Constant Volume (Zero Energy Band) Dual-Duct VAV Boxes

Variable Constant Volume (Zero Energy Band) Dual-Duct VAV Boxes have inlet dampers (with individual damper actuators and air flow sensors) on the cooling and heating supply ducts. The air flow is pressure independent and the Dual Duct VAV Box controller uses the zone temperature to determine the required flow of hot and cold air from the respective ducts into the mixing box and resets the hot duct and cold duct air flow setpoints in sequence as space load changes. The Zero Energy Band (ZEB) is an energy conservation technique that allows temperatures to float between programmable settings to prevent the consumption of heating or cooling energy while the temperature is in this range. As space temperature rises to approach the controller setpoint, the hot air flow volume drops to zero. If space temperature continues to rise

through the ZEB, the output signal from the controller modulates the cold-air damper open. The controller maintains adjustable minimum flows for ventilation, with no overlap of damper operations, during the ZEB when neither heating nor cooling is required. For example, if a zone had a setpoint of 74 degrees and a zero energy band of 2 degrees then the zone temperature would be allowed to float between 73 degrees and 75 degrees before the controller would use hot air to heat the zone or cool air to cool the zone. When the ZEB technique is properly used the comfort of the occupants is not sacrificed in the process of saving energy.

## Dual Duct Constant Volume Systems

### Dual-duct mixing box terminal units

Dual-duct mixing box terminal units generally apply to low-static pressure systems that require large amounts of ventilation. The warm duct damper and the cool duct damper are linked to operate in reverse of each other from a single damper actuator. The controller positions the mixing dampers through a damper actuator to mix warm and cool supply air to maintain space condition. Discharge air quantity depends on the static pressure in each supply duct at that location.

### Dual-duct constant volume mixing box terminal units

Dual-duct constant volume mixing box terminal units are typically used on high-static-pressure systems where the air flow quantity to each space is critical. The units are the same as those described in the previous paragraph, except that they include either an integral mechanical constant volume regulator or an air flow constant volume control furnished by the unit manufacturer to change the damper position to maintain a constant air flow volume with changes in duct static pressure.

## Variable Volume/Variable Temperature (VVT)

VVT systems are also called commercial zoning systems and use a constant volume air supply (roof top unit, heat pump, small air handler) with heating, cooling and economizer functions and vary the flow rates and supply-air temperature into smaller, damper-controlled zones through a single duct distribution system. Each zone damper is modulated based on space temperature. However, damper control is based only on zone temperature and there is no flow control at the zone level as there is in a pressure independent variable air volume (VAV) system. Typically, the zone damper is modulated using an analog signal, providing excellent zone temperature control. A method of providing feedback of zone demand is provided which allows a controller at the rooftop to provide the minimum required amounts of heating and cooling (using economizer when acceptable) based on zone demand.

Because a number of zone dampers can possibly be closed, there needs to be a way to relieve pressure in the supply duct. A bypass damper is normally added in a duct between the supply and return ducts to relieve pressure. The pressure relief damper is normally controlled by sensing supply duct pressure and opening to vent supply air directly to return. This is one difference between a commercial zoning system and true VAV. A true VAV air handler actually varies air volume through the blower.

VVT makes it possible to operate a single-zone heating/cooling unit with multiple-zones and is often used in smaller buildings. Small buildings are not appropriate for VAV systems because the heating and cooling loads are not large enough for a VAV system to operate properly. VVT systems also cost less than VAV systems due to the use of constant volume packaged units, lower pressure ductwork, and they often do not require expensive perimeter heat. The main difference between VAV and VVT is the fact that VAV systems vary the amount of air entering a zone and not the temperature, where a VVT system varies both the amount of air and the temperature of the air entering the zone.

### Single Zone Rooftop Air Handling Unit Control (CVAHU)

Single-zone systems use a Constant Volume Air-Handling Unit (CVAHU) which are usually factory-packaged units mounted on the rooftop of the building, however, single zone air handling units can also be located in a mechanical room of buildings. Single zone units are used in smaller buildings, buildings that have a uniform heating/cooling load in large open zones, or in zones that have special comfort requirements that are different from other areas of the building. The building must also have the space available for the associated air handling equipment. Typical installations include; office/warehouse buildings, large open buildings such as supermarkets, restaurants, and ballrooms and lobbies of large buildings and hotels. Since single zone units are associated with only one zone, many single zone air handling units can be installed in a building. Fan volume control, as found in Variable Air Volume systems is not required, because fan volume and duct static pressure are set by the manufacturer to meet the design needs of the zone.

### Temperature and Ventilation Control

A single space controller or thermostat controls the heating coil, ventilation dampers, and cooling coil in sequence as thermal load varies in the conditioned space. On rooftop mounted units the heating coils are typically electric and the cooling is by a self contained air-conditioning system using direct expansion cooling coils. However, single zone air handling systems that are located in a mechanical room of a building often employ hot water (hydronic) heating coils and use chilled water coils for cooling. The ventilation dampers (Outdoor air, Return air, and Exhaust air) are controlled to use outdoor air for the first-stage cooling when the conditions are appropriate. When outdoor air temperature or heat content (enthalpy) rises to the point that it can no longer be used for cooling, an outdoor air limit control overrides the signal to the ventilation dampers and moves them to the minimum ventilation position, as determined by the minimum positioning switch or the minimum position setpoint in the controller. Indoor air quality control is also accomplished with the Single Zone controller using sensors and control strategies that increase the minimum position of the outdoor air damper to allow more fresh air into the building when the indoor air quality is poor. A zero energy band often separates the heating and cooling control ranges, thus saving energy.

### Unitary Equipment Control

Unitary equipment includes natural convection units, radiant panels, unit heaters, unit ventilators, fan coil units, and heat pumps. Unitary equipment does not require a central fan. Depending on design, unitary equipment may perform one or all of the functions of HVAC - ventilation, filtration, heating, cooling, humidification and distribution. Unitary equipment frequently requires a distribution system for steam or hot and/or chilled water.

Control of unitary equipment varies with system design. Typically, a room thermostat provides a signal to a controlled device to regulate the unit. The unit may use a day/night thermostat for operation at lower setpoints during unoccupied hours. If the unit has a fan, a time clock may be used to turn the fan off at night, and a night thermostat may be used to control the temperature within night limits. When DDC control is used all of the thermostat and time clock functionality is contained in the controller.

### Construction

#### Controllers

The Excel 10 VAV Controller is available in four different models. The W7751B circuit board is ready to be snapped into a section of standard 3.25 in. (82 mm) by 9 in. (228 mm) snaptrack, part number 207912. The W7751B model is intended for OEM installation on VAV boxes at the factory. Connections to the wall module terminals (19 through 23) and the E-Bus communications terminals (29 and 30) are made at screw terminal blocks. Connection for access to the E-Bus is provided by plugging the connector into the communications jack. All other connections are made with quarter inch (6.35 mm) quick connects. See Fig. 4.

The W7751D and W7751F models both use the identical 5 in. by 5 in. circuit board contained in the housing cover. This cover can plug into either the W7751D or F Subbase. The W7751D Subbase allows screw terminations to be made on the inside. This subbase either mounts on a standard 4 in. by 4 in. or a standard 5 in. by 5 in. electrical junction box. It can also be snapped onto standard EN 50 022 DIN rail 35 mm by 7.5 mm (1-3/8 in. by 5/16 in.). For W7751D, see Fig. 5. The W7751F Subbase provides screw terminations to be made on the outside. This subbase either mounts on a panel with screws or snaps onto standard EN 50 022 DIN rail 35 mm by 7.5 mm (1-3/8 in. by 5/16 in.). DIN rail is available through local suppliers. Wires are attached to screw terminal blocks on the top and bottom of the subbase. For W7751F, see Fig. 6.

The W7751H Smart VAV Actuator is a physically smaller Excel 10 VAV Controller. The controller enclosure, which contains the controller circuit board, is constructed of a sheet metal housing and a plastic snap-on cover. The sheet metal housing is attached at the factory to the ML6161B Actuator and has two 1/2 in. (13 mm) knockouts that are compatible with 1/2 in. (13 mm) or 3/4 in. (19 mm) conduit, see Fig. 7. The actuator on the Smart VAV Actuator is field mounted to the VAV box damper shaft and its controller wiring is terminated to screw terminals located at the bottom under a snap-on cover.



**CAUTION**

W7751B,D,F Controllers must be mounted vertically as shown in Fig. 4 through 6. Vertical mounting assures adequate air flow for proper heat dissipation in the controller.

The W7751H Smart VAV Actuator is intended for horizontal shaft mounting only for heat dissipation needs.

**IMPORTANT**

If controller flow sensors are connected to unusually dusty or dirty environments, a 5-micron disposable air filter is recommended for use in the high pressure line (marked as +) connected to the air flow pickup. This applies to all controller models. See Table 10 for filter ordering information.

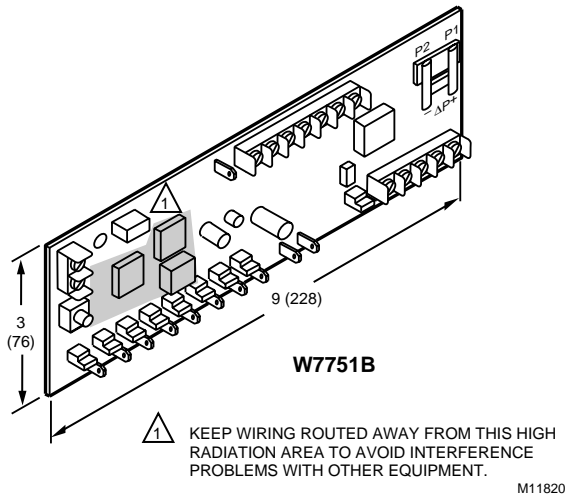


Fig. 4. W7751B construction in in. (mm).

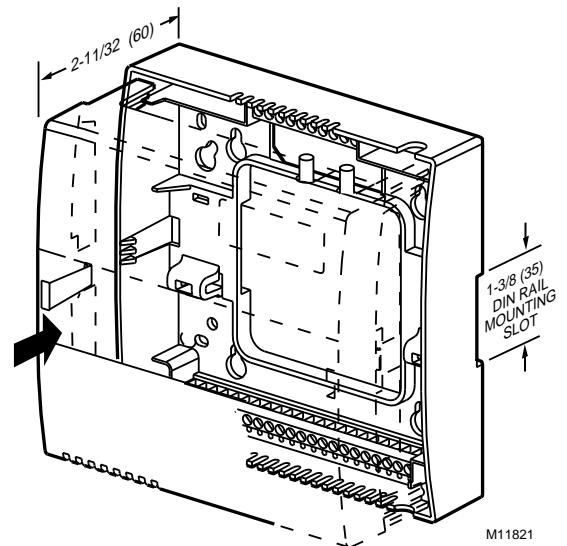
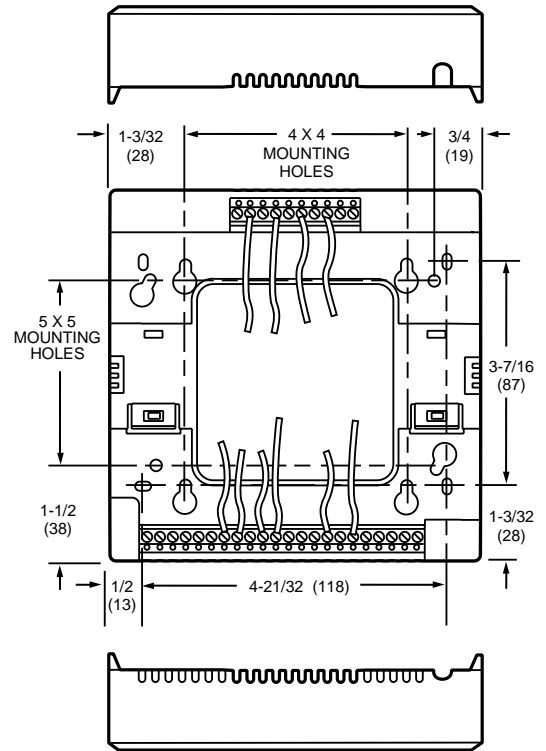


Fig. 5. W7751D construction in in. (mm).

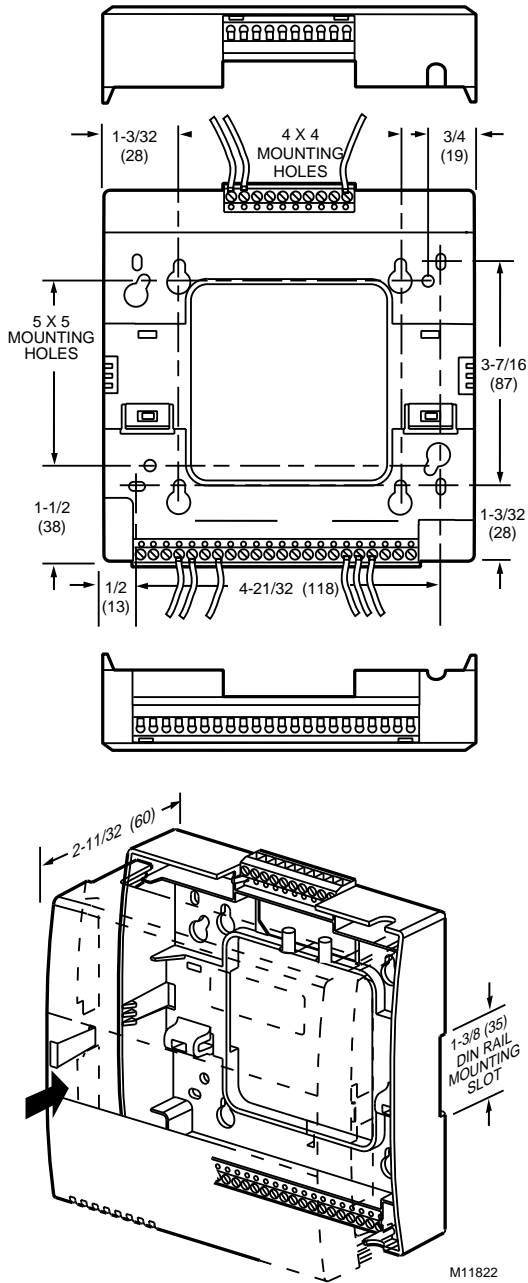


Fig. 6. W7751F construction in in. (mm).

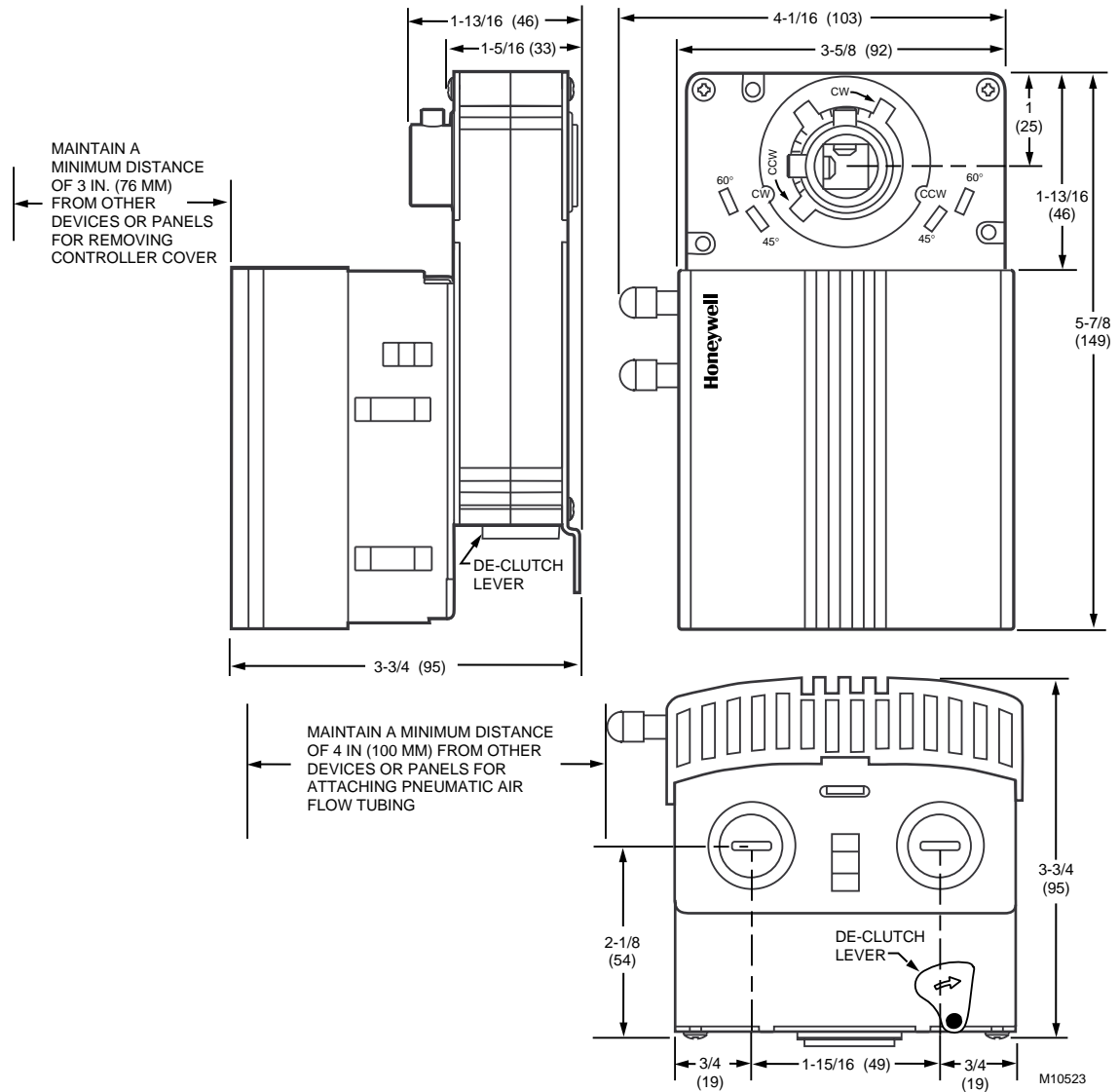


Fig. 7. W7751H construction in in. (mm).

**Performance Specifications**

**Power:**

24 Vac with a minimum of 20 Vac and a maximum of 30 Vac at either 50 or 60 Hz.

**CPU:**

Motorola or Toshiba 3150 Neuron® processor, containing three eight-bit CPU's. Each Neuron has a unique 48-bit network identification number.

**Memory Capacity:**

- 64K ROM/PROM in W7751B,D,F,H
- 512 EEPROM
- 2K RAM

**Specified Space Temperature Sensing Range:**

45° to 99°F (7° to 37°C) with an allowable control setpoint range from 50° to 90°F (10° to 32°C) when initiated from the network and 55° to 85°F (13° to 29°C) when configured and connected to a T7770 Wall Module or T7780 DDWM.

**Communications**

The W7751B,D,F,H Controller uses a transformer-coupled communications port with differential Manchester-encoded data at 78 kilobits per second (kbs). The transformer-coupled communications interface offers a much higher degree of common-mode noise rejection while ensuring dc isolation.

Approved cable types for E-Bus communications wiring is Level IV 22 AWG (0.34 mm<sup>2</sup>) plenum or non-plenum rated unshielded, twisted pair, solid conductor wire. For nonplenum areas, U.S. part AK3781 (one pair) or U.S. part AK3782 (two pair) can be used. In plenum areas, U.S. part AK3791 (one pair) or U.S. part AK3792 (two pair) can be used (see Tables 9 and 10 for part numbers). Contact Echelon® Corp. Technical Support for the recommended vendors of Echelon® approved cables.

The FTT supports a polarity insensitive, free topology wiring scheme that supports star, loop, and/or bus wiring. The maximum bus length when using a combination of star, loop, and bus wiring (singly terminated) is 1640 ft (500m) with the maximum node to node length of 1312 ft (400m). In the event that the limits on the number of nodes or total wire length is exceeded, then a 2-way repeater (Q7740A) can be used to double the node count and the network length or a 4-way repeater (Q7740B) can quadruple the node count and the network length. The maximum number of repeaters per segment is one. A Q7751A E-Bus Router can also be used to effectively double the maximum bus length. The advantage of using the router is that it will segregate traffic to a segment whereas with the repeater all traffic is repeated on each segment. On a doubly terminated E-Bus utilizing bus wiring (continuous daisy-chain with no stubs or taps from the main backbone) the maximum bus length is 4593 ft (1400m) with the maximum node to node length of 3773 ft (1150m).

FTT networks are very flexible and convenient to install and maintain, but it is imperative, to carefully plan the network layout, and create and maintain accurate documentation. Unknown or inaccurate wire run lengths, node to node distances, node counts, total wire length, and misplaced or missing terminators can cause poor network performance. Refer to E-Bus Wiring Guidelines form, 74-2865 for complete description of network topology rules.

**LonMark® Functional Profile**

W7751 Controllers support the LonMark® Functional Profile number 8010 VAV Controller, version 1.0 (see Fig. 8).

**Environmental**

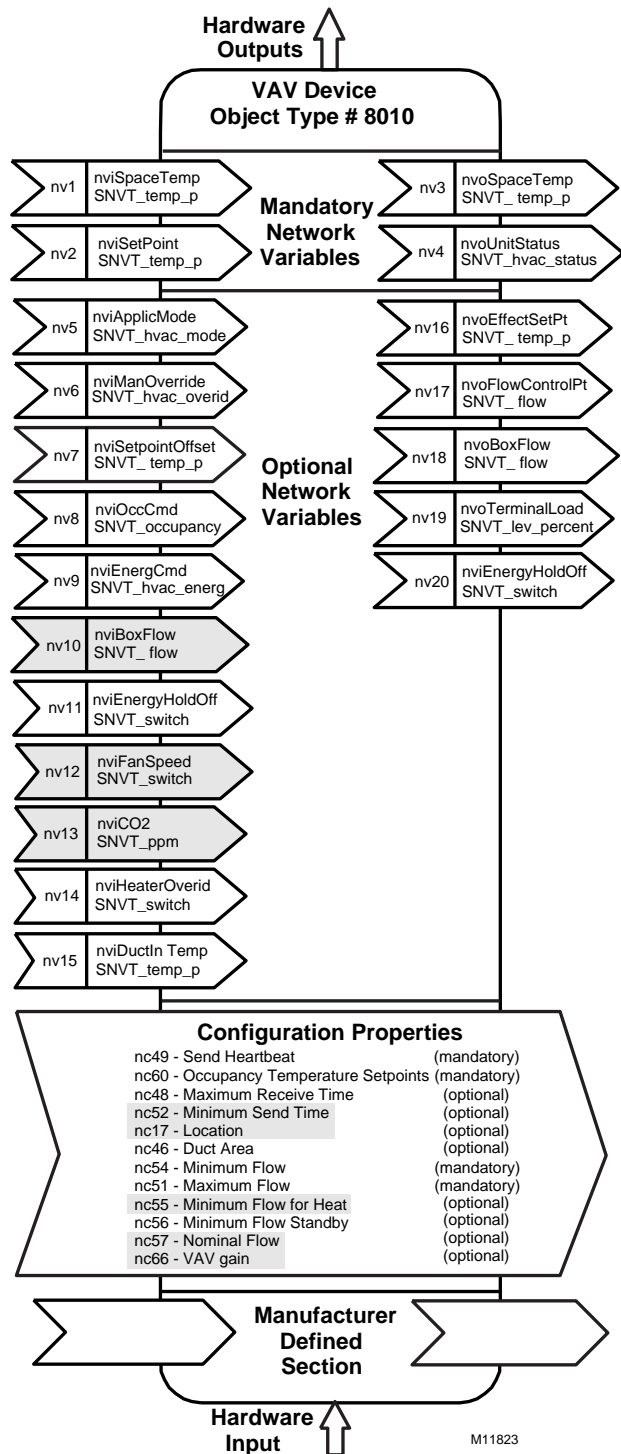
**Operating Temperature:**  
-40° to 150°F (-40° to 65.5°C).

**Shipping Temperature:**  
-40° to 150°F (-40° to 65.5°C).

**Relative Humidity:**  
5 percent to 95 percent noncondensing.

**Vibration:**  
Rated V2 level compliant.

**Hardware:**  
The Excel 10 VAV Box Controllers are available in four models, the W7751B circuit board only, W7751D Plenum version with internal screw connections on the subbase for conduit installations, W7751F Plenum version with external screw connections on the subbase for non-conduit installations, and the W7751H Smart VAV Actuator which in an Excel 10 VAV Box Controller mounted and wired to a ML6161B (90 second) actuator.



**Fig. 8. Functional profile of LonMark® compliant VAV object details (variables not implemented in Excel 10 VAVII are greyed).**

## Inputs/Outputs

The W7751B,D,F and H controllers have the following inputs and outputs:

- Analog inputs - 4 total on W7751B,D,F, 3 total on W7751H.
- Space temperature sensor (fixed location) - T7770 A through D or T7780 DDWM
- Duct velocity pressure sensor (fixed location)-
- Microbridge 0-2 inch velocity pressure sensor

Configurable analog input options, 2 from the 3 listed below on W7751B,D,F, 1 from the 3 listed below for W7751H.

- Setpoint Potentiometer:  
55° to 85°F (13° to 29.5°C) —(9846 to 1290 ohms).
- Discharge Air Temperature  
Type: RTD (NTC).  
Supported Sensors: C7770A1006, C7031C1031, C7031B1033, C7031J1050.
- Supply Air Temperature  
Type: RTD (NTC).  
Supported Sensors: C7770A1006, C7031C1031, C7031B1033.

NOTE: The C7770 or C7031 Air Temperature Sensors or the setpoint potentiometer options are selectable in CARE/E-Vision. (Either one or the other, but not both are allowed on the W7751H.)

## Digital Inputs

5 total on W7751B,D,F, 1 on the W7751H (reserved for the wall module Bypass pushbutton). Dry-contact inputs are sensed using a 9 milliamp at 4.8 volts detection circuit. It is very important that the device used contains high quality, non-corroding contacts with resistivity that does not degrade; that is, increase over time. Use noble metal (such as gold or silver), pimpled or sealed contacts to assure consistent, long-term operation.

- Wall Module Bypass Pushbutton—Momentary DI (Fixed location - See Appendix B—Sequences of Operation for bypass details.)
- Hardware test (Fixed location - not available on the W7751H).
- Three of the following Digital Inputs (DIs) can be configured when using the W7751B,D,F, (not available on the W7751H):  
Window Monitor—Contact Closed = Window is Closed  
Occupancy Switch—Contact Closed = Room is Occupied; Contact Open = Room is Unoccupied  
Heat/Cool change over—Contact Closed = Heat  
Monitoring input—Contact Closed = input off or closed (input reportable on network).

## Digital Outputs:

8 total on W7751B,D,F (configurable locations), 4 total on W7751H (2 fixed position damper outputs and 2 configurable outputs). Configurable digital output options.

- Floating damper open (fixed location on W7751H)
- Floating damper closed (fixed location on W7751H)
- Reheat types  
Reheat (floating) valve open  
Reheat (floating) valve closed  
PWM  
Stage 1  
Stage 2 or Three stage binary control  
Stage 3 (not available on W7751H)
- Peripheral Heating types  
Peripheral heat (floating) valve open  
Peripheral heat (floating) valve closed  
PWM  
Stage 1
- Fan (Series or Parallel)  
On/Off  
PWM
- Auxiliary (On when occupied, Off when unoccupied or Standby)  
Normal (On/Off)  
Pulsed (requires two pairs open and closed)
- Network (up to 2 outputs commanded from the network)  
Normal (On/Off)  
Pulsed (requires two pairs open and closed)

## Triac Outputs on the W7751B,D,F Model:

Power ratings: 20 Vac to 30 Vac at 25 mA MIN to 1.0A MAX current for any voltage.  
(For W7751H, a minimum of 25 mA at 20 Vac and a maximum of 400 mA at 30 Vac.)

## CAUTION

When any device is energized by a Triac, the device must be able to sink a minimum of 25 mA.

NOTE: Triacs sink current to the 24 Vac common (terminals 10 on the W7751B model, see Fig. 60, or terminals 2 and 4 on the W7751D,F models, see Fig. 66, or terminal 2 on the W7751H model, see Fig. 72). The controller and all Triac loads must be wired to the same 24 Vac source.

## LED:

(For Wall Module LED only) 2.5V at 3 mA.

## IMPORTANT:

*If non-Honeywell motors, actuators, or transducers are to be used with Excel 10 Controllers, Triac compatibility must be verified (see previous NOTE).*

## Wall Modules

The T7770 Wall Module for the Excel 10 Controller is available in a variety of configurations (see Product Names section). The models are shown in Fig. 9.



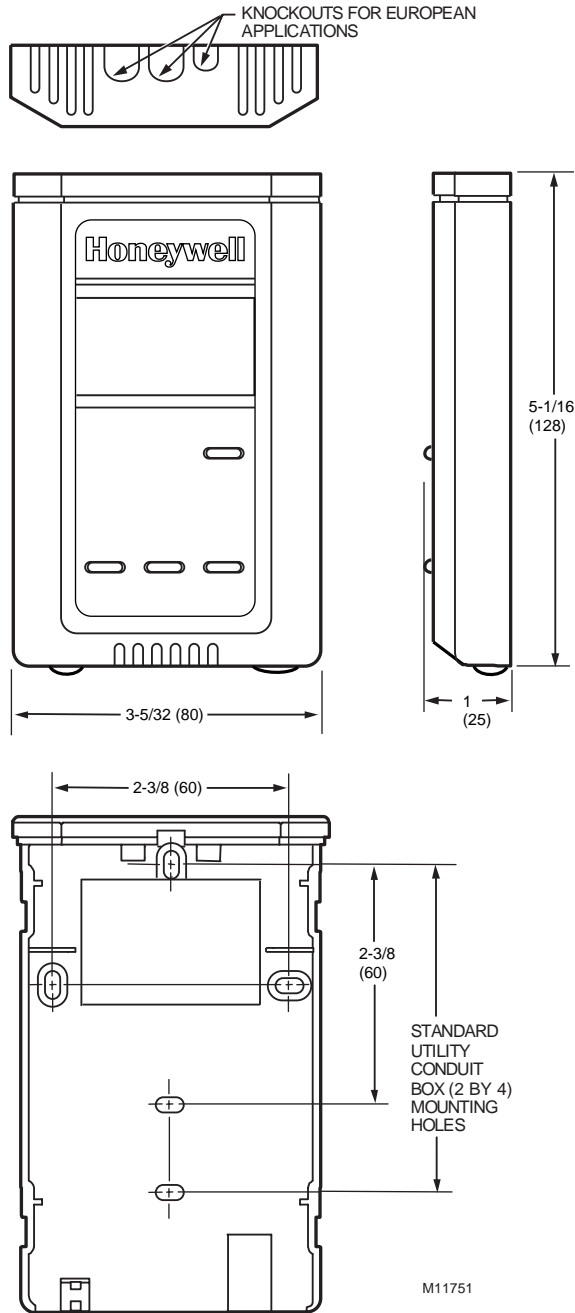


Fig. 10. T7780 construction in in. (mm) sensor.

## Sensor (Duct Mount)

The C7770A Air Temperature Sensor is used for duct temperature sensing with Excel 10 Controllers (see Product Names section). The C7770A Air Temperature Sensor is shown in Fig. 11.

## Configurations

### General

Table 4 provides an overview of the Excel 10 VAV Controller configuration options. All VAV boxes are assumed to have an air flow pickup for connecting to the Microbridge flow through pressure sensor on the Excel 10 VAV Controller. Also, each box must have a flow-regulating damper that is controlled by a Series 60 (floating) type actuator such as the Honeywell ML6161 or a PWM type actuator. Table 5 lists the general mechanical equipment options available with the W7751 VAV Box Controller. See Table 1 for Excel 10 VAV Box Controller capabilities. See Application Step 6. Configure Controllers for further information on configurations.

## CAUTION

The Excel 10 VAV Controller is designed to work with Series 60 (floating) Damper Actuators that have a full stroke damper actuator time between 20 and 600 seconds (0.333 to 10 minutes) or PWM Damper Actuators that have a minimum time (zero percent) of 0.1 second and a maximum overall time of 600 seconds (0.1 second to 10 minutes).

The W7751H Excel 10 VAV Controller is designed to work only with the Series 60 (floating) Damper Actuator (ML6161B) that has a full stroke damper actuator time of 90 seconds.

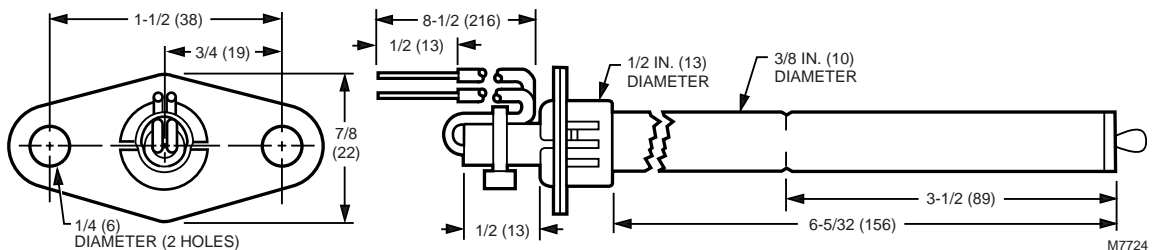


Fig. 11. C7770A construction - in. (mm).

**Table 4. Excel 10 VAV Box Controller Capability.**

Excel 10 VAV Box Controller Capability	W7751B,D,F	W7751H
<b>Fan</b>		
None	X	X
Series	X	X
Parallel Temp	X	X
Parallel Flow	X	X
Parallel PWM	X	X
<b>Reheat</b>		
None	X	X
One Stage Reheat	X	X**
Two Stages or Three Stage Binary Control Reheat	X	X**
Three Stages Reheat	X	—
One Stage Periph	X	X**
Floating Reheat (Two outputs)	X	X**
Floating Periph (Two outputs)	X	X**
Floating Reheat then Periph (Four outputs)	X	—
Floating Periph then Reheat (Four outputs)	X	—
PWM Reheat (One output)	X	X**
PWM Periph (One output)	X	X**
PWM Reheat then Periph (Two outputs)	X	X**
PWM Periph then Reheat (Two outputs)	X	X**
<b>Exhaust Tracking</b>		
Disabled	X	X
Enabled	X	X
<b>Occupancy Sensor</b>		
None	X	X
Connected	X	—*

Excel 10 VAV Box Controller Capability	W7751B,D,F	W7751H
<b>Window Contact</b>		
None	X	X
Connected	X	—*
<b>Wall Module Configuration</b>		
Local	X	X
Shared	X	X
<b>Wall Module Type</b>		
Sensor Only	X	X
Sensor and Setpoint	X	X
Sensor, Setpoint and Bypass	X	X
Sensor and Bypass	X	X
<b>Air Temperature Sensor</b>		
20 K ohm air temperature sensors can be used in conjunction with wall modules	X	X
<b>Dual Duct Pressure Independent</b>		
<b>Flow mixing</b> Cold and hot duct flow pickups	X***	X***
<b>Without flow mixing</b> Cold and hot duct flow pickups	X***	X***
<b>Constant volume</b> Cold and hot duct flow pickups	X***	X***
With cold duct pickup only	X	X
Constant volume with discharge pickup only	X****	X****
<b>Dual Duct Pressure Dependent</b>		
With flow mixing	X	X
Without flow mixing	X	X

\* Available only via the network for the W7751H.

\*\* The W7751H Smart VAV Actuator provides damper control and two configurable outputs available for 2 stages of reheat, floating reheat (requires two outputs), PWM Reheat or Periph (requires one output), PWM Reheat and Periph (requires two outputs) or 1 stage of reheat or Periph (an be PWM) and a serial or parallel fan.

\*\*\* These applications require two W7751 Excel 10 controllers per zone.

\*\*\*\* Flow sensor in discharge air. The temperature control loop controls the cool damper position and the flow controls adjust the heating damper position.



Table 5. Configuration Options Summary For W7751 Controllers.

Option	Possible Configurations for the W7751B,D,F Models	Possible Configurations for the W7751H Model
<b>Fan</b>	1. None	1. None
	2. Parallel Temperature	2. Parallel Temperature
	3. Parallel Flow	3. Parallel Flow
	4. Parallel PWM	4. Parallel PWM
	5. Series	5. Series
<b>Type of Reheat Coil</b>	1. One stage	1. One stage
	2. Two stages or Three Stage Binary	2. Two stages or Three Stage Binary
	3. Three stages	3. Series 60 Modulating electric valve, or pneumatic via transducer.
	4. Series 60 Modulating electric valve, or pneumatic via transducer.	4. Pulse Width Modulating electric valve, or pneumatic via transducer.
	5. Pulse Width Modulating electric valve, or pneumatic via transducer.	5. None
	6. None	
<b>Type of Peripheral Heat*</b>	1. One stage	1. One stage
	2. Series 60 Modulating electric valve, or pneumatic via transducer.	2. Series 60 Modulating electric valve, or pneumatic via transducer.
	3. Pulse Width Modulating electric valve, or pneumatic via transducer.	3. Pulse Width Modulating electric valve, or pneumatic via transducer.
	4. None	4. None
<b>Window Open Option</b>	1. None	1. None
	2. Local Window Open Digital Input - directly wired to the controller. (Contacts closed means Window Closed.)	2. Network (DestWndw signal received via the E-Bus).
	3. Network (DestWndw signal received via the E-Bus).	
<b>Monitor switch Option</b>	1. None	1. None
	2. Local Monitor switch (general purpose) Digital Input -directly wired to the controller. (Contacts closed means that the switch is closed.)	
<b>Occupancy Sensor Option</b>	1. None	1. None
	2. Local Occupancy sensor Digital Input - directly wired to the controller. (Contacts closed means occupancy sensed.)	2. Network (DestOccSensor signal received via the E-Bus).
	3. Network (DestOccSensor signal received via the E-Bus).	
<b>Heat/Cool change over switch Option</b>	1. None	1. None
	2. Local Heat/Cool change over switch Digital Input directly wired to the controller. (Contacts closed means select Heat Mode.)	
<b>Wall Module Option</b>	1. Local (direct wired to the box)	1. Local (direct wired to the box)
	2. Shared (wired to another box)	2. Shared (wired to another box)
<b>Wall Module Type</b>	1. Sensor only	1. Sensor only
	2. Sensor and Setpoint adjust	2. Sensor and Setpoint adjust
	3. Sensor, Setpoint adjust and Bypass	3. Sensor, Setpoint adjust and Bypass
	4. Sensor and Bypass	4. Sensor and Bypass
	5. None	5. None

(continued)

**Table 5. Configuration Options Summary For W7751 Controllers (Continued).**

Option	Possible Configurations for the W7751B,D,F Models	Possible Configurations for the W7751H Model
Air Temperature Sensor	1. Discharge Air Temperature	1. Discharge Air Temperature**
	2. Supply Air Temperature	2. Supply Air Temperature**
	3. None	3. None

\* If both Reheat and peripheral heat are used in the same application:

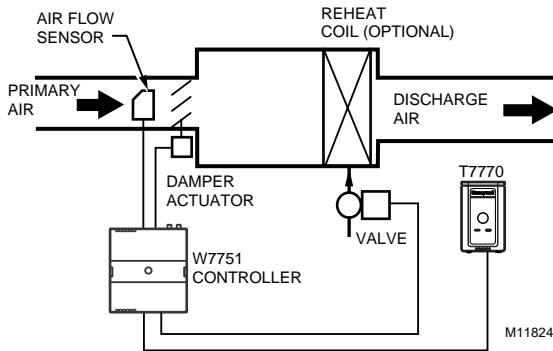
- Both must be same output type such that both are: staged, floating or PWM
- The first and second stage ordering is selectable between stage 1 - reheat, stage 2 peripheral or stage 1- peripheral, stage 2 reheat.

\*\* Only 1 Analog input is configurable on the W7751H and only if the T7770A or D (no Space temperature setpoint) Wall modules are used.

**Type of Box Fan**

Each VAV box that is controlled by a W7751B,D,F,H can have a series fan (see Fig. 22), a parallel fan (see Fig. 23), or no fan (see Fig. 12).

The air temperature sensor cannot be used on the W7751H Smart VAV Actuator with wall modules that have a setpoint.



**Fig. 12. VAV box (without fan).**

Figs. 13 through 21 illustrate the W7751B,D,F,H VAV Controllers that have a box type of (single duct) with DestHvacMode in (the default of Auto).

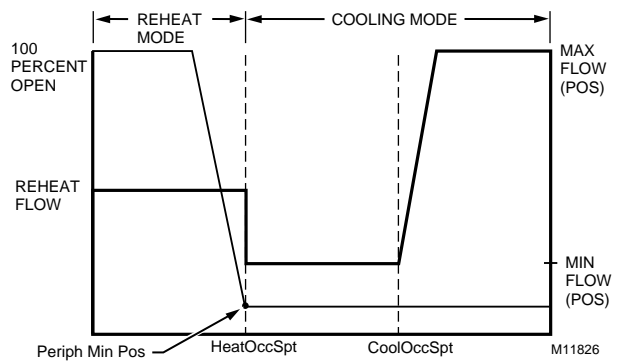
Refer to Fig. 13 to see VAV box modes for Pressure\_Independent or (Pressure\_Dependent), Reheat type Float\_Reheat/Float\_Periph, Non-Proportional.

**Pressure Type:**  
Pressure Independent or (Pressure\_Dependent)

**Reheat Type:**  
Float\_Reheat or Float\_Periph

**Proportional Reheat Flow:**  
Disable

**Periph Min Pos:**  
Greater than 0%



**Fig. 13. VAV box modes for Reheat Type Float\_Reheat/Float\_Periph, Non-Proportional. (suited for Peripheral heat control because the Peripheral output closes to a minimum position (Periph Min Pos) at HeatOccSpt).**

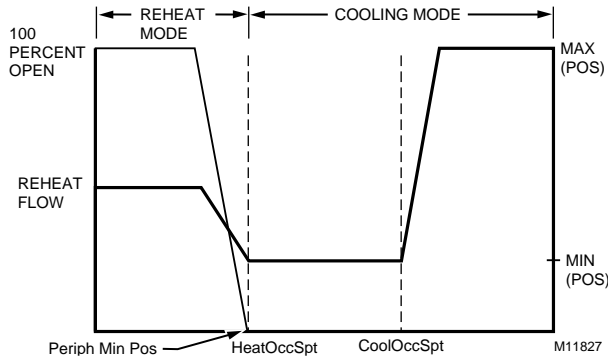
Refer to Fig. 14 to see VAV box modes for Pressure\_Independent or (Pressure\_Dependent), Reheat type Float\_Reheat/Float\_Periph, Proportional.

**Pressure Type:**  
Pressure Independent or (Pressure\_Dependent)

**Reheat Type:**  
Float\_Reheat or Float\_Periph

**Proportional Reheat Flow:**  
Enable

**Periph Min Pos:**  
Equals 0



**Fig. 14. VAV box modes for Reheat Type Float\_Reheat/Float\_Periph, Proportional. (suited for Reheat control because the Reheat closes to zero percent at HeatOccSpt).**

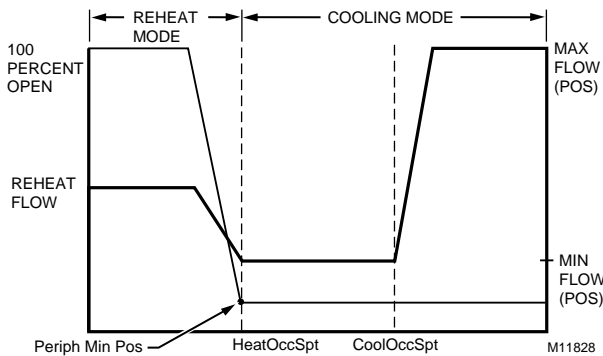
Refer to Fig. 15 to see VAV box modes for Pressure\_Independent or (Pressure\_Dependent), Reheat type Float\_Reheat/Float\_Periph, Proportional.

**Pressure Type:**  
Pressure Independent or (Pressure\_Dependent)

**Reheat Type:**  
Float\_Reheat or Float\_Periph

**Proportional Reheat Flow:**  
Enable

**Periph Min Pos:**  
Greater than 0%



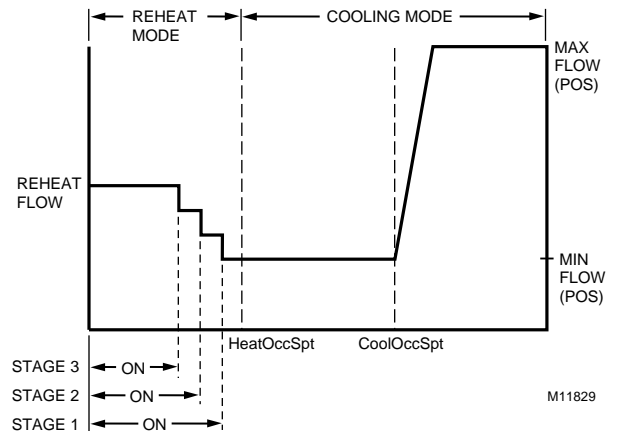
**Fig. 15. VAV box modes for Reheat Type Float\_Reheat/Float\_Periph, Proportional. (suited for Peripheral heat control because the Peripheral output closes to a minimum position (Periph Min Pos) at HeatOccSpt).**

Refer to Fig. 16 to see VAV box modes for Reheat type Elec\_ThreeStage - Proportional.

**Pressure Type:**  
Pressure Independent or (Pressure\_Dependent)

**Reheat Type:**  
Elec\_ThreeStage or (Elec\_ThreeStageBin),  
(Elec\_OneStage), (Elec\_TwoStage)

**Proportional Reheat Flow:**  
Enable



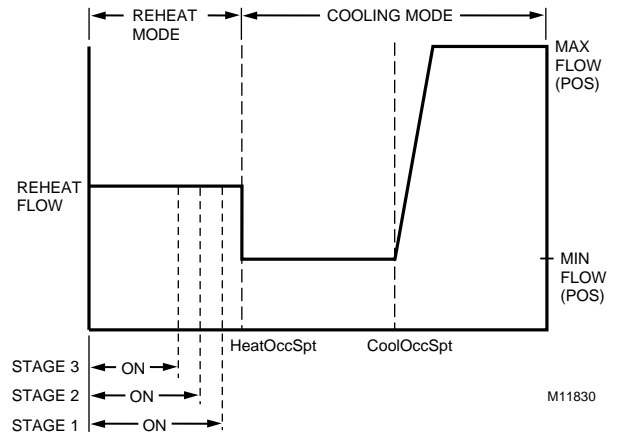
**Fig. 16. VAV box modes for Reheat Type Elec\_ThreeStage - Proportional.**

Refer to Fig. 17 to see VAV box modes for Reheat type Elec\_ThreeStage - Non-Proportional.

**Pressure Type:**  
Pressure Independent or (Pressure\_Dependent)

**Reheat Type:**  
Elec\_ThreeStage or (Elec\_ThreeStageBin),  
(Elec\_OneStage), (Elec\_TwoStage)

**Proportional Reheat Flow:**  
Disable



**Fig. 17. VAV box modes for Reheat Type Elec\_ThreeStage - Non-Proportional.**

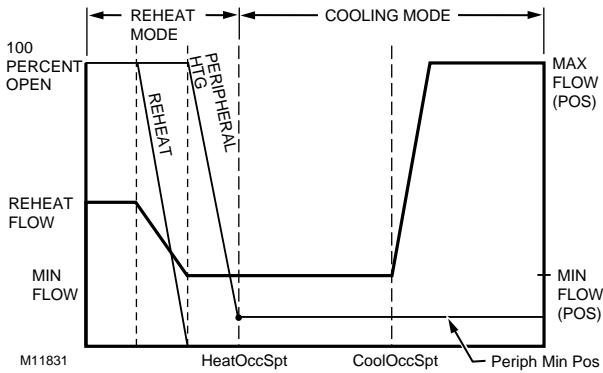
Refer to Fig. 18 to see VAV box modes for Reheat type PeriphThenReheat - Proportional.

**Pressure Type:**  
Pressure Independent or (Pressure\_Dependent)

**Reheat Type:**  
Float\_Periph\_Reheat or (PWM\_Periph\_Reheat)

**Proportional Reheat Flow:**  
Enable

**Periph Min Pos:**  
0% or greater



**Fig. 18. VAV box modes for Reheat type Peripheral Heating Then Reheat - Proportional (Float\_Periph\_Reheat/PWM\_Periph\_Reheat).**

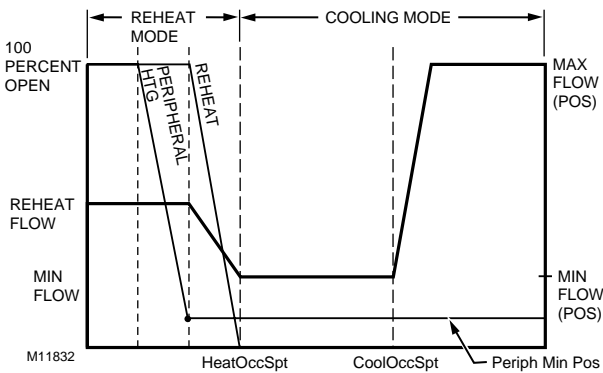
Refer to Fig. 19 to see VAV box modes for Reheat type ReheatThenPeriph - Proportional.

**Pressure Type:**  
Pressure Independent or (Pressure\_Dependent)

**Reheat Type:**  
Float\_Reheat\_Periph or (PWM\_Reheat\_Periph)

**Proportional Reheat Flow:**  
Enable

**Periph Min Pos:**  
0% or greater



**Fig. 19. VAV box modes for Reheat Type Reheat Then Peripheral Heating Proportional (Float\_Reheat\_Periph/PWM\_Reheat\_Periph).**

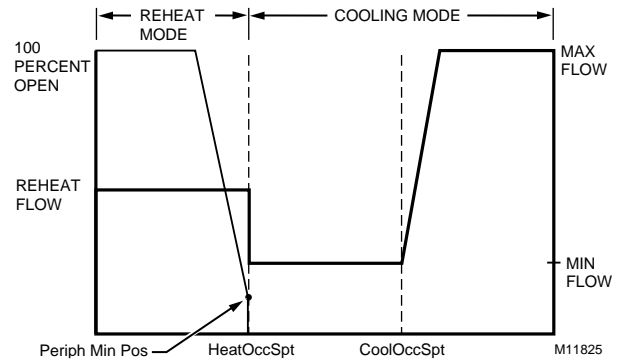
Refer to Fig. 20 to see VAV box modes for Press\_Dependent, Reheat type Float\_Reheat/FloatHotDuctPrDep, Non-Proportional.

**Pressure Type:**  
Pressure\_Dependent

**Reheat Type:**  
FloatHotDuctPrDep

**Proportional Reheat Flow:**  
Disable

**Periph Min Pos:**  
0% or greater



**Fig. 20. VAV box modes for Reheat Type Float\_Reheat/Float\_Periph, no minimum position, reheat goes to zero percent in cooling mode Non-Proportional (suited for Reheat control because the Reheat closes to zero percent at HeatOccSpt).**

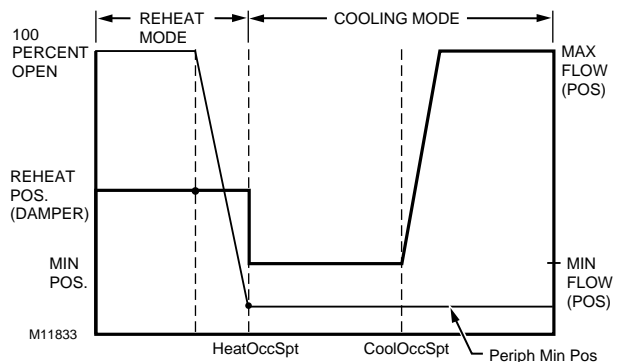
Refer to Fig. 21 to see VAV box modes for Pressure Dependent, Reheat type Float\_Reheat/Float\_Periph.

**Pressure Type:**  
Pressure\_Dependent

**Reheat Type:**  
Float\_Reheat/Float\_Periph

**Proportional Reheat Flow:**  
Disable

**Periph Min Pos:**  
0% or greater



**Fig. 21. VAV box modes for Pressure Dependent, Reheat Type Float Reheat/Float\_Periph.**

A Series fan is intended to run continuously when the main air handler is on and is in-line with the primary air flow through the box. This configuration is sometimes referred to as Variable Volume Supply with Constant Volume Discharge (VVS/CVD).

NOTE: The location of the heating coils can be in the discharge, as shown in Fig. 22, or in the plenum return.

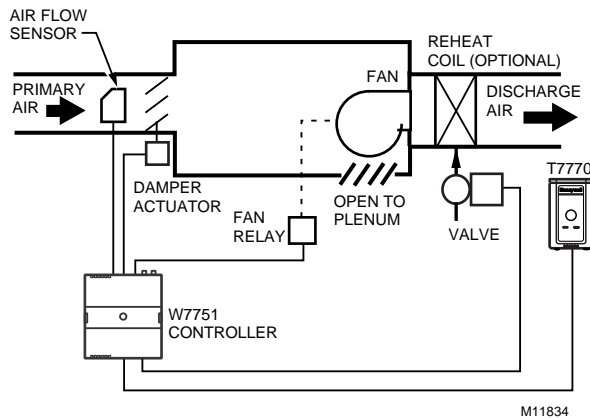


Fig. 22. Series VAV box fan.

A parallel fan, see Fig. 23, is not located in the primary air stream, but is designed to add return air from the plenum into the air stream delivered to the space. The Excel 10 VAV Controller turns on the parallel fan when the space temperature falls below Setpoint as a first stage of reheat (Parallel Temp), or if the air flow falls below a minimum air flow setpoint to maintain a minimum air flow to the space (Parallel Flow).

NOTE: The location of the heating coils can be in the discharge, as shown in Fig. 23, or as part of the plenum air return, either before or after the fan.

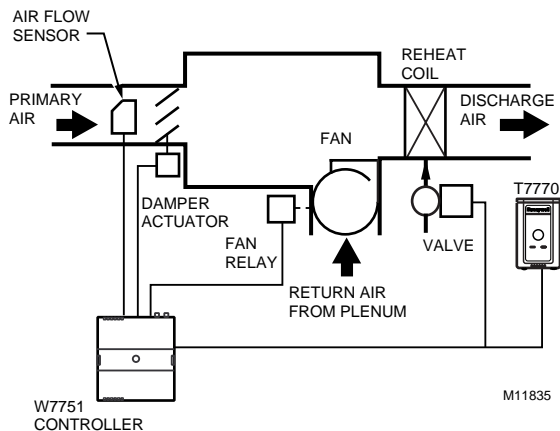


Fig. 23. Parallel VAV box fan.

See Fig. 24a and 24b to see the Heat/Cool Modes for Parallel Temperature/Flow VAV box fans.

PARALLEL FAN TEMP OPERATION:  
COOL/REHEAT MODES

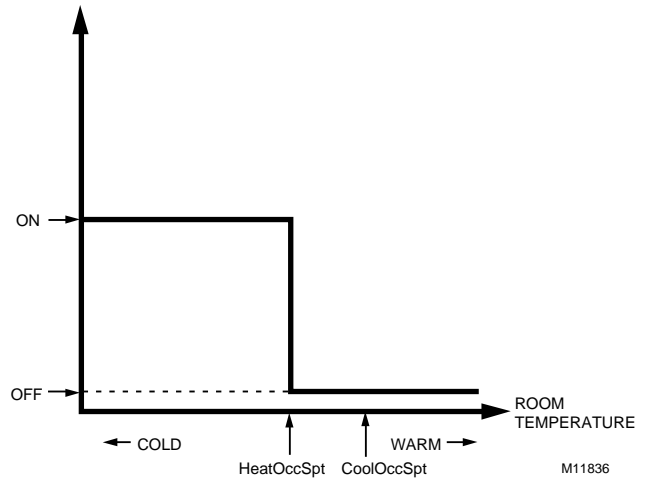


Fig. 24a. Parallel fan temperature operation: for Cool/Reheat modes.

PARALLEL FAN FLOW OPERATION:  
COOL/REHEAT MODES

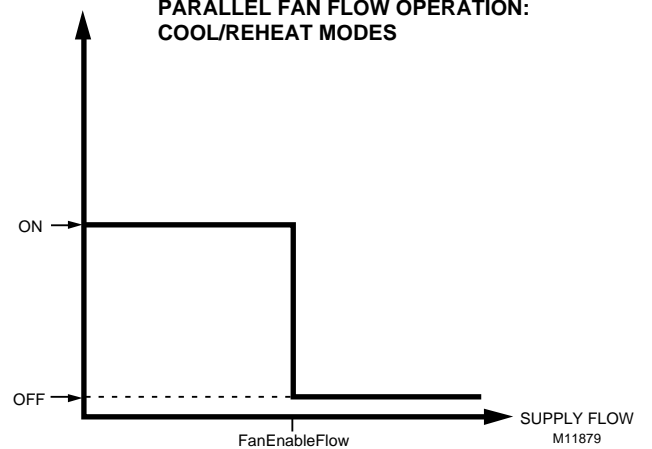
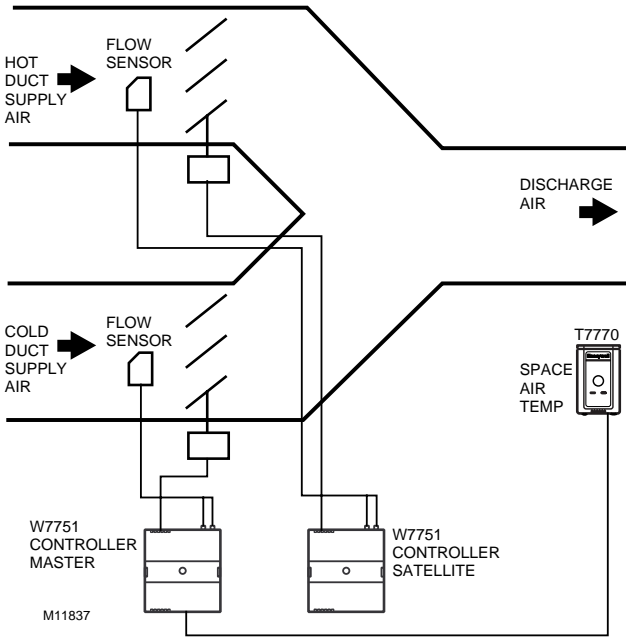


Fig. 24b. Parallel fan flow operation: for Cool/Reheat modes.

Refer to Fig. 25 to see Dual Duct, Pressure Independent, with flow mixing that has cold and hot duct flow pickups.



**Fig. 25. Dual Duct, Pressure Independent, with flow mixing that has cold and hot duct flow pickups (uses a satellite Excel 10 for hot duct).**

**Dual Duct Flow Mixing: (For setup and Calibration refer to the Dual Duct Calibration procedure in Appendix B.)**

**Master flow configuration:**  
Master\_Flow\_Mix

**Master reheat configuration:**  
DualDuctReheat

**Satellite flow configuration:**  
Satel\_Flow\_Mix

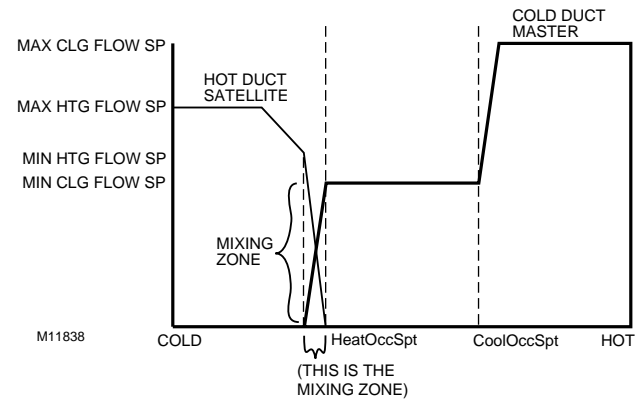
**Satellite reheat configuration:**  
DualDuctReheat

**NOTE:** SrcMaster from the Master Excel 10 must be bound to DestSatellite of the Satellite Excel 10 and SrcBoxFlow of the Satellite Excel 10 must be bound to DestFlowTrack of the Master Excel 10 (see Refer Excel 10 Points in Network menu in E-Vision) in order for this application to function properly.

Dual duct flow mixing uses two control devices, a master (for the cold duct) and a satellite (for the hot duct) to provide pressure independent control. If there is a need for cooling, dual duct flow mixing will control temperature to the cooling setpoint, setting the flow control setpoint for the cold duct between min flow and max flow while setting the hot duct flow setpoint to zero. If the temperature of the space is between the cooling and the heating setpoints, the cold duct will control to the min flow while the hot duct flow is set to zero. If there is a need for heating, the controllers will try to control to the heating setpoint by first modulating the cold duct flow from min flow to zero while simultaneously modulating the hot duct flow from zero to min flow. If there is additional need for heat, the hot duct will modulate from min flow to max flow while the cold duct

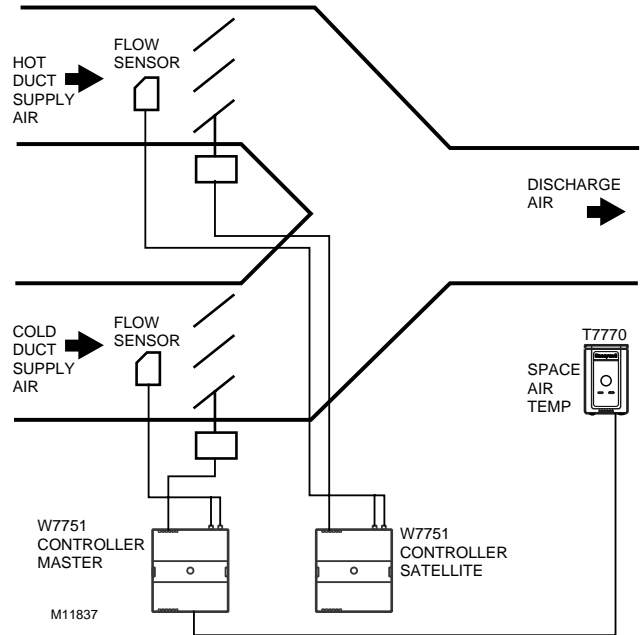
is set to zero. Since during the initial heating load, both the hot and cold duct are supplying air, we have flow mixing.

See Fig. 26 for Heat/Cool Modes for Dual Duct, Pressure Independent, with flow mixing, that has cold and hot duct flow pickups.



**Fig. 26. Heat/Cool Modes for Dual Duct, Pressure Independent, with flow mixing, that has cold and hot duct flow pickups.**

See Fig. 27 for Dual Duct, Pressure Independent, without flow mixing, that has cold and hot duct flow pickups.



**Fig. 27. Dual Duct, Pressure Independent, without flow mixing, that has cold and hot duct flow pickups (uses a satellite Excel 10 for hot duct).**

**Dual Duct No Flow Mixing: (For setup and Calibration refer to the Dual Duct Calibration procedure in Appendix B.)**

**Master flow configuration:**  
Master\_No\_Flow\_Mix

**Master reheat configuration:**  
DualDuctReheat

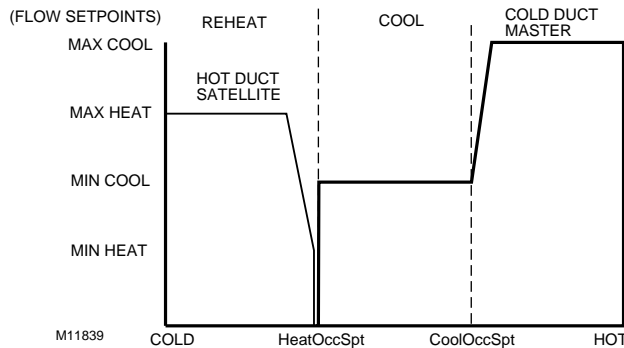
**Satellite flow configuration:**  
Satel\_No\_Flow\_Mix

**Satellite reheat configuration:**  
DualDuctReheat

NOTE: SrcMaster from the Master Excel 10 must be bound to DestSatellite of the Satellite Excel 10 and SrcBoxFlow of the Satellite Excel 10 must be bound to DestFlowTrack of the Master Excel 10 (see Refer Excel 10 Points in Network menu in E-Vision) in order for this application to function properly.

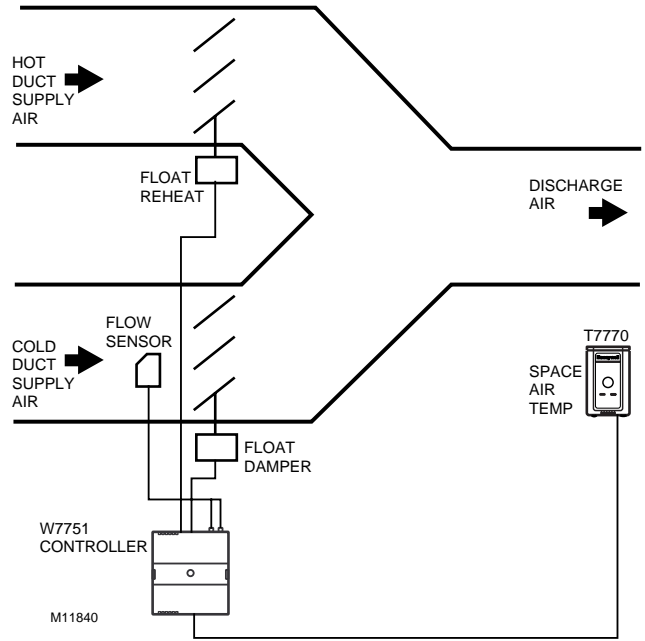
Dual duct flow mixing uses two control devices, a master (for the cold duct) and a satellite (for the hot duct) to provide pressure independent control. If there is a need for cooling, dual duct flow mixing will control temperature to the cooling setpoint, setting the flow control setpoint for the cold duct between min flow and max flow while setting the hot duct flow setpoint to zero. If the temperature of the space is between the cooling and the heating setpoints, the cold duct will control to the min flow while the hot duct flow is set to zero. If there is a need for heating, the controllers will try to control to the heating setpoint by first setting the cold duct flow to zero then modulating the hot duct flow from min flow to max flow; During the heating and cooling only one damper is being used at any one time to provide heating or cooling, this provides no flow mixing.

See Fig. 28 for Heat/Cool Modes for Dual Duct, Pressure Independent, without flow mixing that has cold and hot duct flow pickups.



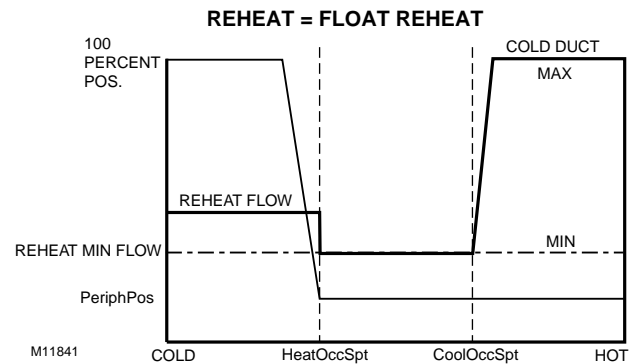
**Fig. 28. Heat/Cool Modes for Dual Duct, Pressure Independent, without flow mixing that has cold and hot duct flow pickups.**

See Fig. 29 for Dual Duct, Pressure Independent cooling, Pressure Dependent heating with flow mixing that has cold duct flow pickup.



**Fig. 29. Dual Duct, Pressure Independent cooling, Pressure Dependent heating with flow mixing that has cold duct flow pickup.**

See Fig. 30 for Heat/Cool Modes for (Reheat = Float Reheat) Dual Duct, Pressure Independent cooling and Pressure Dependent heating, with flow mixing that has cold duct flow pickup.



**Fig. 30. Heat/Cool Modes for (Reheat = Float\_Reheat) Dual Duct, Pressure Independent cooling and Pressure Dependent heating, with flow mixing that has cold duct flow pickup.**

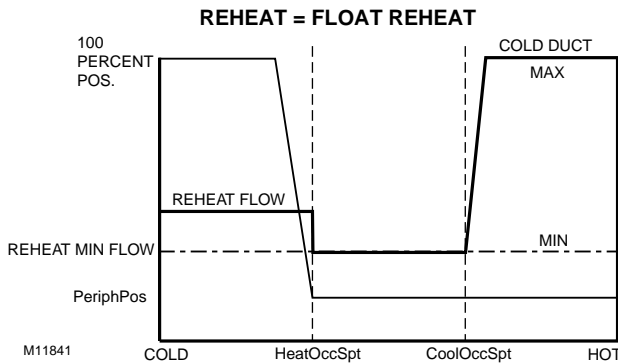
**Dual Duct Flow Mix: (Pressure independent cooling, pressure dependent heating using one Excel 10.)**

**Flow configuration:**  
DD\_CDFlowSensor

**Reheat configuration:**  
Float\_Reheat

Dual duct flow mixing uses one control device to provide pressure independent control of the cold duct. The Floating Reheat, which is traditionally wired to a heating valve actuator, is wired to a hot duct damper instead. PeriphPos is used to set the minimum hot duct damper position, which applies during both reheat and cooling modes. Flow mixing is achieved by mixing hot duct and cold duct air, which takes place during the cooling mode when minimum hot duct position is not zero (PeriphPos), or during the reheat mode if the cold duct Reheat Flow value is not zero.

See Fig. 31 for Heat/Cool Modes for (Reheat = Float Hot Duct Pressure Dependent) Dual Duct, Pressure Independent cooling and Pressure Dependent heating, with flow mixing that has cold duct flow pickup.



**Fig. 31. Heat/Cool Modes for (Reheat = FloatHotDuctPrDep) Dual Duct, Pressure Independent cooling and Pressure Dependent heating, with flow mixing that has cold duct flow pickup.**

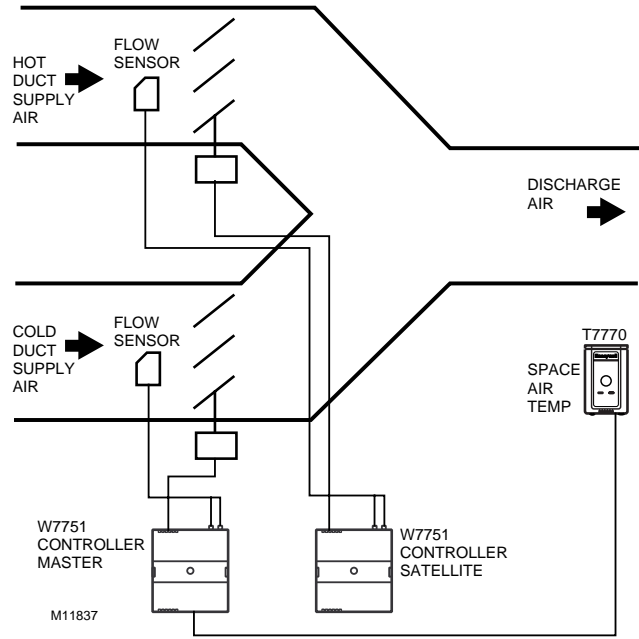
**Dual Duct Flow Mix: (Alternate Configuration)**

**Flow configuration:**  
DD\_CDFlowSensor

**Reheat configuration:**  
FloatHotDuctPrDep

This configuration is the same as the previous description, however, setting PeriphPos to a minimum hot duct position that only applies during reheat mode. During cooling mode, the hot duct damper goes to zero, thus conserving energy. Flow mixing is achieved by mixing hot duct and cold duct air during the reheat mode when the cold duct Reheat Flow value is not zero.

See Fig. 32 for Dual Duct, Pressure Independent cooling and heating, constant volume with hot and cold duct flow pickups.



**Fig. 32. Dual Duct, Pressure Independent cooling and heating, constant volume with hot and cold duct flow pickups.**

**Dual Duct Constant Volume: (For setup and Calibration refer to the Dual Duct Calibration procedure in Appendix B.)**

**Master flow configuration:**  
Master\_Const\_Flow

**Master reheat configuration:**  
DualDuctReheat

**Satellite flow configuration:**  
Satel\_Const\_Flow

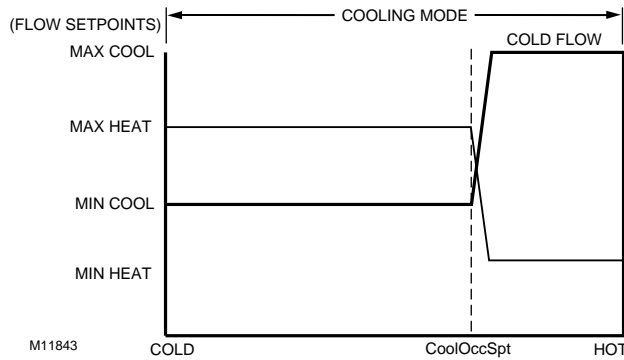
**Satellite reheat configuration:**  
DualDuctReheat

**NOTE:** SrcMaster from the Master Excel 10 must be bound to DestSatellite of the Satellite Excel 10 and SrcBoxFlow of the Satellite Excel 10 must be bound to DestFlowTrack of the Master Excel 10 (see Refer Excel 10 Points in Network menu in E-Vision) in order for this application to function properly.

Dual duct flow mixing uses two control devices, a master (for the cold duct) and a satellite (for the hot duct) to provide pressure independent control. The dual duct constant volume application tries to control the space to the cooling setpoint only. During unoccupied, the controller will try to control the temperature to either the unocc heating (if the space temperature is less than the unocc heating setpoint) or unocc cooling setpoint(if the space temperature is greater than the unocc cooling setpoint). The controller is always in cooling mode, adjusting the cool air from min flow to max flow while simultaneously adjusting the warm air from max flow to min flow.

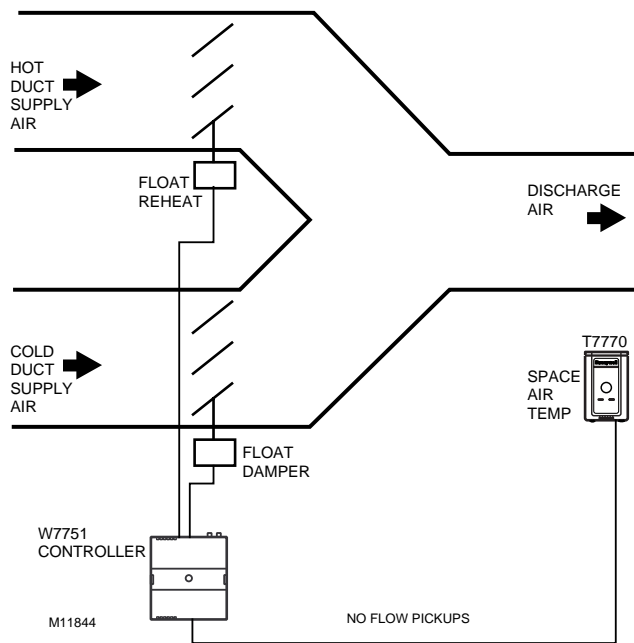


See Fig. 33 for Heat/Cool Modes for Dual Duct, Pressure Independent cooling and heating, constant volume with hot and cold duct flow pickups.



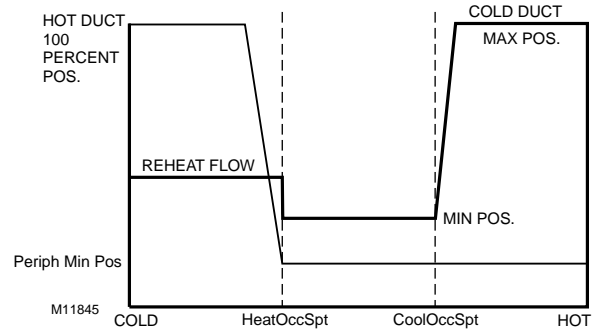
**Fig. 33. Heat/Cool Modes for Dual Duct, Pressure Independent cooling and heating, constant volume with hot and cold duct flow pickups.**

See Fig. 34 for Dual Duct, Pressure Dependent cooling and heating, with Flow mixing and no flow pickups.



**Fig. 34. Dual Duct, Pressure Dependent cooling and heating, with Flow mixing and no flow pickups.**

See Fig. 35 for Heat/Cool Modes for (Reheat = Float Reheat) Dual Duct, Pressure Dependent cooling and heating, with flow mixing that has cold duct flow pickup.



**Fig. 35. Heat/Cool Modes for (Reheat = Float Reheat) Dual Duct, Pressure Dependent cooling and heating, with flow mixing with no flow pickups.**

**Dual Duct Press Flow Mix: (Pressure dependent cooling and heating using one Excel 10.)**

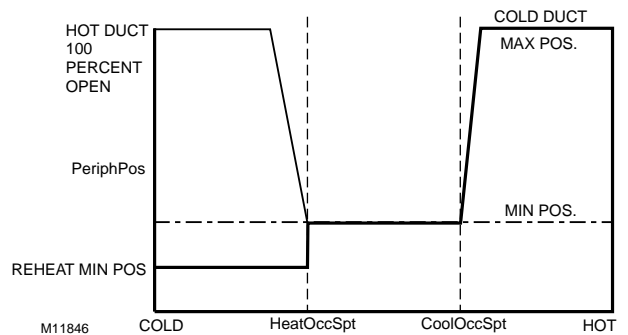
**Flow configuration:**  
DD\_NoFlowSensor

**Reheat configuration:**  
Float\_Reheat

Dual duct flow mixing uses one control device to provide pressure dependent control of the cold and hot ducts. The Floating Reheat, which is traditionally wired to a heating valve actuator, is wired to a hot duct damper instead. PeriphPos is used to set the minimum hot duct damper position, which applies during both reheat and cooling modes. Flow mixing is achieved by mixing hot duct and cold duct air, this takes place during the cooling mode when minimum hot duct position is not zero, or during the reheat mode if the cold duct Reheat Flow value is not zero.

See Fig. 36 for Heat/Cool Modes for Dual Duct, Pressure Dependent cooling and heating, with Flow mixing and no flow pickups.

**REHEAT = FloatHotDuctPrDep**



**Fig. 36. Heat/Cool Modes for Dual Duct, Pressure Dependent cooling and heating, with Flow mixing and no flow pickups.**

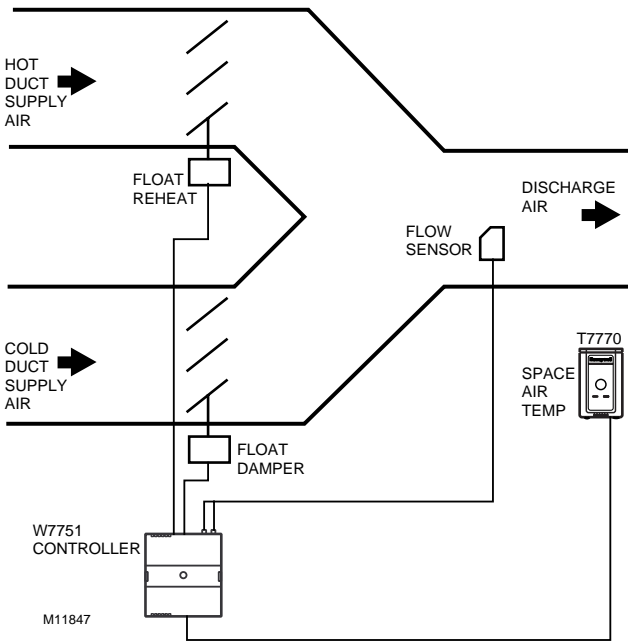
**Dual Duct Press Flow Mix: (Alternate Configuration)**

**Flow configuration:**  
DD\_NoFlowSensor

**Reheat configuration:**  
FloatHotDuctPrDep

This configuration is the same as the previous description, however, setting PeriphPos to a minimum hot duct position that only applies during reheat mode. During cooling mode, the hot duct damper goes to zero, thus conserving energy. Flow mixing is achieved by mixing hot duct and cold duct air during the reheat mode when the cold duct Reheat Flow value is not zero.

See Fig. 37 for Dual Duct, Pressure Independent discharge, with Constant Volume and Discharge air flow pickup.



**Fig. 37. Dual Duct, Pressure Independent discharge, with Constant Volume and Discharge air flow pickup.**

**Dual Duct Discharge Sensor Constant Volume (pressure independent discharge using one Excel 10).**

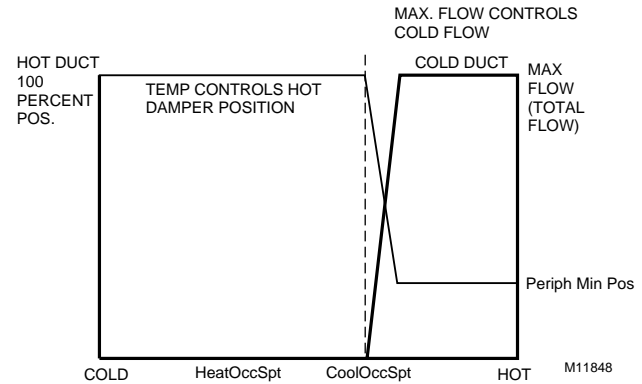
**Flow configuration:**  
DD\_DAFLOWSenConst

**Reheat configuration:**  
Float\_Reheat

Dual duct flow mixing uses one control device to provide pressure independent control of the cold duct and total discharge air. In this control sequence, the temperature sensor controls the Hot duct damper position from the PeriphPos minimum hot duct position to the 100 percent position. The discharge flow sensor, which picks up the cumulative flow of both the cold and hot duct air flows, is used to determine the total flow of air. This total flow of air is used to control the cold duct damper, using whatever amount of cold air is necessary to maintain a single flow value of MaxFlow. (Be aware that setting the Max flow too

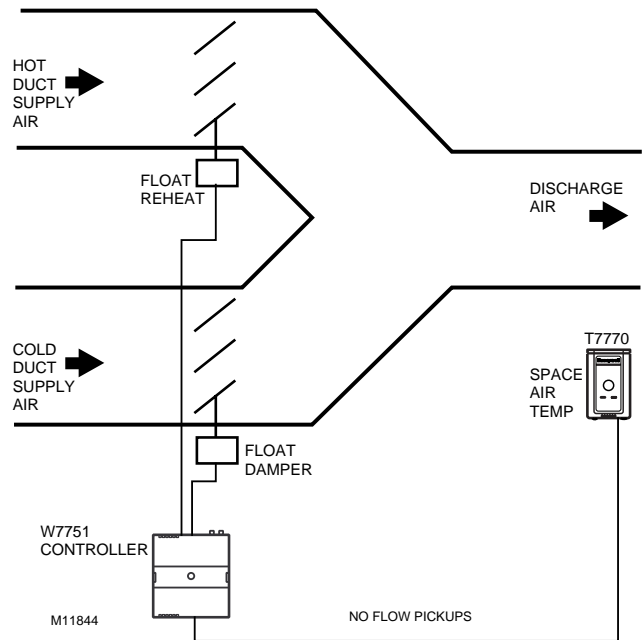
high with a small heating flow capacity will not let the cold damper go to zero during a high demand for heat.)

See Fig. 38 for Heat/Cool Modes for Dual Duct, Pressure Independent Cooling and Pressure Dependent Heating, with Constant Volume and Discharge air flow pickup.



**Fig. 38. Heat/Cool Modes for Dual Duct, Pressure Independent Cooling and Pressure Dependent Heating, with Constant Volume and Discharge air flow pickup.**

See Fig. 39 for Dual Duct, Pressure Dependent cooling and heating, with no Flow mixing and no flow pickups.



**Fig. 39. Dual Duct, Pressure Dependent cooling and heating, with no Flow mixing and no flow pickups.**

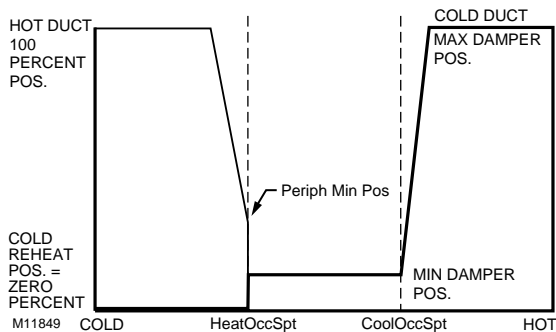
**Dual Duct Press Flow Mix (pressure dependent cooling and heating using one Excel 10).**

**Flow configuration:**  
DD\_NoFlowSensor

**Reheat configuration:**  
FloatHotDuctPrDep

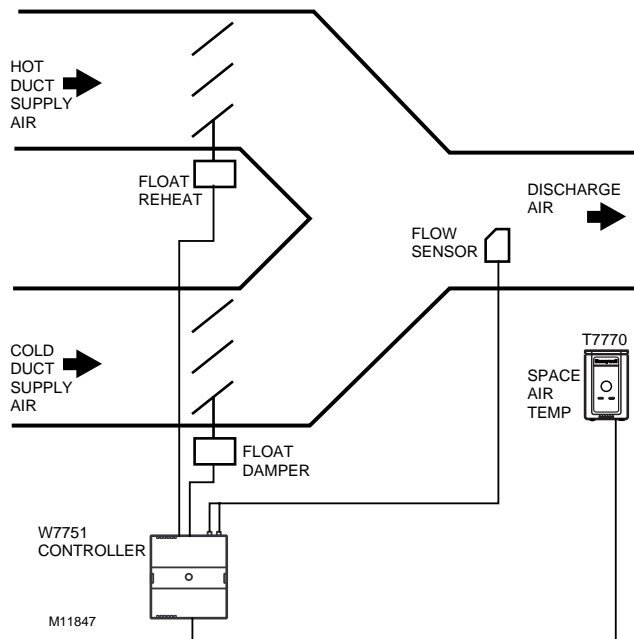
Dual duct flow mixing uses one control device to provide pressure dependent control of the cold and hot ducts. The Floating Reheat, which is traditionally wired to a heating valve actuator, is wired to a hot duct damper instead. PeriphPos will be set to a minimum hot duct position that only applies during reheat mode. During cooling mode, the hot duct damper goes to zero, thus conserving energy. Flow mixing is avoided by setting the cold duct Reheat Flow Value to zero. The minimum flow value to the space will be the minimum hot duct damper position during reheat mode or the cold duct min position during cooling.

See Fig. 40 for Heat/Cool Modes for Dual Duct, Pressure Dependent cooling and heating, with no Flow mixing and no flow pickups.



**Fig. 40. Heat/Cool Modes for Dual Duct, Pressure Dependent cooling and heating, with no Flow mixing and no flow pickups.**

See Fig. 41 for Dual Duct, Pressure Independent Heating and Cooling, with Discharge air flow pickup.



**Fig. 41. Dual Duct, Pressure Independent Heating and Cooling, with Discharge air flow pickup.**

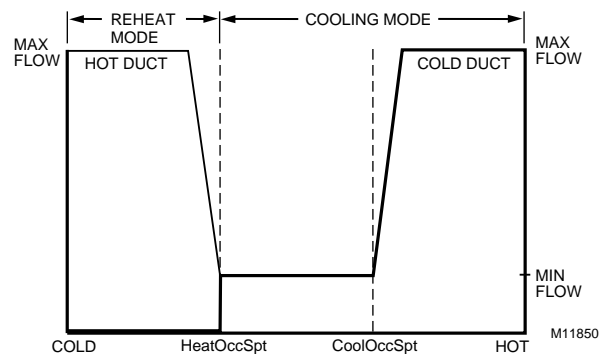
**Dual Duct Pressure Independent (pressure independent heating and cooling using one Excel 10).**

**Flow configuration:**  
DD\_DAFLOWsensor.

**Reheat configuration:**  
Float\_Reheat

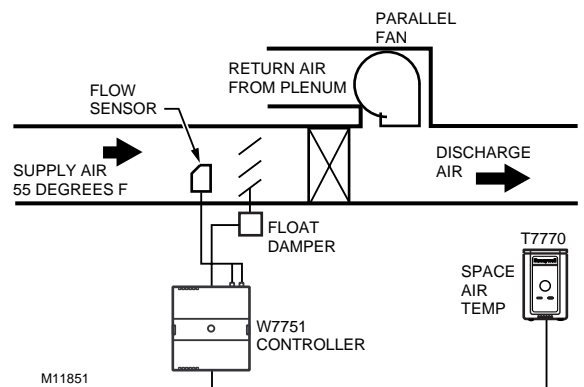
Dual duct flow mixing uses one control device to provide pressure independent control of the cold and hot ducts. The Floating Reheat, which is traditionally wired to a heating valve actuator, is wired to a hot duct damper instead. During reheat mode, only the hot duct damper is controlled and the cold duct is closed. During the cooling mode, only the cold duct damper is controlled, and the hot duct is closed.

See Fig. 42 for Heat/Cool Modes for Dual Duct, Pressure Independent Heating and Cooling, with Discharge air flow pickup.



**Fig. 42. Heat/Cool Modes for Dual Duct, Pressure Independent Heating and Cooling, with Discharge air flow pickup.**

See Fig. 43 for Single Duct, Pressure Independent Cooling, with PWM Parallel Fan.



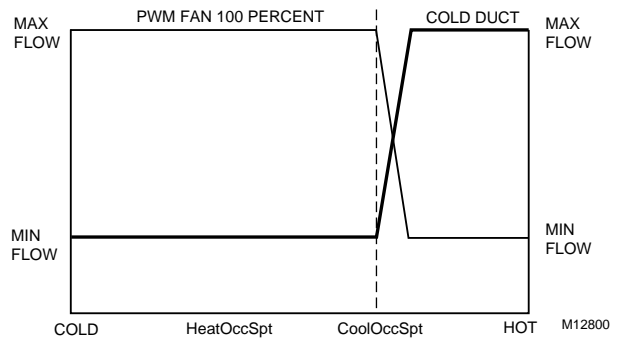
**Fig. 43. Single Duct, Pressure Independent Cooling, with PWM Parallel Fan.**

**PWM fan.**

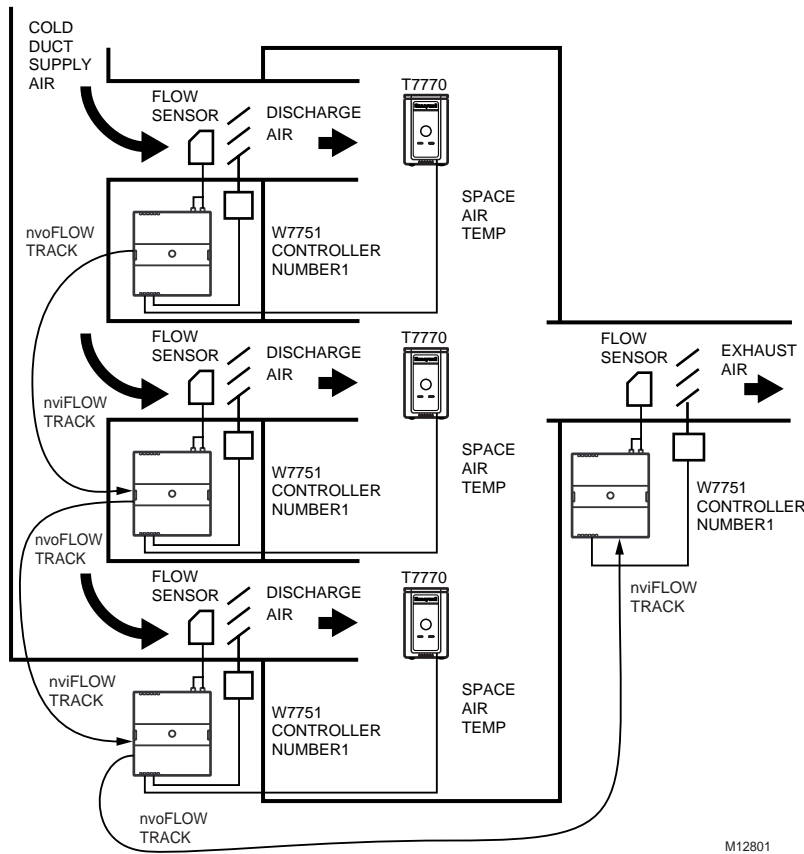
Use this only with single duct configurations. The PWM fan is a variable fan that controls the amount of return air or return plenum air to the space. The PWM fan acts in opposite to the cooling duct damper position for pressure dependent operation, or in opposite to the cooling duct flow for pressure independent.

See Fig. 44 for Modes for Single Duct, Pressure Independent Cooling, with Parallel Fan.

See Fig. 45 for Exhaust Tracking Flow Control.



**Fig. 44. Modes for Single Duct, Pressure Independent Cooling, with Parallel Fan.**



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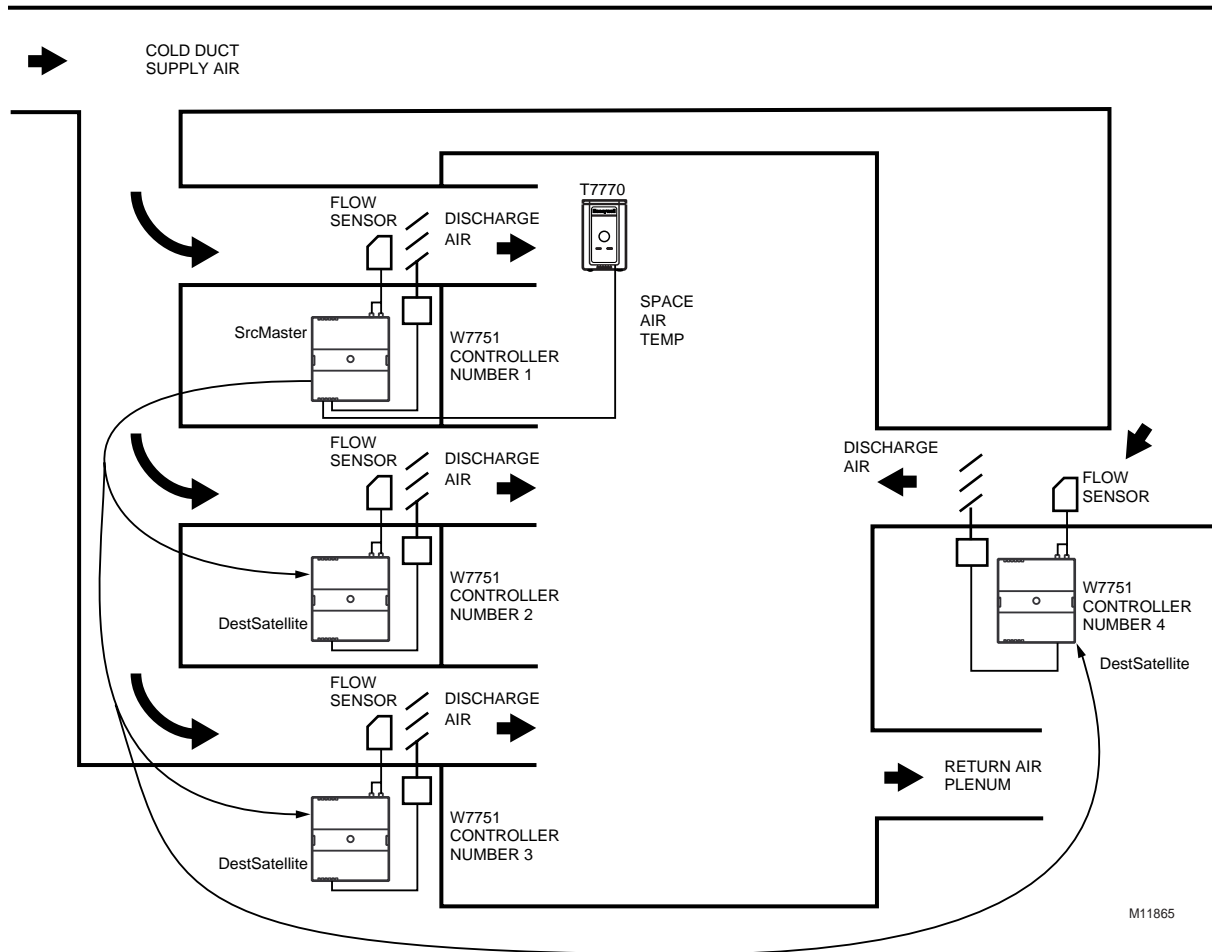
**Configuration of Box Type, Flow Type**

Box Type	Flow Type
Excel 10 VAV number 1 =Single_Duct	SD_Normal_Flow
Excel 10 VAV number 2 =Single_Duct	SD_Normal_Flow
Excel 10 VAV number 3 = Single_Duct	SD_Normal_Flow
Excel 10 VAV number 4 = Flow_Tracking	FLOW_Tracking

Bind the SrcFlowTrack of controller number 1 to the DestFlowTrack of number 2, the SrcFlowTrack of number 2 to the DestFlowTrack of number 3, the SrcFlowTrack of number 3 to the DestFlowTrack of number 4. See Refer Excel 10 Points in Network menu in E-Vision.

**Fig. 45. Exhaust Tracking Flow Control.**

See Fig. 46 for Share Wall Module.



Configuration of VAV Controllers for Share Wall Module.

Excel 10 VAV number	Flow Type	Box Type	Wall Module Type
Excel 10 VAV number 1	= SD_Normal_Flow	Single_Duct	Sensor_Setpoint
Excel 10 VAV number 2	= Shared_Cntrl	Single_Duct	No_Sensor
Excel 10 VAV number 3	= Shared_Cntrl	Single_Duct	No_Sensor
Excel 10 VAV number 4	= Shared_Cntrl	Single_Duct	No_Sensor

Bind SrcMaster of VAV number 1, as Source controller, (see Refer Excel 10 Points in Network menu in E-Vision) to the DestSatellite of VAV number 2 through VAV number 4, as the Destination Excel 10's. Refer to the Share Wall Module under section on Wall Module Options for additional rules and cautions on using the Share Wall Module option.

NOTE: See Fig. 51 for sharing a T7780 DDWM.

Fig. 46. Share Wall Module.

**T7780 DDWM Binding for VAVII Controllers**

Source Controller		Destination Controller	
DDWM	SrcRmTemp	VAVII	DestRmTemp
DDWM	SrcRmTempSpt	VAVII	DestRmTempSpt
DDWM	SrcHvacMode	VAVII	DestHvacMode
DDWM	SrcManualOcc	VAVII	DestManualOcc
VAVII	SrcRmTempSpt	DDWM	DestRmTempActSpt
VAVII	SrcUnitStatus	DDWM	DestUnitStatus

VAVII Configuration

Wall Module Type: No\_Sensor  
 Flow Type: SD\_Normal\_Flow

Refer to the Binding Guide for T7780 DDWM in E-Vision Help (Tables 13, 14 ,15) for additional binding information for binding the T7780 to the VAVII and other Excel 10 Controllers.

## Type of Reheat Coil

Each VAV box can contain a coil(s) for reheating the air delivered to the space. The Excel 10 VAV Controller can control staged electric heat elements, solenoid valves, PWM, Series 60 (floating) or pneumatic modulating valves.

**NOTE:** Pneumatically actuated valves can be controlled using a floating-to-pneumatic transducer device. See Application Step 5. Order Equipment, for further information. Transducer devices are also available to convert the floating outputs to a voltage signal.

The staged reheat control algorithm can control one, two, or three stages of reheat (a third stage of reheat is only available if configured as three stage binary control on the W7751H Smart VAV Actuator). In addition to the proportional, integral, derivative (PID) control algorithm, the Excel 10 VAV Box Controller has an intelligent anticipation cyler incorporated into the staged reheat algorithm. The anticipator control works in unison with the PID temperature control algorithm and cycles the staged reheat coil providing space temperature control with the accuracy of modulating reheat. The stages are activated through Triac digital outputs, one for each stage, wired to 24 Vac contactors (see Fig. 61, 68 and 73 in Application Step 4. Prepare Wiring Diagrams). These outputs can also control 24 Vac solenoid valves on hot water coils instead of electric heat elements. Fig. 47 depicts a typical VAV box with staged reheat.

The Series 60 modulating control is provided through two Triac digital outputs, one to pulse the valve actuator open and one to pulse it closed. Damper control output Triacs operate similarly. See Fig. 62, 66, 67, and 72 in Application Step 4. Prepare Wiring Diagrams for wiring details that connect Series 60 actuators to Excel 10 VAV Controllers. Fig. 67 depicts a typical VAV box with modulating reheat.

PWM control positions the actuator based on the length, in seconds, of the pulse from the digital output. For PWM, the controller outputs a pulse whose length consists of two parts, a minimum and a maximum. The minimum pulse time represents the analog value of zero percent (also indicating a signal presence) and the maximum pulse length that represents an analog value of 100 percent. If the analog value is greater than zero percent, an additional time is added to the minimum pulse time. The length of time added is directly proportional to the magnitude of the analog value. The PWM actuator will begin to use the analog value at the end of the pulse and will continue to use this value until a new pulse is received. Refer to Appendix B under PWM Control for an example. Series 60 actuators are generally less expensive than those for PWM, but the trade-off is that PWM requires only a single controller digital output while floating control uses two digital outputs.

## Pneumatic Valve Actuator Control

Pneumatic hot water or steam valve actuator control can be provided through either PWM using one Triac digital output or by Series 60 using two Triac digital outputs as is used for the Series 60 electric control. These two outputs are used to control the transducer interface that converts to a pneumatic signal.

Fig. 71 depicts a typical VAV box using a PWM Valve Actuator. See Fig. 64, 70 and 75 for wiring an MMC325 Pneumatic Transducer to a W7751 VAV Controller.

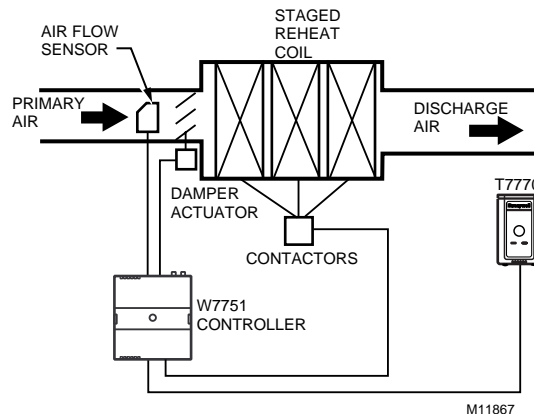


Fig. 47. VAV box with staged reheat coils.

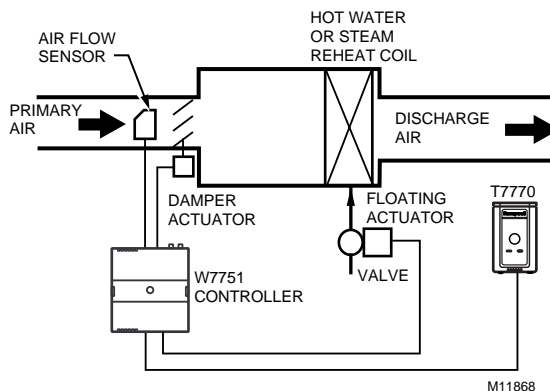
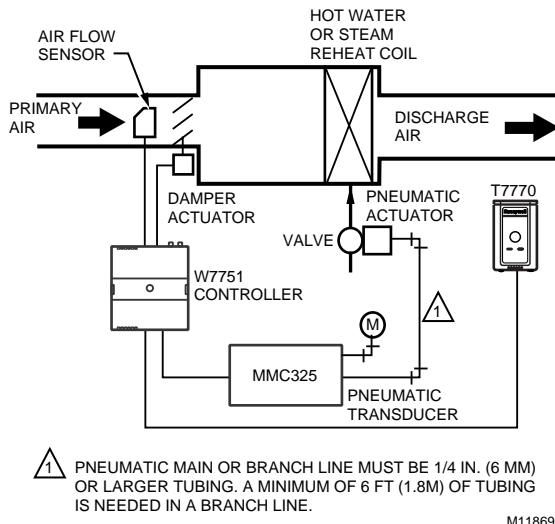


Fig. 48. VAV box with modulating reheat coil (Series 60 floating).

## CAUTION

When choosing the pneumatic pressure range, make sure that the close-off pressure is 2 to 3 psi greater than that of the spring range. When using a spring range of 5 to 10 psi with 10 psi as the Closed position, *do not* use the 0 to 10 psi transducer; use the 0 to 20 psi transducer as the recommended selection.



**Fig. 49. VAV box with modulating reheat coil (pneumatic valve actuator).**

### Exhaust Tracking Option

The basic flow control algorithm can be run in either of two modes: the Temperature Control mode, where the flow rate is modulated to maintain the space temperature and the Exhaust Tracking Control mode (refer to Fig. 45), where the exhaust flow rate is modulated to track the supply air flow in other controllers. If exhaust tracking is selected, the air flow removed from the space is based on the sum of flow rate signals sent over the E-Bus from other controllers (plus or minus a differential). Use the Exhaust Tracking Control mode only as required by the job specifications.

### Occupancy Sensor

W7751B, D, F Excel 10 VAV Controllers provide a digital input for connection to an Occupancy Sensor (W7751H Smart Actuator requires a Network input for this application, Refer to Note 2 below). This is a device, such as a passive infrared motion detector, that contains a dry contact (see following NOTE) closure to indicate whether or not people are present in the space. The Excel 10 VAV Controller expects a contact closure to indicate that the space is Occupied. See Fig. 60 through 63 and 66 through 69 in Application Step 4. Prepare Wiring Diagrams for details on wiring connections.

The control algorithm in the Excel 10 VAV Controller uses the Occupancy Sensor, if configured, to determine the Effective Occupancy (see Table 2) mode of operation. If the Time Of Day (TOD) schedule indicates an Occupied state, and the Occupancy Sensor contact is closed, the Effective Occupancy mode will be Occupied. However, if the TOD schedule indicates an Occupied state and the Occupancy Sensor contact is open, then the Effective Occupancy mode will be STANDBY. The flow control algorithm will then control to the STANDBY Cooling and Heating Setpoints.

If the Occupancy Sensor is not configured, a local controller can be put in the STANDBY mode only by either a one-to-one association of the occupancy sensor from another Excel 10 VAV Controller to the local controller, or by receiving the STANDBY mode signal via the E-Bus.

#### NOTES:

1. The Excel 10 VAV Controller has limited power available (only 9 mA at 4.8 volts) for checking the digital inputs for contact closures. It is very important that the device used contains high quality, noncorroding contacts with resistivity that does not degrade; that is, increase over time. Use noble metal (such as gold or silver), pimpled or sealed contacts to assure consistent, long term operation.
2. The W7751H has no configurable digital inputs. If the W7751H Smart Actuator requires the Window open, Occupancy, or Heat/Cool inputs, then it must be bound over the network (E-Bus) to another W7751 VAV controller that has those physical digital inputs.

The recommended devices for use with the Excel 10 VAV Controller are the EL7628A1007 Ceiling Mount Infrared or the EL7680A1008 Wall Mounted Wide View Infrared Occupancy Sensors. If ultrasonic sensors are required, the EL7611A1003 and the EL7612A1001 Occupancy Sensors are recommended. An EL76XX Power Supply/Control Unit is required for use with these occupancy sensors. The EL7630A1003, can power up to four sensors, and is multitapped for several line voltages. The EL7621A1002 can power three sensors and connects to 120 Vac line voltage. The EL7621A1010 can also power three sensors but connects to 277 Vac line voltage.

### Window Open/Closed Digital Input

W7751B, D, F Excel 10 VAV Controllers provide a digital input to detect whether a window in the space was opened (W7751H Smart Actuator requires a Network input for this application, Refer to Note 2 below). The Excel 10 VAV Controller can be connected to a dry contact (see the following NOTE and Fig. 60 through 63 and 66 through 69 in Application Step 4. Prepare Wiring Diagrams, for details) or a set of contacts wired in series (for monitoring multiple windows) to verify that the window(s) are closed. The algorithm expects a contact closure to indicate the window is closed. If an open window is detected, the algorithm changes the mode of operation to CLOSED, which commands the box damper to the position set in ZeroDmprPos (typically zero or a low value).

If the Window Sensor is not configured, a W7751B,D,F and H Controller can be put in the CLOSED mode using only two methods, either a one-to-one association of the window sensor from another Excel 10 VAV Controller to the local controller, or by receiving the CLOSED mode signal via the E-Bus.

NOTES:

1. (This is the same NOTE as in the Occupancy Sensor section.) The Excel 10 VAV Controller has limited power available (only 9 mA at 4.8 volts) for checking the digital inputs for contact closures. It is very important that the device used contains high quality, noncorroding contacts with resistivity that does not degrade; that is, increase over time. Use noble metal (such as gold or silver), pimpled or sealed contacts to assure consistent, long term operation.
2. The W7751H has **no** configurable digital inputs. If the W7751H Smart Actuator requires the Window open, Occupancy, or Heat/Cool inputs, then it must be bound over the network (E-Bus) to another W7751 VAV controller that has those physical digital inputs.

**Heat/Cool change over**

W7751B, D, F Excel 10 VAV Controllers provide a digital input for connection to an Heat/Cool change over input (W7751H Smart Actuator requires a Network input for this application, Refer to Note 2 below). The Excel 10 VAV Controller expects a contact closure to indicate that the controller will be put into the heat mode or an open contact to be put into the cooling mode. See Figs. 30 through 34 and 36 through 40 in Application Step 4. Prepare Wiring Diagrams for details on wiring connections.

NOTES:

1. (This is the same NOTE as in the Occupancy Sensor section.) The Excel 10 VAV Controller has limited power available (only 9 mA at 4.8 volts) for checking the digital inputs for contact closures. It is very important that the device used contains high quality, noncorroding contacts with resistivity that does not degrade; that is, increase over time. Use noble metal (such as gold or silver), pimpled or sealed contacts to assure consistent, long term operation.
2. The W7751H has no configurable digital inputs. If the W7751H Smart Actuator requires the Window open, Occupancy, or Heat/Cool inputs, then it must be bound over the network (E-Bus) to another W7751 VAV controller that has those physical digital inputs.

**Wall Module Options**

As previously discussed, there are four basic varieties of T7770 Wall Modules (see Product Names and Construction sections). Also, a T7770 can be shared among two or more W7751 Controllers. A T7780 Digital Display Wall Module (DDWM) can also be used in place of the T7770, but the T7780 DDWM requires a network node address which will decrease the number of nodes available for other Excel 10 controllers. The control algorithm must be given this wall module information when configuring the W7751 (see Application Step 6. Configure Controllers).

**Common Temperature Control (Share Wall Module)**

When one or more terminal units serve a common area and a single temperature sensor is specified or is desired to be used for these boxes, the Share Wall Module option can be configured (refer to Fig. 45). One Excel 10 VAV Controller will be configured with a wall module and have the desired options. The other Excel 10 VAV Controller(s) will be configured without wall modules. Refer to the CARE User's Manual, form 74-5587. In order to link these units together, link Share Wall Module through one-to-one options in the Network Manager. Use E-Vision Refer Excel 10 Points option to bind the Wall Module information between the Source (SrcMaster) and Destination (DestSatellite) controllers. In this particular case, the Master temperature control algorithm will control both the Master and Satellite controller outputs.

The preferred method is to use the Share Wall Module (Shared\_Cntrl).

However, an alternative method is to bind the SrcRmTemp of the controller (Master) that has the wall module connected to it, to the DestRmTemp in each of the destination controllers (Satellites) that do not have wall modules. Each controller would use its own temperature control algorithm and internal setpoints. This method could be used when there are many VAV boxes serving the same zone that have different configurations which do not allow using the Share Wall Module option.

**NOTE:** Be aware of a potential problem the (SrcRmTemp and DestRmTemp) method could allow, since each VAV box is executing its own temperature control algorithm (there could be some conflicting control. For example: One box could be cooling at Max flow and another box could be at Min flow or even in the reheat mode.

The following **IMPORTANT** items apply to the Share Wall Module option.

**IMPORTANT**

*The type of reheat option must be the same in each unit; for example, all units must be either staged electric heat or steam/hot water heat. If the staged heat option is present, the master unit (with temperature sensor) must have the same or greater number of stages as any satellite unit.*

*Some or all of the satellite units can be configured without any heat option.*

*If the Share Wall Module option is used, the satellite units will not use any Internal Temperature Setpoints. The master controller Setpoints, as well as Occupancy and Command mode status, will be used in each satellite unit. Each satellite unit will have and use its own MAX, MIN, and Reheat Flow Setpoints.*

*Share Wall Module option can also be used when none of the terminal units have any heating coils. If any units have terminal fans, the type, either serial or parallel, must be the same and the master unit must be configured with a fan.*



## Sensor Options

The C7770A, C7031C1031 or C7031C1033 Air Temperature Sensors are direct-wired temperature sensors that are used to sense discharge or return air in a duct controlled by a W7751 Controller.

NOTE: The C7770A, C7031C1031 or C7031C1033 Air Temperature Sensors cannot be used with the T7770B,C Wall Modules when controlling any W7751H Controller.

## Pneumatic Retrofit Applications

For projects with existing pneumatically-actuated reheat valves, the Excel 10 VAV Controller output must be converted to a pneumatic signal using a transducer device developed for use with Excel 10 VAV Controllers. The transducer is available through Honeywell or directly from the manufacturer, Mamac Systems (see Table 9 for ordering information). Be sure to observe the following CAUTION.

### CAUTION

Pneumatic transducers should not be used to control VAV box dampers; Instead use ML6161B1000 Motors. Pneumatic transducers are intended to control only pneumatic reheat valves.

## APPLICATION STEPS

### Overview

The seven application steps shown in Table 6 are planning considerations for engineering an Excel 10 W7751 System. These steps are guidelines intended to aid understanding of the product I/O options, bus arrangement choices, configuration options and the Excel 10 W7751 Controller role in the overall EXCEL 5000 OPEN™ System architecture.

Table 6. Application Steps.

Step No.	Description
1	Plan The System
2	Determine Other Bus Devices Required
3	Lay Out Communication and Power Wiring
4	Prepare Wiring Diagrams
5	Order Equipment
6	Configure Controllers
7	Troubleshooting

### Step 1. Plan The System

Plan the use of the W7751 Controllers according to the job requirements. Determine the location, functionality and sensor or actuator usage. Verify the sales estimate of the number of W7751 Controllers and T7770 and T7780 Wall Modules required for each model type. Also check the number and type of output actuators and other required accessories.

When planning the system layout, consider potential expansion possibilities to allow for future growth. Planning is very important when preparing to add HVAC systems and controllers in future projects.

T7770 Wall Modules can be installed as either hardwired I/O-only devices or additional wiring can be run to them (for the E-Bus network ) allowing a CARE/E-Vision operator terminal to have access to the E-Bus. The application engineer needs to determine how many wall modules are required of each kind; that is, how many T7770s and T7780s are in the system. (All T7780s are connected to the E-Bus and occupy a node address and all have a connected network access jack.) How many T7770s with E-Bus network connections and how many T7770s without E-Bus network connections are being installed on the job. Clearly document which T7770 wall modules (if any) have network access and locations of any T7780s. This information is required during installation to ensure that the proper number and type of wires are pulled to the wall modules, and the building operators are informed about where they can plug in to the E-Bus network with a portable operator terminal (see Fig. 50 and 51). Refer to Step 4. Prepare Wiring Diagrams for details, about the about the wiring differences between the two types.

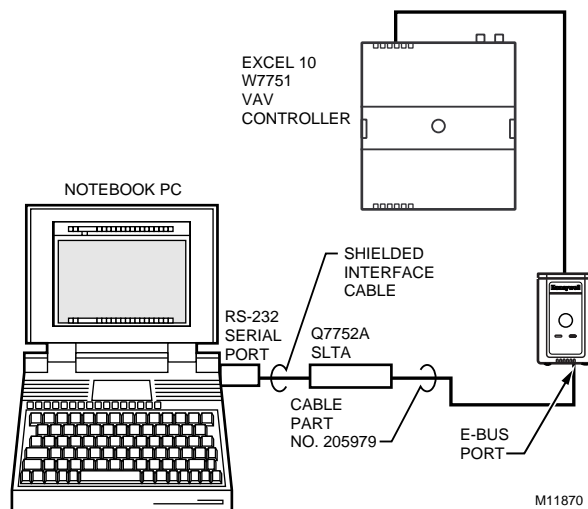


Fig. 50. Connecting the portable operator terminal to the E-Bus.

Refer to the E-Bus Wiring Guidelines, form 74-2865 for complete description of network topology rules. See Application Step 3. Lay Out Communications and Power Wiring, for more information on bus wiring layout, and see Figs. 60 through 74 in Application Step 4. Prepare Wiring Diagrams, for wiring details.

The application engineer must review the Direct Digital Control (DDC) job requirements. This includes the Sequences of Operation for the W7751 VAV units, and for the system as a whole. Usually there are variables that must be passed between the W7751 VAV Controllers and other zone controller(s), or central plant controller(s) that are required for optimum system-wide operation. Typical examples are the TOD Occ/Unocc signal, the outdoor air temperature, demand limit control signal, and smoke control mode signal.

It is important to understand these interrelationships early in the job engineering process to ensure implementation when configuring the controllers. (See Application Step 6. Configure Controllers, for information on the various Excel 10 VAV Controller parameters and on Excel 10 VAV Controller point mapping.)

## Step 2. Determine Other Bus Devices Required

A maximum of 63 nodes can communicate on a single E-Bus segment. Each W7751 VAV Controller or T7780 Wall Module constitutes one node. If more nodes are required, a Q7751A Router is necessary. Using a router allows up to 127 nodes, divided between two E-Bus segments. The router accounts for two of these nodes (one node on each side of the router); a Q7750A Excel 10 Zone Manager takes one node and four nodes are available for operator terminal nodes, leaving 120 nodes available for Excel 10 Controllers and T7780 Wall Modules. All 120 controllers and T7780 Wall Modules are able to talk to each other through the router. A Q7750A Excel 10 Zone Manager is required to connect the E-Bus to the standard EXCEL 5000® System C-Bus. Each Excel 10 Zone Manager can support no more than 120 Excel 10 Controllers and T7780 Wall Modules. This limit is set in the Excel 10 Zone Manager database as an absolute maximum.

Each E-Bus segment is set up with two unused nodes to allow for a CARE/E-Vision operator terminal to be connected to the E-Bus. Multiple CARE/E-Vision terminals can be connected to the bus at the same time. Table 7 summarizes the E-Bus segment configuration rules.

Refer to the E-Bus Wiring Guidelines, form 74-2865 for complete description of network topology rules and the maximum wire length limitations. If longer runs are required, a Q7740A 2-way or Q7740B 4-way repeater can be added to extend the length of the E-Bus. A Q7751A Router can be added to partition the system into two segments and effectively double the length of the E-Bus. Only one router is allowed with each Excel 10 Zone

Manager, and each network segment can have a maximum of 1 repeater.

In addition, a 209541B Termination Module may be required. Refer to the E-Bus Wiring Guidelines, form 74-2865, and the Excel 10 FTT Termination Module Installation Instructions form, 95-7554. See Application Step 3. Lay Out Communications and Power Wiring, and the E-Bus Termination Module subsection in Application Step 4.

## Step 3. Lay Out Communications and Power Wiring

### E-Bus Layout

The communications bus, E-Bus, is a 78-kilobit serial link that uses transformer isolation and differential Manchester encoding. Approved cable types for E-Bus communications wiring is Level IV 22 AWG (0.34 mm<sup>2</sup>) plenum or non-plenum rated unshielded, twisted pair, solid conductor wire. For nonplenum areas, U.S. part AK3781 (one pair) or U.S. part AK3782 (two pair) can be used. In plenum areas, U.S. part AK3791 (one pair) or U.S. part AK3792 (two pair) can be used. (see Tables 9 and 10 for part numbers). Additionally, Echelon® approved cable can be used. Contact Echelon® Corp. Technical Support for the recommended vendors of Echelon® approved cables. The FTT (Free Topology Transceiver) communications bus, E-Bus, supports a polarity insensitive, free topology wiring scheme, refer to E-Bus Wiring Guidelines form, 74-2865 for a complete description of E-Bus network topology rules and Table 7. Fig. 51, 52 and 53 depict three typical E-Bus network topologies; one as a singly terminated bus segment that has 60 nodes or less, one showing two segments and one doubly terminated E-Bus network topology that has two segments. The bus configuration is set up using E-Vision (see the Excel E-Vision User's Guide form, 74-2588).

**Table 7. E-Bus Configuration Rules And Device Node Numbers.**

<b>One E-Bus Segment Example</b>	<b>Maximum Number of Nodes Equals 62</b>
One Q7750A Excel 10 Zone Manager	1 node
Port for operator terminal access (CARE/E-Vision or Hand Held Tool)	2 nodes
Maximum number of Excel 10s and T7780s	60 nodes (Only T7780 Wall Modules are E-Bus nodes)
Total	63 nodes
<b>Two E-Bus Segments Example</b>	
<b>Maximum Number of Nodes Equals 125</b>	
One Q7750A Excel 10 Zone Manager	1 node
One Q7751A Router	2 nodes (1 in each Bus Segment)
Ports for operator terminal access (two CARE/E-Vision terminals or Hand Held Tools)	4 nodes (2 in each Bus Segment)
Maximum number of Excel 10s and T7780s in segment number one	60 nodes (Only T7780 Wall Modules are E-Bus nodes)
Maximum number of Excel 10s and T7780s in segment number two	60 nodes (Only T7780 Wall Modules are E-Bus nodes)
Total	127 nodes

NOTE: For wiring details see the E-Bus Termination Module subsection in Step 4. For wall module wiring, U.S. part AK3782 (non-plenum) or U.S. part AK3792 (plenum) can be used. These cables contain two twisted pairs (one for the run down to the wall module, and one for the run back up to the controller) for ease of installation.

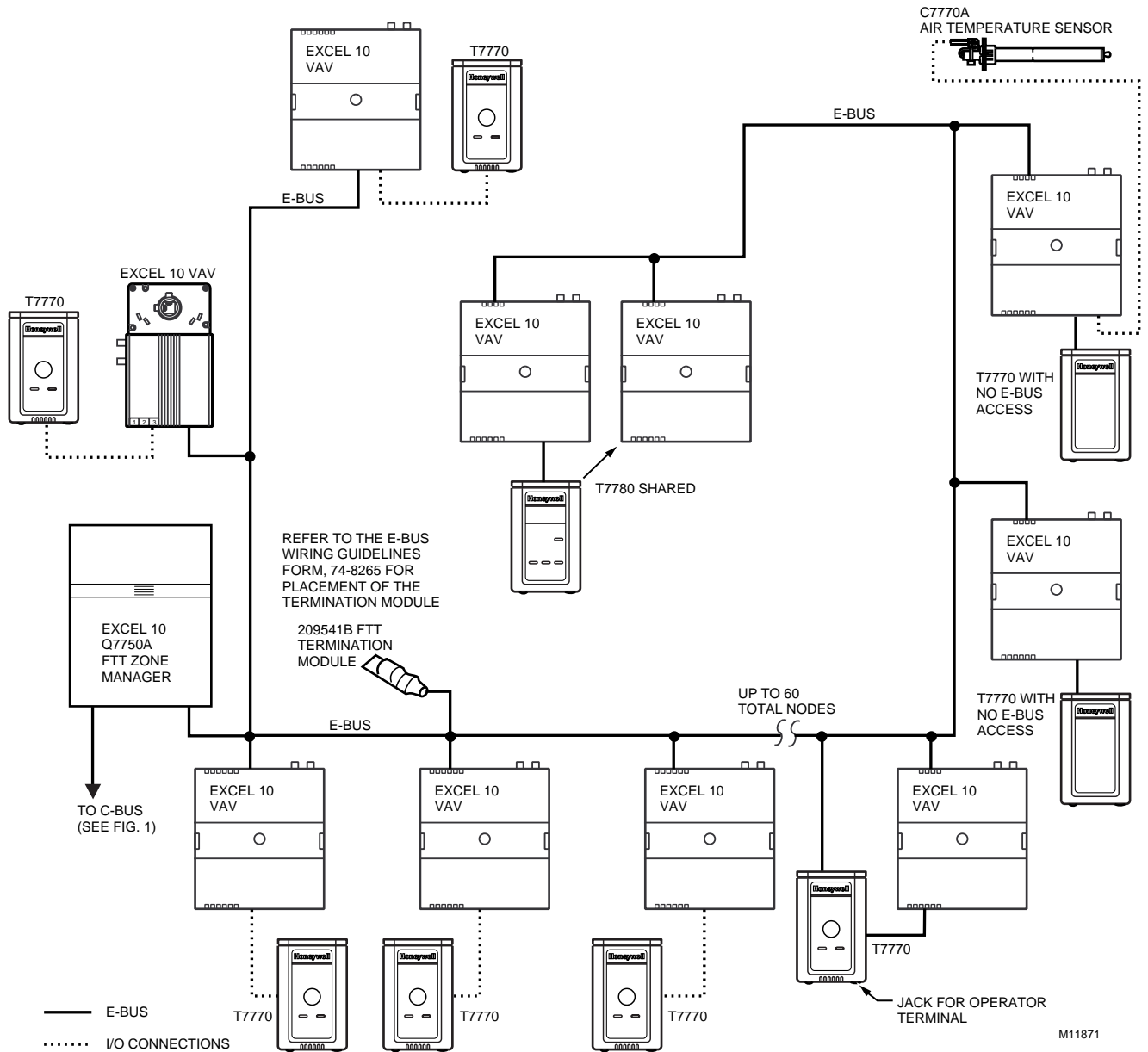


Fig. 51. Singly terminated E-Bus wiring layout for one E-Bus segment.

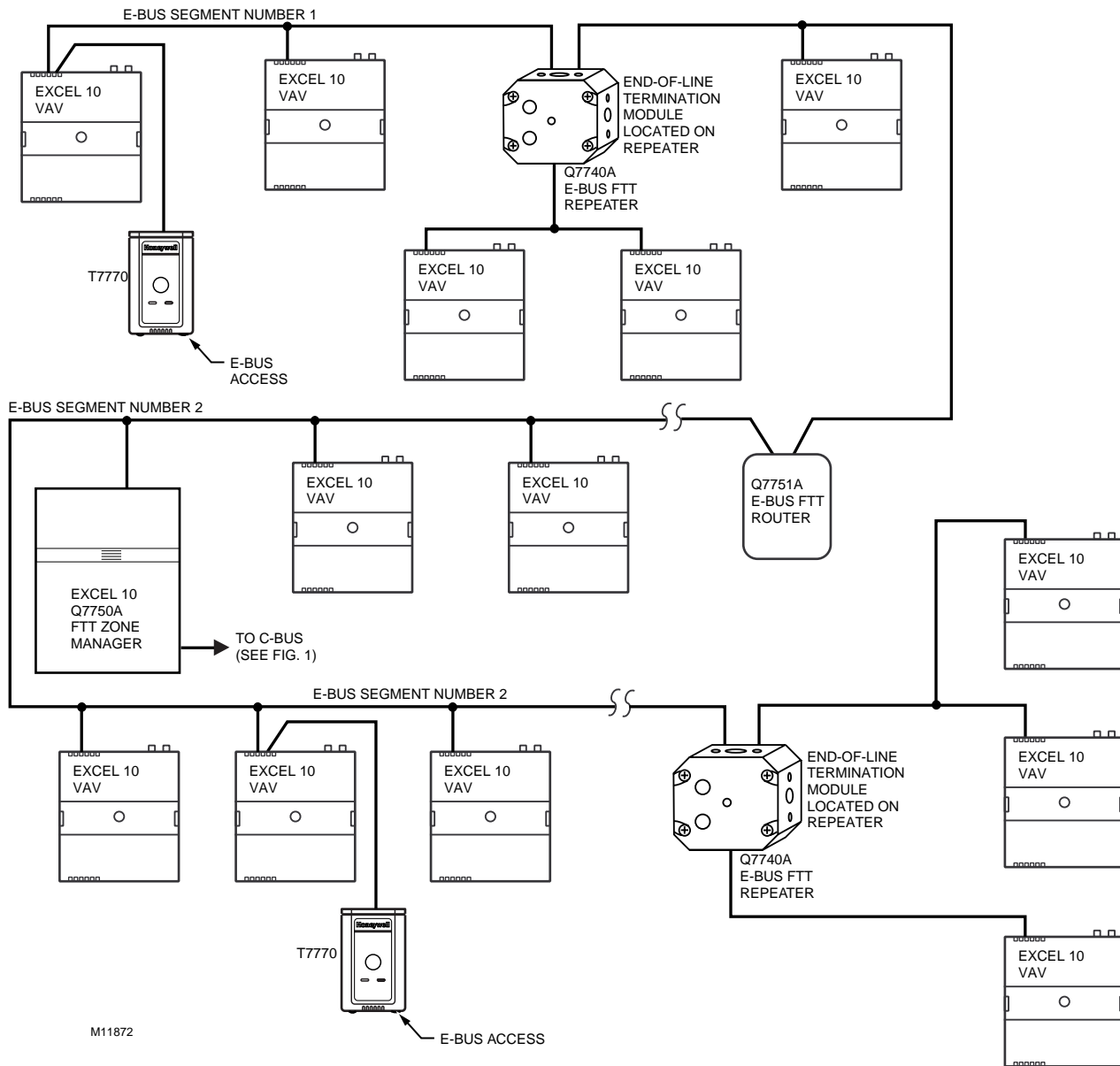


Fig. 52. Singly terminated bus with repeaters and router (total E-Bus length less than 500 meters). E-Bus wiring layout for two E-Bus segments.

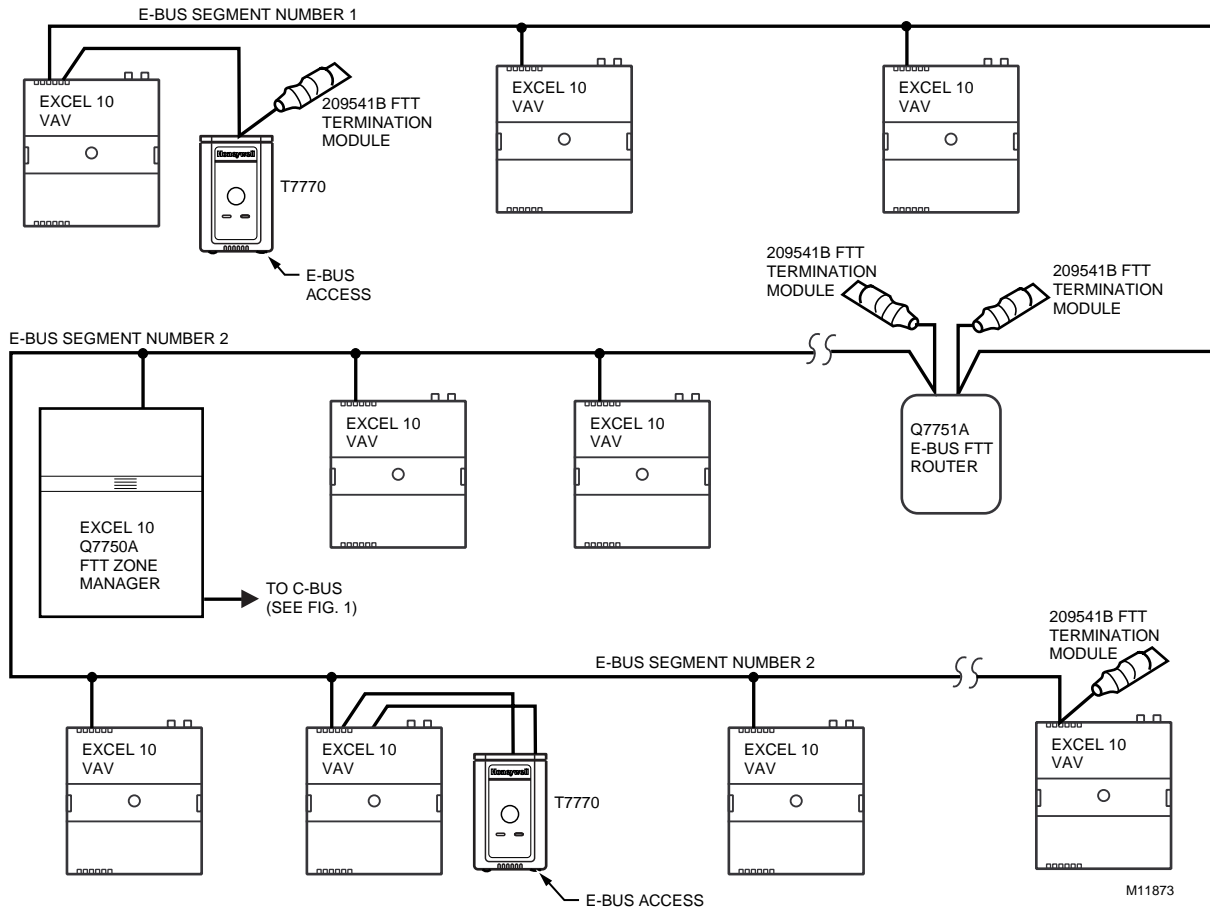


Fig. 53. E-Bus wiring layout for two doubly terminated E-Bus segments.

NOTE: See the E-Bus Termination Module section for wiring details.

**IMPORTANT**

Notes on communications wiring:

- All field wiring must conform to local codes and ordinances.
- Approved cable types for E-Bus communications wiring is Level IV 22 AWG (0.34 mm<sup>2</sup>) plenum or non-plenum rated unshielded, twisted pair, solid conductor wires. For nonplenum areas, U.S. part AK3781 (one pair) or U.S. part AK3782 (two pair) can be used. In plenum areas, U.S. part AK3791 (one pair) or U.S. part AK3792 (two pair) can be used (see Tables 9 and 10 for part numbers). Additionally, Echelon® approved cable can be used. Contact Echelon® Corp. Technical Support for the recommended vendors of Echelon® approved cables.
- Unswitched 24 Vac power wiring can be run in the same conduit as the E-Bus cable.
- Do not use different wire types or gauges on the same E-Bus segment. The step change in line impedance characteristics causes unpredictable reflections on the bus. When using different types is unavoidable, use a Q7751A Router at the junction.

- In noisy (high EMI) environments, avoid wire runs parallel to noisy power cables, or lines containing lighting dimmer switches, and keep at least 3 in. (76 mm) of separation between noisy lines and the E-Bus cable.
- Make sure that neither of the E-Bus wires is grounded.

**Power Wiring**

A power budget must be calculated for each Excel 10 W7751 Controller to determine the required transformer size for proper operation. A power budget is simply the summing of the maximum power draw ratings (in VA) of all the devices to be controlled by an Excel 10 W7751 Controller. This includes the controller itself, the equipment actuators (ML6161, or other motors) and various contactors and transducers, as appropriate, for the Excel 10 configuration.

**Power Budget Calculation Example**

The following is an example power budget calculation for a typical W7751 Excel 10 VAV Controller. Assume a VAV box with a series fan, and modulating reheat valve. The power requirements are:

Device	VA	Information Obtained from the
Excel 10 W7751 VAV Controller	6.0 VA	W7751 Specification Data
ML6161 Damper Actuator	2.2 VA	TRADELINÉ® Catalog
R8242A Contactor for fan	21.0 VA	TRADELINÉ® Catalog in-rush rating
D/X Stages	0.0 VA	(NOTE: For this example, assume the cooling stage outputs are wired into a compressor control circuit and, therefore, have no impact on the power budget.)
M6410A Steam Heating Coil Valve	0.7 VA	TRADELINÉ® Catalog, 0.32A at 24 Vac

TOTAL: 29.9 VA

The Excel 10 VAV System example requires 29.9 VA of peak power; therefore, a 40 VA AT72D Transformer is able to provide ample power for this controller and its accessories. Alternatively, a 75 VA AT88A Transformer could be used to power two Excel 10 Systems of this type, or a 100 VA AT92A Transformer could be used to power three of these controllers and meet NEC Class 2 restrictions (no greater than 100 VA U.S. only). See Fig. 55 and 56 for illustrations of power wiring details. See Table 8 for VA ratings of various devices.

**Table 8. VA Ratings For Transformer Sizing.**

Device	Description	VA
W7751B,D,F	Excel 10 W7751 Controller	6.0
W7751H	Excel 10 Smart VAV Actuator	6.0
T7780A	Excel 10 Wall Module	0.3
ML6161A/B	Damper Actuator, 35 lb-in.	2.2
R8242A	Contactor	21.0
M6410A	Valve Actuator	0.7
MMC325	Pneumatic Transducer	5.0
ML684	Versadrive Valve Actuator	12.0
ML6464	Damper Actuator, 66 lb-in.	3.0
ML6474	Damper Actuator, 132 lb-in.	3.0
ML6185	Damper Actuator SR 50 lb-in.	12.0

For contactors and similar devices, the in-rush power ratings should be used as the worst case values when performing power budget calculations. Also, the application engineer must consider the possible combinations of simultaneously energized outputs and calculate the VA ratings accordingly. The worst case, that uses the largest possible VA load, should be determined when sizing the transformer.

**Line Loss**

Excel 10 Controllers must receive a minimum supply voltage of 20 Vac. If long power or output wire runs are required, a voltage drop due to Ohms Law (I x R) line loss must be considered. This line loss can result in a significant increase in total power required and thereby affect transformer sizing. The following example is an I x R line-loss calculation for a 200 ft (61m) run from the transformer to a W7751 Controller drawing 37 VA using 18 AWG (1.0 mm<sup>2</sup>) wire.

The formula is:

$$\text{Loss} = [\text{length of round-trip wire run (ft)}] \times [\text{resistance in wire (ohms per ft)}] \times [\text{current in wire (amperes)}]$$

From specification data:

18 AWG twisted pair wire has 6.52 ohms per 1000 feet.  

$$\text{Loss} = [(200 \text{ ft}) \times (2 - \text{round-trip}) \times (6.52/1000 \text{ ohms per ft})] \times [(37 \text{ VA})/(24\text{V})] = 4.02 \text{ volts}$$

This means that four volts are going to be lost between the transformer and the controller; therefore, to assure the controller receives at least 20 volts, the transformer must output more than 24 volts. Because all transformer output voltage levels depend on the size of the connected load, a larger transformer outputs a higher voltage than a smaller one for a given load. Fig. 54 shows this voltage load dependence.

In the preceding I x R loss example, even though the controller load is only 37 VA, a standard 40 VA transformer is not sufficient due to the line loss. From Fig. 54, a 40 VA transformer is just under 100 percent loaded (for the 37 VA controller) and, therefore, has a secondary voltage of 22.9 volts. (Use the lower edge of the shaded zone in Fig. 54 that represents the worst case conditions.) When the I x R loss of four volts is subtracted, only 18.9 volts reaches the controller, which is not enough voltage for proper operation.

In this situation, the engineer basically has three alternatives:

1. Use a larger transformer; for example, if an 80 VA model is used, see Fig. 54, an output of 24.4 volts minus the four volt line loss supplies 20.4V to the controller. Although acceptable, the four-volt line-loss in this example is higher than recommended. See the following **IMPORTANT**.
2. Use heavier gauge wire for the power run. 14 AWG (2.0 mm<sup>2</sup>) wire has a resistance of 2.57 ohms per 1000 ft which, using the preceding formula, gives a line-loss of only 1.58 volts (compared with 4.02 volts). This would allow a 40 VA transformer to be used. 14 AWG (2.0 mm<sup>2</sup>) wire is the recommended wire size for 24 Vac wiring.
3. Locate the transformer closer to the controller, thereby reducing the length of the wire run, and the line loss.

The issue of line-loss is also important in the case of the output wiring connected to the Triac digital outputs. The same formula and method are used. The rule to remember is to keep all power and output wire runs as short as practical. When necessary, use heavier gauge wire, a bigger transformer, or install the transformer closer to the controller.

**IMPORTANT**

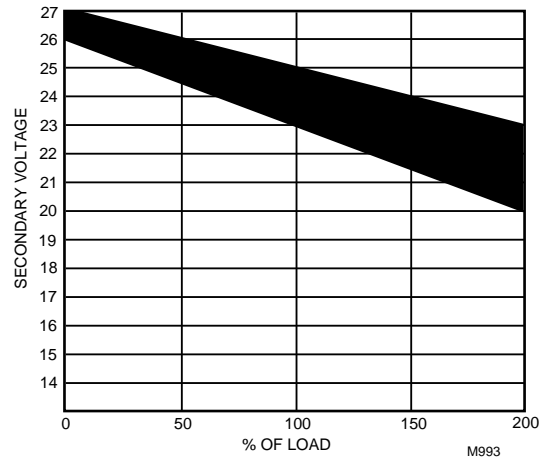
*No installation should be designed where the line loss is greater than two volts to allow for nominal operation if the primary voltage drops to 102 Vac (120 Vac minus 15 percent).*

To meet the National Electrical Manufacturers Association (NEMA) standards, a transformer must stay within the NEMA limits. The chart in Fig. 54 shows the required limits at various loads.

With 100 percent load, the transformer secondary must supply between 23 and 25 volts to meet the NEMA standard. When a purchased transformer meets the NEMA standard DC20-1986, the transformer voltage-regulating ability can be considered reliable. Compliance with the NEMA standard is voluntary.

The following Honeywell transformers meet this NEMA standard:

Transformer Type	VA Rating
AT20A	20
AT40A	40
AT72D	40
AT87A	50
AK3310 Assembly	100



**Fig. 54. NEMA class 2 transformer voltage output limits.**

Attach good earth ground to all W7751 Controllers. Refer to Fig. 55, 56 and 57, 58 through 64 for terminal locations.

**IMPORTANT**

*If the W7751 Controller is used on **Heating and Cooling Equipment (UL 1995 US only)** devices and the transformer primary power is more than 150 volts, connect the transformer secondary to earth ground, see Fig. 57.*

*For the W7751B, attach earth ground to terminal 10 or 12. For the W7751D,F, attach earth ground to terminal 2 or 4. For the W7751H, attach earth ground to terminal 2. See Fig. 56.*

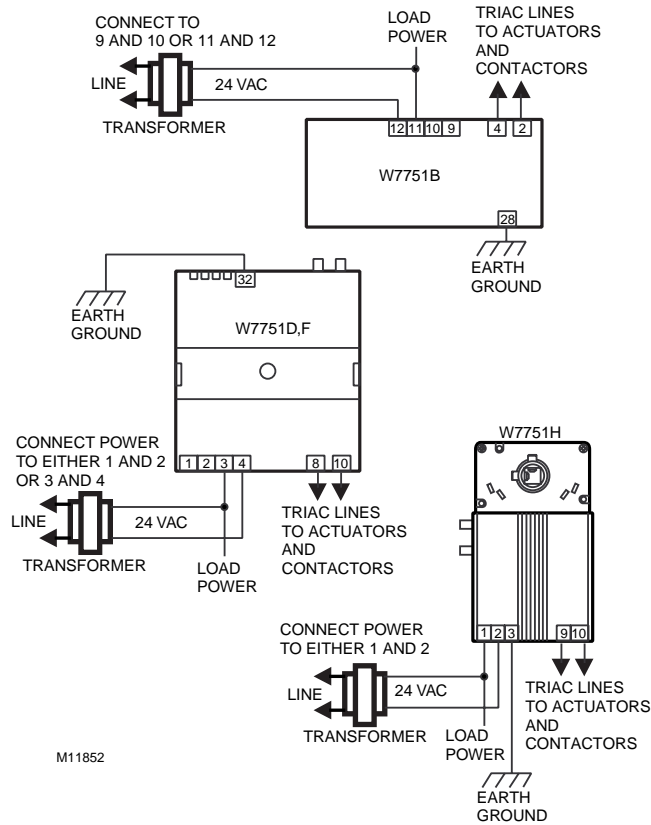


Fig. 55. Power wiring details for one Excel 10 per transformer.

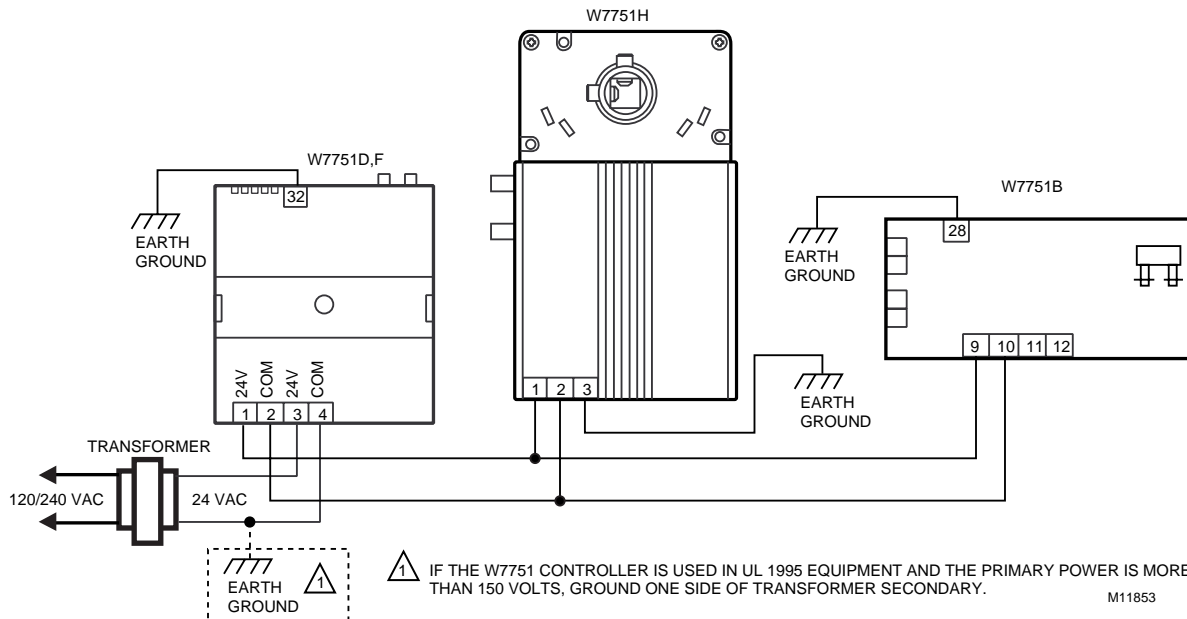


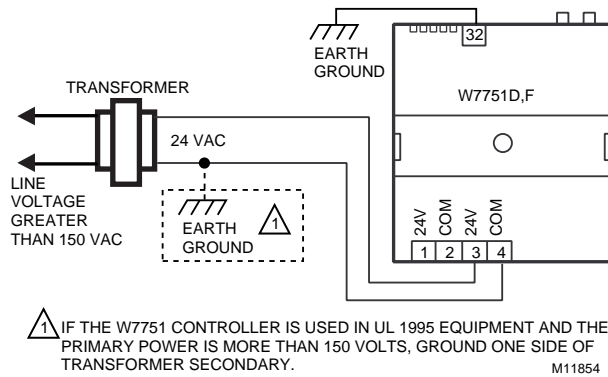
Fig. 56. Power wiring details for two or more Excel 10s per transformer.

**IMPORTANT**

If the W7751 Controller is used on **Heating and Cooling Equipment (UL 1995 US only)** devices and the transformer primary power is more than 150 volts, connect the transformer secondary to earth ground, see Fig. 57.

For the W7751B, attach earth ground to terminal 10 or 12. For the W7751D,F, attach earth ground to terminal 2 or 4. For the W7751H, attach earth ground to terminal 2. See Fig. 56.





**Fig. 57. Transformer power wiring details for one Excel 10 used in UL 1995 equipment (US only).**

### IMPORTANT

#### Notes on power wiring:

- All field wiring must conform to local codes and ordinances.
- To maintain NEC Class 2 and UL ratings, the installation must use transformers of 100 VA or less capacity (U.S. only).
- For multiple controllers operating from a single transformer, the same side of the transformer secondary must be connected to the same input terminal in each controller and the ground terminals (28 on the W7751B, 32 on the W7751D,F and 3 on the W7751H) must be connected to a verified earth ground for each controller in the group. See Fig. 56. (Controller configurations are not necessarily limited to three devices.)
- All output devices must be powered from the same transformer as the one powering the Excel 10 W7751 VAV Controller.
- Use the heaviest gauge wire available, up to 14 AWG (2.0 mm<sup>2</sup>) with a minimum of 18 AWG (1.0 mm<sup>2</sup>) for all power and earth ground connections.
- To minimize EMI noise, do not run Triac output wires in the same conduit as the input wires or the E-Bus communications loop.
- Unswitched 24 Vac power wiring can be run in the same conduit as the E-Bus cable.
- Make earth ground connections with the shortest possible wire run using 14 AWG (2.0 mm<sup>2</sup>) wire. A good earth ground is essential for W7751 operation. Ideally, connect the earth ground to the ground bus at a motor control center or circuit breaker panel. However, if the nearest ideal earth ground is inaccessible, consider an alternate source for earth ground. Metal water pipe is generally a good ground, but do not use sprinkler pipe if prohibited by local codes. Attention must be given when duct work, conduit, or rebar are to be considered as ground sources. It is the responsibility of the installer to assure that these structures are tied back to a known earth ground.

## Step 4. Prepare Wiring Diagrams

### General Considerations

The purpose of this step is to assist the application engineer in developing job drawings to meet job specifications. Wiring details are included for the W7751B,D,F,H and the T7770 and T7780. The drawings detail I/O, power, and communication bus wiring connections.

**NOTE:** For field wiring, when two or more wires are to be attached to the same connector block terminal, be sure to twist them together. Deviation from this rule can result in improper electrical contact. See Fig. 58.

The connector block terminals on the W7751 and on the T7770 and T7780 accept 14 through 22 AWG (2.0 to 0.325 mm<sup>2</sup>) wire. Table 9 lists wiring types, sizes, and length restrictions for Excel 10 products.

### W7751B OEM Version

Fig. 60 through 65 illustrate W7751B Controller wiring for various VAV box configurations. The W7751B OEM version is implemented on a snaptrack-compatible printed wiring board (PWB). Connections to the wall module terminals (19 through 23) and the communications terminals (29 through 32) are made at terminal blocks. Connection for access to the E-Bus is provided by plugging the connector into the communications jack. All other connections are made with 1/4 in. (6.35 mm) quick connects.

**NOTE:** If an Excel 10 VAV Controller or Zone Manager is not connected to a good earth ground, the controllers internal transient protection circuitry is compromised and the function of protecting the controller from noise and power line spikes cannot be fulfilled. This can result in controller lockups that can be fixed by performing a power-down/power-up sequence. This can also result in a damaged circuit board and require replacement of the controller.

Table 9. Field Wiring Reference Table.

Wire Function	Recommended Minimum Wire Size AWG (mm <sup>2</sup> )	Construction	Specification or Requirement	Vendor Wire Type	Maximum Length ft (m)
E-Bus (Plenum)	22 AWG (0.325 mm <sup>2</sup> )	Twisted pair solid conductor, nonshielded or Echelon® approved shielded cable.	Level IV 140°F (60°C) rating	Honeywell AK3791 (one twisted pair) AK3792 (two twisted pairs)	Refer to E-Bus Wiring Guidelines form, 74-2865 for maximum length
E-Bus (Non-Plenum)	22 AWG (0.325 mm <sup>2</sup> )	Twisted pair solid conductor, nonshielded or Echelon® approved cable.	Level IV 140°F (60°C) rating	Honeywell AK3781 (one twisted pair) AK3782 (two twisted pairs)	Refer to E-Bus Wiring Guidelines form, 74-2865 for maximum length
Input Wiring Sensors Contacts	18 to 22 AWG (1.0 to 0.325 mm <sup>2</sup> )	Multiconductor (usually five-wire cable bundle). For runs >200 ft (61m) in noisy EMI areas, use shielded cable.	140°F (60°C) rating	Standard thermostat wire	1000 ft (305m) for 18 AWG 200 ft (61m) for 22 AWG
Output Wiring Actuators Relays	14 AWG (2.0 mm <sup>2</sup> ) (18 AWG (1.0 mm <sup>2</sup> ) acceptable for short runs)	Any pair nonshielded (use heavier wire for longer runs).	NEC Class 2 140°F (60°C) rating	Honeywell AK3702 (18 AWG) AK3712 (16 AWG) AK3754 (14 AWG) or equivalent	Limited by line-loss effects on power consumption. (See Line Loss subsection.)
Power Wiring	14 AWG (2.0 mm <sup>2</sup> )	Any pair nonshielded (use heavier wire for longer runs).	NEC Class 2 140°F (60°C) rating	Honeywell AK3754 (14 AWG) twisted pair AK3909 (14 AWG) single conductor or equivalent	Limited by line-loss effects on power consumption. (See Line Loss subsection.)

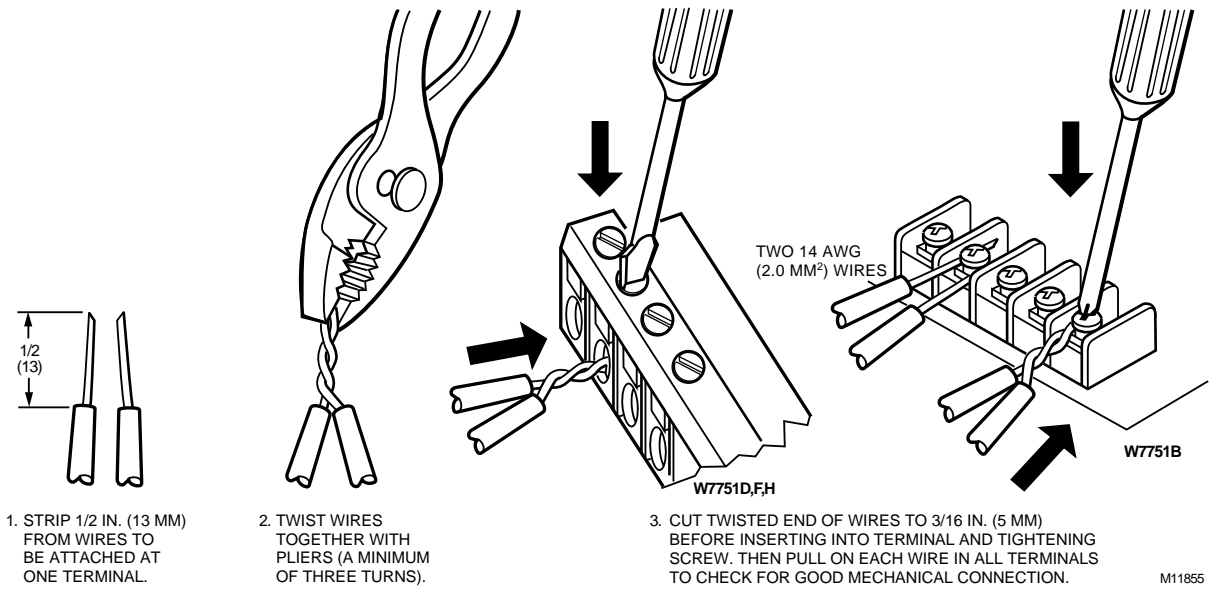


Fig. 58. Attaching two or more wires at terminal blocks.

The W7751B VAV Controller must have two complete loops of the wires coming from the T7770 Wall Modules that pass through the split ferrite cores (Fair-Rite® 044316451 or equivalent Honeywell part 229997CB). The W7751B VAV Controller and the split ferrite cores must also be in a metal enclosure to ensure compliance with CE requirements. See Fig. 59.

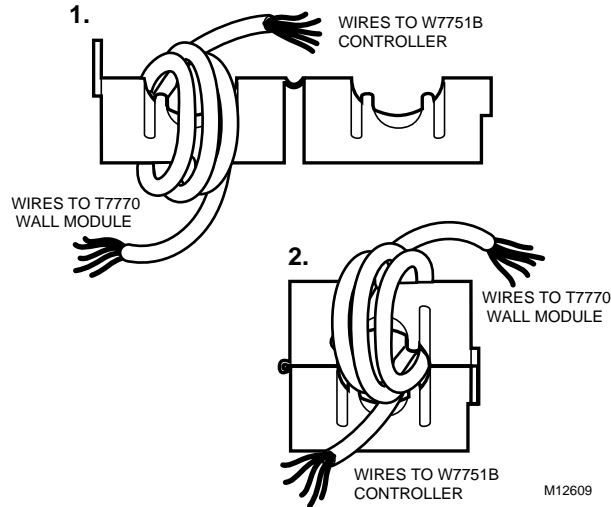
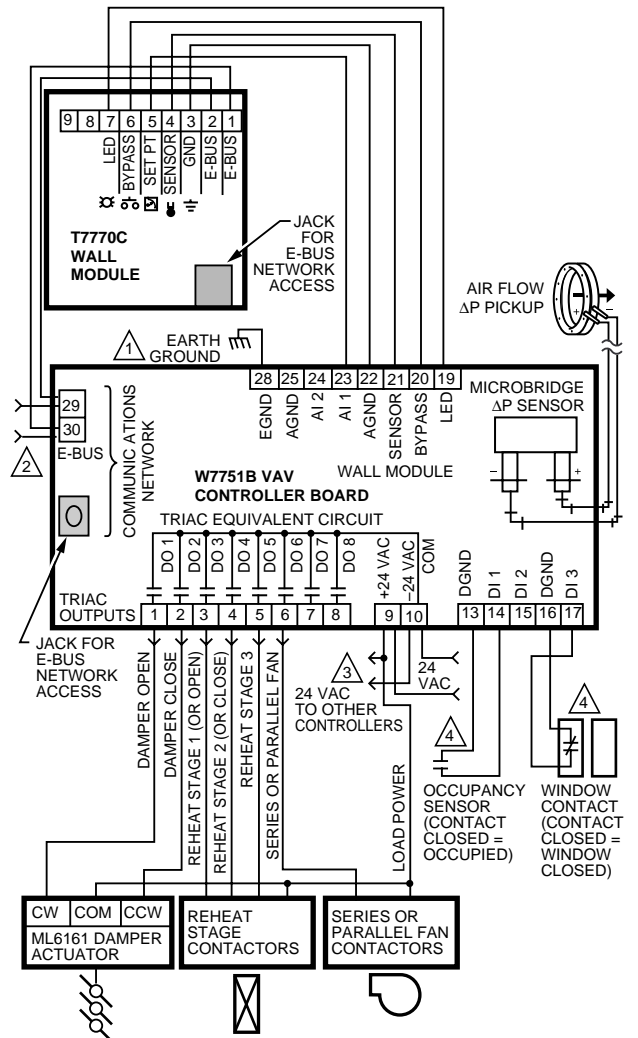
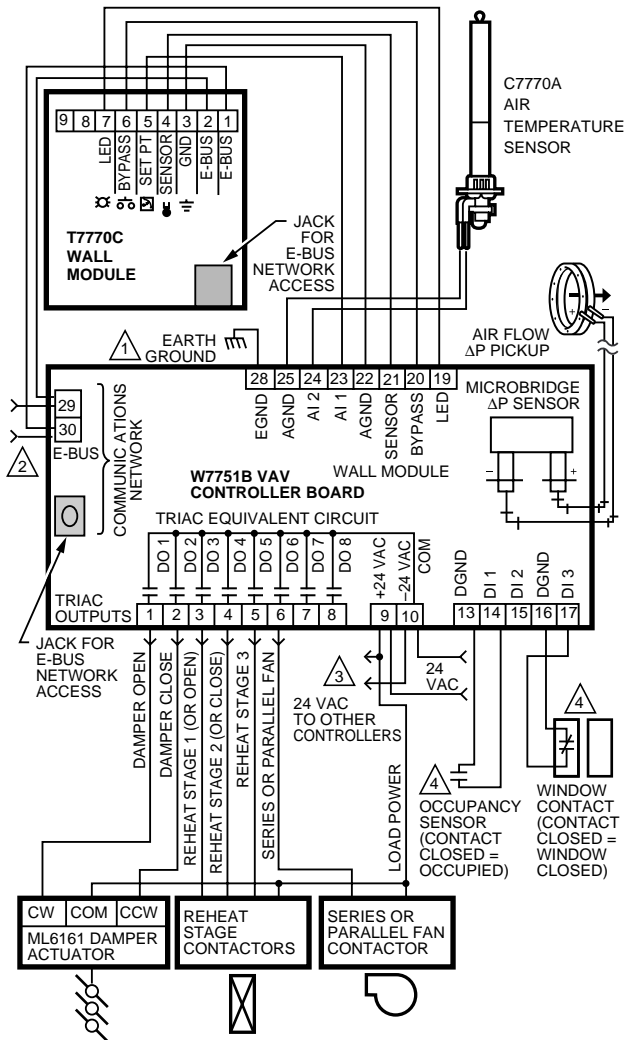


Fig. 59. Ferrite core for T7770 Wall Module wires going to a W7751B VAV Controller.



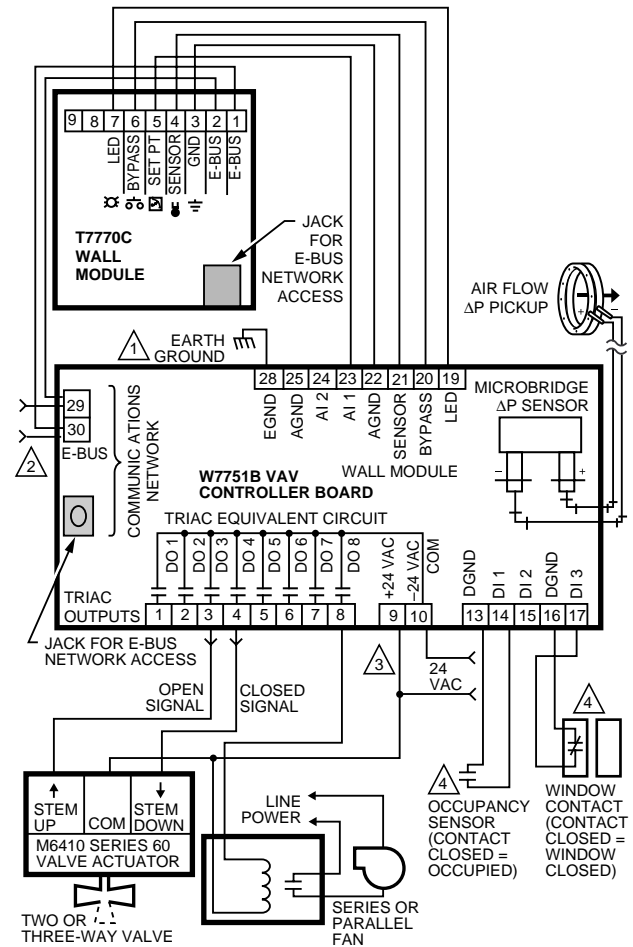
- ⚠ 1 EARTH GROUND WIRE LENGTH SHOULD BE HELD TO A MINIMUM. USE THE HEAVIEST GAUGE WIRE AVAILABLE, UP TO 14 AWG (2.0 MM<sup>2</sup>) WITH A MINIMUM OF 18 AWG (1.0 MM<sup>2</sup>), FOR EARTH GROUND WIRE.
  - ⚠ 2 TO ASSURE PROPER ELECTRICAL CONTACT, WIRES MUST BE TWISTED TOGETHER BEFORE INSERTION INTO THE TERMINAL BLOCK.
  - ⚠ 3 LOAD POWER WIRE CAN BE CONNECTED TO TERMINAL 9.
  - ⚠ 4 CONTACTS MUST BE SUITABLE FOR DRY SWITCHING, 5V AT 10 mA. USE SEALED TYPE, GOLD FLASHED OR PIMPLED CONTACTS.
- M12610

Fig. 60. Typical W7751B application wiring diagram. (For notes 2 and 3, refer to Fig. 58.)



- 1 EARTH GROUND WIRE LENGTH SHOULD BE HELD TO A MINIMUM. USE THE HEAVIEST GAUGE WIRE AVAILABLE, UP TO 14 AWG (2.0 MM<sup>2</sup>) WITH A MINIMUM OF 18 AWG (1.0 MM<sup>2</sup>), FOR EARTH GROUND WIRE.
- 2 TO ASSURE PROPER ELECTRICAL CONTACT, WIRES MUST BE TWISTED TOGETHER BEFORE INSERTION INTO THE TERMINAL BLOCK.
- 3 LOAD POWER WIRE CAN BE CONNECTED TO TERMINAL 9.
- 4 CONTACTS MUST BE SUITABLE FOR DRY SWITCHING, 5V AT 10 mA. USE SEALED TYPE, GOLD FLASHED OR PIMPLED CONTACTS.

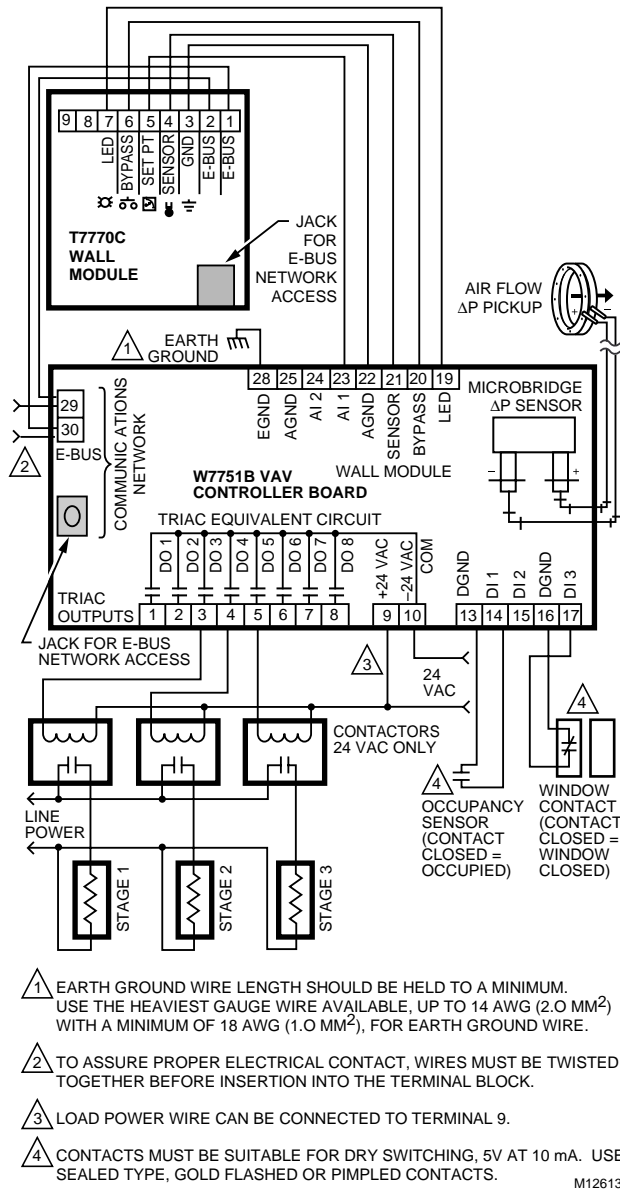
**Fig. 61. Typical W7751B application wiring diagram using the T7770C Wall Module and a C7770A Air Temperature Sensor. (For notes 2 and 3, refer to Fig. 58.)**



- 1 EARTH GROUND WIRE LENGTH SHOULD BE HELD TO A MINIMUM. USE THE HEAVIEST GAUGE WIRE AVAILABLE, UP TO 14 AWG (2.0 MM<sup>2</sup>) WITH A MINIMUM OF 18 AWG (1.0 MM<sup>2</sup>), FOR EARTH GROUND WIRE.
- 2 TO ASSURE PROPER ELECTRICAL CONTACT, WIRES MUST BE TWISTED TOGETHER BEFORE INSERTION INTO THE TERMINAL BLOCK.
- 3 LOAD POWER WIRE CAN BE CONNECTED TO TERMINAL 9.
- 4 CONTACTS MUST BE SUITABLE FOR DRY SWITCHING, 5V AT 10 mA. USE SEALED TYPE, GOLD FLASHED OR PIMPLED CONTACTS.

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**Fig. 62. Typical W7751B modulating reheat valve and a series/parallel fan wiring diagram. (For notes 2 and 3, refer to Fig. 58.)**



See Fig. 64 to wire a pneumatic transducer to a W7751B or Fig. 65 for PWM Reheat and Peripheral Heat Valve Actuators to a W7751B controller.

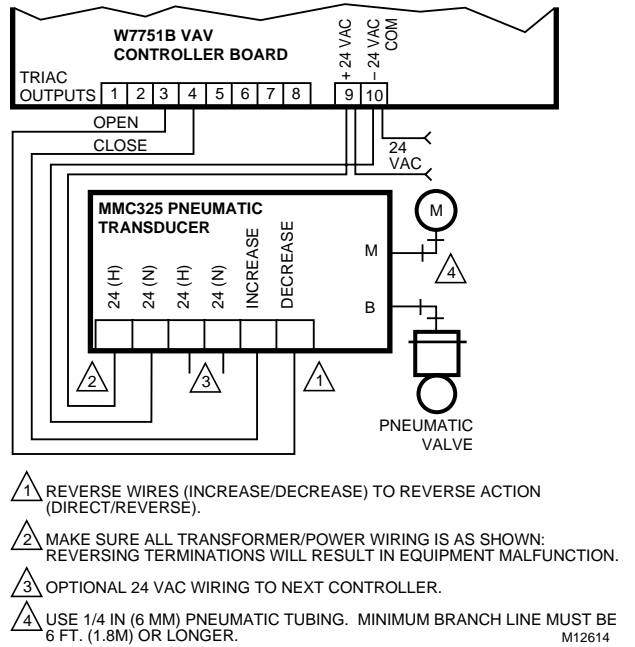


Fig. 64. Typical W7751B pneumatic transducer wiring diagram. (For notes 2 and 3, refer to Fig. 58.)

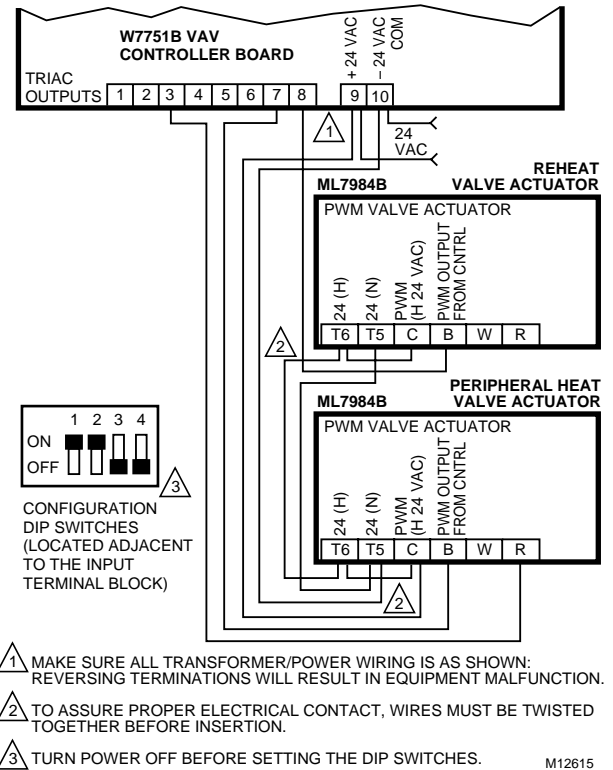


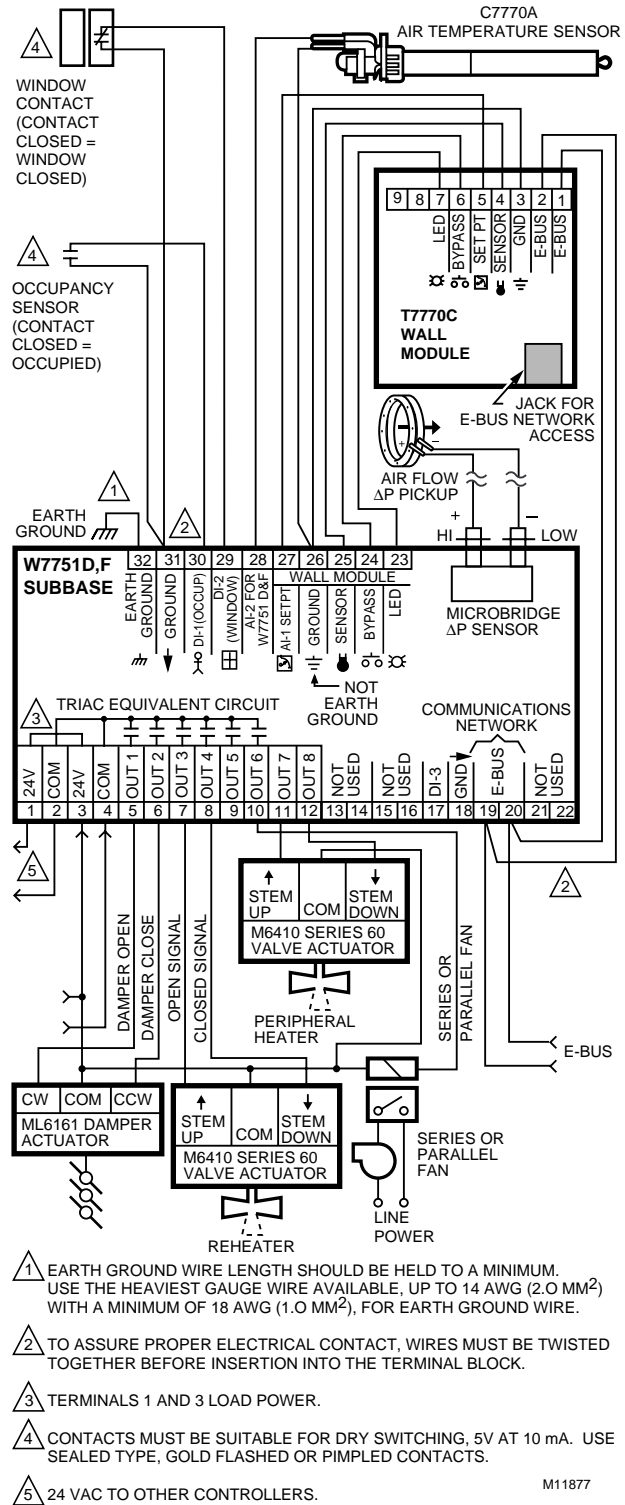
Fig. 65. Typical W7751B PWM reheat and PWM peripheral heat valve actuator wiring diagram. (For notes 2 and 3, refer to Fig. 58.)

NOTE: Make sure to set the Configuration DIP Switch as shown in Fig. 65. Switches 1 through 3 set the timing of the ML7984B valve actuator to match the W7751B outputs (0.1 sec. Min. with a max. time of 25.6 sec.). Switch 4 determines the action of the actuator (Off = Direct Acting, On = Reverse Acting).

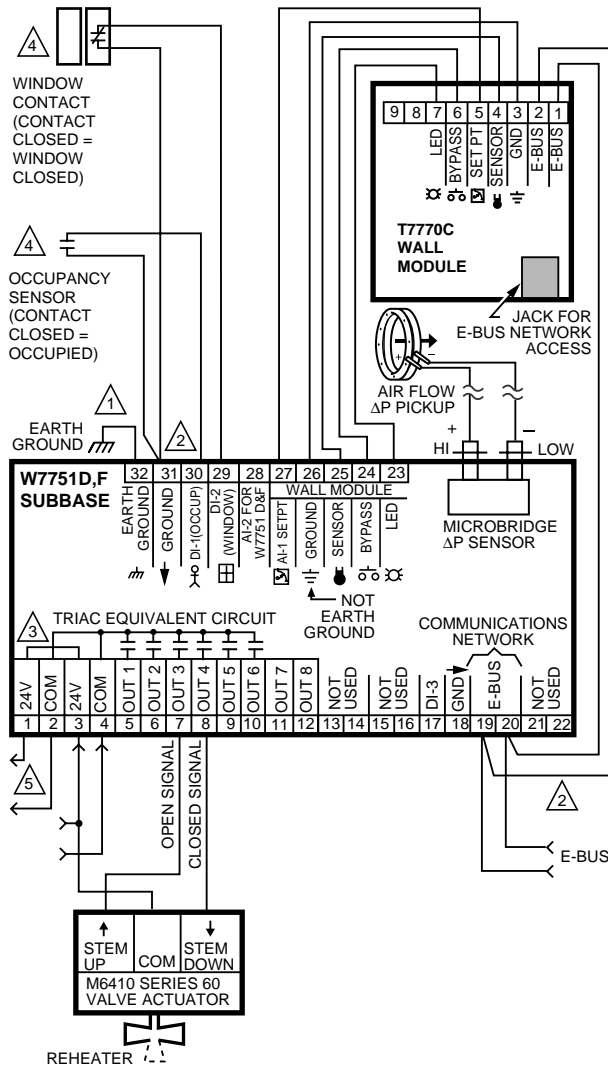
**W7751D,F Field-Mount Versions**

Fig. 66 through 70 illustrate W7751D,F Controller wiring for various VAV box configurations. The W7751D,F Subbases use terminal blocks for all wiring connections.

NOTE: If an Excel 10 VAV Controller or Zone Manager is not connected to a good earth ground, the controllers internal transient protection circuitry is compromised and the function of protecting the controller from noise and power line spikes cannot be fulfilled. This can result in controller lockups that can be fixed by performing a power-down/power-up sequence. This can also result in a damaged circuit board and requires replacement of the controller.



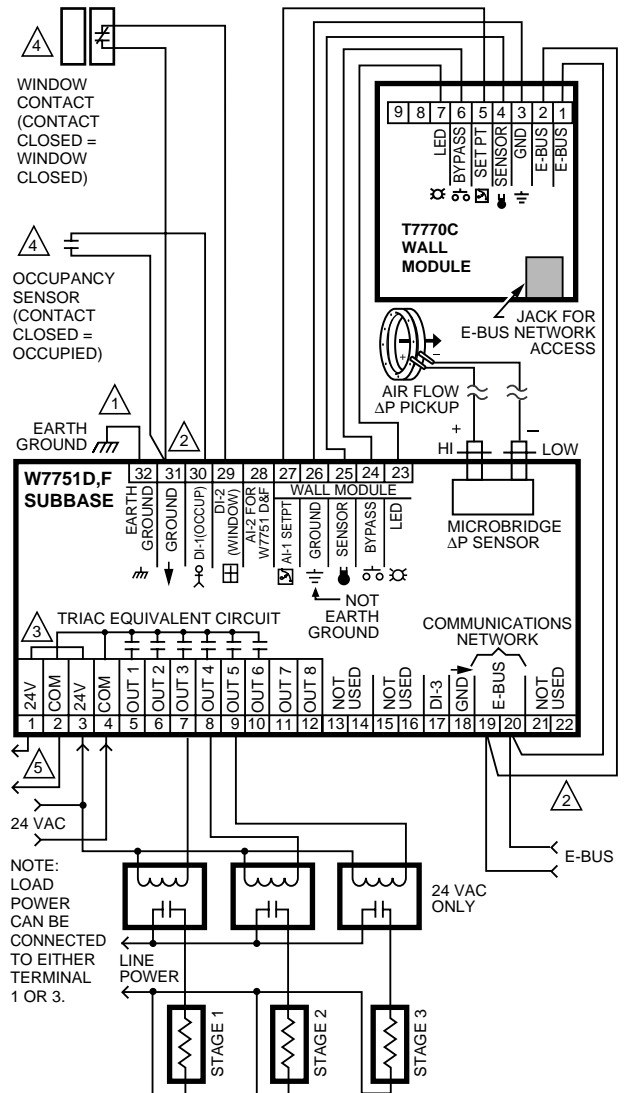
**Fig. 66. Typical W7751D,F VAV box wiring diagram using the T7770C Wall Module and a C7770A Air Temperature Sensor. (For note 2, refer to Fig. 58.)**



- 1 EARTH GROUND WIRE LENGTH SHOULD BE HELD TO A MINIMUM. USE THE HEAVIEST GAUGE WIRE AVAILABLE, UP TO 14 AWG (2.0 MM<sup>2</sup>) WITH A MINIMUM OF 18 AWG (1.0 MM<sup>2</sup>), FOR EARTH GROUND WIRE.
- 2 TO ASSURE PROPER ELECTRICAL CONTACT, WIRES MUST BE TWISTED TOGETHER BEFORE INSERTION INTO THE TERMINAL BLOCK.
- 3 TERMINALS 1 AND 3 LOAD POWER.
- 4 CONTACTS MUST BE SUITABLE FOR DRY SWITCHING, 5V AT 10 mA. USE SEALED TYPE, GOLD FLASHED OR PIMPLED CONTACTS.
- 5 24 VAC TO OTHER CONTROLLERS.

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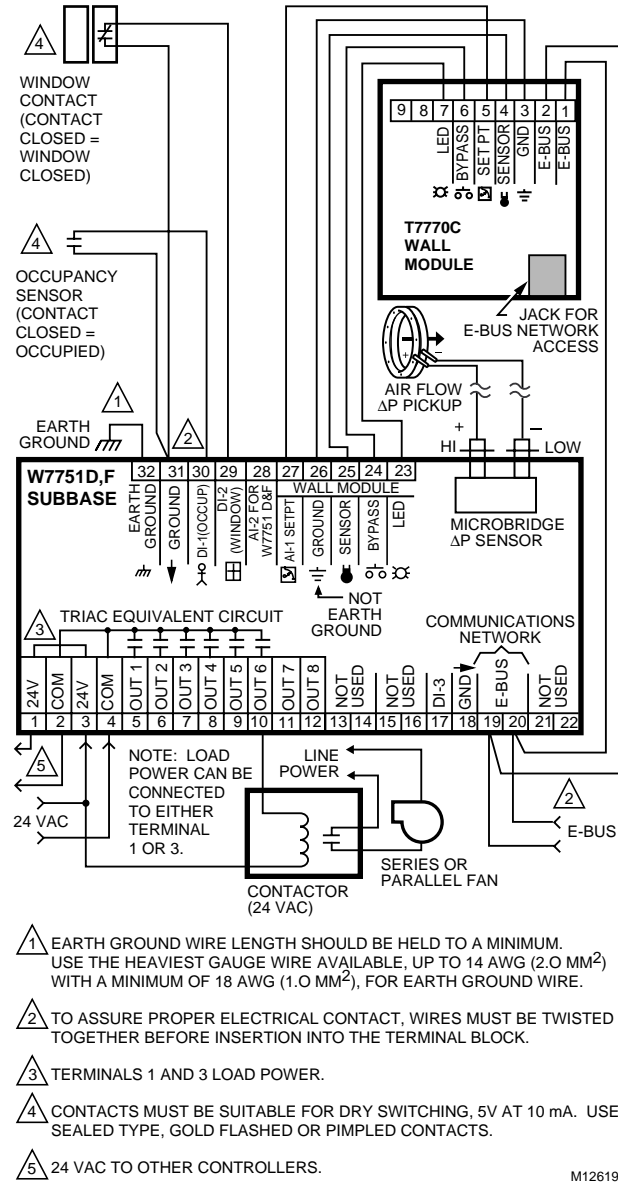
Fig. 67. W7751D,F modulating reheat valve wiring diagram. (For note 2, refer to Fig. 58.)



- 1 EARTH GROUND WIRE LENGTH SHOULD BE HELD TO A MINIMUM. USE THE HEAVIEST GAUGE WIRE AVAILABLE, UP TO 14 AWG (2.0 MM<sup>2</sup>) WITH A MINIMUM OF 18 AWG (1.0 MM<sup>2</sup>), FOR EARTH GROUND WIRE.
- 2 TO ASSURE PROPER ELECTRICAL CONTACT, WIRES MUST BE TWISTED TOGETHER BEFORE INSERTION INTO THE TERMINAL BLOCK.
- 3 TERMINALS 1 AND 3 LOAD POWER.
- 4 CONTACTS MUST BE SUITABLE FOR DRY SWITCHING, 5V AT 10 mA. USE SEALED TYPE, GOLD FLASHED OR PIMPLED CONTACTS.
- 5 24 VAC TO OTHER CONTROLLERS.

M12618

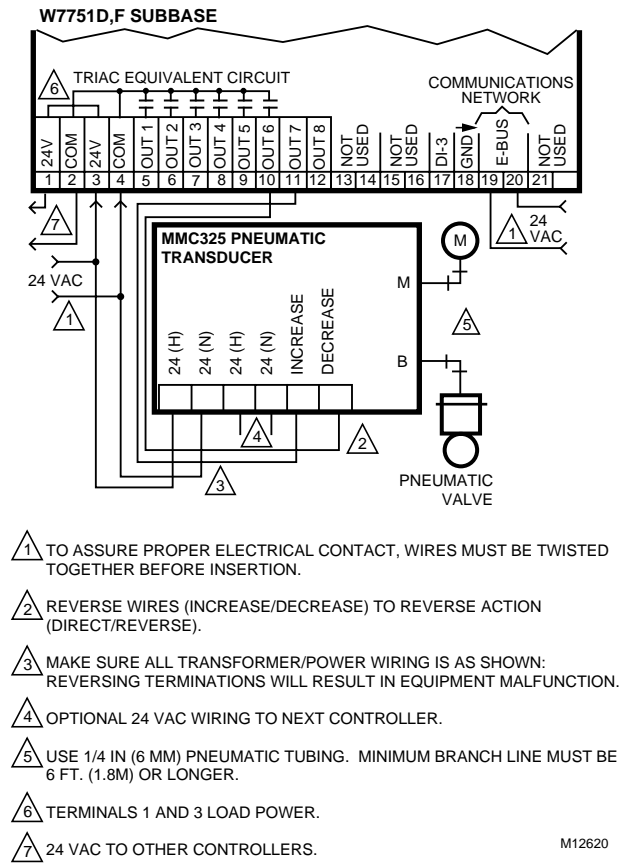
Fig. 68. Typical W7751D,F staged reheat wiring diagram. (For note 2, refer to Fig. 58.)



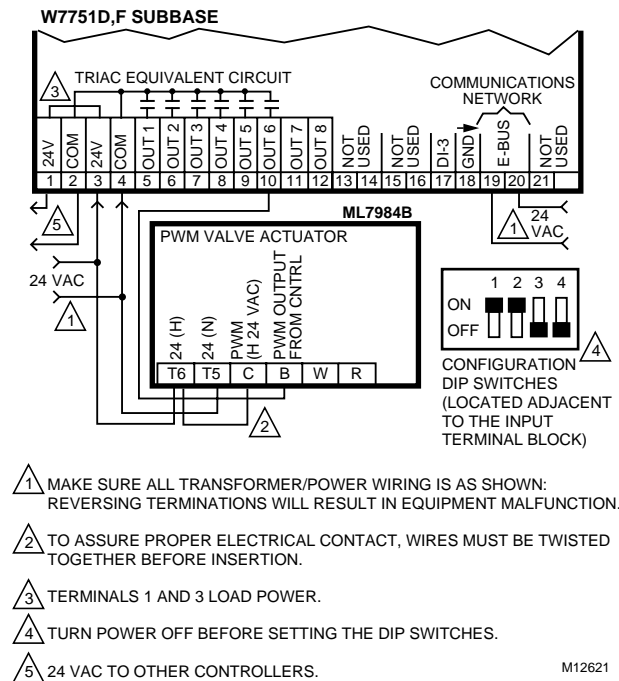
**Fig. 69. Typical W7751D,F series or parallel fan wiring diagram. (For note 2, refer to Fig. 58.)**

See Fig. 70 to wire a pneumatic Series 60 Floating transducer to a W7751D,F or Fig. 71 to wire a PWM Valve Actuator to a W7751D,F controller.

**NOTE:** Make sure to set the Configuration DIP Switch as shown in Fig. 71. Switches 1 through 3 set the timing of the ML7984B valve actuator to match the W7751D,F outputs (0.1 sec. Min. with a max. time of 25.6 sec.). Switch 4 determines the action of the actuator (Off = Direct Acting, On = Reverse Acting).



**Fig. 70. Typical W7751D,F pneumatic transducer wiring diagram. (For notes 2 and 3, refer to Fig. 58.)**



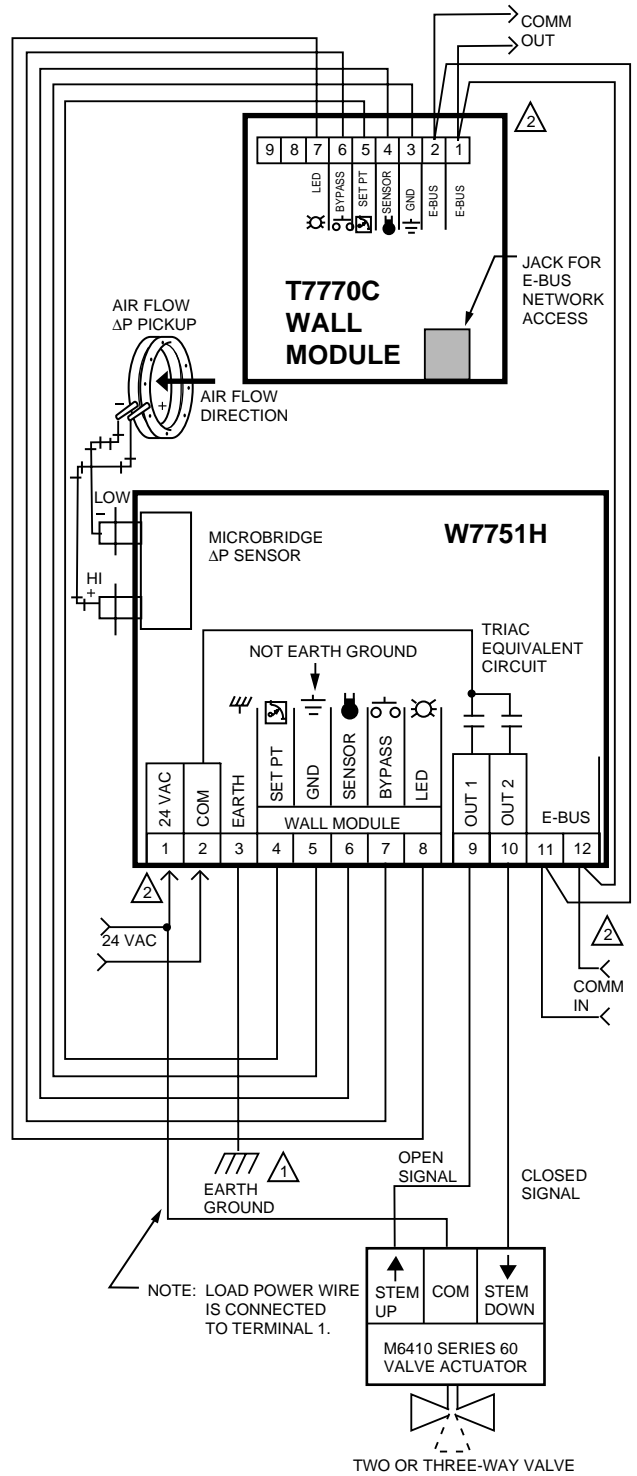
**Fig. 71. Typical W7751D,F PWM reheat and PWM peripheral heat valve actuator wiring diagram. (For notes 2 and 3, refer to Fig. 58.)**



**W7751H Version**

The W7751H has the terminal arrangement shown in Fig. 72. Fig. 72 through 77 provide detailed wiring diagrams for the W7751H. The W7751H uses terminal blocks for all wiring connections. All wiring must comply with applicable electrical codes and ordinances or as specified on installation wiring diagrams.

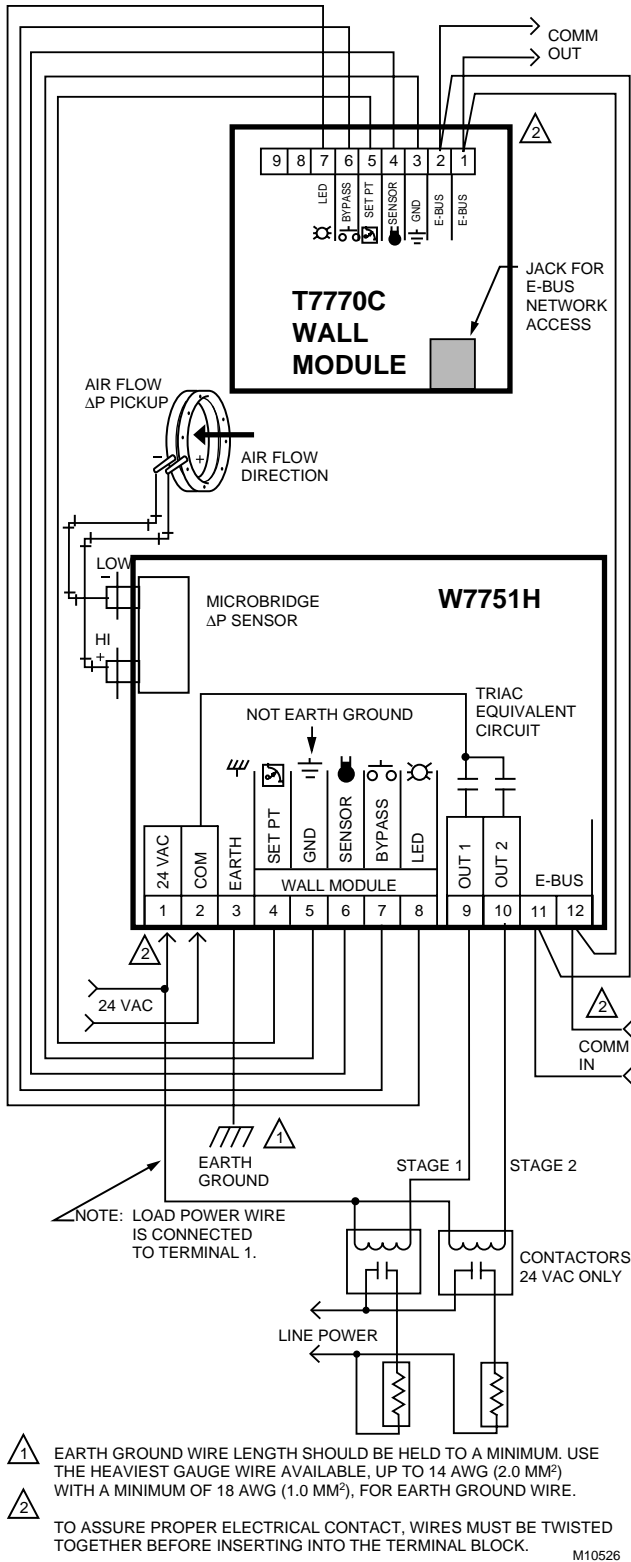
**NOTE:** If an Excel 10 VAV Controller or Zone Manager is not connected to a good earth ground, the controller's internal transient protection circuitry is compromised and the function of protecting the controller from noise and power line spikes cannot be fulfilled. This can result in controller lockups that can be fixed by performing a power-down/power-up sequence. This can also result in a damaged circuit board and require replacement of the controller.



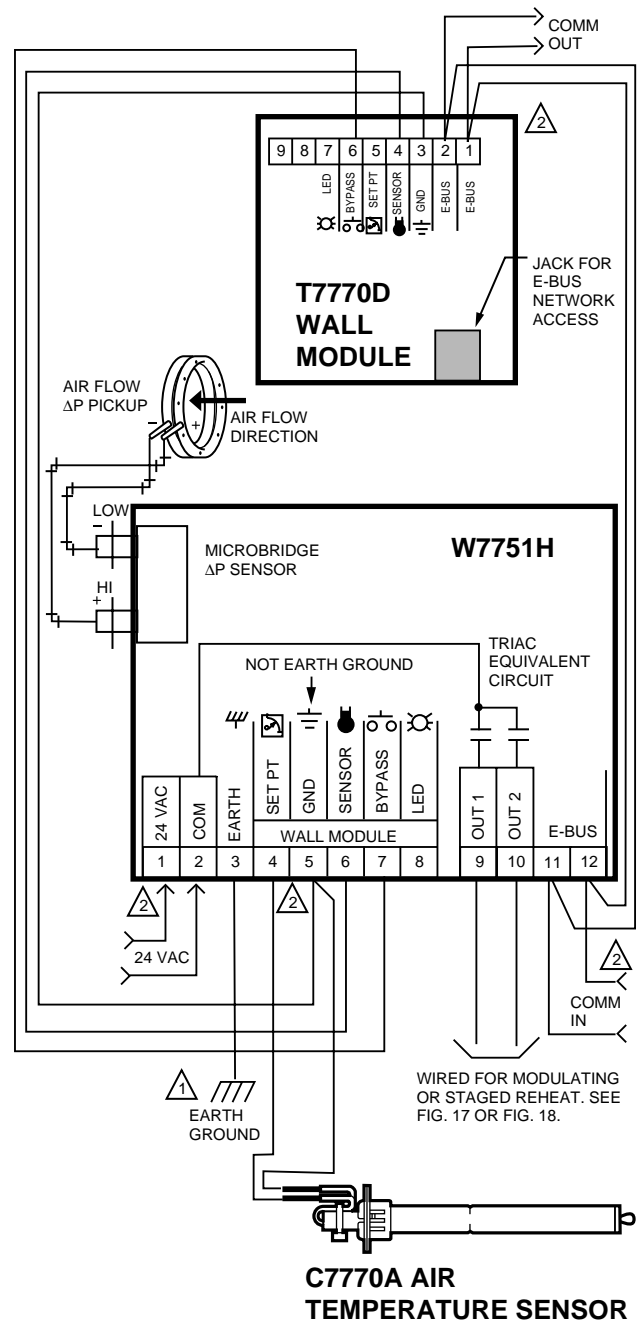
- 1 EARTH GROUND WIRE LENGTH SHOULD BE HELD TO A MINIMUM. USE THE HEAVIEST GAUGE WIRE AVAILABLE, UP TO 14 AWG (2.0 MM<sup>2</sup>) WITH A MINIMUM OF 18 AWG (1.0 MM<sup>2</sup>), FOR EARTH GROUND WIRE.
- 2 TO ASSURE PROPER ELECTRICAL CONTACT, WIRES MUST BE TWISTED TOGETHER BEFORE INSERTING INTO THE TERMINAL BLOCK.

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**Fig. 72. W7751H modulating reheat valve wiring diagram. (For Note 2 instructions, refer to Fig. 58.)**

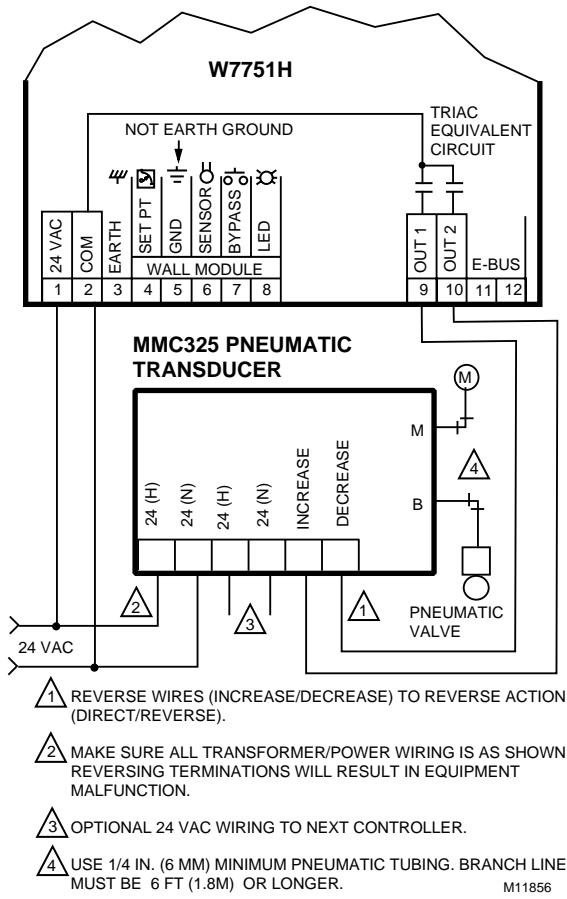


**Fig. 73. W7751H 2-stage reheat wiring diagram.**  
(For Note 2 instructions, refer to Fig. 58.)



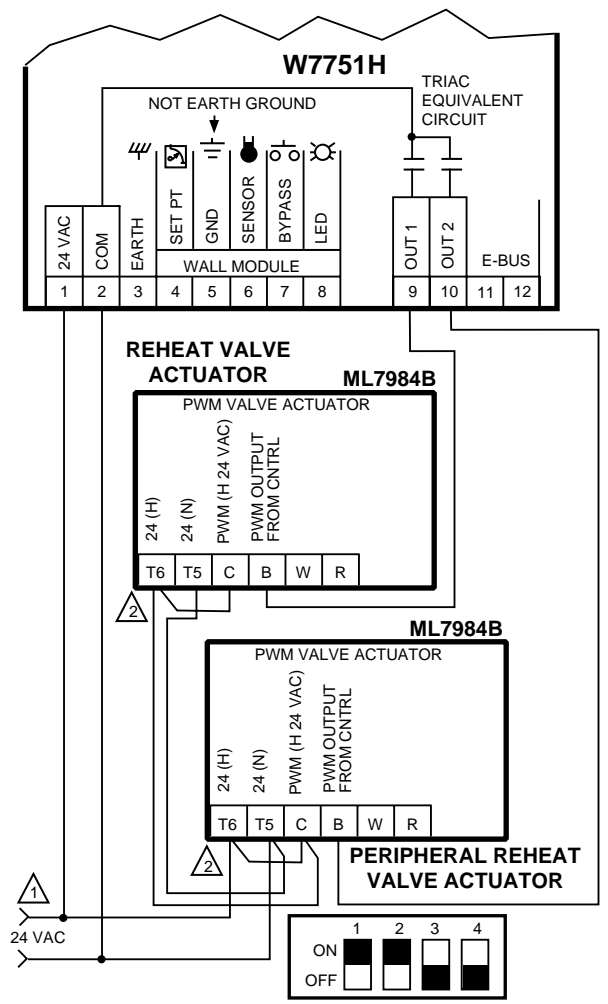
**Fig. 74. W7751H discharge air sensing**  
(For Note 2 instructions, refer to Fig. 58.)

See Fig. 75 to wire a pneumatic Series 60 Floating transducer to a W7751H or Fig. 76 to wire a PWM Valve Actuator to a W7751H controller.



**Fig. 75. Pneumatic Series 60 Floating transducer to W7751H.**

**NOTE:** Make sure to set the Configuration DIP Switch as shown in Fig. 76 and 77. Switches 1 through 3 set the timing of the ML7984B valve actuator to match the W7751H outputs (0.1 sec. Min. with a max. time of 25.6 sec.). Switch 4 determines the action of the actuator (Off = Direct Acting, On = Reverse Acting).



**CONFIGURATION DIP SWITCHES**  
LOCATED ADJACENT TO THE INPUT  
TERMINAL BLOCK ON ML7984B

1 MAKE SURE ALL TRANSFORMER/POWER WIRING IS AS SHOWN; REVERSING TERMINATIONS WILL RESULT IN EQUIPMENT MALFUNCTION.

2 TO ASSURE PROPER ELECTRICAL CONTACT, WIRES MUST BE TWISTED TOGETHER BEFORE INSERTING INTO THE TERMINAL BLOCK.

**Fig. 76. W7751H to PWM Valve Actuator.**

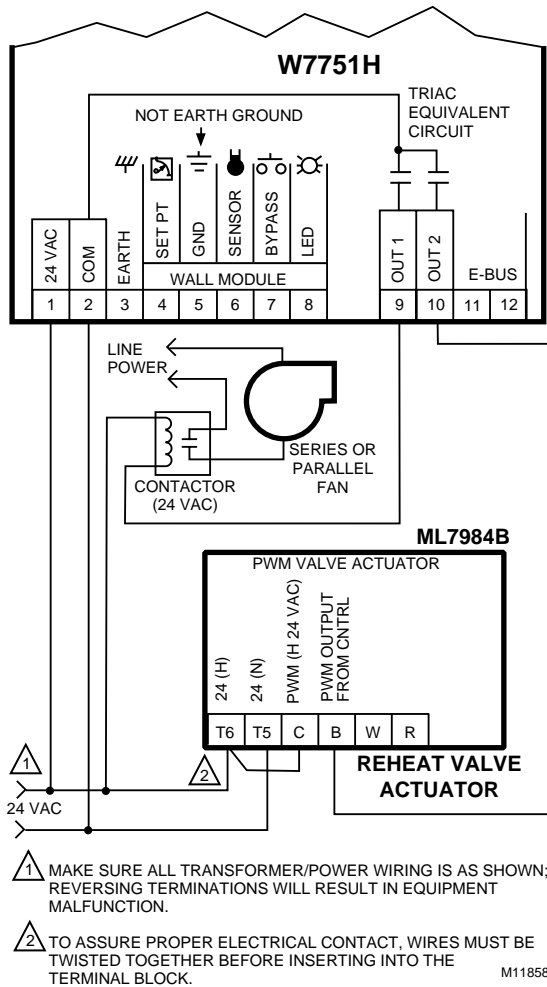


Fig. 77. PWM Valve Actuator and Series or Parallel Fan to W7751H.

### E-Bus Termination Module

E-Bus Free Topology Transceiver (FTT) networks require termination. Depending on the network topology, one or more FTT Termination Modules may be required, see Fig. 78. If an FTT Repeater is required in the network, their on-board terminators can be used in place of the 209541B Termination Module, see Fig. 79. Refer to the *Q7740A,B FTT Repeater Installation Instructions*, form, 95-7555, for information on enabling the on-board network terminators.

FTT networks are very flexible and convenient for installation and maintenance. However it is imperative to carefully plan the network layout, and create and maintain accurate layout documentation.

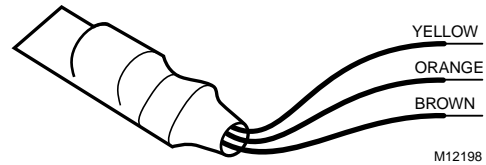
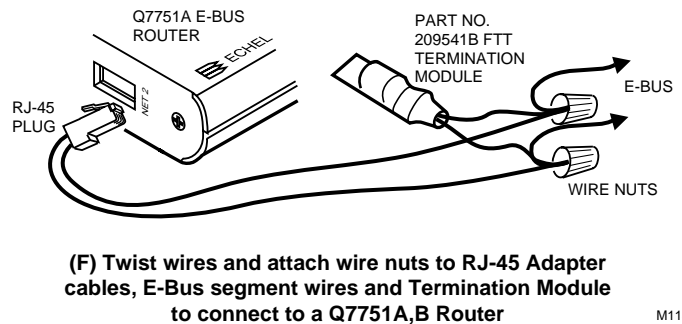
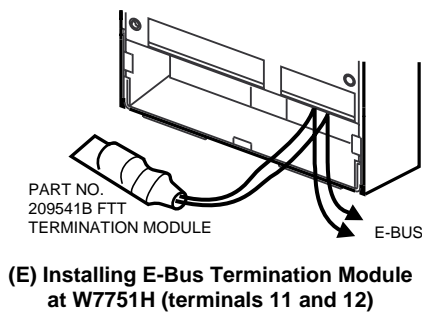
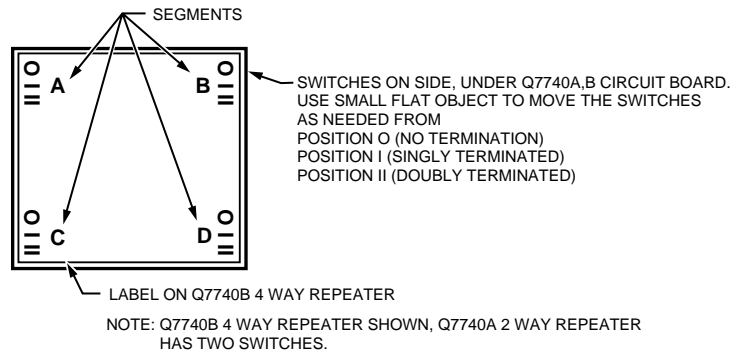
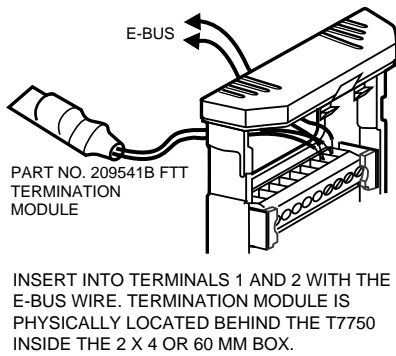
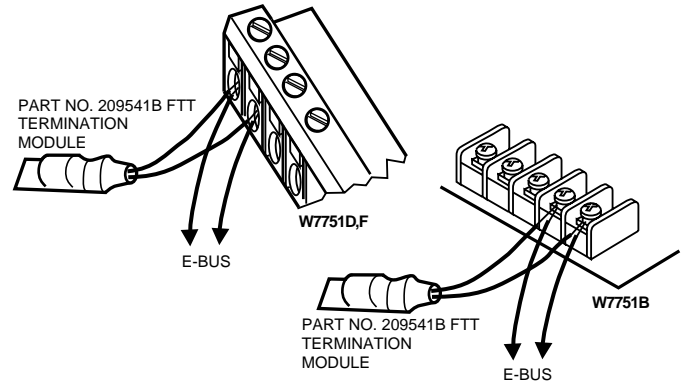
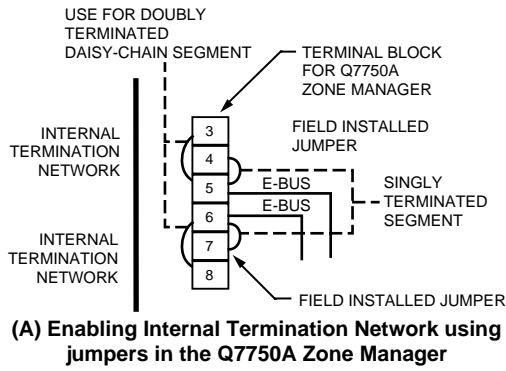


Fig. 78. 209541B FTT Termination Module.

The module has three lead wires, but only two are attached to the E-Bus network. To install the termination module, refer to the *E-Bus Wiring Guidelines*, form 74-2865 for complete rules on network topology and termination module locations. For 209541B Excel 10 FTT Termination module placement and wiring options, see Fig. 79. As with other E-Bus connections, polarity is not important.



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Fig. 79. E-Bus termination wiring options.

## Step 5. Order Equipment

After compiling a bill of materials through completion of the previous application steps, refer to Table 10 for ordering information. Contact Honeywell for information about Controllers and Wall Modules with no logo.

**Table 10. Excel 10 W7751 Controller Ordering Information.**

Part Number	Product Description	Comments
<b>Excel 10 W7751 Controllers</b>		
W7751B2002	OEM Base Board (Only in bulk pack of 10)	Order 207912 Snaptrack (see Accessories)
W7751D2008	Base Board, Mounting Enclosure	With Internal Wiring
W7751F2003	Base Board, Mounting Enclosure	With External Wiring
W7751H2009	Smart VAV Actuator is a factory-combined VAV Box Controller and an ML6161B1000 Actuator	Plenum Rated
Y7751D2006	W7751D2008 Base Board, Mounting Enclosure packed with ML6161B1000 Actuator	With Internal Wiring
Y7751F2001	W7751F2003 Base Board, Mounting Enclosure packed with ML6161B1000 Actuator	With External Wiring
<b>W7751D,F Subbases and Electronics Assembly</b>		
206166A	Subbase for W7751D with Internal Wiring	Available in bulk pack of 10 each (for use with 206168B VAV Controller Assembly).
206167A	Subbase for W7751F with External Wiring	Available in bulk pack of 10 each (for use with 206168B VAV Controller Assembly).
206168B	Cover and Electronics for W7751D,F	Contains Circuit Board for use with 206166A or 206167A Subbase (available only in bulk pack of 10).
<b>T7770 Wall Modules</b>		
T7770A1006	Sensor, Subbase	Use with Excel 5000 or Excel 10 Controllers
T7770A1014	Sensor, Subbase, no logo	Use with Excel 5000 or Excel 10 Controllers
T7770A2004	Sensor, Subbase, Network Connection	Use with Excel 5000 or Excel 10 Controllers
T7770A2012	Sensor, Subbase, Network Connection, no logo	Use with Excel 5000 or Excel 10 Controllers
T7770B1004	Sensor, Subbase, Setpoint, Network Connection	Setpoint uses degrees F Absolute (use with Excel 5000 or Excel 10 Controllers)
T7770B1046	Sensor, Subbase, Setpoint, Network Connection	Setpoint is relative (use with Excel 5000 or Excel 10 Controllers)
T7770B1012	Sensor, Subbase, Setpoint, Network Connection, no logo	Setpoint uses degrees F Absolute (use with Excel 5000 or Excel 10 Controllers)
T7770B1020	Sensor, Subbase, Setpoint, Network Connection	Setpoint uses degrees C Absolute (use with Excel 5000 or Excel 10 Controllers)
T7770B1053	Sensor, Subbase, Setpoint, Network Connection, no logo	Setpoint is relative (use with Excel 5000 or Excel 10 Controllers)
T7770B1038	Sensor, Subbase, Setpoint, Network Connection, no logo	Setpoint uses degrees C Absolute (use with Excel 5000 or Excel 10 Controllers)
T7770C1002	Sensor, Subbase, Setpoint, Bypass, Network Connection	Setpoint uses degrees F Absolute (use with Excel 5000 or Excel 10 Controllers)
T7770C1044	Sensor, Subbase, Setpoint, Bypass, Network Connection	Setpoint is relative (use with Excel 5000 or Excel 10 Controllers)
T7770C1028	Sensor, Subbase, Setpoint, Bypass, Network Connection	Setpoint uses degrees C Absolute (use with Excel 5000 or Excel 10 Controllers)
T7770C1010	Sensor, Subbase, Setpoint, Bypass, Network Connection, no logo	Setpoint uses degrees F Absolute (use with Excel 5000 or Excel 10 Controllers)
T7770C1051	Sensor, Subbase, Setpoint, Bypass, Network Connection, no logo	Setpoint is relative (use with Excel 5000 or Excel 10 Controllers)
T7770C1036	Sensor, Subbase, Setpoint, Bypass, Network Connection, no logo	Setpoint uses degrees C Absolute (use with Excel 5000 or Excel 10 Controllers)

(continued)

Table 10. Excel 10 W7751 Controller Ordering Information (Continued).

Part Number	Product Description	Comments
<b>T7770 Wall Modules (Continued)</b>		
T7770D1000	Sensor, Subbase, Bypass, Network Connection	Use with Excel 5000 or Excel 10 Controllers
T7770D1018	Sensor, Subbase, Bypass, Network Connection, no logo	Use with Excel 5000 or Excel 10 Controllers
<b>T7780 Digital Display Wall Modules</b>		
T7780A1004	Sensor, Digital Display Wall Module with Network Jack, Honeywell Logo	Degrees F Absolute (default)
T7780A1012	Sensor, Digital Display Wall Module with Network Jack, No Logo	Degrees F Absolute (default)
<b>Excel 10 Sensors</b>		
C7770A1006	Air Temperature Sensor. 20K ohm NTC nonlinearized	Duct-mounted sensor that functions as a primary and/or secondary sensor.
C7031B1033	Duct discharge air, hot water 20K ohm NTC	5 in. (127mm) probe use 112622AA Immersion well
C7031C1031	Duct discharge air 20K ohm NTC	18 in. (457mm) probe.
C7031D1062	Hot or chilled water 20K ohm NTC	5 in. (127mm) probe plus 3 in. (76mm) for insulation depth
C7031F1018	Outdoor air temperature 20K ohm NTC	—
C7170A1002	Outdoor air temperature 20K ohm NTC	—
C7031J1050	Duct discharge air (averaging) 20K ohm NTC	144 in. (3.7m)
C7031K1017	Hot or chilled water (strap-on) 20K ohm NTC	—
C7100A1015	PT3000 air temperature sensor	Intended for monitoring or differential control (staged)
<b>Echelon® Based Components and Parts</b>		
Q7750A2003	Excel 10 Zone Manager	Free Topology Transceiver (FTT)
Q7751A2002	Router FTT	FTT
Q7752A2001	Serial Interface	FTT
XD 505A	Standard C-Bus Communications Submodule	—
Q7740A1008	Excel 10 2-way Repeater	Used to extend the length of the E-Bus. Contains built in termination modules that are user selectable.
Q7740B1006	Excel 10 4-way Repeater	Used to extend the length of the E-Bus. Contains built in termination modules that are user selectable.
XD 508	C-Bus Communications Submodule (1 megabit baud rate)	—
209541B	Termination Module	One or two required per E-Bus segment
205979	Operator Terminal Cable for E-Bus	Serial interface to wall module or controller
<b>Accessories</b>		
EL7628A1007, EL7680A1008	Infrared Occupancy Sensors	—
EL7611A1003, EL7612A1001	Ultrasonic Occupancy Sensors	—
EL7630A1003, EL7621A1002, EL7621A1010	Power Supply/Control Units for Occupancy sensors	—

(continued)

Table 10. Excel 10 W7751 Controller Ordering Information (Continued).

Part Number	Product Description	Comments
<b>Accessories (Continued)</b>		
MMC325-010, MMC325-020	Pneumatic Retrofit Transducers. Select pressure range: 0 to 10 psi (68.97 kPa), or 0 to 20 psi (137.93 kPa).	Use to control Pneumatic reheat valves
MMCA530	DIN rail adapter for MMC325 Transducers	—
MMCA540	Metal enclosure for MMC325 Transducers	—
ML6161B1000	Damper Actuator Series 60 (90 Sec.)	—
ML7984B	Valve Actuator PWM	Use with V5011 and V5013F,G Valves
M6410A	Valve Actuator Series 60	Use with V5852A/V5853A or V5862A/V5863A Valves
ML684A1025	Versadrive Valve Actuator with linkage, Series 60	Use with V5011 and V5013 Valves
ML6464A1009	Direct Coupled Actuator (DCA), 66 lb-in., Series 60	—
ML6474A1008	DCA, 132 lb-in. torque, Series 60	—
ML6185A1000	DCA, 50 lb-in. spring return, Series 60	—
V5852A or V5862A	Two-way terminal unit water valve; 0.19, 0.29, 0.47, 0.74, 1.2, and 1.9 C <sub>v</sub> 1/2 in. npt (13 mm) or 2.9 and 4.9 C <sub>v</sub> 3/4 in. npt (19 mm)	Use with M6410 Valve Actuator. Closeoff rating for 0.19 to 1.9 C <sub>v</sub> is 65 psi; for 2.9 and 4.9, C <sub>v</sub> is 45 psi. (Coefficient of volume or capacity index C <sub>v</sub> = gallons per minute divided by the square root of the pressure drop across the valve.)
V5853A or V5863A	Three-way mixing terminal unit hot water valve; 0.19, 0.29, 0.47, 0.74, 1.2, and 1.9 C <sub>v</sub> 1/2 in. npt (13 mm) or 2.9 and 4.9 C <sub>v</sub> 3/4 in. npt (19 mm)	Use with M6410 Valve Actuator. Closeoff rating for 0.19 to 0.74 C <sub>v</sub> is 55 psi; 1.2, and 1.9 C <sub>v</sub> is 22 psi; 2.9 and 4.9 C <sub>v</sub> is 26 psi.
R8242A	Contactors, 24 Vac coil, DPDT	—
AT72D, AT88A, etc.	Transformers	—
EN 50 022	DIN rail 35 mm by 7.5 mm (1-3/8 in. by 5/16 in.)	Obtain locally: Each controller requires 5 in.
207912	Snaptrack, 3.25 in. (82 mm) by 9 in. (228 mm) for use with W7751B Controller	(Pack of 10)
4074EYD	Wallplate for T7770 and T7780 Wall Modules	For covering an existing hole on a wall.
Fair-Rite® 044316451 or equivalent Honeywell part 229997CB	Split ferrite cores	Split ferrite cores must also be in a metal enclosure when used with W7751B VAV Controller.
—	5-micron Air Filters for Microbridge Sensor.	Required for dusty environments. Obtain locally.
<b>Cabling</b>		
—	Serial Interface Cable, male DB-9 to female DB-9 or female DB-25.	Obtain locally from any computer hardware vendor.
Honeywell (U.S. only) AK3791 (one twisted pair) AK3792 (two twisted pairs)	E-Bus (plenum): 22 AWG (0.325 mm <sup>2</sup> ) twisted pair solid conductor, nonshielded or Echelon® approved shielded cable.	Level IV 140°F (60°C) rating
Honeywell (U.S. only) AK3781 (one twisted pair) AK3782 (two twisted pairs)	E-Bus (nonplenum): 22 AWG (0.325 mm <sup>2</sup> ) twisted pair solid conductor, nonshielded or Echelon® approved shielded cable.	Level IV 140°F (60°C) rating
Honeywell AK3725 (U.S.)	Inputs: 18 AWG (1.0 mm <sup>2</sup> ) five wire cable bundle.	Standard thermostat wire
Honeywell AK3752 (U.S. only), typical or equivalent	Outputs/Power: 14 to 18 AWG (2.0 to 1.0 mm <sup>2</sup> )	NEC Class 2 140°F (60°C) rating
Honeywell AK3702 (U.S. only), typical or equivalent	18 AWG (1.0 mm <sup>2</sup> ) twisted pair	Non-plenum
Honeywell AK3712 (U.S. only), typical or equivalent	16 AWG (1.3 mm <sup>2</sup> ) twisted pair	Non-plenum
Honeywell AK3754 (U.S. only), typical or equivalent	14 AWG (2.0 mm <sup>2</sup> ) two conductor	Non-plenum



## Step 6. Configure Controllers

Excel E-Vision PC Software is used to configure W7751 Controllers to match their intended application. The E-Vision User's Guide form, 74-2588 provides details for operating the PC software. Refer to the E-Vision User's Guide form, 74-2588 for application selections and steps to configure the VAV controllers.

### General

The process of configuring Excel 10 VAV Controllers is the same for the W7751B (OEM) model as it is for the W7751D,F,H models. In all four cases, the process involves giving the Excel 10 VAV Controller information.

There are three general categories of information:

1. Hardware I/O Assignment  
The Excel 10 VAV Controller must be informed about the physical equipment wired to its terminals.
2. Personality Information  
Each controller must be given information about its particular VAV box and the zone it serves. Examples are the Space Temperature Setpoints for each mode (Occupied Cool, Occupied Heat, Standby Cool, etc.), the Maximum and Minimum Flow Setpoints, etc., balancing the box is also included in this category.
3. ID Number  
Each Excel 10 Controller must be assigned the Identification Number that gives the device a specific identity on the bus. This is required for proper network communications.

The specific parameters to be configured in each of these three categories are discussed in the following subsections. For a complete list of all Excel 10 VAV Controller User Addresses, see Appendix D.

**NOTE:** To set the following configuration parameters, use the Honeywell CARE/ E-Vision PC tool. These sections describe the various parameters and the allowable settings. For details on using the PC tool, refer to the E-Vision User's Guide form, 74-2588 which provides details for operating the PC software. Refer to the E-Vision User's Guide form, 74-2588 for application selections and steps to configure the Excel 10 W7751B,D,F,H VAV controllers.

### IMPORTANT

*The W7751H Smart VAV Actuator is a physically smaller controller in the Excel 10 family product line. It has a factory-mounted ML6161B1000 Actuator and was designed for basic VAV box control applications. It has all of the control and communications functionality of the W7751B,D,F Controllers with the exception of the following. Physical digital inputs for window open/closed or an occupancy sensor or physical outputs for stage three reheat. It also does not contain a network access communications jack or a self-test input.*

## Hardware I/O Assignment

Excel 10 VAV Controller models have specific terminals preassigned for the wall module inputs and output. Each of the other allowable analog (resistive) and digital inputs along with digital outputs are fully configurable through the E-Vision tool and can be assigned to any of the appropriate input or output terminals. The available options for mechanical equipment are:

### Fan Type

Excel 10 VAV Controllers support five possibilities for the type of Fan in the VAV box

1. None (no VAV box fan exists).
2. Series (a Series type; VAV box fan exists).
3. Parallel Temp (a Parallel type, VAV box fan exists and is used in conjunction with reheat). This allows the VAV box parallel fan, to draw in external return plenum or room temperature air, to add warm air to the VAV discharge air. This parallel fan temp acts like the first stage of reheat.
4. Parallel Flow (a Parallel type, VAV box fan exists and is used when there is not enough primary system air) This allows the VAV box parallel fan to draw in external return plenum or room temperature air to be added to the VAV discharge if the airflow is below a certain flow. This parallel flow guarantees a certain amount of air being delivered to the space, such as an application to prevent condensation of humid air on a window.
5. Parallel PWM (a Parallel type, VAV box fan exists and the fan speed is controlled based on cool demand)

### Reheat Definitions

A floating actuator is a motor that opens when control voltage is applied to the open terminal, and closes when control voltage is applied to the close terminal. For example a 90 second Series 60 motor will open to 50 percent if voltage is applied to the open terminal for 45 seconds (assuming the motor started in the closed position).

A PWM actuator is an actuator that will be closed at a minimum single pulse width measured in seconds and will be opened at a maximum single pulse width. For example on a 28 second PWM actuator, a 0.1 second pulse will close the actuator to zero percent, a 14 second pulse will move that actuator to 50 percent and a 28 second pulse will move the actuator to 100 percent position. In general, PWM actuators will require the command to be repeated every pulse period, so in this example a 50 percent pulse of 14 seconds must be initiated every 28.1 seconds. If the signal is given once and then the connection is either open or shorted, the actuator will stay in its current position.

Stages are digital on/off controls such as steam valves, water valves, or electric coils. Reheat stages are typically turned off if there is insufficient air flow. Reheat stages are not affected by air flow if a series fan ensuring air flow is used. If reheat stages are configured and no stages are active, the controller will control at Min air flow. If one or more stages are active and proportional reheat is disabled, then the controller will control at Reheat air flow. Peripheral Stages do not care about air flow.

Peripheral Heat is a valve or stage used to control perimeter radiation.

Reheat Heat is a valve or stage used to warm up cool air inside the air duct being controlled.

Proportional reheat (if enabled) allows the reheat air flow to change proportionally, between 0 to 100 percent reheat demand, the flow control setpoint will change from min flow setpoint to Max Reheat flow setpoint, respectively. Digital reheat stages will pick appropriate proportional values.

### Reheat Type

There are sixteen possibilities for the type of reheat coil(s) in the box:

1. No\_Local\_Reheat (no reheat coil exists in the VAV box).
2. Elec\_OneStage(a staged On/Off control only, reheat coil exists in the box).
3. Elec\_TwoStage (two stages of reheat exist in the VAV box).
4. Elec\_ThreeStage (three stages of reheat exist in the VAV box) ;not available for the W7751H.
5. Elect\_ThreeStageBin using two physical stages of reheat controlled as three, for example: stage 1, stage 2, then stage 1 and 2 together. This type of reheat works similar to a 3-way light bulb: Off, low, medium and high using just two elements. Elect\_ThreeStageBin is available on the W7751H.
6. Elec\_OneStagePeriph(a staged On/Off control only, baseboard radiation is an example of peripheral heating). This stage is not affected by air flow safeties.
7. Float\_ReHeat\*\* Modulating reheat valve (Series 60 floating control provided through two Digital Output points, one that pulses to open a steam or hot water valve and one that pulses to close the valve). Minimum position refers to the network variable nciAux1SetPt.ubPeriphMinPosS1.
8. Float\_Periph\* Modulating peripheral heat valve (Series 60 floating control provided through two Digital Output points, one that pulses to open a steam or hot water valve and one that pulses to close the valve).
9. Float\_ReHeat\_Periph\* One modulating reheat stage and one modulating peripheral reheat stage. Both stages are controlled via floating motors. Control turns on reheat valve first then peripheral valve.
10. Float\_Periph\_ReHeat\* One modulating reheat stage and one modulating peripheral reheat stage. Both stages are controlled via floating motors. Control turns on peripheral valve first then reheat valve.
11. PWM\_ReHeat\*\* One modulating reheat stage controlling via a pulse width modulation motor.
12. PWM\_Periph\* One modulating Peripheral reheat stage controlling via a pulse width modulation motor.
13. PWM\_ReHeat\_Periph\* One modulating reheat stage and one modulating peripheral reheat stage. Both stages are controlled via a pulse width modulation motor. Control turns on reheat valve first then peripheral valve.
14. PWM\_Periph\_ReHeat\* One modulating reheat stage and one modulating peripheral reheat stage. Both stages are controlled via a pulse width modulation motor. Control turns on peripheral valve first then reheat valve.

15. DualDuctReHeat Reheating is provided by a second hot duct. A satellite controller can be used in conjunction with the master controller to control the hot duct. The master exports the shared values via SrcMaster (bound to DestSatellite in the Satellite controller), and gets the return value from the satellite via SrcBoxFlow (bound to DestFlowTrack in the Master controller).
16. FloatHotDuctPrDep\*\*\* Reheating using a hot duct damper controlled by the floating reheat outputs in the pressure dependent case only.

NOTES: Pneumatic hot water valves can be controlled with an MMC325 Pneumatic Transducer.

\* applies minimum position to the peripheral value during all modes (Cooling, Reheat, Etc.).

\*\* applies minimum position to the reheat value during all modes (Cooling, Reheat, Etc.).

\*\*\* applies minimum position to the reheat value during all modes except Cooling.

### Flow Type

1. SD\_Normal\_Flow (The flow is controlled to satisfy the temperature control algorithm).
2. Flow\_Tracking (the temperature control is turned off and the air flow setpoint equals the sum of SrcFlowTrack and Flow Offset (Cntrl Parameters). Flow tracking can be used to pressurize or depressurize an area by having one or more VAV boxes deliver air to the space and one or more exhaust air from the space. By delivering or exhausting more air than is normally exhausted or delivered, the space can be pressurized or depressurized. Typically one or more boxes deliver air to the space and one box exhausts air from the space. Several nodes (controlling incoming air) can be bound in a daisy-chain to sum the total incoming flow. The last incoming air node is bound to the exhaust node. The exhaust node has Flow Type set to Flow\_Tracking and controls the exhaust air according to Flow Offset (Cntrl Parameters) and SrcFlowTrack.
3. Share Wall Module (The temperature control loop is turned off and the flow is controlled by the wall module at another node. In this case SrcMaster is bound to DestSatellite of another node and the information received in SrcMaster is used to control the air flow. The other node has the temperature sensor connected to it and controls the space temperature by its own damper and the other dampers of all nodes bound to it. This feature (Single Duct Box Type only), is used when only one temperature sensor is used in a large area to control several nodes).
4. Master\_Const\_Flow -master (The master node is connected to a cold air supply duct in a dual duct application and controls the air flow to the space. The satellite is connected to the hot duct. The master commands the satellite nodes damper via DestSatellite. The temperature control loop in the master is enabled and the temperature control loop in the satellite is disabled. Both the master and satellite have air flow sensors. The master controls the satellite so that the total air supplied is always a constant volume. When cooling is called, more Cool air is supplied to the space. When heating is called, more warm air is supplied to the space).

5. Satel\_Const\_Flow -satellite (Refer to the description for Master\_Const\_Flow).
6. Master\_Flow\_Mix -master (The master node is connected to a cold air supply duct in a dual duct application and controls the air flow to the space. The satellite node is connected to the hot duct. The master node commands the satellite nodes damper via DestSatellite. Both the master and satellite have air flow sensors. The temperature control loop is enabled in the master and disabled in the satellite. Both warm air and cold air can be supplied to the space at the same time in the transition from heating to cooling or from cooling to heating - Flow mixing).
7. Satel\_Flow\_Mix -satellite (Refer to the description for Master\_Flow\_Mix).
8. Master\_No\_Flow\_Mix -master (The master node is connected to a cold air supply duct in a dual duct application and controls the air flow to the space. The satellite node is connected to the hot duct. The master node commands the satellite nodes damper via DestSatellite. Both the master and satellite have air flow sensors. The temperature control loop is enabled in the master and disabled in the satellite. Only warm air or cold air may be supplied to the space at the same time. When cooling is called, only Cool air is supplied to the space. When heating is called, only warm air is supplied to the space).
9. Satel\_No\_Flow\_Mix -satellite (Refer to the description for Master\_No\_Flow\_Mix).
10. DD\_DAFlowSensor (The node is connected to control both the cold and hot air supply damper. The physical damper outputs control the cold supply damper and the reheat physical floating outputs controls the hot air damper. The node has an air flow sensor measuring the total discharge air flow. The temperature control loop is enabled, and either warm air or cold air is supplied to the space. When cooling is called, only Cool air is supplied to the space (damper on hot duct is fully closed). When heating is called, only warm air is supplied to the space. There is no satellite node in this case. ReHeat Type is set to Float\_ReHeat for this case).
11. DD\_DAFlowSenConst (The node is connected to control both the cold and hot air supply damper. The physical damper outputs control the cold supply damper and the reheat physical floating outputs controls the hot air damper. The node has an air flow sensor measuring the total discharge air flow. The temperature control loop is enabled. Both warm air and cold air can be supplied to the space at the same time in the transition from heating to cooling or from cooling to heating. ReHeat Type is set to Float\_ReHeat for this case. Measured flow controls the cold duct damper Position and space temperature controls the hot duct damper Position).
12. DD\_CDFlowSensor (The node is connected to control both the cold and hot air supply damper. The physical damper outputs control the cold supply damper and the reheat physical floating outputs controls the hot air damper. The node has an air flow sensor measuring the cold duct air flow. The temperature control loop is enabled. Both warm air and cold air can be supplied to the space at the same time in the transition from heating to cooling or from cooling to heating. ReHeat Type is set to Float\_ReHeat for this case. Measured flow controls the cold duct damper Position and space temperature controls the hot duct damper Position).

## Miscellaneous

These additional configuration parameters can be specified:

1. Wall Module Options:
  - (a) A T7770 Wall Module needs to be connected to the controller.  
Examples are Temperature Sensor Only or Temperature Sensor plus Bypass Switch, etc. Excel 10 VAV Controller can share wall module information with other controllers. This can be done when two or more boxes serve the same space area. In this case, the type of wall module would be *shared*, see Fig. 46. Both the temperature sensor and the setpoint potentiometer can be shared.
  - (b) Remote setpoint type.  
The user-adjustable setpoint potentiometer can work in either of two ways, *relative* (this uses a positive or negative offset of the programmed setpoint) or *absolute*, which means that if the dial says 74°F, the controller uses 74°F for the setpoint if it is within the setpoint limits specified by the Standby Setpoints.
2. Air Temperature Sensor types:
  - (a) Absolute\_Setpoint (When SetPtKnob is set to Absolute Middle, the setpoint knob becomes the center of the Zero Energy Band (ZEB) between the cooling and heating occupied setpoints.)
  - (b) Relative\_Setpoint (uses a positive or negative offset of the programmed setpoint).
  - (c) DischargeAir\_Sensor reports the current discharge temperature for remote monitoring and or logging purposes.
  - (d) Supply\_Air\_Sensor is the temperature of the air being supplied to the VAV control box. It is used by the control process to put the controller into the heat mode.

NOTE: The C7770A Air Temperature Sensor or the setpoint pot options are selectable in CARE/E-Vision. (Only one or the other can be selected for the W7751H Smart VAV Actuator, but not both.)

3. Air flow Pickup:  
The type of physical air flow pickup to be used with this box must be chosen. There is a linearization table associated with each standard type, and once selected, this table is included in the next download to the controller.
4. Duct Area:  
The cross-sectional area of the duct at the location of the air flow pickup must be entered. This is used to convert the measured velocity pressure into air flow in Cubic Feet per Minute (CFM) or Meters Cubed Per Hour (m3h). This value can be entered in CARE in units of square feet or (square meters) or as the duct diameter for a round duct, in inches (meters) via a list box.
5. Optional Sensors:  
Except for the W7751H, each Excel 10 VAV Controller has digital inputs for an Occupancy Sensor and or a Window Contact Sensor that is physically connected to it. Any W7751 Controller can also use another Excel 10 VAV Controller sensor(s) by sharing.

- 6. Line Voltage Frequency Selection:  
Can be set to 50 Hz or 60 Hz.
- 7. Engineering Units Selection:  
Choose English or metric engineering units. Refer to Table D-1 for engineering unit conversion.

NOTE: The reheat outputs can be used to control peripheral heating equipment in the space, such as fin tube radiation. The box air flow rate will be set at the MinFlowHtgSpt (see Table 11). The MinFlowHtgSpt and the MinFlowSpt should be set to the same value when using peripheral heat.

**IMPORTANT**

*Excel 10 VAV Controllers are not capable of controlling both a staged type reheat device and a modulating reheat device in the same VAV box.*

*The W7751H Smart VAV Actuator is a physically smaller controller in the Excel 10 family product line. It has a factory-mounted ML6161B1000 Actuator and was designed for basic VAV box control applications. It has all of the control and communications functionality of the W7751B,D,F Controllers with the exception of the following. Physical digital inputs for window open/closed or an occupancy sensor or physical outputs for stage three reheat. It also does not contain a network access communications jack or a self-test input.*

**Personality Information**

Each controller must be given the setpoint information needed to properly control the space while operating within the parameters determined during setup and balancing. Table 11 lists these parameters along with the valid range and default values for each parameter. (See the CARE, E-Vision, CARE Excel 10 Zone Manager User's Guides, forms 74-5587, 74-2588 and 74-1392, for details on setting these values using CARE/ E-Vision.)

NOTE: The parameters listed in the Personality Information subsection and the Hardware I/O Assignment subsection of Application Step 6 are stored in EEPROM memory. The EEPROM device has a maximum 10,000 allowable number of writes. This means that these parameters should not be written to frequently by another controller that is calculating values every few seconds and sending these values to an Excel 10 VAV Controller.

**Table 11. List Of Setpoint Variables.**

Default User Address	Description	Allowable Values	Default Value
MaxFlowSpt	Air flow rate not to be exceeded during normal Occupied operation.	0 to 10,000 CFM (0 to 16,990) m3h	1,000 CFM (1,700) m3h
MinFlowSpt	Minimum air flow rate to be maintained during normal operation.	0 to 10,000 CFM (0 to 16,990) m3h	0
MinFlowHtgSpt	Air flow rate to be maintained during reheat operation (Pressure Independent – ReheatFlowSpt).	0 to 10,000 CFM (0 to 16,990) m3h	0
MinFlowSbySpt	Air flow rate to be maintained during STANDBY operation.	0 to 10,000 CFM (0 to 16,990) m3h	0
CoolOccSpt*	Space Temperature Setpoint to be maintained during OCC time while in COOL mode operation.	50 to 95°F (10 to 35°C)	73.4°F (23°C)
CoolStbySpt*	Space Temperature Setpoint to be maintained during STANDBY while in COOL mode operation. This value is also used to provide an upper limit on the user adjustable remote setpoint pot (wall module).	50 to 95°F (10 to 35°C)	77°F (25°C)
CoolUnoccSpt*	Space Temperature Setpoint to be maintained during UNOCC while in COOL mode operation.	50 to 95°F (10 to 35°C)	82.4°F (28°C)
HeatOccSpt*	Space Temperature Setpoint to be maintained during OCC time while in HEAT/REHEAT mode operation.	50 to 95°F (10 to 35°C)	70°F (21°C)
HeatStbySpt*	Space Temperature Setpoint to be maintained during STANDBY while in HEAT/REHEAT mode operation. This value is also used to provide a lower limit on the user adjustable remote setpoint pot (wall module) minus Deadband (E-Vision Application selection).	50 to 95°F (10 to 35°C)	66°F (19°C)
HeatUnoccSpt*	Space Temperature Setpoint to be maintained during UNOCC while in HEAT/REHEAT mode operation.	50 to 95°F (10 to 35°C)	61°F (16°C)
BypassTime	Number of minutes to stay in BYPASS mode after the Bypass digital input is pressed.	0 to 1080 min	180 min

(continued)

Table 11. List Of Setpoint Variables (Continued).

Default User Address	Description	Allowable Values	Default Value
DlcBumpTemp	Amount (in degrees) to adjust the Cooling Setpoint upward, or the Heating Setpoint downward, when a high electrical demand condition exists.	0 to 10°F (0 to 5.5) °C	3 °F (1.7 °C)
FlowTrackOfst	Air flow in CFM (m3h) to add to the incoming tracking signals when controller was configured for Exhaust Flow Tracking operation.	-2119 to 2119 CFM (-3600 to 3600) m3h	0

## CAUTION

\*If any value is set out of range >90° or 40°F (>32.2° or <4.4°C), or (CoolOcc < HeatOcc, CoolUnocc < HeatUnocc, CoolStby < HeatStby), the controller sends an alarm and operates at factory default Setpoints 78°F (25.5°C) for Cooling and 65°F (18.5°C) for Heating.

Damper Positions:			
PurgeDmprPos	Damper position based on the air flow setpoint during Night Purge operation (Pressure Independent).  Physical damper position goes to a position as commanded during Night Purge operation (Pressure Dependent).	0 to 100 percent of maximum CFM, (m3h) setpoint. 0 to 100 percent of damper position.	50
WarmupDmprPos	Damper position based on the air flow setpoint during Morning Warm-Up operation (Pressure Independent).  Physical damper position goes to a position as commanded during Morning Warm-Up operation (Pressure Dependent).	0 to 100 percent of maximum CFM, (m3h) setpoint. 0 to 100 percent of damper position.	50
PressDmprPos	Damper position based on the air flow setpoint during Smoke Control operation. For pressurization (Pressure Independent).  Physical damper position goes to a position as commanded during Smoke Control operation. For pressurization (Pressure Dependent).	0 to 100 percent of maximum CFM, (m3h) setpoint. 0 to 100 percent of damper position.	100
DepressDmprPos	Damper position based on the air flow setpoint during Smoke Control operation. For depressurization (Pressure Independent).  Physical damper position goes to a position as commanded during Smoke Control operation. For depressurization (Pressure Dependent).	0 to 100 percent of maximum CFM, (m3h) setpoint. 0 to 100 percent of damper position.	0
WinOpnDmpPos	Damper position based on the air flow setpoint when a Window is Open (Pressure Independent).  Physical damper position goes to a position as commanded when a Window is Open (Pressure Dependent).	0 to 100 percent of maximum CFM, (m3h) setpoint. 0 to 100 percent of damper position.	0
<b>Gains:</b>	NOTE: The following control gains should be adjusted only by authorized Honeywell personnel. For most applications, no adjustment is necessary.		
GainCoolProp	Throttling Range used during COOL mode operation.	1 to 20 DDF (1 to 11)°K	3 DDF (1.66)°K
GainHeatProp	Throttling Range used during HEAT mode operation.	2 to 30 DDF (1.11 to 16.66)°K	5 DDF (2.77)°K
GainCoolInt	Integral time used during COOL mode operation.	0 to 5000 sec	4000 sec
GainHeatInt	Integral time used during HEAT mode operation.	0 to 5000 sec	2400 sec
GainCoolDer	Derivative time used during COOL mode operation.	0 to 255 sec	0 sec
GainHeatDer	Derivative time used during HEAT mode operation.	0 to 255 sec	0 sec
<b>Actuator Speeds or Directions:</b>			
DampMtrSpd	Series 60 actuator motor speed for box damper.	20 to 600 sec	90 sec
ValveMtrSpd	Series 60 actuator motor speed for box reheat valve.	20 to 600 sec	90 sec
PWMPeriod	PWM Period in sec	5 to 600 sec	100 sec
PWMZeroScale	PWM value of zero percent position in sec	0.1 to 600 sec	1 sec
PWMFullScale	PWM value of 100 percent position in sec	5 to 600 sec	99 sec

NOTE: The W7751H uses a 90 second actuator motor, so DmprMtrSpd speed is normally configured at the default of 90 seconds.

## Commissioning

Commissioning refers to the activities performed to optimize the VAV box operation to meet the job specification requirements and overall fine tuning of the box control. E-Vision is the tool used to perform these activities, as described in Appendix B.

### Job Commissioning

The CARE/E-Vision database that is generated for the Excel 10 VAV Controllers and associated Zone Managers contains information concerning interrelationships and network identifications. For this reason, it is mandatory to commission (assign ID and download) all Excel 10 VAV Controllers and the Zone Managers from a *single* database.

This project database can be backed up and restored for placement on various PCs during the commissioning phase (Note: only a single copy can be used at a time) this copy must be re-designated as the *master* and given to the next PC for further commissioning.

## CAUTION

If more than one copy of the same database is used in multiple PCs to assign IDs and download to Excel 10 VAV Controllers, there is currently no means to recombine the multiple copies into a single database for any project. If multiple copies are used, it is necessary to designate one database as the master and re-commission the controllers that do not indicate being commissioned. If E-Vision displays an assigned ID only the application needs to be downloaded to the controller. If no ID has been assigned, assign ID(s) and download the application to the controller(s). In both of these cases, parameter changes (Setpoints, Temperature Sensor Calibration, etc.) made with the other PC database are lost and have to be re-entered. However flow balancing information will not be lost or overwritten.

## ID Number

Each Excel 10 VAV Controller is shipped with an internal Identification Number from the factory. This ID number is on a removable sticker on the inside of the W7751 housing and can be used to assign a CARE Plant to each controller. When assigning the ID numbers, the procedure used depends on if the controllers were installed at the site or if they can be configured one at a time on a bench top.

The ID number can either be manually entered or a node can broadcast its ID number on the E-Bus. The CARE commissioning tool (E-Vision) is used to perform both methods (see E-Vision User's Guide form, 74-2588, Step 12. Commission Controllers).

## Bench Top Configuring

Appendix A presents a simple work bench arrangement of the required hardware and the associated wiring connections to configure Excel 10 W7751D,F Controllers. See the following procedure:

1. With power disconnected to the housing subbase, insert the controller circuit board (in the housing cover) into the subbase unit.
2. Apply power to the controller, and insert the Serial Interface cable into the jack on either the Excel 10 W7751D or F Controllers (see Appendix A).
3. Use the CARE/E-Vision PC tools to configure the controller. (See the CARE, E-Vision User's Guides, forms 74-5587 and 74-2588, for further details.) Use the ID number sticker on the controller or press the bypass button on the wall module.
4. When configuration is completed, power down and remove the W7751D,F from the subbase. Mark the controller with the Plant name or location reference so the installer knows where to install each controller in the building.
5. Repeat with each W7751D,F to be configured.
6. The data file used for this configuration must be used at the job site so the commissioning data matches the controllers.

## Configuring in the Field

If the controllers were installed at the site, use the following procedure to assign the node numbers to the Excel 10 VAV Controller:

1. Instruct the installer to remove the ID sticker from each controller during installation and to attach it to either the job blueprint at the appropriate location or to a tabulated list. Be sure the installer returns these prints to the application engineer after the controllers are installed.
2. Connect to the E-Bus with the CARE PC tool.
3. Configure the W7751 by following the standard CARE procedures (use the job prints as a location reference for the controllers).

## Configuring the Zone Manager

The Q7750A Excel 10 Zone Manager sends out a one-time LonWorks® message containing its 48-bit Neuron ID after any power-up *WARMSTART* or when the Excel 10 Zone Manager is reset by pressing the reset button.

### IMPORTANT

*Pressing the reset button on the Excel 10 Zone Manager causes all application files in the Q7750A, including the C-Bus setup, to be lost.*

The LonWorks message is sent out one time and only on the E-Bus, not on the B-Port. The message will be the same as the one generated after pressing the service pin button, available on all Excel 10 VAV Controllers. The CARE commissioning tool (E-Vision) can use this message to assign the node address.

The *Assign ID* procedure is the same as for an Excel 10 VAV Controller except, instead of pressing the bypass button, the reset button must be pressed or the power must be cycled (down then up) on the Q7750A Excel 10 Zone Manager.

## Excel 10 VAV Controller Point Mapping

In typical Excel 10 VAV Systems, there are often variables that contain values or information that must be shared with other devices on the E-Bus. This is done through a process called Refer Excel 10 Points in the E-Vision tool. If variables or user addresses have to be used over the C-

Bus or monitored through the Zone Manager, the user must assign them as mapped points through the use of the Care Plants. See Table 12. Mapped points are available to the C-Bus. It may be desirable to map to other locations in a system. Table 12 lists commonly mapped points. See Appendix D for a complete list of all Excel 10 VAV Controller User Addresses.

**Table 12. List Of Excel 10 VAV Controller Source Variables:  
Excel 10 VAV Controller Points Are Source Points With Receivers Elsewhere On E-Bus Or C-Bus.**

Source (Excel 10 VAV Controller) Variable Name	Description (Including Receiver Information)	Allowable Values	Typical Destination
SrcOccSensor	This signal contains the effective occupancy status of the Excel 10 VAV Controller.	Occupied Standby Unoccupied Bypass Null	XBS for monitoring.
StatusOverride	This signal contains the state of the remote override button.	Occupied Unoccupied Bypass Null	XBS for monitoring and tenant logging.
StatusMode	Indicates the current Control mode of the Excel 10 VAV Controller.	15 possible values. See Table D4. Status Points.	XBS for monitoring.
AlarmLog0 through AlarmLog 4	Indicates latest 5 alarms detected by the node (if any).	16 possible values. See Table D4. Status Points	XBS for monitoring.
StatusLowFlow	Indicates duct pressure is not sufficient to provide the desired air flow with the damper fully open.	Normal Alarm	XBS for monitoring, or VAV AHU controller for use in the flow control.
StatusFan	If the box has a fan, this indicates its commanded status (On or Off).	Fan is off Fan is on	XBS for monitoring.
HeatStagesOn	If the box has staged reheat, this indicates the current number of stages commanded On.	No Stages Active Single Stage Active Two Stages Active Three Stages Active	XBS for monitoring.
SupplyFlow *	This indicates the current measured air flow in m3h or (CFM) being delivered by the box.	0 to 10,000 CFM (0 to 16,990) m3h	XBS for monitoring, or VAV AHU controller for use in the flow control.
DamperPos **	This indicates the current box damper position (in percent of fully open).	0 to 100 percent*	XBS for monitoring, or VAV AHU controller for use in the flow control.
TerminalLoad	This indicates the current calculated terminal cooling load as a percentage of what the box is designed to handle. Positive value indicates a cooling load. Negative value indicates a heating load.	-160 to 160 percent	XBS for monitoring, or VAV AHU controller for use in the flow control.
HtgVlv_DmpPos	This indicates the current position of the modulating reheat valve or damper as a percentage of fully open.	0 to 100 percent	XBS for monitoring, or VAV AHU controller for use in the flow control.
RmTempActSpt	This indicates the current temperature control point calculated from the various Setpoints and Operating modes.	50 to 95°F (10 to 35°C)	XBS for monitoring, or VAV AHU controller for use in the flow control.
SaFlowCntlSpt	This indicates the current air flow control point calculated by the temperature control or exhaust tracking control algorithms.	0 to 10,000 CFM (0 to 16,990) m3h	XBS for monitoring, or VAV AHU controller for use in the flow control.

\* Not applicable in Pressure Dependent applications.

\*\* Pressure Dependent applications display inaccurate damper positions.

## Step 7. Troubleshooting

### Troubleshooting Excel 10 Controllers and Wall Modules

In addition to the following information, refer to the Installation Instructions and Checkout and Test manual for each product. See the Applicable Literature section for form numbers.

#### Temperature Sensor and Setpoint Potentiometer Resistance Ranges

The T7770 or T7780 Wall Module or the C7770A Air Temperature Sensor has the following specified calibration points, which are plotted in Fig. 80:

Temperature (°F)	Resistance Value (ohms)
98	11755
80	18478
70	24028
60	31525
42	52675

The T7770 Wall Module setpoint potentiometers have the following calibration points:

Temperature (°F)	Resistance Value (ohms)
85	1290
70	5500
55	9846

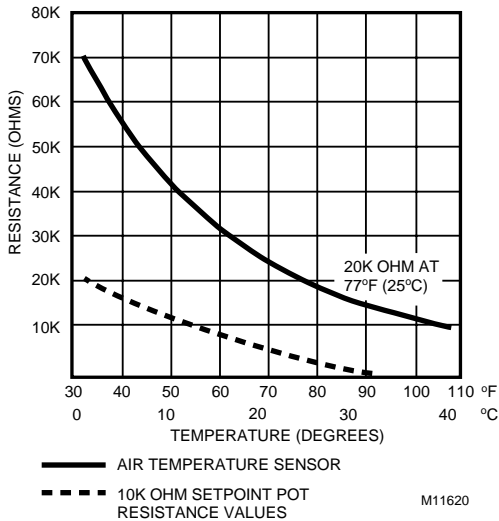


Fig. 80. Temperature sensor resistance plots.

### Alarms

When an Excel 10 has an alarm condition, it reports it to the central node on the E-Bus (typically, the Excel 10 Zone Manager). See Table 13. Information contained in an alarm message is:

- Subnet Number: E-Bus subnet that contains the Excel 10 node that has the alarm condition. Subnet 1 is on the Zone Manager side of the router; Subnet 2 is on the other side.
- Node Number: Excel 10 node that has the alarm condition (see Network Alarm).
- Alarm Type: Specific alarm being issued. An Excel 10 can provide the alarm types listed in Table 13.

NOTE: The node can be reset by switching the node to MANUAL and then to the normal operating mode.

Also, the Excel 10 VAV Controller variables, *AlarmLogX*, where X is 0 through 4, that store the last five alarms to occur in the controller, are available. These points can be viewed through XBS or E-Vision.

Certain alarm conditions are suppressed conditionally as follows:

If an input Excel 10 VAV Controller variable (except RmtFlow1) with failure detect is bound to the same node as the Excel 10 VAV Controller variable Alarm, then the Excel 10 VAV Controller variable Alarm and AlarmLogX do not report the related Excel 10 VAV Controller variable receive failure error and its associated return to normal. Suppression only occurs when the Excel 10 VAV Controller variable Alarm is bound to only one node using LonWorks® subnet node addressing. Suppression occurs only after the input Excel 10 VAV Controller variable has actually received an Excel 10 VAV Controller variable from the node since the latest application restart (or power-up condition). The Excel 10 VAV Controller variable Error contains all the detected current errors even though they can be suppressed for reporting by the Excel 10 VAV Controller variable Alarm and AlarmLogX.

### Broadcasting the Service Message

The Service Message allows a device on the E-Bus to be positively identified. The Service Message contains the controller ID number and, therefore, can be used to confirm the physical location of a particular Excel 10 VAV Controller in a building.

There are two methods of broadcasting the Service Message from an Excel 10 W7751 Controller. One uses a hardware service pin button on the W7751B,D,F,H Controllers (see Fig. 81).

NOTE When pressing the W7751D,F,H service pin button, use a non-metallic object to press the button through the access holes.



Table 13. Excel 10 Alarms.

Name of alarm or error bit	Alarm type number	Meaning of alarm code or error bit
NO_ALARM	0	No alarms presently detected.
COMM_FAILED	1	One or more NV inputs have failed to receive an update within their specified FAILURE_DETECT_TIME.
SENSOR_FAILED	2	One or more sensors have failed.
INVALID_CONFIG	3	The binding of network variables is inconsistent with the configuration.
INVALID_SETPOINT	4	One of the Setpoints is not in the valid range.
NODE_DISABLED_ALM	5	The control algorithm has stopped because the controller is in DISABLED_MODE, MANUAL, or FACTORY_TEST mode. No more alarms are reported when the controller is in the DISABLED_MODE. Alarms continue to be reported if the controller is in the MANUAL, or FACTORY_TEST mode.
FROST_PROTECT_ALM	6	The space temperature is below the frost alarm limit 42.8°F (6°C) when the mode is FREEZE_PROTECT. The alarm condition remains until the temperature exceeds the alarm limit plus hysteresis.
SMOKE_ALARM	7	When the node enters the Pressurize or DePressurize mode, then the node issues the SmokeAlarm.
Comm_Failed_Rtn	129	Return to no alarm after being in an alarm condition. This code is added numerically to another alarm code to indicate that the alarm condition has returned to normal.
Sensot_Failed_Rtn	130	Return to no alarm after being in an alarm condition. This code is added numerically to another alarm code to indicate that the alarm condition has returned to normal.
Invalid_Config_Rtn	131	Return to no alarm after being in an alarm condition. This code is added numerically to another alarm code to indicate that the alarm condition has returned to normal.
Invalid_Setpt_Rtn	132	Return to no alarm after being in an alarm condition. This code is added numerically to another alarm code to indicate that the alarm condition has returned to normal.
Node_Disabled_Rtn	133	Return to no alarm after being in an alarm condition. This code is added numerically to another alarm code to indicate that the alarm condition has returned to normal.
Frost_Protect_Rtn	134	Return to no alarm after being in an alarm condition. This code is added numerically to another alarm code to indicate that the alarm condition has returned to normal.
Smoke_Alarm_Rtn	135	Return to no alarm after being in an alarm condition. This code is added numerically to another alarm code to indicate that the alarm condition has returned to normal.
ALM_NOTIFY_DISABLED	255	The alarm reporting was turned off by DestManMode. No more alarms are reported via nvoAlarm until DestManMode turns on alarm reporting or on application restart.

The other involves using the PC Configuration tool, as follows:

When an *Assign ID* command is issued from the CARE/E-Vision commissioning tool, the node goes into the SERVICE\_MESSAGE mode for five minutes. In the SERVICE\_MESSAGE mode, pressing the occupancy override button on the remote wall module (refer to Fig. 83 for override button location) causes the Service Message to be broadcast on the network. All other functions are normal in the SERVICE\_MESSAGE mode.

If an Excel 10 VAV Controller does not have an override button connected, it can still broadcast the Service Message on the network by temporarily shorting the controller Bypass Input terminal to the Sensor Ground terminal (on the W7751D,F short terminals 24 to 26, on the W7751B short terminals 20 to 22 and on the W7751H short terminals 7 and 5).

The CARE/E-Vision commissioning tool is used to perform the ID Assignment task (see E-Vision User's Guide form, 74-2588).

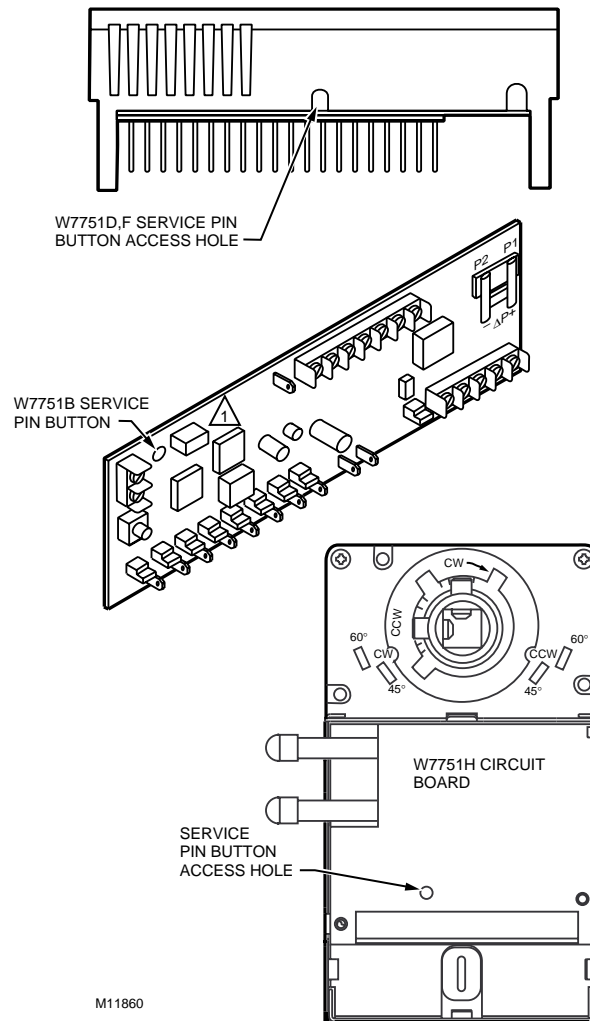


Fig. 81. Location of the Service Pin Button.

## W7751 Controller Status LEDs

The LED on the front of a W7751 Controller provides a visual indication of the status of the device. See Fig. 82. When the W7751 receives power, the LED appears in one of the following allowable states:

1. Off—no power to the processor.
2. Continuous on—processor is in initialized state.
3. Slow blink—controlling, normal state.
4. Fast blink—when the Excel 10 VAV Controller has an alarm condition.

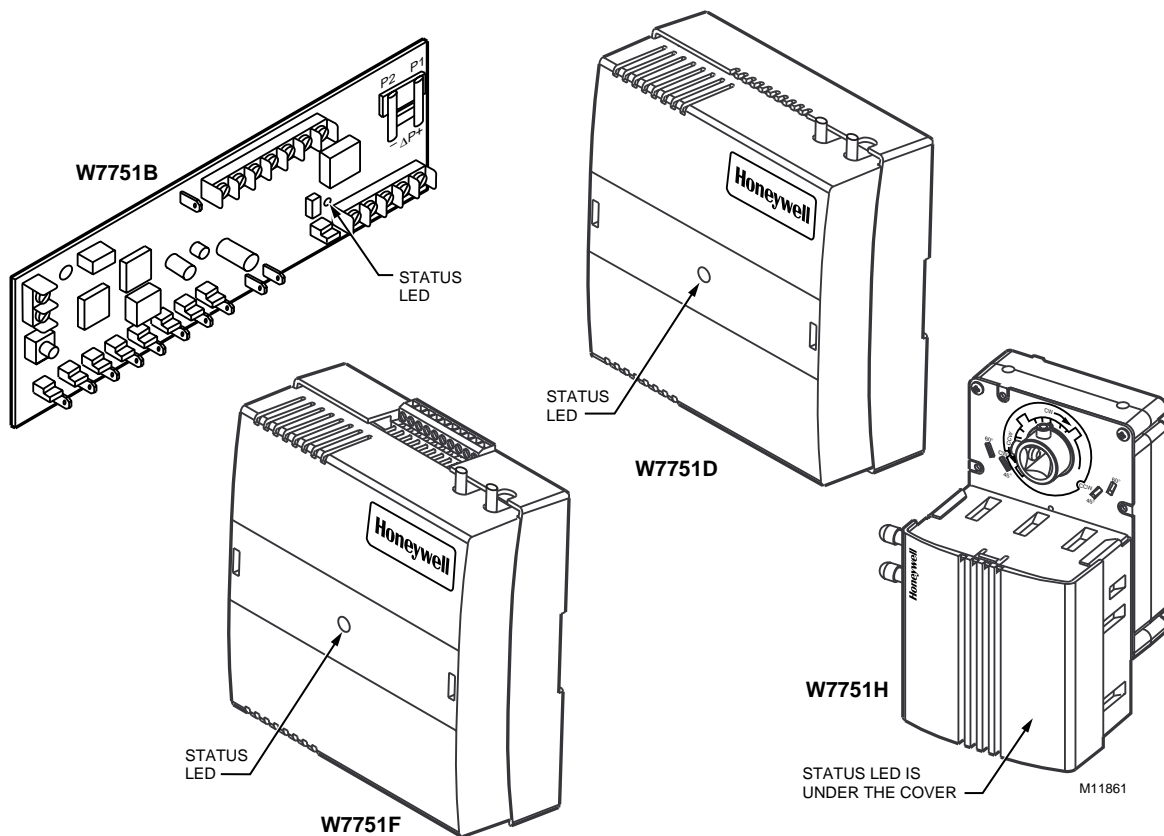


Fig. 82. LED location on W7751s.

**T7770C or D Wall Module Override LED**

The remote override LED, located on either the T7770C or T7770D Wall Module in Fig. 83, display the Manual Override mode of the controller. The modes are:

1. LED = Off. No override active.
2. LED = Continuously On. Bypass mode (timed Occupied override).
3. LED = One flash per second. Continuous Unoccupied override.
4. LED = Two flashes per second. Remote only, continuous Occupied override.

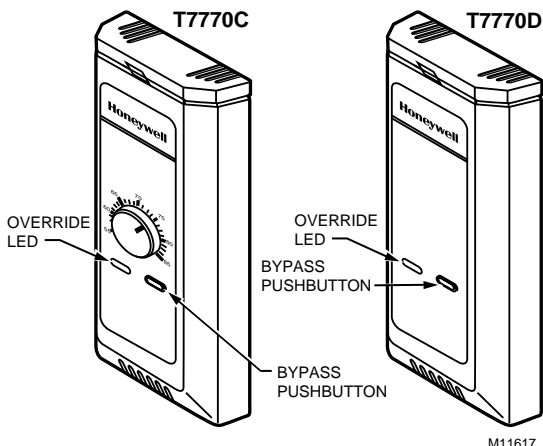


Fig. 83. The T7770C,D Wall Modules LED and Bypass pushbutton locations.

**T7770C,D or T7780 DDWM Bypass Pushbutton Operation**

The Wall Module Bypass pushbutton is located on both the T7770C,D Wall Modules, see Fig. 83. The bypass pushbutton is also located on the T7780 DDWM, see Fig. 85. The T7770C,D Wall Modules can change the controller into various occupancy modes, see Table 14.

**Table 14. Bypass Pushbutton Occupancy Modes**

If Pushbutton is Held Down for at Least	The But for Not More than	Resulting Mode is
<1 second	1 second	No Override active
1 second	4 seconds	Bypass mode (timed Occupied override)
4 seconds	7 seconds	Continuous Unoccupied override

Pressing the wall module bypass pushbutton, located on both the T7770C and T7770D, Wall Modules in Fig. 83, causes the override LED to display the Manual Override mode of the controller, see Fig. 84. The modes are:

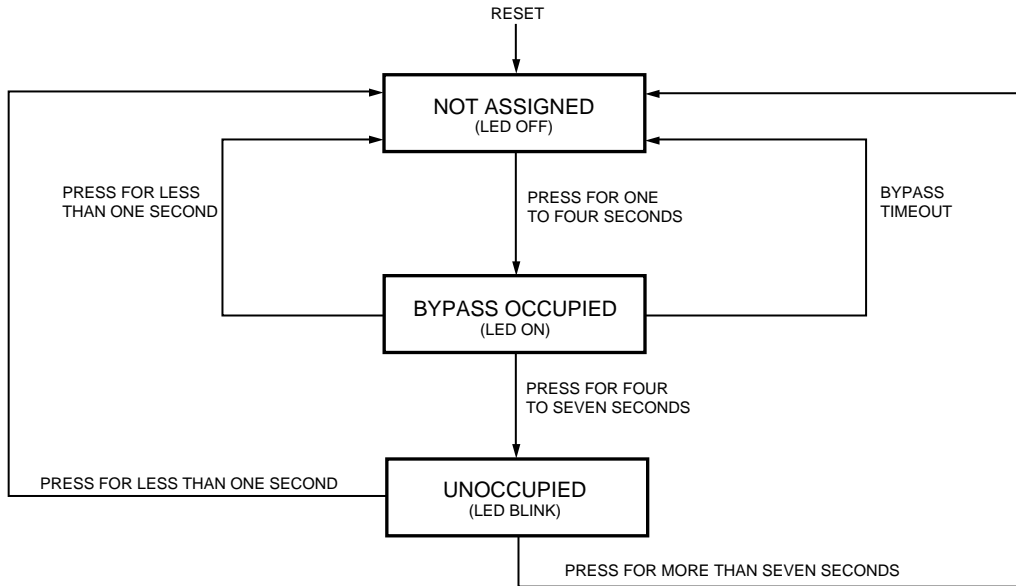
1. LED = Off. No override active.
2. LED = Continuously on. Bypass mode (timed Occupied override).
3. LED = One flash per second. Continuous Unoccupied override.
4. LED = Two flashes per second. Remote only, continuous Occupied override.

NOTES: If the pushbutton is held down for longer than seven seconds, the controller reverts back to mode 1 and repeats the cycle for modes 1 through 3.

Mode 4 (continuous Occupied override, two flashes per second) can only be initiated remotely; that is, over the E-Bus network. An error condition will be displayed as three short blinks and one long blink when the Bypass pushbutton is held down or shorted. The short must be removed to return the controller to proper operation.

### T7780 DDWM Bypass Pushbutton

See Fig. 85 for the T7780 DDWM bypass pushbutton locations (occupied or unoccupied).



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Fig. 84. LED and Bypass pushbutton operation.

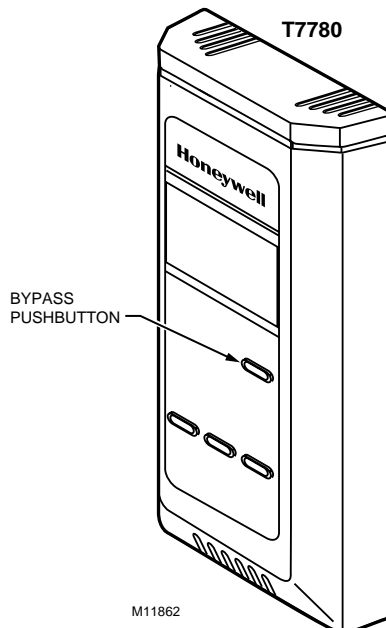


Fig. 85. The T7780 DDWM bypass pushbutton location.

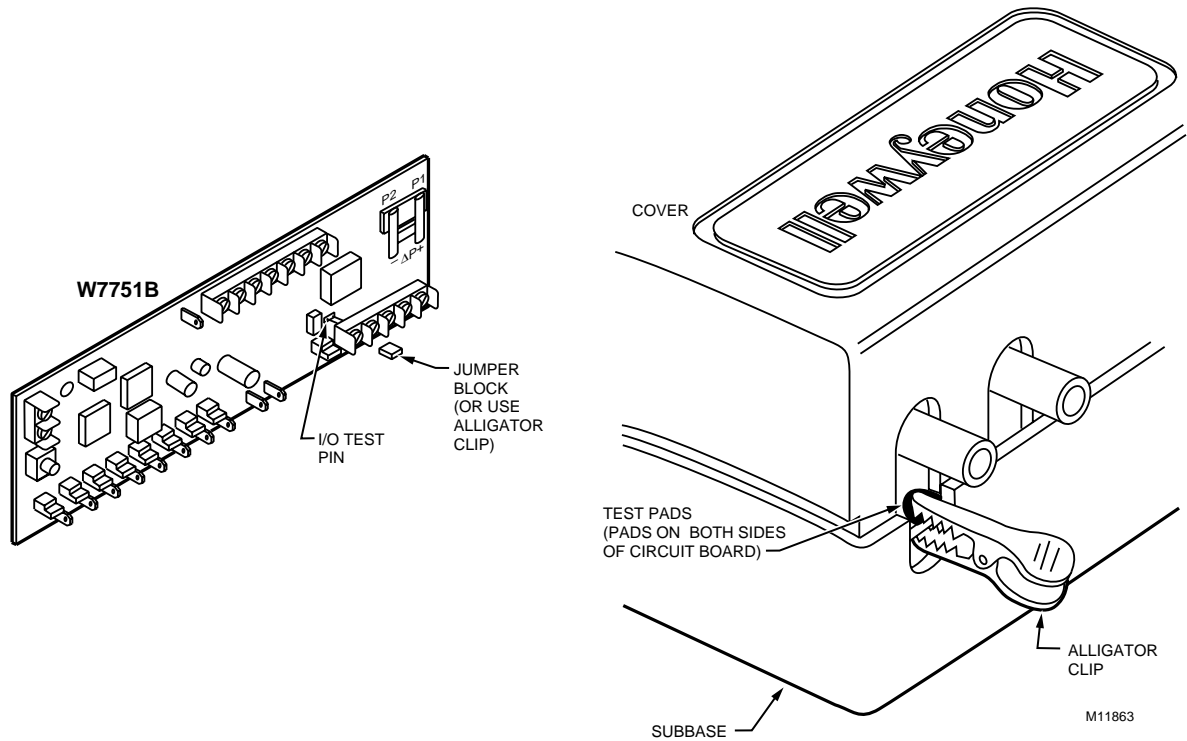
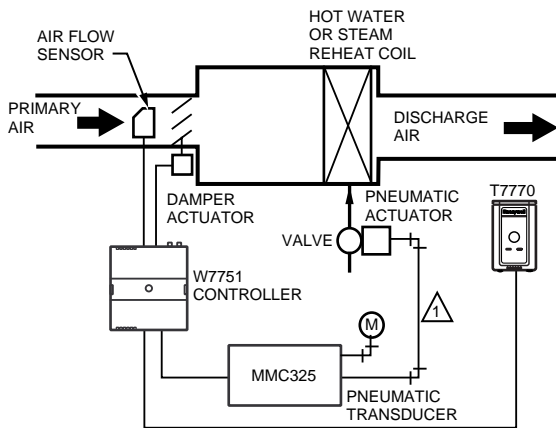


Fig. 86. I/O test pin/pad uses jumper block or alligator clip to short the test pin/pad.

## APPENDICES

### Appendix A. Creating a Work Bench for Configuring Excel 10 W7751D,F VAV Controllers.

Fig. A-1 illustrates one possible test-bed setup for configuring Excel 10 VAV Controllers offsite. This setup allows W7751D,F Controllers to be plugged in, configured from a PC running either CARE/E-Vision, and removed quickly and easily.



⚠ PNEUMATIC MAIN OR BRANCH LINE MUST BE 1/4 IN. (6 MM) OR LARGER TUBING. A MINIMUM OF 6 FT (1.8M) OF TUBING IS NEEDED IN A BRANCH LINE.

M11869

Fig. A-1. Excel 10 VAV Controller configuration work bench.

### Appendix B. Using E-Vision to Commission a W7751 Controller.

#### Job Commissioning

The CARE/E-Vision database that is generated for the Excel 10 VAV Controllers and associated Zone Managers contains information concerning interrelationships and network identifications. For this reason, it is mandatory to commission (assign ID and download) all Excel 10 VAV Controllers and the Zone Managers from a *single* database.

This project database can be backed up and restored to be placed onto various PCs during the commissioning phase (but only a single copy can be used at a time) and then must be re-designated as the *master* and given to the next PC for further commissioning.

#### ID Number

Each Excel 10 VAV Controller is shipped with an internal Identification Number from the factory. This ID number is on a removable sticker on the inside of the W7751 housing and can be used to assign a CARE Plant to each controller. When assigning the ID numbers, the procedure used depends on if the controllers were installed at the site or if they can be configured one at a time on a bench top.

The ID number can either be manually entered or a node can broadcast its ID number on the E-Bus. The CARE commissioning tool (E-Vision) is used to perform both methods (see E-Vision User's Guide form, 74-2588, Step 12. Commission Controllers).

## Bench Top Configuring

Appendix A presents a simple work bench arrangement of the required hardware and the associated wiring connections to configure Excel 10 W7751D,F Controllers. Proceed as follows:

1. With power disconnected to the housing subbase, insert the controller circuit board (contained in the housing cover) into the subbase unit.
2. Apply power to the controller, and insert the Serial Interface cable into the jack on either the Excel 10 W7751D or F Controllers (see Appendix A).
3. Use the CARE/E-Vision PC tools to configure the controller. (See the CARE, E-Vision User's Guides, forms 74-5587 and 74-2588, for further details.) Use the ID number sticker on the controller or press the bypass button on the wall module.
4. When configuration is completed, power down and remove the W7751D,F from the subbase. Mark the controller with the Plant name or location reference so the installer knows where to install each controller in the building.
5. Repeat with next W7751D,F to be configured.
6. The data file used for this configuration must be used at the job site so the commissioning data matches the controllers.

## Configuring in the Field

If the controllers were installed at the site, the procedure to assign the node numbers to the Excel 10 VAV Controller is as follows:

1. Instruct the installer to remove the ID sticker from each controller during installation and to affix it to either the job blueprint at the appropriate location or to a tabulated list. Be sure the installer returns these prints to the application engineer after the controllers are installed.
2. Connect to the E-Bus with the CARE PC tool.
3. Proceed to configure the W7751 (using the job prints for location reference for the controllers) by following the standard CARE procedures.

## Configuring the Zone Manager

The Q7750A Excel 10 Zone Manager sends out a one-time LonWorks® message containing its 48-bit Neuron ID after any power-up *WARMSTART* or when the Excel 10 Zone Manager is reset by pressing the reset button.

### IMPORTANT

*Pressing the reset button on the Excel 10 Zone Manager causes all application files in the Q7751, including the C-Bus setup, to be lost.*

The LonWorks® message is sent out one time and only on the E-Bus, not on the B-Port. The message will be the same as the one generated after pressing the service pin pushbutton available on Excel 10 VAV Controllers and also via the wall module bypass pushbutton. The CARE commissioning tool (E-Vision) can use this message to assign the node address.

The *Assign ID* procedure is the same as for an Excel 10 VAV Controller except, instead of pressing the bypass button, the reset button must be pressed or the power must be cycled (down then up) on the Q7750A Excel 10 Zone Manager.

## Sensor Calibration

The space temperature and the optional resistive inputs can all be calibrated. The wall module setpoint potentiometer *can not* be calibrated. Perform the sensor calibration by adding an offset value (either positive or negative) to the sensed value using E-Vision menus (see E-Vision user's guide, form number 74-2588).

## Air Flow Balancing (For Pressure Independent applications only)

In addition to the ten point Flow Pickup Calibration Table, the Excel 10 VAV Controller provides for 3-point (Maximum, Minimum, and Zero) Air Flow Calibration. This allows the box to be adjusted so it can be certified that the box provides the flow rates specified by the consulting engineer. When balancing is complete, the actual flow from a box should be within 5 to 10 percent of the indicated air flow (as shown on the E-Vision screen).

**NOTE:** There are many sources of error in flow-hood measurements. Flow hood meters typically attain accuracy to within plus or minus three to five percent of full flow. The error can be due to the device being out of calibration, or that it was last calibrated with a different style of diffuser. Even the operator technique plays a role in obtaining repeatable, accurate flow readings. When working with slotted diffusers, *do not use* a hood; *use* a velocity-probe type of instrument.

Follow the diffuser manufacturer's recommendation for how to best measure the air flow through their products.

## Procedure

### CAUTION

Prior to air flow balancing for the first time, perform a zero flow calibration procedure. To do so, power the Excel 10 VAV Controller for one hour or more before performing the procedure.

Select the controller being worked on with E-Vision (see the E-Vision User's Guide, form 74-2588, for general details on using E-Vision). Due to inconsistencies in VGA display cards and modes, be sure to maximize the E-Vision window on the screen (by clicking the up-arrow at the top-right corner of the E-Vision window). This assures that all E-Vision activities are user viewable.

Refer to the Air Flow Balancing section in the E-Vision user's Guide form, 74-2588 for the exact procedure.

## Resetting Air Flow Calibration to Factory Defaults

Refer to the Air Flow Balancing section in the E-Vision user's Guide form, 74-2588 the for exact procedure.

## VAVII Calibration Sequence

Dual Duct VAV box that has flow mixing with constant volume using two W7751 Controllers.

1. Create the Master controller in E-Vision.
    - a. Add a VAVII controller to the network. Name the same as the CARE name if using a Zone Manager.
    - b. Configure the inputs and the outputs through the Application Selection under the Controller menu.
      - 1.) Configuration Tab:
        - a.) Select the controller type (Standard, Smart, OEM).
        - b.) Select the Box Type (Dual\_Duct).
        - c.) Select the Flow Type (Master\_Const\_Flow).
        - d.) Select the Pressure Type (Press\_Independent).
        - e.) Select the Wall Module Type.
        - f.) The Reheat Type will be DualDuctReheat, the Fan Type will be NO\_Fan and Morning Warm-up Type will be Fixed\_Flow\_Spt.
      - 2.) Input Tab:
        - a.) Select the Remote Stpt (Absolute\_Setpoint, Relative\_Setpoint).
        - b.) Select any additional Analog or Digital inputs.
      - 3.) Output Tab:
        - a.) Enter the correct motor speed value (default is 90 seconds).
        - b.) Verify that the direction to open the damper is correct (default is CW).
      - 4.) Cntrl Parameters Tab:
        - a.) Enter the desired Flow Setpoints.
        - b.) Enter the correct Duct area or select the duct diameter from the drop-down list.
      - 5.) Flow Pickup Table Tab:
        - a.) Select the correct Flow Pickup from the Sensor Type drop-down list.
    - c. Click on the OK button to save the changes and exit out of the Application Selection screen.
  2. Create the Satellite controller in E-Vision.
    - a. Add a VAVII controller to the network. Name it the same as the CARE name if using a Zone Manager.
    - b. Configure the inputs and the outputs through Application Selection under the Controller menu.
      - 1.) Configuration Tab:
        - a.) Select the controller type (Standard, Smart, OEM).
        - b.) Select the Box Type (Dual\_Duct).
        - c.) Select the Flow Type (Master\_Const\_Flow).
        - d.) Select the Pressure Type (Press\_Independent).
        - e.) Select the Wall Module Type.
        - f.) The Reheat Type will be DualDuctReheat, the Fan Type will be NO\_Fan and Morning Warm-up Type will be Fixed\_Flow\_Spt.
      - 2.) Input Tab:
        - a.) There will be no Remote Stpt for the Satellite controller.
        - b.) Select any additional Analog or Digital inputs.
      - 3.) Output Tab:
        - a.) Enter the correct motor speed value (default is 90 seconds).
        - b.) Verify that the direction to open the damper is correct (default is CW).
      - 4.) Cntrl Parameters Tab:
        - a.) Enter the desired Flow Setpoints. They should be the same as the Master controller setpoints.
        - b.) Enter the correct Duct area or select the duct diameter from the drop-down list.
        - c.) There are no Cooling or Heating Setpoints or Remote Setpoint limits available for the Satellite controller.
      - 5.) Flow Pickup Table Tab:
        - a.) Select the correct Flow Pickup from the Sensor Type drop-down list.
    - c. Click on the OK button to save the changes and exit out of the Application Selection screen.
    - d. Bind the Wall Module from the Master controller to the Satellite controller and the Satellite box flow to the Master controller.
      - 1.) Select Refer Excel 10 Points (Network Menu item—Offline).
      - 2.) Select the Master controller to be the Source Excel 10.
      - 3.) Select the Satellite controller to be the Destination Excel 10.
      - 4.) Under Source Excel 10 Points, select SrcMaster.
      - 5.) Under Destination Excel 10 Points, select DestSatellite.
      - 6.) Click on the Add button to add the binding to the References list box.
      - 7.) Select the Satellite controller to be the Source Excel 10.
      - 8.) Select the Master controller to be the Destination Excel 10.
      - 9.) Under Source Excel 10 Points, select SrcBoxFlow.
      - 10.) Under Destination Excel 10 Points, select DestFlowTrack.
      - 11.) Click on the Add button to add the binding to the References list box. This will complete the binding that is required between the Master and the Satellite controllers. Click the Close button to exit the Refer Excel 10 Points dialog box.
3. Commission the Master and the Satellite Controllers.
  - a. Select both controllers by clicking once on the Master controller, then hold down the Ctrl key on the keyboard and click on the Satellite controller.
  - b. Go to the Online mode (View menu item).
  - c. Select Assign Neuron ID (Controller menu item). Use the wall module Pushbutton on the Master controller wall module to assign the ID for the Master or manually enter the ID for both the Master and the Satellite controllers. The status for both controllers should be Not Commissioned. Close out the dialog box.

- d. Select Commission (Controller menu item). Both controllers should be listed in the list box and highlighted. Click on the Start button to commission the controllers. Close out the dialog box after both controllers are commissioned.
  - e. Double click on the Master controller to bring up the Application Selection screen and select the Flow Pickup Table Tab.
  - f. Click on the Calculate button (this will create a new flow table based on the factory calibration values that were uploaded from the controller). A message box will display Flow Table Calculations Finished. Press Set or OK to complete. Click on the OK button to close the message box and then click the OK button to update the controller with the new values.
  - g. Repeat steps 3e and 3f for the Satellite controller.
4. Calibrate Air Flow.
- a. To calibrate the Master controller—Select the Master controller (Cold Duct Damper).
  - b. Select Calibration (Controller menu item) and Air\_Flow\_Cal from the VAVII Sensor Calibration list box and then click on the Select button.
  - c. Select the Reset button to load the factory defaults (this is done so the controller has good starting values for the zero, minimum, and maximum calibration).
  - d. Select the Zero button to do the Zero Calibration (this process will take a couple of minutes to complete). When calibration is complete, close the Air Flow Zero Calibration dialog box.
  - e. Select the Maximum button to do the maximum calibration. When Maximum Calibration Status displays Setpoint reached, enter measured flow, then enter the measured value and click on the Calibrate button. When calibration is complete, close the Air Flow Maximum Calibration dialog box.
  - f. Select the Minimum button to do the minimum calibration. When Minimum Calibration Status displays Setpoint reached, enter measured flow, then enter the measured value and click on the Calibrate button. When calibration is complete, close the Air Flow Minimum Calibration dialog box.
  - g. Close the Air Flow Calibration and the VAVII Sensor Calibration dialog boxes.
  - h. Select the Satellite controller (Hot Duct Damper).
  - i. To balance the Hot Duct Damper, the Cold Duct Damper has to be closed. This example will use the Hand Held Tool (HHT) to command the Cold Duct Damper closed. The following steps will guide the user to manually command the damper closed.
    - 1.) Plug the HHT into the Master controllers wall module or the Master controller and turn on the power switch. The HHT software version number will be displayed (it should be 01.01.02 or greater).
    - 2.) Press Enter to get to the main menu. Scroll down to HHT Functions and hit the Enter key.
    - 3.) Scroll down to Change Authorization and hit the Enter key.
    - 4.) Scroll down to Operator Level and hit the Enter key. For new level, enter level 4.
    - 5.) Enter the Password for that level and hit the Enter key. Hit the Prev Menu button a number of times to get back to the VAV2 Main Menu.
    - 6.) Pick the Select Excel 10 menu item and hit the Enter key. Scroll down to Push Button ID and hit the Enter key.
    - 7.) The HHT will prompt the user to press the pushbutton on the Master controllers wall module. The next screen will display Excel 10 Selected and also display the Nodes ID number.
    - 8.) Press any key to go to the VAV2 Main Menu. Scroll down to Service Excel 10 and press the Enter key.
    - 9.) Scroll down to I/O Points and press the Enter key.
    - 10.) Scroll down to Commandable Points and press the Enter key.
    - 11.) Scroll down to Manual Damper/Flow and press the Enter key.
    - 12.) Use the Left or Right arrows to select Position on the bottom line (default is Null). For New Position enter a value of 0 and press the Enter key. The Cold Duct Damper will be driven closed. The display will show the current position of the damper. The ReFresh key will have to be pressed to update the current position. When the damper position displays 0, the user can go to step 4j to calibrate the Satellite controller (Hot Duct Damper).
      - j. To calibrate the Satellite controller, repeat steps 4b through 4g.
      - k. Press the Prev Menu key on the HHT. The HHT will display Manual Damper Leave Fixed?. Select No and press the Enter key to put the damper back under automatic control.
      - l. Press the Prev Menu key a number of times to get back to the VAV2 Main Menu and select the Logout VAV2 menu item and press the Enter key.
5. Verify Calibration.
- a. Select the Master controller (Online Mode).
  - b. Select the Monitor mode (Controller menu item).
  - c. Verify the Cold/Hot Duct Flow values and if the VAV box is reaching setpoints.

## Appendix C. Sequences of Operation.

This Appendix provides the control sequences of operation that are pressure independent or pressure dependent. In pressure dependent applications, the reheat setpoint will default from CFM (m3h) to a fixed percent open position for the damper.

NOTE: Pressure dependent applications require physical minimum and maximum position stops on the damper actuator.



## Common Operations.

The Excel 10 VAV temperature control applications have common configuration options. However, Exhaust Flow Tracking, does not perform temperature control at all, and is strictly a flow control algorithm; therefore, it does not share the common operations. This section describes the common operations.

Each application can have any or all of these devices configured with the restriction that *every* Excel 10 VAV Controller that controls temperature *must* have a temperature sensor (either wired directly to the controller or shared from another Excel 10 VAV Controller).

### Room Temperature Sensor (RmTemp)

This is the room space temperature sensor. This sensor is the T7770 Wall Module or the T7780 DDWM. When it is configured, it provides the temperature input for the W7751 temperature control loop. If it is not configured, it is required that a room temperature sensor value be transmitted from another E-Bus device like the T7780 DDWM. If no valid room temperature value is available to the W7751 Controller, the temperature control algorithm in the controller is disabled, causing the heating and cooling control outputs to be turned off.

It can be required that either Wall Module or Room Temperature sharing be provided from another Excel 10 VAV Controller with a wall module or temperature sensor. The room temperature sensor can be calibrated via E-Vision (see Temperature Sensor Calibration in Appendix B).

### Remote Setpoint (RmtStptPot or DischargeAir\_Sensor)

NOTE: The C7770A Air Temperature Sensor (DischargeAir\_Sensor or Supply\_Air\_Sensor) or the setpoint pot options are selectable in E-Vision. (Either one or the other can be selected, but not both on the W7751H controller.)

This is the Setpoint Potentiometer contained in the T7770 Wall Module. (The T7780 DDWM must be in Setpoint to change a controllers setpoint via the E-Bus. Press the up or down arrow keys once or press the enter key twice to get the T7780 DDWM in Setpoint.) When configured, this occupant value is set to calculate the actual cooling or heating Occupied Setpoint. There are two options for how to calculate the actual setpoint to be used by the temperature control algorithm: (Offset) and (Absolute Middle). When SetPtKnob is set to Offset, the Wall Module setpoint knob represents a number from -5° to +5°C (-9° to +9°F) which is added to the software occupied setpoints for the heat and the cool modes (CoolOccSpt and HeatOccSpt). When SetPtKnob is set to Absolute Middle, the setpoint knob becomes the center of the Zero Energy Band (ZEB) between the cooling and heating occupied setpoints. The size of the ZEB is found by taking the difference between the software heating and cooling occupied setpoints; therefore, for Absolute Middle, the actual setpoints are found as follows:

$$\text{RmTempActSpt (in cooling mode)} = \text{RmtStptPot} + (\text{CoolOccSpt} - \text{HeatOccSpt}) / 2$$

$$\text{RmTempActSpt (in reheat mode)} = \text{RmtStptPot} - (\text{CoolOccSpt} - \text{HeatOccSpt}) / 2$$

During Standby and Unoccupied times, the remote setpoint pot is not referenced, and the software setpoints for those modes are used instead.

The C7770A Air Temperature Sensor is a direct-wired temperature sensor that is used to sense discharge, supply or return air in a duct that can be controlled by an Excel 10 W7751 VAV Controller. When configured, this provides the temperature input for the VAV controller setpoint inputs.

### Setpoint Limits (StptLoLim and StptHiLim)

Remote setpoint pot limits are provided by StptLoLim and StptHiLim. The occupied setpoints used in the control algorithms are limited by these parameters. When the setpoint knob is configured to be of type Absolute Middle, the lowest actual setpoint allowed is equal to StptLoLim, and the highest actual setpoint allowed is equal to StptHiLim. When the setpoint knob is configured to be an Offset type, the lowest actual setpoint allowed is equal to HeatOccSpt - StptLoLim, and the highest allowed is equal to CoolOccSpt + StptHiLim.

### Bypass Mode (StatusOverride and StatusLed)

During Unoccupied periods, the facility occupant can request that Occupied temperature control setpoints be observed by depressing the Bypass pushbutton on the wall module. When activated, the controller remains in Bypass mode until:

1. Bypass Duration Setting has timed out (BypassTime), or
2. User again presses the Wall Module pushbutton to switch off Bypass mode, or
3. Occupancy schedule (DestSchedOcc network input) switches the mode to Occupied.
4. User sets the DestManualOcc network point to Not Assigned.

The LED on the Wall Module (StatusLed) indicates the current bypass mode status (see the T7770C,D Wall Module Override LED section).

### BypassTime

BypassTime is the time between the pressing of the override button at the wall module (or initiating OC\_BYPASS via DestManualOcc) and the return to the original occupancy state. When the bypass state has been activated, the bypass timer is set to BypassTime (default of 180 minutes).

See Table 14 and Fig. 84 and DestBypass in Table D3.

### OverrideType

OverrideType specifies the behavior of the override button on the wall module. There are three possible states that have the following meanings:

NONE-Disables the override button.

NORMAL-Causes the override button to set the Override state to OC\_BYPASS for BypassTime (default 180 minutes), when the override button has been pressed for approximately 1 to 4 seconds, or to set the override state to UNOCC when the button has been pressed for approximately 4 to 7 seconds. When the button is pressed longer than approximately 7 seconds, then the override state is set to OC\_NUL (no manual override is active).

BYPASS\_ONLY causes the override button to set the override state to OC\_BYPASS for BypassTime (default 180 minutes), on the first press (1 to 7 seconds). On the next press, the override state is set to OC\_NUL (no manual over ride is active).

### OverridePriority

OverridePriority configures the override arbitration between DestManualOcc, DestBypassState, and the wall module override button. There are two possible states which have the following meanings:

LAST-Specifies that the last command received from either the wall module or DestManualOcc determines the effective override state.

NET-Specifies that when DestManualOcc is not OC\_NUL, then the effective occupancy is DestManualOcc regardless of the wall module override state.

### Standby Mode

The digital input for an occupancy sensor (usually a motion detector, or can be a time clock) provides the controller with a means to enter an energy-saving Standby mode whenever there are no people in the room. Standby mode occurs when the scheduled occupancy is Occupied, and the occupancy sensor detects no people currently in the room (digital input contacts Closed means people are in the room, and contacts Open means the room is Unoccupied). When in Standby mode, the Excel 10 VAV Controller uses the Standby Cooling (or Heating) Setpoint (CoolStbySpt or HeatStbySpt) for the Actual Space Temperature Setpoint.

### Window Sensor

The digital input for a window contact provides the algorithm with a means to disable its temperature control activities if someone has opened a window or door in the room. When a window is detected to be Open (digital input contacts Open equals window open), the box damper is commanded to control a damper to a configured percentage of maximum CFM (m3h) air flow for the ZeroDmprPos setting. Normal temperature control resumes when the window closes.

### CAV Control

On the occasion where it is required to supply Constant Air Volume (CAV) to the space, applications 1 through 15, can be used by assigning Maximum and Minimum and Reheat Air Flow Setpoints to the same value.

### Continuous Unoccupied Mode

This mode is entered when a wall module is configured with a bypass button that was pressed for four to seven seconds, causing the wall module LED to blink. This mode can also be entered via a network command (ManualOcc set to Unoccupied). If the controller is in this mode, it reverts to the Unoccupied Setpoints and control. The controller remains in this mode indefinitely or until the bypass button is pressed to exit the mode or a network command is sent to clear the mode.

### Share Wall Module

If one or more terminal units serve a common area, and it is specified (or desired) to use a single temperature sensor for these boxes, the Share Wall Module option can be configured. Refer to the Cautions and Notes in the Wall Module Options section, Common Temperature Control (Shared Wall Module subsection).

The operation of the *satellite* controllers follows the temperature control and modes of the controller with the temperature sensor module. For example, this includes Temperature Setpoints and Occupied/Unoccupied/Standby/Bypass, modes. Each *satellite* controller performs flow loop control with its own Maximum, Minimum and Reheat Flow Setpoints, but is directed by the primary controller. For example, if the primary control is at 50 percent of flow; that is, 500 CFM (849 m3h) for MAX/MIN values of 1000/0 CFM (1700/0 m3h), then the *satellite* is also at 50 percent of its own Flow Setpoints, such as 400 CFM (680 m3h) for MAX/MIN values of 800/0 CFM (1360/0 m3h). Similarly, the primary unit directs the percent open or number of heating stages on for the *satellite* units.

### Night Purge

If a terminal unit is put into the Night Purge mode via program (or manual) control, CmdMode set to (Night Purge), the controller performs the following functions (It):

- Disables the temperature control loop.
- Disables the flow control loop.
- Controls a damper to a configured percentage of maximum CFM (m3h) air flow (PurgeDmprPos).
- Enables terminal fan.

### Morning Warm-Up

A Morning Warm-Up cycle commands the Excel 10 VAV Controller to open its VAV box to a preselected position to allow the conditioned space to warm up. (On boxes with reheat, the reheat is locked out during the Warm-Up mode.) When Morning Warm-Up is completed, Excel 10 VAV Controllers are commanded to the Occupied condition.

If a unit is put into Morning Warm-Up mode via program (or manual) control, CmdMode set to (Morning Warm-Up), then the controller disables its temperature and flow loops and performs the following functions (It):

- Controls a damper to a configured percentage of maximum CFM (m3h) air flow (MornWarmupPos).
- Enables terminal fan.
- Disables local heat (staged or modulating).

### Smoke Control

The Excel 10 VAV Controller supports two smoke-related modes, Pressurize, and Depressurize. When the controller is placed in one of these two modes via a network command, the box damper is commanded to a fixed position specified in a separate user-adjustable Setpoint for each mode, and the temperature control function is disabled.

**Demand Limit Control**

When a high-electrical-demand signal is received via the E-Bus network, the controller applies a DlcBumpTemp Setpoint to the current PID error value. This has the effect of bumping the temperature control point to save energy. This offset bumps the cooling control point upward, and bumps the heating control point downward.

**Start-Up**

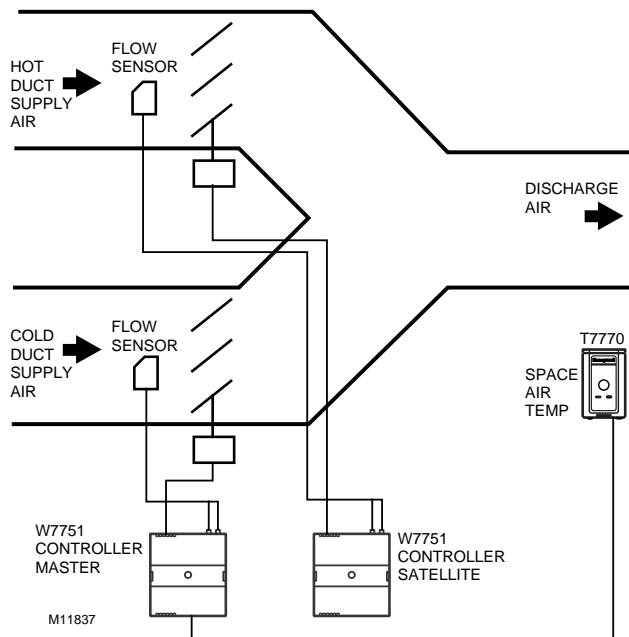
Upon initial start-up or on a restart after power failure, the Excel 10 VAV Controller neuron ID number is used as a random number that assigns the controller to one of two groups, even or odd. Based on this determination, one group of controllers drives its actuators open and the other group drives its actuators closed. Only on initial power-up can a controller drive its actuators to go open. Controllers in these groups go through a controlled restart with different time delays to assure smooth air handling unit start-up, minimizing air distribution problems.

NOTE: After a controller download via E-Vision, the delayed reset time is bypassed and the controller starts after a 40-second initialization.

**Air Flow Control Sequences of Operation**

The primary function of the temperature-control applications is to regulate the quantity in Meters Cubed per Hour or CFM, of supply air delivered to the space to control the space temperature. The algorithm assumes there is cold air in the duct; therefore, as the box damper is opened wider, the space becomes cooler.

**Dual Duct, Pressure Independent, with flow mixing, with cold and hot duct flow pickups (uses a satellite Excel 10 for hot duct).**



**Fig. C-1. Dual Duct, Pressure Independent, with flow mixing, with cold and hot duct flow pickups (uses a satellite Excel 10 for hot duct).**

**Dual Duct Flow Mixing: (For setup and Calibration refer to the Dual Duct Calibration procedure in Appendix B)**

**Master flow configuration:**  
Master\_Flow\_Mix

**Master reheat configuration:**  
DualDuctReheat

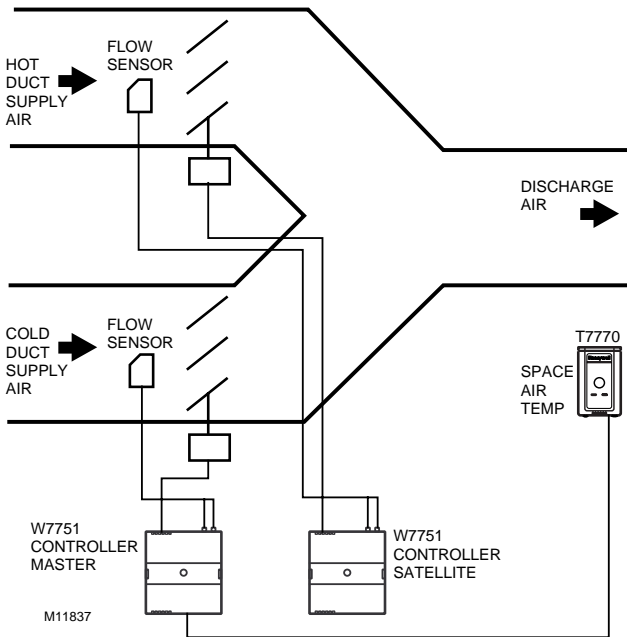
**Satellite flow configuration:**  
Satel\_Flow\_Mix

**Satellite reheat configuration:**  
DualDuctReheat

NOTE: SrcMaster from the Master Excel 10 must be bound to DestSatellite of the Satellite Excel 10 and SrcBoxFlow of the Satellite Excel 10 must be bound to DestFlowTrack of the Master Excel 10 through E-Vision (Refer Excel 10 Points) in order for this application to function properly.

Dual duct flow mixing uses two control devices, a master (for the cold duct) and a satellite (for the hot duct) to provide pressure independent control. If there is a need for cooling, dual duct flow mixing will control temperature to the cooling setpoint, setting the flow control setpoint for the cold duct between min flow and max flow while setting the hot duct flow setpoint to zero. If the temperature of the space is between the cooling and the heating setpoints, the cold duct will control to the min flow while the hot duct flow is set to zero. If there is a need for heating, the controllers will try to control to the heating setpoint by first modulating the cold duct flow from min flow to zero while simultaneously modulating the hot duct flow from zero to min flow. If there is additional need for heat, the hot duct will modulate from min flow to max flow while the cold duct is set to zero. Since during the initial heating load, both the hot and cold duct are supplying air, we have flow mixing.

**Dual Duct, Pressure Independent, without flow mixing, with cold and hot duct flow pickups (uses a satellite Excel 10 for hot duct).**



**Fig. C-2. Dual Duct, Pressure Independent, without flow mixing, that has cold and hot duct flow pickups (uses a satellite Excel 10 for hot duct).**

**Dual Duct No Flow Mixing: (For setup and Calibration refer to the Dual Duct Calibration procedure in Appendix B)**

**Master flow configuration:**

Master\_No\_Flow\_Mix

**Master reheat configuration:**

DualDuctReheat

**Satellite flow configuration:**

Satel\_No\_Flow\_Mix

**Satellite reheat configuration:**

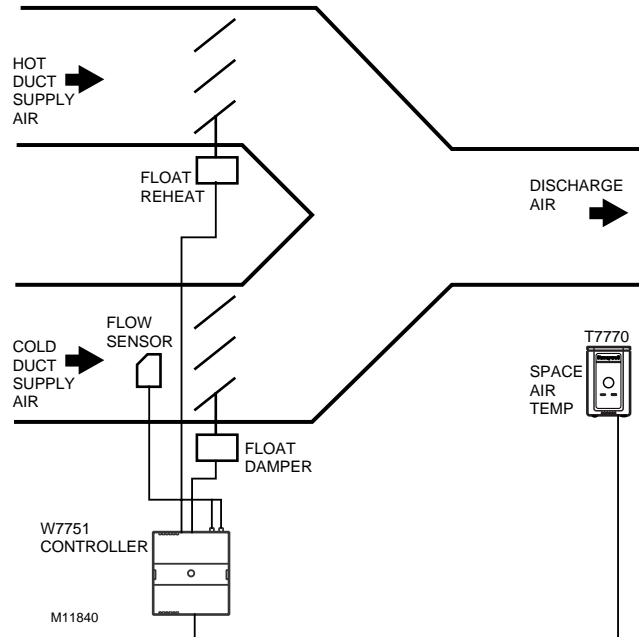
DualDuctReheat

**NOTE:** SrcMaster from the Master Excel 10 must be bound to DestSatellite of the Satellite Excel 10 and SrcBoxFlow of the Satellite Excel 10 must be bound to DestFlowTrack of the Master Excel 10 through E-Vision (Refer Excel 10 Points) in order for this application to function properly.

Dual duct flow mixing uses two control devices, a master (for the cold duct) and a satellite (for the hot duct) to provide pressure independent control. If there is a need for cooling, dual duct flow mixing will control temperature to the cooling setpoint, setting the flow control setpoint for the cold duct between min flow and max flow while setting the hot duct flow setpoint to zero. If the temperature of the space is between the cooling and the heating setpoints, the cold duct will control to the min flow while the hot duct flow is set to zero. If there is a need for heating, the controllers will try to control to the heating setpoint by first

setting the cold duct flow to zero then modulating the hot duct flow from min flow to max flow; During the heating and cooling only one damper is being used at any one time to provide heating or cooling, this provides no flow mixing.

**Dual Duct, Pressure Independent cooling, Pressure Dependent heating with flow mixing, with cold duct flow pickup.**



**Fig. C-3. Dual Duct, Pressure Independent cooling, Pressure Dependent heating with flow mixing, with cold duct flow pickup.**

**Dual Duct Press Flow Mix**

**(pressure dependent cooling and heating using one Excel 10).**

**Flow configuration:**

DD\_CDFlowSensor

**Reheat configuration:**

Float\_Reheat

Dual duct flow mixing uses one control device to provide pressure independent control of the cold duct. The Floating Reheat, which is traditionally wired to a heating valve actuator, is wired to a hot duct damper instead. PeriphPos is used to set the minimum hot duct damper position, which applies during both reheat and cooling modes. Flow mixing is achieved by mixing hot duct and cold duct air, which takes place during the cooling mode when minimum hot duct position is not zero (PeriphPos), or during the reheat mode if the cold duct Reheat Flow value is not zero.

Dual Duct Press Flow Mix:  
(Alternate Configuration)

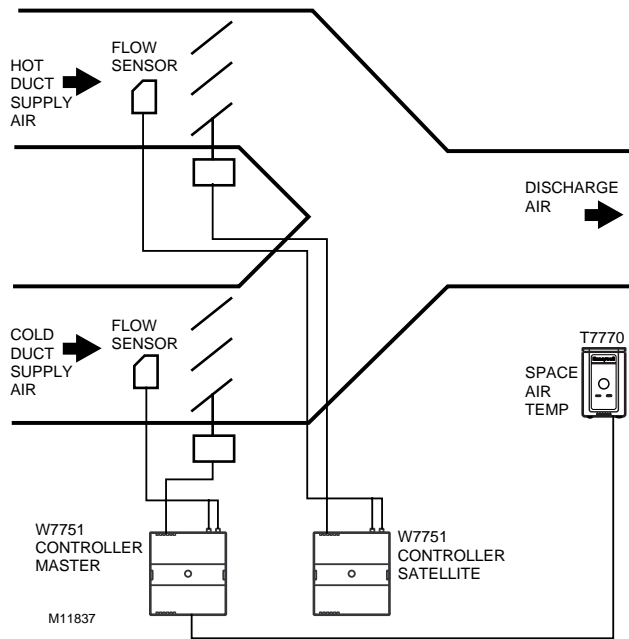
**Flow configuration:**

DD\_CDFlowSensor

**Reheat configuration:**  
FloatHotDuctPrDep

This configuration is the same as the previous description, however, setting PeriphPos to a minimum hot duct position that only applies during reheat mode. During cooling mode, the hot duct damper goes to zero, thus conserving energy. Flow mixing is achieved by mixing hot duct and cold duct air during the reheat mode when the cold duct Reheat Flow value is not zero.

**Dual Duct, Pressure Independent cooling and heating, constant volume with hot and cold duct flow pickups.**



**Fig. C-4. Dual Duct, Pressure Independent cooling and heating, constant volume with hot and cold duct flow pickups.**

**Dual Duct Constant Volume:**

**Master flow configuration:**  
Master\_Const\_Flow

**Master reheat configuration:**  
DualDuctReheat

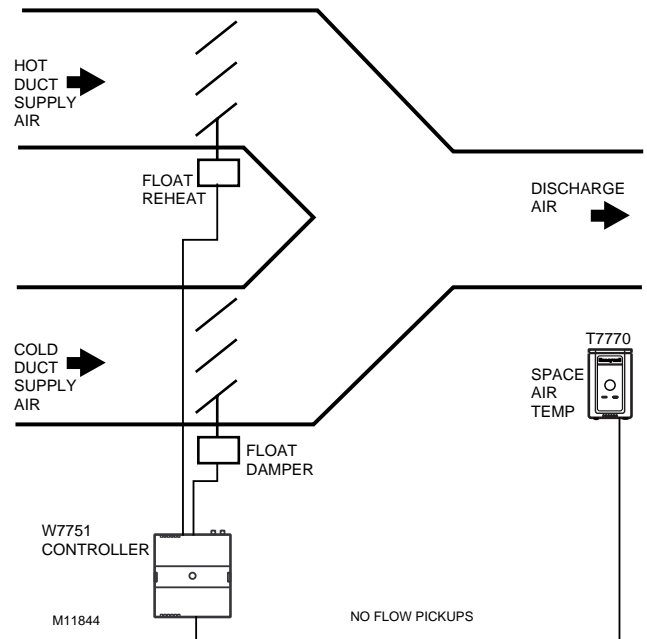
**Satellite flow configuration:**  
Satel\_Const\_Flow

**Satellite reheat configuration:**  
DualDuctReheat

**NOTE:** SrcMaster from the Master Excel 10 must be bound to DestSatellite of the Satellite Excel 10 and SrcBoxFlow of the Satellite Excel 10 must be bound to DestFlowTrack of the Master Excel 10 through E-Vision (Refer Excel 10 Points) in order for this application to function properly.

Dual duct flow mixing uses two control devices, a master (for the cold duct) and a satellite (for the hot duct) to provide pressure independent control. The dual duct constant volume application tries to control the space to the cooling setpoint only. During unoccupied, the controller will try to control the temperature to either the unocc heating (if the space temperature is less than the unocc heating setpoint) or unocc cooling setpoint (if the space temperature is greater than the unocc cooling setpoint). The controller is always in cooling mode, adjusting the cool air from min flow to max flow while simultaneously adjusting the warm air from max flow to min flow.

**Dual Duct, Pressure Dependent cooling and heating, with Flow mixing and no flow pickups.**



**Fig. C-5. Dual Duct, Pressure Dependent cooling and heating, with Flow mixing and no flow pickups.**

**Dual Duct Press Flow Mix (pressure dependent cooling and heating using one Excel 10).**

**Flow configuration:**  
DD\_NoFlowSensor

**Reheat configuration:**  
Float\_Reheat

Dual duct flow mixing uses one control devices, to provide pressure dependent control of the cold and hot ducts. The Floating Reheat, which is traditionally wired to a heating valve actuator, is wired to a hot duct damper instead. PeriphPos is used to set the minimum hot duct damper position, which applies during both reheat and cooling modes. Flow mixing is achieved by mixing hot duct and cold duct air, which takes place during the cooling mode when minimum hot duct position is not zero, or during the reheat mode if the cold duct Reheat Flow value is not zero.

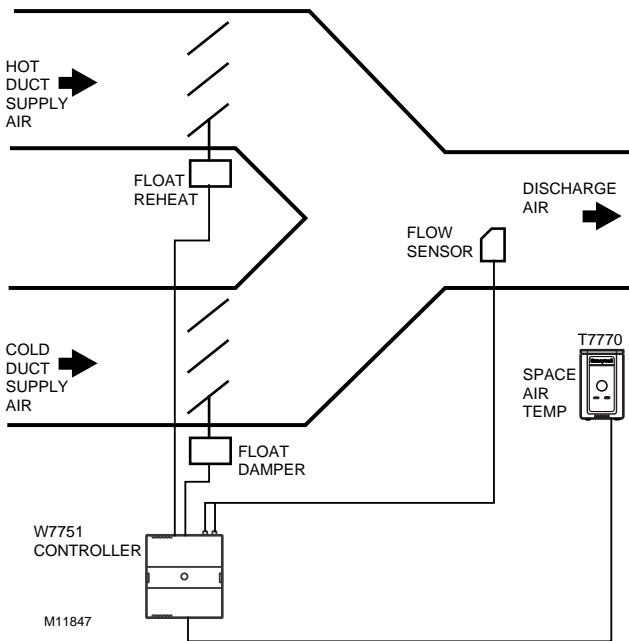
**Dual Duct Press Flow Mix:**  
(Alternate Configuration)

**Flow configuration:**  
DD\_NoFlowSensor

**Reheat configuration:**  
FloatHotDuctPrDep

This configuration is the same as the previous description, however, setting PeriphPos to a minimum hot duct position that only applies during reheat mode. During cooling mode, the hot duct damper goes to zero, thus conserving energy. Flow mixing is achieved by mixing hot duct and cold duct air during the reheat mode when the cold duct Reheat Flow value is not zero.

**Dual Duct, Pressure Independent cooling and Pressure Dependent heating, with Constant Volume and Discharge Air Flow pickup.**



**Fig. C-6. Dual Duct, Pressure Independent cooling and Pressure Dependent heating, with Constant Volume and Discharge Air Flow pickup.**

**Dual Duct Discharge Sensor Constant Volume (pressure dependent cooling and heating using one Excel 10).**

**Flow configuration:**  
DD\_DAFLOWSenConst

**Reheat configuration:**  
Float\_Reheat

Dual duct flow mixing uses one control device, to provide pressure independent control of the cold duct and total discharge air. In this control sequence, the temperature sensor controls the Hot duct damper position from the PeriphPos minimum hot duct position to 100 percent position. The discharge flow sensor, which picks up the cumulative flow of both the cold and hot duct air flows, is used to determine the total flow of air. This total flow of air is used to control the cold duct damper, using whatever amount of cold air is necessary to maintain a single flow value of MaxFlow. (Be aware that setting the Max flow too high with a small heating flow capacity will not let the cold damper go to zero during a high demand for heat).

**Appendix D. Complete List of Excel 10 VAVII Controller User Addresses.**

- D1. Input/Output Points.
- D2. Control Parameters.
- D3. Energy Management Points.
- D4. Status Points.
- D5. Calibration Points.
- D6. Configuration Parameters.
- D7. LonMark® Points.
- D8. Direct Access and Special Points.
- D9. Data Share Points.

Table D-1. Analog Points For Engineering Unit Selection.

Measured Item	English Units (Inch-Pound)		Standard International Units (SI)	
	—	Abbreviations (used in CARE and E-Vision)	—	Abbreviations (used in CARE and E-Vision)
Temperature	Degrees Fahrenheit	F	Degrees Celsius	C
Relative Temperature	Delta Degrees Fahrenheit	DDF	Degrees Kelvin	K
Air Flow	Cubic Feet per Minute	CFM	Meters Cubed per Hour	m3h
Air Flow Velocity	Feet per Minute	FPM	Meters per Second	m/s
Area	Square Feet	Ft2	Square Meters	m2
Length	Inches	in.	Meters	m
Differential Pressure	Inches of Water Column	Inw	kiloPascal	kPa

**NOTE:**

E-Vision - These points are displayed to the user and polled during the E-Vision monitor function. Monitor (M) indicates the point appears in the Software list box. Schematic (S) indicates the point is to be displayed on the schematic air handler diagram directly. Calibrate (C) - These points are calibratable and the calibration dialog (either the temperature or air flow dialog) is displayed. These points are displayed in a listbox by selection of the menu item Controller, Calibration. When the user double clicks on these points the calibration dialog is displayed. Parameter (P) - This information is displayed to the user in the Application Selection screens. These fields are read/write when offline and read only when online.

HW cfg - This information is displayed to the user in the Application Selection screens. These fields are read/write when offline or online.

Manual - These points can be placed in the manual mode. When the user double clicks on these points the manual dialog is displayed, this contains radio buttons; one for Auto and one for Manual.

Test (Test Mode) - These points are commandable when the controller is placed in the test mode via the menu item Controller, Diagnostics, Test Mode. When the user enters this mode, a list box will display the points that can be commanded in this mode.

Table D1. Input/Output Points (Left).

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
RawTempSen1	nvoIO	siTempSensorS7(0)	degrees F -9 to 122 degrees C (-22.8 to 50)		SI_INVALID
RawTempSen2	nvoIO	siTempSensorS7(1)	degrees F -9 to 122 degrees C (-22.8 to 50)		SI_INVALID
RawSpaceTemp	nvoIO	siSpaceTempS7	degrees F 40 to 100 degrees C (4.4 to 37.8)		SI_INVALID
RawFlowVolts	nvoIO	siFlowVoltsS12	Volts 0 to 6.5		SI_INVALID
FlowUncorrected	nvoIO	siFlowUncorrectedS3	-300 to 3500 FPM (-1.5 to 17.5) m/s		0
FlowSensor	nvoIO	siFlowSensorS3	0 to 3500 FPM (0 to 17.5) m/s		0

(continued)



Table D1. Input/Output Points (Right).

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
M		X	X				RawTempSen1 reports the current sensor readings configured by TempInput1Type and TempInput2Type. NOTE: The reported temperature does not include the offset correction added during sensor calibration, TempInput1Cal or TempInput2Cal.
			X				RawTempSen2 reports the current sensor readings configured by TempInput1Type and TempInput2Type. NOTE: The reported temperature does not include the offset correction added during sensor calibration, TempInput1Cal or TempInput2Cal.
			X				RawSpaceTemp is the measured space temperature. If the sensor is not configured or has failed, the value is SI_INVALID. NOTE: The reported temperatures does not includes the offset correction SpaceTempCal.
			X				RawFlowVolts is the on board flow sensor velocity measured by the A/D after pre-amplification and scaling. If a flow sensor error has been detected, RawFlowVolts is set to SI_INVALID.
			X				FlowUncorrected is the air flow velocity measured by the on board flow sensor after zero correction and linearization. If a FlowError has been detected or ConfigPressDep (Press_Dependent in E-Vision) = TRUE, then FlowUncorrected is set to SI_INVALID.
		X	X				FlowSensor is the air flow velocity measured by the on-board flow sensor after zero calibration, linearization, and field corrections. If there is an error, then FlowSensor is set to SI_INVALID.

(continued)

**Table D1. Input/Output Points (Left Continued).**

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
DigOutputByte	nvoIO	ubOut Byte Offset = 12 Bit Offset = 0 (DigitalOut1-8)	FALSE TRUE	0 1	FALSE
DigInputByte	nvoIO	ubDigitalIn Byte Offset = 13 Bit Offset = 7 (DigitalIn1-4)	FALSE TRUE	0 1	FALSE
OccupancySnsr	nvoIO	OccupancySensor	FALSE TRUE	0 1	FALSE
WindowSensr	nvoIO	WindowOpen	FALSE TRUE	0 1	FALSE
HeatCoolCOSw	nvoIO	HeatCoolSwitch	FALSE TRUE	0 1	FALSE
FreeDigInput	nvoIO	MonSwitch	FALSE TRUE	0 1	FALSE
IOTestSwitch	nvoIO	IOTestSwitch	FALSE TRUE	0 1	FALSE
OverrideInput	nvoIO	OverRide	FALSE TRUE	0 1	FALSE
Model	nvoIO	Model	UNKNOWN_MODEL SMALL_MODEL MED_MODEL LARGE_MODEL	0 1 2 3	UNKNOWN_MODEL
RawData0	nvoIO	raw_data(0)	0 to 65535		0
RawData1	nvoIO	raw_data(1)	0 to 65535		0

(continued)

Table D1. Input/Output Points (Right Continued).

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
							DigOutputByte - Bit Offset = 0 (DigitalOut1) DigOutputByte is a byte with a bit representing the state of every physical digital output. On is a 1 (TRUE) and off is a 0 (FALSE). (DigitalOut1 through DigitalOut8).
							DigInputByte Bit Offset = 7 (DigitalIn1): DigInputByte is a byte with a bit for every physical digital input. If the input is shorted to ground, the bit is a 0 or FALSE. If the input is open, the bit is 1 or TRUE. (DigitalIn1 through DigitalIn4).
M		X	X				OccupancySnr is the state of the digital input configured and wired to the local occupancy sensor. 1 means that occupancy is being sensed (input circuit shorted) and 0 means that no occupancy is being sensed (input circuit open).
			X				WindowSensr is the state of the digital input configured and wired to a window open sensor switch. A 1 (input open circuit) means that the window is open, and 0 (input shorted) means that the window is closed.
			X				HeatCoolCOSw is the state of the digital input configured and wired to a Heat/Cool change over switch. The state of HeatCoolCOSw is shown below: FALSE (open): select Cool Mode TRUE (closed): select Heat Mode
			X				FreeDigInput is the state of the digital input configured and wired to a general purpose monitor switch. 1 (input shorted) means that switch is closed, and 0 (input open) means that the switch is open.
							IOTestSwitch is the state of the digital input configured and wired to a IO test input. The state of IOTestSwitch is shown below: FALSE (open): Normal operation TRUE (closed): If Model is Large, perform stand-alone IO test.
			X				OverrideInput indicates the status of the wall module override pushbutton. It is 1 (TRUE) if the button is pressed, and is 0 (FALSE) if it is not pressed.
C							Model: The hardware configuration is encoded as a resistor value connected to an analog resistive input. Model reports the detected hardware configuration. (SMALL_MODEL is the W7751H SmartVAV Actuator. LARGE_MODEL is the W7751D,F VAV Controllers and the W7751B OEM VAV Controller.)
							RawData0 represents the A/D counts from the analog inputs. The counts represent the measured time during the second part of each A/D conversion cycle and can be used during testing of the A/D.
M S							RawData1 represents the A/D counts from the analog inputs. The counts represent the measured time during the second part of each A/D conversion cycle and can be used during testing of the A/D.

(continued)

**Table D1. Input/Output Points (Left Continued).**

<b>User Address</b>	<b>NvName</b>	<b>Field Name</b>	<b>Engineering Units: English (Metric) or States plus Range</b>	<b>Digital State or Value of State</b>	<b>Default</b>
RawData2	nvoIO	raw_data(2)	0 to 65535		0
RawData3	nvoIO	raw_data(3)	0 to 65535		0
RawData4	nvoIO	raw_data(4)	0 to 65535		0
RawData5	nvoIO	raw_data(5)	0 to 65535		0
RawData6	nvoIO	raw_data(6)	0 to 65535		0
RawData7	nvoIO	raw_data(7)	0 to 65535		0

*(continued)*

**Table D1. Input/Output Points (Right Continued).**

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
							RawData2 represents the A/D counts from the analog inputs. The counts represent the measured time during the second part of each A/D conversion cycle and can be used during testing of the A/D.
							RawData3 represents the A/D counts from the analog inputs. The counts represent the measured time during the second part of each A/D conversion cycle and can be used during testing of the A/D.
							RawData4 represents the A/D counts from the analog inputs. The counts represent the measured time during the second part of each A/D conversion cycle and can be used during testing of the A/D.
							RawData5 represents the A/D counts from the analog inputs. The counts represent the measured time during the second part of each A/D conversion cycle and can be used during testing of the A/D.
							RawData6 represents the A/D counts from the analog inputs. The counts represent the measured time during the second part of each A/D conversion cycle and can be used during testing of the A/D.
							RawData7 represents the A/D counts from the analog inputs. The counts represent the measured time during the second part of each A/D conversion cycle and can be used during testing of the A/D.

*(continued)*

**Table D2. Control Parameters (Left).**

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
	nviInUse		0 to 65534		0
DestFlowOffset	nviFlowOffset		-2119 to 2119 CFM (-3600 to 3600) m3h		0
BypassTime	nciAux1SetPt	ubBypassTime	minutes 0 to 1080		180
StptLoLim	nciAux1SetPt	siLowStPtS7	degrees F -9 to 90 degrees C (-22.8 to 32.2)		55
StptHiLim	nciAux1SetPt	siHighStPtS7	degrees F -9 to 90 degrees C (-22.8 to 32.2)		85

(continued)

Table D2. Control Parameters (Right).

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
							<p>nvilnUse: This is used by a management node to indicate to any other management node that it is logged on to the Excel 10 node and that they should not try to interact with any of the Excel 10s network variables. Before the management node reads or writes any network variables, the management node checks nvilnUse for a zero value meaning no other management nodes are already logged on and that a management node can log on to the node. Then the management node writes a number, 1 through 65534, to nvilnUse and periodically writes the same value to indicate that the management node is still logged on. If there are no writes made to nvilnUse for approximately 60 seconds, then the Excel 10 resets nvilnUse to zero to automatically log off the management node. Before interacting with any network variables, the management node verifies that the nvilnUse has not changed. The management node logs off by writing 0 to nvilnUse.</p> <p>During power up, an application restart, or return to on-line from off-line, the Excel 10 sets nvilnUse to 65535 to indicate to the management node that it has returned to on-line.</p>
M	X	X	X		X		<p>DestFlowOffset is used by a building management node to alter the SaFlowCntlSpt for improved air quality. In some operating modes, DestFlowOffset is added to the minimum flow settings to increase the air flow when DestFlowOffset is positive.</p>
M P							<p>BypassTime is the time between the pressing of the override button at the wall module (or initiating Bypass via DestManualOcc) and the return to the original occupancy state. When the bypass state has been activated, the bypass timer is set to BypassTime.</p>
M P							<p>StptLoLim is the lowest value reported by the setpoint knob. Dependent on the configuration of the setpoint knob this setting is either direct (degrees Fahrenheit or Celsius) in case of direct setpoint knob configuration or offset (Delta Degrees or Degrees Kelvin) in case of offset setpoint knob configuration. If the StptLoLim is outside the range shown below, or if StptLoLim is greater than StptHiLim, the limits shown below are used instead.</p> <p>Offset: Low Limit = -9°F (-5°C), High Limit = +9°F (+5°C) Direct: Low Limit = 55°F (12.8°C), High Limit = 85°F (24.4°C)</p>
M P							<p>StptHiLim is the highest value reported by the setpoint knob. Dependent on the configuration of the setpoint knob this setting is either direct (degrees Fahrenheit or Celsius) in case of direct setpoint knob configuration or offset (Delta Degrees or Degrees Kelvin) in case of offset setpoint knob configuration. If the StptHiLim is outside the range shown below, or if StptLoLim is greater than StptHiLim, the limits shown below are used instead.</p> <p>Offset: Low Limit = -9°F (-5°C), High Limit = +9°F (+5°C) Direct: Low Limit = 55°F (12.8°C), High Limit = 85°F (24.4°C)</p>

(continued)

**Table D2. Input/Output Points (Left Continued).**

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
DlcBumpTemp	nciAux1SetPt	ubDlcBumpTempS1	0 to +10 degrees F 0 to +5.6 degrees C		3
FlowTrackOfst	nciAux1SetPt	siTrackModeOffsetSO	-2119 to 2119 CFM (-3600 to 3600) m3h		0
PeriphPos	nciAux1SetPt	ubPeriphMinPosS1	percentage 0 to 100		0
WinOpnDmprPos	nciAux1SetPt	ubWinOpenPosS1	percentage 0 to 100		0
MinDmprPos	nciAux1SetPt	ubMinDamperPosS1	percentage 0 to 100		0
MaxDmprPos	nciAux1SetPt	ubMaxDamperPosS1	percentage 0 to 100		100
ReHeatDmprPos	nciAux1SetPt	ubReHeatDamperPosS1	percentage 0 to 100		50
StdbyDmprPos	nciAux1SetPt	ubStdbyDamperPosS1	percentage 0 to 100		50

(continued)



**Table D2. Control Parameters(Right Continued).**

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
M P							DlcBumpTemp specifies the amount of shift in the controlled space temperature when demand limit control (DestDlcShed) is active. See DestDlcShed for more details.
M P							FlowTrackOfst: When the Mode is FLOW_TRACKING, the air flow setpoint is FlowTrackOfst plus DestFlowTrack.
M P							PeriphPos sets the minimum peripheral reheat valve position as shown below. This feature allows the user to maintain flow in pipes that can otherwise freeze. Reheat Types: No_Local_Reheat. Elec_OneStage. Elec_TwoStage. Elec_ThreeStage. Elec_ThreeStageBin. Elec_OneStagePeriph. Float_Reheat: Minimum position of the floating reheat valve. Float_Periph: Minimum position of the floating peripheral heat valve. Float_Reheat_Periph: Minimum position of the floating peripheral heat valve. Float_Periph_Reheat: Minimum position of the floating peripheral heat valve. PWM_Reheat: Minimum position of the Pulse Width Modulation peripheral heat valve. PWM_Periph: Minimum position of the Pulse Width Modulation peripheral heat valve. PWM_Reheat_Periph: Minimum position of the Pulse Width Modulation peripheral heat valve. PWM_Periph_Reheat: Minimum position of the Pulse Width Modulation peripheral heat valve. DualDuctReheat: Either FloatHotDuctPrDep or Float_Reheat.
M P							WinOpnDmprPos: The five configuration parameters WinOpnDmprPos, MinDmprPos, MaxDmprPos, ReheatDmprPos, and StdbyDmprPos set limits on the damper position when ConfigPressDep (Press_Dependent in E-Vision) is TRUE or when the flow sensor has failed. The following relationships must be true for the control to work properly. MinDmprPos < MaxDmprPos StdbyDmprPos < MaxDmprPos ReheatDmprPos < MaxDmprPos WinOpnDmprPos < MaxDmprPos
M P							MinDmprPos: (See description for WinOpnDmprPos above)
M P							MaxDmprPos: (See description for WinOpnDmprPos above)
M P							ReheatDmprPos: (See description for WinOpnDmprPos above)
M P							StdbyDmprPos: (See description for WinOpnDmprPos above)

(continued)

**Table D2. Control Parameters (Left Continued).**

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
PressDmprPos	nciAux1SetPt	ubPressurizeS1	percentage 0 to 100		100
DepressDmprPos	nciAux1SetPt	ubDePressurizeS1	percentage 0 to 100		0
PurgeDmprPos	nciAux1SetPt	ubNightPurgeS1	percentage 0 to 100		50
WarmupDmprPos	nciAux1SetPt	ubMornWarmS1	percentage 0 to 100		50
TempRamp	nciAux1SetPt	UbTempRampS0	0 to 36°F per Hour 0 to 20°C per Hour		4
FanEnableFlow	nciAux1SetPt	UiFanEnableFlowS0	0 to 10,000 CFM (0 to 16,990) m3h		0
FreshAirReq	nciAux1SetPt	UiFreshAirRequiredS0	0 to 10,000 CFM (0 to 16,990) m3h		0
GainCoolProp	nciAux2SetPt	ubTrCoolS2	1 to 20 degrees F 1 to 10.6 degrees C		3
GainHeatProp	nciAux2SetPt	ubTrHeatS2	2 to 30 degrees F 1 to 17 degrees C		5
GainCoolInt	nciAux2SetPt	SiltCoolS0	seconds 0 to 5000		4000
GainHeatInt	nciAux2SetPt	SiltHeatS0	seconds 0 to 5000		2400
GainCoolDer	nciAux2SetPt	UbDtCoolS0	seconds 0 to 255		0
GainHeatDer	nciAux2SetPt	UbDtHeatS0	seconds 0 to 255		0

(continued)

Table D2. Control Parameters (Right Continued).

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
M P							PressDmprPos: The four configuration parameters PressDmprPos, DepressDmprPos, PurgeDmprPos, and WarmupDmprPos set limits on the damper position when ConfigPressDep (Press_Dependent in E-Vision) is TRUE. When ConfigPressDep (Press_Dependent in E-Vision) is FALSE, they set the limits on the air flow as a percentage of the range between zero and MaxFlowSpt.
M P							DepressDmprPos: (See description for PressDmprPos above).
M P							PurgeDmprPos: (See description for PressDmprPos above).
M P							WarmupDmprPos: (See description for PressDmprPos above).
M P							When EffectOcc is OC_UNOCCUPIED and the NextState is OC_OCCUPIED, then the setpoint is offset by a value Ramp depending on TempRamp, the CmdTUNCOS and the current CoolOccSpt or HeatOccSpt and CoolUnoccSpt or HeaUnoccSpt.
M P							FanEnableFlow: When the FanType is Parallel_Flow, FanEnableFlow is used to determine when there is enough air flow from the main air handler to turn the fan off.
M P							FreshAirReq is the desired amount of fresh air required for this zone.
M P							GainCoolProp is the throttling range for the cooling control loop.
M P							GainHeatProp is the throttling range for the heating control loop.
M P							GainCoolInt is the integral time for the cooling control loop.
M P							GainHeatInt is the integral time for the heating control loop.
M P							GainCoolDer is the derivative time for the cooling control loop.
M P							GainHeatDer is the derivative time for the heating control loop.

(continued)

Table D2. Control Parameters (Left Continued).

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
CorrDmpr10	nciAux2SetPt	ubDamperDrive0	0 to 10 times 0.1 sec.		0
CorrDmpr20	nciAux2SetPt	ubDamperDrive1	0 to 10 times 0.1 sec.		0
CorrDmpr30	nciAux2SetPt	UbDamperDrive2	0 to 10 times 0.1 sec.		0
CorrDmpr40	nciAux2SetPt	UbDamperDrive3	0 to 10 times 0.1 sec.		1
CorrDmpr50	nciAux2SetPt	UbDamperDrive4	0 to 10 times 0.1 sec.		1
CorrDmpr60	nciAux2SetPt	UbDamperDrive5	0 to 10 times 0.1 sec.		1
CorrDmpr70	nciAux2SetPt	UbDamperDrive6	0 to 10 times 0.1 sec.		1
CorrDmpr80	nciAux2SetPt	UbDamperDrive7	0 to 10 times 0.1 sec.		2
CorrDmpr90	nciAux2SetPt	UbDamperDrive8	0 to 10 times 0.1 sec.		3
CorrDmpr100	nciAux2SetPt	UbDamperDrive9	0 to 10 times 0.1 sec.		5

(continued)

Table D2. Control Parameters (Right Continued).

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
M P							CorrDmpr10: The purpose of CorrDmpr10 through CorrDmpr100 is to provide a user determined non-linear relationship between the error in the flow control loop and the damper position. By providing this table the end user can choose to have more accurate flow control at the expense of increased damper motor wear or choose to have less precise control but extend the life of the damper motor. Typically the air flow sensing is noisy due to air flow turbulence in the duct, acoustical noise, and other factors introducing small variations into the sensed air flow. A control loop that tries to track the small variations will cause the damper motor to be constantly trying to correct for the small variations. By ignoring small variations of air flow the life of the motor can be extended without sacrificing comfort. DamperDriveN can be used to compensate for some hysteresis in the damper mechanical linkage. CorrDamperN (Where N can equal 10 through 100) is the damper drive time for each second of time. The units of CorrDamperN is 100 milliseconds of damper motor drive time out of a one second period. For example, 3 means 300 milliseconds of damper motor drive time out of a one second period. The current air flow error causes one of the CorrDamperN to be selected as shown below. If the error is greater than 5940 FPM (29.7 m/s), the damper drive time is set to 12 (which means the damper is driven continuously). CorrDmpr10 corresponds to an error of 0 through 9 FPM (0 through 0.45 m/s).
M P							CorrDmpr20: (see CorrDmpr10 for full description) CorrDmpr20 corresponds to an error of 10 through 19 FPM (0.5 through 0.095 m/s).
M P							CorrDmpr30: (see CorrDmpr10 for full description) CorrDmpr30 corresponds to an error of 20 through 29 FPM (0.1 through 0.145 m/s).
M P							CorrDmpr40: (see CorrDmpr10 for full description) CorrDmpr40 corresponds to an error of 30 through 39 FPM (0.15 through 0.195 m/s).
M P							CorrDmpr50: (see CorrDmpr10 for full description) CorrDmpr50 corresponds to an error of 40 through 49 FPM (0.2 through 0.245 m/s).
M P							CorrDmpr60: (see CorrDmpr10 for full description) CorrDmpr60 corresponds to an error of 50 through 59 FPM (0.25 through 0.295 m/s).
M P							CorrDmpr70: (see CorrDmpr10 for full description) CorrDmpr70 corresponds to an error of 60 through 69 FPM (0.3 through 0.345 m/s).
M P							CorrDmpr80: (see CorrDmpr10 for full description) CorrDmpr80 corresponds to an error of 70 through 79 FPM (0.35 through 0.395 m/s).
M P							CorrDmpr90: (see CorrDmpr10 for full description) CorrDmpr90 corresponds to an error of 80 through 89 FPM (0.4 through 0.445 m/s).
M P							CorrDmpr100: (see CorrDmpr10 for full description) CorrDmpr100 corresponds to an error of 90 through 99 FPM (0.45 through 0.495 m/s).

(continued)

**Table D3. Energy Management Points (Left).**

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
DestWndw	nviEnergyHoldOff	value	0 to 100		0
DestDlcShed	nviDlcShed		0 to 1		0
DestSchedOcc	nviTodEvent	CurrentState	OC_OCCUPIED OC_UNOCCUPIED OC_BYPASS OC_STANDBY OC_NUL	0 1 2 3 255	OC_OCCUPIED
NextState	nviTodEvent	NextState	OC_OCCUPIED OC_UNOCCUPIED OC_BYPASS OC_STANDBY OC_NUL	0 1 2 3 255	OC_OCCUPIED
CmdTUNCOS	nviTodEvent	uiTimeToNextState	minutes 0 to 2880		0
DestBypass	nviBypass	value	0 to 100		0

(continued)

Table D3. Energy Management Points (Right).

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
M	X		X		X		DestWndw allows a sensor at another node (SrcWdw) to be used to hold off the use of energy when a window is open and is typically bound to a corresponding output (DestWndw) of another node. If DestWndw is bound, DestWndw must show hold-off for 300 seconds before DestWndw is changed to hold-off. This makes it possible for several sensors to be ORed together by binding them all to DestWndw. If any one bound sensor shows hold-off, then DestWndw shows hold-off for up to the 300 seconds after the last sensor shows not hold-off. If DestWndw is not bound, the timer or function is not activated.
M	X	X	X		X		DestDlcShed is an input from an energy management system. When DestDlcShed is 0, the temperature control algorithm operates in a normal mode. When DestDlcShed is non-zero, the setpoint is shifted by DlcBumpTemp in the energy saving direction.
M	X	X	X		X		DestSchedOcc indicates the current scheduled occupancy state to the node. DestSchedOcc is used along with other occupancy inputs to calculate the effective occupancy of the node. The valid states and meaning are as follows: OC_OCCUPIED means the energy management system is specifying occupied. OC_STANDBY means the energy management system is specifying that the space is presently between occupied and unoccupied. OC_UNOCCUPIED means the energy management system is specifying that the space is presently unoccupied. OC_BYPASS means the space is scheduled to be occupied even though it is not scheduled to be occupied. OC_NUL currently is not supported.
M			X				NextState is the command from an energy management system that specifies that the occupancy state of the zone will be NextState in MantUNCOS. When EffectOcc is OC_UNOCCUPIED and the NextState is OC_OCCUPIED, then the setpoint is offset by a value Ramp depending on TempRamp, the CmdTUNCOS and the current CoolOccSpt or HeatOccSpt and CoolUnoccSpt or HeaUnoccSpt.
M			X				CmdTUNCOS is the time in minutes until the next change of scheduled occupancy state.
M	X		X		X		DestBypass: The bypass state of one node can be shared with the bypass state of another node using DestBypass and SrcBypass. This allows a wall module at one node to be used to override the scheduled occupancy of another node. The node with DestBypass bound normally does not have a wall module. See the EffectiveOcc and StatusOvrriide for more details. The valid states are as follows: If the state is SW_ON and the value is not zero then the node should bypass the time of day schedule (subject to occupancy arbitration logic). If the state is SW_NUL then the input is not available because it is not bound, the input is no longer being updated by the sender, or OC_BYPASS is no longer being called. This means the same as SW_OFF. If the state is SW_OFF or other, the node should not bypass the time of day schedule. If the state is SW_ON and the value is 0, then the node should not bypass the time of day schedule. If the node receives this combination of state and value, then state is set to SW_OFF.

(continued)

**Table D3. Energy Management Points (Left Continued).**

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
	nviBypass	state	SW_OFF SW_ON SW_NUL	0 1 255	SW_NUL
SrcBypass	nvoBypass	value	0 to 100		0
	nvoBypass	state	SW_OFF SW_ON SW_NUL	0 1 255	SW_NUL
DestFree1	nviFree1	value	percentage 0 to 100		0
	nviFree1	state	SW_OFF SW_ON SW_NUL	0 1 255	SW_NUL



**Table D3. Energy Management Points (Right Continued).**

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
M	X		X		X		nviBypass.state: Refer to DestBypass.
M	X						SrcBypass is the current occupancy state of the node for bypass schedule. The states have the following meanings: If the state is SW_OFF and the value is 0, then EffectiveOcc is not OC_BYPASS. If the state is SW_ON and the value is 100 percent, then EffectiveOcc is OC_BYPASS.
M	X						nvoBypass.state: Refer to SrcBypass.
M	X	X	X		X		DestFree1: This network variable controls the spare or free digital output for auxiliary functions. DestFree1 controls the Free_Net_Maintain or Free_Net_Pulse outputs. The states have the following meaning: If the state is SW_OFF, the corresponding free logical output (and therefore the physical output, if configured) is off. If the state is SW_ON and the value is 0, then the corresponding free logical output (and therefore the physical output, if configured) is off. If the node receives this combination of state and value, then state is set to SW_OFF. If the state is SW_ON and the value is not zero, then the corresponding free logical output (and therefore the physical output, if configured) is on. If the state is SW_NUL, then the network variable is not bound, the communications path from the sending node has failed, or the sending node has failed. The corresponding free logical output does not change if the network variable input fails.
							nviFree1.state: Refer to DestFree1.

Table D4. Status Points (Left).

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
ObjectID	nvoStatus	object_id	0 TO 65535		0
InvalidID	nvoStatus	invalid_id	FALSE TRUE	0 1	FALSE
InvalidRequest	nvoStatus	invalid_request	FALSE TRUE	0 1	FALSE
Disabled	nvoStatus	disabled	FALSE TRUE	0 1	FALSE
OutOfLimits	nvoStatus	out_of_limits	FALSE TRUE	0 1	FALSE
OpenCircuit	nvoStatus	open_circuit	FALSE TRUE	0 1	FALSE
OutOfService	nvoStatus	out_of_service	FALSE TRUE	0 1	FALSE
MechanicalFault	nvoStatus	mechanical_fault	FALSE TRUE	0 1	FALSE
FeedbackFailure	nvoStatus	feedback_failure	FALSE TRUE	0 1	FALSE
OverRange	nvoStatus	over_range	FALSE TRUE	0 1	FALSE
UnderRange	nvoStatus	under_range	FALSE TRUE	0 1	FALSE
ElectricalFault	nvoStatus	electrical_fault	FALSE TRUE	0 1	FALSE
UnableToMeasure	nvoStatus	unable_to_measure	FALSE TRUE	0 1	FALSE
CommFailure	nvoStatus	comm_failure	FALSE TRUE	0 1	FALSE
FailSelfTest	nvoStatus	fail_self_test	FALSE TRUE	0 1	FALSE
SelfTestInProgress	nvoStatus	self_test_in_progress	FALSE TRUE	0 1	FALSE
LockedOut	nvoStatus	locked_out	FALSE TRUE	0 1	FALSE
ManualControl	nvoStatus	manual_control	FALSE TRUE	0 1	FALSE

(continued)

**Table D4. Status Points (Right).**

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
M			X				ObjectID: is set to the value of (1) for VAV object
							InvalidID: If nviRequest.Object_id is not a valid object, InvalidID is set to 1 (TRUE) otherwise it is set to 0 (FALSE).
							InvalidRequest: If nviRequest.object_request is not a valid request for the object addressed, InvalidRequest is set to 1 (TRUE) otherwise it is set to 0 (FALSE).
							Disabled: This field is not supported and is set to 0 (FALSE).
							OutOfLimits: This field is not supported and is set to 0 (FALSE).
							OpenCircuit: This field is not supported and is set to 0 (FALSE).
							OutOfService: This field is not supported and is set to 0 (FALSE).
							MechanicalFault: This field is not supported and is set to 0 (FALSE).
							FeedbackFailure: This field is not supported and is set to 0 (FALSE).
							OverRange: This field is not supported and is set to 0 (FALSE).
							UnderRange: This field is not supported and is set to 0 (FALSE).
							ElectricalFault: This field is not supported and is set to 0 (FALSE).
							UnableToMeasure: This field is not supported and is set to 0 (FALSE).
							CommFailure: This field is not supported and is set to 0 (FALSE).
							FailSelfTest: This field is not supported and is set to 0 (FALSE).
							SelfTestInProgress: This field is not supported and is set to 0 (FALSE).
							LockedOut: This field is not supported and is set to 0 (FALSE).
							ManualControl: This field is not supported and is set to 0 (FALSE).

(continued)

**Table D4. Status Points (Left Continued).**

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
InAlarm	nvoStatus	in_alarm	FALSE TRUE	0 1	FALSE
InOverride	nvoStatus	in_override	FALSE TRUE	0 1	FALSE
PgmId0	nroPgmVer	id(0)			V
PgmId1	nroPgmVer	id(1)			A
PgmId2	nroPgmVer	id(2)			V
PgmId3	nroPgmVer	id(3)			2
MajorVer	nroPgmVer	major_ver			1
MinorVer	nroPgmVer	minor_ver			2
BugFixVer	nroPgmVer	bug_ver			1
PgmVerNodeType	nroPgmVer	node_type			3
AlarmSubnet	nvoAlarm	subnet	1 to 255		0
AlarmNode	nvoAlarm	node	0 to 127		0
AlarmType	nvoAlarm	type 0 to 255	NO_ALARM COMM_FAILED SENSOR_FAILED INVALID_CONFIG INVALID_SETPOINT NODE_DISABLED_ALM FROST_PROTECT_ALM SMOKE_ALARM Comm_Failed_Rtn Sensor_Failed_Rtn Invalid_Config_Rtn Invalid_Setpt_Rtn Node_Disabled_Rtn Frost_Protect_Rnt Smoke_Alarm_Rtn ALM_NOTIFY_DISABLED	0 1 2 3 4 5 6 7 129 130 131 132 133 134 135 255	NO_ALARM

(continued)

**Table D4. Status Points (Right Continued).**

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
							InAlarm: If there are currently any active alarms reported by UnitInAlarm or UnitInAlarm is set to ALARM_NOTIFY_DISABLED, InAlarm is set to 1 (TRUE), otherwise InAlarm is set to 0 (FALSE). When nviRequest.object_request is RQ_REPORT_MASK, then InAlarm is set to 1 (TRUE) to indicate that this function is supported while all other fields are set to 0 (FALSE).
							InOverride: This field is not supported and is set to 0 (FALSE).
						ROM	A one byte ASCII string indicating the type of node (model).
						ROM	A one byte ASCII string indicating the type of node (model).
						ROM	A one byte ASCII string indicating the type of node (model).
						ROM	A one byte ASCII string indicating the type of node (model).
			X			ROM	Software version.
			X			ROM	Software version.
			X			ROM	Software version.
						ROM	The NodeType is a numeric identifier that is stored in EPROM that identifies the Excel 10 node type. Whenever a new software version or upgrade is issued, this is reflected in PgmVerNodeType which typically is read by a network management node to identify the node type. The contents of PgmVerNodeType contain compatible model type information and is fixed at the time when the node software is compiled.
							AlarmSubnet is the LonWorks® subnet number (in domain entry 1 of the nodes domain table) to which the node is assigned.
							AlarmNode is the LonWorks® node number (in domain entry 1 of the nodes domain table) assigned to the node.
							AlarmType is the alarm type being issued. When an alarm condition is no longer TRUE, AlarmType is set to the sum of the alarm conditions numeric value and the RETURN_TO_NORMAL numeric value. The type also is recorded in AlarmLog(0 to 4). When a new alarm is detected, just the corresponding numeric value for the alarm is reported. Refer to Table 13 (Excel 10 Alarms) in the System Engineering Guide for all the error conditions that can be reported.

(continued)

**Table D4. Status Points (Left Continued).**

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
AlarmStatus0	nvoAlarmStatus	alarm_bit(0) Byte Offset = 0 Bit Offset = 0 (CommFail)	FALSE TRUE	0 1	FALSE
AlarmStatus1	nvoAlarmStatus	alarm_bit(0) Byte Offset = 0 Bit Offset = 1 (SensorFail)	FALSE TRUE	0 1	FALSE
AlarmStatus2	nvoAlarmStatus	alarm_bit(0) Byte Offset = 0 Bit Offset = 2 (InvalidConfig)	FALSE TRUE	0 1	FALSE
*(See Comments)	nvoAlarmStatus	alarm_bit(0) Byte Offset = 0 Bit Offset = 3 (InvalidSetPoint)	FALSE TRUE	0 1	FALSE
*(See Comments)	nvoAlarmStatus	alarm_bit(0) Byte Offset = 0 Bit Offset = 4 (NodeDisabled)	FALSE TRUE	0 1	FALSE
*(See Comments)	nvoAlarmStatus	alarm_bit(0) Byte Offset = 0 Bit Offset = 5 (FrostProtect)	FALSE TRUE	0 1	FALSE
*(See Comments)	nvoAlarmStatus	alarm_bit(0) Byte Offset = 0 Bit Offset = 6 (SmokeEmergency)	FALSE TRUE	0 1	FALSE

(continued)

**Table D4. Status Points (Right Continued).**

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
		X	X				alarm_bit(0) Byte Offset = 0 Bit Offset = 0 (CommFail) alarm_bit ( n ) contains a bit for every possible alarm condition. Each alarm type has a corresponding bit in alarm_bit ( n ) (AlarmType: 1.24, without RETURN_TO_NORMAL).
							alarm_bit(0) Byte Offset = 0 Bit Offset = 1 (SensorFail) alarm_bit ( n ) contains a bit for every possible alarm condition. Each alarm type has a corresponding bit in alarm_bit ( n ) (AlarmType: 1.24, without RETURN_TO_NORMAL).
							alarm_bit(0) Byte Offset = 0 Bit Offset = 2 (InvalidConfig) alarm_bit ( n ) contains a bit for every possible alarm condition. Each alarm type has a corresponding bit in alarm_bit ( n ) (AlarmType: 1.24, without RETURN_TO_NORMAL).
							alarm_bit(0) Byte Offset = 0 Bit Offset = 3 (InvalidSetPoint) alarm_bit ( n ) contains a bit for every possible alarm condition. Each alarm type has a corresponding bit in alarm_bit ( n ) (AlarmType: 1.24, without RETURN_TO_NORMAL). *(Not accessible in E-Vision)
							alarm_bit(0) Byte Offset = 0 Bit Offset = 4 (NodeDisabled) alarm_bit ( n ) contains a bit for every possible alarm condition. Each alarm type has a corresponding bit in alarm_bit ( n ) (AlarmType: 1.24, without RETURN_TO_NORMAL). *(Not accessible in E-Vision)
							alarm_bit(0) Byte Offset = 0 Bit Offset = 5 (FrostProtect) alarm_bit ( n ) contains a bit for every possible alarm condition. Each alarm type has a corresponding bit in alarm_bit ( n ) (AlarmType: 1.24, without RETURN_TO_NORMAL). *(Not accessible in E-Vision)
							alarm_bit(0) Byte Offset = 0 Bit Offset = 6 (SmokeEmergency) alarm_bit ( n ) contains a bit for every possible alarm condition. Each alarm type has a corresponding bit in alarm_bit ( n ) (AlarmType: 1.24, without RETURN_TO_NORMAL). *(Not accessible in E-Vision)

(continued)

**Table D4. Status Points (Left Continued).**

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
AlarmLog0 (AlarmLog1) (AlarmLog2) (AlarmLog3) (AlarmLog4)	nvoAlarmLog	type (0 to 4) 0 to 255 (AlarmTypeLog0)	NO_ALARM COMM_FAILED SENSOR_FAILED INVALID_CONFIG INVALID_SETPOINT NODE_DISABLED_ALM FROST_PROTECT_ALM SMOKE_ALARM Comm_Failed_Rtn Sensor_Failed_Rtn Invalid_Config_Rtn Invalid_Setpt_Rnt Node_Disabled_Rnt Frost_Protect_Rnt Smoke_Alarm_Rtn ALM_NOTIFY_DISABLED	0 1 2 3 4 5 6 7 129 130 131 132 133 134 135 255	NO_ALARM

(continued)



**Table D4. Status Points (Right Continued).**

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
			X				type (0 to 4): 0 to 255 (AlarmLog0) A supervisory node can poll the AlarmLog(0 to 4) output for a short alarm history. The last five alarm reports sent via nvoAlarm are reported via AlarmLog(0 to 4). When ALM_NOTIFY_DISABLED is entered into the log, further alarms or return to normals are not entered into the log, until alarm reporting is again enabled. If nvoAlarm is bound and not being acknowledged, the last alarm report entered into AlarmLog(0 to 4) is the one that was not acknowledged. See nvoAlarm and nvoAlarmStatus for related subjects. Type (n) specifies the alarm that was issued via nvoAlarm. See nvoAlarm for the alarm types used in AlarmLog(0 to 4). The newest alarm is reported in type( 0 ) and the oldest is reported in type( 4 ). When a new entry is made to the log, the oldest entry is lost.

(continued)

**Table D4. Status Points (Left Continued).**

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
CntrlFieldNo	nvoData (nvoCtlDataG)	FieldNo	UPDATE_ALL_FIELDS UPDATE_NO_FIELDS Mode_FIELD EffectOcc_FIELD OverRide_FIELD SchedOcc_FIELD NetManOcc_FIELD SenOcc_FIELD BypassTimer_FIELD TempControlPt_FIELD SpaceTemp_FIELD DischargeTemp_FIELD SupplyTemp_FIELD FreshAirRatio_FIELD BoxFlowControlPt_FIELD BoxFlow_FIELD BoxHeatFlow_FIELD DamperPos_FIELD ReheatPos_FIELD PeriphHeatPos_FIELD FanSpd_FIELD HeatStages_FIELD PeriphHeatOn_FIELD Free1On_FIELD AuxOn_FIELD FanOn_FIELD DlcShed_FIELD HeatCoolSwitch_FIELD WindowOpen_FIELD MonSwitch_FIELD LowFlowAlarm_FIELD	0 127 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29	UPDATE_ALL_FIELDS

(continued)

**Table D4. Status Points (Right Continued).**

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
							<p>CntrlFieldNo: nvoData and nvoCtlDataG are output network variables indicating the node status. The information contained in these network variables are typically used to display the node status on an operator terminal, used in a trend log, or used in a control process. The information contained in nvoCtlDataG and nvoData are identical. nvoData is a polled network variable and must be polled by the receiver. nvoCtlDataG uses the Significant event notification with Guaranteed Period Update with Changefield (SGPUC) mechanism. FieldNo indicates which other data field in the SGPUC network variable has changed since the last time it was sent on the network according to the SGPUC mechanism.</p>

(continued)

**Table D4. Status Points (Left Continued).**

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
StatusMode	nvoData (nvoCtlDataG)	Mode	START_UP_WAIT HEAT COOL REHEAT MORN_WARM NIGHT_PURGE PRESSURIZE DEPRESSURIZE TRACKFLOW MANUAL_POS MANUAL_FLOW FREEZE_PROTECT FACTORY_TEST IOTEST FLOAT_OUT_SYNC DISABLED MANUAL	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	(This value will be calculated.)
EffectiveOcc	nvoData (nvoCtlDataG)	EffectOcc	OC_OCCUPIED OC_UNOCCUPIED OC_BYPASS OC_STANDBY OC_NUL	0 1 2 3 255	(This value will be calculated.)
StatusOverride	nvoData (nvoCtlDataG)	OverRide	OC_OCCUPIED OC_UNOCCUPIED OC_BYPASS OC_STANDBY OC_NUL	0 1 2 3 255	(This value will be calculated.)
StatusSchOcc	nvoData (nvoCtlDataG)	SchedOcc	OC_OCCUPIED OC_UNOCCUPIED OC_BYPASS OC_STANDBY OC_NUL	0 1 2 3 255	(This value will be calculated.)

(continued)

**Table D4. Status Points (Right Continued).**

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
M		X	X				StatusMode: The result of the controller determining which mode of operation it currently is in. At each power-up, the controller remains in the Start-Up and Wait mode (40 second initialization period). After that period, the mode changes to initialize actuators that will fully close the damper and valve actuators to insure full travel when under program control. The various other modes are due to normal operation as well as manual and network commands.
M		X	X				EffectiveOcc is the effective occupancy arbitrated from StatusSchOcc, StatusOccSen, and StatusOverride. EffectiveOcc is used to select the current temperature setpoint.
M		X	X				StatusOverride is the effective manual override state arbitrated from StatusManOcc (same as DestManualOcc), DestByPass, the wall module override button and, BypassTimer.
M		X	X				When SrcMaster is bound to DestSatellite, the occupancy in the satellite is not used.

(continued)

**Table D4. Status Points (Left Continued).**

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
StatusManOcc	nvoData (nvoCtlDataG)	NetManOcc	OC_OCCUPIED OC_UNOCCUPIED OC_BYPASS OC_STANDBY OC_NUL	0 1 2 3 255	(This value will be calculated.)
StatusOccSen	nvoData (nvoCtlDataG)	SenOcc	OC_OCCUPIED OC_UNOCCUPIED OC_BYPASS OC_STANDBY OC_NUL	0 1 2 3 255	(This value will be calculated.)
BypassTimer	nvoData (nvoCtlDataG)	BypassTimer	minutes 0 to 2880		(This value will be calculated.)
RmTempActSpt	nvoData (nvoCtlDataG)	siTempControlPtS7	50 to 85 degrees F (10 to 30) degrees C		(This value will be calculated.)
RmTemp	nvoData (nvoCtlDataG)	siSpaceTempS7	40 to 100 degrees F (4.4 to 38) degrees C		(This value will be calculated.)
DischargeTemp	nvoData (nvoCtlDataG)	siDischargeTempS7	30 to 122 degrees F (-1 to 50) degrees C		(This value will be calculated.)
SupplyTemp	nvoData (nvoCtlDataG)	siSupplyTempS7	30 to 122 degrees F (-1 to 50) degrees C		(This value will be calculated.)

(continued)

**Table D4. Status Points (Right Continued).**

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
M		X	X				StatusManOcc reports the network manual occupancy state from DestManualOcc. When StatusManOcc is OC_OCCUPIED then the space is occupied. When StatusManOcc is OC_UNOCCUPIED, the space is not occupied. When StatusManOcc is OC_BYPASS, the space is occupied for BypassTime (5 minute intervals) after DestManualOcc first becomes OC_BYPASS. The timing is done in this node. If DestManualOcc changes to another value, the timer is stopped. When StatusManOcc is OC_STANDBY, the space is on Standby. When StatusManOcc is OC_NUL or other unspecified value, no manual occupancy control is requested.
M		X	X				StatusOccSen indicates the current state of the sensed occupancy and is calculated from DestOccSensor and the local occupancy sensor via OccupancySnr. The local sensor and DestOccSensor are ORed together. If either the local sensor or DestOccSensor shows occupancy, then StatusOccSen shows occupancy. If StatusOccSen is OC_OCCUPIED, then the space is occupied. If StatusOccSen is OC_UNOCCUPIED, then the space is not occupied. If StatusOccSen is OC_NUL, then no local sensor is configured and either DestOccSensor has not been changed since application restart or has not been received periodically when bound.
M		X	X				BypassTimer: The time left in the bypass timer is BypassTimer minutes. If BypassTimer is zero, then the bypass timer is not running. BypassTimer is calculated as follows: If BypassTimer is not zero, it is decremented every minute. If the wall module button is pressed and then released, or StatusManOcc (same as DestManualOcc) is received via the network.
M		X	X				RmTempActSpt: The current temperature control point (such that, the current actual space temperature setpoint which the controller is presently trying to maintain in the conditioned space) is calculated from the various setpoints, operating modes, network variable inputs, and other parameters. The final result is stored in RmTempActSpt and SrcRmTempSpt.
M		X	X				RmTemp is the space temperature used by the control process and is read from another node via DestRmTemp or a local sensor via RawSpaceTemp. If DestRmTemp is not Invalid, then DestRmTemp has priority. If both the DestRmTemp and the RawSpaceTemp has failed or are not configured, RmTemp is Invalid. If RmTemp is reporting the local physical sensor, then the reported space temperature includes the offset correction SpaceTempCal.
M		X	X				DischargeTemp reports the current discharge temperature for remote monitoring and/or logging purposes. It is read from a local sensor via either RawTempSen1 or RawTempSen2 (Analog 1 or Analog 2 as configured by E-Vision.) If the local sensor has failed or is not configured, DischargeTemp is Invalid. If DischargeTemp is reporting the local physical sensor, then the reported temperature includes the offset correction TempInput1Cal or TempInput2Cal.
M		X	X				SupplyTemp is the temperature of the air being supplied to the variable air volume control box. It is used by the control process and is either read from another node via DuctTempIn or a local sensor via either RawTempSen1 and RawTempSen2 (Analog 1 or Analog 2 as configured by E-Vision.) If DuctTempIn is not Invalid, then DuctTempIn has priority over the local physical sensor. If both the DuctTempIn and the local sensor has failed or are not configured, SupplyTemp is Invalid. If SupplyTemp is reporting the local physical sensor, then the reported temperature includes the offset correction TempInput1Cal or TempInput2Cal.

(continued)

**Table D4. Status Points (Left Continued).**

<b>User Address</b>	<b>NvName</b>	<b>Field Name</b>	<b>Engineering Units: English (Metric) or States plus Range</b>	<b>Digital State or Value of State</b>	<b>Default</b>
FreshAirRatio	nvoData (nvoCtlDataG)	siFreshAirRatio	percentage 0 to 163.84		(This value will be calculated.)
SaFlowCntlSpt	nvoData (nvoCtlDataG)	uiBoxFlowControlPtS0	0 to10,000 CFM (0 to 16,990) m3h		(This value will be calculated.)
SupplyFlow	nvoData (nvoCtlDataG)	uiBoxFlowS0	0 to10,000 CFM (0 to 16,990) m3h		(This value will be calculated.)
HotDuctFlow	nvoData (nvoCtlDataG)	uiBoxHeatFlowS0	0 to10,000 CFM (0 to 16,990) m3h		(This value will be calculated.)
DamperPos	nvoData (nvoCtlDataG)	ubDamperPosS1	percentage 0 to 100		(This value will be calculated.)
HtgVlv_DmpPos	nvoData (nvoCtlDataG)	ubReheatPosS1	percentage 0 to 100		(This value will be calculated.)

*(continued)*



**Table D4. Status Points (Right Continued).**

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
M		X	X				FreshAirRatio is FreshAirReq divided by SrcBoxFlow. When FreshAirRatio is Large (greater than 100 percent), there is insufficient fresh air being supplied to the zone even if the supply air is 100 percent fresh air. When FreshAirRatio is small, there is sufficient fresh air being supplied to the zone. FreshAirRatio is used for coordination within the HVAC subsystem and energy management decisions by the supply equipment. If the actual FreshAirRatio is greater than 150 percent, FreshAirRatio reports 150 percent. If SrcBoxFlow is zero, then FreshAirRatio is Invalid. If the calculated ratio is greater than the range that can be handled by a two byte number, then FreshAirRatio is set to the biggest number possible before Invalid is indicated.
M		X	X				SaFlowCntlSpt: The current air flow setpoint is reported by SaFlowCntlSpt. SaFlowCntlSpt is a Significant event notification and Guaranteed Periodic Update (SGPU) variable with a 10.6 CFM (18 m3h) significant update difference.
M		X	X				SupplyFlow reports the air flow measured at the node. When the actual flow velocity is less than 3000 FPM (15 m/s), then SupplyFlow reports zero. If a flow sensor error has been detected or the pressure type is ConfigPressDep (Press_Dependent in E-Vision) is true, then SupplyFlow is set to Invalid. If FlowSensor is Invalid, then SupplyFlow and SrcBoxFlow are also Invalid
M		X	X				HotDuctFlow: When ReheatType specifies DualDuctReHeat, HotDuctFlow reports the air flow of the associated satellite node that is controlling the hot air flow from the hot air duct. The satellite node reports its box flow to the master node by binding the satellites SrcBoxFlow to the masters DestFlowTrack. The masters HotDuctFlow then reports DestFlowTrack.
M		X	X				DamperPos: When the damper is operated by a floating output motor, DamperPos indicates the current position of the damper. When ConfigPressDep (Press_Dependent in E-Vision) is false, the damper position is set to control the air flow in the space so that the measured air flow is SaFlowCntlSpt. If the flow sensor fails, the damper modulates between 15 percent and 60 percent to control temperature only. When ConfigPressDep (Press_Dependent in E-Vision) is true the damper position is controlled by the control algorithm.
M		X	X				HtgVlv_DmprPos: When the reheat type is Float_ReHeat, HtgVlv_DmprPos reports the current reheat motor position. When the DD_DAFlowSensor or DD_DAFlowSenConst is properly configured, then HtgVlv_DmprPos reports the position of the hot duct damper.

(continued)

**Table D4. Status Points (Left Continued).**

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
PeriphVlvPos	nvoData (nvoCtlDataG)	ubPeriphHeatPosS1	percentage 0 to 100		(This value will be calculated.)
FanSpeed	nvoData (nvoCtlDataG)	ubFanSpdS1	percentage 0 to 100		(This value will be calculated.)
HeatStagesOn	nvoData (nvoCtlDataG)	HeatStages	0 to 3		(This value will be calculated.)
PeripHeatOn	nvoData (nvoCtlDataG)	PeripHeatOn	FALSE TRUE	0 1	(This value will be calculated.)
StatusFreeOut	nvoData (nvoCtlDataG)	Free1On	FALSE TRUE	0 1	(This value will be calculated.)
StatusAuxOut	nvoData (nvoCtlDataG)	AuxOn	FALSE TRUE	0 1	(This value will be calculated.)
StatusFan	nvoData (nvoCtlDataG)	FanOn	FALSE TRUE	0 1	(This value will be calculated.)
StatusDlcShd	nvoData (nvoCtlDataG)	DlcShed	FALSE TRUE	0 1	(This value will be calculated.)
StatusChgovr	nvoData (nvoCtlDataG)	HeatCoolSwitch	FALSE TRUE	0 1	(This value will be calculated.)
StatusWndw	nvoData (nvoCtlDataG)	WindowOpen	FALSE TRUE	0 1	(This value will be calculated.)
StatusDigIn	nvoData (nvoCtlDataG)	MonSwitch	If the StatusDigIn is open, the switch is open. If the StatusDigIn is closed the switch is closed.	0 1	(This value will be calculated.)

(Continued)

Table D4. Status Points (Right Continued).

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
M		X	X				PeriphVlvPos: When the peripheral reheat is modulating, PeriphVlvPos reports the current peripheral reheat motor position.
M		X	X				FanSpeed: When the Fan_Type Is Parallel_PWM, then current FanSpeed is as follows: If the Effective Occupancy is OC_OCCUPIED, OC_STANDBY, OC_UNOCCUPIED with a demand calling for cool and the Mode is COOL, then the FanSpeed is inversely proportional to the demand for cooling and varies between zero and 100 percent. If the Mode is MORN_WARM, REHEAT, HEAT with demand for heating; Or NIGHT_PURGE, then the FanSpeed is 100 percent, otherwise the FanSpeed is zero percent.
M		X	X				HeatStagesOn: When the reheat is staged, HeatStagesOn reports the number of reheat stages currently turned on. When the fan is off, or air flow in the duct is less than half the FlowControlStpt, then the HeatStagesOn is 0 to prevent reheat coils from over heating.
M		X	X				PeriphHeatOn: When the peripheral heat is staged, PeriphHeatOn reports whether the peripheral heating stage is currently turned on (true) or turned off (false).
M		X	X				StatusFreeOut reports the current state of the StatusFreeOut output. true means on, and false means off.
M		X	X				StatusAuxOut indicates the state of the auxiliary digital output or the state of the latching relay attached to the AuxiliaryPulse_On or the AuxiliaryPulse_Off digital outputs. The physical outputs must be configured through Optional Outputs in E-Vision to the logical outputs to actually work. StatusAuxOut follows the EffectiveOcc mode. If EffectiveOcc is OC_UNOCCUPIED then StatusAuxOut is false or off. If EffectiveOcc is OC_OCCUPIED then StatusAuxOut is true or on. If EffectiveOcc is OC_BYPASS then StatusAuxOut is true or on. If EffectiveOcc is OC_STANDBY then StatusAuxOut is false or off.
M		X	X				StatusFan: The current state of the fan is reported by StatusFan when the Fan_Type is not Parallel_PWM.
M		X	X				StatusDlcShed indicates the state of DestDlcShed. When StatusDlcShed is true the temperature control intergral error is bumped in the energy saving direction by DlcBumpTemp.
M		X	X				StatusChgovr is the state of the digital input configured as HeatCool_ChngOvr. If the state of StatusChgovr is false, then the COOL mode is selected. If the state of StatusChgovr is true, then the HEAT mode is selected.
M		X	X				StatusWndw indicates the current state of the window sensor and is calculated from DestWndw and the local window sensor via StatusWndw. The local sensor and DestWndw are ORed together. If either the local sensor or DestWndw shows that the window is open, then StatusWndw shows that the window is open. If StatusWndw is false then the window is closed. If StatusWndw is true then the window is open.
M		X	X				StatusDigIn is the state of the digital input configured as Status_Alarm_Input through Digital Input Configuration in E-Vision. If the StatusDigIn is OPEN then the switch is open. If the StatusDigIn is CLOSED then the switch is closed.

(continued)

Table D4. Status Points (Left Continued).

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
StatusLowFlow	nvoData (nvoCtlDataG)	LowFlowAlarm	FALSE TRUE	0 1	(This value will be calculated.)
SpaceTempError* (See Comments)	nvoError	error_bit(0) Byte Offset = 0 Bit Offset = 0 (SpaceTempError)	FALSE TRUE	0 1	FALSE
SetPointError* (See Comments)	nvoError	error_bit(0) Byte Offset = 0 Bit Offset = 1 (SetPointError)	FALSE TRUE	0 1	FALSE
DischgTempError* (See Comments)	nvoError	error_bit(0) Byte Offset = 0 Bit Offset = 2 (DischgTempError)	FALSE TRUE	0 1	FALSE
SupplyTempError* (See Comments)	nvoError	error_bit(0) Byte Offset = 0 Bit Offset = 3 (SupplyTempError)	FALSE TRUE	0 1	FALSE
ADCalError* (See Comments)	nvoError	error_bit(0) Byte Offset = 0 Bit Offset = 4 (ADCalError)	FALSE TRUE	0 1	FALSE
HWConfigError* (See Comments)	nvoError	error_bit(0) Byte Offset = 0 Bit Offset = 5 (HWConfigError)	FALSE TRUE	0 1	FALSE
FlowError* (See Comments)	nvoError	error_bit(0) Byte Offset = 0 Bit Offset = 6 (FlowError)	FALSE TRUE	0 1	FALSE
* (See Comments)	nvoError	error_bit(1) Byte Offset = 1 Bit Offset = 1 (nvApplicModeError)	FALSE TRUE	0 1	FALSE

(Continued)

**Table D4. Status Points (Right Continued)**

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
M		X	X				StatusLowFlow: If StatusLowFlow is false, then the duct pressure is sufficient to allow the desired air flow. If StatusLowFlow is true, then the duct pressure is not sufficient to meet the desired air flow at a fully open damper. * Not available in E-Vision, but can be accessed via the Hand Held Tool (HHT).
			X				SpaceTempError: A value of 1 (TRUE) indicates that data was not available from the sensor and will result in a SENSOR_FAILED alarm. A value of 0 (FALSE) indicates a normal condition. If there is a space temp sensor failure, temperature control is turned off and the damper position is set to either a minimum position of closed depending on the EffectiveOcc, Mode, and FlowControlType. Fan operation is not affected. * Not available in E-Vision, but can be accessed via the HHT.
							SetPointError: A value of 1 (TRUE) indicates that data was not available from the sensor and will result in a SENSOR_FAILED alarm. A value of 0 (FALSE) indicates a normal condition. If there is a setpoint sensor failure, the control loop will use the default occupied setpoints to control space temperature. * Not available in E-Vision, but can be accessed via the HHT.
							DischgTempError: A value of 1 (TRUE) indicates that data was not available from the sensor and will result in a SENSOR_FAILED alarm. A value of 0 (FALSE) indicates a normal condition. No action is taken if a sensor failure occurs. * Not available in E-Vision, but can be accessed via the HHT.
							SupplyTempError: A value of 1 (TRUE) indicates that data was not available from the sensor and will result in a SENSOR_FAILED alarm. A value of 0 (FALSE) indicates a normal condition. If a supply temp sensor failure occurs, the supply temperature is taken out of the Mode arbitration logic. * Not available in E-Vision, but can be accessed via the HHT.
							ADCalError: A value of 1 (TRUE) indicates that data was not available from the sensor and will result in a SENSOR_FAILED alarm. A value of 0 (FALSE) indicates a normal condition. No action is taken if a sensor failure occurs. * Not available in E-Vision, but can be accessed via the HHT.
							HWConfigError: A value of 1 (TRUE) indicates that data was not available from the sensor and will result in a SENSOR_FAILED alarm. A value of 0 (FALSE) indicates a normal condition. If a hardware config sensor failure occurs, Model is marked as UNKNOWN. * Not available in E-Vision, but can be accessed via the HHT.
							FlowError: A value of 1 (TRUE) indicates that data was not available from the sensor and will result in a SENSOR_FAILED alarm. A value of 0 (FALSE) indicates a normal condition. If a flow sensor failure occurs, the action taken is: If mode is COOL, the damper is modulated between 15 percent and 60 percent. If mode is REHEAT, the damper is set to a calculated value. * Not available in E-Vision, but can be accessed via the HHT.
							nvApplicModeError: A value of 1 (TRUE) indicates that data was not available from the sensor and will result in a COMM_FAILED alarm. A value of 0 (FALSE) indicates a normal condition. Upon a failure, the network variable is set to the FD value. * Not available in E-Vision, but can be accessed via the HHT.

(continued)

**Table D4. Status Points (Left Continued).**

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
* (See Comments)	nvoError	error_bit(1) Byte Offset = 1 Bit Offset = 2 (nvSptOffsetError)	FALSE TRUE	0 1	FALSE
* (See Comments)	nvoError	error_bit(1) Byte Offset = 1 Bit Offset = 3 (nvEngHoldOffError)	FALSE TRUE	0 1	FALSE
* (See Comments)	nvoError	error_bit(1) Byte Offset = 1 Bit Offset = 5 (nvDuctInTempError)	FALSE TRUE	0 1	FALSE
* (See Comments)	nvoError	error_bit(1) Byte Offset = 1 Bit Offset = 6 (nvDlcShedError)	FALSE TRUE	0 1	FALSE
* (See Comments)	nvoError	error_bit(1) Byte Offset = 1 Bit Offset = 7 (nvTodEventError)	FALSE TRUE	0 1	FALSE
* (See Comments)	nvoError	error_bit(2) Byte Offset = 2 Bit Offset = 0 (nvBypassError)	FALSE TRUE	0 1	FALSE
* (See Comments)	nvoError	error_bit(2) Byte Offset = 2 Bit Offset = 1 (nvSensorOccError)	FALSE TRUE	0 1	FALSE
* (See Comments)	nvoError	error_bit(2) Byte Offset = 2 Bit Offset = 2 (nvFlowTrackError)	FALSE TRUE	0 1	FALSE
* (See Comments)	nvoError	error_bit(2) Byte Offset = 2 Bit Offset = 3 (nvFlowOffsetError)	FALSE TRUE	0 1	FALSE
* (See Comments)	nvoError	error_bit(2) Byte Offset = 2 Bit Offset = 4 (nvFree1Error)	FALSE TRUE	0 1	FALSE

(continued)

**Table D4. Status Points (Right Continued)**

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
							nvSptOffsetError: A value of 1 (TRUE) indicates that data was not available from the sensor and will result in a COMM_FAILED alarm. A value of 0 (FALSE) indicates a normal condition. Upon a failure, the network variable is set to the FD value. * Not available in E-Vision, but can be accessed via the HHT.
							nvEngHoldOffError: A value of 1 (TRUE) indicates that data was not available from the sensor and will result in a COMM_FAILED alarm. A value of 0 (FALSE) indicates a normal condition. Upon a failure, the network variable is set to the FD value. * Not available in E-Vision, but can be accessed via the HHT.
							nvDuctInTempError: A value of 1 (TRUE) indicates that data was not available from the sensor and will result in a COMM_FAILED alarm. A value of 0 (FALSE) indicates a normal condition. Upon a failure, the network variable is set to the FD value. * Not available in E-Vision, but can be accessed via the HHT.
							nvDlcShedError: A value of 1 (TRUE) indicates that data was not available from the sensor and will result in a COMM_FAILED alarm. A value of 0 (FALSE) indicates a normal condition. Upon a failure, the network variable is set to the FD value. * Not available in E-Vision, but can be accessed via the HHT.
							nvTodEventError: A value of 1 (TRUE) indicates that data was not available from the sensor and will result in a COMM_FAILED alarm. A value of 0 (FALSE) indicates a normal condition. Upon a failure, the network variable is set to the FD value. * Not available in E-Vision, but can be accessed via the HHT.
							nvBypassError: A value of 1 (TRUE) indicates that data was not available from the sensor and will result in a COMM_FAILED alarm. A value of 0 (FALSE) indicates a normal condition. Upon a failure, the network variable is set to the FD value. * Not available in E-Vision, but can be accessed via the HHT.
							nvSensorOccError: A value of 1 (TRUE) indicates that data was not available from the sensor and will result in a COMM_FAILED alarm. A value of 0 (FALSE) indicates a normal condition. Upon a failure, the network variable is set to the FD value. * Not available in E-Vision, but can be accessed via the HHT.
							nvFlowTrackError: A value of 1 (TRUE) indicates that data was not available from the sensor and will result in a COMM_FAILED alarm. A value of 0 (FALSE) indicates a normal condition. Upon a failure, the network variable is set to the FD value. * Not available in E-Vision, but can be accessed via the HHT.
							nvFlowOffsetError: A value of 1 (TRUE) indicates that data was not available from the sensor and will result in a COMM_FAILED alarm. A value of 0 (FALSE) indicates a normal condition. Upon a failure, the network variable is set to the FD value. * Not available in E-Vision, but can be accessed via the HHT.
							nvFree1Error: A value of 1 (TRUE) indicates that data was not available from the sensor and will result in a COMM_FAILED alarm. A value of 0 (FALSE) indicates a normal condition. Upon a failure, the network variable is set to the FD value. * Not available in E-Vision, but can be accessed via the HHT.

(continued)

**Table D4. Status Points (Left Continued).**

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
* (See Comments)	nvoError	error_bit(2) Byte Offset = 2 Bit Offset = 5 (nvShareError)	FALSE TRUE	0 1	FALSE
FlowTrackingError * (See Comments)	nvoError	error_bit(3) Byte Offset = 3 Bit Offset = 0 (FlowTrackingError)	FALSE TRUE	0 1	FALSE
ShareError * (See Comments)	nvoError	error_bit(3) Byte Offset = 3 Bit Offset = 1 (ShareError)	FALSE TRUE	0 1	FALSE
DualDuctError * (See Comments)	nvoError	error_bit(3) Byte Offset = 3 Bit Offset = 2 (DualDuctError)	FALSE TRUE	0 1	FALSE
	FileDirHeader	Version			
	FileDirHeader	NumFiles			
	FileDir	Size			
	FileDir	Type			
	FileDir	pData			



**Table D4. Status Points (Right Continued)**

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
							nvShareError: A value of 1 (TRUE) indicates that data was not available from the sensor and will result in a COMM_FAILED alarm. A value of 0 (FALSE) indicates a normal condition. Upon a failure, the network variable is set to the FD value. * Not available in E-Vision, but can be accessed via the HHT.
							FlowTrackingError: A value of 1 (TRUE) indicates a failure to receive a bound network variable and results in an INVALID_CONFIG alarm. A value of 0 (FALSE) indicates a normal condition. A FlowTracking error occurs when the FlowControlType is FlowTracking and nviFlowTrack is not bound to another node. * Not available in E-Vision, but can be accessed via the HHT.
							ShareError: A value of 1 (TRUE) indicates a failure to receive a bound network variable and results in an INVALID_CONFIG alarm. A value of 0 (FALSE) indicates a normal condition. A Share error occurs when FlowControlType is ShareWallModule and nviShare is not bound to another node. If a Share error occurs, temperature control is turned off and the damper is set to either a minimum position or closed depending on the EffectOcc, Mode, and FlowControlType. Fan operation is not affected. * Not available in E-Vision, but can be accessed via the HHT.
							DualDuctError: A value of 1 (TRUE) indicates a failure to receive a bound network variable and results in an INVALID_CONFIG alarm. A value of 0 (FALSE) indicates a normal condition. A DualDuct error occurs when: a) FlowControlType is DDSatNoFlowMix or DDSatFlowMix or DDSatConstVol and nviShare is not bound to another node or b) FlowControlType is DualDuctNoFlowMix or DualDuctFlowMix or DualDuctConstVol and nviFlowTrack is not bound to another node. If a DualDuct error occurs, temperature control is turned off and the damper is set to either a minimum position or closed depending on the EffectOcc, Mode, and FlowControlType. Fan operation is not affected. * Not available in E-Vision, but can be accessed via the HHT.
							FileVersion (a one byte quantity) specifies the major / minor version of the file. The most significant nibble contains the major version number and the least significant nibble contains the minor version number.
							NumFiles is the number of files in the directory. There is a FileSize, FileType and FileAddress record for each file following the NumFiles.
							FileSize is the length of the file.
							FileType specifies the Lonmark file type entered into the file directory. Type 1 is a configuration parameter value file. Type 2 is a configuration parameter template file.
							pData (FileAddress) specifies the address in the Excel 10 at which the file is located.

Table D5. Calibration Points (Left).

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
FacFlowGain	nciFactoryCal	FlowGain	0 to 127		127
FacFlowOffset	nciFactoryCal	FlowOffset	0 to 127		0
FacHighCalVolts	nciFactoryCal	HighCalVoltsS12	volts 0 to 5		2.75
FacFlowVoltZero	nciFactoryCal	FlowVoltZeroS12	volts 0 to 5		0.5
FacFlowVoltMid	nciFactoryCal	FlowVoltMidS12	volts 0 to 5		2.6
FacFlowVoltHigh	nciFactoryCal	FlowVoltHighS12	volts 0 to 5		4.5
CalFloVlt1	nciVoltsCal	ubS5(0)	volts 0 to 5		0.5
CalFloVlt2	nciVoltsCal	ubS5(1)	volts 0 to 5		0.53125
CalFloVlt3	nciVoltsCal	ubS5(2)	volts 0 to 5		0.56250
CalFloVlt4	nciVoltsCal	ubS5(3)	volts 0 to 5		0.62500
CalFloVlt5	nciVoltsCal	ubS5(4)	volts 0 to 5		0.71875

(continued)

Table D5. Calibration Points (Right).

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
C				X			FacFlowGain is a calibration factor programmed at the factory for determining the gain of the flow sensor. This calibration is necessary because the sensor spans will vary considerably from one sensor to another. FacFlowGain is loaded into the scale amplifier hardware at application_restart and once per second when Mode is Factory Test.
C				X			FacFlowOffset is a calibration factor programmed at the factory for determining the gain of the flow sensor. This calibration is necessary because the sensor offset varies considerably from one sensor to another. FacFlowOffset is loaded into the scale amplifier hardware at application_restart and once per second when Mode is Factory Test.
C				X			FacHighCalVolts is the measured internal calibration voltage and is used by the node to correct the voltage input and analog input readings.
C				X			FacFlowVoltZero, FacFlowVoltMid, and FacFlowVoltHigh are calibration factors read and used only during factory, OEM, or field customization for calculation of the flow linearization table.
C				X			FacFlowVoltMid: FacFlowVoltZero, FacFlowVoltMid, and FacFlowVoltHigh are calibration factors read and used only during factory, OEM, or field customization for calculation of the flow linearization table.
C				X			FacFlowVoltHigh: FacFlowVoltZero, FacFlowVoltMid, and FacFlowVoltHigh are calibration factors read and used only during factory, OEM, or field customization for calculation of the flow linearization table.
							CalFloVlt1 is an array of sensor voltage points (after the scaling amplifier) plotted on the x-axis. This data together with CalFlo1 form a flow sensor linearization curve that is applied to the flow sensor.
							CalFloVlt2 is an array of sensor voltage points (after the scaling amplifier) plotted on the x-axis. This data together with CalFlo2 form a flow sensor linearization curve that is applied to the flow sensor.
							CalFloVlt3 is an array of sensor voltage points (after the scaling amplifier) plotted on the x-axis. This data together with CalFlo3 form a flow sensor linearization curve that is applied to the flow sensor.
							CalFloVlt4 is an array of sensor voltage points (after the scaling amplifier) plotted on the x-axis. This data together with CalFlo4 form a flow sensor linearization curve that is applied to the flow sensor.
							CalFloVlt5 is an array of sensor voltage points (after the scaling amplifier) plotted on the x-axis. This data together with CalFlo5 form a flow sensor linearization curve that is applied to the flow sensor.

(continued)

Table D5. Calibration Points (Left Continued).

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
CalFloVlt6	nciVoltsCal	ubS5(5)	volts 0 to 5		0.94
CalFloVlt7	nciVoltsCal	ubS5(6)	volts 0 to 5		1.37
CalFloVlt8	nciVoltsCal	ubS5(7)	volts 0 to 5		2.19
CalFloVlt9	nciVoltsCal	ubS5(8)	volts 0 to 5		3.75
CalFloVlt10	nciVoltsCal	ubS5(9)	volts 0 to 5		4.5
CalFlo1	nciFlowCal	siS3(0)	0 to 3500 FPM (0 to 17.5) m/s		0
CalFlo2	nciFlowCal	siS3(1)	0 to 3500 FPM (0 to 17.5) m/s		281 FPM (1.43 m/s)
CalFlo3	nciFlowCal	siS3(2)	0 to 3500 FPM (0 to 17.5) m/s		398 FPM (2.02 m/s)
CalFlo4	nciFlowCal	siS3(3)	0 to 3500 FPM (0 to 17.5) m/s		563 FPM (2.86 m/s)
CalFlo5	nciFlowCal	siS3(4)	0 to 3500 FPM (0 to 17.5) m/s		746 FPM (3.79 m/s)
CalFlo6	nciFlowCal	siS3(5)	0 to 3500 FPM (0 to 17.5) m/s		1057 FPM (5.37 m/s)

(continued)

**Table D5. Calibration Points (Right Continued).**

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
							CalFloVlt6 is an array of sensor voltage points (after the scaling amplifier) plotted on the x-axis. This data together with CalFlo6 form a flow sensor linearization curve that is applied to the flow sensor.
							CalFloVlt7 is an array of sensor voltage points (after the scaling amplifier) plotted on the x-axis. This data together with CalFlo7 form a flow sensor linearization curve that is applied to the flow sensor.
							CalFloVlt8 is an array of sensor voltage points (after the scaling amplifier) plotted on the x-axis. This data together with CalFlo8 form a flow sensor linearization curve that is applied to the flow sensor.
							CalFloVlt9 is an array of sensor voltage points (after the scaling amplifier) plotted on the x-axis. This data together with CalFlo9 form a flow sensor linearization curve that is applied to the flow sensor.
							CalFloVlt10 is an array of sensor voltage points (after the scaling amplifier) plotted on the x-axis. This data together with CalFlo10 form a flow sensor linearization curve that is applied to the flow sensor.
							CalFlo1 is an array of sensor flow velocity in ft/min plotted on the y-axis. This data together with CalFloVlt1 form a flow sensor linearization curve that is applied to the flow sensor.
							CalFlo2 is an array of sensor flow velocity in ft/min plotted on the y-axis. This data together with CalFloVlt2 form a flow sensor linearization curve that is applied to the flow sensor.
							CalFlo3 is an array of sensor flow velocity in ft/min plotted on the y-axis. This data together with CalFloVlt3 form a flow sensor linearization curve that is applied to the flow sensor.
							CalFlo4 is an array of sensor flow velocity in ft/min plotted on the y-axis. This data together with CalFloVlt4 form a flow sensor linearization curve that is applied to the flow sensor.
							CalFlo5 is an array of sensor flow velocity in ft/min plotted on the y-axis. This data together with CalFloVlt5 form a flow sensor linearization curve that is applied to the flow sensor.
							CalFlo6 is an array of sensor flow velocity in ft/min plotted on the y-axis. This data together with CalFloVlt6 form a flow sensor linearization curve that is applied to the flow sensor.

(continued)

Table D5. Calibration Points (Left Continued).

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
CalFlo7	nciFlowCal	siS3(6)	0 to 3500 FPM (0 to 17.5) m/s		1496 FPM (7.6 m/s)
CalFlo8	nciFlowCal	siS3(7)	0 to 3500 FPM (0 to 17.5) m/s		2106 FPM (10.7 m/s)
CalFlo9	nciFlowCal	siS3(8)	0 to 3500 FPM (0 to 17.5) m/s		2978 FPM (15.13 m/s)
CalFlo10	nciFlowCal	siS3(9)	0 to 3500 FPM (0 to 17.5) m/s		3338 FPM (16.96 m/s)
BalZerActl	nciFld3PtCal	siCalActualLoS3	-400 to 400 FPM (-2 to +2 m/s)		0
BalZerAprnt	nciFld3PtCal	siCalApparentLoS3	-400 to 400 FPM (-2 to +2 m/s)		0
BalMinActl	nciFld3PtCal	siCalActualMidS3	0 to 1000 FPM (0 to 5 m/s)		807 FPM (4.1 m/s)
BalMinAprnt	nciFld3PtCal	siCalApparentMidS3	0 to 1000 FPM (0 to 5 m/s)		807 FPM (4.1 m/s)
BalMaxActl	nciFld3PtCal	siCalActualHiS3	0 to 3500 FPM (0 to 17.5) m/s		3445 FPM (17.5 m/s)
BalMaxAprnt	nciFld3PtCal	siCalApparentHiS3	0 to 3500 FPM (0 to 17.5) m/s		3445 FPM (17.5 m/s)
FacZeroVolts	nciFlowVoltOffsetS12		volts -1.5 to 1.5		0

Table D5. Calibration Points (Right Continued).

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
							CalFlo7 is an array of sensor flow velocity in ft/min plotted on the y-axis. This data together with CalFloVlt7 form a flow sensor linearization curve that is applied to the flow sensor.
							CalFlo8 is an array of sensor flow velocity in ft/min plotted on the y-axis. This data together with CalFloVlt8 form a flow sensor linearization curve that is applied to the flow sensor.
							CalFlo9 is an array of sensor flow velocity in ft/min plotted on the y-axis. This data together with CalFloVlt9 form a flow sensor linearization curve that is applied to the flow sensor.
							CalFlo10 is an array of sensor flow velocity in ft/min plotted on the y-axis. This data together with CalFloVlt10 form a flow sensor linearization curve that is applied to the flow sensor.
C M							BalZerActl specifies a field correction of the flow at three points (zero, min, and max). BalZerActl is a measured value, typically zero.
C M							BalZerAprnt specifies a field correction of the flow at three points (zero, min, and max). BalZerAprnt is the apparent air flow when the measured air flow is BalZerActl (typically zero).
C M							BalMinActl specifies a field correction of the flow at three points (zero, min, and max). BalMinActl is a measured value, typically referred to as the minimum flow.
C M							BalMinAprnt specifies a field correction of the flow at three points (zero, min, and max). BalMinAprnt is the apparent air flow when the measured air flow is BalMinActl.
C M							BalMaxActl specifies a field correction of the flow at three points (zero, min, and max). BalMaxActl is a measured value typically referred to as the maximum flow.
C M							BalMaxAprnt specifies a field correction of the flow at three points (zero, min, and max). BalMaxAprnt is the apparent air flow when the measured air flow is BalMaxActl.
							FacZeroVolts: This value is subtracted from the flow sensor voltage before flow sensor linearization. FacZeroVolts is updated to RawFlowVolts - CalFloVolts1 when one of two conditions occur: a) A new value in nciFld3PtCal is changed, Mode is MANUAL_POS, DamperPos is zero. b) Mode changes from FLOAT_OUT_SYNC to an operating mode, DisableAutoZero is FALSE, and abs(RawFlowVolts) > 2.592 (32 + FacFlowGain). NOTE: When FacFlowGain = 45 (nominal) and the linearization curve is the default value, then the auto zero threshold = 311 FPM (1.555 m/s).

**Table D6. Configuration Parameters (Left).**

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
DestHvacMode	nviApplicMode		HVAC_AUTO HVAC_HEAT HVAC_MRNG_WRMUP HVAC_COOL HVAC_NIGHT_PURGE HVAC_NUL	0 1 2 3 4 255	HVAC_AUTO
	nciDeviceName				ASCII Blanks
ApplicationType	nciAppIVer	application_type	0 to 255		0
VersionNo	nciAppIVer	version_no	0 to 255		0
	nciAppIVer	time	seconds		0

(continued)



**Table D6. Configuration Parameters (Right).**

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
M	X	X			X		DestHvacMode is an input that coordinates a particular controller with the supply air handler control or any other supervisory controller. The possible states have the following meanings: HVAC_AUTO; This Mode is selected automatically depending on whether cooling or reheating is required to reach the temperature setpoint. HVAC_HEAT; Warm air is supplied and the control loop should be in the Heat Mode. HVAC_MRNG_WRMUP; Warm air is being supplied to the node and the morning-warm-up control strategy is in effect. HVAC_COOL; Cool air is supplied and the control loop should be in Cool Mode. HVAC_NIGHT_PURGE; Outdoor air is being supplied to the node and the night-purge strategy is in effect. HVAC_NUL; AppliModeln does not affect the Mode selection.
							nciDeviceName is an 18 character field used to identify the node uniquely as one object at the site or project. The contents of the nciDeviceName is maintained by a management node. If nciDeviceName is all ASCII blanks, it is considered unconfigured.
							ApplicationType identifies the current application number of the Excel 10.
							VersionNo identifies the version number of the Excel 10 application.
							The time stamp of the last change to the Excel 10 application configuration. Time meets the ANSI C time stamp requirement specifying the number of seconds elapsed since midnight (0:00:00), January 1, 1970. It is represented in the Intel Format and is four bytes in length.

(continued)

**Table D6. Configuration Parameters (Left Continued).**

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
FlowCntrlType	nciConfig	FlowControlType	FLOW_NORMAL FLOW_TRACKING SHARE_WALLMODULE DD_SATEL_NOFLOWMIX DD_SATEL_FLOWMIX DD_SATEL_CONSTVOL DUALDUCT_NOFLOWMIX DUALDUCT_FLOWMIX DUALDUCT_CONSTVOL DUALDUCT_DISCHSENSOR DUALDUCT_DISCHSENSOR_CV	0 1 2 3 4 5 6 7 8 9 10	FLOW_NORMAL

(continued)

Table D6. Configuration Parameters (Right Continued).

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
							<p>FlowCntrlType sets the type of flow control being implemented as shown below: NOTE: E-Vision names are in brackets [(FlowType) - (Box Type)]. FLOW_NORMAL [SD_Normal Flow - Single Duct]: The flow is controlled to satisfy the temperature control algorithm. FLOW_TRACKING [FLOW_Tracking - Flow_Tracking]: The temperature control is turned off and the air flow setpoint equals the sum of DestFlowTrack and FlowTrackOfst. This feature is used to balance the flow between several input VAV boxes and one exhaust VAV box in a room. If a non zero value is assigned to FlowTrackOfst, then the room is pressurized or depressurized. SHARE_WALLMODULE [Shared_Cntrl - Single Duct]: The temperature control loop is turned off and the flow is controlled by the wall module at another node. In this case DestSatellite is bound to SrcMaster of another node and the information received in DestSatellite is used to control the air flow. The other node has the temperature sensor connected to it and controls the space temperature by its own damper and the other dampers of all nodes bound to it. This feature is used when only one temperature sensor is used in a large area to control several nodes. DUALDUCT_CONSTVOL [Master_Const_Flow - Dual_Duct] (master) and DD_SATEL_CONSTVOL [Satel_Const_Flow - Dual_Duct] (satellite): The master node is connected to a cold air supply duct in a dual duct application and controls the air flow to the space. The satellite is connected to the hot duct. The master commands the satellite nodes damper via SrcMaster. The temperature control loop in the master is enabled and the temperature control loop in the satellite is disabled. Both the master and satellite have air flow sensors. The master controls the satellite so that the total air supplied is always a constant volume. When cooling is called, more cool air is supplied to the space. When heating is called, more warm air is supplied to the space. MinFlowSpt in both nodes should be set to 0. The nodes never enter reheat Mode in this configuration. (See NOTE at the end of this comments section.) DUALDUCT_FLOWMIX [Master_Flow_Mix - Dual_Duct] (master) and DD_SATEL_FLOWMIX [Satel_Flow_Mix - Dual_Duct] (satellite): The master node is connected to a cold air supply duct in a dual duct application and controls the air flow to the space. The satellite node is connect to the hot duct. The master node commands the satellite nodes damper via SrcMaster. Both the master and satellite have air flow sensors. The temperature control loop is enabled in the master and disabled in the satellite. Both warm air and cold air can be supplied to the space at the same time in the transition from heating to cooling or from cooling to heating (See NOTE at the end of this comments section.) DUALDUCT_NOFLOWMIX [Master_No_Flow_Mix - Dual_Duct] (master) and DD_SATEL_NOFLOWMIX [Satel_NO_Flow_Mix - Dual_Duct] (satellite): The master node is connected to a cold air supply duct in a dual duct application and controls the air flow to the space. The satellite node is connected to the hot duct. The master node commands the satellite nodes damper via SrcMaster. Both the master and satellite have air flow sensors. The temperature control loop is enabled in the master and disabled in the satellite. Only warm air or cold air can be supplied to the space at the same time. When cooling is called, only cool air is supplied to the space. When heating is called, only warm air is supplied to the space.</p>

(Continued)

(continued)

**Table D6. Configuration Parameters (Left Continued).**

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default

*(continued)*

Table D6. Configuration Parameters (Right Continued).

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
							<p>DUALDUCT_DISCHSENSOR [DD_DAFLOWSensor - Dual_Duct]: The node is connected to control both the cold and hot air supply damper. The physical damper outputs control the cold supply damper and the reheat physical floating outputs control the hot air damper. The node has an air flow sensor measuring the total discharge air flow. The temperature control loop is enabled, and either warm air or cold air is supplied to the space. When cooling is called, only cool air is supplied to the space (damper on satellite is fully closed). When heating is called, only warm air is supplied to the space. There is no satellite node in this case. ReheatType is set to Float_ReHeat for this case.</p> <p>DUALDUCT_DISCHSENSOR_CV [DD_DAFLOWSenConst - Dual_Duct]: The node is connected to control both the cold and hot air supply damper. The physical damper outputs control the cold supply damper and the reheat physical floating outputs controls the hot air damper. The node has an air flow sensor measuring the total discharge air flow. The temperature control loop is enabled. Both warm air and cold air can be supplied to the space at the same time in the transition from heating to cooling or from cooling to heating. ReheatType is set to Float_ReHeat for this case. Measured flow controls the cold duct damper position and space temperature controls the hot duct damper position. The node never enters reheat Mode in this configuration.</p> <p>FLOW_NORMAL [DD_CDFLOWSensor - Dual_Duct]: Dual duct flow mixing uses on control device to provide pressure independent control of the cold duct. The floating reheat, which is traditionally wired to a heating valve actuator, is wired to a hot duct damper instead. PeriphPos is used to set the minimum hot duct damper position, which applies during both reheat and cooling modes. Flow mixing is achieved by mixing hot duct and cold duct air, this takes place during the cooling mode when minimum hot duct position is not zero (PeriphPos), or during the reheat mode if the cold duct reheat flow value is not zero.</p> <p>NOTE: In these Dual Duct applications there is two nodes. One is the master and the other is the satellite. It is advisable to set MaxFlowSpt and MinFlowSpt in both the Satellite and Master nodes to the same values.</p>

(continued)

**Table D6. Configuration Parameters (Left Continued).**

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
ReHeatType	nciConfig	ReHeatType	No_Local_Reheat Elec_OneStage Elec_TwoStage Elec_ThreeStage Elec_ThreeStageBin Elec_OneStagePeriph Float_Reheat Float_Periph Float_ReheatPeriph Float_PeriphReheat PWM_Reheat PWM_Periph PWM_ReheatPeriph PWM_PeriphReheat Dual_Duct_Reheat FloatHotDuctPrDep	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15	No_Local_Reheat

(continued)

**Table D6. Configuration Parameters (Right Continued).**

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
							<p>ReHeatType specifies the kind of reheat used with the node as listed below:                      No_Local_Reheat, no reheat is enabled.                      Elec_OneStage, one stage of reheat.                      Elec_TwoStage, two stages of reheat.                      Elec_ThreeStage, three stages of reheat.                      Elec_ThreeStageBin, two stages of reheat. Stage two usually has twice the heating capability of stage one.                      Elec_OneStagePeriph, one stage of peripheral heating (such as baseboard radiation heat).                      Float_Reheat, one modulating reheat stage controlling via a floating motor.                      Float_Periph, one modulating peripheral heat stage controlling via a floating motor.                      Float_ReheatPeriph, one modulating reheat stage and one modulating peripheral reheat stage. Both stages are controlled via floating motors. Reheat is the first stage.                      Float_PeriphReheat, one modulating reheat stage and one modulating peripheral reheat stage. Both stages are controlled via floating motors. Peripheral reheat is the first stage.                      PWM_Reheat, one modulating reheat stage controlling via a pulse width modulation motor.                      PWM_Periph, one modulating peripheral reheat stage controlling via a pulse width modulation motor.                      PWM_ReheatPeriph, one modulating reheat stage and one modulating peripheral heat stage. Both stages are controlled via pulse width modulation motors. Reheat is the first stage of heat.                      PWM_PeriphReheat, one modulating reheat stage and one modulating peripheral reheat stage. Both stages are controlled via pulse width modulation motors. Peripheral reheat is the first stage.                      Dual_Duct_Reheat, reheating is provided by a second hot duct.                      FloatHotDuctPrDep, reheating using a hot duct damper controlled by the floating reheat outputs in the pressure dependent case only.</p>

(continued)

Table D6. Configuration Parameters (Left Continued).

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
MornWarmType	nciConfig	MornWarmType	Fixed_Flow_Spt Mod_Flow_and_Reheat Mod_Flow_No_Reheat	0 1 2	Fixed_Flow_Spt
DampMtrSpd	nciConfig	uiDamperMtrTimeS0	seconds 20 to 600		90
ValveMtrSpd	nciConfig	uiHeatMrtTimeS0	seconds 20 to 600		90
PWMPeriod	nciConfig	siPwmPeriodS4	seconds 5 to 600		100
PWMZeroScale	nciConfig	siPwm0pcntS4	seconds 5 to 600		1
PWMFullScale	nciConfig	siPwm100pcntS4	seconds 5 to 600		99
SpaceTempCal	nciConfig	siSpaceTempZeroCalS7	-5 to +5 degrees F (-2.8 to +2.8) degrees C		0
TempInput1Cal	nciConfig	siTempCalS7(0)	-15 to +15 degrees F (-8.4 to +8.4) degrees C		0
TempInput2Cal	nciConfig	siTempCalS7(1)	-15 to +15 degrees F (-8.4 to +8.4) degrees C		0

(continued)



Table D6. Configuration Parameters (Right Continued).

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
							MornWarmType: The node can receive a morning warm-up command from the air equipment control so that the control will change to operate with warm supply air. The morning warm-up types supported are listed below: Fixed_Flow_Spt, warm air is being supplied via the duct, the temperature control is turned off, and either the damper position or air flow is commanded to a configurable setpoint. Mod_Flow_and_Reheat, warm air is being supplied via the duct and the temperature control is reverse acting. Reheat can be turned on in this configuration to supply warmer air to the space. Mod_Flow_No_Reheat, warm air is being supplied via the duct and the temperature control is reverse acting. Reheat is not enabled in this configuration.
							DampMtrSpd is how long it takes for the damper motor to move one cycle of travel from closed to open.
							ValveMtrSpd is how long it takes for any reheat or peripheral reheat valve motors to move one cycle of travel from closed to open.
							PWMPeriod: When pulse width modulation is used, the period of one pulse width modulation cycle is PwmPeriod seconds.
							PWMZeroScale: When pulse width modulation is used, the period of a pulse for zero percent output (damper or valve at closed position) is PWMZeroScale seconds.
							PWMFullScale: When pulse width modulation is used, the period of a pulse for full scale output (damper or valve at open position) is PWMFullScale seconds.
C							SpaceTempCal provides offset calibration for the space analog sensor input and is added to the sensed value.
C							TempInput1Cal provides offset calibration for the sensors selected by TempInput1Cal and are added to the sensed value.
C							TempInput2Cal provide offset calibration for the sensors selected by TempInput2Cal and are added to the sensed value.

(continued)

**Table D6. Configuration Parameters (Left Continued).**

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
OverrideType	nciConfig	OverrideType	None Bypass_UnOcc Only_Bypass	0 1 2	(This value will be calculated.)
OvrPriority	nciConfig	OverridePriority	Last_Cmd ManOcc_Cmd	0 1	ManOcc_Cmd
WallModSpType	nciConfig	UseWallModStPt	FALSE TRUE	0 1	FALSE
ReheatPropCnt	nciConfig	ReheatPropControl	FALSE TRUE	0 1	FALSE

(continued)

Table D6. Configuration Parameters (Right Continued).

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
							OverrideType specifies the behavior of the override button as listed below: None, the override button is disabled or not configured. Bypass_UnOcc, causes the effective manual override state to be OC_BYPASS, OC_UNOCCUPIED, or OC_NUL depending on the length of the button press. Only_Bypass, causes the effective manual override state to be OC_BYPASS or OC_NUL depending on the length of the button press.
							OvrPriority configures the override arbitration between DestManualOcc, DestByPass, and the wall module override button as shown: Last_Cmd: Last command received from either the wall module or DestManualOcc determines the effective override state. ManOcc_Cmd: When DestManualOcc is not OC_NUL, the effective occupancy is DestManualOcc regardless of the wall module override state.
							WallModSpType specifies the setpoint temperature source when the effective occupancy is OC_OCCUPIED. If WallModSpType is true, then, based on the type of setpoint knob configured, then temporary variables OccHeat and OccCool are changed as shown below: FALSE, Setpoint Knob type = No Change TRUE, Setpoint Knob type = Direct: OccHeat = WallModSetPt - ZEB/2 OccCool = WallModSetPt + ZEB/2 (ZEB = OccCool - OccHeat) TRUE, Setpoint Knob type = Offset: OccHeat = OccHeat + WallModSetPt OccCool = OccCool + WallModSetPt
							ReheatPropCnt determines the amount of air flow when the Mode is reheat as shown below: FALSE: The reheat air flow and damper position is set to a fixed value. TRUE: Reheat air flow and damper position varies according to the temperature control loop.

(continued)

**Table D6. Configuration Parameters (Left Continued).**

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
ConfigPressDep	nciConfig	PressureDependent	FALSE TRUE	0 1	FALSE
PowerFrequency	nciConfig	FiftySixtyHz	FALSE TRUE	0 1	FALSE
DisableAutoZero	nciConfig	DisableFlowAutoZero	FALSE TRUE	0 1	FALSE

Table D6. Configuration Parameters (Right Continued).

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
							<p>ConfigPressDep (Press_Dependent in E-Vision) specifies that the flow control algorithm used is as described below:</p> <p>FALSE: Pressure independent control is implemented using a cascaded control algorithm. The temperature control algorithm specifies the desired air flow and the cascaded flow control algorithm measures and controls the air flow to the desired air flow setpoint. The air flow is independent of the supply air pressure. An air flow sensor is required to measure the actual air flow.</p> <p>TRUE: Pressure dependent control is implemented using the space temperature to control the damper Position directly. The air flow is dependent on the supply air pressure. The air flow sensor is not used to control air flow.</p>
							PowerFrequency specifies the mains frequency, 1=50Hz, 0=60Hz.
							DisableFlowAutoZero: When TRUE, disables the auto-zero process of the flow sensor before linearization, when Mode changes from FloatingOutSync to an operating mode. When DisableFlowAutoZero is FALSE, auto-zero process occurs.

**Table D7. LonMark® (Left).**

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
	nviRequest (SNVT_obj_request)	object_id	0 to 65535		1
	nviRequest (SNVT_obj_request)	object_request	RQ_NORMAL RQ_DISABLED RQ_UPDATE_STATUS RQ_SELF_TEST RQ_UPDATE_ALARM RQ_REPORT_MASK RQ_OVERRIDE RQ_ENABLE RQ_RMV_OVERRIDE RQ_CLEAR_ATATUS RQ_CLEAR_ALARM RQ_NUL	0 1 2 3 4 5 6 7 8 9 10 255	RQ_NORMAL
FileDirectory	nroFileDirectory (SNVT_address)				Assigned by LonBuilder
DestRmTemp	nviSpaceTemp (SNVT_temp_p)		degrees F 14 TO 122 degrees C (-10 TO 50)		Invalid
DestRmTempSpt	nviSetPoint (SNVT_temp_p)		degrees F 50 TO 95 degrees C (10 TO 35)		Invalid

(continued)

Table D7. LonMark® (Right).

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
							object_id: Provides the mechanism to request a particular status report (via nvoStatus) for a particular object within this node. Object_id selects the object being referenced by nviRequest. The only appropriate value of object_id is 1 for the VAV object, all others are invalid.
							object_request: When object_request is RQ_NORMAL or RQ_UPDATE_STATUS then the status (via nvoStatus) will be reported for the object addressed by object_id. When object_request is RQ_REPORT_MASK then the status bits will be reported that are supported in nvoStatus by the object which is addressed by object_id. Bits that are supported by the object are set to one. RQ_NORMAL, RQ_UPDATE_STATUS, and RQ_REPORT_MASK are the only supported items. All other object_request items are not supported at this time and will return an invalid_request (nvoStatus) in the object status.
							FileDirectory specifies the address in the Excel 10 at which the configuration parameter directory is located. Address is in hexadecimal format and assigned by the LonBuilder
M	X	X	X		X		DestRmTemp is the space temperature sensed by another node and is typically bound to SrcRmTemp of another node having a space temperature sensor. If DestRmTemp has a value other than SI_INVALID it is used as the sensed space temperature by the node rather than using any local hardwired sensor. If the value is outside the allowed range 14 to 122°F (-10 to 50°C), then the node uses the value of the nearest range limit. When DestRmTemp is not bound to another node, DestRmTemp can be used to fix the sensed temperature. A management node can write a value other than SI_INVALID, causing the node to use DestRmTemp instead of the hardwired sensor. An application restart or power failure causes the fixed sensor value to be forgotten and DestRmTemp to be returned to SI_INVALID
M	X	X	X		X		DestRmTempSpt is an input network variable used to determine the temperature control point of the node. If DestRmTempSpt is not SI_INVALID, then it is used to determine the control point of the node. If nviSetPoint is SI_INVALID, then other means are used to determine the control point. See RmTempActSpt for more information.

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Table D7. LonMark® (Left Continued).

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
SrcRmTemp	nvoSpaceTemp (SNVT_temp_p)		degrees F 14 TO 122 degrees C (-10 TO 50)		Invalid
SrcUnitStatus	nvoUnitStatus (SNVT_hvac_status )	mode	HVAC_AUTO HVAC_HEAT HVAC_MRNG_WRMUP HVAC_COOL HVAC_NIGHT_PURGE HVAC_PRE_COOL HVAC_OFF HVAC_TEST HVAC_EMERG_HEAT HVAC_FAN_ONLY HVAC_NUL	0 1 2 3 4 5 6 7 8 9 255	HVAC_OFF
UnitHeatOutputPri	nvoUnitStatus (SNVT_hvac_status )	heat_output_primary	percentage 0 to 100		0
UnitHeatOutputSec	nvoUnitStatus (SNVT_hvac_status )	heat_output_secondary	percentage 0 to 100		0
UnitCoolOutput	nvoUnitStatus (SNVT_hvac_status )	cool_output	percentage 0 to 100		0
UnitEconOutput	nvoUnitStatus (SNVT_hvac_status )	econ_output	percentage 0 to 100		Invalid
UnitFanOutput	nvoUnitStatus (SNVT_hvac_status )	fan_output	percentage 0 to 100		0
UnitInAlarm	nvoUnitStatus (SNVT_hvac_status )	in_alarm	aFALSE aTRUE aALARM_NOTIFY_DISABLED	0 1 255	aFALSE

(continued)



Table D7. LonMark® (Right Continued).

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
M	X						SrcRmTemp is the sensed space temperature from the locally wired sensor. SrcRmTemp is typically bound to DestRmTemp of another node which can not have its own space temperature sensor but controls in the same space. The reported space temperature includes the offset correction SpaceTempCal. If the space temperature sensor is not connected or is shorted, or if DestRmTemp is bound to another node, then SrcRmTemp is set to SI_INVALID.
	X						SrcUnitStatus is set according to the StatusMode. If StatusMode is Pressurize, DePressurize, TrackFlow, Flowt_Out_Sync, or FreezeProtect the mode is set to HVAC_NUL which indicates that the node is in a mode not supported by the SNVT_hvac_mode data type. If StatusMode is HEAT or REHEAT, then the mode is set to HVAC_HEAT, which indicates that heating energy is being supplied to the controlled space. If StatusMode is COOL, then the mode is set to HVAC_COOL, which indicates that cooling energy is being supplied to the controlled space. If StatusMode is StartUpWait or DISABLED_MODE, then the mode is disabled or off. If StatusMode is MornWarm the mode is set to HVAC_MRNG_WRMUP which indicates that the heated air is being supplied for morning-warm-up. If StatusMode is NightPurge, the mode is set to HVAC_NIGHT_PURGE which indicates that the outside air is being supplied for night purge. If StatusMode is IOTest, FactoryTest, Manual, ManualPos, or ManualFlow the mode is set to HVAC_TEST which indicates that the node is in a manual or test mode. HVAC_AUTO, HVAC_PRE_COOL, HVAC_EMERG_HEAT, and HVAC_FAN_ONLY are not supported.
							UnitHeatOutputPri reports the current percentage of reheat stages or modulating reheat that are turned on. If the reheat type is DualDuctReHeat, UnitHeatOutputPri reports the current percentage of heat requested of the hot duct. When reheat is configured, UnitHeatOutputPri is set to Invalid.
							UnitHeatOutputSec reports the current percentage of peripheral heat stages of modulating peripheral heat stages that are turned on. When peripheral heat is not configured UnitHeatOutputSec is set to Invalid.
							UnitCoolOutput reports the current percentage of cooling stages or modulating cooling that are turned on.
							UnitEconOutput is always set to invalid.
							UnitFanOutput: If a one speed fan is configured, UnitFan is 100 percent when the fan is running and is zero when the fan is not running. If a Parallel_PWM fan is configured, UnitFanOutput reports the fan speed as a percentage.
							UnitInAlarm: When there is an alarm reported by AlarmStatus(N) (nvoAlarmStatus), then UnitInAlarm is set to 1 (TRUE), otherwise UnitInAlarm is set to 0 (FALSE). If alarms reporting is suppressed via DestManMode, then UnitInAlarm is set to ALARM_NOTIFY_DISABLED.

(continued)

Table D7. LonMark® (Left Continued).

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
FlowManState	nviManOverride (SNVT_hvac_overid)	state	HVO_OFF HVO_POSITION HVO_FLOW_VALUE HVO_FLOW_PERCENT HVO_OPEN HVO_CLOSE HVO_MINIMUM HVO_MAXIMUM HVO_NUL	0 1 2 3 4 5 6 7 255	HVO_OFF
FlowManPercent	nviManOverride (SNVT_hvac_overid)	percent	percentage 0 to 100		0
FlowManValue	nviManOverride (SNVT_hvac_overid)	flow	0 to 10,000 CFM (0 to 16,990) m3h		0
DestSptOffset	nviSetPtOffset (SNVT_temp_p)		degrees F -10.0 to +10.0 degrees C (-5.6 to +5.6)		0
DestManOcc	nviManOcc (SNVT_occupancy)		OC_OCCUPIED OC_UNOCCUPIED OC_BYPASS OC_STANDBY OC_NUL	0 1 2 3 255	OC_NUL

(continued)

Table D7. LonMark® (Right Continued).

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
P	X		X		X		FlowManState is used to control the damper position or air flow manually. The enumerated values have the following meanings: HVO_OFF: normal operation. HVO_POSITION: set DamperPos to FlowManPercent position. HVO_FLOW_VALUE: set SaFlowCntlSpt to FlowManValue, m3h (CFM). (see NOTE.) HVO_FLOW_PERCENT: set SaFlowCntlSpt to FlowManPercent where zero percent is MinFlowSpt and 100 percent is MaxFlowSpt. (See NOTE.) HVO_OPEN: fully open the damper. HVO_CLOSE: fully close the damper. HVO_MINIMUM: set SaFlowCntlSpt to MinFlowSpt. HVO_MAXIMUM: set SaFlowCntlSpt to MaxFlowSpt. HVO_NUL: same as HVO_OFF NOTE: When ConfigPressDep (Press_Dependent in E-Vision) is true, then SaFlowCntlSpt is set to zero, causing the damper to close. When ConfigPressDep (Press_Dependent in E-Vision) is false and the flow sensor has failed, then the damper position is set to an estimated percentage of MaxFlowSpt.
P	X		X		X		FlowManPercent: Refer to FlowManState.
P	X		X		X		FlowManValue: Refer to FlowManState.
M	X	X	X		X		DestSptOffset is input from an operator terminal or from an energy management system used to shift the effective temperature setpoint by adding DestSptOffset to the otherwise calculated setpoint. If the value is outside the allowed range, -10 to +10°F (-5.6 to +5.6°C), then the node uses the value of the nearest range limit.
M	X	X	X		X		DestManOcc is an input from a network connected operator interface or other node that indicates the state of a manual occupancy control thus overriding the scheduled occupancy state. DestManOcc is used along with other occupancy inputs to calculate the effective occupancy of the node. See the EffectiveOcc and the StatusManOcc for more details. The valid enumerated values have the following meanings: OC_OCCUPIED indicates occupied. OC_UNOCCUPIED indicates not occupied OC_BYPASS indicates that the space is occupied for BypassTime seconds after DestManOcc is first set to OC_BYPASS. The timing is done by the bypass timer in this node. If DestManOcc changes to another value the timer is stopped. OC_STANDBY indicates that the space is in standby. OC_NUL and all unspecified values means that no manual occupancy control is requested. When DestManOcc changes from OC_OCCUPIED, OC_UNOCCUPIED, OC_BYPASS, or OC_STANDBY to OC_NUL, any bypass condition is canceled.

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Table D7. LonMark® (Left Continued).

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
DestEmergCmd	nviEmergCmd (SNVT_hvac_emerg)		EMERG_NORMAL EMERG_PRESSURIZE EMERG_DEPRESSURIZ E EMERG_PURGE EMERG_SHUTDOWN EMERG_NUL	0 1 2 3 4 255	EMERG_NORMAL
DestWndw	nviEnergyHoldOff (SNVT_switch)	value	percentage 0 to 100		0
	nviEnergyHoldOff (SNVT_switch)	state	SW_OFF SW_ON SW_NUL	0 1 255	SW_NUL
SrcRmTempSpt	nvoEffectSetPt (SNVT_temp_p)		degrees F 50 TO 95 degrees C (10 TO 35)		Invalid
FlowControlStpt	nvoFlowControlPt (SNVT_flow)		0 to 10,000 CFM (0 to 16,990) m3h		0
TerminalLoad	nvoTerminalLoad (SNVT_lev_percent)		percentage -163.84 o 163.84		0
SrcBoxFlow	nvoBoxFlow (SNVT_flow)		0 to 10,000 CFM (0 to 16,990) m3h		0
SrcWndw	nvoEnergyHoldOff (SNVT_switch)	value	percentage 0 to 100		0
	nvoEnergyHoldOff (SNVT_switch)	state	SW_OFF SW_ON SW_NUL	0 1 255	SW_NUL

(continued)

Table D7. LonMark® (Right Continued).

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
M	X	X	X		X		DestEmergCmd is an emergency input from a device that determines the correct action during a given emergency, such as a fire. If DestEmergCmd is EMERG_NORMAL, this indicates normal conditions and the damper position is set by the control algorithm. If DestEmergCmd is EMERG_PRESSURIZE, then the damper starts the Pressurize operation set according to PressDmprPos. If DestEmergCmd is EMERG_DEPRESSURIZE, then the damper starts the DePressurize operation set according to DepressDmpPos. If DestEmergCmd is EMERG_SHUTDOWN, EMERG_PURGE, or EMERG_NUL then the damper will indicate normal conditions and the position is set by the control algorithm.
M	X		X		X		DestWndw allows the hard wired window sensor to be used by other nodes on the network.
M	X		X		X		nviEnergyHoldOff.state: When the nviEnergyHoldOff.state is SW_OFF or SW_NULL, this indicates window is closed (not hold-off). When the nviEnergyHoldOff.state is SW_ON and DestWndw is 0, indicates window is closed (not hold-off). If the node receives this combination of state and value, then state is set to Off. When the nviEnergyHoldOff.state is SW_ON and DestWndw is not 0, indicates window open (hold-off).
M	X						SrcRmTempSpt is the current temperature control point. This is the current actual space temperature setpoint which the controller is trying to maintain in the conditioned space. See RmTempActSpt for more details. SrcRmTempSpt is updated according to the Significant event notification and Guaranteed Periodic Update (SGPU) mechanism where a significant change is plus or minus 0.3 degrees F, plus or minus 0.07 degrees C.
	X						FlowControlStpt has the same value as SaFlowCntlSpt except that it is an Significant event notification and Guaranteed Periodic Update (SGPU) variable with a 10.6 CFM (18 m3h) significant update difference.
	X	X					TerminalLoad reports the demand for supply energy. Positive numbers are cooling demand and negative numbers are heating demand. 100 percent is the maximum for the terminal capacity (valves/dampers at 100 percent setting). Terminal loads greater than 100 percent indicate that the terminal is not able to supply the required heating or cooling energy. TerminalLoad is used for coordination within the HVAC subsystem and energy management decisions by the supply equipment.
M	X						SrcBoxFlow reports the air flow measured at the node. When the actual flow velocity is less than 3000 FPM (15) m/s, then SrcBoxFlow reports zero. If a flow sensor error has been detected or ConfigPressDep (Press_Dependent in E-Vision) is true, then SrcBoxFlow is set to Invalid. SrcBoxFlow is an Significant event notification and Guaranteed Periodic Update (SGPU) variable with a 4.24 CFM (7.2) m3h significant update difference. If FlowSensor is Invalid, then SupplyFlow and SrcBoxFlow are also Invalid.
							SrcWndw allows the hard wired window sensor to be used by other nodes on the network.
							nvoEnergyHoldOff.state: When the nvoEnergyHoldOff.state is SW_OFF and SrcWndw is zero percent this indicates the window is closed (not hold-off). When the nvoEnergyHoldOff.state is SW_ON and SrcWndw is 100 percent this indicates the window is open. (hold-off). When the nvoEnergyHoldOff.state is SW_NUL and SrcWndw is zero percent this indicates the window sensor is not configured.

(continued)

Table D7. LonMark® (Left Continued).

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
DestOccSensor	nviOccCmd (SNVT_occupancy)		OC_OCCUPIED OC_UNOCCUPIED OC_BYPASS OC_STANDBY OC_NUL	0 1 2 3 255	OC_NUL
NodeSendT	nciNodeSendT		seconds 0 to 600		0
SendHeartBeat	nciSndHrtBt		seconds 0 to 600		0
CoolOccSpt	nciSetPts (SNVT_temp_setpt)	occupied_cool	degrees F 50 TO 95 degrees C (10 TO 35)		73.4 degrees F (23) degrees C
CoolStbySpt	nciSetPts (SNVT_temp_setpt)	standby_cool	degrees F 50 TO 95 degrees C (10 TO 35)		77 degrees F (25) degrees C
CoolUnoccSpt	nciSetPts (SNVT_temp_setpt)	unoccupied_cool	degrees F 50 TO 95 degrees C (10 TO 35)		82.4 degrees F (28) degrees C
HeatOccSpt	nciSetPts (SNVT_temp_setpt)	occupied_heat	degrees F 50 TO 95 degrees C (10 TO 35)		70 degrees F (21) degrees C
HeatStbySpt	nciSetPts (SNVT_temp_setpt)	standby_heat	degrees F 50 TO 95 degrees C (10 TO 35)		66 degrees F (19) degrees C
HeatUnoccSpt	nciSetPts (SNVT_temp_setpt)	unoccupied_heat	degrees F 50 TO 95 degrees C (10 TO 35)		61 degrees F (16) degrees C

(continued)

Table D7. LonMark® (Right Continued).

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
M	X	X	X		X		DestOccSensor allows an occupancy sensor at another node to be used as the occupancy sensor for this node and is typically bound to the occupancy sensor output (SrcOccSensor) from another node. If DestOccSensor is bound, DestOccSensor must show OC_UNOCCUPIED for the 300 seconds before DestOccSensor is changed to OC_UNOCCUPIED. This makes it possible for several occupancy sensors to be ORed together by binding them all to DestOccSensor. If any one bound occupancy sensor shows OC_OCCUPIED, then DestOccSensor shows OC_OCCUPIED for up to the 300 seconds after the last sensor shows OC_OCCUPIED. If DestOccSensor is not bound, the timer or function is not activated. The valid enumerated values have the following meanings: OC_OCCUPIED indicates space is occupied. OC_UNOCCUPIED indicates space is not occupied. OC_BYPASS, OC_STANDBY and OC_NUL are the same as OC_OCCUPIED.
							NodeSendT: The maximum time between updates of network variable outputs (nvoStatus) from the node object.
							SendHeartBeat is the Significant event notification with Guaranteed Period Update with ChangeField (SGPUC) and Significant event notification and Guaranteed Periodic Update (SGPU) time (heart beat time) between updates of network variable outputs. NOTE: SendHeartBeat should be set to 55 seconds by a management node to be compatible with a Honeywell system.
M P		X	X				CoolOccSpt specifies the space temperature setpoint for various operating modes and effective occupancy. The setpoints can be changed during day-to-day operation of the node by an operator interface via a management tool. The fields specify the setpoint temperature for heating and cooling modes and effective occupancy (OC_OCCUPIED, OC_STANDBY, or OC_UNOCCUPIED) as their names suggest.
M P		X	X				CoolStbySpt: Refer to CoolOccSpt.
M P		X	X				CoolUnoccSpt: Refer to CoolOccSpt.
M P		X	X				HeatOccSpt: Refer to CoolOccSpt.
M P		X	X				HeatStbySpt: Refer to CoolOccSpt.
M P		X	X				HeatUnoccSpt: Refer to CoolOccSpt.

(continued)

**Table D7. LonMark® (Left Continued).**

<b>User Address</b>	<b>NvName</b>	<b>Field Name</b>	<b>Engineering Units: English (Metric) or States plus Range</b>	<b>Digital State or Value of State</b>	<b>Default</b>
RcvHeartBeat	nciRcvHrtBt		seconds 0 to 600		0
DuctArea	nciDuctArea		0 to 4.1 ft2 (0 to 0.372) m2		0
MinFlowSpt	nciMinFlow		0 to 10,000 CFM (0 to 16,990) m3h		0
MaxFlowSpt	nciMaxFlow		0 to 10,000 CFM (0 to 16,990) m3h		1,000 CFM (1,700) m3h
MinFlowHtgSpt	nciMinFlowHeat		0 to 10,000 CFM (0 to 16,990) m3h		0
MinFlowSbySpt	nciMinFlowStdby		00 to 10,000 CFM (0 to 16,990) m3h		0



Table D7. LonMark® (Right Continued).

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
							RcvHeartBeat is the failure detection time for network variables outputs. NOTE: RcvHeartBeat should be set to 300 seconds by a management node to be compatible with a Honeywell system.
M P							DuctArea is used to calculate air flow in volume CFM (m3h) from the air velocity used internally in the node.
M P							MinFlowSpt: The four configuration parameters MinFlowSpt, MinFlowSbySpt, MaxFlowSpt, and MinFlowHtgSpt set limits on the air flow when the Pressure Type is ConfigPressDep (Press_Dependent in E-Vision) is FALSE. The following relationships must be true for the control to work properly: MinFlowSpt < MaxFlowSpt MinFlowSpt < MinFlowHtgSpt MinFlowSbySpt < MaxFlowSpt MinFlowHtgSpt < MaxFlowSpt
M P							MaxFlowSpt: Refer to MinFlowSpt.
M P							MinFlowHtgSpt: Refer to MinFlowSpt.
M P							MinFlowSbySpt: Refer to MinFlowSpt.

**Table D8. Direct Access and Special Points (Left).**

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
DestManMode	nviManualMode		MODE_ENABLE MODE_DISABLE MODE_MANUAL SUPPRESS_ALARMS UNSUPPRESS_ALARMS	0 1 2 3 4	MODE_ENABLE

(continued)

**Table D8.Direct Access and Special Manual Points (Right).**

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
M	X	X	X		X		<p>DestManMode is an input which is used to disable the Excel 10s control algorithms and to manually set the physical outputs. DestManMode remains unchanged until another mode has been commanded or an application restart has been performed. See StatusMode for more details. The valid enumerated values are:</p> <p>MODE_ENABLE enables the node so that the control algorithm determines the operating mode, and controls the physical outputs. MODE_ENABLE is the default state after power restore or application restart. If the mode was MODE_MANUAL and DestManMode is set to MODE_ENABLE, the node then goes through application_restart.</p> <p>MODE_DISABLE sets the node to the DISABLED mode. The alarm NODE_DISABLED is initiated, all control loops are disabled, and the physical outputs are turned off. The physical inputs, network variable inputs, and network variable outputs are still functioning when the node is in the DISABLED mode.</p> <p>MODE_MANUAL sets the node into the MANUAL mode. The alarm NODE_DISABLED_ALARM is initiated, all control loops are disabled, and the physical outputs are controlled manually as commanded by nviManValue. The nodes configuration variables and nviManValue are used to set valves, dampers, and/or digital output to the desired manual positions or state(s). The physical inputs, network variable inputs, and network variable outputs are still functioning when the node is in the MODE_MANUAL mode. SUPPRESS_ALARMS causes AlarmType to be set to ALARM_NOTIFY_DISABLED, and AlarmLog0 through AlarmLog4 to no longer record alarms. If alarms are suppressed, UNSUPPRESS_ALARMS causes AlarmType and AlarmLog0 through AlarmLog4 to be returned to reporting alarms. See AlarmType for more details. All unspecified values are the same as MODE_ENABLE.</p>

(continued)

**Table D8. Direct Access and Special Points (Left Continued).**

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
ManFactoryTest	nviManValue	ManFactoryTest	NormalOp Test1On Test2On Test3On Test4On Test5On Test6On Test7On Test8On TestAllOff TestAllOn TestAllDisabled TestScaleAmpOff	0 1 2 3 4 5 6 7 8 9 10 11 12	NormalOp
ManDamp	nviManValue	ManDamperPos	percentage 0 to 100		0
ManReheat	nviManValue	ManReheatPos	percentage 0 to 100		0
ManPeriph	nviManValue	ManPeripHeatPos	percentage 0 to 100		0
ManFanSpeed	nviManValue	ManFanSpeed	percentage 0 to 100		0
ManHeat1	nviManValue	ManHeat1ON	OFF ON	0 1	OFF
ManHeat2	nviManValue	ManHeat2ON	OFF ON	0 1	OFF
ManHeat3	nviManValue	ManHeat3ON	OFF ON	0 1	OFF

(continued)

**Table D8.Direct Access and Special Manual Points (Right Continued).**

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
					X		<p>ManFactoryTest: The node (Mode) and the physical output(s) energized for various values of ManFactoryTest are described as below: NormalOp or unspecified value and node (Mode) is determined by other network variables, then the physical outputs are controlled by algorithms or other fields in ManFactoryTest. (This test is only used when the controller is specifically in the Factory Test Mode, (factory only) this mode can not be accessed by (XI 584) Direct Access or E-Vision. Test1On: D01 is energized. Test2On: D02 is energized. Test3On: D03 is energized. Test4On: D04 is energized. Test5On: D05 is energized. Test6On: D06 is energized. Test7On: D07 is energized. Test8On: D08 is energized. TestAllOff: no output is energized. TestAllOn: all outputs are energized. TestAllDisabled: All output bits are turned on but the output drivers are disabled causing the outputs to be off. This checks the driver Disable function of the hardware. TestScaleAmpOff: the scaling amplifier between the sensor and the A/D is turned off so that the amplified sensor voltage can be directly measured by the A/D converter or a voltmeter connected to a circuit board Test point. During FactoryTest Mode, all control loops are disabled, and the physical outputs are controlled manually as commanded by nviManValue on a bit by bit basis ignoring the nodes configuration variables. The physical inputs, network variable inputs, and network variable outputs are still functioning when the node is in the FactoryTest Mode.</p>
					X		<p>ManDamp: During Manual Mode, ManDamp sets the damper position to the specified position. If ManDamp is 0 or 100 percent, the motor is overdriven for a period longer than the motor time to ensure that it is at the end of travel.</p>
					X		<p>ManReheat: During Manual Mode, ManReheat sets the reheat valve position to the specified position. If ManReheat is 0 or 100 percent, the floating motor is overdriven for a period longer than the motor time to ensure that it is at the end of travel. The PWM_Reheat modulation output is also controlled by ManReheat.</p>
					X		<p>ManPeriph: During Manual Mode, ManPeriph sets the peripheral reheat valve position to the specified position. If ManPeriph is 0 or 100 percent, the floating motor is overdriven for a period longer than the motor time to ensure that it is at the end of travel. The PWM_Periph modulation output is also controlled by ManPeriph.</p>
					X		<p>ManFanSpeed: If a variable speed fan is configured, during Manual Mode, ManFanSpeed sets the fan speed.</p>
					X		<p>ManHeat1: During Manual Mode ReheatStage1 (the first stage of Elec_ThreeStage) and ReheatBinary1 (the first stage of Elec_ThreeStageBin) output is on when the field is true and off when the field is false.</p>
					X		<p>ManHeat2: During Manual Mode ReheatStage2 (the second stage of Elec_ThreeStage) and ReheatBinary2 (the second stage of Elec_ThreeStageBin) output is on when the field is true and off when the field is false.</p>
					X		<p>ManHeat3: During Manual Mode ReheatStage3 (the third stage of Elec_ThreeStage) and ReheatBinary3 (the third stage of Elec_ThreeStageBin) output is on when the field is true and off when the field is false.</p>

(continued)

**Table D8. Direct Access and Special Points (Left Continued).**

<b>User Address</b>	<b>NvName</b>	<b>Field Name</b>	<b>Engineering Units: English (Metric) or States plus Range</b>	<b>Digital State or Value of State</b>	<b>Default</b>
ManPeriphHeat	nviManValue	ManPeriphHeatON	OFF ON	0 1	OFF
ManFan	nviManValue	ManFanON	OFF ON	0 1	OFF
ManFreeOn	nviManValue	ManFreeON	OFF ON	0 1	OFF
ManAuxOn	nviManValue	ManAuxON	OFF ON	0 1	OFF

**Table D8.Direct Access and Special Manual Points (Right Continued).**

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
					X		ManPeriphHeat: During Manual Mode PeriphReheatStg1 output is on when the field is true and off when the field is false.
					X		ManFan: During Manual Mode, Series, Parallel_Temp, and Parallel_Flow outputs are on when the field is true and off when the field is false.
					X		ManFreeON, during Manual Mode can be either Free_Net_Maintain or Free_Net_Pulse (two outputs). The on state of Free_Net_Maintain will command the output on (true), the off state of Free_Net_Maintain will command the output off (false). The on state for Free_Net_Pulse will command the on (true) output for one second, the off state for Free_Net_Pulse will command the off (false) output for one second.
					X		ManAuxON, during Manual Mode can be either Auxiliary_Maintain or Auxiliary_Pulse (two outputs). The on state of Auxiliary_Maintain will command the output on (true), the off state of Auxiliary_Maintain will command the output off (false). The on state for Auxiliary_Pulse will command the on (true) output for one second, the off state for Auxiliary_Pulse will command the off (false) output for one second.

**Table D9. Data Share Points (Left).**

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
ManHtgOverValue	nviHeaterOverid	value	percentage 0 to 100		0
	nviHeaterOverid	state	SW_OFF SW_ON SW_NUL	0 1 255	SW_NUL
DestDuctTemp	nviDuctInTemp		degrees F 14 TO 122 degrees C (-10 to 50)		Invalid
SrcOccSensor	nvoSensorOcc		OC_OCCUPIED OC_UNOCCUPIED OC_BYPASS OC_STANDBY OC_NUL	0 1 2 3 255	OC_NUL
DestSatellite	nviShare	Mode	START_UP_WAIT HEAT COOL REHEAT MORN_WARM NIGHT_PURGE PRESSURIZE DEPRESSURIZE TRACKFLOW MANUAL_POS MANUAL_FLOW FREEZE_PROTECT FACTORY_TEST IOTEST FLOAT_OUT_SYNC DISABLED MANUAL	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	DISABLED

(continued)



Table D9.Data Share Points (Right).

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
M	X						ManHtgOverValue manually controls the reheat and peripheral reheat. Normally the reheat is controlled automatically.
							nviHeaterOverid: When the nviHeaterOverid.state is SW_OFF or SW_NULL, this indicates reheat and peripheral reheat are automatically controlled. When the nviHeaterOverid.state is SW_ON and ManHtgOverValue is 0 this indicates reheat and peripheral reheat are automatically controlled. nviHeaterOverid.state is set to off. When the nviHeaterOverid.state is SW_ON and ManHtgOverValue is greater than zero this indicates reheat and peripheral reheat are turned off.
M	X		X				DestDuctTemp is the temperature of the air being supplied to the VAV control box as read by another node on the network. If DestDuctTemp has a value other than Invalid, it is used as the sensed supply air temperature by the node rather than using any local hardwired sensor. If the value is outside the allowed range, then the node uses the value of the nearest range limit. When DestDuctTemp is not bound to another node, DestDuctTemp can be used to fix the sensed temperature. A management node can write a value other than Invalid, causing the node to use DestDuctTemp instead of the hardwired sensor. An application restart or power failure causes the fixed sensor value to be forgotten and DestDuctTemp to be returned to Invalid.
M	X						SrcOccSensor is an output showing the current state of the hard wired occupancy sensor. The valid states are as follows: OC_OCCUPIED indicates that the space is occupied. OC_UNOCCUPIED indicates that the space is not occupied. OC_NUL means no output is available because it is not configured.
M	X		X				DestSatellite is the current operating mode of the sending node. The receiving node generally sets its operating mode to the same mode as the sending node. However when the sending node is in IOTest, FactoryTest, or StartUpWait, the receiving node sets it operating mode to Disabled. For a list of operating modes, see Mode.

(continued)

**Table D9. Data Share Points (Left Continued).**

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
DestReheatStg	nviShare	ReheatStg	0 to 3		0
DestReheatCmd	nviShare	ubReheatCmdS1	percentage 0 to 100		0
DestTempFlowCmd	nviShare	siTempFlowCmdS4	percentage 0 to 100		0
DestEffectOcc	nviShare	EffectOcc	OC_OCCUPIED OC_UNOCCUPIED OC_BYPASS OC_STANDBY OC_NUL	0 1 2 3 255	OC_OCCUPIED
SrcMaster	nvoShare	Mode	START_UP_WAIT HEAT COOL REHEAT MORN_WARM NIGHT_PURGE PRESSURIZE DEPRESSURIZE TRACKFLOW MANUAL_POS MANUAL_FLOW FREEZE_PROTECT FACTORY_TEST IOTEST FLOAT_OUT_SYNC DISABLED MANUAL	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	DISABLED
SrcReheatStg	nvoShare	ReheatStg	0 to 3		0
SrcReheatCmd	nvoShare	ubReheatCmdS1	percentage 0 to 100		0
SrcTempFlowCmd	nvoShare	siTempFlowCmdS4	percentage 0 to 100		0

(continued)

Table D9.Data Share Points (Right Continued).

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
M			X				DestReheatStg: When the mode is reheat and ReHeatType specifies staged reheat, then SrcReheatStg indicates the number of stages that should be turned on in the receiving nodes.
M			X				DestReheatCmd: When the mode is reheat and ReHeatType specifies modulating reheat, then SrcReheatCmd indicates the amount of reheat that should be turned on in the receiving nodes.
M			X				DestTempFlowCmd is an output command of the temperature control loop in terms of percentage of flow capacity mapped to the minimum - maximum flow range (zero percent as minimum flow and 100 percent as maximum flow).
M			X				DestEffectOcc is the effective occupancy specified by the sending node to the receiving node, and is the same as SrcEffectOcc in the sending node.
M	X						SrcMaster is the current operating mode of the sending node. The receiving node generally sets its operating mode to the same mode as the sending node. However when the sending node is in IOTest, FactoryTest, or StartUpWait, the receiving node sets its operating mode to Disabled. For a list of operating modes, see Mode.
M							SrcReheatStg: When mode is reheat and ReHeatType specifies staged reheat, then SrcReheatStg indicates the number of stages that should be turned on in the receiving nodes.
M							SrcReheatCmd: When the mode is reheat and ReHeatType specifies modulating reheat, then DestReheatCmd indicates the amount of reheat that should be turned on in the receiving nodes.
M							SrcTempFlowCmd is an output command of the temperature control loop in terms of percentage of flow capacity mapped to the minimum - maximum flow range (zero percent as minimum flow and 100 percent as maximum flow).

(continued)

**Table D9. Data Share Points (Left Continued).**

User Address	NvName	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State or Value of State	Default
SrcEffectOcc	nvoShare	EffectOcc	OC_OCCUPIED OC_UNOCCUPIED OC_BYPASS OC_STANDBY OC_NUL	0 1 2 3255	OC_OCCUPIED
DestFlowTrack	nviFlowTrack		0 to 67808 CFM (0 to 115200) m3h		0
SrcFlowTrack	nvoFlowTrack		0 to 67808 CFM (0 to 115200) m3h		0
SrcMonSw	nvoMonSw	value	0 to 100		0
	nvoMonSw	state	SW_OFF SW_ON SW_NUL	0 1 255	SW_NUL

Table D9.Data Share Points (Right Continued).

Share (SH), Map (MA), Direct Access (DA) E-Vision (EV): Calibrate (C), Monitor (M), Parameter (P), Schematic (S) Hardware Configuration (HW), Manual Point (MN), Test (TS)							Comments
EV	SH	MA	DA	HW	MN	TS	
M							SrcEffectOcc is the effective occupancy specified by the sending node to the receiving node, and is the same as DestEffectOcc in the sending node.
M	X		X				DestFlowTrack is bound to SrcBoxFlow of the previous node in the flow tracking daisy chain.
M	X						SrcFlowTrack reports the air flow measured at the node plus DestFlowTrack. If a flow sensor error has been detected or ConfigPressDep (Press_Dependent in E-Vision) is true, then SrcFlowTrack is set to Invalid. If DestFlowTrack is Invalid, SrcFlowTrack is also set to Invalid.
M	X						SrcMonSw allows the monitor switch to be shared with another node. The output values have the following meanings: state = OFF, value = zero percent: monitor switch is open. state = ON, value = 100 percent: monitor switch is closed. Sate = NULL, value = 0: monitor switch is not configured.
							nvoMonSw.state: Refer to SrcMonSw.

### Appendix E. Q7750A Excel 10 Zone Manager Point Estimating Guide.

Memory size approximation is shown in Fig. E-1: (All sizes in bytes.)

When *memory size* is less than 110,000 bytes, the size is adequate.

When *memory size* is between 110,000 and 128,000 bytes, the application may be too large. The user must expect to reduce the application complexity, reduce the number of attached Excel 10 VAV Controllers or distribute the Excel 10 VAV Controllers among more than one Zone Manager.

When *memory size* is greater than 128,000, the size is too large. The application size must be reduced as described above.

#### Approximate Memory Size Estimating Procedure.

1. Determine the number of points per controller required at the Central (for example, XBS).

NOTE: All remaining points that are not mapped are available for accessing through the *Direct Access* feature.

2. Calculate the number of Excel 10 Zone Manager program points that will be used in the control logic and in the switching table.
3. Estimate the program complexity of the Zone Manager (one of three levels).
  - a. No time programs, control logic, or switching tables.
  - b. 10K of control logic (one time program, five switching tables, and five control loops).
  - c. 20K of control logic (multiple time programs, ten switching tables, and ten control loops). Use Fig. E-1 to determine the number of Excel 10 Controllers that can be connected to the Zone Manager.

NOTE: Where the number of Excel 10 Controllers exceeds 60 a Router is required.

4. Repeat the calculation for each Q7750A Excel 10 Zone Manager in the project.

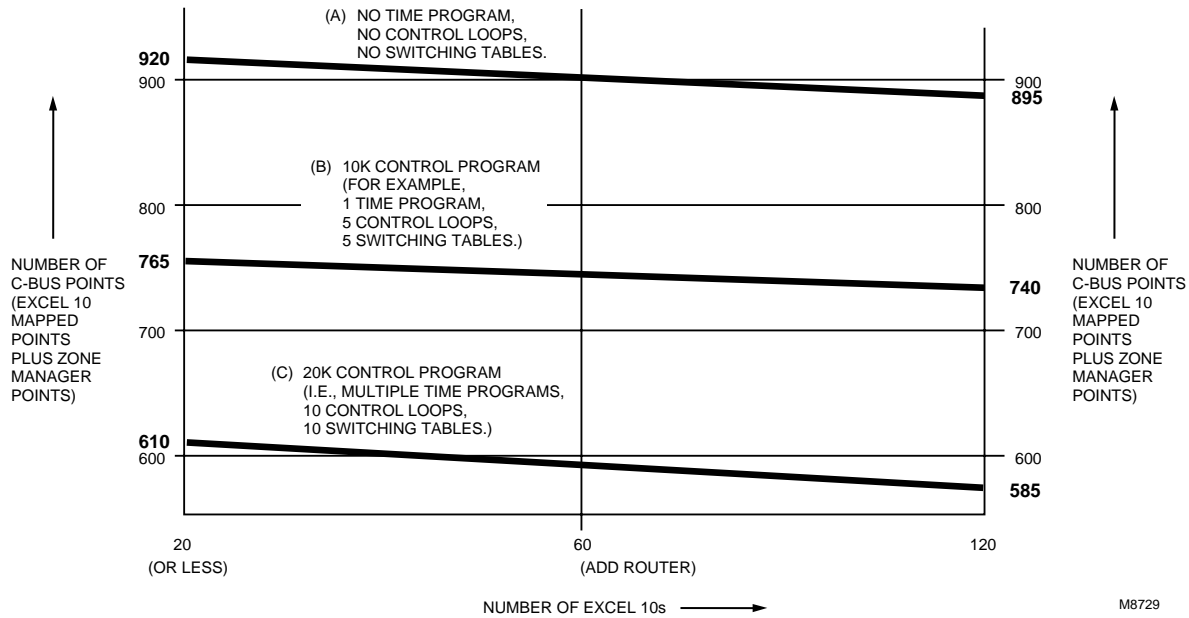


Fig. E-1. Point capacity estimate for Zone Manager.

The exact equation to use to calculate memory size is:

- Memory size = 21,780
- + 4096 (in case of a time program)
- + CARE Control Program
- + 14 x time points x Excel 10 Controllers
- + 50 x Excel 10 Controllers
- + map complexity x Excel 10 Controllers x mapped points
- + 57 x C-Bus points
- + 7488 x Excel 10 Controller types

Where:

- time points = number of switch points in time program per Excel 10 VAV Controller
- Excel 10 Controllers = number of attached Excel 10 VAV Controllers
- C-Bus points = including mapped points and others; for example, Remote Points
- Mapped points = number of mapped points for each Excel 10 VAV Controller, including One-to-Many and Many-to-One mechanism
- Excel 10 Controller types = number of different Excel 10 Controller types (currently four)
- Map complexity =
  - 20 = using One-to-Many and not using points with read/write ability
  - 30 = average
  - 45 = many points with read/write ability

## APPENDIX F. Custom Flow Pickup Tables (not Applicable for Pressure Dependent Applications).

A major function of the Excel 10 VAV Controller is to measure air flow from multi-point flow pickup assemblies installed in the supply duct of terminal air units. To provide the most accurate measurements of this flow, the Excel 10 VAV Controller is designed to accept flow pickup tables for the specific pickup assembly installed. Tables for many of the standard terminal unit manufacturer pickup assemblies are provided as a CARE option selection during Excel 10 plant configuration (see Applicable Literature section for CARE User manual document numbers).

To add custom pickup tables to CARE when a flow sensor assembly is not currently in the CARE selection list, a table can be added which is a correlation listing various differential pressures versus flow velocities used to provide corrected flow calculations.

NOTE: These tables are in units of inches of water column Inw (kPa) to flow velocity in Feet Per Minute (FPM), or in meters per second (m/s).

Table F-1 is a sample of the table to use to enter values for the custom flow pickup table in CARE.

**Table F-1. Sample Table.**

Differential Pressure Inw (kPa)		Flow Velocity FPM (L/sec)	
0.00		0	
0.01	(0.0025)	280	(142)
0.02	(0.005)	396	(201)
0.04	(0.001)	560	(284)
0.08	(0.02)	792	(402)
0.15	(0.0375)	1084	(551)
0.30	(0.075)	1534	(779)
0.60	(0.15)	2169	(1102)
1.00	(0.25)	2800	(1422)
1.50	(0.375)	3429	(1742)

Restrictions and requirements for these tables:

1. First entry must be 0.00 differential pressure and 0 velocity.
2. Maximum differential pressure entry must not be greater than 2.00 Inw (0.5 kPa).
3. Maximum flow velocity entry must not be greater than 3500 FPM (1778 L/sec).
4. All entries must be sequential and increasing in values.
5. Although differential pressure steps are not specified, it is better to have increased resolution at the lower ranges where most control occurs (the preceding steps are a good starting point).

There are various methods where suppliers of the flow pickup assemblies provide data that can be used to create this table. In most cases, some conversion is required to prepare this data for entry. Examples of the steps for various information provided by the flow pickup supplier are described in Methods 1 and 2.

### Method 1. Pressure Velocity Formula

In some cases, the flow pickup supplier will furnish a formula that provides a relationship between differential pressure and flow velocity. These formulas are independent of duct size and are the easiest to convert to the required flow pickup table as follows:

Metal Industries Series 400 flow pickup has the following pressure/velocity relationship:

$$P_v = (V/2800)^2$$

Where:

( $P_v$  is differential pressure in Inw).  
( $V$  is flow velocity in FPM).

This formula can be rewritten, for convenience, to solve for Velocity:

$$V = (P_v)^{1/2} \times 2800$$

By selecting the desired values for  $P_v$  such as (0.01, 0.02, 0.04, etc.), Table F-1 can be generated; for example, at 0.6 Inw.

$$V = (0.6)^{1/2} \times 2800 = 2168.87 \text{ FPM (1102 L/sec).}$$

Also, note that at the maximum differential pressure table entry of 2.00 Inw (0.5 kPa), the velocity would be 3960 FPM (2012 L/sec), which would exceed the maximum velocity entry of 3500 (1778 L/sec). In this case, another pressure value was selected so the resulting velocity value would be less than 3500 FPM (1778 L/sec). (For this case, the flow velocity at 1.5 Inw (0.375 kPa) is 3429 FPM (1742 L/sec).)

### Method 2. Pressure Versus Flow Graph

In almost all cases, the flow pickup supplier will provide a graph for variously sized boxes with the relationship between flow, in CFM and differential pressure in Inw. An example of the format of this graph is shown in Fig. F-1.

The procedure needed to create the required custom flow pickup table for CARE involves some estimation in reading these charts and additional math to convert to the required units.

For a specific box size that is 10 inches, sets of readings of differential pressure Inw and flow (CFM) must be obtained. These flow readings must then be converted to velocity in FPM by dividing by the duct area for the specific box (for a 10 inch box, the area is 0.545 ft<sup>2</sup> (0.05 m<sup>2</sup>)).

For box type 410 (10 inch box) in Fig. F-1, these values would be as listed in Tables F-2 and F-3 (subject to interpretation of accurately reading these graphs).

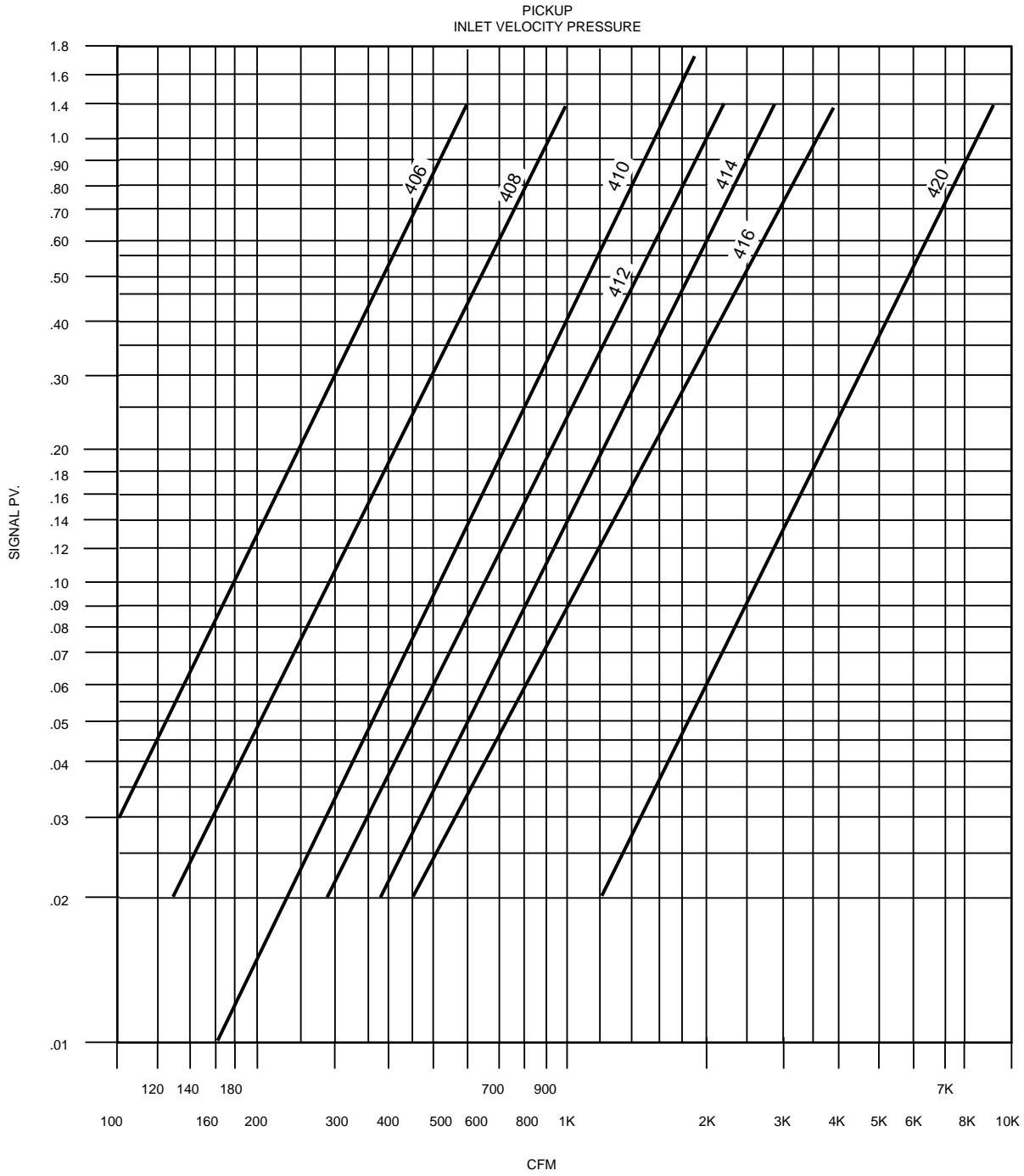


Fig. F-1. Pressure versus flow.

M4502



**Table F-2. Sample Readings in CFM (m3s).**

Inw (kPa)	CFM (m3s)
0.00	0
0.01 (0.0025)	160 (272)
0.02 (0.005)	230 (391)
0.04 (0.001)	320 (544)
0.08 (0.02)	450 (764)
0.15 (0.0375)	600 (1019)
0.30 (0.075)	860 (1461)
0.60 (0.15)	1100 (1869)
1.00 (0.25)	1575 (2675)
1.50 (0.375)	1900 (3228)

Then, applying the formula:  
 $FPM = CFM/Area$

Where:  
 Area is 0.545, and adding the 0/0 starting point, the final table is established.

**Table F-3. Sample Readings in FPM (m/s).**

Inw (kPa)	FPM (m/s)
0.00	0
0.01 (0.0025)	294 (1.49)
0.02 (0.005)	422 (2.14)
0.04 (0.001)	587 (2.98)
0.08 (0.02)	826 (4.2)
0.15 (0.0375)	1101 (5.59)
0.30 (0.075)	1578 (8.02)
0.60 (0.15)	2018 (10.25)
1.00 (0.25)	2890 (14.68)
1.50 (0.375)	3486 (17.71)

NOTE: Even though Table F-3 is for the same sensor that was described in Method 1, these values are similar but not the same as the values in Table F-1.

The error encountered in manually reading values from a chart can be minimized by using a large, clear chart. The final errors of differential pressure versus velocity (regardless of method obtained) can be corrected during air flow balancing at the job.

Additional methods of providing data for air flow pickup assemblies are:

Table of Flow CFM versus differential pressure for each duct size.

K factors for each duct size, typically in a formula similar to:

$$CFM = (Pv)^{1/2} \times K$$

In each case, methods similar to the two preceding descriptions can be used to create the required differential pressure versus velocity table required for the Excel 10 VAV Controller.

In general, when tables for different duct sizes vary less than one or two percent at each reading, a combined table (typically, an average reading at each differential pressure step) can be created and used.





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