



SERIES 7000



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GENERAL NOTES

- All data herein is subject to change without notice. Refer to www.enviro-tec.com for current catalog and control sequence drawings.
- Refer to IOM manual at www.enviro-tec.com.
- Refer to Series 7000 Application Guide and sequence drawings at www.enviro-tec.com.
- See Analog Electronic Controls drawings at www.enviro-tec.com for connections.

ANALOG VARIABLE AIR VOLUME TERMINAL CONTROLS ARE A COST EFFECTIVE ALTERNATIVE TO DDC CONTROLS

Fierce competition motivates commercial office building owners and real estate managers to provide comfortable office space while minimizing air conditioning power consumption and initial construction costs. Direct Digital Controls (DDC) are frequently mounted on each variable air volume (VAV) terminal, permitting communication between the automation system central monitor and each VAV unit. State-of-the-art Analog Electronic Controls (AEC) for VAV terminals provide a viable lower cost alternative to DDC control.

Both sophisticated, solid state Analog Electronic and DDC VAV controllers provide superior zone comfort by minimizing room temperature deviation from setpoint. Both systems permit night setback and morning warm-up operation. Both allow the user to factory and/or field set minimum and maximum airflow settings. Both provide pressure independent control. Neither requires annual calibration as do the proportional pneumatic controllers.

In view of the cost difference between Analog Electronic controllers and DDC controllers (see tables at right), when should the owner and HVAC system designer use DDC VAV control?

DDC control systems provide two way communications between the VAV terminal controllers and the automation system front end. A building manager, from his office, can view zone temperatures, VAV unit operating status, zone airflow rates, and zone heating and cooling setpoints. He can reset zone temperature setpoints and

What is the First Cost Premium for DDC Communications Between VAV Terminals and the Building Automation Front End?

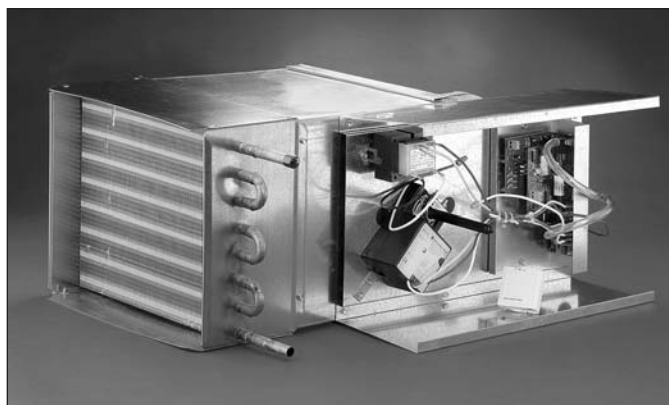
The VAV controller type significantly impacts the building cost. The VAV controller contributes between \$.21 and \$1.44 per square foot to the initial cost of a building. The first cost of a DDC VAV controller is more than the cost of the VAV single zone terminal. The analog VAV control is less than half the cost of the DDC control.

DDC vs. ANALOG CONTROL COSTS

	Analog Controls	DDC Controls
Controller & Thermostat	\$152	\$257
Wiring & Setup	\$40	\$175
Total	\$192	\$432

VAV CONTROLS COST PER SQUARE FOOT

	Analog Controls		DDC Controls	
Average Zone Area	300 Sq. Ft.	900 Sq. Ft.	300 Sq. Ft.	900 Sq. Ft.
Cost per Square Foot	\$.64	\$.21	\$1.44	\$.48



ENVIRO-TEC[®] electronic analog and DDC controllers are quality tested for 24 hours prior to final assembly within a NEMA 1 enclosure with transformer and unit safeties. All terminal units and control assemblies are ETL listed with the electronic controllers factory mounted. ENVIRO-TEC[®] onboard transducers and FlowStar[™] airflow sensors are capable of accurately controlling at lower airflow rates than typically available in the industry.

minimum and maximum airflow limits. Zone controllers can send an alarm to the central monitor when abnormal conditions arise. These are powerful tools which meet requirements for some owners and tenants.

However, for the typical office space, the owner may find it more cost effective to limit DDC building automation to large chillers, boilers, major air handling units, fire and life safety systems, and other critical applications.

For non-critical zones, VAV zone terminals may only require Analog Electronic Controllers with system interlock controls. The VAV Analog Electronic Controls have the same dependability and accuracy as DDC Controls. They also allow the minimum and maximum CFM setpoints to be adjusted from the local space thermostat for ease of balancing the airside of the HVAC system. In addition, the Series 7000 Analog Electronic Controls incorporate a plug-in modular design for ease of adding features such as morning warm-up, night set back and additional stages of heat, without replacing the original master controller.

Communications wiring for DDC controllers may become prohibitive when great distances or remote buildings are involved. In those cases, stand-alone Analog Electronic Controls may be the only practical choice.

Commissioning DDC VAV systems requires factory trained staff familiar with DDC hardware and software, increasing the installed costs of DDC systems. The operating cost also increases because the owner has to employ highly trained technicians to maintain the system or pay for expensive yearly

maintenance contracts from the local controls manufacture representative.

When renovating buildings that have pneumatic controls or expanding campuses that have long used pneumatic VAV controls, the owner should consider replacing the pneumatic controls with Analog Electronic VAV Controls. Analog Electronic VAV Controls enjoy several advantages over their pneumatic counterparts with approximately the same initial installed first cost.

- Analog controls eliminate the first cost of air compressors, filters and driers.
- Analog controls, unlike pneumatic, do not require annual calibration of thermostat and controllers.
- Air compressor, pneumatic piping and filter/drier maintenance and operating costs are eliminated.
- Analog controllers maintain space temperatures within plus or minus 1° F which provides better comfort and greater energy efficiency than pneumatic controllers.

Many VAV system renovations are accomplished without replacing the sheet metal VAV terminals. Control system problems, such as malfunctioning VAV controllers and oil and water in pneumatic tubing, often have rendered a VAV system inoperable. Failure to annually calibrate pneumatic controls can also render the VAV system inoperable. In these instances, the system can be repaired by changing only the controls. Pressure dependent systems can be upgraded to a pressure independent systems by adding duct airflow sensor kits.

Savings to the owner can be substantial. VAV terminals and ductwork are reused. Disturbance of the ceiling is minimal. The controls retrofit is done in a fraction of the time that a complete renovation might take.

Conclusion:

Stand-alone, Analog Electronic VAV Controllers offer the same reliability and low maintenance as DDC controls at a much lower operating and first cost. In addition, analog electronic controls require only a standard volt/ohms multi-meter for setup and calibration, whereas DDC controls require a laptop or PC computer with expensive software and in many cases, costly specialized product training. One of the only advantages of the DDC alternative, is the communication with the PC workstation front end. As building owners and designers develop new projects and renovate existing properties, careful economic analysis will be required when selecting between Analog Electronic and communicating DDC control systems.



ENVIRO-TEC® electronic control retrofit kits facilitate field renovations of existing VAV terminals. All electronic analog control sequences include NEMA 1 enclosures and transformers. Model RFT-MS airflow sensors and flow sensing stations are available when renovating pressure dependent systems and converting to pressure independent control. ENVIRO-TEC® retrofit control kits can be installed on the existing VAV terminals of most manufacturers.

SERIES 7000 MODULAR, PRESSURE INDEPENDENT VAV CONTROL SYSTEM

The heart of the Series 7000 Control System is the master controller. It incorporates a differential pressure transducer, airflow control and air valve modulation circuitry, and a DC power supply. With a thermostat and actuator, it serves as a stand-alone cooling only, pressure independent VAV control system. The master controller also includes connectors to allow modules to be added in the factory or field to configure the system for various types of terminals: single or dual duct, series flow or variable volume fan. Other standard options are discussed below.

FLOW SENSING METHOD

A center averaging differential pressure sensor (FlowStar™) located in the inlet collar of the VAV terminal is piped to a hot wire differential pressure transducer located within the electronic controller. A small orifice in the transducer creates a minute airflow which is proportional to the differential pressure. This flow passes over a hot thermistor, causing an increase in dissipation and increasing its resistance. Since cooler air would also have the effect of increasing resistance, a second thermistor is incorporated for temperature compensation. The electronic circuitry causes a constant difference in resistance (temperature) between the two thermistors by increasing power to the hot thermistor as flow increases, and decreasing power to the hot thermistor as flow decreases. The power required to maintain this constant difference is the parameter used for flow control.

AIR VALVE CONTROL

The electronic signal developed by the differential pressure transducer is compared to a signal developed from a rapid response thermistor within the electronic thermostat. Setpoint corresponds to the minimum flow limit set at the thermostat. The electronic controller modulates the air valve actuator from minimum flow to maximum flow (also set at the thermostat) to provide cooling as necessary to maintain space temperature. As the actual airflow approaches airflow setpoint, the actuator control circuitry uses pulse width modulation (PWM) to slow the rate of change of the airflow, thus preventing overshoot and hunting. A calibration curve of DC voltage vs. CFM is provided so that flow limits may be set without actual airflow being present.

HEAT / FAN CONTROL

Four types of heat and two types of fan control are available with the Series 7000. Heat options include staged electric or hot water, floating modulating hot water, proportional modulating hot water or proportional modulating SSR electric heat. Either terminal and/or baseboard heat may be controlled.

Both variable volume and series flow fan control strategies are available. For variable volume applications, the unit fan is energized one degree below setpoint. A half degree of hysteresis prevents rapid cycling. For series flow applications, the fan runs constantly during day mode.

Two methods of reverse fan rotation are provided on series flow fan terminals. If system air is failed, the primary air valve is closed and the fan is de-energized to prevent re-application of air from spinning the fan wheel in reverse before the fan restarts. On application of power to the terminal, the primary air valve is closed for three to five minutes before the fan is started, in case primary air had spun the fan wheel in reverse before the fan terminal was powered.

For staged heat applications, a stage of electric or hot water heat is energized two degrees below setpoint. Up to two additional stages may also be energized at three and four degrees below setpoint. All stages are provided with a half degree of hysteresis to prevent rapid cycling.

In floating modulating applications, the valve actuator is pulsed in the open direction when the space temperature reaches two degrees below setpoint. If the temperature continues to fall, the valve actuator is pulsed again in the open direction. If the temperature does not decrease, the valve actuator is not energized, thus remaining in position. On an increase in space temperature, the valve actuator is pulsed in the closed direction. The length of the pulses is proportional to the temperature difference from two degrees below setpoint.

An analog signal is used to position a hot water valve actuator in proportional hot water heat applications. When space temperature drops to two degrees below setpoint, the valve is positioned open slightly. If temperature continues to drop, the valve actuator is positioned further open. If temperature rises, the valve actuator is positioned in the closed direction. The degree of position change is dependent on the temperature difference from two degrees below setpoint.

Proportional electric heat applications use an analog signal to control a voltage to a pulse width modulation (PWM) circuit which in turn, time proportions the on and off times of an SSR (solid state relay). When space temperature falls two degrees below setpoint, very short pulses of current provide a small amount of heat. As space temperature continues to fall, the pulses become longer to provide more heat.

All types of heat applications for single duct VAV terminals feature an auxiliary (heating) minimum. When heat is energized in these applications, minimum airflow setpoint is increased to a field adjustable volume for optimal airflow with heat.

NIGHT SETBACK

An airflow switch senses when the main air handlers have been shut down, initiating night setback. The controller causes the air valve actuator to close the valve. When space temperature falls to an offset value set on a setback/

warm-up module, the fan is energized and heat is modulated to maintain temperature. The setpoint temperature in this mode is the day setpoint minus the offset value.

MORNING WARMUP/ AUTOMATIC CHANGEOVER

An electronic duct sensor signals the presence of warm supply air to the terminal, which inhibits heat and fan operation and drives the air valve open to the maximum airflow setpoint. When the thermostat is satisfied, the controller drives the air valve as necessary to maintain setpoint. For applications such as gas-fired central heat requiring constant airflow across the heater, a constant volume version of morning warm-up is available. On sensing warm supply air, the air valve is driven to maximum airflow setpoint. This setpoint is maintained until cool primary supply air is sensed, when the air valve begins modulating in the day (cooling) mode.

PRESSURE CONTROL

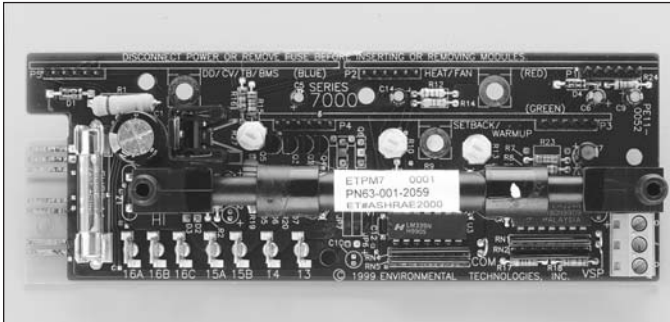
Two control sequences provide a means of controlling static pressure in applications utilizing a constant volume air handler. The controller is mounted in a sheet metal enclosure which incorporates an integral static pressure probe. This assembly is mounted on the main duct with the probe inserted into the duct. As static pressure increases, the electronic controller sends a signal to open a pressure regulating air valve which will bypass air to the return plenum. As static pressure decreases, the air valve is driven closed, thus bypassing less

air and maintaining constant static pressure in the duct.

WARRANTY

The Series 7000 analog electronic controls are warranted for 18 months from shipment or 12 months from start-up, whichever comes first.

SERIES 7000 PRESSURE INDEPENDENT MASTER CONTROLLER



SPECIFICATIONS

Supply Voltage

- 24VAC - 10%, + 15%, 50/60Hz

Power Consumption

- 10 VA max. (including actuator)

Flow Sensing Method

- Center Averaging FlowStar™ Differential Pressure Sensor and Hot Wire Differential Pressure Transducer

Range

- 0.015" - 1.5" w.g.

Thermostat Outputs

- +18 VDC (short circuit protected)
- DC Common

Thermostat Inputs

- Flow Setpoint Voltage

Actuator Control Outputs

- Pulse Width Modulated
- Operates with a 3 wire floating point actuator

Sensor Inputs

- Differential Pressure Transducer (tubing)

Connections

- Screw Type, Terminal Block (thermostat)
- 1/4" Quick Connect (24VAC input and actuator outputs)
- 0.025" 50 pin headers (modules)

Ambient Storage Temperature

- -35°F to 150°F, 0 to 95% rH, non-condensing

Ambient Operating Temperature

- 35°F to 120°F, 10 to 95% rH, non-condensing

Size

- 2.25"W x 6.125"L

Enclosure (Bracket) Material Size

- 4.375"W x 7.5"L x 2.625"D

This device is an electronic printed circuit board assembly housed in a sheet metal enclosure. A hot-wire differential pressure transducer is mounted on the printed circuit board. A computer generated label indicates controller type, inventory number, and factory order number. High and low ports, along with terminal number designations are screened on the printed circuit board.

CONNECTIONS

Thermostat connections are fixed screw terminal type for rapid installation and servicing. Field connections are made by stripping wire approximately 1/4", inserting wire in connector, and tightening screw firmly. 24VAC input connections are 1/4" quick disconnect type. All wiring except input power and thermostat are provided by the factory.

The ports of the pressure transducer are located on the printed circuit board. Flexible tubing provides airtight, kink-free connection to transitions through the wall of the sheet metal enclosure. 1/4" I.D. flame retardant tubing is used for piping external to the sheet metal enclosure. Piping is provided at the factory, except in retrofit applications.

Modular design allows for ease of adding optional features to the master controller. Connectors are provided on the electronic printed circuit board to accept the heat/fan, setback/warm-up and/or flow control modules. Modules are color-coded for visual aid in selecting the desired temperature control sequence.

CALIBRATION

The pressure transducer is pre-calibrated at the factory. It should never need recalibration and cannot be calibrated in the field.

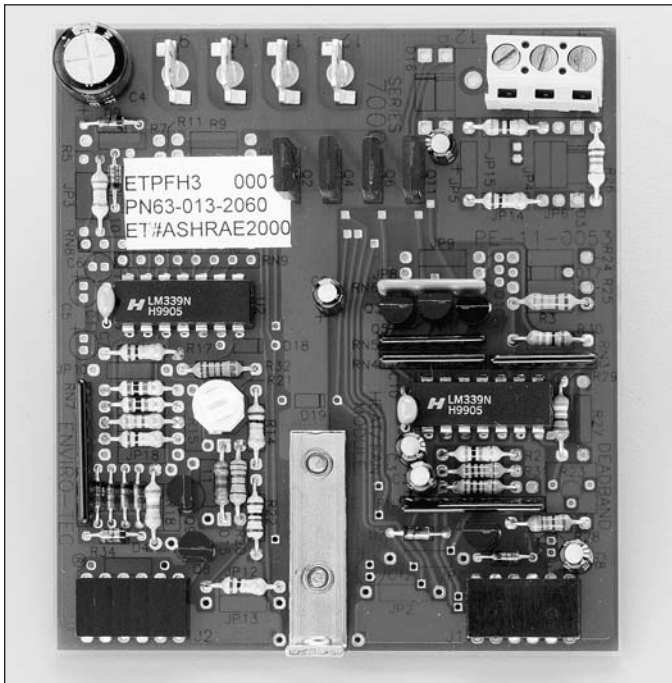
MOUNTING

Attaches to mounting plate with plastic standoffs. May be mounted in any position. Controllers are factory mounted, except on some retrofit applications.

MAINTENANCE

Input power must be maintained within specified limits. No other maintenance is necessary.

HEAT / FAN MODULES



SPECIFICATIONS

Supply Voltage

- 18 VDC \pm 3% (from Master Controller)

Thermostat Inputs

- Heat Demand Voltage

Thermostat Outputs

- Auxiliary (Heating) Minimum Select

Sensor Inputs

- Pressure Switch

Control Outputs

- 0-10 / 2-10 VDC (proportional heat)
- 24 VAC, 15 VA max. each (staged or floating heat)

Connections

- Screw Type, Terminal Block (thermostat & sensors)
- 1/4" Quick Connect (24 VAC control outputs)
- Through-mount Receptacle (master controller)

Ambient Storage Temperature

- -35°F to 150°F, 0 to 95% rH, non-condensing

Ambient Operating Temperature

- 35°F to 120°F, 5 to 95% rH, non-condensing

Size

- 3.10"W x 3.45"L

PCB Color Code

- Red

NOTE: Specific input and output configurations will vary depending on model.

MODELS

ETPFH3: 3 staged heat outputs w/auxiliary (heating) minimum. Staged outputs are energized at 2°F, 3°F and 4°F below temperature setpoint.

ETPFH2: Constant fan output with two staged heat outputs. Stages are energized at 2°F and 3°F below temperature setpoint. On application of power, damper closes and fan stays off for three minutes to prevent reverse fan rotation. A pressure switch input allows damper to be closed and fan de-energized for night operation.

ETPHM1: Proportional 10-2 VDC (N.O.) modulating heat output w/auxiliary (heating) minimum. Output is off at 2°F below temperature setpoint, full on at 5°F below setpoint.

ETPFVHM1: Variable fan output and proportional 10-2 VDC (N.O.) modulating heat output. Fan energizes 1°F below temperature setpoint. Heat output is off at 2°F below setpoint, full on at 5°F below setpoint.

ETPFHMI: Constant fan output and proportional 10-2 VDC (N.O.) modulating heat output. Heat output is off at 2°F below setpoint, full on at 5°F below setpoint. On application of power, damper closes and fan stays off for three minutes to prevent reverse fan rotation. A pressure switch input allows damper to be closed and fan de-energized for night operation.

ETPHM2: Floating, modulating (tri-state) heat output without auxiliary (heating) minimum. Modulates at 2°F below temperature setpoint.

ETPFVHM2: Variable fan output and floating, modulating (tri-state) heat output. Fan energizes 1°F below temperature setpoint. Heat modulates at 2°F below temperature setpoint.

ETPFHM2: Constant fan output and floating, modulating (tri-state) heat output. Heat modulates at 2°F below temperature setpoint. On application of power, damper closes and fan stays off for three minutes to prevent reverse fan rotation. A pressure switch input allows damper to be closed and fan de-energized for night operation.

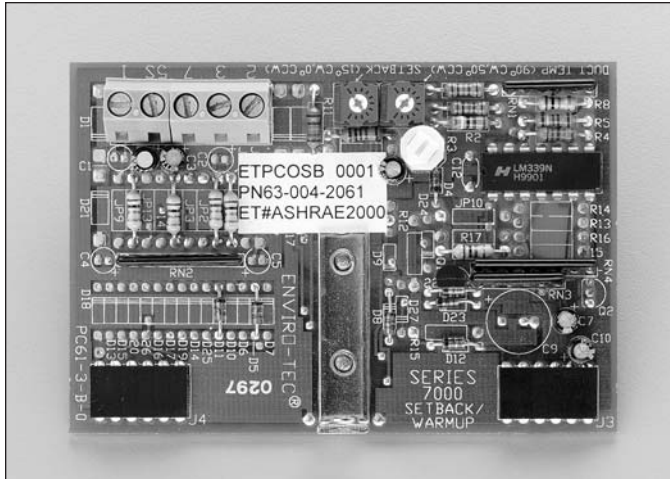
ETPHM3: Proportional 2-10 VDC modulating heat output for SSR applications w/auxiliary (heating) minimum. Output is off at 2°F below temperature setpoint, full on at 5°F below setpoint.

ETPFVHM3: Variable fan output and proportional 2-10 VDC modulating heat output. Fan energizes 1°F below temperature setpoint. Heat output is off at 2°F below setpoint, full on at 5°F below setpoint.

ETPFHM3: Constant fan output and proportional 2-10 VDC modulating heat output for SSR applications. Heat output is off at 2°F below setpoint, full on at 5°F below setpoint. On application of power, damper closes and fan stays off for three minutes to prevent reverse fan rotation. A pressure switch input allows damper to be closed and fan de-energized for night operation.

ETPFH3: Constant fan output with 3 staged heat outputs. Stages are energized at 2°F, 3°F and 4°F below temperature setpoint. On application of power, damper closes and fan stays off for three minutes to prevent reverse fan rotation. A pressure switch input allows damper to be closed and fan de-energized for night operation.

SETBACK / WARM-UP MODULES



SPECIFICATIONS

Supply Voltage

- 18 VDC \pm 3% (from Master Controller)

Thermostat Inputs

- Heat Demand Voltage

Thermostat Outputs

- Cooling/Heating Select

Sensor Inputs

- Duct Temperature Sensor
- Pressure Switch

Connections

- Screw Type, Terminal Block (thermostat & sensors)
- Through-mount Receptacle (master controller)

Ambient Storage Temperature

- -35°F to 150°F, 0 to 95% rH, non-condensing

Ambient Operating Temperature

- 35°F to 120°F, 5 to 95% rH, non-condensing

Size

- 3.45"W x 2.40"L

PCB Color Code

- Green

NOTE: Specific input and output configurations will vary depending on model.

MODELS

ETPCO: Changeover or modulating warmup. Damper reverses modulation when an inlet duct sensor senses warm air. Contact closure may be used in lieu of duct sensor, if desired.

ETPSB: Night setback. Pressure switch input causes damper to close and fan and heat to cycle around an adjustable offset from day temperature setpoint.

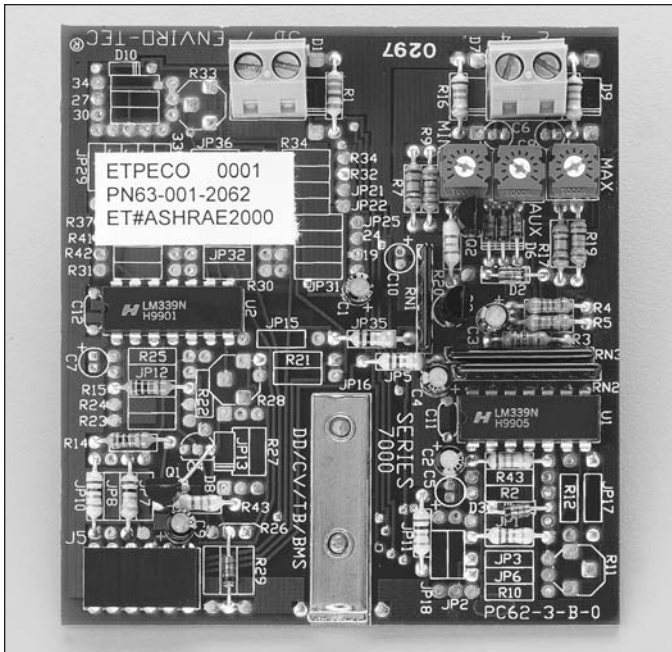
ETPW: Fixed warmup. Damper goes to maximum airflow setpoint when an inlet duct sensor senses warm air. Contact closure may be used in lieu of duct sensor, if desired.

ETPCOSB: Night setback and changeover/modulating warmup. Pressure switch input causes damper to close and fan and heat to cycle around an adjustable offset from day temperature setpoint. Damper reverses modulation when an inlet duct sensor senses warm air. Contact closure may be used in lieu of duct sensor, if desired.

ETPWSB: Night setback and fixed warmup. Pressure switch input causes damper to close and fan and heat to cycle around an adjustable offset from day temperature setpoint. Damper goes to maximum airflow setpoint when an inlet duct sensor senses warm air. Contact closure may be used in lieu of duct sensor, if desired.

ETPSR: Return or discharge air temperature control.

FLOW CONTROL MODULES



SPECIFICATIONS

Supply Voltage

- 18 VDC \pm 3% (from Master Controller)

Thermostat Inputs

- Heat Demand Voltage
- Tracking Offset

Module Inputs

- Auxiliary Minimum Select
- Cooling / Heating Select

Control Inputs

- 2-10 VDC or 4-20 mADC (BMS control)

Control Outputs

- 2-10 VDC or 4-20 mADC (flow indication)

Connections

- Screw Type, Terminal Block (thermostat & sensors)
- Through-mount Receptacle (master controller)

Ambient Storage Temperature

- -35°F to 150°F, 0 to 95% rH, non-condensing

Ambient Operating Temperature

- 35°F to 120°F, 5 to 95% rH, non-condensing

Size

- 3.00"W x 3.25"L

PCB Color Code

- Blue

NOTE: Specific input and output configurations will vary depending on model.

MODELS

ETPCV2: Two constant primary air volumes. Particular volume selected through contact closure. Separate input allows damper to be closed on contact closure.

ETPUC: Cold deck control for dual duct applications. Includes airflow adjustments.

ETPUH: Hot deck control for dual duct applications. Includes airflow adjustments and temperature offset adjustment.

ETPEIO: Analog slave for BMS control on SDR and VFR applications. 2-10 VDC control input from BMS and 2-10 VDC flow indication output to BMS. Includes airflow adjustments and dual minimums.

ETPFEIO: Analog slave for BMS control on CFR applications. 2-10 VDC control input from BMS and 2-10 VDC flow indication output to BMS. Includes airflow adjustments.

ETPECO: Airflow adjustments with changeover input and dual minimums.

ANALOG ELECTRONIC THERMOSTAT



SPECIFICATIONS

Temperature Sensor:

Rapid response, glass encapsulated, hermetically sealed thermistor.

Temperature Setpoint Range:

- 50°F to 90°F (hidden or exposed)
- 10°C to 32°C (exposed only)
- 1° Increments

Supply Voltage:

- 18 VDC \pm 3% (supplied by controller; short circuit protected)

Analog Outputs:

- Flow Setpoint Voltage
- Heat Demand Voltage

Analog Inputs:

- Cool/Heat Select
- Heat Min Select

Adjustments:

- Minimum Flow
- Maximum Flow
- Heating Minimum Flow
- Temperature Setpoint
- Temperature Calibration

Connectors:

- Protected Screw Terminal Block

Ambient Storage Temperature:

- -35°F to 140°F (-37°C to 60°C),
0 TO 95% rH, non-condensing

Ambient Operating Temperature:

- 40°F to 122°F (5°C to 50°C),
5 TO 95% rH, non-condensing

Size:

- 2.0"W x 2.0"H x 0.6"D
(51 x 51 x 15 mm)

The Johnson Controls model ETST5AW analog electronic thermostat is used with Series 7000 pressure independent controllers and optional modules to control both fan powered and single duct variable air volume terminals in HVAC systems. The thermostat provides accurate control of space temperature in an attractive, low profile unit. It includes minimum and maximum air volume limit adjustments for ease of balancing. Options include hidden or exposed temperature setpoint, English or metric setpoint scale, and locking cover. Several mounting methods are available.

FEATURES

- Low profile contemporary design
- External screw terminal block for easier field termination
- Minimum and maximum air volume limits are located at the thermostat for convenience of balancing
- A separate heating minimum air volume setpoint is provided for use with single duct VAV reheat terminals
- Concealed setpoint or exposed temperature setpoint adjustment with English or metric scale

TEST AND BALANCE

Air volume limits are set using airflow calibration curves and a digital voltmeter or flow hood. Instructions are provided in the Installation, Operation and Maintenance Manual for ENVIRO-TEC[®] Series 7000 Analog Electronic Controls.

CALIBRATION

Thermostats are factory calibrated and rarely require field temperature calibration.

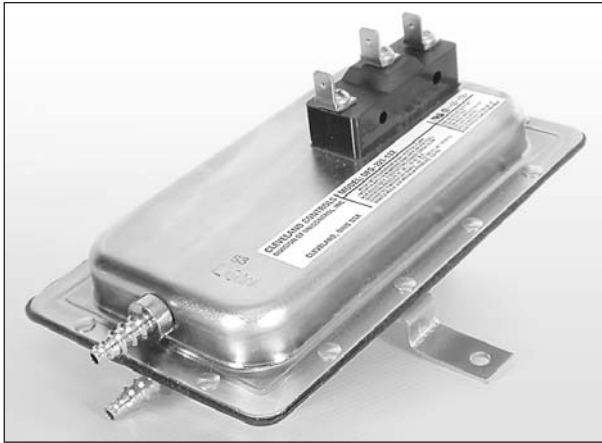
MOUNTING

All necessary screws, wall anchors, and a junction box plate are provided to mount the 2" thermostat to dry wall or a vertical or horizontal single gang junction box.

MAINTENANCE

The 2" thermostat requires no routine maintenance or calibration.

AIR PRESSURE SWITCH



SPECIFICATIONS

Voltage:

- 278 VA pilot duty @ 24 VAC
- 300 VA pilot duty @ 120 to 277 VAC

Electrical Switch:

- Single pole, normally closed, snap acting contacts

Electrical Connection:

- 1/4" male quick-connect terminals

Operating Pressure:

- Fixed - 0.05" w.g. (± 0.02 " w.g.)
- Adjustable - 0.05" w.g. (± 0.02 " w.g.) to 12.0" w.g.

Maximum Pressure:

- 1/2 PSIG

Environmental (Storage and Operating):

- -40 to 180°F
- 5 - 95% rH, non-condensing

This device is used in conjunction with a total pressure sensor located in the primary air inlet of fan terminals. When primary air is shut down, the air pressure switch makes a contact closure, thus closing a circuit to the electronic controller. This indicates the desire for night time operation and the controller goes into the night setback mode.

CONNECTIONS

Two barbed fittings are provided for standard 3/8" O.D. flexible tubing to sample total and/or static pressure signals.

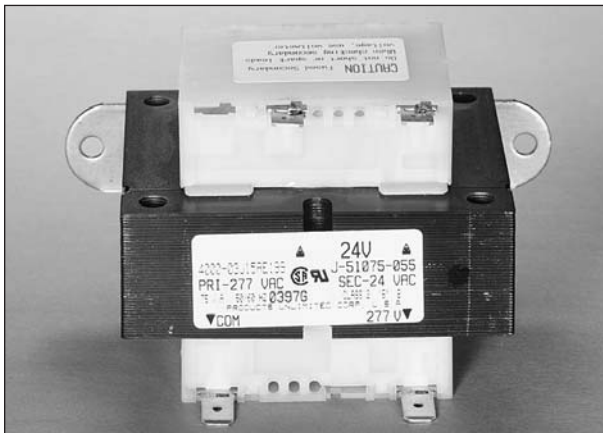
MOUNTING

This device is secured to terminal by two sheet metal screws through mounting holes located on a bracket. It should be mounted in the vertical plane so the internal diaphragm is not working against gravity.

MAINTENANCE

No routine maintenance is required

TRANSFORMER



SPECIFICATIONS

Secondary Voltage:

- 24 VAC, $\pm 15\%$, 50/60 Hz
- 50 VA standard, 75 VA available
- Higher VA's available on special order

Primary Voltages Available:

- 120, 208, 240, 277, 480 VAC
- All Single Phase

This device provides the control voltage (24 VAC) to the controller, actuator, and contactors from a high voltage source in the building. This device is a UL rated component. Where applicable, it is incorporated in the electric heater or fan power circuitry.

CONNECTIONS

All primary and secondary voltages are connected via spade type terminals.

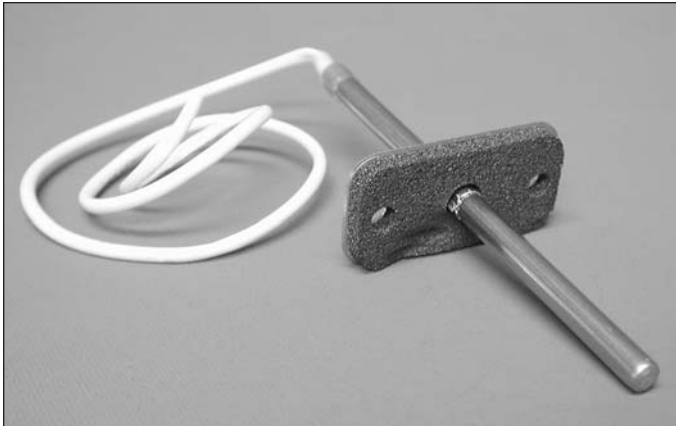
MOUNTING

This device is factory mounted using sheet metal screws.

MAINTENANCE

No routine maintenance is required.

DUCT TEMPERATURE SENSOR



This device incorporates a rapid response, glass encapsulated, hermetically sealed thermistor and linearization network encapsulated in flame retardant tubing. An aluminum tube and flange support the device's cable and allow mounting to ductwork.

CALIBRATION

This device is pre-calibrated at the factory to a specific controller bearing a matching serial number. For field replacement, calibration instructions are provided in the Installation, Operation and Maintenance manual for ENVIRO-TEC[®] Series 7000 Analog Electronic Controls.

SPECIFICATIONS

Resistance:

- 22.1 Kohm, ± 10% at 77°F, NCT

Ambient Storage Temperature:

- -35 to 150°F, 0 to 95% rH, non-condensing

Ambient Operating Temperature:

- 0 to 120°F, 10 to 95% rH, non-condensing

MOUNTING

This device is factory mounted to the air valve inlet using two sheet metal screws, except in retrofit applications.

MAINTENANCE

No routine maintenance is required.


FLOATING POINT CONTROL DIRECT COUPLED ACTUATOR

Refer to the M9104 Series Product Bulletin at www.enviro-tec.com

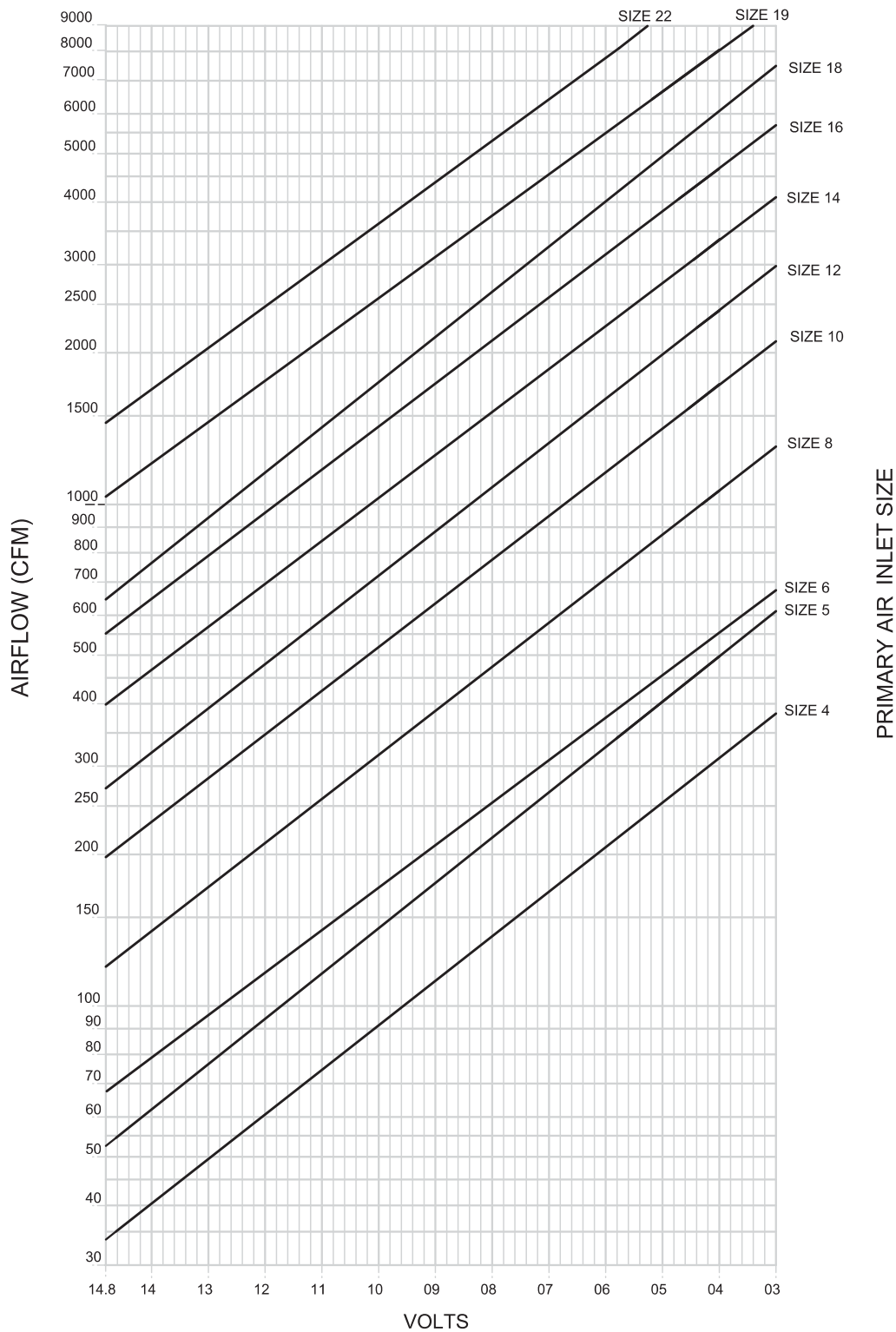
AIRFLOW RANGES (CFM)

ENVIRO-TEC [®] TERMINAL INLET SIZE	SERIES 7000 ANALOG ELECTRONIC	
	MINIMUM*	MAXIMUM
4	35	225
5	55	350
6	65	550
8	120	1000
10	195	1600
12	280	2300
14	400	3100
16	550	4100
19	1025	6500
22	1450	8000

* Factory CFM settings (except zero) will not be made below this range, due to reduction in control accuracy.

 The ENVIRO-TEC[®] Windows[®] based computer selection program is available through your ENVIRO-TEC[®] representative for complete terminal selection with Series 7000 controls.

SERIES 7000 CALIBRATION CHART



- For air terminals with a desired minimum setpoint of 0 CFM, set minimum voltage at 17 VDC.
- Sizes 6 through 22 utilize FlowStar™ multi-axis center averaging sensor.
- Sizes 4 and 5 utilize single axis, linear averaging multi-point sensor.

SINGLE AND DUAL DUCT CONTROL SEQUENCES

CONTROL SEQUENCE NUMBER	SINGLE DUCT											DUAL DUCT	
	SUMMER / WINTER CHANGEOVER OR WARM-UP (REVERSE DAMPER MODULATION)	WARM-UP (DAMPER TO MAX. CFM)	DUAL MINIMUM CFM SETPOINTS	CONSTANT VOLUME ²	STATIC PRESSURE CONTROL (0.1 - 1.0" W.C.)	STATIC PRESSURE CONTROL (0.5 - 2.5" W.C.)	NO HEAT OPTIONS (COOLING ONLY)	UP TO 3 STAGES ELECTRIC (ON/OFF) OR HOT WATER REHEAT ¹ (2 Pos.)	PROPORTIONAL MODULATING HOT WATER REHEAT ¹	FLOATING MODULATING HOT WATER REHEAT ¹	PROPORTIONAL (SSR) ELECTRIC REHEAT ¹	CONSTANT OR VARIABLE VOLUME DISCHARGE CONTROL	VARIABLE VOLUME WITH ZERO HEATING MINIMUM ³
SD7000							◆						
SD7001			◆					◆					
SD7003			◆						◆				
SD7004			◆							◆			
SD7005			◆								◆		
SD7100	◆												
SD7101	◆		◆					◆					
SD7103	◆		◆										
SD7104	◆		◆							◆			
SD7105	◆		◆								◆		
SD7300		◆					◆						
SD7301		◆	◆					◆					
SD7303		◆	◆						◆				
SD7304		◆	◆							◆			
SD7305		◆	◆	◆ ²							◆		
SD7600													
SD7606					◆								
SD7607						◆							
DT7100												◆	
DD7200													◆

Notes:

1. All Heat Options feature a separate heating minimum setpoint which may be disabled if not desired.
2. For constant volume applications with reheat, select SD7001, SD7003, SD7004, or SD7005 depending on type of heat as described.
3. Refer to Series 7000 Application Guide at www.enviro-tec.com for full sequence description.

SERIES FLOW FAN POWERED CONTROL SEQUENCES

CONTROL SEQUENCE NUMBER	SUMMER / WINTER CHANGEOVER OR WARM-UP (REVERSE DAMPER MODULATION)	WARM-UP (DAMPER TO MAX. CFM)	NIGHT ² SETBACK	NIGHT ¹ LOCKOUT	FAN AND UP TO 2 STAGES ELECTRIC (ON/OFF) OR HOT WATER REHEAT (2 Pos.)	FAN AND UP TO 3 STAGES ELECTRIC (ON/OFF) OR HOT WATER REHEAT (2 Pos.)	PROPORTIONAL MODULATING HOT WATER REHEAT	FLOATING MODULATING HOT WATER REHEAT	PROPORTIONAL (SSR) ELECTRIC REHEAT
FC7001				◆	◆				
FC7002				◆		◆			
FC7003				◆			◆		
FC7004				◆				◆	
FC7005				◆					◆
FC7101	◆			◆	◆				
FC7102	◆			◆		◆			
FC7103	◆			◆			◆		
FC7104	◆			◆				◆	
FC7105	◆			◆					◆
FC7201			◆			◆			
FC7202			◆				◆		
FC7203			◆					◆	
FC7204			◆						◆
FC7205			◆						◆
FC7301		◆		◆					
FC7302		◆		◆		◆			
FC7303		◆		◆			◆		
FC7304		◆		◆				◆	
FC7305		◆		◆					◆
FC7401		◆	◆		◆				
FC7402		◆	◆			◆			
FC7403		◆	◆				◆		
FC7404		◆	◆					◆	
FC7405		◆	◆						◆
FC7501	◆		◆		◆				
FC7502	◆		◆			◆			
FC7503	◆		◆				◆		
FC7504	◆		◆					◆	
FC7505	◆		◆						◆

Notes:

1. Night Lockout: when the air terminal temperature controller detects that the main system air is off, the primary air valve closes and the unit fan and heat are de-energized for night operation. Provided for all sequences except for those with Night Setback.
2. Night Setback: when the air terminal temperature controller detects that the main system air is off, the terminal automatically closes the primary air valve and cycles the fan and heat to maintain the offset temperature value as set on the terminal controller.

PARALLEL FLOW FAN POWERED CONTROL SEQUENCES

CONTROL SEQUENCE NUMBER	SUMMER / WINTER CHANGEOVER OR WARM-UP (REVERSE DAMPER MODULATION)	WARM-UP (DAMPER TO MAX. CFM)	NIGHT SETBACK	FAN AND UP TO 2 STAGES ELECTRIC (ON/OFF) OR HOT WATER REHEAT (2 Pos.)	FAN AND UP TO 3 STAGES ELECTRIC (ON/OFF) OR HOT WATER REHEAT (2 Pos.)	PROPORTIONAL MODULATING HOT WATER REHEAT	FLOATING MODULATING HOT WATER REHEAT	PROPORTIONAL (SSR) ELECTRIC REHEAT
FV7001				◆				
FV7002					◆			
FV7003						◆		
FV7004							◆	
FV7005								◆
FV7101	◆			◆				
FV7102	◆				◆			
FV7103	◆					◆		
FV7104	◆						◆	
FV7105	◆							◆
FV7201			◆	◆				
FV7202			◆		◆			
FV7203			◆			◆		
FV7204			◆				◆	
FV7205			◆					◆
FV7301		◆		◆				
FV7302		◆			◆			
FV7303		◆				◆		
FV7304		◆					◆	
FV7305		◆						◆
FV7401		◆	◆	◆				
FV7402		◆	◆		◆			
FV7403		◆	◆			◆		
FV7404		◆	◆				◆	
FV7405		◆	◆					◆
FV7501	◆		◆					
FV7502	◆		◆		◆			
FV7503	◆		◆			◆		
FV7504	◆		◆				◆	
FV7505	◆		◆					◆

GENERAL NOTES

Since the actions below involve control signals, they must be done with a dry contact closure (contact closure cannot be paralleled from terminal to terminal):

CLOSE DAMPER

To close the air valve, open ETPM7 terminal 6 to thermostat terminal 5.

Sample Application: Could be used during smoke sequences to isolate different areas.

OPEN DAMPER

To open the air valve fully, short ETPM7 terminal 6 to ETPM7 terminal 7.

Sample Application: Could be used by airside test and balance to set CFM of the air handler.

OPEN AIR VALVE TO MAXIMUM CFM SETPOINT

To open the air valve to maximum CFM setpoint, disable heat and disable VFR fan (if applicable), short ETPH terminal 5 to ETPH terminal 7 (if present) or ETPM7 terminal 7.

Sample Application: Could be used during airside test and balance.

DISABLE HEAT

To disable heat and heating minimum (SD only), short ETPM7 terminal 4 to ETPM7 terminal 7.

Sample Application: Could be used if boiler is off and you don't want the VAV terminals to go into heating mode.

CONNECTING MORE THAN ONE BOX TO A THERMOSTAT

To operate up to four air terminals from one thermostat, wire first terminal to thermostat per sequence diagram. Parallel connector terminals 5 (if present), 6 and 7 to other air terminals. Do not connect connector terminal 8's together as serious damage will result. Since balancing is performed at the thermostat, all air terminals should be balanced with same voltages. In addition, for best results, all air terminals connected for this application should be the same size.

Sample Application: Could be used in open area where one thermostat could sense general temperature and control several air terminals in unison.

GENERAL

Furnish and install an ENVIRO-TEC[®] Series 7000 Pressure Independent Analog Electronic Control System where indicated on the plans and in the specifications. The complete system shall be fully operational and include the following:

- Single duct, dual duct, and/or fan powered terminal units
- Pressure independent Series 7000 analog electronic zone controllers with integral differential pressure transducer
- Analog electronic wall thermostat
- Electronic air valve actuator
- 24 VAC control transformers
- Air pressure switches as required
- Electronic duct temperature sensors as required

TERMINAL UNITS

Provide terminal units with multi-axis center averaging differential pressure sensor as specified in Section ____, "Air Terminal Units."

ANALOG ELECTRONIC ZONE CONTROLLER

The fully standalone controller shall consist of an electronic circuit board with integral flow-compensated differential pressure transducer. The circuit board shall incorporate different type terminals for AC and DC connection to prevent damage caused by inadvertent field wiring errors. Thermostat, sensor and contact closure terminations shall be through screw terminal connectors for easy field termination. 24 VAC terminations shall be of the quick-connect type. The circuit board shall also incorporate an automotive-style, glass tube fuse circuit protector for ease of local replacement.

Modular design shall allow for ease of adding optional features such as fan, stages of heat, morning warm-up, summer/winter changeover, night setback and smoke purge and shall be accomplished by selecting the appropriate modular card and plugging it into the existing master controller. Controllers that require replacement to change or update options are not acceptable. The use of separately wired modules to implement optional features is not acceptable due to the increased risk of control problems from inadvertent field wiring errors and intermittent connections.

Series flow fan terminal controllers shall incorporate logic to prevent reverse rotation of the unit fan on power interruption or introduction of primary air.

REHEAT CONTROL

The plug-in Heat Modules, used with single duct or fan powered air terminal controllers, shall be capable of controlling the following types of ducted reheat: 1) Control up to three stages of Electric Duct Heat, 2) Provide 3-wire floating point control for Hot Water Reheat, 3) Provide proportional modulating control for Hot Water Reheat, 4) Provide proportional SSR control for Electric Duct Heat.

ELECTRONIC DUCT TEMPERATURE SENSOR

Where required by the control sequence, each control package shall include a supply air duct temperature sensor furnished, mounted and wired by the terminal unit manufacturer.

Summer/Winter Changeover: When the supply air temperature increases to a field adjustable setpoint, between 50° and 90°F, the controller shall automatically reverse the control action of the air valve and modulate the air valve to condition the space with warm air from the RTU or Air Handler.

Morning Warmup: When the supply air temperature increases to a field adjustable setpoint, between 50° and 90°F, the controller shall automatically drive the air valve to the Maximum CFM position and allow for conditioning of the space with warm air from the RTU or Air Handler.

DIFFERENTIAL PRESSURE TRANSDUCER

The flow-compensated differential pressure transducer shall be permanently mounted on the analog electronic control circuit board. The analog electronic control shall drive the transducer in such a way as to produce a voltage output proportional to flow. Transducers with outputs proportional to differential pressure are not acceptable. The controller shall use the flow proportional voltage output to maintain desired airflow within five percent of setpoint regardless of changes in system static pressure. Inlet mounted, single point hot-wire velocity transducers are not acceptable.

ANALOG ELECTRONIC WALL THERMOSTAT

The analog electronic thermostat circuit board shall incorporate a glass encapsulated, hermetically sealed rapid response thermistor, a hidden temperature setpoint with scale marked in one degree Fahrenheit increments, and maximum, cooling minimum and heating minimum airflow

limit adjustments. All thermostat signals shall be low voltage, low current for short circuit protected DC.

The thermostat shall be capable of being installed directly to drywall, or to a horizontally or vertically mounted single-gang junction box with an adapter plate provided. The thermostat shall not protrude further than 5/8" from the wall or adapter plate when installed.

Where required by the control sequence, each thermostat shall include both heating and cooling minimum airflow adjustments. The control system shall allow both the heat and heating minimum to be disabled via a dry contact closure provided by the Temperature Controls Contractor.

ELECTRONIC ACTUATOR

The electronic actuator shall be a separate component from the control system. Due to the high cost of replacement parts after the warranty period, systems with the actuator integral to the electronic controller are not acceptable.

The electronic actuator shall be capable of stalling indefinitely at the terminal unit's mechanical stops without damage either to the actuator or the terminal, and maintain positive mechanical pressure against the unit's closed foam seal to prevent excessive airflow leakage. The use of end switches to limit the damper's mechanical travel is not acceptable. DC current to the actuator motor in the stall position shall be electronically limited to prevent damage to the motor due to excessive power dissipation.

CONTROL TRANSFORMER

Provide a 24 VAC control transformer sized to match the power requirements of the terminal and voltage available in the building.

AIR PRESSURE SWITCH

Where required by the control sequence, each control package shall include an air pressure switch furnished, mounted and wired by the terminal unit manufacturer. When the switch senses that the system static pressure has failed, the controller and unit shall automatically switch to the night setback mode. Fan and heat shall be used to maintain the separate night temperature offset.

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