Single Duct Variable Air Volume Terminal (Model TSS)

Model TSS Terminals provide Variable Air Volume (VAV) control beyond the typical single duct box. They are specifically designed for precise air delivery throughout the entire operating range, regardless of the installed inlet conditions. These units can be ordered with or without a Direct Digital Controller (DDC), which can operate as a stand-alone unit, on a Johnson Controls® N2 trunk, or on a LON trunk.

TSS Terminals take advantage of typical benefits provided by single duct units while performing at extremely low sound levels. This is critical in today's buildings where occupants are placing more emphasis on indoor acoustics.

The ability to provide comfort to the occupant is the measurement of quality for any VAV terminal. Comfort is achieved through quiet and precise control of airflow to the occupied space.

The TSS Terminal is manufactured and assembled with a multi-point, center-averaging airflow sensor. This sensor provides a signal to the controller enabling it to quietly and precisely measure airflow. Accurate measurement is the basis for airflow control.

Bundled with the TSS Terminal is a digital controller from the VAV Modular Assembly (VMA) Series or the LN Series. Each model in the VMA1400 Series and the LN Series combines a controller, pressure sensor, and actuator housed in one preassembled unit.

Unique features that reduce installation and commissioning time while enhancing VAV system operation make the VMA the product of choice for VAV systems.

The VMA and LN Series controls can be used in these types of applications:

- *Cooling only*
- *Cooling with Reheat and/or Exhaust*

Note: For more information on the VMA1400 Series, refer to the *Variable Air Volume Modular Assembly (VMA) 1400 Series Product Bulletin (LIT-635058).*

Note: For more information on the LN Series, refer to the *Metasys® System LN Series VAV and VVT Profile Application Controllers Product Bulletin (LIT-1201910).*

Figure 1: Single Duct Variable Air Volume Terminal (Model TSS)

Figure 2: VMA1410 and VMA1420

Figure 3: LN Series Controller

Features and Benefits	
❑ **Factory-Provided DDC**	An integrated VAV box with controls eliminates the coordination and difficulties associated with factory mounting
❑ **Factory-Commissioned DDC**	Reduces startup time and lowers risk through downloading of software, setting of parameters, addressing, and testing at the factory
❑ **Flexible Design**	Provides application flexibility, while providing options that can meet even the most stringent job requirements
❑ **Superior Flow Measuring**	Provides for lower minimum Cubic Feet per Minute (cfm) values, which reduces energy costs and noise while maintaining comfort in the zone
❑ **Integrated Module**	Includes controller, pressure sensor, and/or actuator, preassembled to reduce installation time
❑ **Enhanced Actuator**	Provides a fast response stepper motor that drives the damper from full open to close in 30 seconds (VMA Series)
❑ **Automated Commissioning**	Uses Proportional Adaptive (P-Adaptive) and Pattern Recognition Adaptive Control (PRAC) for continuous loop tuning (VMA Series)
❑ **Advanced Diagnostics**	Offers damper stall detection, starved box detection, actuator motor duty cycle, VAV box flow test, and other diagnostics on most models (VMA Series)
❑ **Multiple Network Communications**	Enables integration into a Building Automation System (BAS)
❑ **Standard Applications**	Provides proven designs and quick selection of proper variables to ensure proper operation
❑ **Quick Installation**	Reduces installation time with the low profile compact design and standard metal hanging straps
❑ **Agency Certified**	Wired in compliance with all applicable National Electrical Code (NEC) requirements and tested in accordance with Air Conditioning and Refrigeration Institute (ARI) Standard 880
❑ **Easy Maintenance and Service**	Requires no periodic maintenance and provides trouble-free operation

Model TSS Terminals

Flexibility

Selection and Layout

The TSS provides flexibility in system design. The compact cabinet design and quiet operation give the system designer the versatility to place units directly above occupied spaces. It is not necessary to locate the unit in the crowded space above a hall or corridor, which reduces lengthy and expensive discharge duct runs. The sensor ensures accurate control, even when space constraints do not permit long straight inlet duct runs to the terminal.

Sizes

Model TSS Terminals are available in 10 unit sizes to handle airflow capacities between 45 and 8,000 Cubic Feet per Minute (cfm).

Convenience

Quality

All TSS Terminals are thoroughly inspected during each step of the manufacturing process, including a comprehensive pre-ship inspection, to ensure the highest quality product available. All TSS Terminals are packaged to minimize damage during shipment.

Quick Installation

A standard single point electrical main power connection is provided with all electronic controls and electrical components located on the same side of the casing for quick access, adjustment, and troubleshooting. Installation time is further minimized due to the availability of factory-calibrated controls and a low profile, compact design.

The sensor ensures accurate airflow measurement, regardless of the field installation conditions. A calibration label and wiring diagram is located on the terminal for quick reference during startup.

The terminal is constructed to allow installation with standard metal hanging straps. Optional hanger brackets for use with all-thread support rods or wire hangers are also available.

Value and Security

Quality

All metal components are fabricated from G90 galvanized steel. Unlike most manufacturers' terminals, the TSS is capable of withstanding a 125-hour salt spray test without showing any evidence of red rust.

Energy Efficiency

In addition to quiet and accurate temperature control, the building owner benefits from lower operating costs. The highly amplified velocity pressure signal from the inlet sensor allows precise airflow control at low air velocities.

The sensor's airfoil shape provides minimal pressure drop across the terminal. This allows the central fan to run at a lower pressure and with less brake horsepower.

Agency Certification

Model TSS Terminals with electronic controls and/or electric heat are listed with ETL as an assembly and bear the ETL label.

Note: ETL is a mark issued by Intertek Testing Services (ITS) ETL SEMKO Division.

TSS Terminals and accessories are wired in compliance with all applicable NEC requirements and tested in accordance with ARI Standard 880.

Maintenance and Service

TSS Terminals require no periodic maintenance and provide trouble-free operation. Controls are located on the outside of the unit casing for easy access by maintenance personnel.

Standard Features

Construction

Standard construction features include:

- ARI 880 certified and labeled
- 22-gauge, G90 galvanized steel casing and valve
- 1/2" 4 lb·ft^3 skin, dual density fiberglass insulation (mechanically fastened for added security)

Primary Air Valve

Standard primary air valve features include:

- embossed rigidity rings
- low thermal conductance damper shaft
- position indicator on external end of damper shaft
- mechanical stops for open and closed position
- center-averaging airflow sensor
- brass balancing tees
- plenum-rated sensor tubing

Hot Water Coils

Standard hot water coil features include:

- ARI 410 certified and labeled
- 1-, 2-, 3-, 4-row coils
- left- or right-hand connections
- tested at a minimum of 450 psig under water and rated at 300 psig working pressure at 200°F

Electrical Components

Standard electrical components include:

- cETL listed for safety compliance with Underwriters Laboratories Inc.® (UL) 1995
- National Electrical Manufacturers Association (NEMA) Type 1 wiring enclosure

Electric Heat

Standard electric heat features include:

- cETL listed as an assembly for safety compliance
- automatic reset primary and back-up secondary thermal limits
- airflow switch
- single-point power connection
- hinged electrical enclosure door
- fusing per NEC

Optional Features

Construction

Optional construction features include:

- 20-gauge G90 galvanized steel construction
- 3/4” and 1” insulation
- scrim-reinforced, foil-faced insulation meeting American Society for Testing and Materials (ASTM) C1136 for mold, mildew, and humidity resistance
- 1/2” closed cell insulation
- double wall construction
- mounting brackets to accept all thread hanging rods or wire hangers
- low temperature construction for use in thermal storage applications (includes a thermally isolated primary air inlet and a composite damper shaft)

Hot Water Coil

Optional hot water coil features include:

- coil access plate for cleaning coil

Electrical Components

Optional electrical components include:

- toggle disconnect switch
- primary and secondary transformer fusing

Electric Heat

Optional electric heat features include:

- proportional Solid State Relay (SSR) heater control
- mercury contactors
- door interlocking disconnect switches

Controls

Optional controls include:

- Direct Digital Controls (DDC)
- pneumatic controls

VMA1400 Series Controllers

Actuator Enhancements

The VMA1410 and 1420 use an actuator with a fast response stepper motor, which is quiet (<35 dBA) and precise (23 K resolution). The stepper motor drives the damper from full open to full close in 30 seconds. This significantly reduces the time to commission and balance a VAV terminal box. The stepper motor quickly and accurately adjusts the damper position in response to new conditions, minimizing position hunting and motor runtime.

Applications

The VMA1400 Series controllers can be configured for most single duct VAV applications. The VMA1420 requires an additional damper actuator with Differential Pressure Transducer (DPT) sensor for supply/exhaust applications and dual duct applications.

Standard applications for the VMA1410 and 1420 reside in the Heating, Ventilating, and Air Conditioning (HVAC) PRO library, which is a section of the Global Operations Support library. See Table 1 for more detailed application and control options. Also refer to the *Variable Air Volume Modular Assembly* (*VMA) 1400 Series Application Note (LIT-6375125).*

Advanced Diagnostics

The VMA1400 Series has several unique diagnostic features. Diagnostics include damper stall detection, starved box detection, actuator motor duty cycle, VAV box flow test, and others.

The VMA constantly monitors the space temperature and airflow and generates alarms to alert the operator of setpoint deviations. The operator can react quickly, taking corrective action to get the system back into desired operation. This ensures occupants better comfort control.

Factory Commissioning

Whenever the VMA Series controls are ordered on the TSS Series, the factory downloads the correct application into the controller. In addition, the factory also sets the Area and K Factor for the size of the box on which it is installed. If provided, the factory also sets the minimum/maximum Cubic Feet per Minute (cfm) and address. Each box is thoroughly tested at end-of-line prior to packaging.

Automated Commissioning

Because the VMA1410 and 1420 perform loop tuning automatically, there is no need to set proportional bands and integration terms. There is no need to set any jumpers or switches. Even network addressing can be done via software, if desired.

The VMA1410 and 1420 are configured to detect the damper end-stops automatically. On power up, the actuator drives to both hard stops on the VAV box and remembers these positions. These automated features get the system operating quickly.

LN Series Controllers

LN-VAVL-0 and LN-VAVC-0 Controllers

LN-VAVL-0 and LN-VAVC-0 controllers include an enclosure with actuator, pressure sensor, eight Input/Outputs (I/Os), and LONWORKS® Network Services (LNS®) plug-in.

Applications

The LN-VAVL-0 Series controllers can be configured for most single duct VAV applications. The LN-VAVC-0 requires an additional damper actuator with Differential Pressure Transducer (DPT) sensor for supply/exhaust applications and dual duct applications.

Standard applications for the LN-VAVL-0 and the LN-VAVC-0 reside in the Global Operations Support library.

Table 1: Applications

Applications	Control Options	VMA1400		LON	
		1410	1420	LN-VAVL-0	LN-VAVC-0
System Types	Single Duct	X	X	X	X
	Pressure Independent	X	X	X	X
	Supply/Exhaust		X		X
Heating (Terminal Box)	Floating 3-Wire Valve Actuator		X	X	X
	Proportional Valve Actuator		X	X	X
	Normally Open or Normally Closed Valve		X	X	X
	1- to 3-Stage Electric		X		
	Electric Coil SSR Control		X	X	X
Heating (Supplemental)	Floating 3-Wire Valve Actuator		X	X	X
	Proportional Valve Actuator		X	X	X
	Normally Open or Normally Closed Valve		X	X	X
	Single Stage Electric		X	X	X
Cooling (Terminal Box)	Stepper Motor Damper Actuator	X	X		
Floating/3-Wire (Incremental) Actuator	External Damper and Valve		X		X
	Valve Only		X	X	X
Proportional Actuator	External Damper and Valve		X		X
Lighting	On/Off (In Relation to Occupancy Mode)		X		X
Modes	Occ/Temp	X	X	X	X
	Occ/Unocc	X	X	X	X

Standard Terminal Construction

Accurate Airflow Control Sensor

The air valve features an airflow sensor that has brought new meaning to airflow control accuracy. The multi-axis design uses between 12 and 20 sensing points that sample total pressure at center points within equal concentric cross-sectional areas, effectively traversing the air stream in two planes. Each distinct pressure reading is averaged within the center chamber before exiting the sensor to the controlling device.

This sensor adds a new dimension to signal amplification. Most differential pressure sensors provide a signal equal to 1.5 times the equivalent velocity pressure signal. This sensor provides a differential pressure signal that is 2.5 to 3 times the equivalent velocity pressure signal. This amplified signal allows more accurate and stable airflow control at low airflow capacities. Low airflow control is critical for indoor air quality, reheat minimization, and the prevention of overcooling during light loads.

Unlike other sensors, which use a large probe surface area to achieve signal amplification, this sensor uses an unprecedented, streamlined design that generates amplified signals. This streamlined design also generates less pressure drop and noise.

The VAV schedule should specify the minimum and maximum airflow setpoints, maximum sound power levels, and maximum air pressure loss for each terminal. The specification for the VAV terminal must detail the required performance of the airflow sensor.

Amplifying the Airflow Sensor Signal Provides for Lower Minimum Airflow Setpoints

Many VAV controllers require a minimum differential pressure signal of 0.03 inches wg. The airflow sensor should be able to generate this signal with only 400 to 450 FPM air velocity through the inlet collar.

Conventional airflow sensors without amplification capabilities require approximately 700 FPM to generate a 0.03 inches wg signal. If 700 FPM represents a 20% minimum condition, the inlet velocity would be 3500 FPM at the maximum airflow setpoint, resulting in extremely noisy conditions. In addition, the airflow sensor should generate a differential pressure range of at least 1-inch wg over the operating range of the terminal unit.

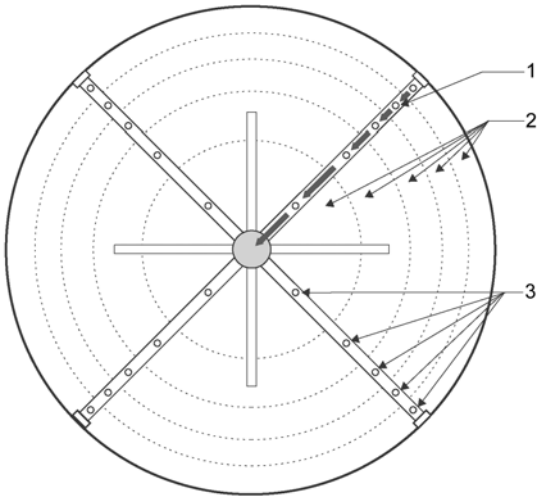

Figure 4: Airflow Sensor

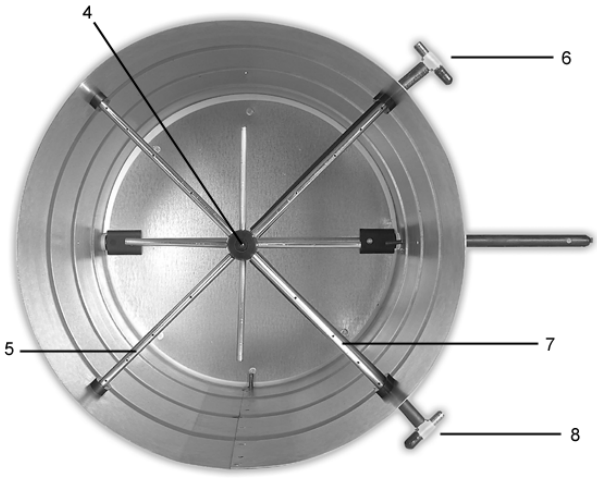

Figure 5: Airflow Sensor in Collar

Table 2: Airflow Sensor Features

Feature	Description
1	Each pressure input signal is routed to the center averaging chamber
2	Equal, concentric circular areas (three to five circles based on size)
3	Total pressure measured at the center of each concentric circle (12 to 20 sensing points based on size)
4	Airfoil-shaped averaging chamber for low-pressure loss and noise
5	Two-axis low profile design
6	Averaged and amplified differential pressure output to controlling device
7	Pressure output is routed behind probe to minimize pressure loss and noise
8	Brass field-pressure measuring tap

Model TSS

The TSS Terminal incorporates many unique features. Most of these standard features are expensive options for other manufacturers.

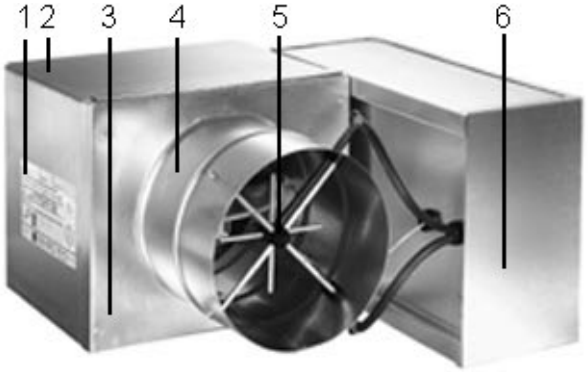

Figure 6: Model TSS – Standard Features (Front View)

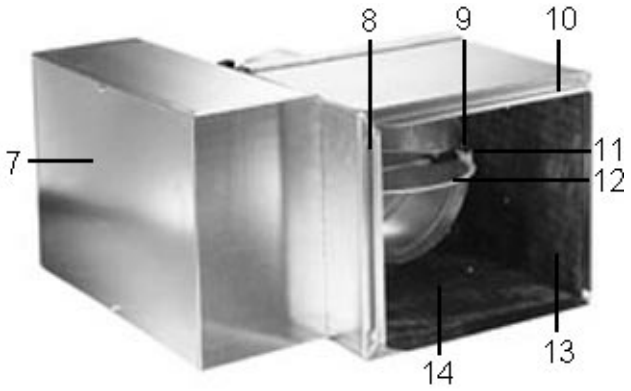

Figure 7: Model TSS – Standard Features (Rear View)

Table 3: Model TSS – Standard Features

Feature	Description
1	Product label includes tagging, airflow, and electrical information
2	Mechanical lock construction ensures lowest possible casing leakage
3	G90 galvanized steel casing withstands 125-hour salt spray test per ASTM B-117
4	Roll-formed inlet collar with integral stiffening ribs adds strength and rigidity
5	Patented airflow sensor
6	Electrical devices installed within a NEMA Type 1 Enclosure, with single point power connection
7	Units with electronic controls listed with ETL for safety compliance
8	Slip and drive discharge collar for quick field installation
9	Self-lubricating bearing to reduce friction and air leakage
10	Insulation edge covered by metal — no raw edges of insulation exposed to airstream
11	Solid composite damper shaft prevents condensation and breakage
12	Low leakage damper incorporates closed cell foam gasket
13	Mechanically fastened insulation for added security
14	1/2" thick, 4 $lb \cdot ft^3$ skin, dual density insulation complying with UL 181 and National Fire Protection Association (NFPA) 90A, and ASTM C1071
(not shown)	Factory-supplied and installed controls

Electric Heater Selection

Model TSS-E

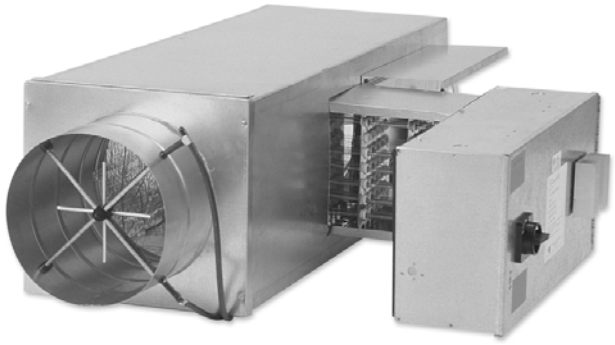

Figure 8: Model TSS-E – Inlet View

Figure 9: Model TSS-E – Rear Inlet View

Historically, heater elements placed downstream of a VAV damper have experienced two major problems:

- elements fail prematurely due to hot spots resulting from an uneven air velocity profile over the heater face
- heaters suffer rapid nuisance cycling of the contactors and elements because the airflow switch probe is located on the low-pressure (downstream side) of the VAV damper

Our unique electric heat VAV terminal, the TSS-E, solves these problems. The heater elements are located midway between the air inlet and the damper. This design provides uniform airflow over the face of the electric heater at all damper positions. Element life is extended, reducing repair cost and inconvenience.

With the heater elements located on the high-pressure side of the VAV damper, the airflow pressure switch receives a reliable pressure signal even at minimum damper positions. This arrangement provides greater safety, as well as enhanced reliability.

The TSS-E design permits tremendous flexibility when selecting kW, voltage, phase, balanced or unbalanced circuiting and method of control.

Model TSS-E Standard Features

Model TSS-E standard features include:

- cETL listed as an assembly
- single-point power connection
- primary auto-reset high limit
- secondary high limit
- airflow switch
- hinged control panel
- ni-chrome elements
- primary/secondary power terminations
- fusing per NEC
- wiring diagram and ETL label
- Available kW increments are as follows:
  0.5 to 5.0 kW - .25 kW; 5.0 to 10.0 kW - .50 kW;
  Above 10 kW - 1.0 kW

Model TSS-E Optional Features

Model TSS-E optional features include:

- disconnect (toggle or door interlocking)
- Pneumatic Electric (PE) switches
- mercury and magnetic contactors
- manual reset secondary limit
- proportional control (SSR)
- 24 volt control transformer

Model TSS-E Selection Procedure

With standard heater elements, the maximum capacity (kW) is obtained by dividing the heating (minimum) Standard Cubic Feet per Minute (scfm) by 70. In other words, the terminal must have at least 70 scfm per kW. In addition, each size terminal has a maximum allowable kW based upon the specific heater element configuration (for example, voltage, phase, and number of steps).

Heaters require a minimum of 0.07" wg downstream static pressure to ensure proper operation.

Table 4: Selection Equations

Equations			
kW	=	scfm x ΔT x 1.085* / 3413	*Air density at sea level - reduce by 0.036 for each 1,000 feet of altitude above sea level.
scfm	=	kW x 3413 / ΔT x 1.085 *	
ΔT	=	kW x 3413 / scfm x 1.085*	

Table 5: Calculating Line Amperage

Equations		
Single Phase Amperes	=	kW x 1,000 / Volts
Three Phase Amperes	=	kW x 1,000 / Volts x 1.73

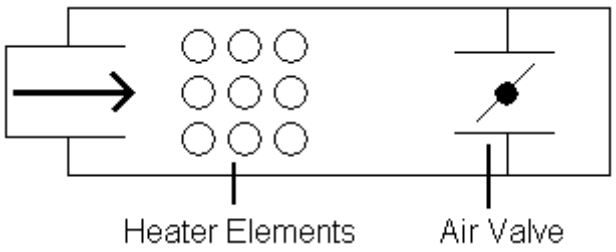

Figure 10: Electric Heat Diagram

The TSS-E uses a unique design that has the electric heater elements upstream of the air valve, enabling lower scfm to be used due to an even flow across the coils. By controlling the air after the coils, the TSS-E provides more reliable sensing of static pressure in the duct and longer life of the heating coils.

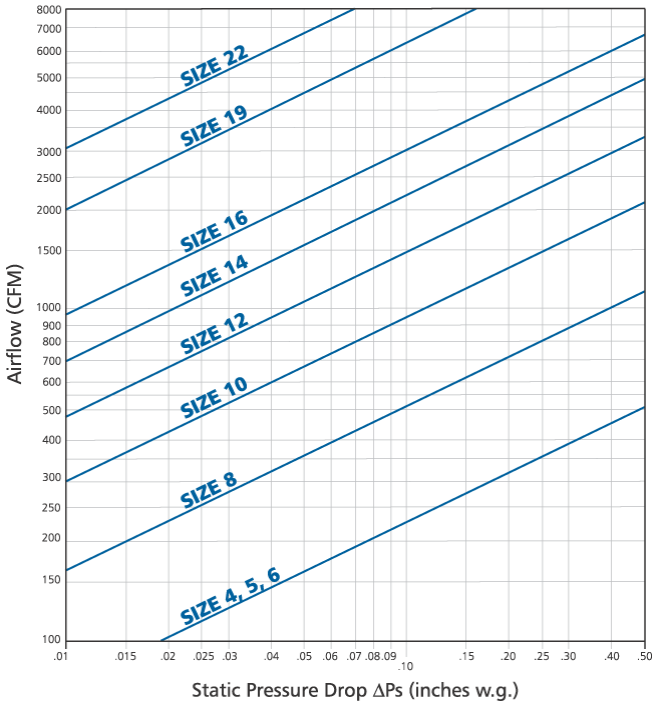

Figure 11: Electric Heater Pressure Drop

Hot Water Coil Selection

Model TSS-W

Figure 12: Model TSS-W

Table 6: Model TSS-W – Definition of Terms

Term	Definition
EAT	Entering Air Temperature (°F)
EWT	Entering Water Temperature (°F)
LWT	Leaving Water Temperature (°F)
LAT	Leaving Air Temperature
CFM	Air Volume (cubic feet per minute)
GPM	Water Capacity (Gallons per Minute)
MBH	1,000 BTUH
BTUH	Coil Heating Capacity (British Thermal Units per Hour)

Model TSS-W Standard Features

Model TSS-W standard features include:

- aluminum fin construction with die-formed spacer collars for uniform spacing
- mechanically expanded copper tubes leak tested to 450 psig air pressure and rated at 300 psig working pressure at 200°F
- male sweat type water connections
- 1-, 2-, 3-, and 4-row configurations

Model TSS-W Optional Features

Model TSS-W optional features include:

- low-pressure steam coils
- multi-circuit coils for reduced water pressure drop
- opposite hand water connections
- bottom and top access plates for cleaning

Model TSS-W Selection Procedure

Performance is based on a temperature difference of 125°F between the entering water and the entering air. For Variable Air Volume Applications, the static pressure drop must be based on the maximum air volume.

Table 8 gives correction factors for various entering ΔTs (difference between EWT and EAT). Multiply MBH values obtained from selection tables by the appropriate correction factor to obtain the actual MBH value. Air and water pressure drop can be read directly from the selection tables. The LAT and LWT can be calculated from the following fundamental formulas:

Table 7: LAT/LWT Fundamental Formulas

Formulas				
LAT	=	EAT	+	$\frac{\text{BTUH}}{1.085 \times \text{cfm}}$
LWT	=	EWT	-	$\frac{\text{BTUH}}{500 \times \text{GPM}}$

Table 8: Model TSS-W Correction Factors

Entering Water - Air Temperature Differential (ΔT) Correction Factors															
ΔT	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90
Factor	0.15	0.19	0.23	0.27	0.31	0.35	0.39	0.43	0.47	0.51	0.55	0.59	0.63	0.67	0.71
ΔT	95	100	105	110	115	120	125	130	135	140	145	150	155	160	165
Factor	0.75	0.79	0.83	0.88	0.92	0.96	1.00	1.04	1.08	1.13	1.17	1.21	1.25	1.29	1.33

Technical Specifications

VAV Modular Assembly (VMA) 1400 Series

Product Code Number	Cooling Only:	Cooling w/Reheat and/or Fan:
Single Unit:	AP-VMA1410-0	AP-VMA1420-0
Bulk Pack:	AP-VMA1410-0D	AP-VMA1420-0D
Buy American:	AP-VMA1410-0G	AP-VMA1420-0G
Supply Voltage	20-30 VAC at 50 or 60 Hz	
Optional Fuse Current	0.6 ampere for VMA1410; 2.0 amperes for a VMA1420	
Power Consumption	VMA1410/1420:	10 VA maximum (Relay and valve requirements not included.)
Ambient Operating Conditions	0 to 50°C (32 to 122°F)	
Ambient Storage Conditions	-40 to 70°C (-40 to 158°F)	
Terminations	6.3 mm (1/4 in.) spade lugs (Communication has screw terminals.)	
Serial Interfaces	N2 Bus and Zone Bus	
N2 Controller Addressing	DIP switch set (1-253) Addresses 254 and 255 are reserved. Software addressable with HVAC PRO software, Release 7.02 or later.	
Communications Bus	N2 between VMA and the Network Control Module (NCM) or N30. Zone Bus between VMA and room sensor (8-pin phone jack or wire to spade lugs or optional plug-on terminals) (Not available when the TE-7720 RF Receiver is applied.)	
Mounting	One screw (included) mounts the VMA1410/1420 to the VAV box. One screw attaches the damper shaft to the actuator, 8 mm (5/16 in.) square head set screw with 44 N·m (389.4 lb·in.) of axial holding power for up to 13 mm (1/2 in.) round damper shafts. Minimum damper shaft length is 44.5 mm (1 3/4 in.).	
Housing	Plastic housing for controller/actuator with UL94-5VB Plenum Flammability Rating	
Dimensions (L x W x H)	VMA1410/1420:	153 x 102 x 102 mm (6 x 4 x 4 in.)
Actuator Torque	4 N·m (35 lb·in) minimum (VMA1410/1420 only)	
Shipping Weight	VMA1410/1420:	13.1 kg (29 lb) for a box of ten, 1.3 kg (2.8 lb) each
Electrical Inputs	Analog Inputs: Nickel, silicon, platinum (1 K ohm), or NTC (2.25 K) RTD room sensors, 1.6 K setpoint potentiometer (2-wire) Voltage input for 0-10 VDC (humidity or pressure sensor) Binary Inputs: Dry contacts Input configurations vary based on model type.	
Velocity Pressure	Velocity Pressure for 374 Pa (0-1.5 inches wc)	
Outputs	No outputs on VMA1410 (internal stepper motor) Binary outputs, 24 VAC triac switched, 25-500 mA loads Stepper drive, 2 to 767 steps per second (23,000 step resolution) (VMA1410/1420 only) Analog output, 0-10 VDC @ 10 mA maximum	
Standards Compliance	CSA 22.2 No. 205, UL 916, UL 94-5VB, FCC Part 15, Subpart B, Class A and B, C-tick Australia/NZ, AS/NZS 4251.1, CISPR 22, Class B, CE Directive (89/336/EEC, EN50081-1, EN50082-2) Industrial, IEEE 472, IEEE518, IEEE587 Category A/B, IEC-950, IEC 801-2, -3, -4, -6, -7, -8, ANSI C62.41 A/B	

Metasys System LN Series Variable Air Volume Profile Application Controller

Product Code Number	LN-VAVLx-0
Power Requirements	Voltage: 24 VAC, ±15%, 50/60 Hz Typical Consumption: 5 VA Maximum Consumption: 10 VA Protection: 5 Ampere removable fuse
Environmental	Operating Temperature: 0 to 70°C (32 to 158°F) Storage Temperature: -20 to 70°C (-4 to 158°F) Relative Humidity: 0 to 90% Noncondensing
General	Standard: LONMARK® Functional Profile VAV #8010 Processor: Neuron® 3150; 8 bits, 10 MHz Memory: Nonvolatile Flash 64 K (APB application and configuration properties) Communication: LonTalk® Protocol Transceiver: TP/FT-10; 78 kbps Battery (for clock only): Real-time Clock Chip Enclosure: Material: PVC, flammable class VO Dimension: 124 x 226 x 63 mm (4.88 x 8.9 x 2.48 in.) Weight: 0.835 kg (1.84 lbs) Safety: CSA and UL Listed
Damper Motor	Motor: LM24-Mus Torque: 4 N·m (35 lb·in.) Angle of Rotation: 95° adjustable Fits shaft diameter: 8.5 to 18.2 mm (5/16 to 3/4 in.) Power Supply from Controller
Inputs	Number: 4 Universal Digital: Dry Contact Voltage: 0-10 VC, Accuracy ±0.5% Current: 4-20 mA with 500 K ohms external resistor, Accuracy: ±0.5% Resistor: Thermistor Type 2 10 K ohms Accuracy: ±0.5°C (±0.9°F) Resolution: 0.1°C (0.18°F) Range: -40 to 55°C (-40 to 131°F) Potentiometer 10 K ohms Linear 2-point setpoint adjustment Min/Max linear configuration Configurable on several points Input Resolution: 12 bits analog/digital converter One Differential pressure: Range 125-250-500 Pa (0.5-1-2 inches wc), Accuracy ±3% full scale

Continued on next page. . .

Metasys System LN Series Variable Air Volume Profile Application Controller (Cont.)

Outputs	Number: 4
	3 Digital: Triac 24 VAC ±15%, 50/60 Hz, maximum charge 1.0 Ampere, internal or external supply
	1 Tri-mode Analog:
	0-10 VDC (linear), PWM or digital 0-12 VDC
	60 mA maximum @ 12 VDC (60°C [140°F])
	Maximum load: 200 ohms
	Auto reset fuse: 60 mA @ 60°C (140°F), 100 mA @ 20°C (68°F)
	Analog Output Resolution: 8 bits digital/analog converter

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.

JOHNSON CONTROLS

Controls Group
507 E. Michigan Street
P.O. Box 423
Milwaukee, WI 53201

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