

## Variable Air Volume Modular Assembly (VMA14x0)

The VAV Modular Assembly (VMA14x0) is a configurable digital controller with a pressure sensor and an actuator, housed in a prewired unit. The actuator uses a fast response stepper motor for quick damper positioning. There are many new and unique features that reduce installation and commissioning time, while enhancing VAV system operation. This makes the VMA the product of choice for VAV systems.

The VMA14x0 is offered as two models:

- cooling only (VMA1410)
- cooling with reheat (VMA1420)

Both are designed for pressure independent, single duct systems. The VMA1420 can also be used with parallel or series fan powered boxes.



**Figure 1: VMA**

<b>Features and Benefits</b>	
<input type="checkbox"/> <b>Integrated Module</b>	Pre-assembled controller with pressure sensor and actuator reduces installation time. The compact footprint is easy to handle.
<input type="checkbox"/> <b>Enhanced Actuator</b>	Fast response stepper motor drives the damper from fully opened to closed in only 30 seconds and accurately positions the damper to minimize motor runtime, extending motor life.
<input type="checkbox"/> <b>Automated Commissioning</b>	Proportional adaptive algorithms (patented P-Adaptive and Pattern Recognition Adaptive Control (PRAC) technologies) provide continuous loop tuning.
<input type="checkbox"/> <b>Advanced Diagnostics</b>	System deviations related to flow, damper travel, and energy use can be identified and corrected using comparative values.
<input type="checkbox"/> <b>Network Communications</b>	VMA can be integrated as a part of a facility management system.
<input type="checkbox"/> <b>Easy Configuration</b>	Simple question/answer software format for quick selection of project specific applications.

## Actuator Enhancements

The VMA uses a new actuator with a fast response stepper motor, which is quiet (<35 dB) and smooth (23K resolution). The stepper motor drives the damper from fully opened to fully closed in **30 seconds**. This significantly reduces the time to commission and balance a VAV terminal box. The stepper motor quickly and precisely adjusts the damper position in response to new conditions, which minimizes position hunting and motor runtime. The motor duty cycle is recorded and ready for reporting on request from the Metasys® Operator Workstation (OWS).

## Applications

The VMA can be configured for most single duct VAV applications. Standard applications reside in the EuroPRO for Windows® library, which utilizes a question/answer wizard format. A single sideloop is available for analog input to analog or binary output.

See Table 1 for more detailed application and control options. Also refer to the *Variable Air Volume Modular Assembly (VMA) Application Note, MET-CTW-08*, in the *Configuration Tools for Windows Manual, MET-CTW*.

**Table 1: Applications**

Applications	Control Options	Model	Model
		VMA1410	VMA1420
<b>System Types</b>	Single Duct	✓	✓
	Fan Powered (Series or Parallel)		✓
	Pressure Independent	✓	✓
<b>Heating (Terminal Box)</b>	Incremental Valve Actuator		✓
	Proportional Valve Actuator		✓
	Normally Open (N.O.) or Normally Closed (N.C.) Valve		✓
	1-3 Stage Electric		✓
<b>Heating (Supplemental)</b>	Incremental Valve Actuator		✓
	Proportional Valve Actuator		✓
	Normally Open (N.O.) or Normally Closed (N.C.) Valve		✓
	Single Stage Electric		✓
<b>Cooling (Terminal Box)</b>	Stepper Motor Damper Actuator	✓	✓
<b>Fan (Fan Powered Terminal Box)</b>	Parallel, Zone Temperature Setpoint		✓
	Parallel, Air Flow Setpoint		✓
	Series, On/Off Control		✓
	Series, Proportional Control		✓
<b>Lighting</b>	On/Off (In Relation to Occupancy Mode)		✓
<b>Modes</b>	Occupied/Temporary Occupied/Standby/Off/Shutdown/Window	✓	✓

## Advanced Diagnostics

The VMA has several unique diagnostic features. The damper position is recorded to identify any deviations that may indicate problems with damper travel. Diagnostics include damper stall detection, starved box detection, stepper motor duty cycle, VAV box flow test, and others.

Alarms alert the operator of system changes. The operator can react quickly, taking corrective action to get the system back into desired operation. This assures occupants better comfort control.

## Functionality

Quick installation and easy commissioning help to greatly reduce VAV setup time. The integrated VMA package design eliminates the need to fasten and wire the actuator and sensor to the controller.

The unique stepper motor allows fast positioning of the damper. Modular assembly and automated tuning reduces the total time spent at the job site, yet provides a quality installation. New software commissioning tools quickly monitor and adjust all operating parameters.

If a power failure occurs, there is no need to reload software, since the programs and configuration data are saved in non-volatile Flash memory.

Additionally, firmware upgrades can be downloaded to existing units when enhancements are developed, without replacing the VMA.

This all adds up to significant savings to you in reduced installation costs.

## Automated Commissioning

Simply mount the controller, wire the controller, configure and download the application, and commission. There is no need to set proportional bands and integration terms, since loop tuning is done automatically. There is no need to set any jumpers or switches, except for network addressing. Refer to Table 2 for point assignments and ratings.

The controller is configured to set the end-stops automatically. On power up, the actuator drives to both end-stops and retains these positions. These automated features get your system operating quickly.

## Hardware

The VMA modular assembly is in a durable plenum rated plastic housing. The controller and pressure sensor are enclosed in one module attached to the actuator.

The unique VMA plastic housing may eliminate the need for a separate enclosure for plenum rated construction. Check code requirements for appropriate applications. Line voltage relays and transformers still require an enclosure.

The N2 communication connector has removable screw terminals. I/O connections to the VMA are easy-to-use spade lugs. If you prefer screw terminal I/O connections, be sure to order the appropriate optional removable screw terminal kit accessories.

The differential pressure sensor in the VMA provides consistent flow readings with minimal drift. This means auto-zero calibration is required less often. There are no filters to change, which ensures accuracy. (Flow through pressure sensors require filter changes.)

A Light-Emitting Diode (LED), visible through the VMA housing, indicates that power is connected and communications have been established.

**Table 2: Available VMA Models**

Inputs/Outputs	Points	Rating	VMA1410 (Cooling Only)	VMA1420 (Cooling w/ reheat)
<b>Analog Inputs:</b>				
Zone Temperature	AI-1	1K Ni, Si, Pt, or 2.25K NTC	✓	✓
Zone Setpoint	AI-2	1.6K ohm Potentiometer	✓	✓
Sideloop (humidity, dew point)	AI-3	0-10 VDC		✓
Supply Air Temperature or Supplemental Heat Temperature	AI-4	1K Ni, Si, Pt, or 2.25K NTC		✓
Velocity Pressure	Internal	0-374 Pascal / 0-1.5 in. W.C.	✓	✓
<b>Binary Inputs:</b>				
Temporary Occupied Button (with LED on TE-7000)	BI-1	Dry contact	✓	✓
Occupied	BI-2	Dry contact	✓	✓
Off or Window or Shutdown	BI-3	Dry contact	✓	✓
<b>Analog Outputs:</b>				
Proportional Heat	AO-1 AO-2	0-10 VDC @ 10 mA 0-10 VDC @ 10 mA		✓ ✓
<b>Binary Outputs:</b>				
Lights, Fan Box Heat - Valve or 1-3 stage Electric Supplemental Heat - Valve or Single Stage Electric Box Heat	BO-1 - BO-5	24 VAC Triac @ 0.5A		✓
Stepper Motor with Position Feedback	Internal	2-phase Stepper (up to 93° rotation @ 4 N·m / 35 lb·in.)	✓	✓

## Installation

Field mounting the VMA is easy. Minimal wiring and fastening, automatic loop tuning, fast damper response, and multiple units powered by one transformer are only some of the timesaving features.

The small housing, 153 mm length x 102 mm width x 102 mm height / 6 x 4 x 4 inches, meets industry mounting requirements and is easy to handle.

Only one mounting screw is used to mount the VMA to the VAV terminal box. Additionally, a single set screw attaches the damper shaft to the actuator. The set screw has a self-locking cup point end to resist loosening due to vibration.

The actuator coupling is serrated to provide additional damper shaft grip and minimizes shaft slippage during operation. The coupling accommodates shafts from 10-mm / 3/8-inch square or round, up to 13-mm / 1/2-inch diameter round. A gear release lever allows

easy resetting of the damper to fully opened or closed.

The controller address, which is unique for each VMA, is set using the DIP switches that are accessible through the VMA housing.

The AC power input is isolated from the DC inputs and outputs by an internal transformer. This eliminates polarity issues, ground loops, and the need for a separate isolation transformer. Power, N2 communications, and binary outputs are all separately isolated.

## **M**etasys Network Configuration

You can realize even greater benefits when the VMA is part of a larger Metasys Network that serves your facility. To accommodate indoor air quality concerns and energy savings strategies, the Metasys Network provides more complete building control than ever. The VMA connects to the Metasys N2 Bus and a Network Control Module (NCM200 or later, as appropriate).

With the network configuration, you can plug your laptop directly into the NCM to monitor controllers on the N2 Bus. No additional converters are required.

## **T**ool Configuration

The VMA integrated controller is easily configured using the EuroPRO for Windows software tool. The software runs on a Metasys Operator Workstation (OWS) connected to the N2 Bus to configure, download, and commission the controller.

Configure the VMA using EuroPRO for Windows by simply responding to a series of “yes/no” and multiple choice questions, and then specifying setpoints and other parameters. EuroPRO for Windows has a library of applications, control sequences, and algorithms that automatically configure the controller in response to your answers.

Once configured, you can make future changes to the control setpoints and operating parameters from any Metasys Operator Workstation or from any laptop connected to the VMA or room sensor.

## **R**oom Sensors

A variety of room sensor connections are available for use with the VMA. Choose either the Metastat®

TE-6400 nickel or platinum (1K ohm) sensor or the TE-7000 with the thermistor sensing element NTC (2.25K ohm). The TE-7000 room sensor has a LED to indicate Occupancy mode. The VMA will also retrofit to existing silicon sensors (TE-6000-960).

The VMA connects to the room sensor via an 8-pin phone jack or screw terminal connection on the back of the TE-6400, or an 8-wire screw connection on the back of the TE-7000.

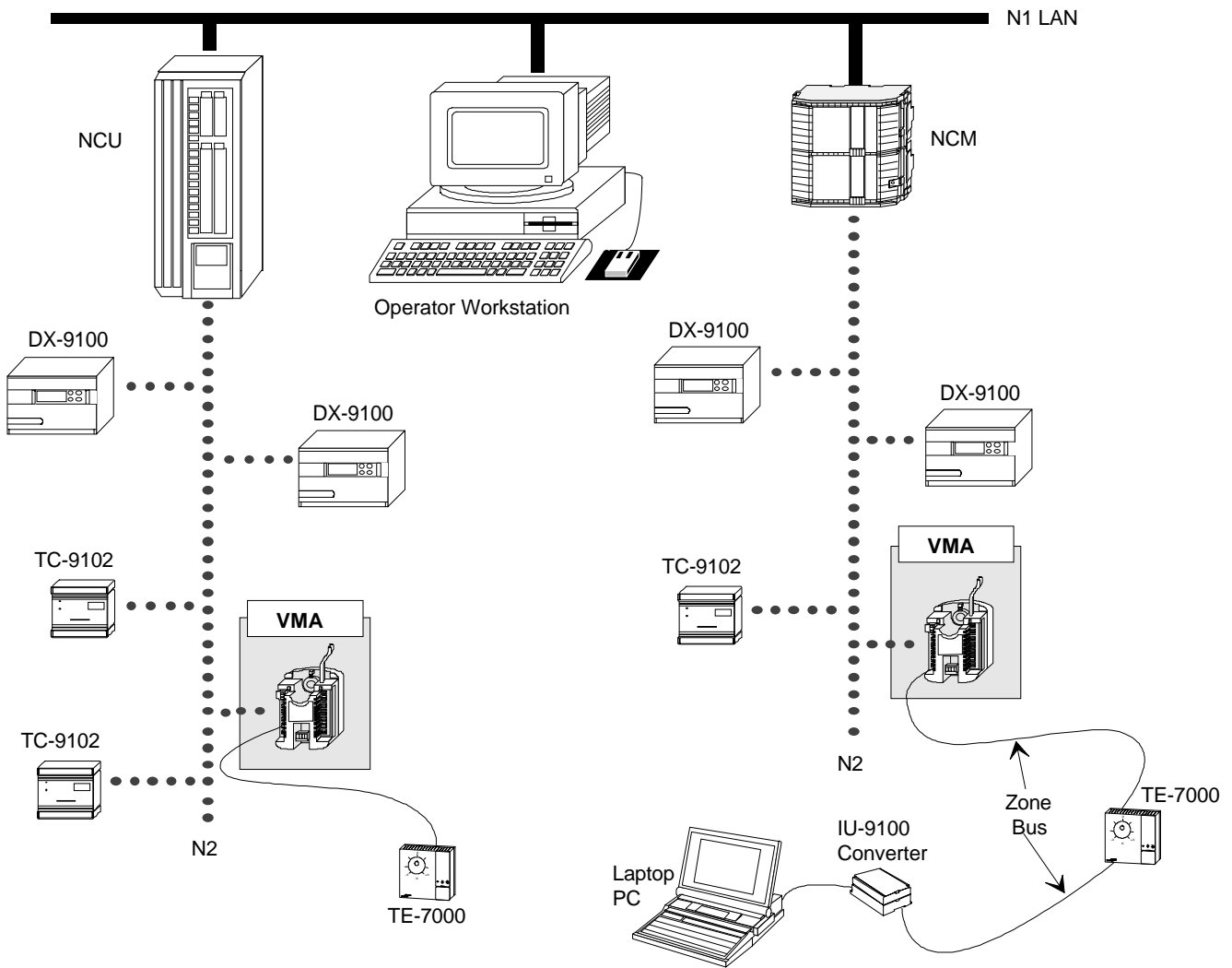
Using the 6-pin phone jack on the TE-6x00 or TE-7000 room sensors with a converter, you can connect a laptop to download, commission, and balance.

## **B**alancing Tools

The VMA includes a new balancing tool option, which makes balancing fast and accurate. Located in the EuroPRO commissioning tool, the balancing tool screen allows for adjustments, based on Balancer readings. The screen includes box area, K-factor, and flow requirement data. Manually calculating the K-factor is no longer required, reducing chances for calculation error.

## **A**IM Tools

An enhanced room schedule in spreadsheet format saves time to commission and balance the VMA. New parameters can be added, including: minimum/maximum flow, K-factor, box area, and bias setting. Parameter adjustments can be made in the spreadsheet, then downloaded to multiple VMAs, even those with different configurations. A spreadsheet report can be printed showing information for all zones in the project.



**Figure 2: VMA on the Metasys Network**

# Accessories (Order Separately)

**Table 3: Accessories**

<b>Transformer</b>	AS-XFR050	AS-XFR100	Y63 through Y66 Series
<b>Screw Terminal Kit</b>	AP-TBK1002-0*	Removable 2-position screw terminal kit (order in multiples of 100 pcs)	
	AP-TBK1003-0*	Removable 3-position screw terminal kit (order in multiples of 100 pcs)	
	AP-TBK4N2-0	<u>Replacement</u>	Removable N2 Bus 4-position screw terminal kit (order in multiples of 10 pcs)
* These terminals fit over the existing I/O spade lugs.			
<b>Room Sensors</b>	TE-6400 or TE-7000		
<b>Room Sensor Wall Mounting Plate</b>	TE-6400W-600 for <u>Metastat</u> TE-7000 (Wall mounting plate included with <u>TE-7000</u> these models)		
<b>Configuration Tools for Windows Software</b>	WS-EURPRO-0 (Europe)		WS-WINPRO-0 Release 7.00 (North America)
<b>Converters</b>	IU-9100-0 (Europe)	AS-CBLPRO-2 (North America)	

# Specifications

<b>Product Name</b>	Variable Air Volume Modular Assembly (VMA)		
<b>Product Code Number</b>	<b>cooling only models:</b>		
	Single Unit	AP-VMA1410-0	AP-VMA1420-0
	Bulk Pack	AP-VMA1410-0D	AP-VMA1420-0D
<b>Supply Voltage</b>	20-30 VAC at 50 or 60 Hz		
<b>Optional External Fuse Current</b>	0.6 ampere for VMA1410, 2.0 ampere for a VMA1420		
<b>Power Consumption</b>	12 VA maximum (relay and valve requirements not included)		
<b>Ambient Operating Conditions</b>	0 to 50°C / 32 to 122°F		
<b>Ambient Storage Conditions</b>	-40 to 70°C / -40 to 158°F		
<b>Terminations</b>	6.3-mm / 1/4-inch spade lugs (communications has screw terminals)		
<b>Serial Interfaces</b>	N2 Bus and Zone Bus		
<b>N2 Controller Addressing</b>	DIP switch set (1- <u>253249</u> ) Addresses <u>254</u> and <u>250-255</u> are reserved.		
<b>Communications Buses (RS-485)</b>	N2 between VMA and NCM (3-wire)		
	Zone Bus between VMA and room sensor (8-pin phone jack or wire to spade lugs or optional plug-on terminals)		
<b>Mounting</b>	One screw mounts the VMA to the VAV box.		
	One screw clamps damper shaft to the actuator (8-mm / 5/16-inch square coupler set screw with 44 N·m / 375 lb-in. of axial holding power for <u>up to</u> 13-mm / 1/2-inch round damper shafts).		
	Minimum damper shaft length is 44.5 mm / 1-3/4 inches.		
<b>Housing</b>	Plastic housing for controller/actuator with UL94-5VB Plenum Flammability Rating		
<b>Dimensions (L x W x H)</b>	153 x 102 x 102 mm / 6 x 4 x 4 inches		
<b>Actuator Torque</b>	4 N·m / 35 lb-in. minimum		
<b>Shipping Weight</b>	13.1 kg / 29 lb for a box of ten, 1.3 kg / 2.8 lb each		

Continued on next page . . .

## Specifications (Cont.)

---

<b>Electrical Inputs</b>	Analog Inputs: <ul style="list-style-type: none"><li>• Nickel, silicon, or platinum (1K ohm) or NTC (2.25K) RTD room sensors, 1.6K setpoint potentiometer (2-wire)</li><li>• Voltage input for 0-10 VDC (humidity or dew point sensor)</li></ul> Binary Inputs: <ul style="list-style-type: none"><li>• Dry contacts</li><li>• LED driver for temporary occupancy on TE-7000</li></ul> Input configurations vary based on model type.
<b>Velocity Pressure</b>	Velocity Pressure for 374 Pascal / 0-1.5 in. W.C.
<b>Outputs</b>	No outputs on VMA1410 Binary outputs, 24 VAC triac switched, 25-500 mA loads Internal stepper drive, 2 to 767 steps per second (23,000 step resolution) Analog output, 0-10 VDC @ 10 mA
<b>Standards Compliance</b>	CE Directive 89/336/EEC EN50081-1, EN50082-2 Industrial IEC-950, IEC 801-2, -3, -4, -6, -7, -8, IEEE 472, IEEE518, IEEE587 Category A/B CSA 22.2 No. 205 UL 916, UL 864 (UUKL), UL 94-5VB CISPR 22, Class B FCC Part 15, Subpart B, Class A and B ANSI C62.41 A/B

---

*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.*

*Metasys® is a registered trademark of Johnson Controls. Microsoft® Windows® is a registered trademark of the Microsoft Corporation.*



**Johnson Controls International**  
Westendhof 8  
45143 Essen  
Germany

**www.johnsoncontrols.com**  
Metasys European Sales Resource Manual  
Rev. Level 0299  
Printed in Germany