VAV Modular Assembly (VMA) 1430

Application

The Variable Air Volume Modular Assembly (VMA) 1430 is a digital controller with a pressure sensor in a prewired unit. The VMA1430 uses an external floating/3-wire or proportional actuator.

For additional information, refer to the following documents:

- *Variable Air Volume Modular Assembly (VMA) 1400 Series Overview and Engineering Guidelines Technical Bulletin (LIT-6363120)*
- *Variable Air Volume Modular Assembly (VMA) 1400 Series Application Note (LIT-6375125)*

Use HVAC PRO software to program this controller. (Use EURO PRO in Europe.)

Installation

Prepare the VMA1430 for mounting using the following procedure:

1. Check that you have the essential equipment and tools.
2. For the VMA1410 and 1420, make certain that the damper shaft protrudes at least 44 mm (1 3/4 in.) from the VMA mounting surface.
3. Ensure the VMA installation site meets environmental requirements.
4. Make sure the VMA mounting location has adequate clearance for future servicing.
5. Set the VMA-specific N2 address. See the *Setup and Adjustments* section in this document.
   a. Via hardware, use the N2 switches. Use Addresses 1-253 only.
   b. Via software, set the hardware addresses to 0 or 255. Then use the VAV Balancing Tool (VBT), HVAC PRO, or EURO PRO software to perform software addressing.

Refer to the *Mounting and Wiring Variable Air Volume Modular Assembly (VMA) 1400 Series Controllers Technical Bulletin (LIT-6363125)* for detailed instructions.

Mounting

Mount the VMA in a location where wiring connections are accessible. Use the following procedure to mount the VMA:

1. Secure the VMA with two self-drilling No. 10 screws through the two VMA mounting slots with a power screwdriver and 100 mm (4 in.) extension socket. Otherwise, use a punch to mark the positions of the two mounting slots, and then drill holes into the VAV box through the marks using a 3.5 mm (9/64 in.) drill bit. Insert the mounting screws and tighten to secure the VMA.

IMPORTANT: Do not overtighten the screws, or the threads may strip. If mounting to the VAV box, make sure the screws do not interfere with damper blade movement.

2. Loop the pneumatic tubing to include a trap for condensation, or mount the VMA higher than the tubing. Attach the tubing from the VMA to the VAV Box pickup. The HI (red) tubing is connected to the inlet or high-pressure side, and the clear tubing is connected to the low side (Figure 1).

Location Considerations

Consider the following when positioning and orienting the VMA:

- Mount the VMA on a vertical and flat surface where it functions best, such as the side of the VAV box.
- Route or loop the tubing, so a portion of it is lower than the pressure sensor, to create a moisture trap that prevents any condensation from entering the sensor.
- Do not make any sharp bends in the tubing, as this could collapse the tube and block the pressure path.
- Verify wiring terminals are accessible.
- Ensure that no extra mounting brackets, linkage, or couplers are required for standard mounting.

- Locate the VMA so that it has adequate clearance for future servicing and is protected from moisture and corrosive fumes.

Wiring

WARNING: Risk of Electric Shock.
Disconnect each of multiple power supplies before making electrical connections. More than one disconnect may be required to completely de-energize equipment. Contact with components carrying hazardous voltage can cause electric shock and may result in severe personal injury or death.

IMPORTANT: Equipment Damage. Do not allow Binary Outputs to short while energized. Shorting of Binary Outputs while energized will destroy the VMA output triac.

Read these precautions before touching the terminals or wiring the VMA and its accessories:

- Make all wiring connections in accordance with the National Electrical Code (NEC) and state and local regulations. For transformer primaries above 150 VAC, the secondary must be earth grounded at the transformer to meet NEC. Terminal 1 can be earth grounded. Grounding on Terminal 1 results in 24 VAC being applied to DCOM with respect to earth.
- 24 VAC to 24 VAC isolation transformers are not necessary. The power supply is internally isolated.
- Terminal 3 is an earth ground connection (optional).
- Locate equipment and route the wiring so that twisted pair signal wiring is separated from power wiring by at least 150 mm (6 in.).
- Make all wiring connections to the VMA using only copper conductors. To establish tight, reliable electrical connections, use the correct wire sizes for the terminals. Avoid very thin solid wires, such as 26 AWG or less than 0.6 mm, which tend to break.
- Daisy chain the N2 Bus. The use of Y or T connections without a repeater installed as the T-tap may cause a loss of communications. Make sure that there is at least one End-of-Line termination on the N2 Bus (usually at the Network Control Module [NCM] or N30).
- Do not run N2 Bus, Zone Bus, Analog Input (AI), Binary Input (BI), Analog Output (AO), or Binary Output (BO) wiring in the same conduit as line voltage wiring (above 30 VAC), or with wiring that switches power to highly inductive loads such as contactors, coils, motors, or generators.
- Run Zone Bus, AI, AO, and BI wiring in the same bundle or conduit where convenient. If the BO wiring is not wired through other switches or contacts, such as actuator end-of-travel switches, bundle it with the other Input/Output (I/O) wiring where convenient.

The following are general wiring considerations:

- The VMA includes isolated N2, isolated binary outputs, and isolated 24 VAC.
- The 24 VAC power input is internally transformer isolated by the VMA. To meet NEC requirements for line voltage greater than 150 VAC, Terminal 1 can be earth grounded.
- Large insulated spade lugs with a polarizing tab (for high voltage) do not fit on the VMA.

Use the following procedure to wire the VMA:

1. Terminate wiring per engineering drawings. Figure 1 shows a typical wiring example.
2. Install the N2 Bus to the Network Control Module (NCM) or N30/N31 controller in a daisy chain only.
3. Connect power to the VMA.
4. Download, commission, and balance the VMA.

Table 1: VMA Wiring List

Point	Description	Range	Input or Load Impedance (ohms)	Maximum Voltage	Maximum Current	Cable Length in Meters (Feet)	Wire Size in mm or mm^2 (AWG)
AI-1*	Zone Temperature	1 K ohm Nickel, Silicon, or Platinum	10 K	5 VDC	0.5 mA	150 (500)	1.5 mm^2 (18)
						30 (100)	0.6 mm (24)
		2.25 K ohm NTC (Negative Temperature Coefficient)	10 K	5 VDC	0.5 mA	150 (500)	0.6 mm to 1.5 mm^2 (24 to 18)
AI-2*	Zone Setpoint	1.6 K ohm 2-wire potentiometer	10 K	5 VDC	0.5 mA	150 (500)	1.5 mm^2 (18)
						30 (100)	0.6 mm (24)
AI-3*	Humidity Transmitter	0 to 10 VDC	1.1 M	16.5 VDC	15 mA	150 (500)	0.6 mm to 1.5 mm^2 (24 to 18)
AI-4*	Supplemental Heat Temperature or Supply Air Temperature	1 K ohm Nickel, Silicon, or Platinum	10 K	5 VDC	0.5 mA	150 (500)	1.5 mm^2 (18)
						30 (100)	0.6 mm (24)
		2.25 K ohm NTC	10 K	5 VDC	0.5 mA	150 (500)	0.6 mm to 1.5 mm^2 (24 to 18)
AI-5*	Velocity Pressure (internal)	0 to 1.5 inch W.C. (0.5 to 4.5 VDC)	250 K	5 VDC	0.020 mA	Internal	NA
BI-1*	Temporary Occupied	0-5 VDC, 3.1 V trigger	440	5 VDC	10 mA	150 (500)	1.5 mm^2 (18)
						30 (100)	0.6 mm (24)
BI-2*	Occupied (comfort)	0-15 VDC, 2.5 V trigger	47 K	17 VDC	0.3 mA	150 (500)	0.6 mm to 1.5 mm^2 (24 to 18)
BI-3*	Window, Off (shutdown)	0-15 VDC, 2.5 V trigger	47 K	17 VDC	0.3 mA	150 (500)	0.6 mm to 1.5 mm^2 (24 to 18)
AO-1*	Proportional Damper Actuator/Heat/ Humidity/Fan Speed	0-10 VDC	1 K-10 M	10 VDC	10 mA	150 (500)	1.5 mm^2 (18)
						60 (200)	0.6 mm (24)

Continued on next page . . .

Point (Cont.)	Description	Range	Input or Load Impedance (ohms)	Maximum Voltage	Maximum Current	Cable Length in Meters (Feet)	Wire Size in mm or mm^2 (AWG)
AO-2*	Proportional Damper Actuator/ Heat/Humidity/ Fan Speed	0-10 VDC	1 K-10 M	10 VDC	10 mA	150 (500)	1.5 mm^2 (18)
						60 (200)	0.6 mm (24)
BO-1, 2, 3, 4, 5 ^	Floating/3-wire Damper Actuator/ Fan/Box or Supplemental Heating Valve/ Baseboard Heat/ Electric Heat/ Lighting	24 VAC @ 25-500 mA	48-1000	30 VAC	100 mA	150 (500)	1.5 mm^2 (18)
					100 mA	30 (100)	0.6 mm (24)
					500 mA	30 (100)	1.5 mm^2 (18)
					500 mA	6 (20)	0.6 mm (24)
N2 Bus*^	Networking Bus	+ 5 V transmit, + 0.2 V receive	200	5 VDC	100 mA	5000 (1500)	0.6 mm to 1.5 mm^2 (24 to 18)
Zone Bus*	Local Room Sensor Bus	± 0 to 5 VDC	>3000	5 VDC	100 mA	150 (500)	0.6 mm to 1.5 mm^2 (24 to 18)
Room Sensor Cable*	AI-1, AI-2, BI-1, Zone Bus, and +15 VDC	See Zone Bus above.				7.5 (25)	0.6 mm (24) 8-conductor phone cable
						15 (50)	
						30 (100)	
+15 VDC*	DC Output Supply	14-18 VDC	1 K-10 M	18 VDC	35 mA	150 (500)	1.5 mm^2 (18)
						60 (200)	0.6 mm (24)
24 VAC^ Power In	AC Supply Voltage	20-30 VAC	20-144 each (0.125-1.2 amperes each)	30 VAC	125 mA (100 VA cable length)	67 (222)	6 mm^2 (10)
						42 (140)	4 mm^2 (12)
						17 (55)	1.5 mm^2 (16)
						11 (35)	1.5 mm^2 (18)

* Isolated from 24 VAC

^ Isolated from AI, BI, AO, Zone Bus, 15 VDC

Notes: All field terminals are power limited.

When wiring a TE-6700 Room Sensor to a VMA, the Zone Bus requires +15 VDC, ZB+, and a BI COM for proper operation (see Figure 1).

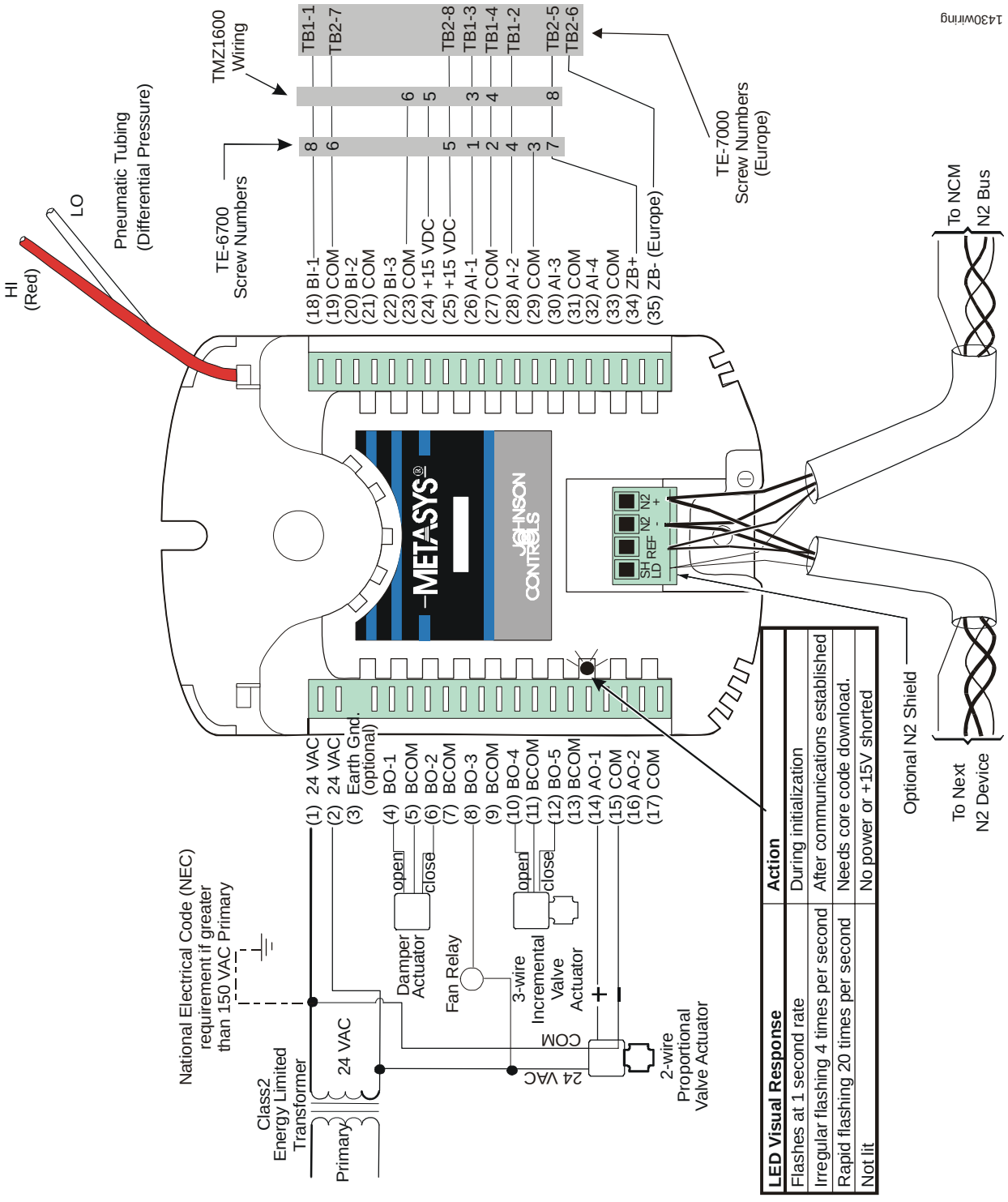

Figure 1: Typical VMA1430 Wiring Interface

Setup and Adjustments

Setting up the VMA1430 requires setting the N2 addresses and setting the damper position.

Setting the N2 Addresses

There are two ways to set the N2 addresses for Variable Air Volume (VAV) boxes: hardware addressing or software addressing. Hardware addresses take priority over software addresses. If you use software addressing, you must disable the hardware address of each VMA by setting the N2 address Dual Inline Package (DIP) switch to 0 or to 255.

Hardware Addressing

In hardware addressing, the N2 address DIP switches on the side of the VMA are manually set to the appropriate address (Figure 2). The N2 hardware address equals the sum of the values beside each DIP switch that is set to ON. For example, if the first DIP switch (1) and the fifth DIP switch (16) are both set to ON, the N2 hardware address for that controller is 17 (1 + 16 = 17).

Use Addresses 1-253 (254 is reserved and should not be used by any N2 device on the same N2 trunk).

Software Addressing

In software addressing, HVAC PRO software Release 8.01 or later is used to set the N2 address of each VMA over the Zone Bus. The VMA must be at firmware Revision B12 or later in order to use software addressing.

To use software addressing:

1. Set all N2 address DIP switches to Address 0 or 255, and install the VMAs.

   If the DIP switches are set to any other value during power up, the controller defaults to hardware addressing.

2. Supply power to the units.
3. Program each address through the Zone Bus using a laptop, AS-CBLPRO-2 or AS-CVTPROx00-0 converter, and HVAC PRO software Release 8.01 or later. Select either Controller Information or VMA Balancer Tool from the Action menu in HVAC PRO software.

   If you select Controller Information, select Single Device.

4. Select Zone Bus. The Controller Information screen or VMA Balancer Tool screen appears.
5. Select an N2 address from the drop-down list.
6. Click Set Address.
7. Wait for the new address to appear in the N2 Address field of the Controller Information screen or Balancer Tool screen.

Alternately, program each address through the Zone Bus using a Palm™ compatible handheld device and the VMA1400 Balancing Tool (VBT) software. Refer to *Auxiliary Gear Technical Bulletin (LIT-6363080)* and *Using the VMA1400 Balancing Tool (VBT) Software Technical Bulletin (LIT-6363092).*

Refer to the *Testing and Receiving Data from Controllers* chapter *(LIT-6375040)* of the *HVAC PRO User's Guide* for more information.

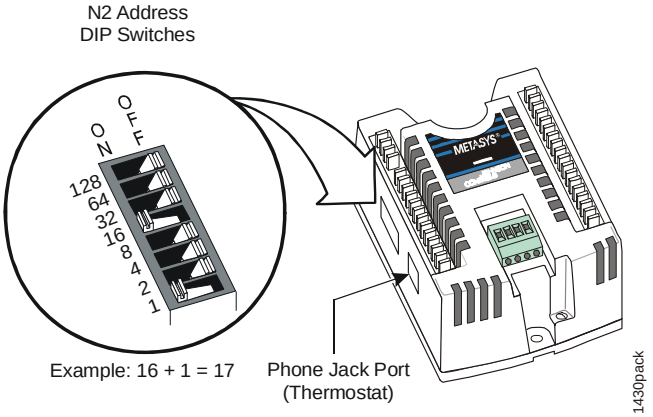

Figure 2: VMA1430 Controller

Setting the Damper Position

Use the following procedure to set the damper position.

1. Locate the damper position. Note the direction to close the damper.
2. Set the damper position:
   a. For 90° boxes, grasp the damper shaft firmly with pliers and manually position it to fully **closed** (icon perpendicular to airflow). Push down and hold the gear release lever and turn the VMA coupler until it contacts the mechanical end-stop at the fully closed position.
   b. For 45° or 60° boxes, grasp the damper shaft firmly with pliers and manually position it to fully **open**. Push down and hold the gear release lever and turn the VMA coupler until it contacts the mechanical end-stop at the fully open position.
3. Tighten the set screw to the shaft using an 8 mm (5/16 in.) wrench or 10 mm (3/8 in.) 12 point socket wrench. Tighten to 17 to 21 N·m [150 to 180 lb·in. (14 lb·ft)].
4. Push the gear release lever down, and turn the VMA coupler by hand to ensure that the damper rotates from full closed to full open positions without binding.
5. Plug or seal the end of hollow damper shaft to stop cold duct air from affecting the circuitry when the VMA is mounted in another enclosure.
6. Attach the pneumatic tubing to the pressure sensor with the HI (red) tubing connected to the inlet or high pressure side. The clear tube connects to the LO inlet of the VAV box.

Repairs and Replacement

Use Table 2 to order replacement controllers and accessories.

Table 2: Ordering Information

Product Code Number	Description
AP-VMA1430-0	VMA1430 controller, single unit
AP-VMA1430-0D	VMA1430 controller, bulk pack
AP-VMA1430-0G	VMA1430 controller, Buy American
AP-TBK1002-0	2-position screw terminals that plug into spade lugs
AP-TBK1003-0	3-position screw terminals that plug into spade lugs
AS-CBLPRO-2	Converter for programming address
AS-CVTPROx00-0	Converter for programming address

Technical Specifications

Product	Variable Air Volume Modular Assembly (VMA)
Power Requirements	Supply Voltage: 20-30 VAC at 50 or 60 Hz Power Consumption: 3 VA maximum (relay, actuator, and valve requirements not included)
Optional 24 VAC Fuse Current	1.2 ampere
Terminations	Standard: 6.3 mm (1/4 in.) spade lugs except communications, which are screw terminals Optional: 2 or 3 position screw terminals that plug into spade lugs (optional accessories AP-TBK1002-0 or AP-TBK1003-0)
Controller Addressing	DIP switch set (1-253). Address 254 is reserved (0 or 255 is for software addressing).
Communications Bus	N2 Bus between VMA controller and NCM or N30 supervisory controller Zone Bus between VMA controller and room sensor (8-pin phone jack or wire to spade lugs)
Mounting	Mounts to duct with two self-drilling mounting screws provided.
Agency Listings	IEEE472, IEEE518, IEEE587 Category A/B, ANSI, C62.41 C-tick Australia/NZ, AS/NZS 4251.1 CFR47, Part 15, Subpart B, Class A/B UL 916 Listed, UL 94-5VB, CSA 22.2 No. 205, IEC-950, IEC 801 CE Directive (89/336/EEC, EN50081-1, EN50082-2)
Ambient Operating Conditions	0 to 50°C (32 to 122°F) 10 to 90% RH noncondensing
Ambient Storage Conditions	-40 to 70°C (-40 to 158°F) 10 to 90% RH noncondensing

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.

FCC Part 15 Label - Note: This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of FCC Rules. These limits are designed to provide reasonable protection against harmful interference when this equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the users will be required to correct the interference at their own expense.

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