VMA1826/1832 VAV Controller Installation Instructions

MS-VMA1826-0 MS-VMA1832-0

Part No. 24-10143-373, Rev. H
Issued April 2016

Refer to the QuickLIT website for the most up-to-date version of this document.

Applications

The VMA18 Series programmable VAV box controllers are intended for use as functional replacements for the VMA1410, VMA1415, VMA1420, and the VMA1440 controllers.

a VMA1826 controllers are well suited for commercial zoning applications and can be used for pressure dependent VAV box applications where no differential pressure tranduser (DPT) is required.

Note: At CCT Release 10.1, VMA18 Series controllers can be configured as either N2 devices or as standard devices. This ability provides a potential cost-effective protocol upgrade path for existing customers and should be considered when you install the controller.

Important: When you receive a VMA18 Series controller from the factory or upgrade the firmware or main code, the controller defaults to using the MS/TP communications protocol. The Load Summary screen of CCT 10.1 and above shows the connection as **Wired Field Bus**, indicating that the MS/TP protocol is in use. If you have an N2 application, the Load Summary screen indicates that you need to switch the communications protocol to N2.

These VMA controllers feature an integral digital pressure sensor, a damper actuator, and a 32-bit microprocessor. The controller's small package size facilitates quick field installation and efficient use of space for field replacements, while still enabling precision control performance.

Note: Connecting an IOM to the VMA via the SA Bus connection is not supported.

See *Sensor Replacement and Reuse Scenarios* for information regarding sensor compatibility and replacement.

North American Emissions Compliance

United States

This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the 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 may cause harmful interference, in which case the users will be required to correct the interference at their own expense.

Canada

This Class (A) digital apparatus meets all the requirements of the Canadian Interference-Causing Equipment Regulations.
Cet appareil numérique de la Classe (A) respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Installation

Observe these guidelines when installing a VMA18 Series controller:

- Transport the VMA controller in the original container to minimize vibration and shock damage to the VMA controller.
- Do not drop the VMA controller or subject it to physical shock.

Parts Included

- one VMA18 Series controller with removable N2/FC bus terminal block
- one installation instructions sheet
- two 1/4 in. x 1/4 in. (6.35 mm x 6.35 mm) brass fittings
- one self-drilling No. 10 x 25 mm (1 in.) screw
- two 12-in. (30.48 cm.) pieces of flexible tubing

Johnson Controls

- one controller/sensor Y cable adapter
- one 8-pin to 6-pin single-socket cable adapter

Note: Remove the cap plug from the TSTAT port of the controller and save for future use. The cap plug is used on existing sensor ports that are no longer used.

Materials and Special Tools Needed

Note: You may not require all the materials listed for your controller installation.

- several 6 mm (1/4 in.) female spade terminals for input and output wiring and crimping tool or spade mounted terminal blocks
- small straight-blade screwdriver for securing wires in the terminal blocks
- 8 mm (5/16 in.) wrench or 10 mm (3/8 in.) 12-point socket to tighten the square coupler bolt
- several shims or washers to mount the VMA
- power screwdriver, 100 mm (4 in.) extension socket, punch, drill, and 3.5 mm (9/64 in.) drill bits to mount the VMA
- pliers to open and close the damper
- required length of 3.97 mm (5/32 in.) ID pneumatic tubing and barbed fittings

Mounting

Observe these guidelines when mounting a VMA:

Important: When the air supply to the VAV box is below 10°C (50°F), make sure that any condensation on the VAV box, particularly on the damper shaft, does not enter the VMA electronics. Mount the VMA vertically above the damper shaft to allow any shaft condensation to fall away from the VMA. Additional measures may be required in some installations.

- Ensure the mounting surface can support the VMA and any user-supplied enclosure.
- Mount the VMA on a hard, even surface whenever possible.
- Use shims or washers to mount the VMA securely and evenly on the mounting surface.
- Mount the VMA in an area free of corrosive vapors that matches the ambient conditions specified in the *Technical Specifications* section.
- Provide sufficient space around the VMA for cable and wire connections and adequate ventilation through the controller (50 mm [2 in.] minimum on the top, bottom, sides and front of the controllers).
- Do not mount the VMA in areas where electromagnetic emissions from other devices or wiring can interfere with controller communication.
- Avoid mounting the VMA on surfaces with excessive vibration.
- Because the VMA controller is smaller than the VMA1410, VMA1415, VMA1420, and VMA1440 controllers, we recommend plugging the unused open hole with the screw from the original VMA14 mounting when using the VMA18 to replace a VMA14 Series controller.

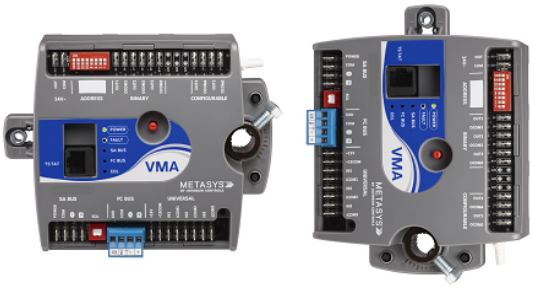
On panel or enclosure mount applications, observe these additional guidelines:

- Do not install the VMA in an airtight enclosure.
- Mount the VMA so that the enclosure walls do not obstruct cover removal or ventilation through the controller.
- Mount the VMA so that the power transformer and other devices do not radiate excessive heat to the controller.

To mount the VMA18 Series controller:

1. Place the VMA18 Series controller in the proper mounting position on the damper shaft so that the wiring connections are easily accessible.
   Note: The line from the captive spacer and screw through the center of the damper shaft must be either horizontal or vertical and the wall plate must be wall-mounted to comply with requirements (*Figure 1*).

Figure 1: Possible VMA18 Series Controller Mounting Positions



Make sure the VMA controller base is parallel to the VAV box (perpendicular to the damper shaft). If needed, use a spacer to offset tipping of the VMA controller caused by the shaft bushings.

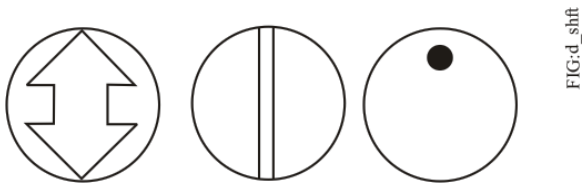
Note: Using the alignment marks to center the captive spacer ensures sufficient VMA18 controller movement in either direction.

2. Secure the self-drilling No. 10 screw through the shoulder washer (*Figure 3*) with a power screwdriver and 100 mm (4 in.) extension socket. Otherwise, use a punch to mark the position of the shoulder washer, and then drill a hole into the VAV box using a 3.5 mm (9/64 in.) drill bit. Insert the mounting screw and tighten against the washer.
   Note: The mounting screw for the VMA controller does not use the same hole as the screw for the VMA1410, VMA1415, VMA1420, and VMA1440 controller. We recommend plugging the unused open hole with the screw from the original VMA14 mounting when using the VMA18 to replace a VMA14 Series controller.

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.

3. Locate the damper position using the typical marking on the end of the damper shaft (*Figure 2*).

Figure 2: Typical Damper End Shaft Icons



4. Note the direction, clockwise (CW) or counterclockwise (CCW), required to close the damper. Grasp the damper shaft firmly with pliers, and either manually close the damper (for 90° boxes) or manually open the damper (for 45° or 60° boxes).
5. Push down and hold the Manual Override button (*Figure 3*) and turn the VMA controller coupler until it contacts the mechanical end-stop at either the fully closed (90° boxes) or fully open (45° and 60° boxes) position.
6. If the damper for a 90° box closes CCW, rotate the coupler to the CCW mechanical limit. If the damper for a 90° box closes CW, rotate the coupler to the CW mechanical limit. The open end-stop is automatically set for 90° boxes.

   For 45° and 60° boxes, hard stops must be provided at both fully closed and fully open damper positions. By installing the VMA controller at the fully open position, the VMA controller provides the open stop for 45° and 60° boxes. The closed damper seal provides the fully closed stop.
7. Tighten the square coupler bolt to the shaft using an 8 mm (5/16 in.) wrench or 10 mm (3/8 in.) 12-point socket. Tighten to 10.5 to 11.5 N·m (95 to 105 lb·in).
8. Loop the pneumatic tubing to include a trap for condensation. If needed, use the included brass fittings and attach the included pieces of tubing to the tubing of the VMA controller. Attach the tubing from the VMA controller to the dual port fitting on the VMA controller and the other ends of the tubing to the pressure transducer in the VAV box application (*Figure 3*). The VMA1826 does not come with the tubing pieces.
   Note: The VMA uses a digital non-flow pressure sensor with bidirectional flow operation, which allows the high- and low-pressure DP tube connections to be made to either barbed fitting on the VMA controller. You do not need to make a specific high- or low-side connection when you attach the tubing to the barbed fittings on the VMA.
9. Push the manual release button, and turn the actuator coupling manually to ensure that the actuator can rotate from full-closed to full-open positions without binding.
10. Complete the mounting by rotating the damper to the full-open position.

⚠ CAUTION

Risk of Property Damage. Rotate the damper to the full-open position before starting the air handler. Failure to rotate the damper to the full-open position may result in damage to the VAV box or ductwork when the air handler is started.

Mise En Garde: Risque de dégâts matériels: Faire pivoter le registre pour le placer en position d'ouverture complète avant de démarrer l'unité de traitement d'air. Le non-respect de cette directive risque d'endommager le caisson de l'unité à volume d'air variable (VAV) ou le réseau de conduites au démarrage de l'unité de traitement d'air.

Figure 3: VMA18 Series Controller Wiring Terminations and Physical Features

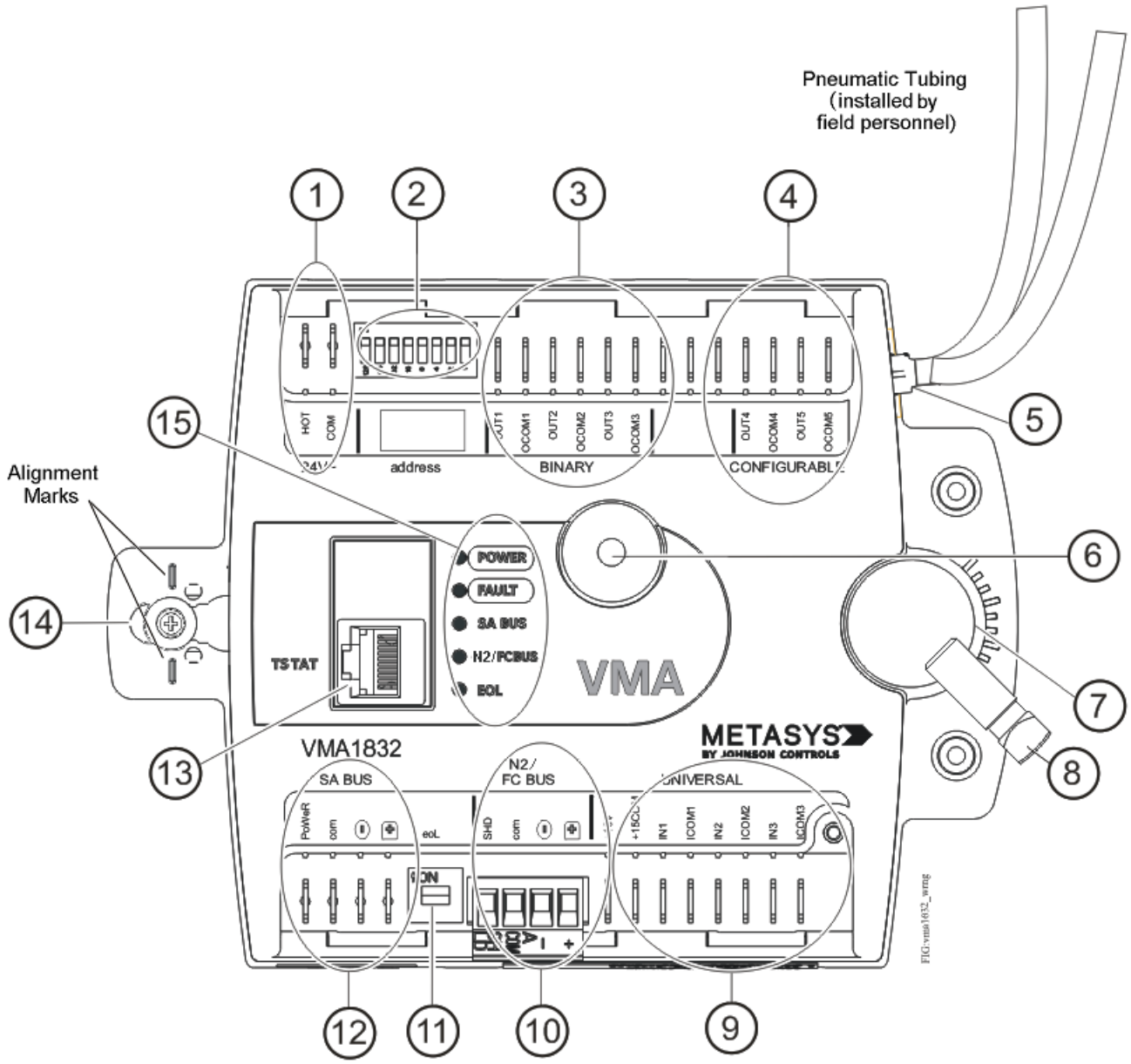


Table 1: VMA18 Series Controller Feature Callout Numbers and Descriptions

Callout	Physical Features: Description and References
1	24 VAC, Class 2 Supply Power Spade Terminals (See *Supply Power Spade Terminals*)
2	Device Address DIP Switch Block (See *Setting the Device Address*)
3	Binary Outputs, 24 VAC Triacs (See *Table 4*)
4	Configurable Outputs: Voltage Analog Output (0–10 VDC) and Binary Output (24 VAC Triac) (See *Table 4*)
5	Dual Port Fitting (See *Figure 3*) Not included in the VMA1826 model.
6	Manual Override Switch (See *Mounting*)
7	Controller Coupler (See *Mounting*)
8	Coupler Bolt (See *Mounting*)
9	Universal Input: Voltage Analog Input (0–10 VDC) Resistive Analog Inputs (0–600k ohm) (See *Table 4*): 0–2k Potentiometer RTD: 1k Nickel, 1k Platinum, or A99B SI NTC: 10K Type L (10K JCI Type II is equivalent to Type L) or 2.252K Type II Dry Contact Binary Input
10	N2/FC Bus Pluggable Screw Terminal Block (See *N2/FC Bus Terminal Block*)
11	EOL (End-of-Line) Switch (See *Setting the EOL Switch*)
12	SA Bus Spade Terminals (See *SA Bus Spade Lugs*)
13	TSTAT Modular Port: RJ-45 8-Pin Modular Jack (See *Modular Port*)
14	Captive Spacer and Screw (See *Figure 3*)
15	LED Status Indicators (See *Table 7*)

Wiring

⚠ CAUTION

Risk of Electric Shock. Disconnect the power supply before making electrical connections to avoid electric shock.

Mise En Garde: Risque de décharge électrique: Débrancher l'alimentation avant de réaliser tout raccordement électrique afin d'éviter tout risque de décharge électrique.

Important: Do not connect supply power to the controller before finishing wiring and checking all wiring connections. Short circuits or improperly connected wires can result in damage to the controller and void any warranty.

Important: Do not exceed the controller electrical ratings. Exceeding controller electrical ratings can result in permanent damage to the controller and void any warranty.

Important: Use copper conductors only. Make all wiring in accordance with local, national, and regional regulations.

Important: Electrostatic discharge can damage controller components. Use proper electrostatic discharge precautions during installation, setup, and servicing to avoid damaging the controller.

For detailed information on configuring and wiring an N2 Bus, refer to the *N2 Communications Bus Technical Bulletin (LIT-636018)*.

VMA Terminals and Bus Ports

See *Figure 3* for input and output terminal and bus port locations on the VMA18 Series controllers. Observe the following guidelines when wiring a VMA18 controller.

Input and Output Terminals

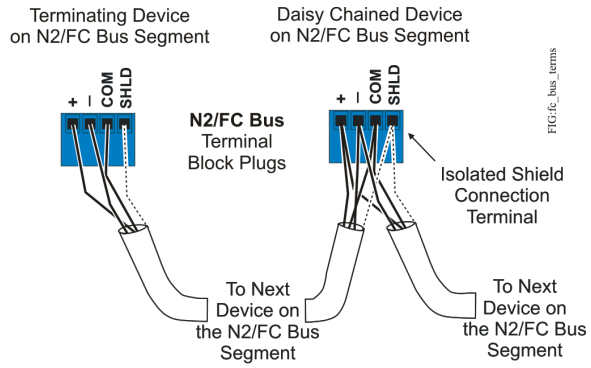
The input spade terminals are located on the side of the VMA near the N2/FC Bus terminal block. The output spade terminals are located on the opposite side of the controller near the power supply spade terminals. See *Table 4* for more information.

N2/FC Bus Terminal Block

The N2/FC Bus terminal block is a blue, removable, 4-terminal plug that fits into a board-mounted jack.

Wire the removable N2/FC Bus terminal block plugs on the VMA and other field controllers in a daisy-chain configuration using 3-wire twisted, shielded cable as shown in *Figure 4*. See *Table 5* and *Table 6* for more information.

Figure 4: N2/FC Bus Terminal Block Wiring



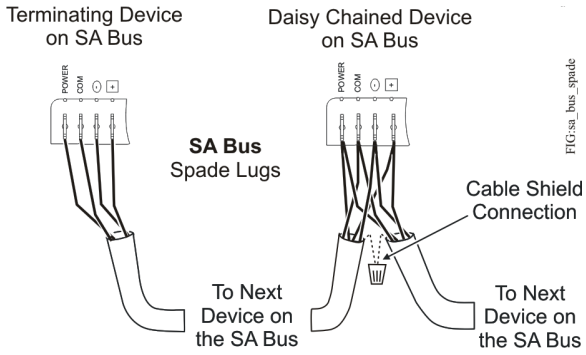
Stranded 3-Wire Twisted Shielded Cable

Note: The Shield terminal (SHLD) on the N2/FC Bus terminal block is isolated and can be used to connect the cable shields on the bus (*Figure 4*).

SA Bus Spade Lugs

Wire the SA Bus spade lugs on the VMA and other SA Bus devices in a daisy-chain configuration using 4-wire twisted, shielded cable as shown in *Figure 5*. See *Table 6* for more information.

Figure 5: SA Bus Spade Lug Wiring



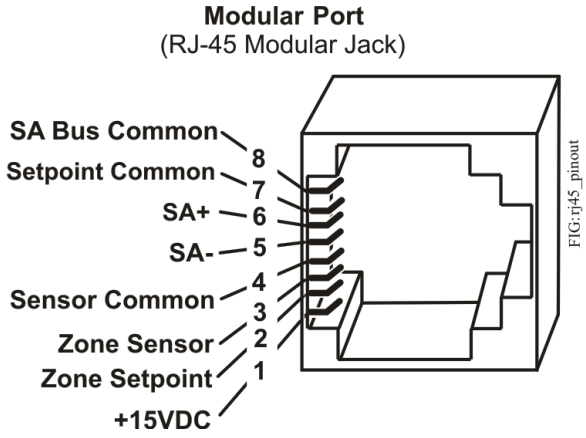
Stranded, 4-Wire (2 Twisted Pair) Shielded Cable
(One twisted pair is the **+** and **-** leads.
The second pair is COM and SA PWR.)

Note: Connecting an IOM to the VMA via the SA Bus connection is not supported.

Modular Port

The modular (TSTAT) port on the face of the VMA (*Figure 3*) is an RJ-45, 8-position modular jack used to connect your new or existing sensor to the VMA using one of the two included adapters. Refer to the Sensor Replacement section in the *N2 VMA Application Note (LIT-12011829)*.

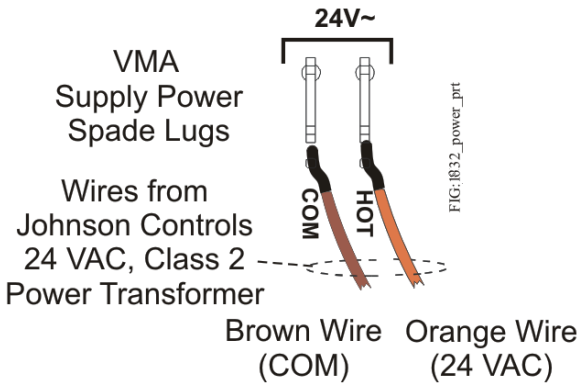
Figure 6: Pin Number Assignments for the Modular Port on VMA18 Controllers



Supply Power Spade Terminals

Wire the 24 VAC supply power wires from the transformer to the HOT and COM terminals on the spade terminal as shown in *Figure 7*. See *Table 6* for more information.

Figure 7: 24 VAC Supply Power Spade Terminal Wiring



Important: The supply power terminal block on the VMA18 is a two-position spade lug (*Figure 7*). Exercise caution while rewiring the power plug when replacing an existing controller. Stray wire strands may make contact and cause a short circuit across the 24 VAC power supply.
To maintain proper phasing when replacing the existing VMA14xx controller with the VMA18 controller, connect the power wire from 24 VAC: 1 terminal on the existing controller to the HOT power terminal on the VMA18. Also connect the power wire from the 24 VAC: 2 terminal on the existing controller to the COM power terminal on the VMA18 controller.

The supply power wire colors may be different on transformers from other manufacturers. Refer to the transformer manufacturer's instructions and the project installation drawings for wiring details.

Important: Connect 24 VAC supply power to the VMA and all other network devices so that transformer phasing is uniform across the network devices. Powering network devices with uniform 24 VAC supply power phasing reduces noise, interference, and ground loop problems. The VMA does not require an earth ground connection.

To wire the VMA18 Series controller:

1. Terminate wiring per engineering drawings.
2. Wire network sensors and other devices to the VMA's Bus.
3. Wire the N2/FC Bus in a daisy chain (see *Table 6*).
4. Ensure that the VMA's device address DIP switches are set to the appropriate device address. (See *Setting the Device Address*.)
5. Connect the VMA controller to 24 VAC, Class 2 power.

Refer to the *N2 VMA Application Note (LIT-12011829)* for more information about replacing an existing controller with an VMA18 controller.

VMA Terminal Functions, Ratings, Requirements, and Wiring Guidelines

Input and Output Wiring Guidelines

Table 4 provides information about the functions, ratings, and requirements for the VMA input and output terminals, and *Table 5* provides guidelines for wire sizes and cable lengths.

In addition to the wiring guidelines in *Table 4*, observe these guidelines when wiring VMA inputs and outputs:

- Run all low-voltage wiring and cables separate from high-voltage wiring.
- All input and output cables, regardless of wire size or number of wires, should consist of twisted, insulated, and stranded copper wires.
- Shielded cable is not required for input or output cables.
- Shielded is recommended for input and output cables that are exposed to high electromagnetic or radio frequency noise.
- Cable runs of less than 30 m (100 ft) typically do not require an offset in the input/output software setup. Cable runs over 30 m (100 ft) may require an offset in the input/output software setup.

Maximum Cable Length versus Load Current

Use *Figure 12* to estimate the maximum cable length relative to the wire size and the load current (in mA) when wiring inputs and outputs.

N2/FC and SA Bus and Supply Power Wiring Guidelines

Table 6 provides information about terminal block functions, ratings, and requirements.

Table 6 also provides wire size, cable type, and cable length guidelines for wiring the VMA communication buses and supply power.

In addition to the guidelines in *Table 6*, observe these guidelines when wiring the SA and N2/FC Buses and supply power:

- Run **all** low-voltage wiring and cables separate from high-voltage wiring.
- All N2/FC and SA Bus cables, regardless of wire size, should be twisted, insulated, stranded copper wire.
- Shielded cable is strongly recommended for all N2/FC and SA Bus cables.
- Refer to the *N2 Communications Bus Technical Bulletin (LIT-636018)* for detailed information regarding wire size and cable length requirements for the N2/FC and SA buses.

Termination Diagrams

A set of termination diagrams provides details for wiring inputs and outputs to the VMA18 Series controllers. See the figures in this section for the applicable termination diagrams.

Table 2: Termination Details

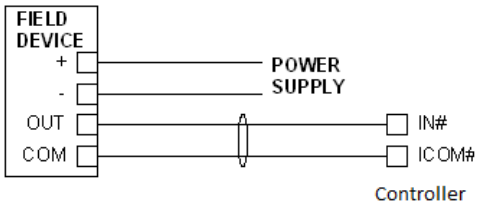
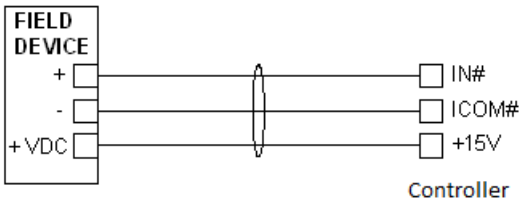
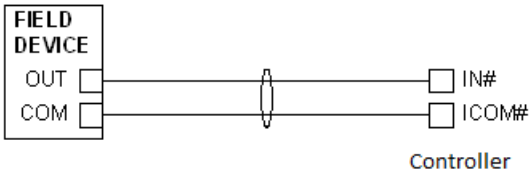
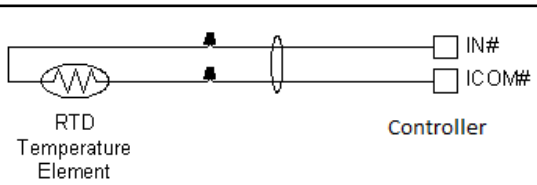
Type of Field Device	Type of Input/Output	Termination Diagrams
Voltage Input - External Source	UI	
Voltage Input - Internal Source	UI	
Voltage Input (Self-Powered)	UI	
Temperature Sensor	UI	

Table 2: Termination Details

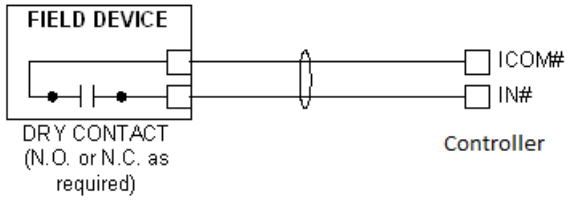
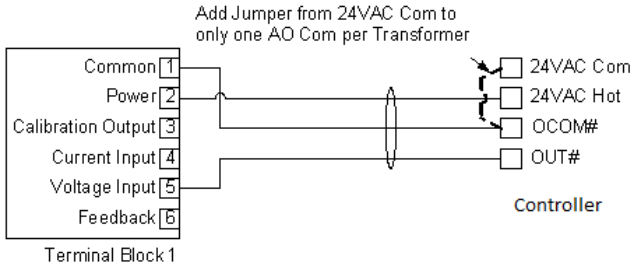
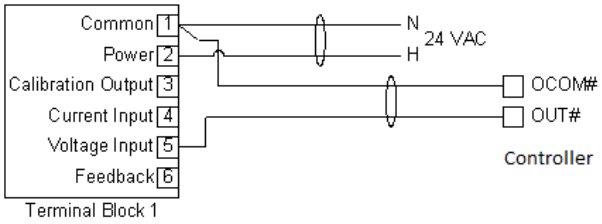
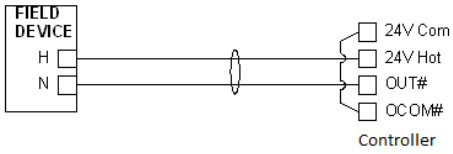
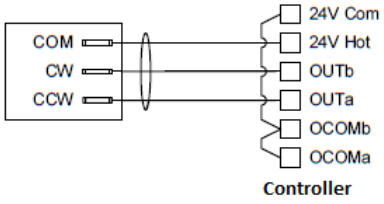
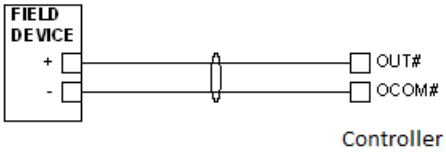
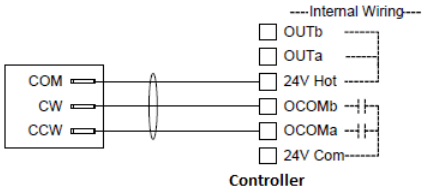
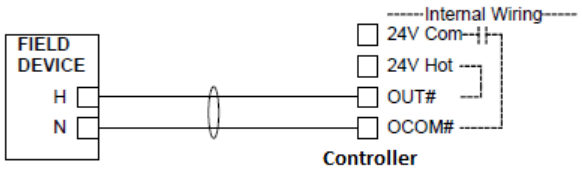
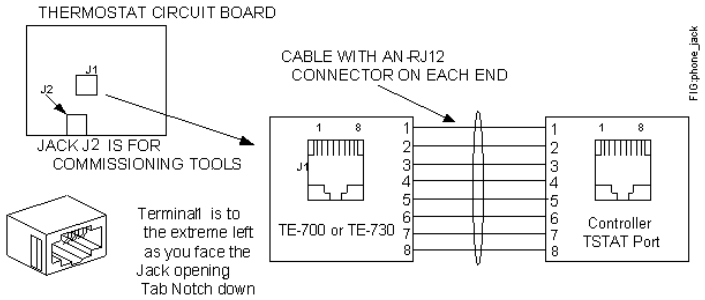
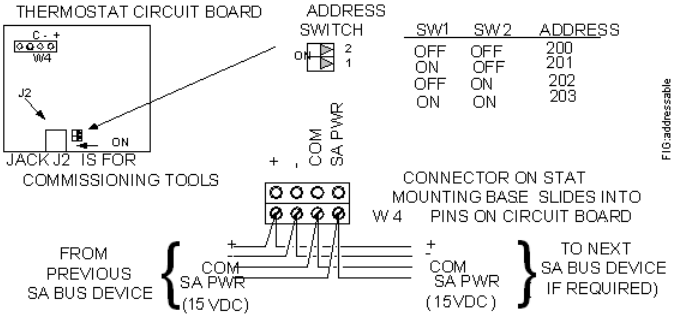
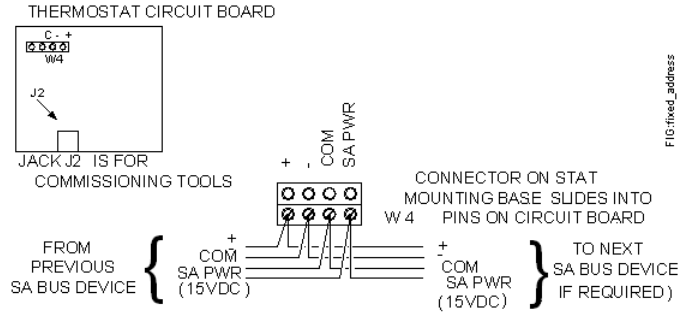
Type of Field Device	Type of Input/Output	Termination Diagrams
Dry Contact	UI	
0–10 VDC Output to Actuator (External Source)	CO	
0–10 VDC Output to Actuator (Internal Source)	CO	
24 VAC Triac Output (Switch Low, External Source)	CO	 **Note:** Only applies to CO4 and CO5.
Incremental Control to Actuator (Switch Low, External Source)	CO	 **Note:** Applies to CO4 and CO5.
Analog Output (Voltage)	CO	

Table 2: Termination Details

Type of Field Device	Type of Input/Output	Termination Diagrams
Incremental Control to Actuator (Switch Low, Internally Sourced)	BO	 **Note:** Applies to BO1, BO2, and BO3.
24 VAC Binary Output (Switch Low, Internally Sourced)	BO	 **Note:** Only applies to BO1, BO2, and BO3.
Temperature Sensor with Modular Jack	SA Bus	 **Note:** The bottom jack (J2) on the TE-700 and TE-6x00 Series Sensors is not usable as a zone bus or an connection.
Network Stat with Terminals Addressable	SA Bus	
Network Stat with Terminals (Fixed Address = 199)	SA Bus	

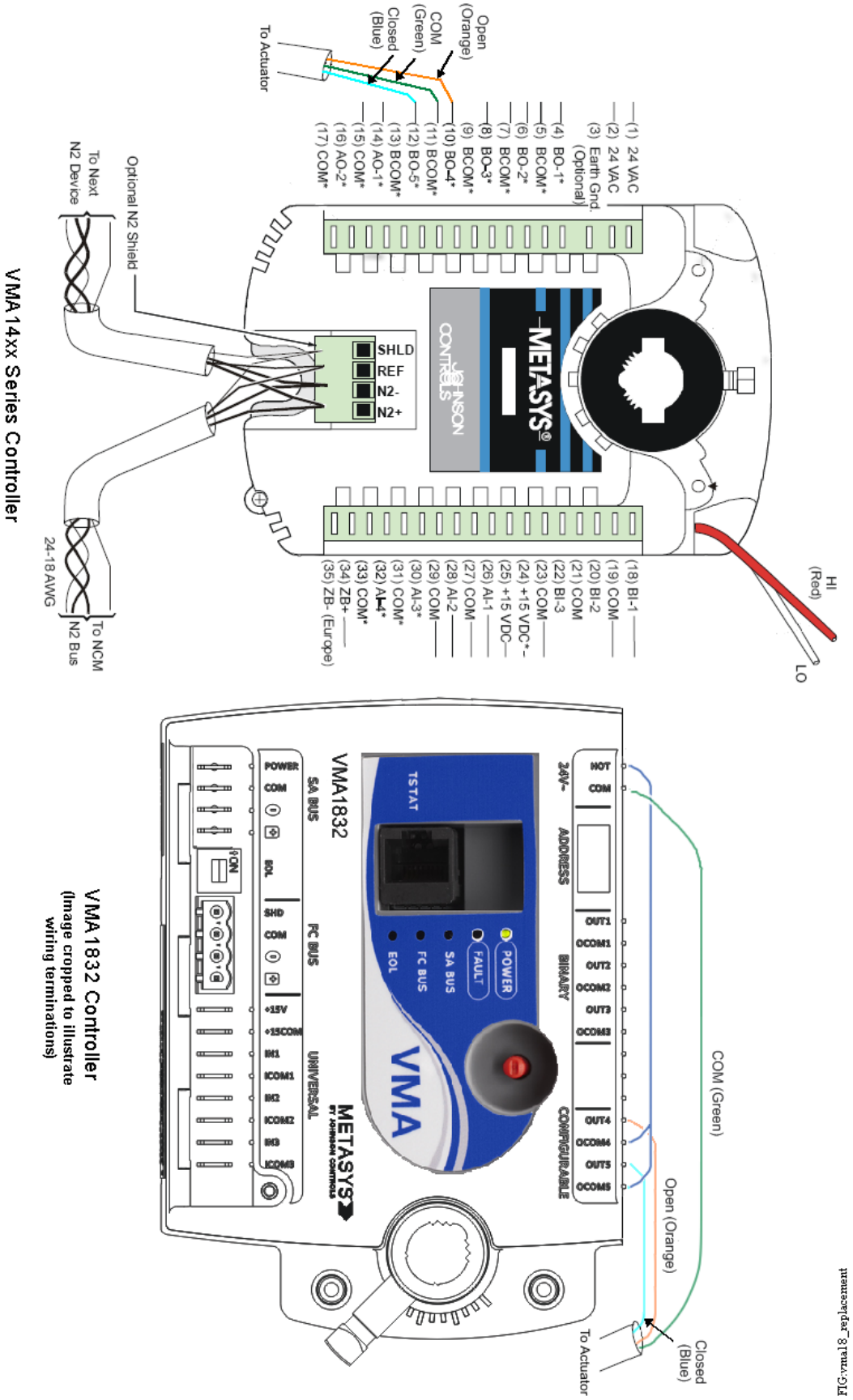
VMA Replacement Wiring Diagram

Consider the following information when replacing a VMA1410, VMA1415, VMA1420, or VMA1440 controller with a VMA18 controller.

The VMA142x controller has five binary outputs (BOs) and internally supplies 24 VAC. The VMA18 controller has three binary outputs (BOs) and supplies 24 VAC to these BOs. The VMA18 controller has two configurable outputs (COs) and these two COs require an external low voltage power source. Refer to *Variable Air Volume Modular Assembly (VMA) 1400 Series (LIT-635058)* for the Input/Output (I/O) point differences between the VMA1410 and VMA1420.

See *Figure 8* for wiring instructions.

Figure 8: VMA Replacement Wiring Diagram



Sensor Replacement and Reuse Scenarios

This section describes sensor replacement and reuse scenarios for replacing a VMAS1410, VMA1415, VMA1420, or VMA1440 controller with VMA18 controllers.

See *Table 3* for a description of the most popular sensor models used with the VMA1410, VMA1415, VMA1420, or VMA1440 controllers, the sensor replacement and reuse scenarios for that sensor model, and sensor replacement and reuse instructions.

Important: Complete all the steps in the *Mounting* section before following the instructions in this section.

Table 3: Sensor Replacement and Reuse Scenarios

Sensor Used With VMA1410, VMA1415, VMA1420, or VMA1440 Controller	Sensor Replacement and Reuse Scenarios	Instructions
TE-6xxx Series (see *TE-6xxx Series Sensor Connected to VMA Controller*)	Replace a sensor with an NS Series Sensor **Note:** Replacing a TE-6xxx Series Sensor is recommended over reusing the sensor because it provides a usable port at the sensor location for commissioning.	*Replacing a TE-6xxx Series Sensor*
	Reuse a sensor, installing an adapter at a VMA controller location	*Reusing a TE-6xxx Series Sensor*
AP-TMZ1600-0 (see *Replacing an AP-TMZ1600-0 Sensor Connected to a VMA Controller*)	Replace a sensor with an NS Series Sensor	*Replacing an AP-TMZ1600-0 Sensor Connected to a VMA Controller*
TE-7710-0 Series Wireless Transmitter and TE-7720-0 Wireless Receiver (see *Replacing a TE-7710-0 Series Wireless Transmitter and TE-7720-0 Wireless Receiver Connected to a VMA Controller*)	Replace with aWRZ Series Wireless Sensor and a WRZ7860 Series One-to-One Receiver	*Replacing a TE-7710-0 Series Wireless Transmitter and TE-7720-0 Wireless Receiver Connected to a VMA Controller*
TE-700 Series (see *TE-700 Series Sensor Connected to a VMA Controller*)	Replace a sensor with a TE-730 Series Sensor	*Replacing a TE-700 Series Sensor*
	Reuse a sensor	*Reusing a TE-700 Series Sensor*

Sensor Replacement Scenario Descriptions

TE-6xxx Series Sensor Connected to VMA Controller

Follow the instructions in the *Replacing a TE-6xxx Series Sensor* section to replace a TE-6xxx Series Sensor with a functionally equivalent NS Series Network Sensor, or in the *Reusing a TE-6xxx Series Sensor* section to reuse a TE-6xxx Series Sensor connected to a VMA controller.

Replacing the sensor with an NS Series Network Sensor is preferred to reusing the TE-6xxx Series Sensor because the NS sensor allows for easier controller commissioning. Be sure to use an NS sensor with similar dimensions as the existing sensor in order to match the original sensor installation.

Note: If temporary occupancy is required for the application on the TE-67xx and TE-68xx Series Sensors, set the DIP switch positions on the back of the sensor to down, up, and down. This setting only applies to single and no setpoint controller models (not dual setpoint controller models).

Refer to the *NS Series Network Sensors Product Bulletin (LIT-12011574)* for a complete list of available NS Series Network Sensors.

Replacing a TE-6xxx Series Sensor

Use the following instructions to replace a TE-6xxx Series Sensor with a functionally equivalent NS Series Network Sensor.

Note: Replacing a TE-6xxx Series Sensor is recommended over reusing the sensor.

Note: When replacing a TE-6xxx Series sensor with an NS Series sensor and dissimilar paint or wall covering is visible outside of the new sensor, consider using the NS-WALLPLATE-0 for the new NS sensor. See *Table 8* for more information.

1. Remove the TE-6xxx Series Sensor from the wall and disconnect the 8-pin male jack from the back of the sensor.
2. Plug the 8-pin male jack that was plugged into the back of the sensor into the 8-pin female socket on the single-socket adapter (*Figure 9*) provided with the VMA18 controller.
3. Plug the 6-pin male jack on the single socket adapter into the modular jack connection on the NS Series Network Sensor.
4. Mount the NS Series Network Sensor in the same location the TE-6xxx Series Sensor was previously mounted, concealing the adapter assembly in the existing wall opening behind the sensor. Refer to the installation instructions for the applicable NS Series Sensor model.
5. Plug the Wireless Commissioning Converter into the 6-pin socket on the NS Series Network Sensor.

Note: When using an NS Series Network Sensor with screw terminal block terminations, see the wiring diagram in the installation instructions for the applicable NS Series Sensor model.

Figure 9: Single-Socket Adapter

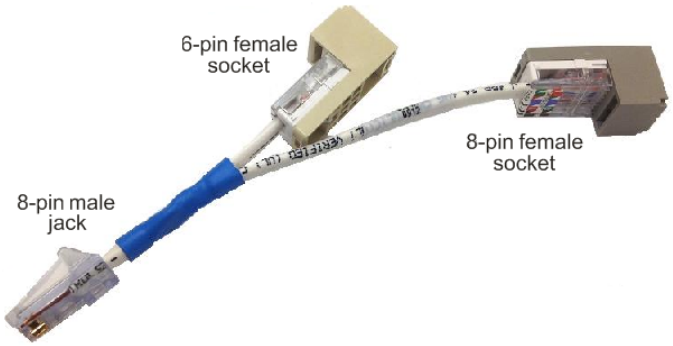
Reusing a TE-6xxx Series Sensor

See the instructions in this section to reuse a TE-6xxx Series Sensor with the VMA controller. The Y adapter provided in the VMA18 accessory pack is required for this procedure.

Note: The adapter **must be** installed at the VMA controller location.

See *Installing the Adapter at the VMA Controller Location* to install the adapter at the VMA controller location.

Figure 10: Y Adapter



Installing the Adapter at the VMA Controller Location

Use the following instructions to install the adapter at the VMA location.

1. Disconnect the 8-pin male jack that is plugged into the VMA1410, VMA1415, VMA1420, or VMA1440 controller.
2. Plug the 8-pin male jack that was plugged into the VMA controller into the 8-pin female socket on the Y adapter (*Figure 11*).
3. Plug the 8-pin male jack on the Y adapter into the VMA18 controller socket labeled TSTAT (*Figure 11*).
4. Plug the Wireless Commissioning Converter (BTCVT) into the 6-pin socket on the Y adapter. When commissioning is complete, allow the 6-pin socket to remain unconnected (*Figure 11*).

Replacing an AP-TMZ1600-0 Sensor Connected to a VMA Controller

Use the following instructions to replace an AP-TMZ1600-0 sensor connected to a VMA controller.

Note: The AP-TMZ1600-0 sensor is not supported for use with the VMA18 controller and **must** be replaced with a NS Series Network Sensor. Refer to the *NS Series Network Sensors Product Bulletin (LIT-12011574)* for a complete list of available NS Series Network Sensors.

1. Remove the AP-TMZ1600-0 sensor and disconnect the 8-pin male jack from the back of the sensor.
2. Plug the 8-pin male jack from the VMA controller into the 8-pin female socket on the single-socket adapter (*Figure 9*) included with the VMA18 controller.
3. Plug the 6-pin male jack on the single socket adapter into the modular jack connection on the back of the NS Series Network Sensor.
4. Mount the NS Series Network Sensor in the same location the AP-TMZ1600-0 Sensor was previously mounted, concealing the adapter assembly in the existing wall opening behind the sensor. Refer to the installation instructions for the applicable NS Series Sensor model.
5. Plug the Wireless Commissioning Converter into the 6-pin socket on the NS Series Network Sensor.

Note: When using an NS Series Network Sensor with screw terminal block terminations, see the wiring diagram in the installation instructions for the applicable NS Series Sensor model.

Replacing a TE-7710-0 Series Wireless Transmitter and TE-7720-0 Wireless Receiver Connected to a VMA Controller

Use the following instructions to replace a TE-7710-0 Series Wireless Transmitter and TE-7720-0 Wireless Receiver connected to a VMA controller, or to convert the wired sensors used with the VMA18 controller to wireless.

Note: The TE-7710-0 Series Wireless Transmitter and TE-7720-0 Wireless Receiver **must both** be replaced with aWRZ Series Wireless Sensor and a WRZ7860-0 Series One-to-One Receiver. Refer to the *WRZ Series Wireless Room Sensors Product Bulletin (LIT-12011653)* for a complete list of available WRZ Series Wireless Room Sensors.

1. Disconnect the 6-foot interface cable connecting the VMA controller and the TE-7720-0 Wireless Receiver.
2. Plug one end of the 6-foot interface cable into the VMA18 socket labeled TSTAT.
3. Plug the other end of the 6-foot interface cable into the 8-pin female socket of the single-socket adapter.
4. Plug the male end of the single-socket adapter directly into the Wireless Commissioning Converter.
5. Complete commissioning of the VMA18 controller and disconnect the Wireless Commissioning Converter.
   Note: Sensor point information such as temperature, setpoint, and occupancy is not available during commissioning.
6. Install the WRZ Series Wireless Sensor and a WRZ7860-0 Series One-to-One Receiver in the same locations as the previous sensor and receiver. Refer to the *WRZ Series Wireless Room Sensors Installation Instructions (Part No. 24-10332-2)* and the *WRZ-7860-0 Installation Instructions (Part No. 24-10563-47)*.
7. Plug the 6-pin male jack on the adapter into the WRZ7860-0 receiver.

Note: When using an WRZ Series Sensor with screw terminal block terminations, refer to the wiring diagram in the installation instructions for the applicable WRZ Series Sensor model.

TE-700 Series Sensor Connected to a VMA Controller

Follow the instructions in *Replacing a TE-700 Series Sensor* to replace a TE-700 Series Sensor with a TE-730 Series Sensor, or *Reusing a TE-700 Series Sensor* to reuse a TE-700 Series Sensor connected to a VMA controller.

Replacing a TE-700 Series Sensor

Replace a TE-700 Series Sensor with a TE-730 Series Sensor. No cable adapters are required for this scenario.

Note: Refer to the *TE-730 Series Sensor Installation Instructions (Part No. 24-10674-0)* to install the TE-730 Series Sensor.

Reusing a TE-700 Series Sensor

See the instructions in this section to reuse a TE-700 Series Sensor when connected to a VMA18 controller.

1. Disconnect the 8-pin male jack plugged into the VMA controller.
2. Plug the 8-pin male jack on the Y adapter (*Figure 9*) provided with the VMA controller into the 8-pin female socket labeled TSTAT on the VMA18 controller.
3. Plug the 8-pin male jack that was plugged into the VMA controller into the 8-pin female socket of the Y adapter.
   Note: The 6-pin connection is not used for this scenario and it should remain unconnected.
4. Refer to the *TE-730 Series Sensor Installation Instructions (Part No. 24-10674-0)* to install the TE-730 Series Sensor.

Figure 11: Y Adapter at Controller Location

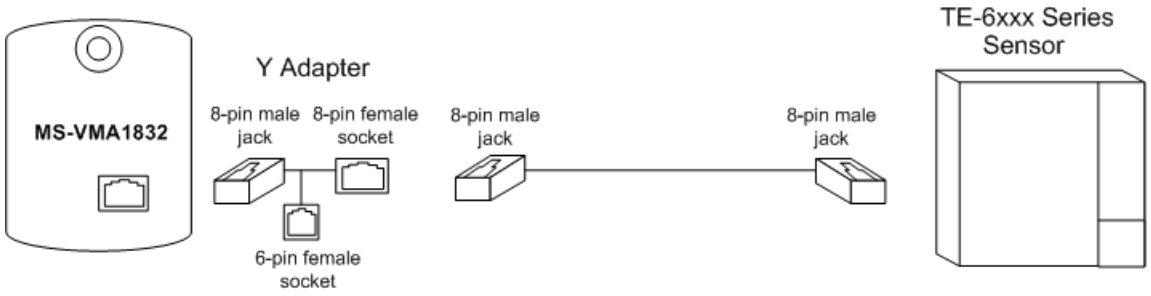


Table 4: I/O Terminal Blocks, Functions, Ratings, Requirements, and Cables

Terminal Block Label	Terminal Labels	Function, Ratings, and Requirements	To Determine Wire Size and Maximum Cable Length[1]
UNIVERSAL (Inputs)	**+15 V**	**15 VDC Power Source** for active (3-wire) input devices connected to the Universal INn terminals. Provides 35 mA total current.	Same as (Universal) **IN***n*. **Note:** Use 3-wire cable for devices that source power from the +15 V terminal.
	IN*n*	**Analog Input - Voltage Mode (0–10 VDC)** 10 VDC maximum input voltage Internal 75k ohm Pulldown	See Guideline A in *Table 5*.
		Analog Input - Resistive Mode (0–600k ohm) Internal 12 V, 15k ohm pull up Qualified Sensors: 0–2k potentiometer, RTD (1k Nickel [Johnson Controls sensor], 1k Platinum, and A99B Silicon Temperature Sensor) Negative Temperature Coefficient (NTC) Sensor 10K Type L (10K JCI Type II is equivalent to Type L) or 2.252K Type II	See Guideline A in *Table 5*.
		Binary Input - Dry Contact Maintained Mode 1 second minimum pulse width Internal 12 V, 15k ohm pull up	See Guideline A in *Table 5*.
	ICOM*n*	**Universal Input Common** for all Universal IN terminals **Note:** All Universal ICOMn terminals share a common, which is isolated from all other commons.	Same as (Universal) **IN***n*.
BINARY (Outputs)	**OUT***n*	**Binary Output - 24 VAC Triac (Internal Power)** Sources internal 24 VAC power (24~ HOT)	See Guideline C in *Table 5*.
	OCOM*n*	**Binary Output - 24 VAC Triac (Internal Power)** Connects OCOMn to 24~ COM when activated. Internal Power Source: 30 VAC maximum voltage to load 0.5 A maximum output current 1.3 A at 25% duty cycle 40 mA minimum load current	See Guideline C in *Table 5*.

Table 4: I/O Terminal Blocks, Functions, Ratings, Requirements, and Cables

Terminal Block Label	Terminal Labels	Function, Ratings, and Requirements	To Determine Wire Size and Maximum Cable Length[1]
CONFIGURABLE (Outputs)	**OUT***n*	**Analog Output - Voltage Mode (0–10 VDC)** 10 VDC maximum output voltage 10 mA maximum output current External 1k to 50K ohm load required	See Guideline A in *Table 5*.
		Binary Output 24 VAC Triac Connects OUT to OCOM when activated. External Power Source: 30 VAC maximum voltage to load 0.5 A maximum output current 1.3 A at 25% duty cycle 40 mA minimum load current	See Guideline C in *Table 5*.
	OCOM*n*	**Analog Output Signal Common**: All Configurable Outputs defined as Analog Outputs share a common, which is isolated from all other commons except the Binary Input common.	Same as (Configurable) **OUT***n*.
		Binary Output Signal Common: All Configurable Outputs defined as Binary Outputs are isolated from all other commons, including other Configurable Output commons.	

1 *Table 5* defines cable length guidelines for the various wire sizes that may be used for input and output wiring.

Table 5: Cable Length Guidelines for Recommended Wire Sizes

Guideline	Wire Size/Gauge and Type	Maximum Cable Length and Type	Assumptions
A	1.5 mm^2 (18 AWG) stranded copper	457 m (1,500 ft) twisted wire	100 mV maximum voltage drop Depending on the cable length and the connected input or output device, you may have to define an offset in the setup software for the input or output point.
	0.8 mm (20 AWG) stranded copper 297 m (975 ft) twisted wire	297 m (975 ft) twisted wire	
	0.6 mm (22 AWG) stranded copper 183 m (600 ft) twisted wire	183 m (600 ft) twisted wire	
	24 AWG stranded copper 107 m (350 ft) twisted wire	107 m (350 ft) twisted wire	
B	1.5 mm^2 (18 AWG) stranded copper	229 m (750 ft) twisted wire	100 mV maximum voltage drop Depending on the cable length and the connected input or output device, you may have to define an offset in the setup software for the input or output point.
	0.8 mm (20 AWG) stranded copper 297 m (975 ft) twisted wire	137 m (450 ft) twisted wire	
	0.6 mm (22 AWG) stranded copper 183 m (600 ft) twisted wire	91 m (300 ft) twisted wire	
	24 AWG stranded copper 107 m (350 ft) twisted wire	61 m (200 ft) twisted wire	
C	See *Figure 12* to select wire size/gauge. Use stranded copper wire.	See *Figure 12* to determine cable length. Use twisted wire cable.	N/A

Figure 12: Maximum Wire Length by Current and Wire Size

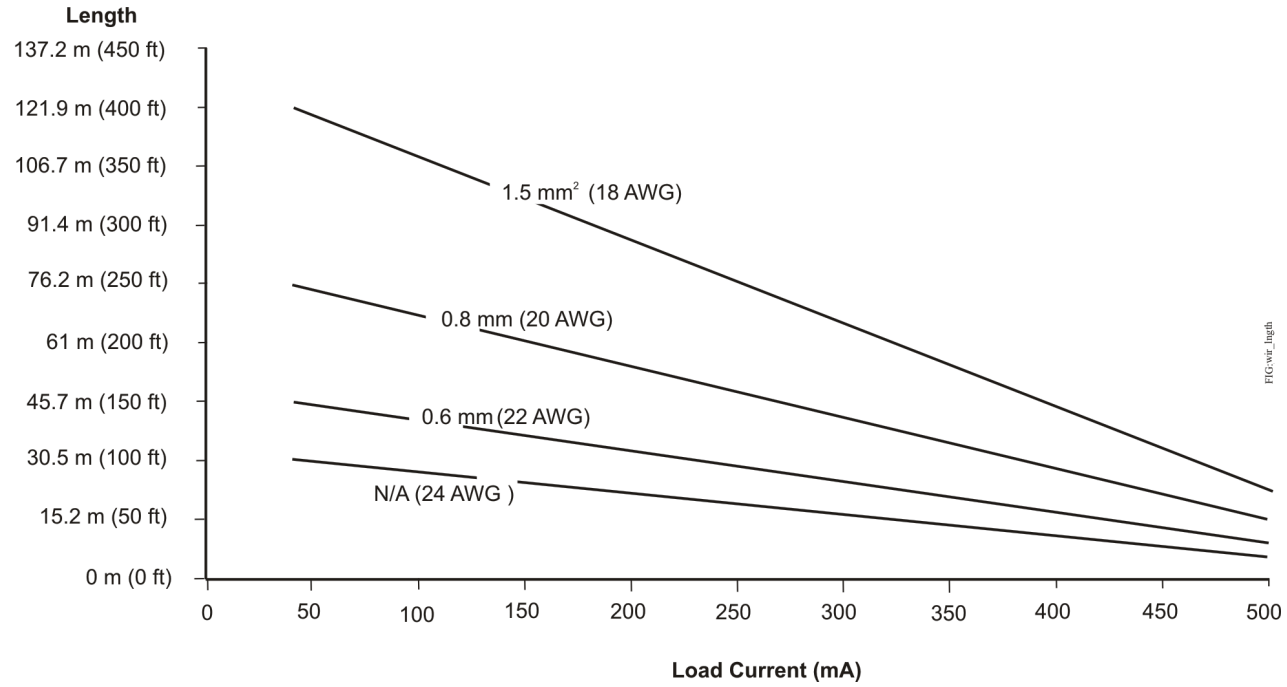


Table 6: Communication Bus and Supply Power Terminal Blocks, Functions, Ratings, Requirements, and Cables

Terminal Block/Port Label	Terminal Labels	Function, Electrical Ratings/Requirements	Recommended Cable Type[2]
N2/FC BUS[2]	**+** **-**	N2/FC Bus Communications	Use existing cable or 18 AWG
	COM	Signal Reference (Common) for bus communications	
	SHLD	Isolated terminal (optional shield drain connection)	
SA BUS	**+** **-**	SA Bus Communications	0.6 mm (22 AWG) stranded, 4-wire (2 twisted-pairs), shielded cable recommended **Note:** The + and - wires are one twisted pair, and the COM and SA PWR are the second twisted pair.
	COM	SA Bus Signal Reference and 15 VDC Common	
	SA PWR	15 VDC Supply Power for Devices on the SA Bus	
TSTAT	**TSTAT**	RJ-45 8-Position Modular Connector provides +15 VDC Power for: • Wireless Commissioning Converter • VAV Balancing Tool • One-to-One Wireless Receiver	24 AWG 3-pair CAT 3 Cable <30.5 m (100 ft)

Table 6: Communication Bus and Supply Power Terminal Blocks, Functions, Ratings, Requirements, and Cables

Terminal Block/Port Label	Terminal Labels	Function, Electrical Ratings/Requirements	Recommended Cable Type[2]
24~	**HOT**	**24 VAC Power Supply - Hot** Supplies 20–30 VAC (Nominal 24 VAC)	0.8 mm to 1.5 mm^2 (20 to 18 AWG) 2-wire
	COM	**24 VAC Power Supply Common** (Isolated from all other Common terminals on controller)	

1 See *Table 5* to determine wire size and cable lengths for cables other than the recommended cables.
2 The N2/FC Bus wiring recommendations in this table are for N2 bus communications at 9,600 baud. For more information, refer to the *N2 Communications Bus Technical Bulletin (LIT-636018)*.

Setup and Adjustments

Important: Electrostatic discharge can damage controller components. Use proper electrostatic discharge precautions during installation, setup, and servicing to avoid damaging the controller.

Setting the Device Address

field controllers are slave devices on N2 buses. Before operating field controllers on a bus, you must set a valid and unique device address for each controller on the bus.

You set a field controller's device address by setting the positions of the switches on the Device Address DIP switch block at the top of the controller (*Figure 3*). Device addresses 1 through 253 are the valid N2 addresses for these N2 controllers.

Valid MS/TP addresses for wired controllers are 4 through 127. For wireless controllers, valid addresses are 132 through 255 (132 [132-128=4] through 255 [255-128=127]).

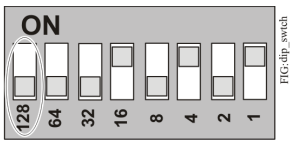
For wireless controllers, the address 120 through 127 are used by the ZigBee® Coordinator. This may cause a smaller field device range.

If the VMA18 Series controller may eventually be converted to MS/TP, use addresses 4 through 127 for a wired VMA controller or addresses 132 through 253 for a future wireless VMA controller, if possible. Using these addresses simplifies the MS/TP conversion process.

Note: *Metasys* field controllers ship with Switch 128 ON and the remaining address switches OFF rendering the controllers wired slave devices, which do not operate on MS/TP buses, but do not interfere with bus operation. Set a valid and unique device address on the field controller before applying power to the controller on the bus.

The DIP switch block (*Figure 13*) has eight switches numbered 128, 64, 32, 16, 8, 4, 2, and 1. Switches 128 through 1 are device address switches.

Figure 13: Device Address Switches Set to 21



To set the device addresses on a *Metasys* field controller:

1. Set all of the switches on the field controller's device address DIP switch block (128 through 1) to OFF.
2. Set one or more of the eight address switches (128 through 1) to ON, so that the sum of the switch numbers set to ON equals the intended device address.

   Set the highest number switch that is less than or equal to the intended device address to ON. Then continue setting lower numbered switches until the total equals the intended address. For example, if the intended device address is 21, set Switch 16 to ON first, then set Switch 4 to ON, followed by Switch 1 (16+4+1=21). See *Figure 13*.
3. Set a unique and sequential device address for each of the field controllers connected on the N2 bus, starting with device address 1.

   To ensure the best bus performance (if the protocol is changed to BACnet MS/TP), set sequential device addresses with no gaps in the device address range (4, 5, 6, 7, 8, 9, and so on). The field controllers do not need to be physically connected on the bus in their numerical device address order.
4. Write each field controller's device address on the white label below the DIP switch block on the controller's cover.

Refer to the *N2 Communications Bus Technical Bulletin (LIT-636018)* for more information on field controller device addresses and how to set them on N2 buses.

Setting the EOL Switch

Each field controller has an switch, which, when set to ON (up), sets the field controller as a terminating device on the bus. See *Figure 3* for the EOL switch location on the field controller. The default EOL switch position is OFF (down).

Figure 14: EOL Switch Positions

To set the EOL switch on a field controller:

1. Determine the physical location of the field controller on the N2 or FC Bus.
2. Determine if the field controller must be set as a terminating device on the bus.
   Note: Refer to the *N2 Communications Bus Technical Bulletin (LIT-636018)* for the N2 bus EOL termination rules. Refer to the *MS/TP Communications Bus Technical Bulletin (LIT-12011034*) for the FC bus EOL termination rules.
3. If the field controller is a terminating device on the N2 or FC Bus, set the EOL switch to ON. If the field controller is not a terminating device on the bus, set the EOL switch to OFF.
   Note: When the EOL switch is set to ON, the LED light on the face of the controller is illuminated.

Commissioning

Use the following procedure to commission the VMA18 controller:

1. Download the control application to the VMA controller using the Refer to the Controller Tool *Help (LIT-12011147)*.
2. Commission the VAV Box. Refer to the Controller Tool *Help (LIT-12011147)*.
3. Perform airflow balancing on the VAV box. Refer to the *VAV Balancing Tool Technical Bulletin (LIT-12011087)*.
4. Perform commissioning checkout procedures. Refer to the Controller Tool *Help (LIT-12011147)*.

CCT connects to the VMA through a laptop computer using any one of three connection options: the Wireless Commissioning Converter, the Wireless ZigBee USB Dongle, or the wired BACnet Ethernet to MS/TP Router. These connection options require additional hardware listed in *Table 8*.

For more detailed N2 VMA controller commissioning information, refer to the *N2 VMA Application Note (LIT-12011829).*

Troubleshooting

Table 7 provides LED status indicator information for troubleshooting the VMA18 controller.

Repair Information

If the VMA18 Series controller fails to operate within its specifications, replace the unit. For a replacement unit, contact the nearest Johnson Controls representative.

Accessories

Use *Table 8* to order accessories.

Table 7: VMA18 Controller Status LEDs

LED Label	LED Color	Normal State	Descriptions of LED States
POWER	Green	On Steady	Off Steady = No power On Steady = Power is supplied by primary voltage
FAULT	Red	Off Steady	Blink - 2 Hz = Download or startup in progress, not ready for normal operation, SA Bus devices offline (such as Netsensors) Off Steady = No faults On Steady = Device fault or no application loaded
N2/FC BUS	Green	Blink - 2 Hz	Blink - 2 Hz = Data transmission (normal communication) Off Steady = No data transmission (auto baud in progress) On Steady = Communication lost; waiting to join communication ring

Table 7: VMA18 Controller Status LEDs

LED Label	LED Color	Normal State	Descriptions of LED States
SA BUS	Green	Blink - 2 Hz	Blink - 2 Hz = Data transmission (normal communication) Off Steady = No data transmission (N/A - auto baud not supported) On Steady = Communication lost; waiting to join communication ring
EOL	Amber	Off	On Steady = EOL is active Off Steady = EOL is not active

Table 8: VMA18 Controller Accessories (Order Separately)

Product Code Number	Description
Y64T15-0	Transformer, 120/208/240 VAC Primary to 24 VAC Secondary, 92 VA, Foot Mount, 30 in. Primary Leads and 30 in. Secondary Leads, Class 2
Y65A13-0	Transformer, 120 VAC Primary to 24 VAC Secondary, 40 VA, Foot Mount (Y65AS), 8 in. Primary Leads and 30 in. Secondary Leads, Class 2
Y65T42-0	Transformer, 120/208/240 VAC Primary to 24 VAC Secondary, 40 VA, Hub Mount (Y65SP+), 8 in. Primary Leads and Secondary Screw Terminals, Class 2
Y65T31-0	Transformer, 120/208/240 VAC Primary to 24 VAC Secondary, 40 VA, Foot Mount (Y65AR+), 8 in. Primary Leads and Secondary Screw Terminals, Class 2
AS-CBLVMA-1	Cable Adapter, 8-pin Female Socket to 6-Pin Male Jack (Bulk Pack of 10)
AP-TBK4FC-0	Replacement MS/TP FC Bus Terminal, 4-Position Connector, Blue, Bulk Pack (10 pack)
AS-CBLVMA-2	Cable Adapter, 8-pin Female Socket to 8-pin Male Jack with 6-Pin Female Socket for Wireless Commissioning Converter (Bulk Pack of 10)
MS-BTCVT-1	Wireless Commissioning Converter with Technology
NS-WALLPLATE-0	Network Sensor Wall Plate (80 mm by 80 mm [3.15 in. by 3.15 in.] square), used with an 80 mm by 80 mm (3.15 in. by 3.15 in.) network sensor and must be mounted to a 0.6 m by 1.2 m (2 ft by 4 ft) wall box
NS Series Network Sensors	Refer to the *NS Series Network Sensors Product Bulletin (LIT-12011574)* for specific sensor model descriptions.

Technical Specifications

Table 9: VMA18 Series Controllers

Product Code Numbers	**MS-VMA1832-0:** Cooling with Reheat and Fan Control **MS-VMA1826-0:** Same as above except with no differential pressure sensor
Supply Voltage	24 VAC (nominal, 20 VAC minimum/30 VAC maximum), 50/60 Hz, Power Supply Class 2 (North America), Safety Extra-Low Voltage (SELV) (Europe)
Power Consumption	10 VA typical, 14 VA maximum **Note:** The VA ratings do not include any power supplied to the peripheral devices connected to Binary Outputs (BOs) or Configurable Outputs (COs), which can consume up to 12 VA for each BO or CO, for a possible total consumption of an additional 60 VA (maximum).
Ambient Conditions	**Operating:** 0 to 50°C (32 to 122°F) **Storage:** -40 to 70°C (-40 to 158°F)
Terminations	Inputs/Outputs, SA bus, and Supply Power: 6.3 mm (1/4 in.) Spade Lugs N2/FC Bus Pluggable Screw Terminal Block TSTAT Modular Port: RJ-45 8-Pin Modular Jack
Controller Addressing	**N2 Open Protocol:** Valid field controller device addresses 1–253 **BACnet MS/TP:** DIP switch set; valid field controller device addresses 4–127 (Device addresses 0–3 and 128–255 are reserved and not valid field controller addresses.)
Communications Bus[1]	**RS-485: selectable between BACnet MS/TP or N2** FC Bus: 1.5 mm (18 AWG) standard 3-wire, twisted, shielded cable recommended between the supervisory controller and field controllers SA Bus: 0.6 mm (22 AWG) stranded, 4-wire (2-twisted pairs) shielded cable recommended from the VMA controller for network sensors and other sensor/actuator devices; includes a terminal to source 15 VDC supply power from VMA to SA Bus devices[1]
Analog Input/Analog Output Accuracy	**Analog Input:** 15-bit resolution on UIs **Analog Output:** 0–10 VDC ± 200 mV
Air Pressure Differential Sensor (VMA1832 Only)	Range: -1.5 in. to 1.5 in. W.C. **Performance Characteristics:** Accuracy: ±0.75% Full Span Maximum[2] (±0.0225 in. W.C.) Typical accuracy at zero (null) pressure is ±0.003 in. W.C.
Actuator Rating	4 N·m (35 lb·in) minimum shaft length = 44 mm (1-3/4 in.)
Mounting	Mounts to damper shaft using single set screw and to duct with single mounting screw
Dimensions (Height x Width x Depth)	165 x 125 x 73 mm (6.5 x 4.92 x 2.9 in.) **Center of Output Hub to Center of Captive Spacer:** 135 mm (5-5/16 in.)
Weight	0.65 kg (1.45 lb)

Table 9: VMA18 Series Controllers

Compliance CE	**United States:** UL Listed, File E107041, CCN PAZX, UL 916, Energy Management Equipment; Suitable for use in other environmental air space (plenums) in accordance with Section 300.22(C) of the National Electric Code. FCC Compliant to CFR47, Part 15, Subpart B, Class A.
	Canada: UL Listed, File E107041, CCN PAZX7, CAN/CSA C22.2 No. 205, Signal Equipment; Industry Canada Compliant, ICES-003
	Europe: CE Mark – Johnson Controls, Inc. declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive.
	Australia and New Zealand: RCM Mark, Australia/NZ Emissions Compliant.

1 For more information, refer to the *N2 Communications Bus Technical Bulletin (LIT-636018).*
2 Combined error due to calibration, accuracy, non-linearity, and temperature variation.

The performance specifications are nominal and conform to acceptable industry standard. 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.

European Single Point of Contact:
JOHNSON CONTROLS
WESTENDHOF 3
45143 ESSEN
GERMANY

NA/SA Single Point of Contact:
JOHNSON CONTROLS
507 E MICHIGAN ST
MILWAUKEE WI 53202
USA

APAC Single Point of Contact:
JOHNSON CONTROLS
C/O CONTROLS PRODUCT MANAGEMENT
NO. 22 BLOCK D NEW DISTRICT
WUXI JIANGSU PROVINCE 214142
CHINA

Building Efficiency
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