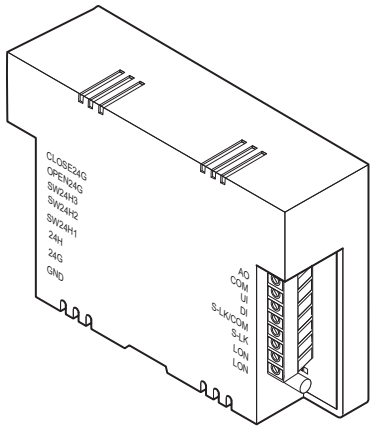
Schneider Electric

TAC I/A Series MicroNet Variable Air Volume Controller Without Actuator Installation Instructions

Application

TAC I/A Series MicroNet™ MNL-V3RVx VAV Controllers are interoperable air volume controllers designed in accordance with LONMARK™ guidelines. These controllers provide pressure-independent control for cooling and reheat applications. The MNL-V3RVx features MN-Sx Digital Sensor support, LED indicators, three digital relay outputs, an integral velocity pressure transducer, and two triac outputs for interface with an external actuator. This controller functions in standalone mode or as part of a MicroNet LONWORKS™ network using the integral FT 3150™ Free Topology communications transceiver. A direct connection to a WPA-LON WorkPlace Communication adapter and a PC with WorkPlace Tech Tool software is necessary to download and modify applications.



MNL-V3RVx

Model Chart

Model	Inputs/ Outputs	Control Strategy		
		Box Config	**Reheat Type**	**Other**
MNL-V3RVx[a]	3 Digital Contact Outputs (DOs)	• Cooling • Series Fan • Parallel Fan • Induction	• Staged Electric • Floating/ Proportional Hydronic • Time Proportioned • None	• Occupancy • Satellite
	1 Analog Output (AO)			
	2 Triac Outputs (TOs)			
	1 Universal Input (UI)			
	1 Digital Input (DI)			

[a] Vx denotes LONMARK VAV (Variable Air Volume) profile and profile version number.

Applicable Documentation

F-Number	Description	Audience	Purpose
F-26277	TAC I/A Series MicroNet MN-Sx Series Sensors General Instructions	– Application Engineers – Installers – Service Personnel – Start-up Technicians	Provides step-by-step installation and checkout procedures for TAC I/A Series MicroNet MN-Sx Series Sensors. Also contains instructions for sensor operation.
F-26303	TAC I/A Series MicroNet System Overview	– Application engineers – Installers – Start-up technicians – Service personnel	Provides an overview of the TAC I/A Series MicroNet System. It includes brief descriptions of the hardware and software components, and how they may be combined to create MicroNet networks and stand-alone systems.
F-26363	EN-206 Guidelines for Powering Multiple Full-Wave and Half-Wave Rectifier Devices from a Common Transformer	– Application Engineers – Installers – Service Personnel	Offers guidelines for avoiding equipment damage associated with improperly wiring devices of varying rectifier types. Contains instructions for identifying device rectifier type, guidelines for correctly powering devices of varying rectifier types, and examples illustrating proper power wiring techniques.
F-26421	MicroNet VAV Flow Balance User's Manual	– Application Engineers – Installers – Service Personnel – Start-up Technicians	Provides step-by-step instructions for using the MicroNet VAV Flow Balance software.
F-27254	WorkPlace Tech Tool 4.0 Engineering Guide	– Application Engineers – Installers – Service Personnel – Start-up Technicians	Provides engineering and technical information for applying and using all aspects of WorkPlace Tech Tool.
F-26507	TAC I/A Series MicroNet Systems Engineering Guide	– Application Engineers – Installers – Service Personnel – Start-up Technicians	Provides engineering and technical information to assist in designing a complete MicroNet controller system using different architectures, components, and software.
F-27255	WorkPlace Tech Tool 4.0 User's Guide	– Application Engineers – Installers – Service Personnel – Start-up Technicians	Provides step-by-step instructions for using WorkPlace Tech Tool.

Installation

Inspection

Inspect the carton for damage. If damaged, notify the carrier immediately. Inspect controllers for damage upon receipt.

Requirements

(These items not provided)

- Installer must be a qualified technician
- Job wiring diagrams
- Tools:
  - Digital Volt-ohm meter (DVM)
  - Drill and bits for mounting screw
  - Static protection wrist strap
- MNA-FLO-1 enclosure for connecting to conduit (optional)
- Class 2 power transformer supplying a nominal 24 Vac (20.4 to 30 Vac) with a minimum rating of 12 VA, 50/60 Hz per controller, plus Digital Output (DO) and Triac loads. Each DO can be up to an additional 24 VA maximum and each Triac load an additional 18 VA maximum. In the European Community, transformer must conform to EN 60742
- Terminators:
  - One LON-TERM1 terminator is required for each free topology segment
  - Two LON-TERM2 terminators is required for each bus topology segment
- Two #10 sheet metal screws
- 0.170 in. (17/100 in.) I.D. FRPE polyethylene tubing or 0.125 in. (1/8 in.) I.D. or 0.25 in. (1/4 in.) O.D. Tygon™ tubing for piping connections. Not more than 5 ft (1.52 m) long.

Precautions

General

Warning: Electrical shock hazard! Disconnect power before installing or removing the cover.

- Follow Static precautions when installing this equipment.
- Use copper conductors that are suitable for 167 °F (75 °C).
- Make all connections according to the electrical wiring diagram and the national and local electrical codes.

Static Precautions

Static charges damage electronic components. The microprocessor and associated circuitry are extremely sensitive to static discharge. Use the following precautions when installing, servicing, or operating the system.

- Work in a static-free area.
- Discharge static electricity by touching a known, securely grounded object.
- Use a wrist strap connected to earth ground when handling the controller's printed circuit board.

Federal Communications Commission (FCC)

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in residential installations. This equipment generates, uses, and can radiate radio frequency energy and may cause harmful interference if not installed and used in accordance with the instructions. Even when instructions are followed, there is no guarantee that interference will not occur in a particular installation. If this equipment causes harmful interference to radio or television reception—which can be determined by turning the equipment off and on—the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/television technician for help.

Canadian Department of Communications (DOC)

This class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

European Community Directives

This equipment meets all requirements of European Community Directives for Low Voltage (72/23/EEC), General Safety (92/59/EEC), and Electromagnetic Compatibility (89/336/EEC).

Location

The MNL-V3RVx controllers are suitable for indoor use only.

Caution:

- Avoid locations where excessive moisture, corrosive fumes, vibration, or explosive vapors are present.
- Avoid electrical noise interference. Do not install near large contactors, electrical machinery, or welding equipment.
- Locate where ambient temperatures do not exceed 131 °F (55 °C) or fall below 32 °F (0° C) and relative humidity does not exceed 85 % or fall below 5 %, non-condensing.

Mounting

MNL-V3RVx controllers can be mounted in any direction and on any plane. Mounting dimensions are shown in Figure-1

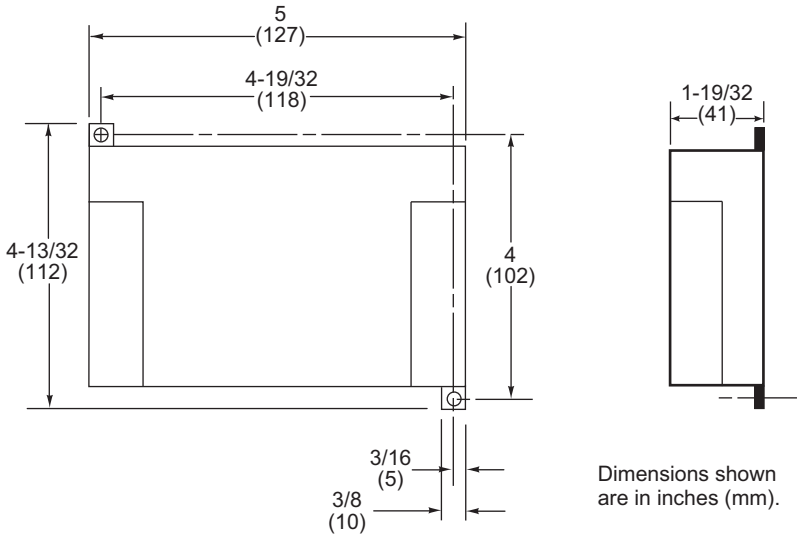


Figure-1 Mounting Dimensions.

Differential (Velocity) Pressure Sensor Connections

Use either 0.170 in. (17/100 in.) I.D. FRPE polyethylene tubing or 0.125 in. (1/8 in.) I.D. or 0.25 in. (1/4 in.) O.D. Tygon tubing for piping connections. Maximum length of tubing is 5 ft (1.52 m).

1. Remove plastic fitting caps from the barbed fittings.
2. Connect tubing to the barbed fittings on the VAV Controller. See Figure-2.

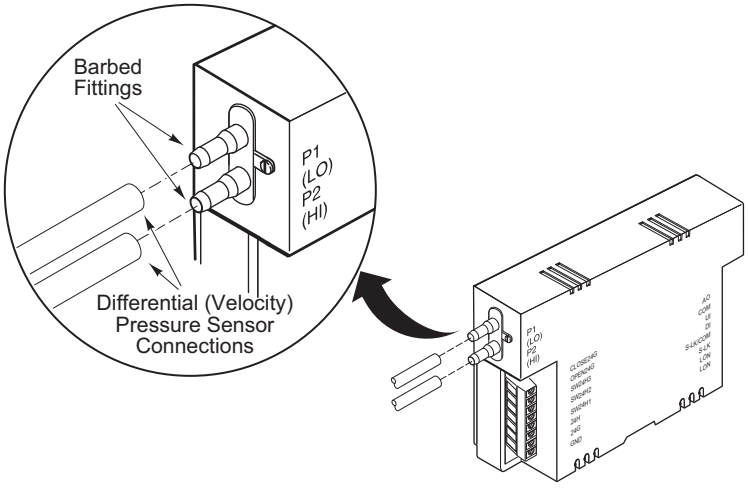


Figure-2 Differential Pressure Connections.

3. Connect the tube from the controller's P1 fitting to the low pressure tap on the VAV terminal. See Figure-3.
4. Connect the tube from the controller's P2 fitting to the high pressure tap on the VAV terminal. See Figure-3.

Differential (Velocity) Pressure Gauge

Use a differential (velocity) pressure gauge to calibrate and verify that the central system is delivering accurate pressure. Figure-3 shows the connections for attaching the gauge. When the gauge is removed, the restrictors must be plugged or removed from the tubing.

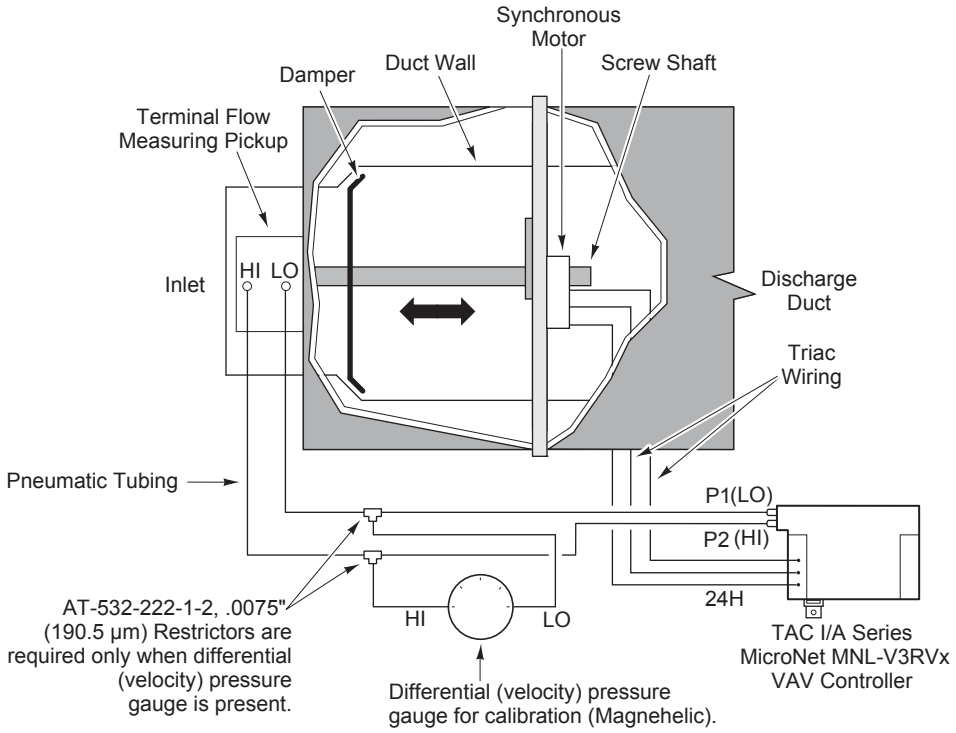


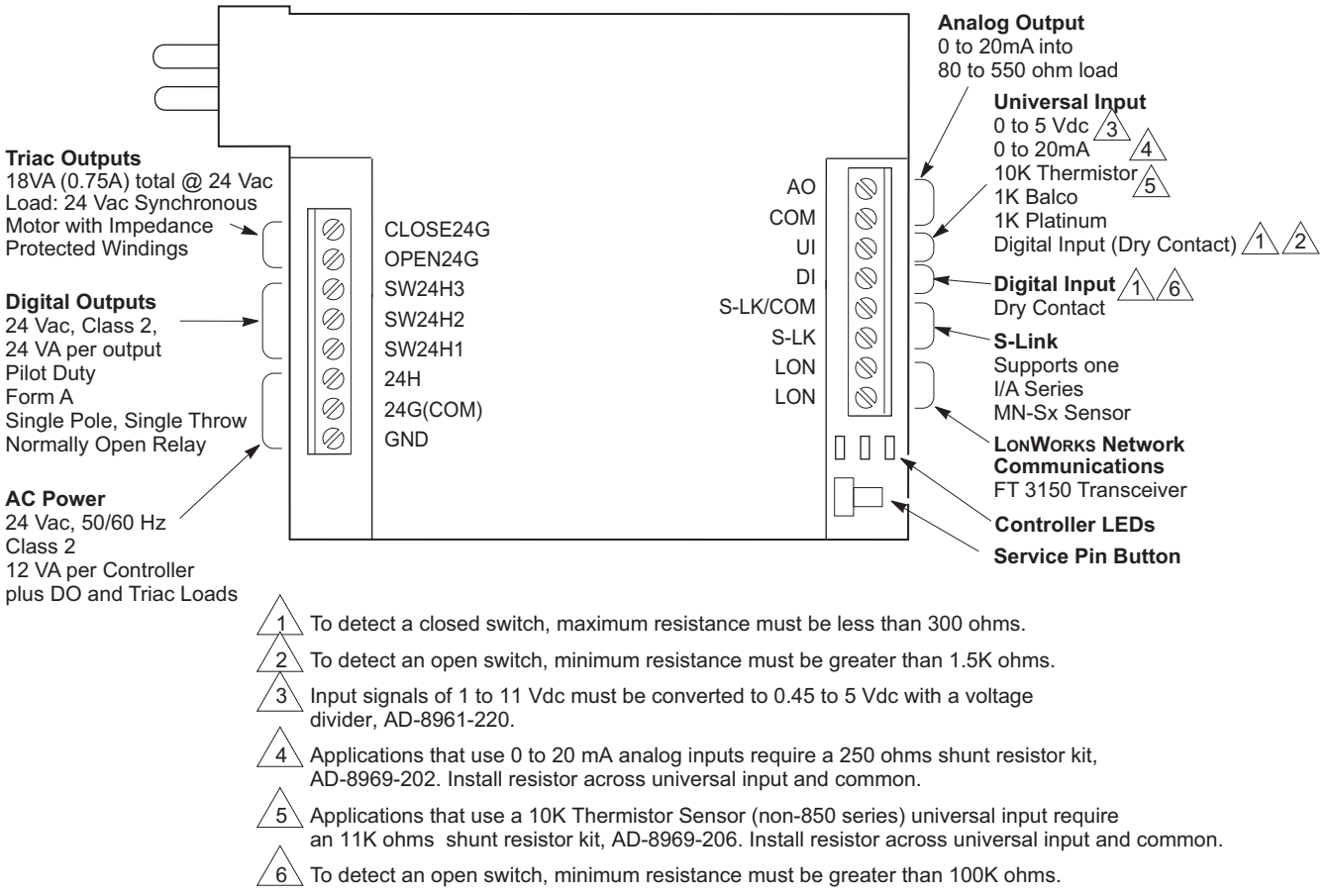
Figure-3 Internal View of VAV Terminal Box with Triac Driven Synchronous Motor and Pneumatic Tubing Detail.

Wiring

The following electrical connections can be made to TAC I/A Series MicroNet MNL-V3RVx controllers:

- Sensor Link (S-Link) connection to a TAC I/A Series MicroNet Sensor (MN-Sx)
- MicroNet LONWORKS network (LON) connection to a MicroNet Interface (MI) and other MicroNet controllers
- LONWORKS network connection from the controller to a TAC I/A Series MicroNet Sensor (optional)
- I/O connections including:
  - One Universal Input (UI)
  - One Digital Input (DI)
  - One Analog Output (AO)
  - Two Triac Outputs (TO)
  - Three Digital Outputs (DO)
- Power connection to a 24 Vac nominal Class 2 (EN 60742) power source and earth ground.

See Figure-4 for wiring terminal information.



1 To detect a closed switch, maximum resistance must be less than 300 ohms.

2 To detect an open switch, minimum resistance must be greater than 1.5K ohms.

3 Input signals of 1 to 11 Vdc must be converted to 0.45 to 5 Vdc with a voltage divider, AD-8961-220.

4 Applications that use 0 to 20 mA analog inputs require a 250 ohms shunt resistor kit, AD-8969-202. Install resistor across universal input and common.

5 Applications that use a 10K Thermistor Sensor (non-850 series) universal input require an 11K ohms shunt resistor kit, AD-8969-206. Install resistor across universal input and common.

6 To detect an open switch, minimum resistance must be greater than 100K ohms.

Figure-4 MNL-V3RVx Series Terminal Connections.

Communications Wiring

Caution:

- Communication wire pairs must be dedicated to MN-Sx (S-Link) and MicroNet LONWORKS network (LON) communications. They cannot be part of an active, bundled telephone trunk.
- Shielded cable is not required for S-Link or LON wiring.
- If the cable is installed in areas of high RFI or EMI, the cable must be in conduit.
- If shielded wire is used, the shield must be connected to earth ground, at one end only, by a 470K ohm, 1/4 watt resistor. Shield must be continuous from one end of the trunk to the other.

Communications wiring includes a connection between the controller and a TAC I/A Series MicroNet Sensor via the S-Link and a connection between the controller and the MicroNet LONWORKS Network (LON). An optional LON connection between the controller and one TAC I/A Series MicroNet Sensor is also possible. Figure-4 shows S-Link and LON wiring terminations.

Sensor Link (S-Link) Wiring

S-Link wiring powers and enables the MN-Sx sensor. The S-Link needs at least 24 gage (0.205 mm^2), twisted pair, voice grade telephone wire. The capacitance between conductors cannot be more than 32 pF per foot (0.3 m). If shielded cable is used, the capacitance between any one conductor and the others, connected to the shield, cannot be more than 60 pF per foot (0.3 m). Maximum wire length is 200 ft. (61 m).

Note:

- Controller supports one TAC I/A Series MicroNet Sensor (MN-Sx).
- S-Link wiring is polarity insensitive.
- If conduit is used between a TAC I/A Series Sensor and a controller, the MicroNet LONWORKS network and S-Link wiring can be in the same conduit. However, the LON and S-Link wiring must use separate cables.
- S-Link wiring (*not* LON wiring) can be in the same conduit with UI, AO, and DI Wiring.

MicroNet LONWORKS Network (LON) Wiring

An approved Category 4 or 5, twisted-pair (two conductors) cable may be used for connecting to both the MicroNet LONWORKS Network and the optional LONWORKS Network connection between the controller and an MN-Sx sensor. LONWORKS Network wiring is polarity insensitive.

Caution: Do not mix with UI, DI, AO, DO, or power types of wiring. If conduit is used between a TAC I/A Series Sensor and a controller, LON wiring and S-Link wiring can be in the same conduit. However, the LON and S-Link wiring must use separate cables.

MNL-V3RVx controllers use the LONWORKS Free Topology Transceiver FT 3150 and support polarity-insensitive bus (daisy-chain) and free-wiring topologies (all combinations of star, tee, and loop). A maximum of 62 nodes can be connected per segment.

Note: The FT 3150 transceiver used in the MNL-V3RVx controller is fully compatible with the TP/FT-10 channel, allowing it to communicate with I/A Series MicroNet controllers that use the FTT-10 transceiver. See *TAC I/A Series MicroNet System Engineering Guide,* F-26507 to design a MicroNet LONWORKS TP/FT-10 network, including recommended topologies and approved cable types.

- Use of the LON terminals to connect to the MN-Sx sensor permits use of the sensor's built-in LON jack.
- To preserve the integrity of the network, the LON wiring connecting an I/A Series MicroNet controller to an MN-Sx sensor must be run to the sensor and back, in daisy-chain fashion. A wire "spur" must not be used to connect the sensor to the controller.
- While the MN-Sx sensor is not counted as a "node" in the LONWORKS network (LON), all LON wiring to the sensor must be counted when determining the length of the FTT wiring segment.

I/O Wiring

I/O connections include universal inputs, analog outputs, digital inputs, and digital outputs (relay and triac outputs). See Figure-4 for proper wire terminal information.

Caution: If shielded wire is used, connect only one end of the shield to earth ground, at the controller.

Universal Inputs (UI), Analog Outputs (AO), and Digital Inputs (DI)

Caution:

- Input and output devices cannot share common wiring. Each connected device requires a separate signal and return conductor.
- Power wiring cannot share conduit with UI, AO, S-Link, LON, or DI wiring.

Note:

- If maximum closed switch voltage is not more than 1.0 V *and* minimum open switch voltage is at least 4.5 V, then solid state switches may be used for a UI or a DI.
- UI, AO, DI, and S-Link wiring can share a single conduit.

UI, AO, DI, wiring needs at least 24 gage (0.205 mm^2), twisted pair, voice grade telephone wire. The capacitance between conductors cannot be more than 32 pF per foot (0.3 m). If shielded cable is used, the capacitance between any one conductor and the others, connected to the shield, cannot be more than 60 pF per foot (0.3 m).

Table-1 UI, AO, and DI Wiring Specifications.

Connection	Gage AWG (mm^2)	Maximum Distance ft. (m)
UI, AO, and DI	18 (0.823)	300 (91)
	20 (0.518)	200 (61)
	22 (0.326)	125 (38)
	24 (0.205)	75 (23)

Digital Outputs (Relay and Triac)

Caution:

- DO wiring cannot be intermixed with DI, UI, AO, S-Link, or LON wiring.
- DO terminals accept one 16 gage (1.31 mm^2) wire or two 18 gage (0.823 mm^2) wires. The selected wire gage must be consistent with the load current rating.
- MNL-V3RVx controllers are Class 2-only devices where:
  - Each relay output (SW24H1, SW24H2, and SW24H3) can support up to 24 Vac at 24 VA pilot duty.
  - Triac outputs can support up to 24 Vac at 18 VA total.

Note:

- Digital Output wiring can be intermixed with power wiring.
- The minimum permissible load for Digital Outputs is 10 mA at 5 Vdc.

Relay Outputs

Each relay output is an isolated Form A (SPST) relay that switches the controller's 24H AC input voltage to the output load.

Table-2 Relay Output Load Specifications.

Specification	Value
Maximum Relay Contact Switched Output Voltage	voltage at 24H terminal[a]
Maximum Output Load @ 24 Vac, Pilot Duty	24 VA
Minimum Controllable Load	10.0 mA
Maximum Off-state Leakage Current	3.5 mA
Minimum Cycles at Rated Load @ 0.4 Power Factor	300,000 cycles

[a] Switched output voltage is equivalent to value of input voltage.

Triac Output

Triacs are semiconductor AC switches that operate only AC loads. The controller provides two triac outputs that can be used to operate a 24 Vac synchronous motor with impedance-protected windings. Refer to Figure-5.

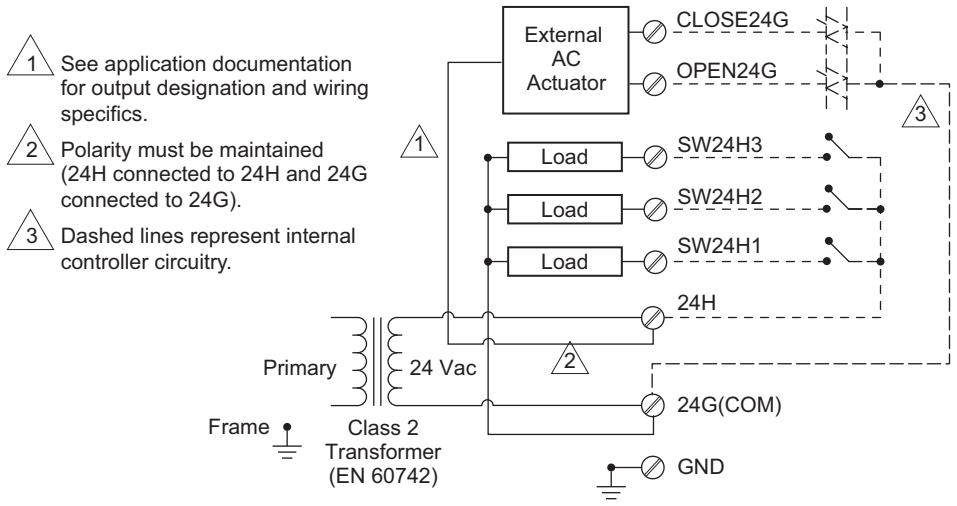


Figure-5 Relay Output and Triac Output Field Wiring

Triac output load specifications are shown in Table-3.

Table-3 Triac Output Electrical Specifications.

Characteristic	Specification
Maximum Triac-Switched Output Voltage	24H Terminal Voltage[a]
Minimum Triac-Switched Output Voltage	24H Terminal Voltage, 1.9 Vac
Rating	18 VA (0.75 A) @ 24 Vac each output. Total of 18 VA @ 24 Vac for both outputs at any one time.
Motor Requirements	24 Vac Synchronous with Impedance-Protected Windings
Default Output State	OFF (inactive)
Output Short Circuit Protection	None
Maximum Off-state Leakage Current	3.5 mA
Minimum Permissible Load	15 mA

[a] Switched output voltage is equivalent to value of input voltage.

Power Supply Wiring

Caution:

- This product contains a non-isolated half-wave rectifier power supply and must not be powered by transformers used to power other devices containing non-isolated full-wave rectifier power supplies. Refer to *EN-206, Guidelines for Powering Multiple Full-Wave and Half-Wave Rectifier Devices from a Common Transformer,* F-26363, for detailed information.
- Power wiring cannot be intermixed with LON, S-Link, UI, AO, or DI wiring.
- Use a Class 2 power transformer (EN 60742) supplying a nominal 24 Vac (20.4 to 30 Vac) with a minimum rating of 12 VA at 50/60 Hz plus digital output loads (72 VA total at 24 VA each) and triac output loads (total of 18 VA). The supply to the transformer must have a breaker or disconnect.
- The Class 2 power transformer may be used to power multiple Class 2 powered devices provided that the transformer is properly sized to power all equipment simultaneously and all devices contain the same type of rectifier power supplies or internal isolation.
- The transformer frame must be grounded.
- When powering multiple Class 2 devices from the same Class 2 power transformer, polarity must be observed (24H connected to 24H and 24G connected to 24G).

Note:

- Power terminals accept one 16 gage (1.31 mm^2) wire or two 18 gage (0.823 mm^2) wires.
- Power wiring can be intermixed with DO wiring.
- Twisted or untwisted cable can be used for power wiring.
- To preserve the integrity of the network, the LON wiring connecting an I/A Series MicroNet controller to an MN-Sx sensor must be run to the sensor and back, in daisy-chain fashion. A wire “spur” must not be used to connect the sensor to the controller.

Figure-6 and Figure-7 illustrate acceptable wiring configurations.

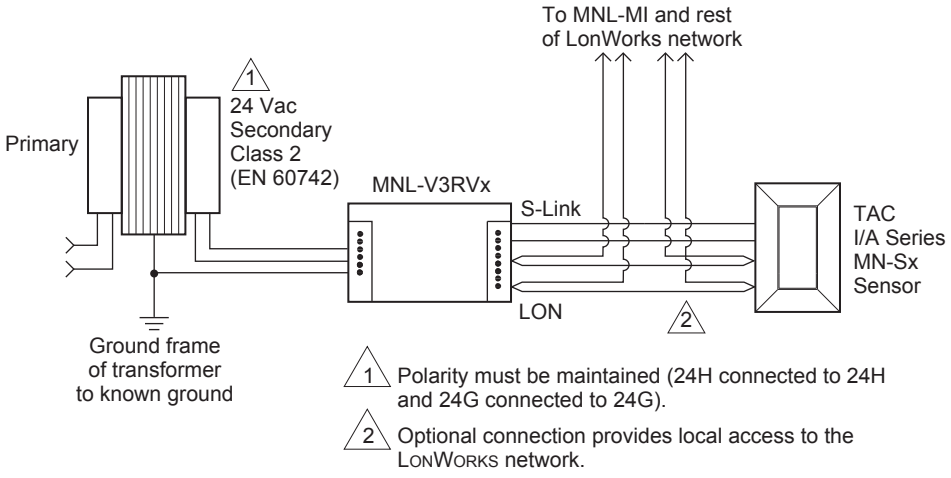


Figure-6 Single Controller Powered from a Separate Class 2 (EN 60742) Power Source.

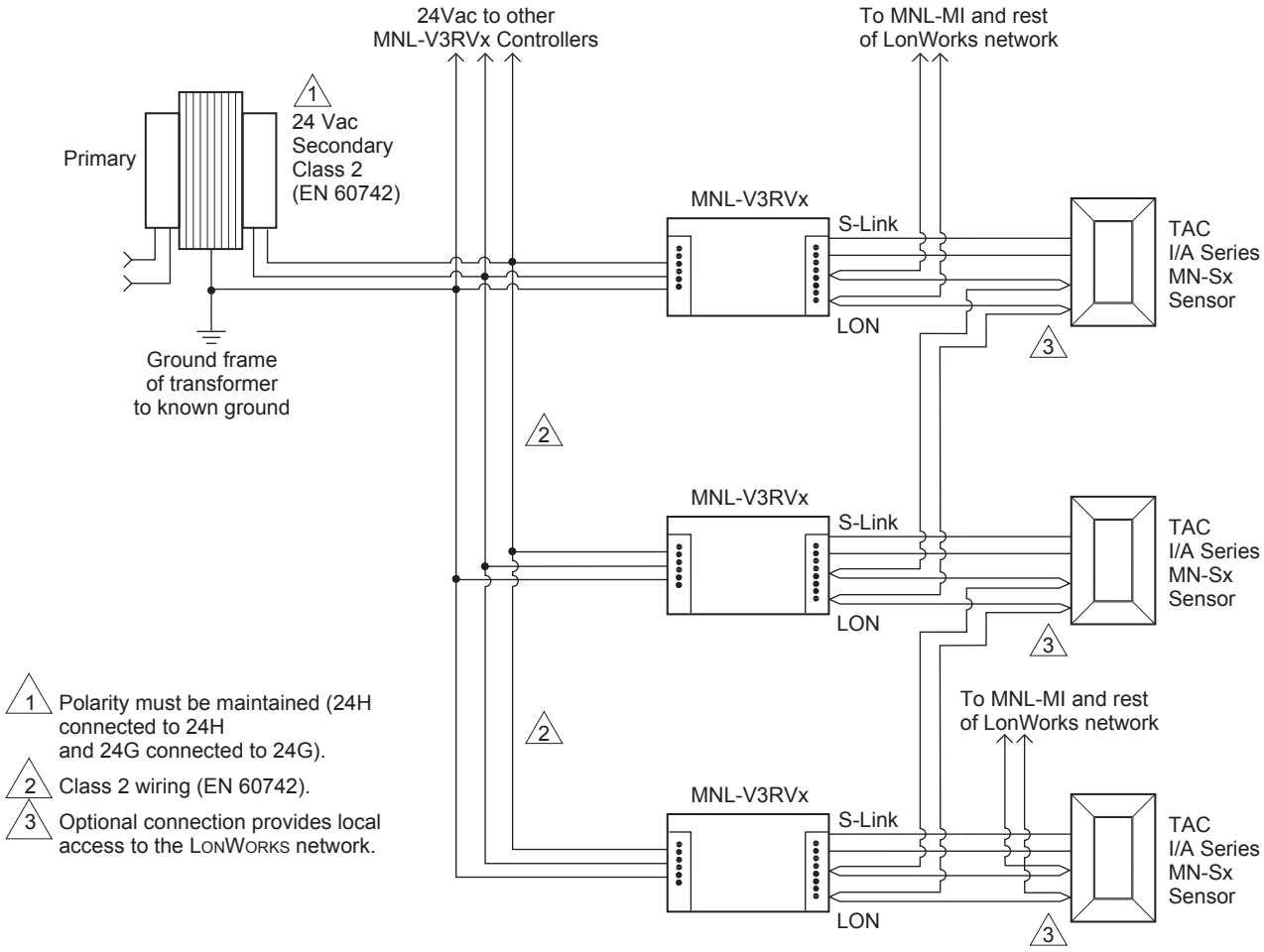


Figure-7 Multiple Controllers Powered from a Single Class 2 (EN 60742) Power Source and Sharing Communications in a Free Topology Segment.

Checkout

Mechanical Hardware Checkout

1. Verify that wiring between the TAC I/A Series MicroNet Sensor and the controller is installed according to the job wiring diagram and the national and local wiring codes.

Note: Wiring of the S-Link and MicroNet LONWORKS network between the sensor and the controller is not polarity sensitive.

2. If the controller is part of a MicroNet LONWORKS network, verify that the TP/FT-10 LONWORKS network wiring between the controller and the other devices is installed according to the job wiring diagram and the national and local electrical codes.
3. Verify that 24 Vac power is provided from a Class 2 power transformer (EN 60742) and wiring is installed according to the job wiring diagrams and the national and local electrical codes.
4. If multiple devices are powered from the same transformer, verify that wiring polarity has been maintained between all the connected devices (24H connected to 24H and 24G connected to 24G).
5. If multiple devices are powered from a common transformer, verify that all issues associated with powering multiple devices from a common transformer have been addressed.

Note: For more information, refer to *EN-206, Guidelines for Powering Multiple Full-Wave and Half-Wave Rectifier Devices from a Common Transformer*, F-26363.

6. Verify that the relay and triac outputs are wired according to the job wiring diagram and the national and local electrical codes.
7. Make certain that current requirements of the controlled devices do not exceed the rating of the controller's digital outputs.
8. Verify that piping from the air station's velocity pressure sensor is properly connected to P1 LO and P2 HI fittings on the controller.

Communications Hardware Checkout

1. Verify that the controller is in a manually controlled, safe state.
2. Place the controller's power breaker in the ON position. See the job wiring diagrams.
3. Observe the green Data Transmission LED (Figure-8) and do the following:
   a. If the green Data Transmission LED is steady on or blinking, go to step 4.
   b. If the green Data Transmission LED is off, check the power.
4. Observe the red Service LED (Figure-8) and do one of the following:
   a. If the red Service LED is off or flashing, proceed with downloading an application using WorkPlace Tech Tool (WP Tech) and configuring the controller with a third party network management tool. Refer to *WorkPlace Tech Tool 4.0 Engineering Guide,* F-27254, for details on downloading applications.
   b. If the red Service LED is steady on, turn power to the controller OFF, wait 5 seconds, and then turn the power ON. If the red Service LED is still steady on, turn the power OFF and replace the controller.
5. If the controller is connected to a MicroNet LONWORKS network (LON), verify that the Reception and Transmission LEDs (Figure-8) indicate normal operation. See Table-4.

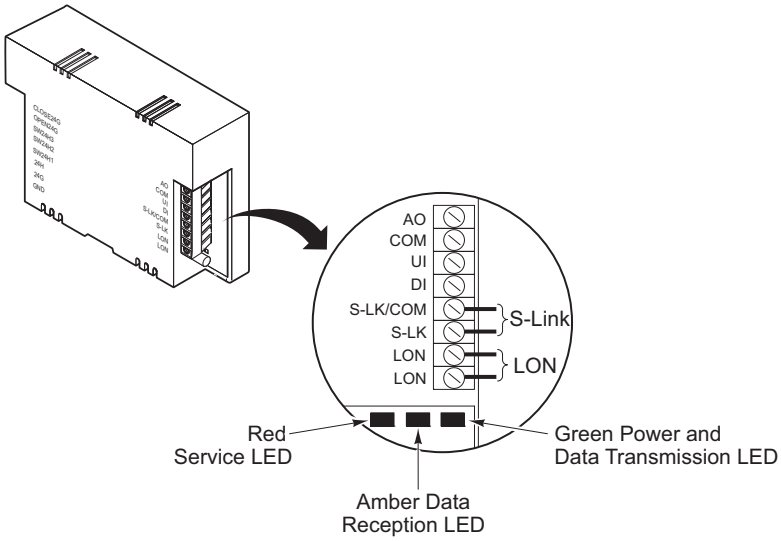


Figure-8 Location of Controller LEDs

Table-4 LED Indication.

Indicator	Context	Status	Corrective Action
Data Reception LED – Amber	Anytime	Blinks when the controller receives data from the LONWORKS network.	None required.
		On indicates a possible network connection problem, or that a large amount of network traffic is present.	Check connections on all nodes
		Off indicates that data reception is not taking place.	None required.
Data Transmission LED – Green	Anytime	Blinks when the controller transmits data to the LONWORKS network.	
		On indicates that the controller is not transmitting data. On also indicates that power is being applied to the controller.	
		Off indicates there is no power to the controller.	Check power.
Service LED – Red	Power-up	The LED blinks once to indicate successful power-up.	None required.
	Wink mode	Blinks (3 seconds on, 1 second off) three times to indicate the physical location of the controller. If a sensor (MN-Sx) is connected, its red Occupancy LED will flash (once per second) during the wink period.	
	Anytime	On indicates that the Neuron application is not running. Neuron applications are not field replaceable.	Replace the controller.
	Anytime	Blinks (once per second) to indicate that the Neuron application is loaded, but the Neuron's communication parameters are not loaded, are being reloaded, or have been corrupted. The Neuron is considered unconfigured. Communication parameters cannot be configured by field personnel.	Use a third party network management tool to commission the controller, or use the change state tool in WorkPlace Tech Tool (version 4.0 or greater) to set the Neuron™ to the configured/online state. While the controller is unconfigured, WP Tech can be used to download an application, but at the completion of the download, WP Tech versions 4.0 and higher will restore the Neuron to the unconfigured state.
	Anytime	Off may indicate that the Neuron application is loaded but the device is offline. In this state, a pre-loaded HVAC application will not run.	Use a third party network management tool to commission the controller, or use the change state tool in WorkPlace Tech Tool (version 4.0 or greater) to set the Neuron™ to the configured/online state. While the controller is offline, WP Tech can be used to download an application, but at the completion of the download, WP Tech versions 4.0 and higher will restore the Neuron to the offline state.
	Anytime	Off usually indicates a normal state. In this state, the controller operates normally and you can download and/or run HVAC applications.	If the controller is able to accept and/or run a downloaded HVAC application, no action is required.

Controller Selection

Identical pairs of factory barcode labels are attached to each controller. The labels can be used to select controllers for application downloading purposes. Each pair of labels contains a unique Neuron ID. One of the labels remains on the controller permanently; while the other label can be placed on a job site node list plan. The Neuron ID can then be entered into a job network profile through the WorkPlace Tech Tool (must be version 4.0 or greater). The WorkPlace Tech Tool (or third party network management tool) can then download an application to the selected controller. See *WorkPlace Tech Tool 4.0 Users Guide*, F-27254, for additional information.

Caution: Be sure to only press the service pin button *briefly* when selecting a controller. Do not *hold* the service pin button. Holding the service pin button for 6 seconds or longer will *completely unconfigure* the controller. See *WorkPlace Tech Tool 4.0 Engineering Guide*, F-27254, for additional information.

The service pin button is also used to select controllers. When this button is pressed, the controller sends a broadcast message containing its Neuron ID to the online or connected WorkPlace Tech Tool (or third party network management tool). After the message is received, the controller can be selected for application downloading. See *WorkPlace Tech Tool 4.0 Engineering Guide,* F-27254, for additional information.

Service

Components within MNL-V3RVx controllers can not be field repaired. If there is a problem with a controller, follow the steps below before contacting your local Schneider Electric office.

1. Make sure the controllers are connected and communicating to the desired devices.
2. Check that all sensors and controlled devices are properly connected and responding correctly.
3. If the controller is operating, make sure the correct profile and application are loaded by checking the LONMARK Program ID and the nviDeviceInfo, using WorkPlace Tech Tool. For more information, see *WorkPlace Tech Tool 4.0 Engineering Guide,* F-27254.
4. Record the precise hardware setup, including the following:
   - Version numbers of applications software.
   - Controller's firmware version number.
   - Information regarding the WorkPlace Tech Tool.
   - Complete description of difficulties encountered.

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F-26284-5 March 2010 ptm

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