Installation, Operation, and Maintenance

Tracer® MP503 Input/Output Module

⚠SAFETY WARNING

Only qualified personnel should install and service the equipment. The installation, starting up, and servicing of heating, ventilating, and air-conditioning equipment can be hazardous and requires specific knowledge and training. Improperly installed, adjusted or altered equipment by an unqualified person could result in death or serious injury. When working on the equipment, observe all precautions in the literature and on the tags, stickers, and labels that are attached to the equipment.

April 2020

CNT-SVX09E-EN

TRANE TECHNOLOGIES

Introduction

Warnings, Cautions, and Notices

Safety advisories appear throughout this manual as required. Your personal safety and the proper operation of this machine depend upon the strict observance of these precautions.

The three types of advisories are defined as follows:

WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury. It could also be used to alert against unsafe practices.
NOTICE	Indicates a situation that could result in equipment or property-damage only accidents.

Copyright

Trademarks

Agency Listings and Compliance

The European Union (EU) Declaration of Conformity is available from your local Trane® office.

Revision History

CNT-SVX09D-EN

- Added the Agency Listings and Compliance statement.

CNT-SVX09C-EN

- Cost Savings: Update to mount plate and metal enclosure to remove metal screw/nut and use plastic PEM nut. Change to figure illustrations.

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Overview and Specifications

This guide provides installation and configuration information for the Tracer™ MP503 input/output (I/O) module, as well as a description of its operations. The overview includes a product description, specifications, and descriptions of additional components needed in some MP503 applications.

Product Description

The MP503 I/O module is a field-installed device used to monitor inputs and control binary outputs. The module has four universal inputs that can be configured as binary, thermistor, 0–20 mA, or 0–10 Vdc, as well as four binary outputs.

Storage Environment

If a MP503 I/O module is to be stored for a substantial amount of time, store it in an indoor environment that meets the following requirements:

- Temperature: –40° to 185°F (–40° to 85°C)
- Relative humidity: 5–95%, non-condensing

Operating Environment

Operate a MP503 I/O module in an environment that meets the following requirements:

- Temperature: –40°F to 158°F (–40°C to 70°C)
- Relative humidity: 5–95%, non-condensing

Dimensions

Plastic Cover Model

- Height: 5.375 in. (137 mm)
- Width: 6.875 in. (175 mm)
- Depth: 2 in. (51 mm)

Metal Cover Model

- Height: 9.0 in (25 mm)
- Width: 10.37in. (263 mm)
- Depth: 2.25 in. (58 mm)

Clearances

For wiring, ventilation, and maintenance, provide the following minimum clearances for the MP503:

Plastic Cover Model

- Front: 4.0 in. (102 mm)
- Each side: 1.0 in. (25 mm)
- Top and bottom: 4.0 in. (102 mm)

Metal Cover Model

- Front: 24.0 in. (610 mm)
- Each side: 2.0 in. (51 mm)
- Top and bottom: 1.0 in. (25 mm)

Power

The transformer must meet the following minimum requirements for the controller and its output devices:

- 19–30 Vac (24 Vac nominal)
- 50/60 Hz
- 9 VA and 12 VA maximum per binary output utilized

Agency Listing/Compliance

CE—Immunity:

EMC Directive 89/336/EEC

EN 50090-2-2:1996

EN 50082-1:1997

EN 50082-2:1995

EN 61326-1:1997

CE—Emissions:

EN 50090-2-2:1996 (CISPR 22) Class B

EN 50081-1:1992 (CISPR 22) Class B

EN 55022:1998 (CISPR 22) Class B

EN 61326-1:1997 (CISPR 11) Class B

UL and C-UL listed:

Energy Management Equipment—PAZX (UL 916)

UL 94-5V (UL flammability rating for plenum use)

FCC Part 15, Subpart B, Class B

Figure 1. MP503 plastic cover model dimensions and clearances

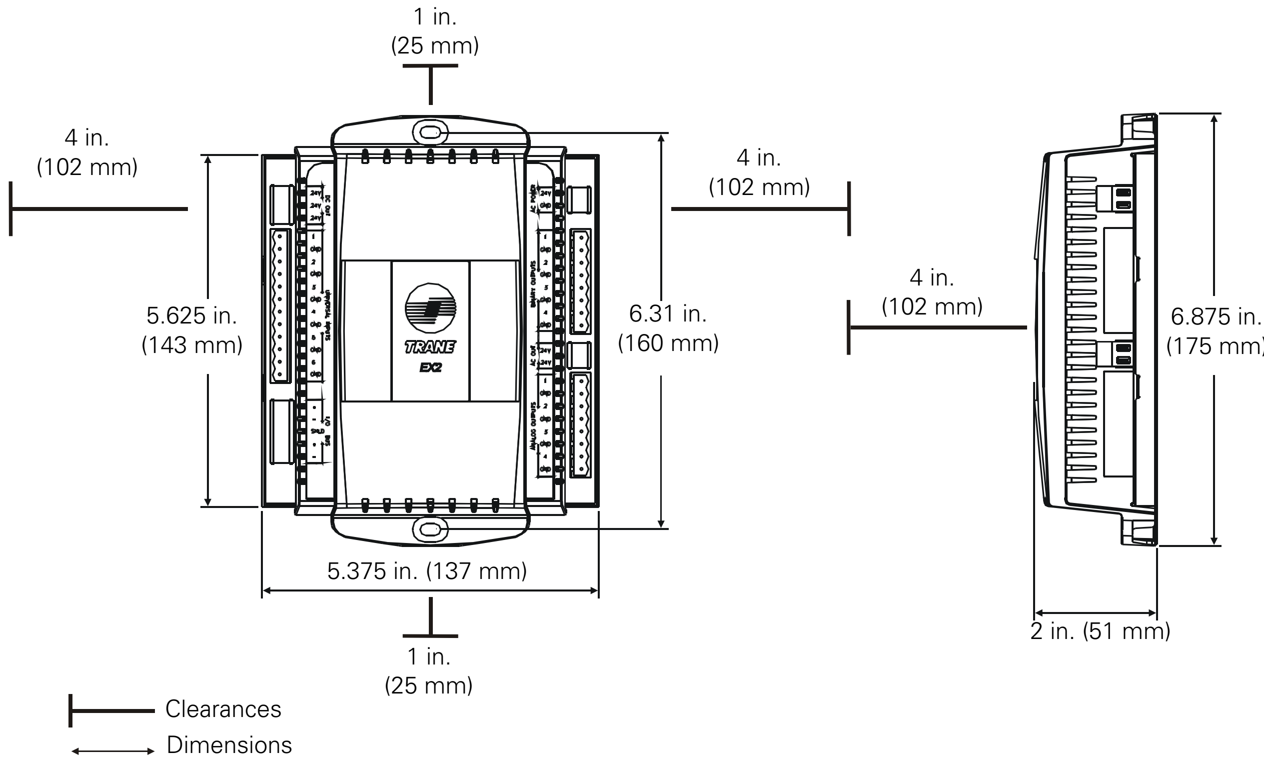
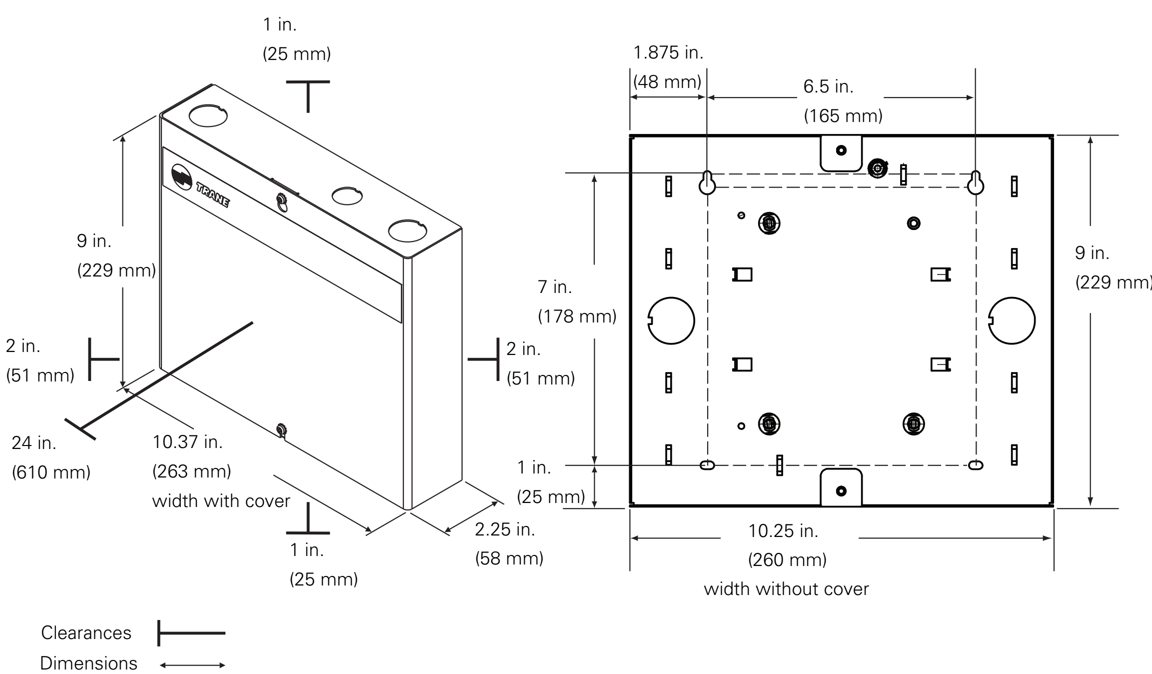


Figure 2. MP503 metal cover model dimensions and clearances



General Wiring Information

This section provides information about the following:

- Input/output terminal wiring
- AC power wiring
- Communication link wiring and addressing

Input/Output Terminal Wiring

- All input/output terminal wiring for the MP503 must meet the following requirements:
- All wiring must comply with the National Electrical Code™ (NEC) and local codes.
- Use only 18 AWG twisted-pair wire with stranded, tinned-copper conductors (Trane recommends shielded wire).
- Binary output wiring must not exceed 1000 ft (300 m).
- Binary input and 4–20 mA input wiring must not exceed 1000 ft (300 m).
- Thermistor input and 0–10 Vdc input wiring must not exceed 300 ft (100 m).

Important: *Do not run input/output wires in the same wire bundle with any ac power wires.*

For more details about wiring, refer to the section, "Applications for the MP503," p. 11.

AC Power Wiring

⚠CAUTION

Equipment Damage!

To prevent equipment damage, do not share 24 Vac between devices.

⚠CAUTION

Equipment Damage!

Complete input/output wiring before applying power to the MP503. Failure to do so may cause damage to the device or power transformer due to inadvertent connections to power circuits.

⚠WARNING

Hazardous Voltage!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

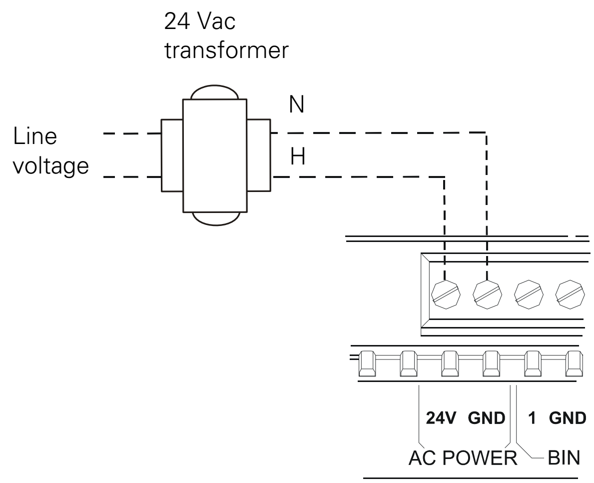
⚠WARNING

Hazardous Voltage!

Ensure that the 24 Vac transformer is properly grounded. Failure to do so could result in death or serious injury and/or damage to equipment.

The recommended wire for ac power is 16 AWG (1.3 mm2)copper wire. All wiring must comply with National Electrical Code and local codes. The ac power connections are in the top left corner of the MP503 as shown Figure 3.

Figure 3. Connecting ac power wires to the module



Use a UL-listed Class 2 power transformer supplying a nominal 24 Vac (20–30 Vac). The transformer must be sized to provide adequate power to the MP503 (10 VA) and to the output devices [including relays], to a maximum of 12 VA per output utilized. The MP503 may be powered by an existing transformer integral to the controlled equipment, provided the transformer has adequate power available and proper grounding is observed.

Communication Link Wiring and Addressing

The MP503 communicates with the BAS and with other devices through a LonTalk® communication link.

Important: *For important instructions on network wiring, refer to the Tracer Summit™ Hardware and Software Installation Guide (BMTX-SVN01).*

Wiring for the communication link must meet the following requirements:

- All wiring must comply with the National Electrical Code and local codes.
- 22 AWG Level 4 un-shielded communications wire recommended for most Comm5 installations.
- Termination resistors are required for wiring LonTalk devices communicating on a network. For important instructions on using termination resistors for LonTalk applications, refer to the *Tracer Summit Hardware and Software Installation Guide* (BMTX-SVN01).

Each MP503 has a unique 12-character alphanumeric device address for communicating on a BAS network. This address, referred to as a Neuron ID, is assigned in the factory before the product is shipped. Each device can be identified by viewing its unique Neuron ID, which is on a printed label attached to the circuit board of the device. Additional adhesive-backed, peel-off Neuron ID labels are tethered to the device for placing on mechanical prints or unit location worksheets. The Neuron ID will appear when communication is established with a service tool (such as the Rover™ service tool) or a BAS. An example Neuron ID is 00-01-64-1C-2B-00.

Mounting the Module

This Section provides information about the following:

- Location recommendations
- Operating environment requirements
- Mounting recommendations

Location Recommendations

Trane recommends locating the MP503:

- Near the controlled equipment to reduce wiring costs
- Where it is easily accessible for service personnel
- Where public access is restricted to minimize the possibility of tampering or vandalism

Operating Environment Requirements

Operate the MP503 in an environment that meets the following requirements:

- Temperature: –40°F to 158°F (–40°C to 70°C)
- Relative humidity: 5–95%, non-condensing

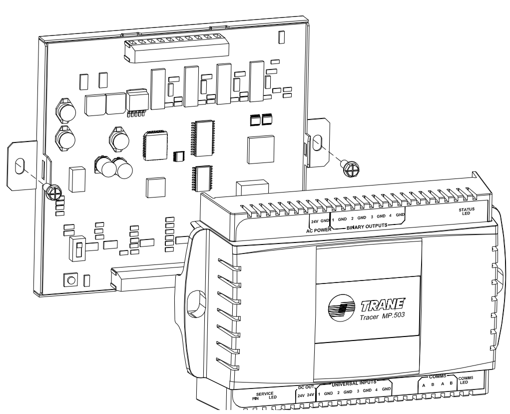
Mounting Recommendations

Important: *Leave the cover on when mounting the MP503 to avoid the possibility damaging the circuit board during installation.*

Mounting recommendations are as follows:

- Mount the module in any direction, other than with the front of the cover facing downward.
- Mount using the two 3/16 in. (4.8 mm) radius mounting holes provided (refer to Figure 4). Mounting fasteners are not included.
- Attach the module securely so it can withstand vibrations of associated heating, ventilating, and air-conditioning (HVAC) equipment.
- If the module is mounted in a small enclosed compartment, complete all wiring connections before securing the module in the compartment.

Figure 4. Mounting the MP503



Applications for the MP503

The MP503 is a field-installed device that is used to monitor inputs and control binary outputs. The module has four (4) configurable inputs and four (4) binary outputs. This section provides information about the function of inputs and outputs and examples of wiring applications for MP503.

Inputs

The MP503 has four (4) inputs. Each input can be configured (in any combination) as:

- Binary
- Thermistor
- 0–20 mA
- 0–10 Vdc.

The factory-default input type is a thermistor. To change the configuration of the input, use the device plug-in and a service tool, such as the Rover service tool. No jumpers need to be set on the circuit board.

Binary Inputs

When an input is configured as binary, the MP503 equates a signal of 0 Vac with open contacts and 24 Vac with closed contacts.

Thermistor Inputs

Thermistor inputs are used to measure temperature. They must be Trane 10kW (at 25°C) thermistors. Any Trane zone temperature sensor can be connected to the MP503; however, the module will not recognize the setpoint thumbwheel or fan speed switch that appears on some sensors.

0–20 mA Inputs

Many common sensors, such as humidity, pressure, and flow sensors, provide a 4–20 mA output. Any of these types of sensors can be connected to an input on the MP503 and configured for 0–20 mA.

Important: *Because most sensors have 4–20 mA outputs rather than 0–20 mA outputs, some scaling is required. The scaling cannot be done on the MP503. The MP503 transmits the raw mA reading.*

To power these sensors, 24 Vdc is available from the MP503 circuit board (refer to Figure 5, p. 12).

0–10 Vdc Inputs

The MP503 can read a value from a sensor that provides a 0–10 Vdc signal.

Important: *When using a sensor with a smaller range (such as 2–10 Vdc or 6–9 Vdc), some scaling is required. The scaling cannot be done on the MP503. The MP503 transmits the raw voltage reading.*

To power these sensors, 24 Vdc is available from the MP503 circuit board (refer to Figure 5, p. 12).

Outputs

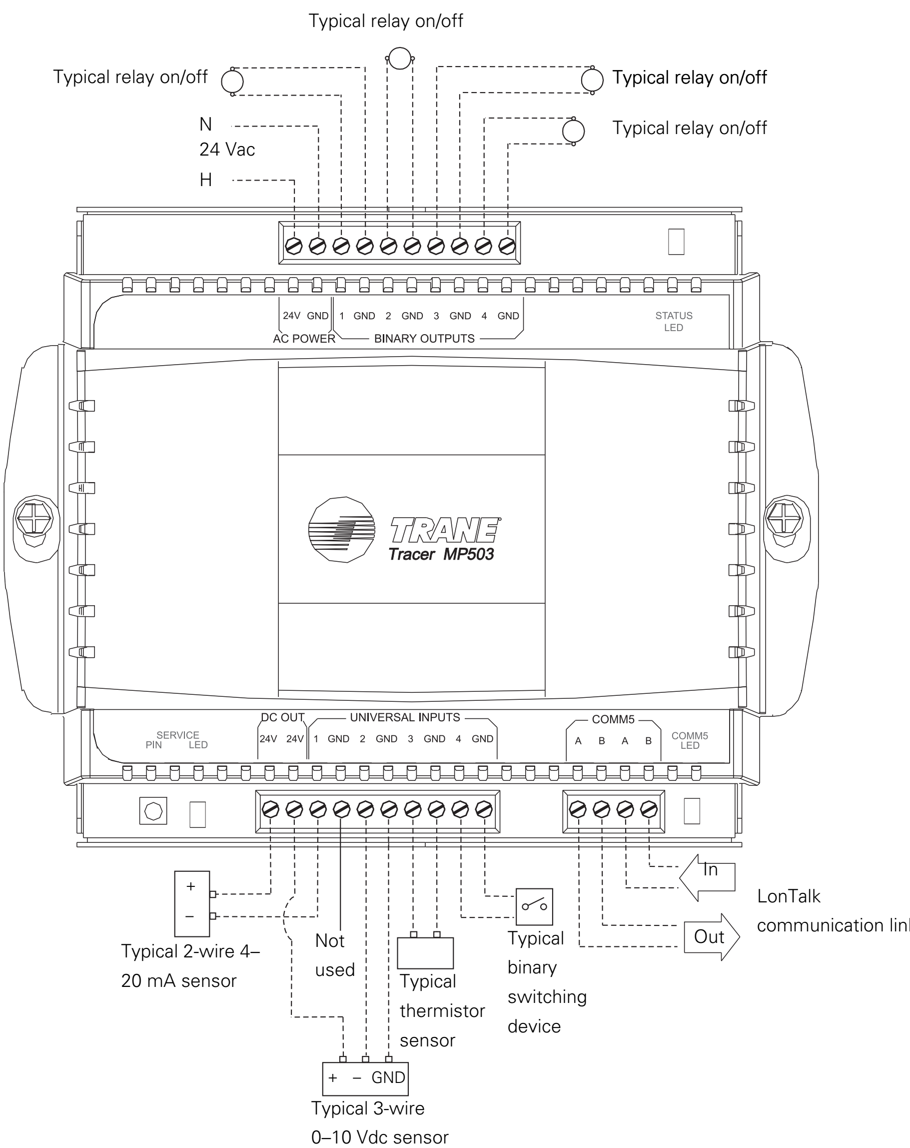
The binary outputs are *Form A single-pole, single-throw (SPST) relay outputs*. These relays switch 24 Vac and are not dry contacts.

Important: *A pilot relay is required for any application requiring dry contacts. Relays connected to the binary outputs on the module cannot exceed 12 VA or 0.5 A current draw at 24 Vac.*

Wiring Requirements and Options

Figure 5 shows the wiring of each type of input on the MP503 and the wiring for a typical binary output.

Figure 5. Input/output terminal wiring for the MP503



Network Variable Bindings

The LonTalk communication protocol allows data to be shared between devices (either as stand-alone or with a BAS) on a LonTalk network as is referred to as *peer-to-peer communication*. An example of peer-to-peer communication would be when two or more devices are serving the same space, share data (such as a temperature reading) without having to pass the data through a BAS.

Network variables are used to share data between devices. The method used to direct data from one device to another is called *network variable binding*, or just binding. A network variable output from one device is bound to a network variable input on another device. An output variable from one device can be bound to input variables on many other devices.

This section provides information about how to use network variable bindings in MP503 applications.

Network Variables

Each network variable is a standard type. This standard type is referred to as a *standard network variable type* (SNVT, pronounced *snivet*). To bind two variables together, the variables must be the same type of network variable. For example, an output of type SNVT_temp_p can only be bound to an input of type SNVT_temp_p. For more information about SNVTs, refer to www.lonmark.org.

Binding Network Variables

Important: *Only LonTalk devices can use network variable binding. Devices on other communication links do not have this capability.*

BAS communication typically does not require the use of network variable binding because a Tracer Summit BCU automatically binds to the proper data in a device. However, communication speed can be increased between two devices by binding their data rather than having the BAS read the information from one device, and then broadcasting it to another.

Use the Rover™ service tool to create bindings (refer to the *Rover Operation and Programming Guide* (EMTX-SVX01).

MP503 Bindings

The principal uses of an MP503 are to gather data (sensor readings) for use by a BAS or peer device and to allow a BAS or peer device to control MP503 binary outputs. Therefore, the use of bindings is very important in MP503 applications.

The following examples in this section illustrate some common applications in which bindings are used with the MP503.

Receiving Data

A network variable input (nvi) receives data from other devices on the LonTalk network. Network variable inputs (including their SNVTs) that are commonly used in MP503 bindings are shown in Table 1

Table 1. Tracer MP503 network variable inputs

Variable Name	Data Type	Description
nviBOP1Request	SNVT_switch	Binary Output 1 Request: • The requested state of binary output 1. • Bind to this nvi to control the binary output from another device on the network.
nviBOP2Request	SNVT_switch	Binary Output 2 Request: • The requested state of binary output 2. • Bind to this nvi to control the binary output from another device on the network.
nviBOP3Request	SNVT_switch	Binary Output 3 Request: • The requested state of binary output 3. • Bind to this nvi to control the binary output from another device on the network.
nviBOP4Request	SNVT_switch	Binary Output 4 Request: • The requested state of binary output 4. • Bind to this nvi to control the binary output from another device on the network.

Sending Data

A network variable output (nvo) sends data to other devices on the LonTalk network. The network variable outputs (including their SNVTs) that are commonly used in MP503 bindings are shown in Table 2.

Table 2. Tracer MP503 network variable outputs

Variable name	Data type	Description
nvoTemperature1	SNVT_temp_p	Universal Input 1 Status Output: • Indicates the value of universal input 1 if it is configured as thermistor. • If universal input 1 is not configured as thermistor, this output is invalid.
nvoTemperature2	SNVT_temp_p	Universal Input 2 Status Output: • Indicates the value of universal input 2 if it is configured as thermistor. • If universal input 2 is not configured as thermistor, this output is invalid.
nvoTemperature3	SNVT_temp_p	Universal Input 3 Status Output: • Indicates the value of universal input 3 if it is configured as thermistor. • If universal input 3 is not configured as thermistor, this output is invalid.
nvoTemperature4	SNVT_temp_p	Universal Input 4 Status Output: • Indicates the value of universal input 4 if it is configured as thermistor. • If universal input 4 is not configured as thermistor, this output is invalid.

Table 2. Tracer MP503 network variable outputs (continued)

Variable name	Data type	Description
nvoBIP1Status	SNVT_switch	Universal Input 1 Status Output: • Indicates the value of universal input 1 if it is configured as binary. • If universal input 1 is not configured as binary, this output is invalid.
nvoBIP2Status	SNVT_switch	Universal Input 2 Status Output: • Indicates the value of universal input 2 if it is configured as binary. • If universal input 2 is not configured as binary, this output is invalid.
nvoBIP3Status	SNVT_switch	Universal Input 3 Status Output: • Indicates the value of universal input 3 if it is configured as binary. • If universal input 3 is not configured as binary, this output is invalid.
nvoBIP4Status	SNVT_switch	Universal Input 4 Status Output: • Indicates the value of universal input 4 if it is configured as binary. • If universal input 4 is not configured as binary, this output is invalid.
nvoCurrent1	SNVT_amp_mil	Universal Input 1 Status Output: • Indicates the value of universal input 1 if it is configured as 0–20 mA. • If universal input 1 is not configured as 0–20 mA, this output is -3276.8.
nvoCurrent2	SNVT_amp_mil	Universal Input 2 Status Output: • Indicates the value of universal input 2 if it is configured as 0–20 mA. • If universal input 2 is not configured as 0–20 mA, this output is -3276.8.
nvoCurrent3	SNVT_amp_mil	Universal Input 3 Status Output: Indicates the value of universal input 3 if it is configured as 0–20 mA. If universal input 3 is not configured as 0–20 mA, this output is -3276.8.
nvoCurrent4	SNVT_amp_mil	Universal Input 4 Status Output: • Indicates the value of universal input 4 if it is configured as 0–20 mA. • If universal input 4 is not configured as 0–20 mA, this output is -3276.8.
nvoVolts1	SNVT_volt	Universal Input 1 Status Output: • Indicates the value of universal input 1 if it is configured as 0–10 Vdc. • If universal input 1 is not configured as 0–10 Vdc, this output is -3276.8.
nvoVolts2	SNVT_volt	Universal Input 2 Status Output: • Indicates the value of universal input 2 if it is configured as 0–10 Vdc. • If universal input 2 is not configured as 0–10 Vdc, this output is -3276.8.
nvoVolts3	SNVT_volt	Universal Input 3 Status Output: • Indicates the value of universal input 3 if it is configured as 0–10 Vdc. • If universal input 3 is not configured as 0–10 Vdc, this output is -3276.8.

Table 2. Tracer MP503 network variable outputs (continued)

Variable name	Data type	Description
nvoVolts4	SNVT_volt	Universal Input 4 Status Output: • Indicates the value of universal input 4 if it is configured as 0–10 Vdc. • If universal input 4 is not configured as 0–10 Vdc, this output is -3276.8.
nvoBOP1Status	SNVT_switch	Binary Output 1 Status Output: • Indicates the value of binary output 1.
nvoBOP2Status	SNVT_switch	Binary Output 3 Status Output: • Indicates the value of binary output 2.
nvoBOP3Status	SNVT_switch	Binary Output 3 Status Output: • Indicates the value of binary output 3.
nvoBOP4Status	SNVT_switch	Binary Output 4 Status Output: • Indicates the value of binary output 4.

Examples of Network Variable Bindings

The following examples show four (4) common uses of bindings in MP503 applications.

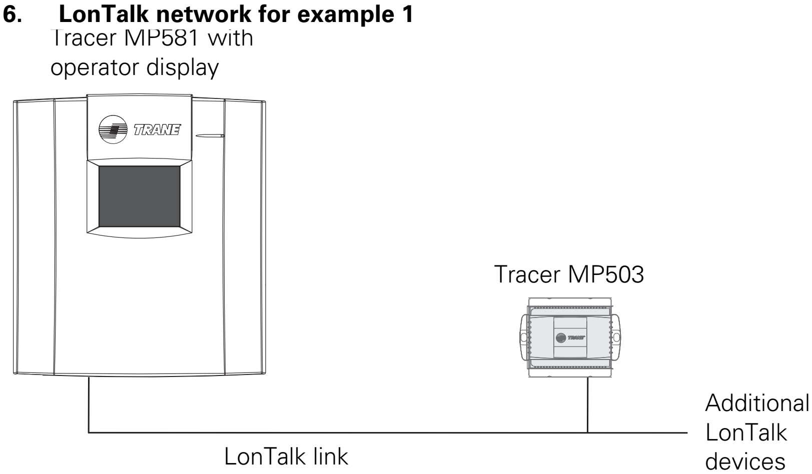
Example 1: Display Sensor Readings from a MP503 on a MP581 Operator Display

In this example, four different sensors are connected to a MP503. A thermistor reading the outside air temperature is connected to universal input 1 on the MP503. A 4–20 mA sensor reading the outside air humidity is connected to universal input 2. Two binary inputs from a fire panel (Alarm Status and Fire Panel Trouble) are connected to universal input 3 and universal input 4, respectively. An MP581 is on the same LonTalk link as the MP503. The MP581 is controlling an air-handling unit (AHU). The outside air enthalpy is required to control the economizer on the AHU.

The building operator also wants to know the outside air temperature and humidity, so those values should be displayed on the operator display of the MP581. The location of the outside air sensors make it convenient to wire those points to the MP503.

Use bindings to allow the economizer control in the MP581 to calculate outside air enthalpy and to display the four inputs from the MP503 on the operator display of the MP581. Figure 6 shows the LonTalk network for this example.

Figure 6. LonTalk network for example 1



Use the Rover service tool to create bindings. (Refer to the *Rover Operation and Programming Guide (*EMTX-SVX01). Using the Rover service tool, select the network variable from the MP503 and then select the MP581. The Rover service tool shows only the variables in the MP581 for the SNVT that matches the variable selected in the MP503 (refer to Table 3.

Table 3. Bindings for example 1

Network Variable Output on the MP503	Binding To	Network Variable Input on the MP581
nvoTemperature1	⇨	nviTemp01[a]
nvoCurrent2	⇨	nviCurrent_mA01[b]
nvoBIP3Status	⇨	nviSwitch01[c]
nvoBIP4Status	⇨	nviSwitch01[c]

(a) The MP581 has 40 generic temperature (SNVT_temp_p) network variable inputs available for binding (nviTemp01 through nviTemp40).
(b) The MP581 has 8 generic current (SNVT_amp_mil) network variable inputs available for binding (nviCurrent_mA01 through nviCurrent_mA08).
(c) The MP581 has 40 generic binary (SNVT_switch) network variable inputs available for binding (nviSwitch01 through nviSwitch40).

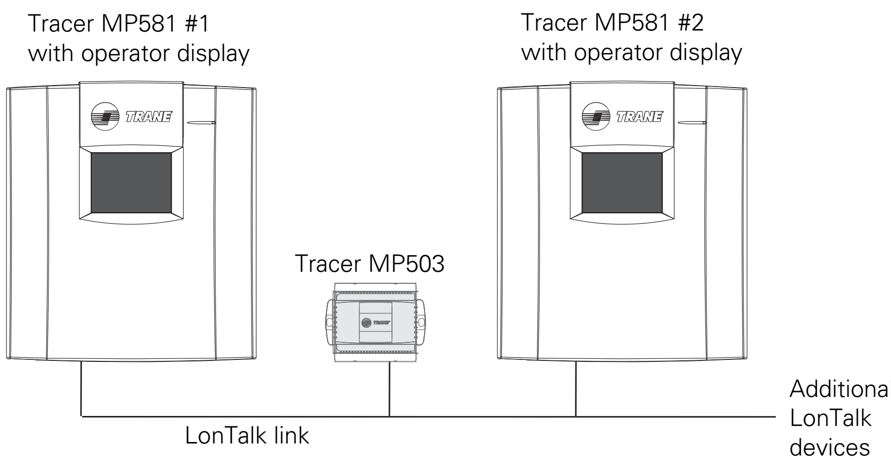
After completing the bindings, program the MP581 to display this data on the operator display.

Important: *Remember that the outside air humidity is being transmitted over the network in units of mA. Some custom programming is required in the MP581 to convert the humidity from units of mA to units of percent (%). Custom programming in the MP581 also uses the outside air temperature and humidity to calculate the outside air enthalpy and use it to control the economizer of the AHU.*

Example 2: Display Sensor Readings from a MP503 on Two Different MP581 Operator Displays

This example builds on example 1 and shows that bindings can be *one-to-many*. In this example, a second MP581 is added to the system as described in example 1. The second MP581 also controls an AHU. This AHU requires the outside air enthalpy in order to control its economizer. As in example 1, use bindings to allow the economizer control in the second MP581 to calculate outside air enthalpy. Figure 7 shows the LonTalk network for this example.

Figure 7. LonTalk network for example 2



Use the Rover service tool to create bindings. (Refer to the *Rover Operation and Programming Guide* (EMTX-SVX01). Using the Rover service tool, select the network variable from the MP503 and then select the second MP581. The Rover service tool shows only the variables in MP581 #2 of the SNVT that matches the variable selected in the MP503. Table 4 shows the bindings required between the MP503 and MP581 #2.

Table 4. Bindings for example 2

Network Variable Output on the MP503	Binding To	Network Variable Input on the MP581 #2
nvoTemperature1	⇨	nviTemp01[(a)]
nvoCurrent2	⇨	nviCurrent_mA01[(b)]
1 The Tracer MP581 has 40 generic temperature (SNVT_temp_p) network variable inputs available for binding (nviTemp01 through nviTemp40). 2 The Tracer MP581 has 8 generic current (SNVT_amp_mil) network variable inputs available for binding (nviCurrent_mA01 through nviCurrent_mA08).		

(a) The MP581 has 40 generic temperature (SNVT_temp_p) network variable inputs available for binding (nviTemp01 through nviTemp40).
(b) The MP581 has 40 generic temperature (SNVT_temp_p) network variable inputs available for binding (nviTemp01 through nviTemp40).

After completing the bindings, program Tracer MP581 #2 to calculate enthalpy from the outside air temperature and humidity.\

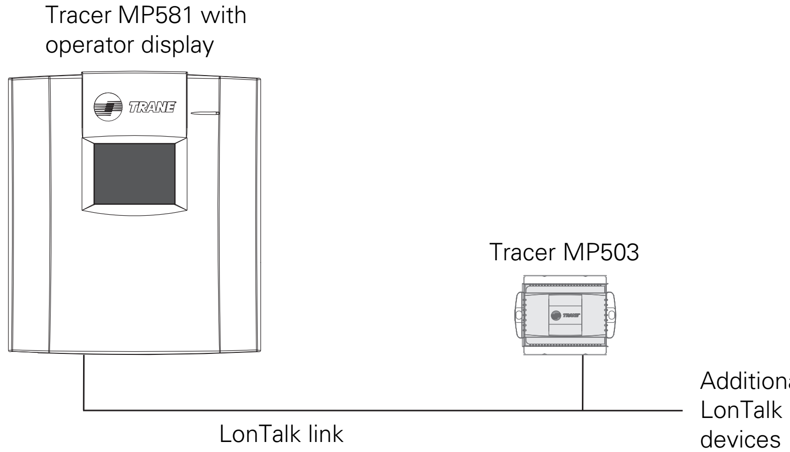
Important: *Custom programming is required to display this data on the operator display of Tracer MP581 #2. Remember that the outside air humidity is being transmitted over the network in units of mA. Some custom programming is required in Tracer MP581 #2 to convert the humidity from units of mA to units of percent (%) before performing the enthalpy calculation.*

Example 3: Control a Binary Output on the MP503 from a MP581

This example shows an *nvi* on the MP503 being bound, which allows a binary output on the MP503 to be controlled by another device on the LonTalk network. In this example, binary output 1 on the MP503 is starting and stopping an exhaust fan. The MP503 is communicating via the LonTalk network to a MP581 that is controlling an AHU. The AHU and the exhaust fan follow the same schedule; for example, whenever the AHU runs, the exhaust fan runs.

Bind an nvo on the MP581 to an nvi on the MP503 so the AHU and exhaust fan run together. Figure 8 shows the LonTalk network for this example.

Figure 8. LonTalk network for example 3



Use the Rover service tool to create bindings (refer to the *Rover Operation and Programming Guide* (EMTX-SVX01). Using the Rover service tool, select the network variable from the MP581 and then select the MP503. The Rover service tool shows only the variables in the MP503 of the SNVT that matches the variable selected in the MP581. Table 5 shows the required bindings.

Table 5. Bindings for example 3

Network Variable Output on the MP581	Binding To	Network Variable Input on the MP503
nvoSwitch01[a]	⇨	nviBOP1Request

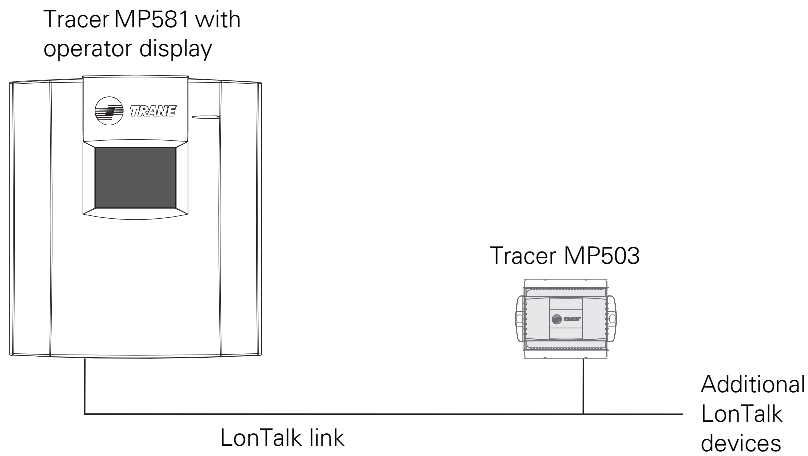
(a) The MP581 has 40 generic binary (SNVT_switch) network variable outputs available for binding (nvoSwitch01 through nvoSwitch40).

Custom programming in the MP581 controls nvoSwitch01. Write a custom program to control nvoSwitch01 **ON** when the AHU is **ON** and **OFF** when the AHU is **OFF**. The network binding passes the command to the binary output on the MP503.

Example 4: Use a Sensor Reading on a MP503 to Control a Pump VFD on a MP581

In this example, an MP581 is controlling the variable frequency drive (VFD) of a chilled water pump. Use a differential pressure sensor (4–20 mA output) to control the speed of this pump. Unfortunately, the differential pressure sensor is located more than 1000 ft. away from the pump, therefore, it cannot be wired directly to the universal input on the MP581. Install an MP503 to read the differential pressure and then use network bindings to send the pressure value to the MP581 controlling the chilled water pump VFD. Figure 9 shows the LonTalk network for this example.

Figure 9. LonTalk network for example 4



Use the Rover service tool to create bindings (refer to the *Rover Operation and Programming Guide* (EMTX-SVX01). Using the Rover service tool, select the network variable from the MP503 and then select the MP581. The Rover service tool shows only the variables in the MP581 of the SNVT that matches the variable selected in the MP503. Table 6 shows the required bindings.

Table 6. Bindings for example 4

Network Variable Output on the MP503	Binding To	Network Variable Input on the MP581
nvoCurrent1	⇨	nviCurrent_mA01[a]

(a) The MP581 has 8 generic current (SNVT_amp_mil) network variable inputs available for binding (nviCurrent_mA01 through nviCurrent_mA08).

Status Indicators

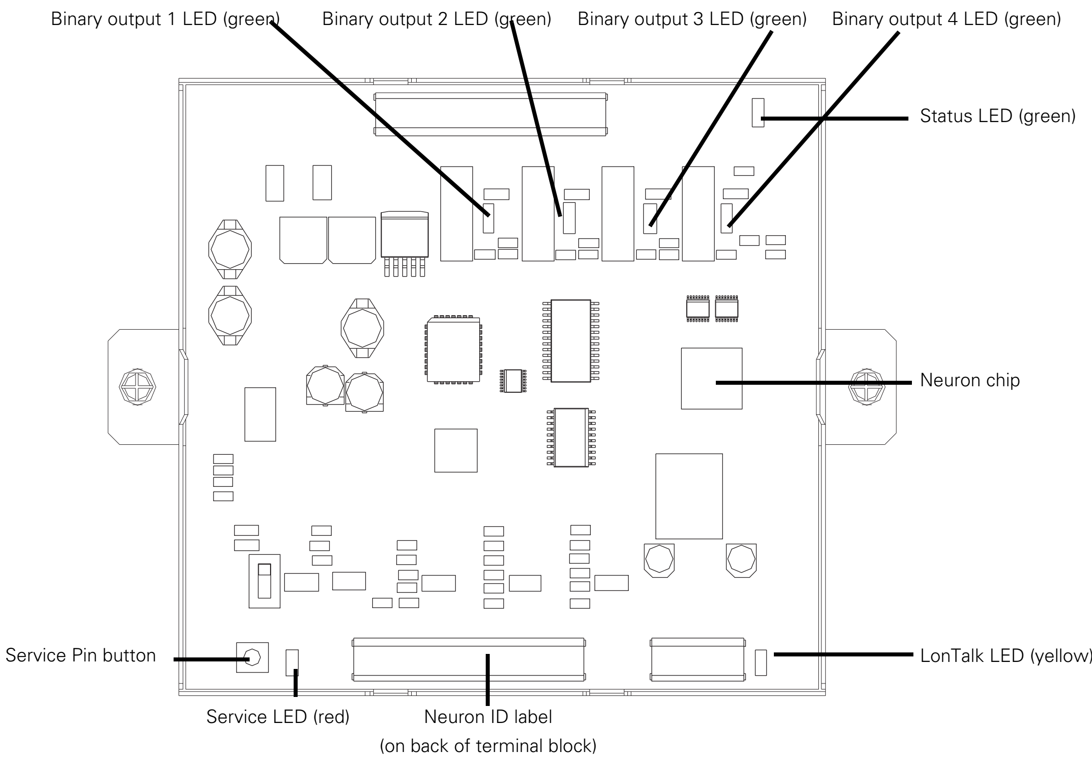
This section provides information about the following:

- MP503 circuit board
- Service pin button
- Interpreting LEDs
- Diagnostics

MP503 Circuit Board

Figure 10 shows the location of the Service Pin button, the Neuron ID label, and LEDs.

Figure 10. Tracer MP503 I/O module circuit board



Service Pin Button

The Service Pin button is located as shown inFigure 10 above, and is used to:

- Identify a device
- Add a device to the active group
- Verify PCMCIA communications
- Make the Status (green) LED *wink* to verify that the module is communicating on the link

Refer to the *Rover Operation and Programming Guide* (EMTX-SVX01).

Interpreting LEDs

Red Service LED

The red Service LED indicates whether the module is capable of operating normally (refer to Table 7).

Table 7. Red Service LED

LED Activity	Explanation
LED is off continuously when power is applied to the module.	The module is operating normally.
LED is on continuously when power is applied to the module.	The module is not working properly, or someone is pressing the Service Pin button.
LED flashes once every second.	The module is not executing the application software because the network connections and addressing have been removed.[a]

(a) Restore the module to normal operation using the Rover service tool. Refer to the *Rover Operation and Programming Guide* (EMTX-SVX01).

Green Status LED

The green Status LED indicates whether the module has power applied to it (refer to Table 8).

Table 8. Green Status LED

LED Activity	Explanation
LED is on continuously.	Power is on (normal operation).
LED blinks (1/4 second on, 1/4 second off for 10 seconds).	The auto-wink option is activated, and the module is communicating.[a]
LED is off continuously.	Either the power is off or the module has malfunctioned.

(a) Sending a request from the Rover service tool will request the green LED on the module to blink (wink) and a notification that the module received the signal and is communicating.

Yellow LonTalk LED

The yellow LonTalk LED (see Figure 10 on page 28) indicates the communications status of the module (refer to Table 9).

Table 9. Yellow LonTalk LED

LED Activity	Explanation
LED is off continuously.	The module is not detecting any communication (normal for stand-alone applications).
LED blinks.	The module detects communication (normal for communicating applications, including data sharing).
LED is on continuously.	Abnormal condition. This condition often indicates that external noise is affecting the MP503.

Binary Output LEDs (4 Green)

Four (4) green LEDs on the MP503 circuit board indicate the status of the four binary outputs (refer to Table 10).

Table 10. Binary output LEDs

Binary Output [a]	LED Number
1	CR8
2	CR9
3	CR10
4	CR11

(a) Each binary output LED reflects the status of the output relay on the circuit board. It may or may not reflect the status of the equipment the binary output is controlling. Field wiring determines whether or not the state of the binary output LED also applies to status of the end device.

Table 11. Binary output LEDs

LED Activity	Explanation
LED is on continuously.	The relay output is energized.
LED is off continuously.	The relay output is de-energized or there is no power to the board.

Diagnostics

Diagnostics do not affect the operation of the MP503. When the diagnostic clears, the module resumes normal operation. All diagnostics generated by the MP503 are automatic (non-latching) diagnostics. They clear automatically when the problem that generated the diagnostic is resolved. Table 12 lists the diagnostics for the MP503.

Table 12. Diagnostics

Diagnostic	Probable Cause	Consequence	Diagnostic Type
Normal	The MP503 has just been powered or a clear alarm command has just been sent to the MP503.	None—this is expected behavior.	N/A
24 Vdc failure	The 24 Vdc circuit is no longer providing the correct supply voltage.	All binary outputs go off.	Automatic (non-latching)
Input configuration changed	The configuration of one of the inputs has been changed.	None—this is only information.	Automatic (non-latching)

Troubleshooting

This section provides information about general troubleshooting steps to perform if there is a problem with the operation of the equipment controlled by the MP503.

Important: *Troubleshooting that involves accessing live electrical devices must be conducted only by a properly trained and authorized electrician or trained technician.*

When encountering operational problems with the MP503, first perform the initial troubleshooting in the following section, "Initial Troubleshooting".

After performing the initial troubleshooting steps, refer to the following sections for further diagnosis:

- "Troubleshooting Binary Output (Relay Output)," p. 24
- "Troubleshooting Universal Input," p. 25

Initial Troubleshooting

Always perform the initial troubleshooting steps listed in Table 13 before moving on to the specific area of trouble. Perform the steps in the order they are listed.

Table 13. Initial troubleshooting steps

Step Number	Action	Probable Cause
Step 1	Look at the red Service LED. If it is flashing once per second, the module is not executing the application software because the network connections and addressing have been removed. Refer to the section, "Status Indicators," p. 20. Use the Rover service tool to restore normal operation. For more details, refer to the *Rover Operation and Programming Guide* (EMTX-SVX01).	MP503 is not configured
Step 2	Look at the green Status LED. It should be on continuously during normal operation. A blinking Status LED indicates abnormal behavior for the MP503. Refer to the section, "Status Indicators," p. 20.	MP503 circuit board problem
Step 3	Use your meter (set to measure ac voltage) to measure the voltage across the ac power terminals on the MP503 (with ac wires connected). If the voltage is approximately 24 V (20–30 V) on the terminals, the board is receiving adequate input power. The MP503 circuit board has a problem. If the voltage is approximately 0 V, proceed to the next step.	MP503 circuit board problem
Step 4	Disconnect the ac wires from the input power terminals. Use your meter (set to measure ac voltage) to measure the voltage across the ac wires. If the voltage is still approximately 0 V, the board is not receiving the power it needs to run.	Input power problem

Troubleshooting Binary Output (Relay Output)

If a binary output (relay output) is not turning on the equipment wired to it, then follow the troubleshooting steps in Table 14. Perform the steps in the order they are listed.

The troubleshooting steps assume the equipment connected to the binary output is **OFF** when it is believed to be **ON** and vice versa when it should be **OFF**.

Table 14. Binary output (relay output) troubleshooting of external wiring

Step Number	Action	Probable Cause
Step 1	Perform the initial troubleshooting steps described in Table 13, p. 23 and verify that general board operation is functioning.	General board problem.
Step 2	Inspect the wiring. Is there a good connection between the wire and the terminal blocks? Look for shorts or opens. Pay particular attention to wire splices.	Wiring problem.
Step 3	Look at the status LED for the binary output you are troubleshooting. If the LED is **ON**, the MP503 is energizing its output relay. Use volt meter (set to measure ac voltage) to measure the voltage across the binary output terminals on the MP503. If the voltage is approximately 24 V, the problem lies beyond the MP503. Is the wiring to the equipment good? Is there a pilot relay and is it functioning correctly? Is a Hand-Off-Auto (HOA) switch overriding the equipment? If the voltage is approximately 0 V, proceed to the next step.	Wiring problem.
Step 4	Remove the wires from the binary output terminals and measure the voltage again. If the voltage is 24 V, there is a wiring or equipment problem external to the MP503. If the voltage is still approximately 0 V, the MP503 is commanding the output to be **OFF** and further investigation is required. Refer to Table 15 to troubleshoot the configuration and operation of the binary output.	Wiring problem.

Table 15. Binary output (relay output) troubleshooting of configuration and operation

Step Number	Action	Probable Cause
Step 1	Connect the Rover service tool to the LonTalk communication link, start the Rover service tool, and select the MP503 from the Active Group Tree. The device plug-in for the selected MP503 appears with the Status screen displayed in the workspace. For more details, refer to the *Rover Operation and Programming Guide* (EMTX-SVX01).	—
Step 2	Select the Bindings button to view the Network Variable Bindings Summary screen for the LonTalk network that includes this MP503. (The Bindings button will be disabled if the MP503 is the only device currently on the network.) Is this binary output bound? Is it bound to more than one network device? If it is bound to two devices, one may be commanding the binary output on while the other commands it off. For more information about network bindings, refer to the section, "Network Variable Bindings," p. 13.	Bindings problem.
Step 3	If the binary output is correctly bound to another device, is that device communicating? If it has not communicated for at least 15 minutes, the binary output will go to its communication loss position. The communication loss position is configurable using the device plug-in. Proceed to the next step to view or edit the communication loss position of the binary output.	Network communications problem.
Step 4	To view the communication loss position of the binary output, select the **Close** button to return to the Status screen. Press the Configuration button, then select the Outputs tab. The communication loss position for a binary output can be set to On, Off, or Last State. For example, if you expect the equipment controlled by the binary equipment to be on but it is off because of the communication loss position, you may want to change the communication loss position from Off or Last State to On.	Incorrect communication loss position.

Troubleshooting Universal Input

If a universal input value appears incorrect, follow the troubleshooting steps in Table 16 and Table 17.

Table 16. Troubleshooting universal inputs using the device plug-in

Step Number	Action	Probable Cause
Step 1	Connect the Rover service tool to the LonTalk communication link, start the Rover service tool, and select the MP503 from the Active Group Tree. The device plug-in for the selected MP503 will appear with the Status screen displayed in the workspace. For more details, refer to the *Rover Operation and Programming Guide* (EMTX-SVX01).	—
Step 2	On the Inputs tab, check the value of each universal input. For thermistor inputs, the reading is shown in both degrees (Fahrenheit or Celsius) and Ohms. If the input does not show the expected value, proceed to the next step to verify the input configuration.	—
Step 3	Select the Configuration button, then select the Inputs tab to view the Input Type. If it is not correct, select the correct type from the drop-down list. Select the Download button, then select the Save button. If the configuration is correct for the input you are troubleshooting, proceed to Table 17.	Input configuration problem.

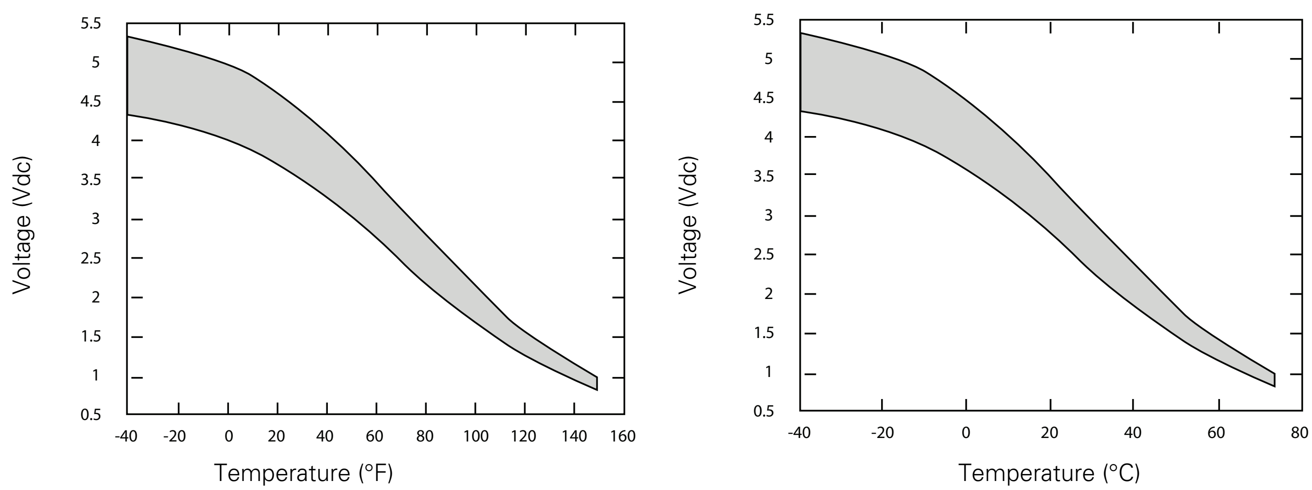
Table 17. Troubleshooting universal inputs using a meter at the module

Step number	Action	Probable Cause
Step 1	Perform the initial troubleshooting steps described in Table 13, p. 23 and verify that general board operation is functioning.	General board problem.
Step 2	Inspect the wiring. Is there a good connection between the wire and the terminal blocks? Look for shorts or opens. Pay particular attention to wire splices.	Wiring problem.
Step 3	What type of universal input are you investigating? • For thermistor, proceed to Table 18, p. 25. • For binary, proceed to Table 19, p. 26. • For 0–20 mA, proceed to Table 20, p. 26. • For 0–10 Vdc, proceed to Table 20, p. 26.	—

Table 18. Universal input troubleshooting with a thermistor input

Step Number	Action	Probable Cause
Step 1	After following the steps in Table 17, use the volt meter (set to read dc voltage) to measure the voltage across the terminals for the input. Verify the voltage falls into the gray area of the curve in Figure 11, p. 26 for the current temperature. If the voltage reading is not appropriate for the current temperature, you have a sensor wiring problem. If the voltage is correct for the current temperature, proceed to the next step.	Sensor wiring problem.
Step 2	Disconnect the sensor wires from the input terminals. Use the volt meter (set to read dc voltage) to measure the voltage across the terminals for the input. The voltage should be 4.75–5.25 Vdc (see Table 22 on page 27). If the voltage is not in that range, the MP503 has a circuit board problem.	Circuit board problem.

Figure 11. Voltage measured across terminals vs. temperature



Note: *The correct region is shown in gray. A range of measurements is shown due to the variability of reference voltages the thermistors.*

Table 19. Universal input troubleshooting with a binary input

Step Number	Action	Probable Cause
Step 1	After following the steps in Table 17, p. 25, disconnect the sensor wires from the input terminals. Use volt meter (set to read dc voltage) to measure the voltage across the terminals for the input you are troubleshooting. The voltage should be 16.00–18.00 Vdc (refer to Table 22, p. 27). If the voltage is not in that range, the MP503 has a circuit board problem.	Circuit board problem.

Table 20. Universal input troubleshooting with a 0–20 mA input

Step Number	Action	Probable Cause
Step 1	After following the steps in Table 17, p. 25, use your meter (set to read dc voltage) to measure the voltage across the terminals for the input you are troubleshooting. Verify the voltage falls on the curve shown in Figure 12, p. 27 for the input current. If the voltage is not appropriate for the mA reading, you have a sensor wiring problem. If the voltage is correct for the mA reading, proceed to the next step.	Sensor wiring problem.
Step 2	Disconnect the sensor wires from the input terminals. Use your meter (set to read dc voltage) to measure the voltage across the terminals for the input you are troubleshooting. The voltage should be 0.10–0.13 Vdc (refer to Table 22, p. 27). If the voltage is not in that range, the MP503 has a circuit board problem.	Circuit board problem.

Figure 12. Voltage measured across terminals vs. input current

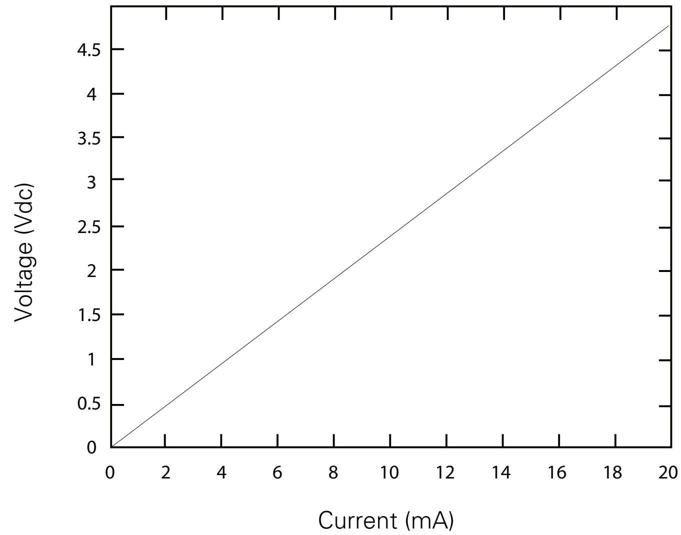


Table 21. Universal input troubleshooting with a 0–10 Vdc input

Step Number	Action	Probable Cause
Step 1	After following the steps in Table 17, p. 25, disconnect the sensor wires from the input terminals. Use the volt meter (set to read dc voltage) to measure the voltage across the terminals for the input you are troubleshooting. The voltage should be 3.1–3.8 Vdc (see Table 22, p. 27). If the voltage is not in that range, the MP503 has a circuit board problem.	Circuit board problem.

Table 22. Voltage measurements at universal inputs (no sensor connected)

Input Type	Expected Value	Acceptable Range
Thermistor	5.00 Vdc	4.75 to 5.25 Vdc
Binary	17.00 Vdc	16.00 to 18.00 Vdc
0–20 mA	0.116 Vdc	0.100 to 0.130 Vdc
0–10 Vdc	3.43 Vdc	3.10 to 3.80 Vdc

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