



Installation and Operation

Tracer™ MP503 Input/Output Module



Special Notifications

Special notifications

Warnings, Cautions, "Important" statements, and Notes appear at appropriate locations throughout this manual. Read them carefully.

WARNING

Indicates a potentially hazardous situation, which, if not avoided, could result in serious injury or death.

CAUTION

Indicates a potentially hazardous situation, which, if not avoided, may result in minor or moderate injury.

CAUTION

Indicates a situation in which property-damage-only accidents could occur, and also used to alert against unsafe practices.

IMPORTANT

Alerts installer, servicer, or operator to potential actions that could cause the product or system to operate improperly but will not likely result in potential for damage.

Note: A note may be used to make the reader aware of useful information, to clarify a point, or to describe options or alternatives.

Tracer MP503 Input/Output Module Installation and Operation

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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 Tracer MP503 applications.

Product description

The Tracer 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 Tracer 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 85°C (–40° to 185°F)
- Relative humidity: 5–95%, noncondensing

Operating environment

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

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

Overview and specifications

Dimensions

For complete dimensional drawing, see Figure 1.

- Height: 137 mm (5 3/8 in.)
- Width: 175 mm (6 7/8 in.)
- Depth: 51 mm (2 in.)

Clearances

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

- Front: 100 mm (4 in.)
- Each side: 25 mm (1 in.)
- Top and bottom: 100 mm (4 in.)

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

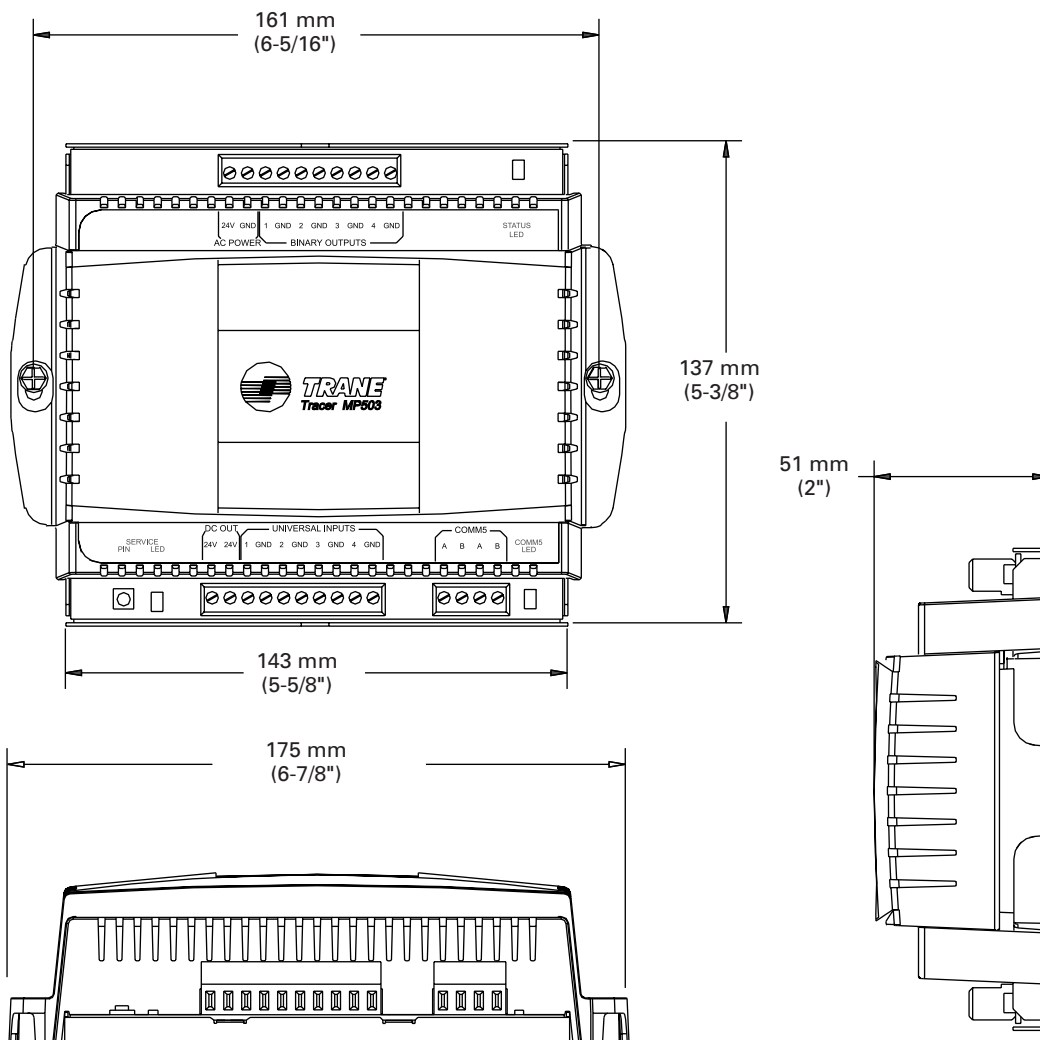
UL and C-UL listed:

- Energy Management Equipment—PAZX (UL 916)

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

FCC Part 15, Subpart B, Class B

Figure 1: Tracer MP503 I/O module dimensions



Overview and specifications

Additional components

The Tracer MP503 I/O module requires the use of additional components for monitoring and proper control of the associated equipment. Use of various components depends on the application. They are not included with the Tracer MP503 I/O module.

Power transformer

A UL-listed Class 2 transformer is required to power the Tracer MP503 and associated output relays (if connected). The transformer must be sized to provide adequate power to the Tracer MP503 (10 VA) and outputs (up to 12 VA per binary output).

Input devices

Four different types of inputs may be connected to the universal inputs on the Tracer MP503 I/O module:

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

The binary input equates a signal of 0 Vac with open contacts and 24 Vac with closed contacts. Thermistor inputs must be Trane 10 k Ω (at 25°C) thermistors. Any Trane zone temperature sensor can be connected to the Tracer MP503; however, the module will not recognize the setpoint thumbwheel or fan speed switch that is included on some sensors.

The inputs are software configurable only; there are no jumpers to set on the circuit board. Use the device plug-in to change the input configuration from its factory default. (The inputs are factory configured to be thermistor.)

Output devices

The Tracer MP503 has four binary outputs. The binary outputs are form A (SPST) relay outputs. These relays switch 24 Vac; they are not dry contacts. 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.

General wiring information

This chapter provides specifications and general information about wiring the Tracer MP503 I/O module. The module requires wiring for:

- Input/output terminals
- AC power to the module
- Communication-link wiring, if the module is to communicate with a building automation system (BAS) or other LonTalk Comm5 devices

Input/output terminal wiring

All input/output terminal wiring for the Tracer MP503 I/O module must meet the following requirements:

- All wiring must comply with the National Electrical Code and local codes.
- Use only 0.64 mm²–1 mm² (18–22 AWG), twisted-pair wire with stranded, tinned-copper conductors. (Shielded wire is not required for input/output wiring. Shield connections are not included on the module.)
- Binary output wiring must not exceed 300 m (1000 ft).
- Binary input and 4–20 mA input wiring must not exceed 300 m (1000 ft).
- Thermistor input and 0–10 Vdc input wiring must not exceed 100 m (300 ft).
- Do not run input/output wires in the same wire bundle with any ac-power wires.

For detailed wiring information and diagrams, see Chapter 4, “Applications of the Tracer MP503.”

AC-power wiring

WARNING

HAZARDOUS VOLTAGE!

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

WARNING

HAZARDOUS VOLTAGE!

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

CAUTION

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

CAUTION

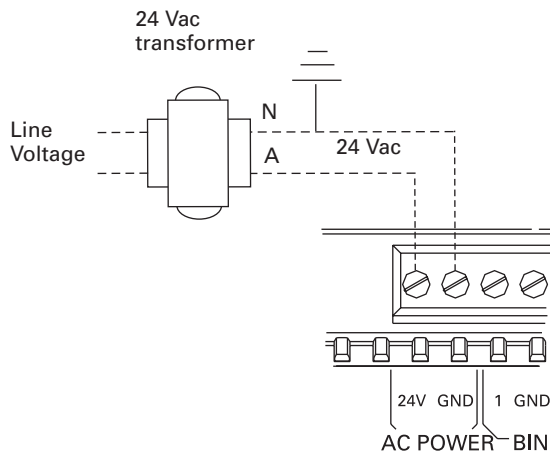
To prevent device damage, do not share 24 Vac between devices.

The recommended wire for ac power is 1.3 mm² (16 AWG) 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 Tracer MP503 I/O module (see Figure 2).

General wiring information

Figure 2 – 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 Tracer MP503 I/O module (10 VA) and output devices, including relays, to a maximum of 12 VA per output utilized. The Tracer 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 Tracer MP503 I/O module communicates with the BAS and with other devices through a LonTalk Comm5 communication link.

IMPORTANT

For important instructions on network wiring, refer to the *Tracer Summit Hardware and Software Installation guide (BMTW-SVN01B-E4)*.

Wiring for the communication link must meet the following requirements:

- All wiring must comply with the National Electrical Code and local codes.
- Communication-link wire must be plenum-rated, 0.64 mm² (18 AWG), shielded, twisted pair with stranded, tinned-copper conductors. Wire capacitance between conductors must be 72 ±6 pF/m (23 ±2 pF/ft). Use only Trane part number 400-2028 wire or the equivalent. Echelon Level IV specification wire is not supported.

- At the module, the shield should be spliced with the shield from the next section of communication-link wiring and taped to prevent any connection to ground.
- Termination resistors are required for wiring LonTalk Comm5 devices communicating on a network. For important instructions on using termination resistors for Comm5 applications, refer to the Tracer Summit Hardware and Software Installation guide (BMTW-SVN01B-E4).

Each Tracer MP503 I/O module 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 chapter gives recommendations and requirements for mounting the Tracer MP503 I/O module.

Location recommendations

Trane recommends locating the Tracer MP503 I/O module:

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

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

Mounting recommendations

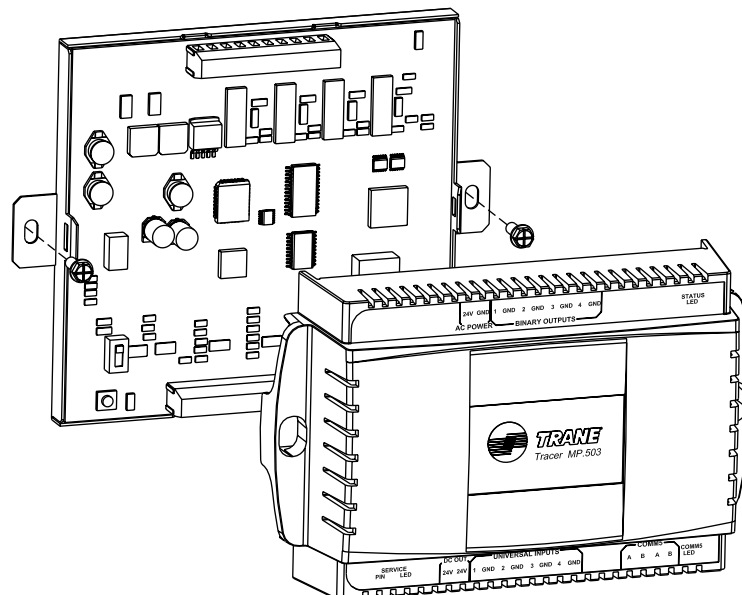
IMPORTANT

Leave the cover on when mounting the Tracer MP503 I/O module to avoid the possibility of 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 4.8 mm (3/16 in.) radius mounting holes provided (see Figure 3). 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 3 – Mounting the Tracer MP503 I/O module



Applications of the Tracer MP503

This chapter provides information about the function of inputs and outputs and examples of wiring for Tracer MP503 applications. The Tracer MP503 I/O module is a field-installed device. It is used to monitor inputs and control binary outputs. The module has four configurable inputs and four binary outputs.

Inputs

The Tracer MP503 has four inputs. Each input can be configured to be binary, thermistor, 0–20 mA, or 0–10 Vdc. You may have any mixture of these input types connected to the module. The factory-default input type is 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 Tracer 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 10k Ω (at 25°C) thermistors. Any Trane zone temperature sensor can be connected to the Tracer 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. You can install any of these sensors, connect it to an input on the Tracer MP503, and configure that input 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 at the Tracer MP503. The Tracer MP503 transmits the raw mA reading.

To power these sensors, 24 Vdc is available from the Tracer MP503 circuit board. See Figure 4 for wiring details.

0–10 Vdc inputs

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

IMPORTANT

If you are 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 at the Tracer MP503. The Tracer MP503 transmits the raw voltage reading.

To power these sensors, 24 Vdc is available from the Tracer MP503 circuit board. See Figure 4 for wiring details.

Outputs

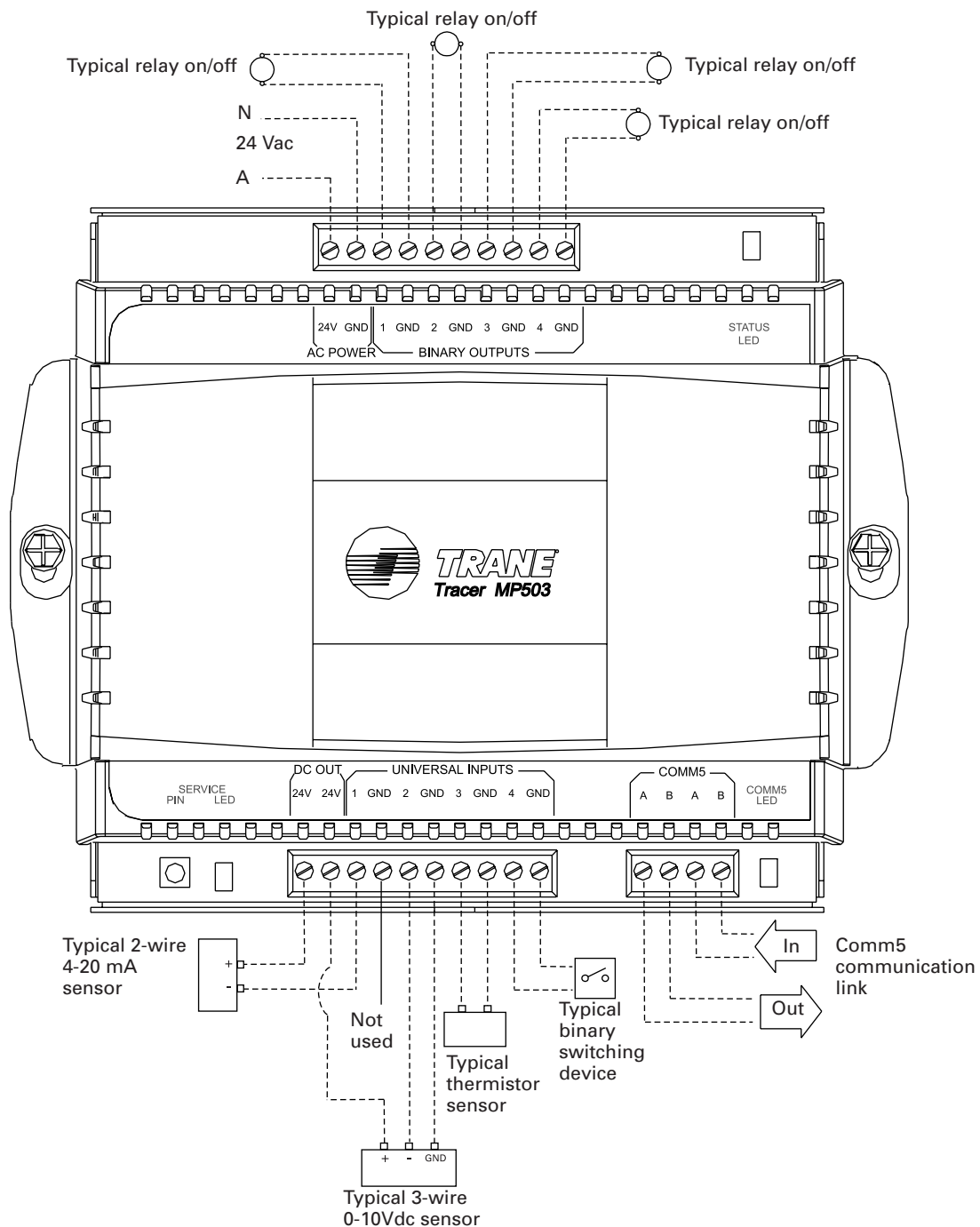
The binary outputs are form A (SPST) relay outputs. These relays switch 24 Vac; they are not dry contacts. A pilot relay is required for any application requiring dry contacts. Relays connected to the binary outputs on the module cannot exceed 12 VA or 0.5 A current draw at 24 Vac.

Applications of the Tracer MP503

Wiring requirements and options

Figure 4 shows the wiring of each type of input on the Tracer MP503 I/O module. The figure also shows the wiring for a typical binary output.

Figure 4 – Input/output terminal wiring for the Tracer MP503 I/O module



Network variable bindings

This chapter describes how to use network variable bindings in Tracer MP503 I/O module applications.

Overview

The LonTalk Comm5 communication protocol allows data to be shared between devices (stand-alone or with a BAS) on a Comm5 network. This is called peer-to-peer communication. As an example of peer-to-peer communication, two or more devices 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.

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 they must be the same network variable type. 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, see the LonMark web site (www.lonmark.org). From that web site you can download the official list of SNVTs.

Binding network variables

IMPORTANT

Only Comm5 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 will automatically bind to the proper data in a device. However, communication speed may be increased between two devices by binding their data rather

than having the BAS read the information from one device and then broadcast it to another. Use the Rover service tool to create bindings (see the *Rover Operation and Programming* guide, EMTX-SVX01B-EN).

Tracer MP503 bindings

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

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

Receiving data

A network variable input (nvi) receives data from other devices on the Comm5 network. Network variable inputs (including their SNVTs) that are commonly used in Tracer 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.

Network variable bindings

Sending data

A network variable output (nvo) sends data to other devices on the Comm5 network. The network variable outputs (including their SNVTs) that are commonly used in Tracer 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.
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.

Network variable bindings

Table 2 - Tracer MP503 network variable outputs

Variable name	Data type		Description
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.
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 2 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.

Network variable bindings

Examples of network variable bindings

The following examples show four common uses of bindings in Tracer MP503 applications.

Example 1: Display sensor readings from a Tracer MP503 on a Tracer MP581 operator display

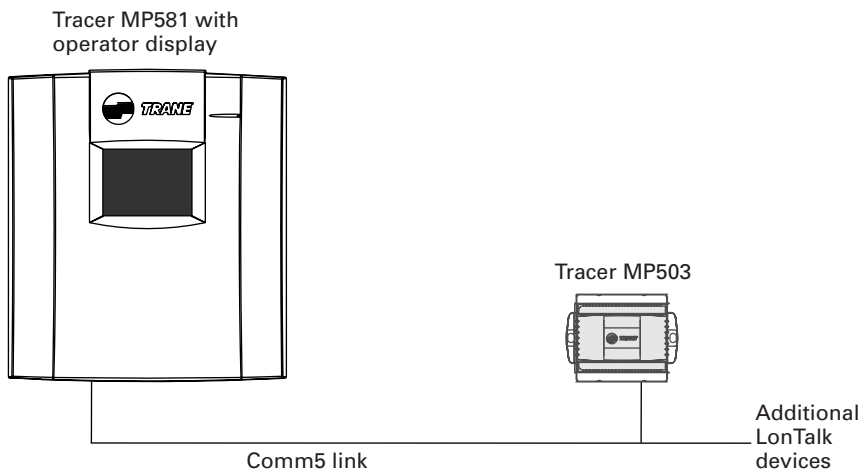
In this example, four different sensors are connected to a Tracer MP503. A thermistor reading the outside air temperature is connected to universal input 1 on the Tracer MP503. A 4–20 mA sensor reading the outside air humidity is connected to universal input 2. Two binary inputs from a fire panel (Alarm Status and Fire Panel Trouble) are connected to universal input 3 and universal input 4, respectively. A Tracer MP581 is on the same Comm5 link as the Tracer MP503. The Tracer 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 Tracer MP581. The location of the outside air sensors made it convenient to wire those points to the Tracer MP503 also.

Use bindings to allow the economizer control in the Tracer MP581 to calculate outside air enthalpy and to display the four inputs from the Tracer MP503 on the operator display of the Tracer MP581. Figure 5 shows the Comm5 network for this example.

Use the Rover service tool to create bindings. (See the *Rover Operation and Programming* guide, EMTX-SVX01B-EN.) Using the Rover service tool, select the network variable from the Tracer MP503 and then select the Tracer MP581. The Rover service tool shows you only the variables in the Tracer MP581 of the SNVT that matches the variable you selected in the Tracer MP503.

Figure 5 - Comm5 network for example 1



Network variable bindings

Table 3 shows the bindings needed.

Table 3 - Bindings for example 1

Network variable output on the Tracer MP503		Network variable input on the Tracer MP581	
nvoTemperature ¹	binds to	nviTemp01 ¹	
nvoCurrent ²	binds to	nviCurrent_mA01 ²	
nvoBIP3Status	binds to	nviSwitch01 ³	
nvoBIP4Status	binds to	nviSwitch01 ³	

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).

³ The Tracer MP581 has 40 generic binary (SNVT_switch) network variable inputs available for binding (nviSwitch01 through nviSwitch40).

Once you have completed the bindings, you need to program the Tracer MP581 to display this data on the operator display. Remember that the outside air humidity is being transmitted over the network in units of mA. Some custom programming is required in the Tracer MP581 to convert the humidity from units of mA to units of percent (%). Custom programming in the Tracer MP581 will also use the outside air temperature and humidity to calculate the outside air enthalpy and use it to control the economizer of the AHU.

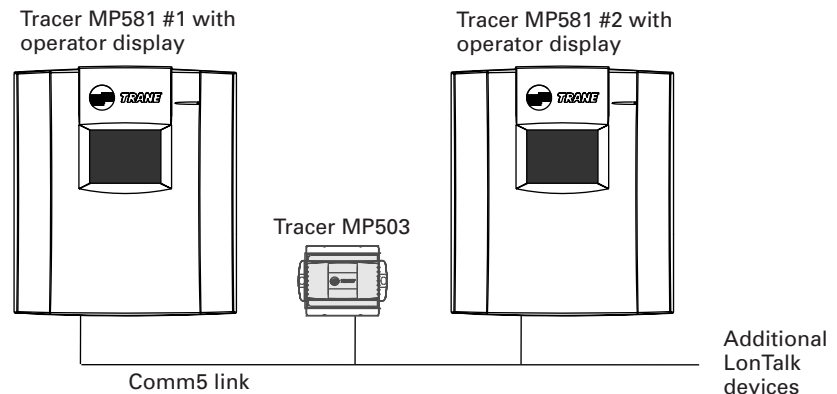
Network variable bindings

Example 2: Display sensor readings from a Tracer MP503 on two different Tracer MP581 operator displays

This example builds on example 1 and shows that bindings can be “one to many.” In this example, a second Tracer MP581 is added to the system described in example 1. The second Tracer MP581 also controls an AHU. This AHU also 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 Tracer MP581 to calculate outside air enthalpy.

Figure 6 shows the Comm5 network for this example.

Figure 6 – Comm5 network for example 2



Use the Rover service tool to create bindings. (See the *Rover Operation and Programming* guide, EMTX-SVX01B-EN.) Using the Rover service tool, select the network variable from the Tracer MP503 and then select the second Tracer MP581. The Rover service tool shows you only the variables in Tracer MP581 #2 of the SNVT that matches the variable you selected in the Tracer MP503.

Network variable bindings

Table 4 shows the bindings needed between the Tracer MP503 and Tracer MP581 #2.

Table 4 - Bindings for example 2

Network variable output on the Tracer MP503		Network variable input on the Tracer MP581 #2
nvoTemperature1	binds to	nviTemp01 ¹
nvoCurrent2	binds to	nviCurrent_mA01 ²

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).

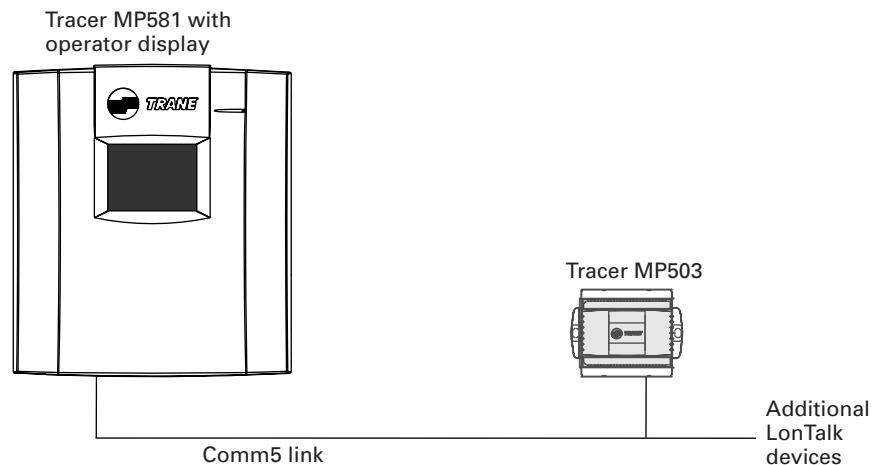
Again, after you have completed the bindings, you need to program Tracer MP581 #2 to calculate enthalpy from the outside air temperature and humidity. Custom programming is also required to display this data on the operator display of Tracer MP581 #2. Remember that the outside air humidity is being transmitted 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 Tracer MP503 from a Tracer MP581

This example shows an nvi on the Tracer MP503 being bound, which allows a binary output on the Tracer MP503 to be controlled by another device on the Comm5 network. In this example, binary output 1 on the Tracer MP503 is starting and stopping an exhaust fan. The Tracer MP503 is communicating via the Comm5 network to a Tracer 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 Tracer MP581 to an nvi on the Tracer MP503 so the AHU and exhaust fan run together. Figure 7 shows the Comm5 network for this example.

Figure 7 – Comm5 network for example 3



Use the Rover service tool to create bindings. (See the *Rover Operation and Programming* guide, EMTX-SVX01B-EN.) Using the Rover service tool, select the network variable from the Tracer MP581 and then select the Tracer MP503. The Rover service tool shows you only the variables in the Tracer MP503 of the SNVT that matches the variable you selected in the Tracer MP581.

Network variable bindings

Table 5 shows the bindings needed.

Table 5 - Bindings for example 3

Network variable output on the Tracer MP581		Network variable input on the Tracer MP503
nvoSwitch01 ¹	binds to	nviBOP1Request

¹The Tracer MP581 has 40 generic binary (SNVT_switch) network variable outputs available for binding (nvoSwitch01 through nvoSwitch40).

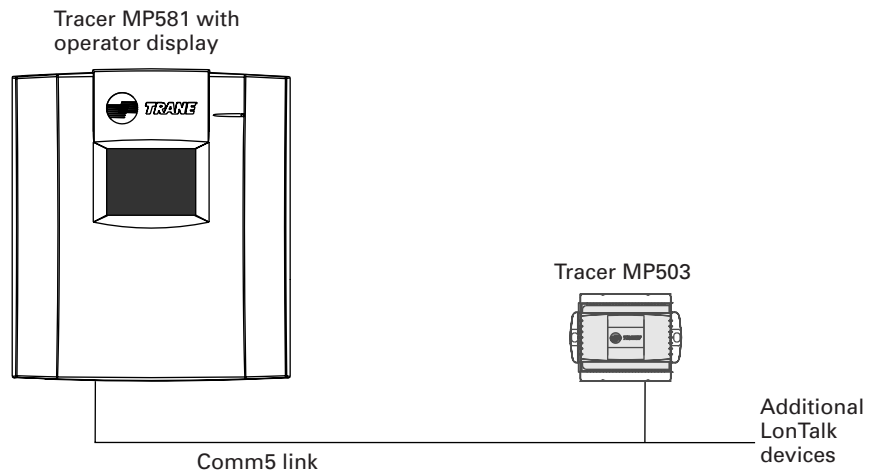
Custom programming in the Tracer MP581 controls nvoSwitch01. Write a custom program to control nvoSwitch01 on when the AHU is on and off when the AHU is off. The network binding passes the command to the binary output on the Tracer MP503.

Example 4: Use a sensor reading on a Tracer MP503 to control a pump VFD on a Tracer MP581

In this example, a Tracer MP581 is controlling the variable frequency drive (VFD) of a chilled water pump. We want to 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 300 m (1000 ft.) away from the pump, so it cannot be wired directly to the universal input on the Tracer MP581. Install a Tracer MP503 to read the differential pressure and then use network bindings to send the pressure value to the Tracer MP581 controlling the chilled water pump VFD.

Figure 8 shows the Comm5 network for this example.

Figure 8 – Comm5 network for example 4



Use the Rover service tool to create bindings. (See the *Rover Operation and Programming* guide, EMTX-SVX01B-EN.) Using the Rover service tool, select the network variable from the Tracer MP503 and then select the Tracer MP581. The Rover service tool shows you only the variables in the Tracer MP581 of the SNVT that matches the variable you selected in the Tracer MP503.

Network variable bindings

Table 6 shows the bindings needed.

Table 6 - Bindings for example 4

Network variable output on the Tracer MP503		Network variable input on the Tracer MP581
nvoCurrent1	binds to	nviCurrent_mA01 ¹

¹ The Tracer MP581 has 8 generic current (SNVT_amp_mil) network variable inputs available for binding (nviCurrent_mA01 through nviCurrent_mA08).

Once you have completed the bindings, you need to program the Tracer MP581 to use this data to control the pump speed. Remember that the differential pressure is being transmitted over the network in units of mA. Some custom programming is required in the Tracer MP581 to convert the differential pressure from units of mA to the proper units of pressure. Custom programming in the Tracer MP581 will then use the pressure to control the speed of the chilled water pump.

Status indicators for operation and communication

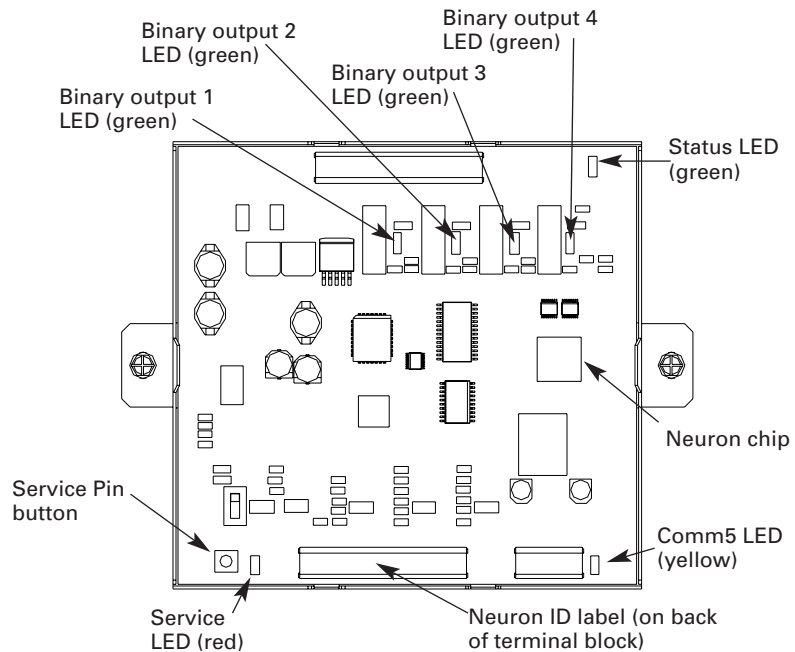
This chapter describes the operation and communication status indicators on the Tracer MP503 I/O module, including:

- A description of the location and function of the Service Pin button and the light-emitting diodes (LEDs) located on the module
- A complete list of the diagnostics that can occur, their effect on module outputs, and an explanation of how diagnostics are cleared and the device restored to normal operation

Tracer MP503 circuit board

Figure 9 shows the location of the Service Pin button, the Neuron ID and label, and the LEDs on the Tracer MP503 I/O module circuit board.

Figure 9 - Tracer MP503 I/O module circuit board



Service Pin button

The Service Pin button is located as shown in Figure 9. The Service Pin button is used to:

- Identify a device (see "Identifying a device" in the *Rover Operation and Programming* guide, EMTX-SVX01B-EN)
- Add a device to the active group (see "Adding a device" in the *Rover Operation and Programming* guide)
- Verify PCMCIA communications (see "Verifying PCMCIA communications" in the *Rover Operation and Programming* guide)
- Make the Status (green) LED "wink" to verify that the module is communicating on the link (see Table 8 and "Setting the auto-wink option" in the *Rover Operation and Programming* guide)

Status indicators for operation and communication

Interpreting LEDs

Service LED

The red Service LED (see Figure 9) indicates whether the module is capable of operating normally. See 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. ¹

¹ Restore the module to normal operation using the Rover service tool. Refer to the Rover Operation and Programming guide (EMTX-SVX01B-EN) for more information.

Status LED

The green Status LED (see Figure 9) indicates whether the module has power applied to it. See 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. ¹
LED is off continuously.	Either the power is off or the module has malfunctioned.

¹ By sending a request from the Rover service tool, you can request the green LED on the module to blink ("wink"), a notification that the module received the signal and is communicating.

Status indicators for operation and communication

Comm5 LED

The yellow Comm5 LED (see Figure 9) indicates the communications status of the module. See Table 9.

Table 9 - Yellow Comm5 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,
LED is on continuously.	Abnormal condition. This condition often indicates that external noise is affecting the Tracer MP503.

Binary output LEDs

Four green LEDs on the Tracer MP503 circuit board indicate the status of the four binary outputs. The location of each LED is shown in Figure 9. Table 10 shows the LED number for each binary output.

Table 10 - LED numbers for binary output LEDs

Binary output	LED number
1	CR8
2	CR9
3	CR10
4	CR11

Note: 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 describes the LED states.

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 Tracer MP503. When the diagnostic clears, the module resumes normal operation. Table 12 lists the diagnostics for the Tracer MP503.

All diagnostics generated by the Tracer MP503 are automatic (non-latching) diagnostics. They clear automatically when the problem that generated the diagnostic is solved.

Table 12 - Diagnostics

Diagnostic	Probable cause	Consequence	Diagnostic type
Normal	The Tracer MP503 has just been powered or a clear alarm command has just been sent to the Tracer 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 information only.	Automatic (non-latching)

Troubleshooting

This chapter outlines some general troubleshooting steps that should be performed if there is a problem with the operation of the equipment controlled by the Tracer MP503. This chapter describes some common problems; however, it cannot describe every possible problem. Troubleshooting that involves accessing live electrical devices must be conducted only by a properly trained and authorized electrician or trained technician.

If you encounter operational problems with the Tracer MP503 I/O module, you must first perform initial troubleshooting steps; see "Initial troubleshooting."

After you have performed the initial troubleshooting steps, refer to specific sections in this chapter to further diagnose the following operational problems:

- If a binary output is not turning on the equipment wired to it, see "Binary output (relay output) troubleshooting."
- If you see a universal input value that appears incorrect, see "Universal input troubleshooting."

Troubleshooting

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	<p>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. For a complete explanation of this LED behavior, see Table 7 in Chapter 6, "Status indicators for operation and communication."</p> <p>Use the Rover service tool to restore normal operation. See the Rover Operation and Programming guide (EMTX-SVX01B-EN) for more information.</p>	Tracer MP503 is not configured
Step 2	<p>Look at the green Status LED. It should be on continuously during normal operation. A blinking Status LED indicates abnormal behavior for the Tracer MP503. For a complete explanation of this LED behavior, see Table 8 in Chapter 6, "Status indicators for operation and communication."</p>	Tracer MP503 circuit board problem
Step 3	<p>Use your meter (set to measure ac voltage) to measure the voltage across the ac power terminals on the Tracer MP503 (with ac wires connected). See Figure 2.</p> <p>If the voltage is approximately 24 V (20–30 V) on the terminals, the board is receiving adequate input power. The Tracer MP503 circuit board has a problem.</p> <p>If the voltage is approximately 0 V, proceed to the next step.</p>	Tracer MP503 circuit board problem
Step 4	<p>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.</p> <p>If the voltage is still approximately 0 V, the board is not receiving the power it needs to run.</p>	Input power problem

Troubleshooting

Binary output (relay output) troubleshooting

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 you think it should be on. The steps are nearly the same if the equipment is on when you think 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 on page 26 and verify that general board operation is okay.	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	<p>Look at the status LED for the binary output you are troubleshooting. (See “Binary output LEDs”.) If the LED is on, the Tracer MP503 is energizing its output relay.</p> <p>Use your meter (set to measure ac voltage) to measure the voltage across the binary output terminals you are troubleshooting on the Tracer MP503.</p> <p>If the voltage is approximately 24 V, the problem lies beyond the Tracer 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?</p> <p>If the voltage is approximately 0 V, proceed to the next step.</p>	Wiring problem
Step 4	<p>Remove the wires from the binary output terminals and measure the voltage again.</p> <p>If the voltage is 24 V, there is a wiring or equipment problem external to the Tracer MP503.</p> <p>If the voltage is still approximately 0 V, the Tracer MP503 is commanding the output to be off and you need to investigate the Tracer MP503 further. See Table 15 to troubleshoot the configuration and operation of the binary output.</p>	Wiring problem

Troubleshooting

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

Step number	Action	Probable cause
Step 1	<p>Connect the Rover service tool to the Comm5 communication link, start the Rover service tool, and select the Tracer MP503 you are troubleshooting from the Active Group Tree. The device plug-in for the selected Tracer MP503 will appear with the Status screen displayed in the workspace.</p> <p>See the <i>Rover Operation and Programming</i> guide (EMTX-SVX01B-EN) for more information.</p>	–
Step 2	<p>Select the Bindings button to view the Network Variable Bindings Summary screen for the Comm5 network that includes this Tracer MP503. (The Bindings button will be disabled if the Tracer 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.</p> <p>For more information about network bindings, see Chapter 5, “Network variable bindings.”</p>	Bindings problem
Step 3	<p>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.</p>	Network communications problem
Step 4	<p>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.</p> <p>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.</p>	Incorrect communication loss position

Troubleshooting

Universal input troubleshooting

If you see a universal input value that appears incorrect, then follow the troubleshooting steps in the following tables:

- Table 16 describes steps you can take using the device plug-in to troubleshoot inputs. You do not have to be at the module to use the device plug-in to view the inputs.
- Table 17 describes troubleshooting inputs with a meter at the module.

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

Step number	Action	Probable cause
Step 1	<p>Connect the Rover service tool to the Comm5 communication link, start the Rover service tool, and select the Tracer MP503 you are troubleshooting from the Active Group Tree. The device plug-in for the selected Tracer MP503 will appear with the Status screen displayed in the workspace.</p> <p>See the <i>Rover Operation and Programming</i> guide (EMTX-SVX01B-EN) for more information.</p>	–
Step 2	<p>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.</p> <p>If the input does not show the value you expect, proceed to the next step to verify the input configuration.</p>	–
Step 3	<p>Select the Configuration button, then select the Inputs tab. For the universal input you are troubleshooting, view the Input Type.</p> <p>If it is not correct, select the correct type from the drop-down list. Select the Download button, then select the Save button.</p> <p>If the configuration is correct for the input you are troubleshooting, proceed to Table 17.</p>	Input configuration problem

Troubleshooting

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 and verify that general board operation is okay.	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	<p>What type of universal input are you investigating?</p> <ul style="list-style-type: none"> • For thermistor, proceed to Table 18. • For binary, proceed to Table 19. • For 0–20 mA, proceed to Table 20. • For 0–10 Vdc, proceed to Table 21. 	—

Table 18 - Universal input troubleshooting with a thermistor input

Step number	Action	Probable cause
Step 1	<p>After following the steps in Table 17, 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 into the gray area of the curve in Figure 10 for the current temperature.</p> <p>If the voltage reading is not appropriate for the current temperature, you have a sensor wiring problem.</p> <p>If the voltage is correct for the current temperature, proceed to the next step.</p>	Sensor wiring problem
Step 2	<p>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.</p> <p>The voltage should be 4.75–5.25 Vdc (see Table 22). If the voltage is not in that range, the Tracer MP503 has a circuit board problem.</p>	Circuit board problem

Troubleshooting

Figure 10 - Voltage measured across terminals vs. temperature

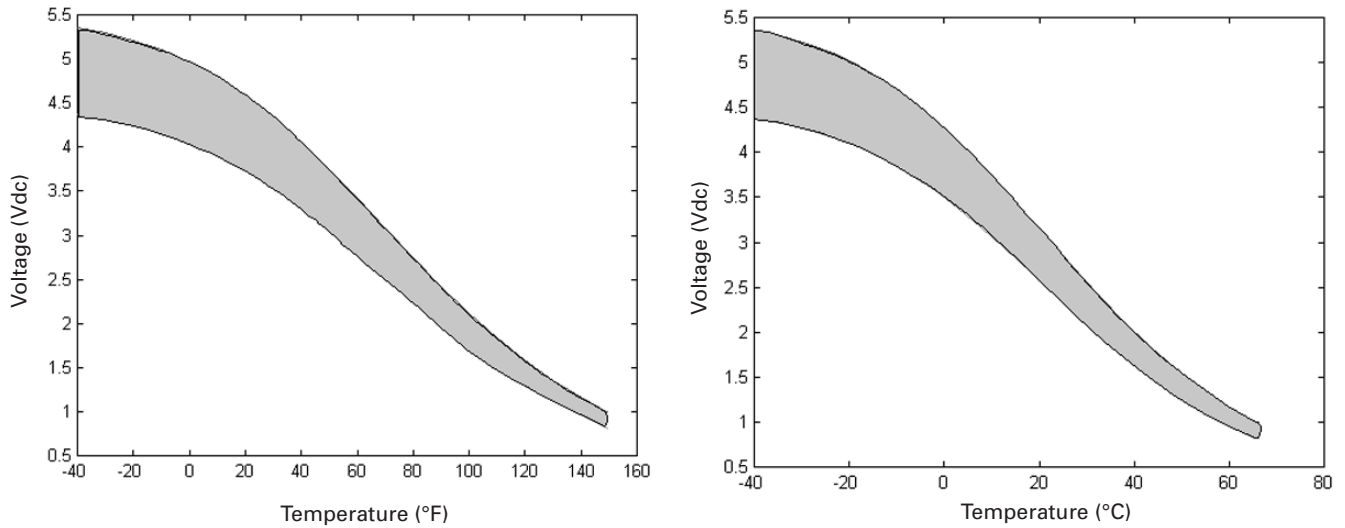


Figure Note:

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

Table 19 - Universal input troubleshooting with a binary input

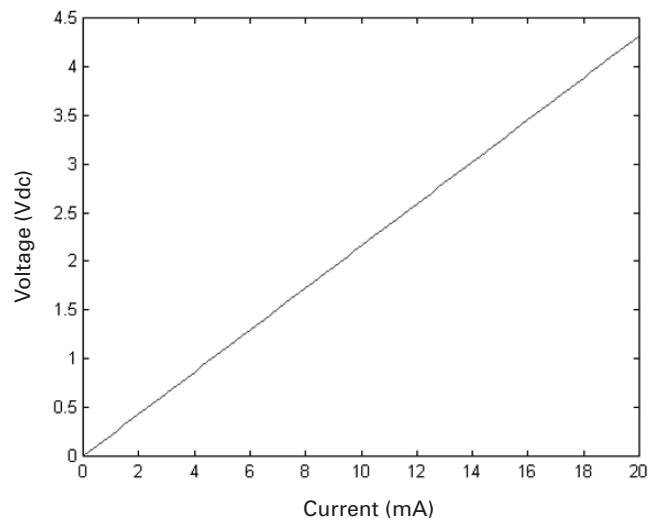
Step number	Action	Probable cause
Step 1	<p>After following the steps in Table 17, disconnect the sensor wires from the input terminals. Use your meter (set to read dc voltage) to measure the voltage across the terminals for the input you are troubleshooting.</p> <p>The voltage should be 16.00–18.00 Vdc (see Table 22). If the voltage is not in that range, the Tracer MP503 has a circuit board problem.</p>	Circuit board problem

Troubleshooting

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

Step number	Action	Probable cause
Step 1	<p>After following the steps in Table 17, 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 11 for the input current.</p> <p>If the voltage is not appropriate for the mA reading, you have a sensor wiring problem.</p> <p>If the voltage is correct for the mA reading, proceed to the next step.</p>	Sensor wiring problem
Step 2	<p>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.</p> <p>The voltage should be 0.10–0.13 Vdc (see Table 22). If the voltage is not in that range, the Tracer MP503 has a circuit board problem.</p>	Circuit board problem

Figure 11 - Voltage measured across terminals vs. input current



Troubleshooting

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

Step number	Action	Probable cause
Step 1	<p>After following the steps in Table 17, 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.</p> <p>The voltage should be 3.1–3.8 Vdc (see Table 22). If the voltage is not in that range, the Tracer MP503 has a circuit board problem.</p>	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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