Hardware Installation

Tracer™ MP581 Programmable Controller

CNT-SVN01C-EN

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Revision history

Document number and date	Description
CNT-SVN01C-EN November 2005	• Binary output ratings corrected • EX2 best wiring practices added • I/O wiring diagrams changed • Contrast adjustment note added • Important note regarding termination board grounding screw added

Note: This document, in printed form or as an electronic file on a product CD, is accurate as of its publication date. The electronic version of this document may display a more current publication date and a higher revision level than this document.

NOTICE:

Warnings and Cautions appear at appropriate sections throughout this manual. Read these carefully:

⚠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, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

CAUTION

Indicates a situation that may result in equipment or property-damage-only accidents.

The following format and symbol conventions appear at appropriate sections throughout this manual:

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.

Contents

Chapter 1

Overview

This guide shows how to install the Tracer MP581 programmable controller.

Product description

The Tracer MP581 programmable controller provides direct digital control of a variety of heating, ventilation, and air-conditioning (HVAC) equipment. The Tracer MP581 supports the following new- and existing-building applications:

- Air-handler control, including support of the LonMark® Space Comfort Controller (SCC) profile and the Discharge Air Controller (DAC) profile
- Control of mechanical-room equipment, including cooling towers, pumps, boilers, and heat exchangers
- Control of an HVAC network for mid-sized buildings
- Nearly any control process with an execution frequency of one second or greater

Specifications

The Tracer MP581 conforms to the specifications shown in Table 1.

Table 1. Tracer MP581 specifications

Dimensions (see Figure 6 on page 11 for dimensional drawing)	16.5 in. × 14.75 in. × 5.5 in. (418 mm × 373 mm × 140 mm)
Weight	15 lb (7 kg)
Operating temperature	Frame-mount (without enclosure): From –40°F to 158°F (–40°C to 70°C) With enclosure: From 32°F to 122°F (0°C to 50°C)
Storage temperature	Without display: From –58°F to 203°F (–50°C to 95°C) With display: From –13°F to 149°F (–25°C to 65°C)
Humidity	10–90% non-condensing
Altitude	6500 ft (2000 m)
Installation	Category 3
Pollution	Degree 2
High-voltage power requirements	North America: 98–132 Vac, 1 A maximum, 1 phase Other: 196–264 Vac, 1 A maximum, 1 phase

Additional components

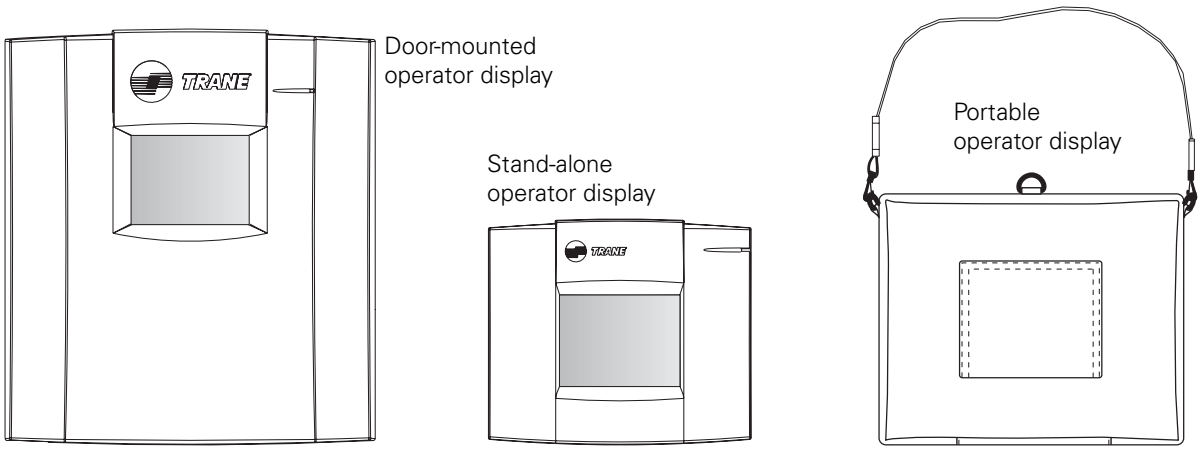
The Tracer MP581 controller requires additional components for certain applications and has several options for adding an operator display.

Operator display models

The operator display is available in three models (see Figure 1):

- Door-mounted operator display
- Stand-alone operator display, for mounting up to 150 ft (46 m) from the controller
- Portable operator display with carrying case

Figure 1. Operator display models



Sensors

The Tracer MP581 supports the following sensors:

- Zone temperature sensors (thermistors and linear resistance for thumbwheels)
- Linear 0–20 mA, such as humidity sensors
- Pressure sensors (use only the Trane 5 Vdc pressure-sensor kit—part number 4020 1159)
- Linear 0–10 Vdc, such as indoor air-quality sensors
- Resistance temperature detectors (up to four)
- Motion sensors, time clocks, and other binary switch devices

The Rover service tool is required to configure Tracer MP581 inputs for all types of sensors.

Note:
The Tracer MP581 supports all Trane zone sensors but does not support fan switches (HIGH, MED, LOW, AUTO, and OFF).

EX2 expansion modules

You can add up to four EX2 expansion modules to a Tracer MP581 controller. Each expansion module adds the following points to a Tracer MP581:

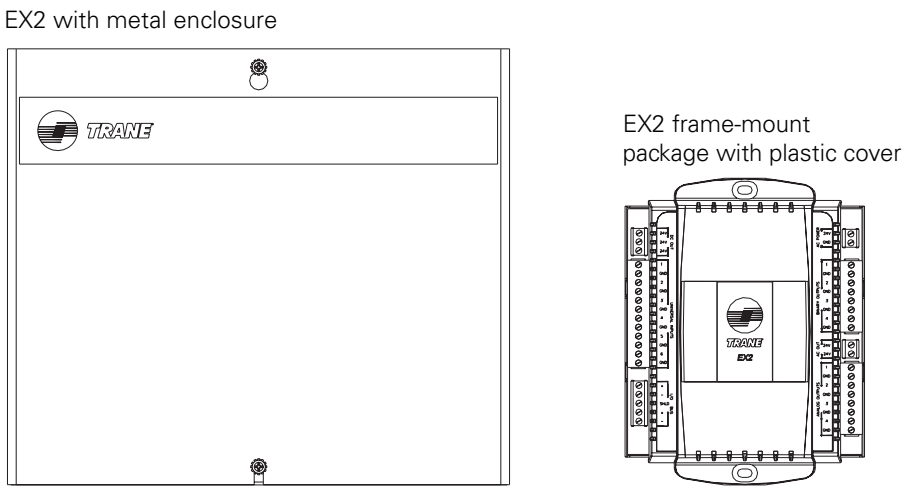
- Six universal inputs
- Four binary outputs
- Four analog outputs

The EX2 is available in two packages:

- Frame-mount with plastic cover (4950 0499)
- Metal enclosure (4950 0500)

Figure 2 illustrates the two packages. For dimensions and other information, see Chapter 13, “Installing EX2 expansion modules.”

Figure 2. EX2 expansion module packages



Power transformer

The frame-mounted Tracer MP581, which ships without an enclosure, requires a UL-listed Class 2 transformer providing 70 VA at 24 Vac.

Agency listings/compliance

This section lists compliance with Conformity European (CE) and Underwriters Laboratories (UL) standards.

Tracer MP581 controller

CE—Immunity:

EN 50090-2-2:1996

CE—Electromagnetic emissions:

EN 50090-2-2:1996
EN 61000-3-2:1995
EN 61000-3-3:1995

UL and C-UL listed—Energy management system

UL 916

FCC Part 15, Class A

Expansion module

CE—Immunity:

EN 50082-1:1997
EN 50082-2:1995
EN 50090-2-2:1996
EN 61326-1:1997

CE—Electromagnetic emissions:

EN 50011-1:1998—Class B
EN 50022-1:1998—Class B
EN 50090-2-2:1996—Class B
EN 61326-1:1997—Class B

UL and C-UL listed—Energy management equipment

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

FCC Part 15 Subpart B—Class A

Inspection upon receipt

Make sure that you have received the correct parts with your Tracer MP581 controller. Visually inspect all parts for obvious defects or damage. All components are thoroughly inspected before leaving the factory. Any claims for damage incurred in shipping should be filed with the carrier.

Tracer MP581 with enclosure

The Tracer MP581 with enclosure ships with:

- Enclosure with pre-mounted termination board
- Main circuit board in a plastic frame
- Enclosure door
- Plastic bag containing four #10 (5 mm) wall anchors and four #10 × 1.5 inch (5 × 40 mm) screws
- Installation sheet

Frame-mounted Tracer MP581

The frame-mounted Tracer MP581 ships with:

- Termination board in a plastic frame
- Main circuit board in a plastic frame
- Installation sheet

Note:
The four #8 (4 mm) screws required to mount the frame-mounted Tracer MP581 are not supplied.

Required tools

To install the Tracer MP581 controller and check it for proper operation, you will need the following tools:

- Drill
- Phillips-head screwdriver
- Small flat-tip screwdriver (for terminal screws)
- Digital multi-meter

Chapter 2

Installing the frame-mounted Tracer MP581

This chapter applies only to the frame-mounted Tracer MP581 controller. You can use the frame-mounted Tracer MP581 to replace older controllers in existing equipment or to mount in new equipment or custom enclosures.

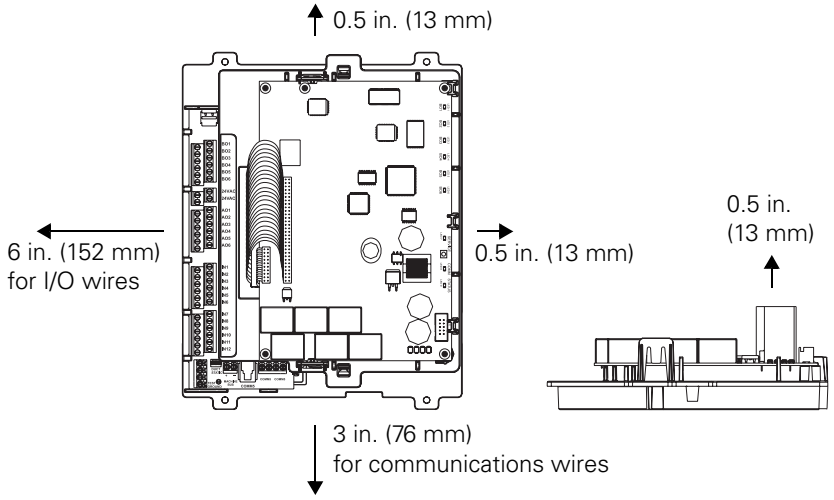
Enclosure requirements

Before installing the frame-mounted Tracer MP581, make sure that the enclosure or mounting space meets the following minimum requirements:

- Minimum clearances as shown in Figure 3
- 24 Vac dedicated power supply
- Compliance with National Electrical Code and applicable local electrical codes for high-voltage power wiring to the enclosure

Note:
The Tracer MP581 with enclosure is mounted in a National Electrical Manufacturers Association (NEMA) 1 enclosure. To meet NEMA 4 specifications, you can order the frame-mounted Tracer MP581 (model BMTM000CA0A0) and mount it in a separately purchased NEMA 4 enclosure.

Figure 3. Frame-mounted Tracer MP581 minimum clearances

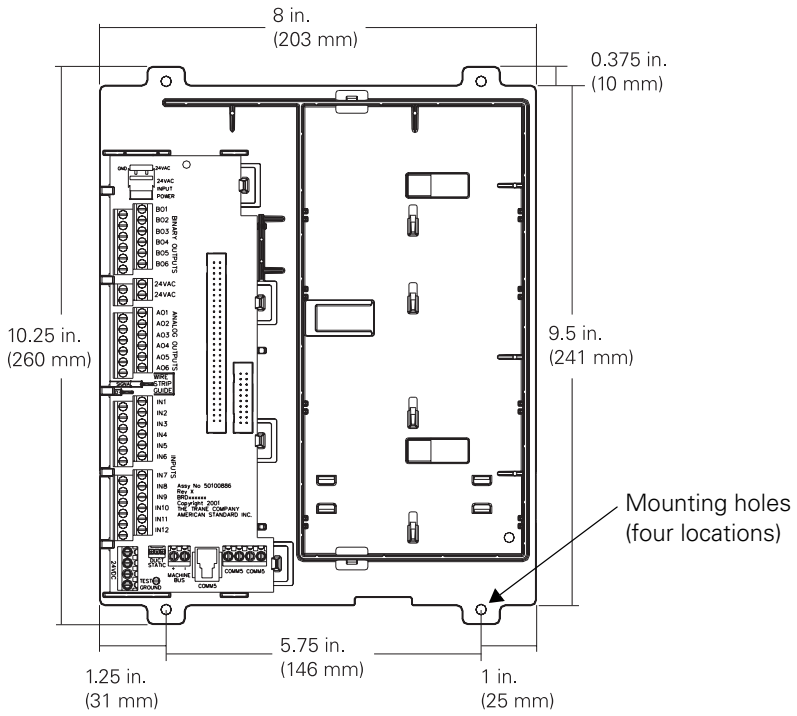


Installing the termination board

To install the termination board in a separately purchased enclosure or in other equipment:

1. Remove the controller from its packaging and separate the top and bottom frames.
2. Using the bottom frame (with the termination board) as a template, mark the location of the four mounting holes on the mounting surface (see Figure 4).

Figure 4. Frame-mounted dimensions and mounting holes



3. Set the controller aside and drill holes for #8 (4 mm) screws at the marked locations.
4. Secure the controller to the mounting surface with #8 (4 mm) screws (not supplied).

To install input/output wires, the main circuit board, and other components, follow the instructions in the following chapters.

Chapter 3

Mounting the enclosure

This chapter describes location requirements and shows how to mount the Tracer MP581 enclosure.

Selecting a mounting location

Make sure that the location meets the operating environment requirements and clearance requirements described in the following sections. The Tracer MP581 controller must be installed indoors. Trane recommends locating the Tracer MP581 controller:

- Near the controlled equipment to reduce wiring costs
- Where service personnel have easy access
- Where it is easy to see and interact with the operator display
- Where public access is restricted to minimize the possibility of tampering or vandalism

CAUTION

Equipment damage!

Install the Tracer MP581 in a location that is out of direct sunlight. Failure to do so may cause the Tracer MP581 to overheat.

Operating environment requirements

Make sure that the operating environment conforms to the specifications listed in Table 2.

Table 2. Operating environment specifications

Temperature	With enclosure: From 32°F to 122°F (0°C to 50°C) Frame-mount (without enclosure): From –40°F to 158°F (–40°C to 70°C)
Humidity	10–90% non-condensing
Altitude	6500 ft (2000 m)
High-voltage power requirements	North America: 98–132 Vac, 1 A maximum, 1 phase Other: 196–264 Vac, 1 A maximum, 1 phase
Weight	Mounting surface must be able to support 25 lb (12 kg)

Note:
The Tracer MP581 with enclosure is mounted in a National Electrical Manufacturers Association (NEMA) 1 enclosure. To meet NEMA 4 specifications, you can order the frame-mounted Tracer MP581 (model BMTM000CA0A0) and mount it in a separately purchased NEMA 4 enclosure.

Clearances

Make sure that the mounting location has enough room to meet the minimum clearances shown in Figure 5. Figure 6 on page 11 shows the dimensions of the Tracer MP581 enclosure.

Figure 5. Minimum clearances for enclosure

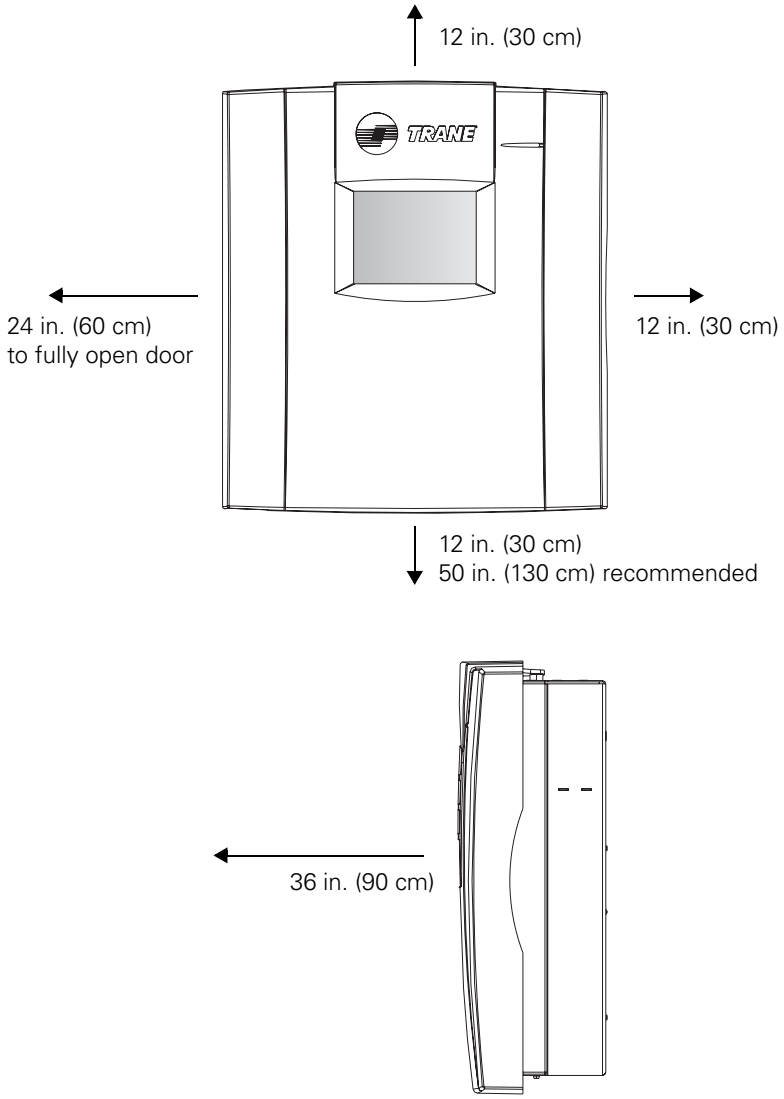
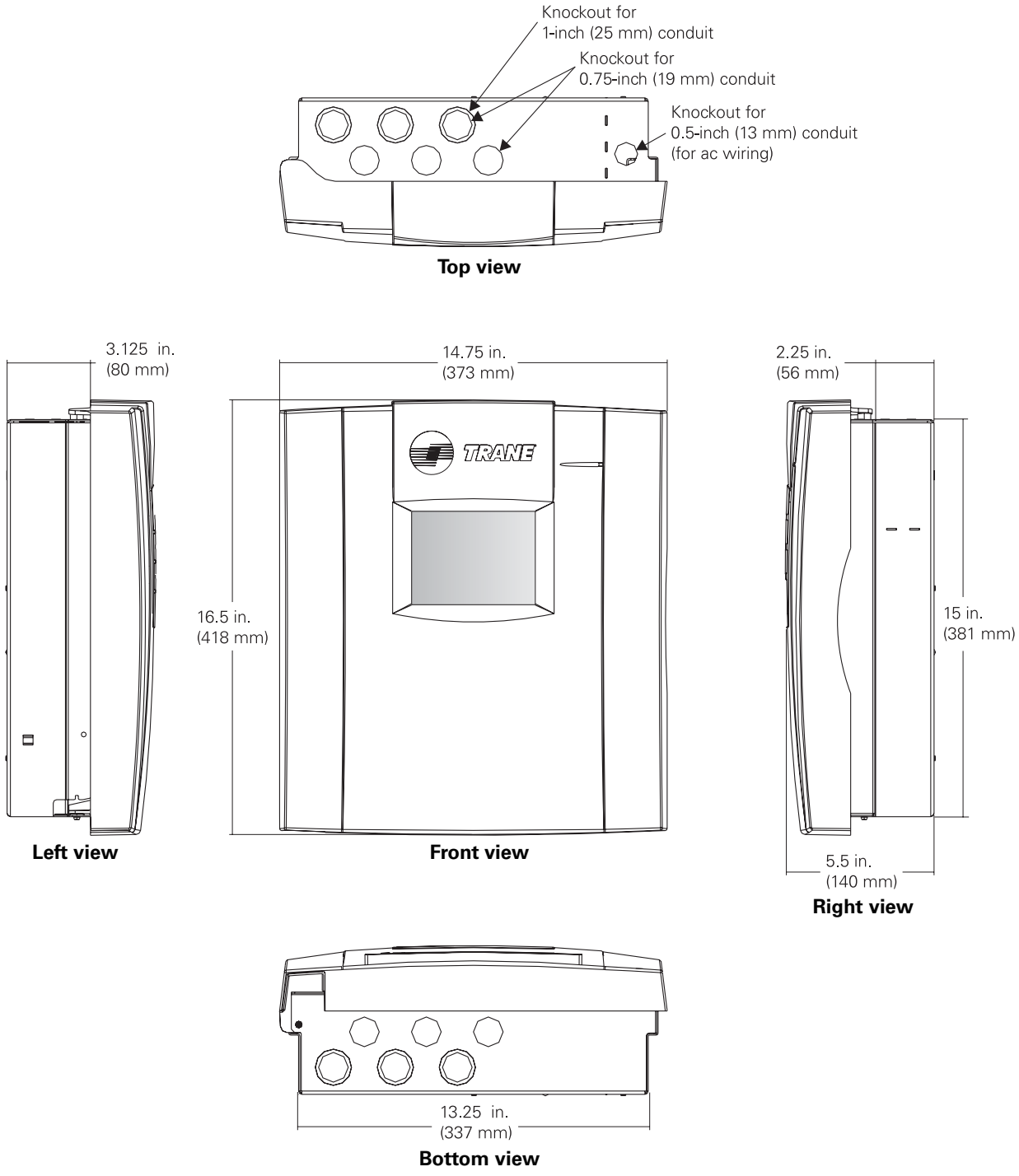


Figure 6. Tracer MP581 enclosure dimensions



Note:
Six of the twelve knockouts are dual-sized knockouts for 1-inch (25 mm) and 0.75-inch (19 mm) conduit.

Mounting the enclosure

The back of the enclosure is shipped with the termination board installed inside of it.

IMPORTANT

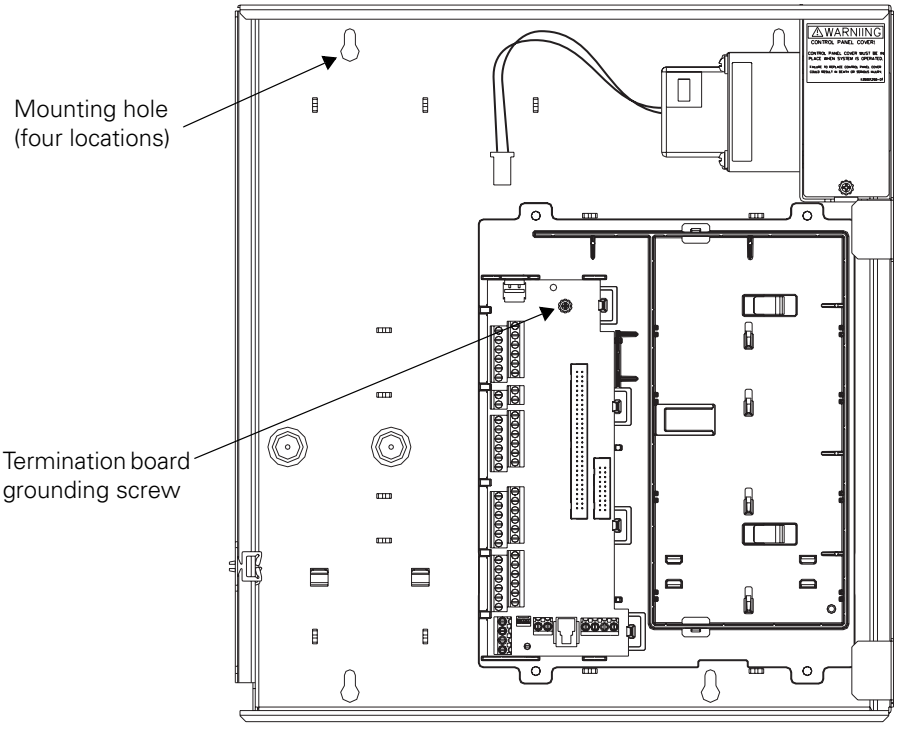
The termination board should be shipped with the grounding screw installed. Verify this by checking the location shown in Figure 7.

The enclosure door is shipped separately. If the door has already been attached to the enclosure back, remove it.

To mount the enclosure:

1. Using the enclosure as a template, mark the location of the four mounting holes on the mounting surface (see Figure 7).

Figure 7. Enclosure mounting holes



2. Set the enclosure aside and drill holes for the screws at the marked locations.

   Drill holes for #10 (5 mm) screws or #10 wall anchors. Use wall anchors if the mounting surface is dry wall or masonry.

3. Insert wall anchors if needed.
4. Secure the enclosure to the mounting surface with the supplied #10 (5 mm) screws.

Chapter 4

Wiring high-voltage ac power

This chapter shows how to wire high-voltage ac power to the enclosure.

Local power requirements

The Tracer MP581 controller is available in five configurations, described in Table 3. Before wiring high-voltage power, make sure that you have the correct model for local power requirements. You can find the model number on the shipping label or on the product label inside the enclosure.

Table 3. Tracer MP581 models

Model Number	Description
BMTM000AA0A0	Enclosure, 120 Vac
BMTM000AA0A1	Enclosure, 120 Vac, with operator display
BMTM000BA0A0	Enclosure, 230 Vac, CE-compliant
BMTM000BA0A1	Enclosure, 230 Vac, with operator display, CE-compliant
BMTM000CA0A0	Frame-mounted, 24 Vac, CE-compliant

Circuit requirements

To ensure proper operation of the Tracer MP581, install the power supply circuit in accordance with the following guidelines:

- The Tracer MP581 must receive high-voltage power from a dedicated power circuit. Failure to comply may cause control malfunctions.
- A disconnect switch for the dedicated power circuit must be near the controller, within easy reach of the operator, and marked as the disconnecting device for the controller.
- High-voltage power-wire conduits or wire bundles must not contain input/output wires. Failure to comply may cause the controller to malfunction due to electrical noise.
- High-voltage power wiring must comply with the National Electrical Code (NEC) and applicable local electrical codes.
- High-voltage power wiring requires three-wire 120/230 Vac service. Use copper conductors only.

Note:
The voltage utilization range for the Tracer MP581 transformer is 98–132 Vac (120 Vac nominal) or 196–264 Vac (230 Vac nominal). The panel detects whether the current is 50 or 60 cycle.

Wiring high-voltage power

⚠WARNING

Hazardous voltage!

Before making electrical connections, lock open the supply-power disconnect switch. Failure to do so could result in death or serious injury.

CAUTION

Use copper conductors only!

Unit terminals are designed to accept copper conductors only. Other conductors may cause equipment damage.

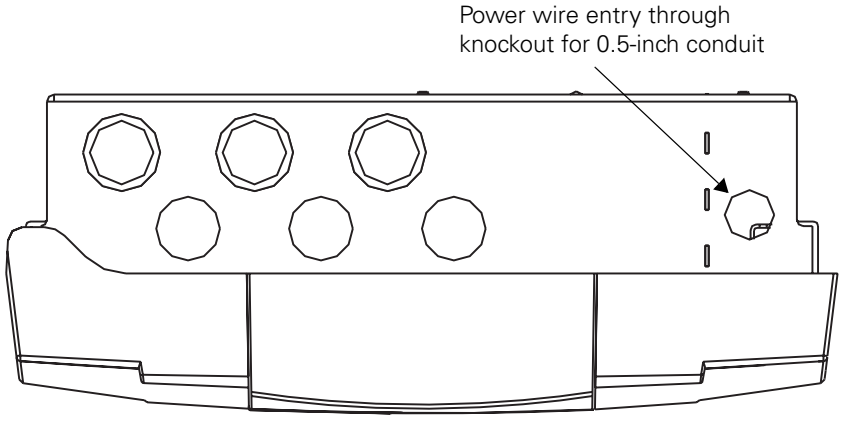
IMPORTANT

Make sure that you have the correct Tracer MP581 model for 120 Vac or 230 Vac. Table 3 on page 13 lists the available models.

To connect high-voltage power wires:

1. Lock open the supply-power disconnect switch.
2. At the top right corner of the enclosure, remove the knockout and install 0.5-inch (13 mm) conduit (see Figure 8).

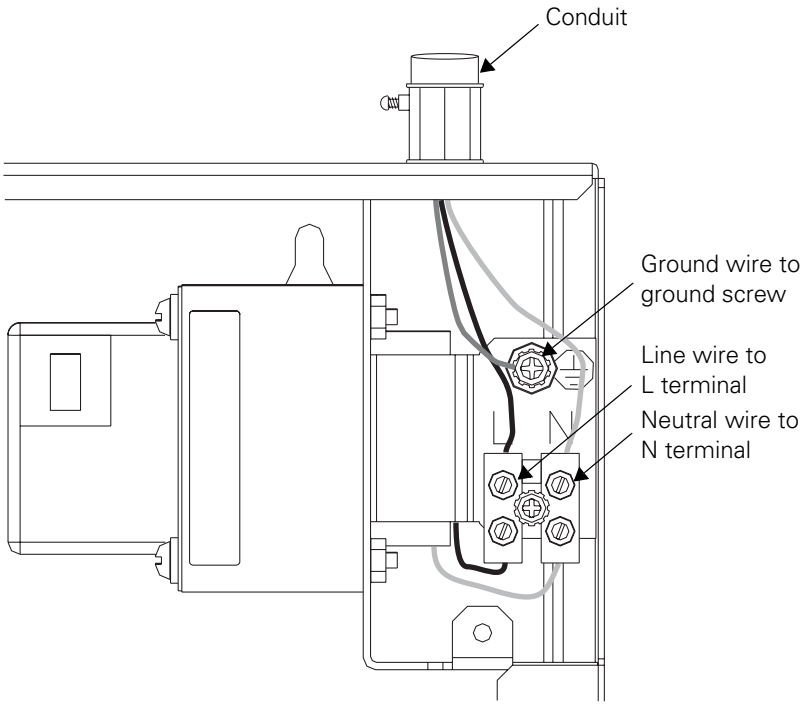
Figure 8. Knockout for high-voltage power wires



3. Open or remove the Tracer MP581 door if it is already installed.
4. Inside of the enclosure at the top-right corner, remove the high-voltage area cover plate.
5. Feed the high-voltage power wires into the enclosure.

6. Connect the line wire to the L terminal as shown in Figure 9.

Figure 9. Terminal block for high-voltage power wires



7. Connect the neutral wire to the N terminal.
8. Connect the green ground wire to the chassis ground screw. The ground wire should be continuous back to the circuit-breaker panel.
9. Replace the cover plate.

⚠WARNING

Hazardous voltage!

The cover plate must be in place when the controller is operating. Failure to replace the cover plate could result in death or serious injury.

10. On a label, record the location of the circuit-breaker panel and the electrical circuit. Attach the label to the cover plate.

Chapter 5

Wiring inputs and outputs

The Tracer MP581 enclosure is designed to simplify the wiring and configuration of inputs and outputs by providing a large space for routing wires and by eliminating the need to manipulate jumpers. Table 4 lists Tracer MP581 inputs and outputs.

Table 4. Inputs and outputs

Type	Number	Description
Universal inputs	12	Dry-contact binary, thermistor, 0–20 mA, 0–10 Vdc, linear resistance. The first four inputs can be used directly with resistance temperature detectors (RTDs).
Static pressure input	1	Differential pressure sensor, 5 Vdc, 0–5 in. wc
Binary outputs	6	Powered relay contacts, 12 VA at 24 Vac
Analog outputs	6	0–10 Vdc or 0–20 mA

Input/output wiring guidelines

Input/output wiring must meet the following guidelines:

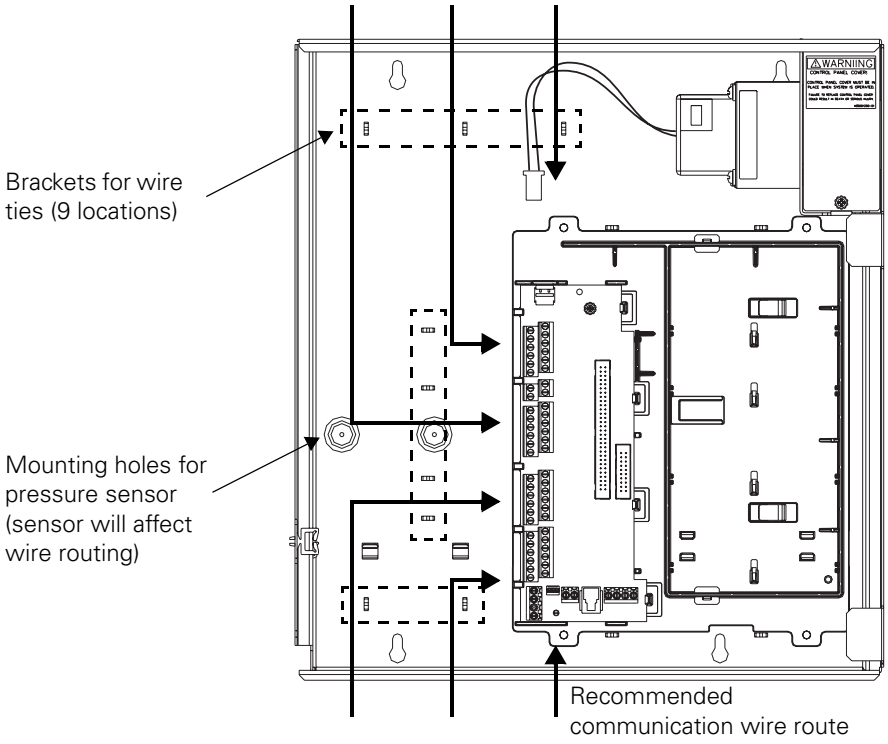
- Wiring must conform with the National Electrical Code and local electrical codes.
- Use only 18–22 AWG (1.02–0.643 mm^2), twisted-pair wire with stranded, tinned-copper conductors.
- Binary input/output wires must not exceed 1,000 ft (300 m).
- Analog input wires must not exceed 300 ft (100 m) for thermistors and 0–10 Vdc inputs and 1,000 ft (300 m) for 0–20 mA inputs.
- Analog output wires must not exceed 1,000 ft (300 m) for 0–10 Vdc outputs and 0–20 mA outputs.
- Do not run input/output wires in the same wire bundle with high-voltage power wires. Running input/output wires with 24 Vac power wires is acceptable, but the input wire must be shielded.
- Terminate input/output wires before installing the main circuit board (see Chapter 8, “Installing the circuit board”).

Wire routing

Figure 10 shows how to route input/output wires through the enclosure. It also shows the locations of wire-tie brackets. See Figure 6 on page 11 for knockout locations and dimensions. Metal conduit may be required by local codes when running input/output wires.

Note:
If your application requires a pressure sensor, install the pressure sensor before wiring other inputs and outputs. (So that the mounting holes are not covered by wires.) For more information, refer to Chapter 6, "Installing the pressure sensor."

Figure 10. Wire routing



Providing low-voltage power for inputs and outputs

The Tracer MP581 controller can provide low-voltage power to inputs and outputs. Figure 11 on page 20 shows the location of the low-voltage screw terminals on the termination board. The following limitations apply:

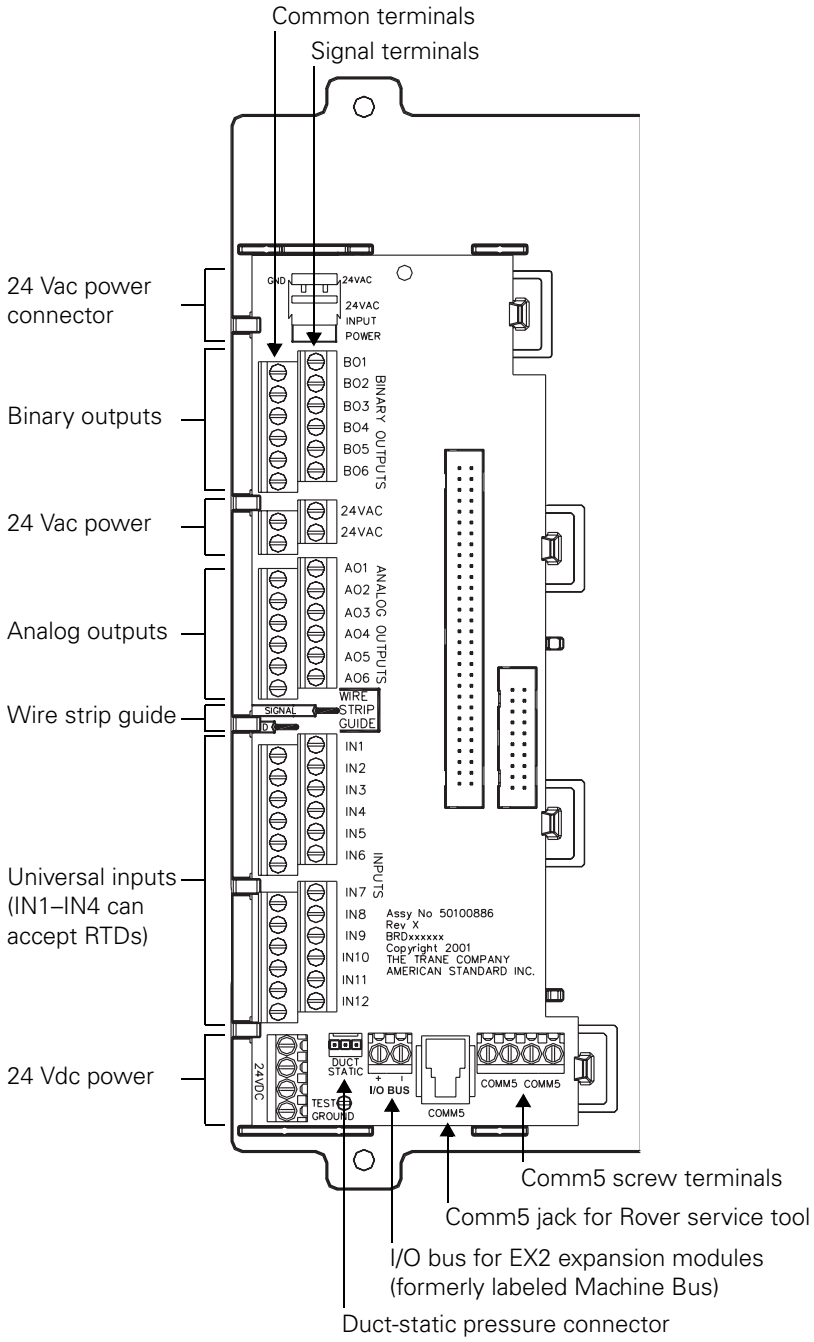
- Four 24 Vdc screw terminals supply a total of up to 250 mA of power.
- Two 24 Vac screw terminals supply a total of up to 50 VA of power. The 50 VA of available power supplies both the 24 Vac screw terminals and binary outputs.

Note that more than one input or output can receive power from a given screw terminal. The only limitation is the total amount of power supplied.

Screw-terminal locations

Figure 11 shows screw-terminal locations on the termination board. The top row of screw terminals is for signal wires, and the bottom row of screw terminals is for common wires. To make sure that the wires lie flat, use the wire strip guide on the termination board to strip input/output wires to the correct length.

Figure 11. Screw-terminal locations



Wiring universal inputs

The Tracer MP581 controller has 12 universal inputs. Use the Rover service tool to configure inputs for analog or binary operation.

The common terminals on the Tracer MP581 termination board are connected to the metal enclosure by means of a ground screw. Shield wires should be connected to a common terminal. Table 5 shows the load the Tracer MP581 places on sensors.

Table 5. Load placed on sensors

Input type	Load on sensor
Vdc (linear)	21 kΩ
mA (linear)	221 Ω

Wiring binary inputs

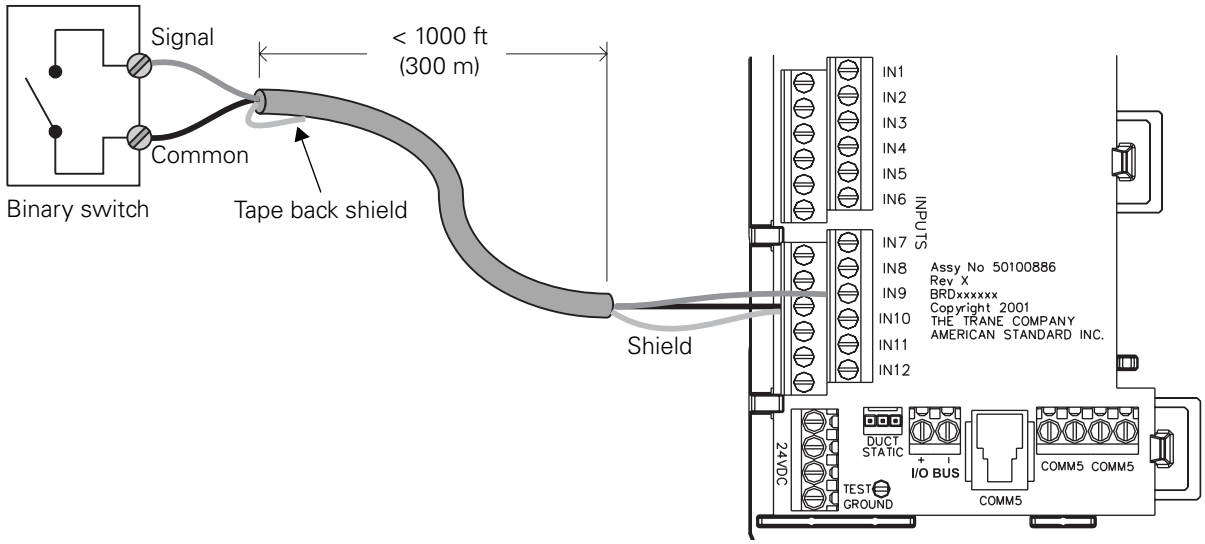
Use binary inputs to monitor statuses, such as fan on/off and alarm resets.

To wire a binary input:

1. Connect the common wire to a common terminal as shown in Figure 12.

   Note that because the common terminals are in parallel, you can wire the common wire to any available common terminal.
2. Connect the shield wire to a common terminal at the termination board and tape it back at the input device.
3. Connect the signal wire to an available input terminal (IN1–IN12).
4. Use the Rover service tool to configure the input for binary operation.

Figure 12. Wiring a binary input



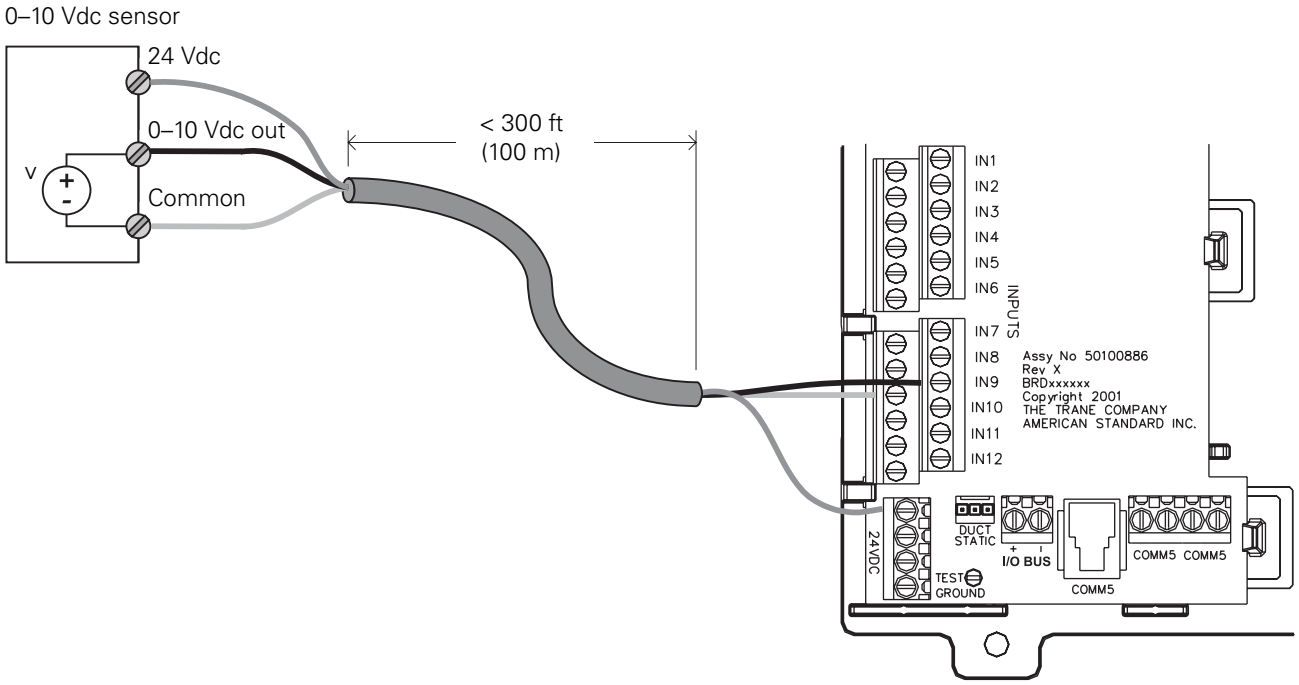
Wiring 0–10 Vdc analog inputs

Common 0–10 Vdc analog inputs include indoor air-quality sensors and pressure sensors.

To wire a 0–10 Vdc analog input:

1. Use the shield wire as the common connection, connecting it to a common terminal at the sensor and at the termination board (see Figure 13).
2. Connect the signal wire to an available input terminal (IN1–IN12).
3. Connect the supply wire to a 24 Vdc or 24 Vac terminal as required.
4. Use the Rover service tool to configure the input for analog operation.

Figure 13. Wiring a 0–10 Vdc analog input



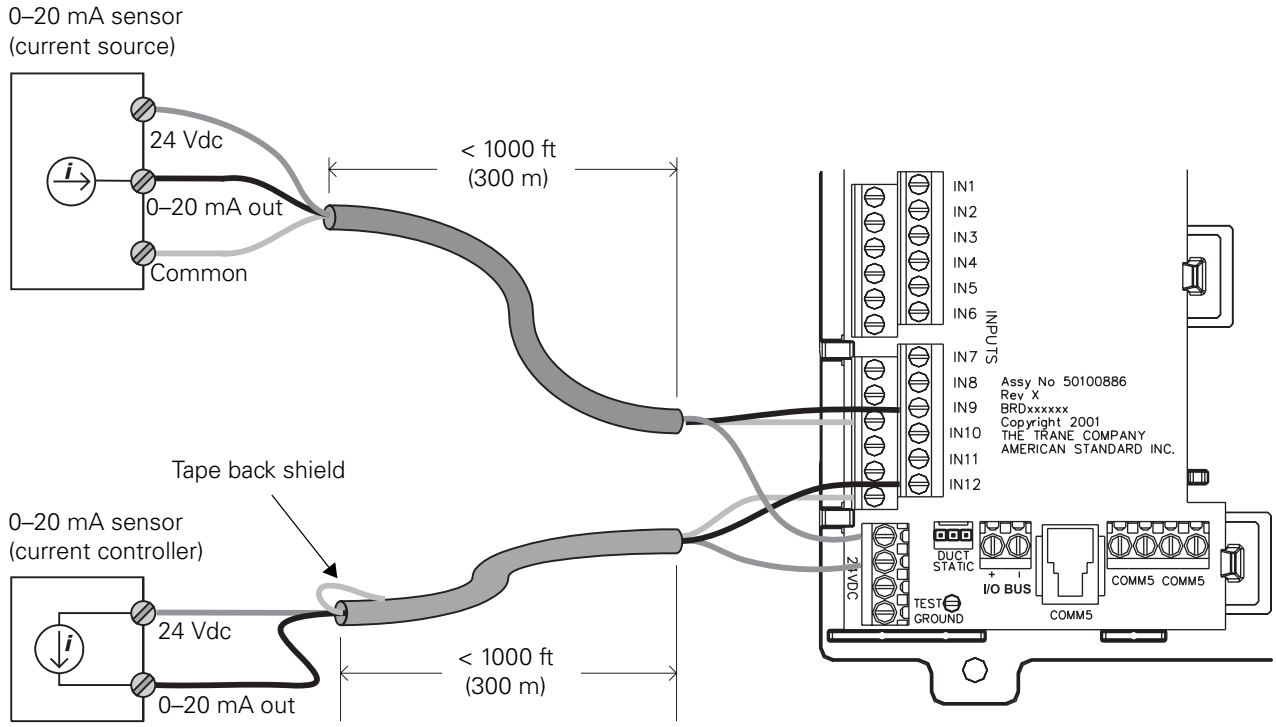
Wiring 0–20 mA analog inputs

Common 0–20 mA analog inputs include humidity sensors and pressure sensors.

To wire a 0–20 mA analog input:

1. For three-wire applications, use a 3-conductor cable with a shield. . For two-wire applications, use a 2-conductor cable with a shield. Connect the shield to a common terminal at the termination board and tape it back at the sensor (see Figure 14). Do not use the shield as the common connection.
2. Connect the signal wire to an available input terminal (IN1–IN12).
3. Connect the supply wire to a 24 Vdc or 24 Vac terminal as required.
4. Use the Rover service tool to configure the input for analog operation.

Figure 14. Wiring 0–20 mA analog inputs



Wiring variable resistance analog inputs

Variable resistance analog inputs include 10K thermistors, resistance temperature detectors (RTDs), and setpoint thumbwheels on zone sensors.

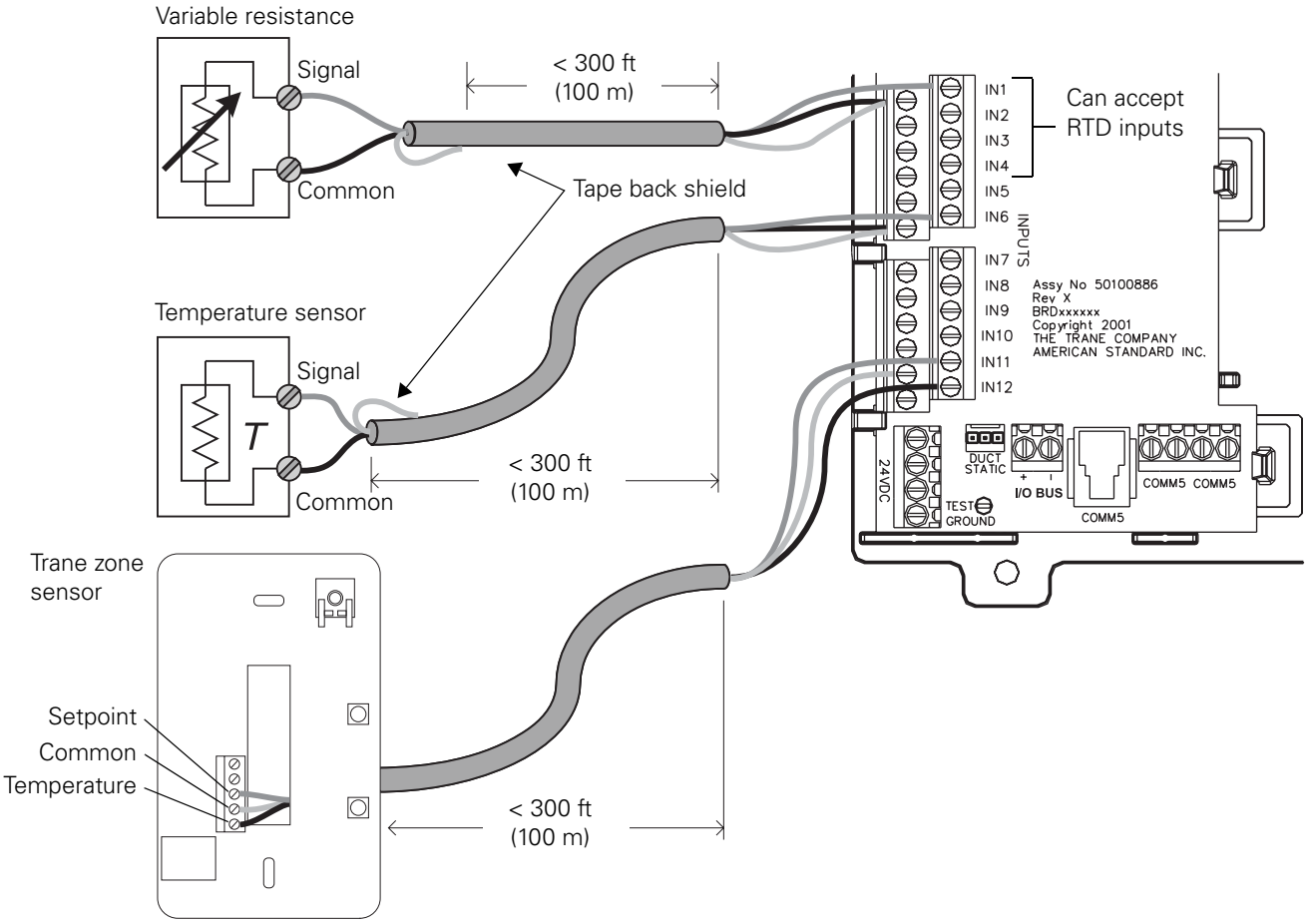
IMPORTANT

The Tracer MP581 controller can accept RTDs only on inputs 1–4.

To wire a variable resistance analog input:

1. For three-wire applications, use a 3-conductor cable with a shield(see Figure 15). For two-wire applications, use a 2-conductor cable with a separate shield. Connect the shield to a common terminal board and tape it back at the output device. Do not use the shield wire as a common connection.
2. Connect the signal wire to an available input terminal (IN1–IN12).
3. Use the Rover service tool to configure the input for analog operation.

Figure 15. Wiring variable resistance analog inputs



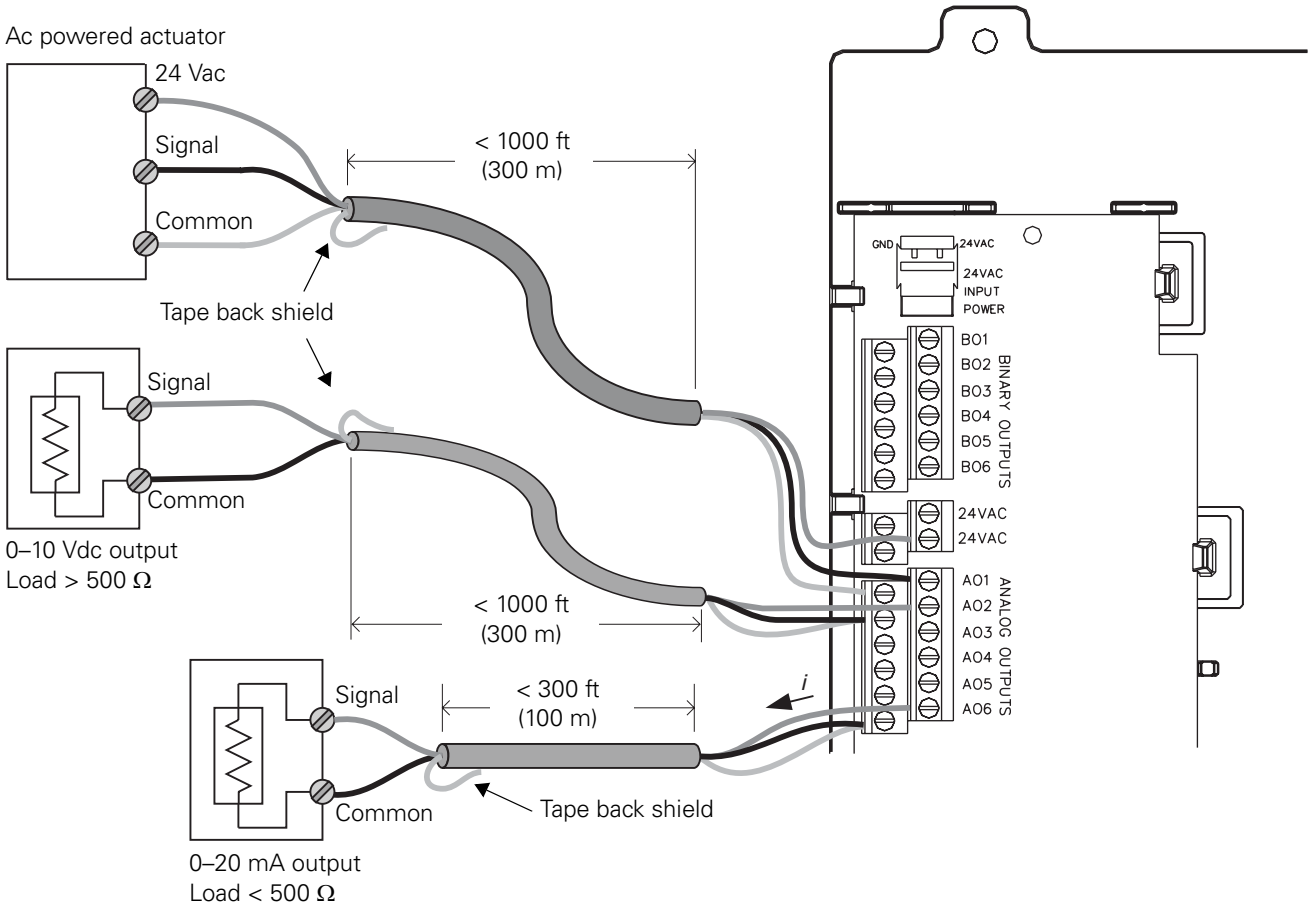
Wiring analog outputs

The Tracer MP581 controller has six analog outputs. These outputs can be either 0–10 Vdc outputs or 0–20 mA outputs. Analog outputs control actuators and secondary controllers.

To wire an analog output:

1. For three-wire applications, use the shield wire as the common connection (see Figure 16). For two-wire applications, connect the shield wire to a common terminal at the termination board and tape it back at the output device.
2. Connect the signal wire to an available analog output terminal (AO1–AO6).
3. Connect the supply wire to a 24 Vac terminal as required.
4. Use the Rover service tool to configure the analog output.

Figure 16. Wiring analog outputs



Wiring binary outputs

The Tracer MP581 controller has six binary outputs. These are powered outputs, not dry-contact outputs.

IMPORTANT

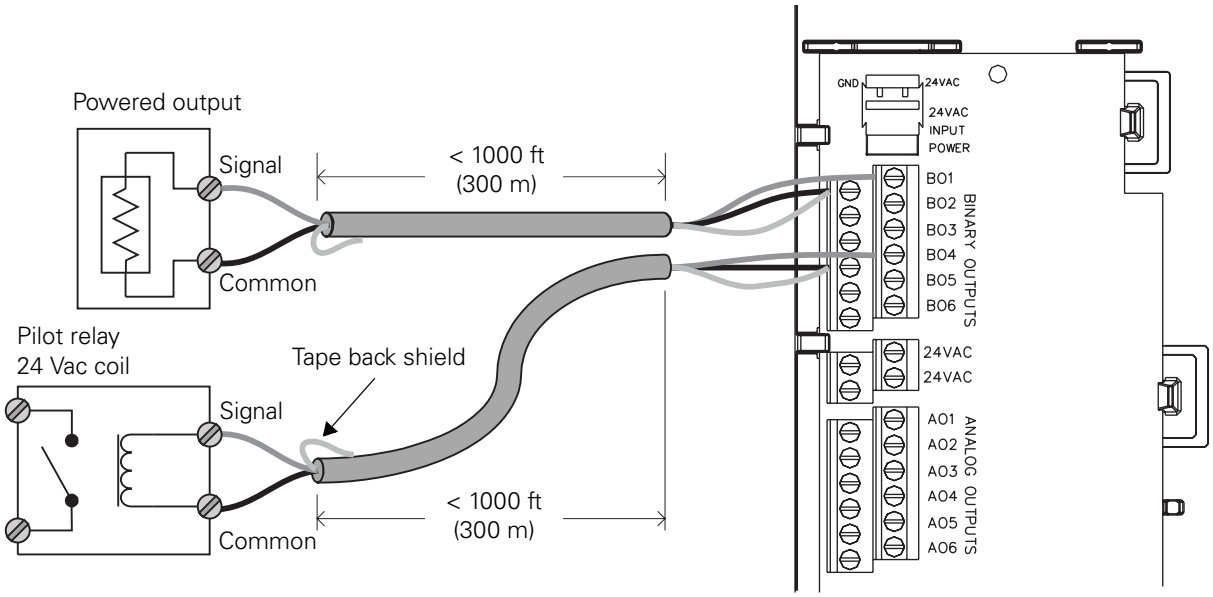
Use pilot relays for dry-contact outputs and when the load current is greater than 0.5 A. Use powered outputs when the load current is less than 0.5 A.

Note:
When controlling coil-based loads, such as pilot relays, do not forget to account for "inrush" current. Inrush current can be three (or more) times greater than the operating current. You can find information on inrush current for specific types of outputs in their product specifications.

To wire a binary output:

1. Connect the common wire to a common terminal as shown in Figure 17.
2. Connect the shield wire to a common terminal at the termination board and tape it back at the output device.
3. Connect the signal wire to an available binary output terminal (BO1–BO6).
4. Use the Rover service tool to configure the binary output.

Figure 17. Wiring binary outputs



Checking inputs

Follow the procedures in this section to test inputs for proper operation.

IMPORTANT

Perform the tests in this section before providing power to the termination board or installing the main circuit board. Failure to do so will result in incorrect multi-meter readings.

To test inputs for proper operation, you need the following tools:

- Digital multi-meter
- Small flat-tip screwdriver

Checking thermistor inputs

To check thermistor inputs for proper operation:

1. Make sure that the sensor is connected.
2. Set the multi-meter to measure Vac, then measure the voltage across the input at the signal and common screw terminals.

   The measured voltage should be less than 0.1 Vac. If the voltage is greater than this, temperature readings may change erratically.
3. Set the multi-meter to measure Vdc, then measure the voltage across the input at the signal and common screw terminals.

   The measured voltage should be less than 0.1 Vdc. If the voltage is greater than this, temperature readings may be offset from the expected results.

CAUTION

Equipment damage!

Continue to step 4 only if you completed steps 2 and 3 successfully. Measuring resistance may damage the meter if the voltage is too high.

4. Set the multi-meter to measure resistance. If you completed steps 2 and 3 successfully, measure the resistance across the input at the signal and common screw terminals.

   The resistance should be between 241 kΩ and 837 Ω, which translates to temperatures of –30°F and 200°F (–34°C and 93°C). Specific temperatures and resistances are shown in Table 6 on page 28.

Table 6. Temperature and resistance characteristics of sensors

Temperature (°F and °C)	Thermistor resistance (Ω)	Balco RTD resistance (Ω)	375 Platinum RTD resistance (Ω)	385 Platinum RTD resistance (Ω)
–30°F (–34°C)	241,071	798	868	865
–20°F (–29°C)	170,041	816	889	886
–10°F (–23°C)	121,326	835	910	908
0°F (–18°C)	87,511	855	932	930
10°F (–12°C)	63,769	875	953	952
20°F (–7°C)	46,919	895	975	974
30°F (–1°C)	34,839	915	996	996
40°F (4°C)	26,221	936	1,017	1,017
50°F (10°C)	19,955	957	1,038	1,039
60°F (16°C)	15,333	978	1,059	1,061
70°F (21°C)	11,889	1,000	1,080	1,082
80°F (27°C)	9,298	1,022	1,101	1,104
90°F (32°C)	7,330	1,044	1,122	1,125
100°F (38°C)	5,824	1,067	1,143	1,147
125°F (52°C)	3,382	1,125	1,195	1,200
150°F (66°C)	2,049	1,185	1,247	1,254
175°F (79°C)	1,296	1,247	1,299	1,307
200°F (93°C)	837	1,311	1,350	1,360

Checking resistance temperature detector (RTD) inputs

To check RTD inputs for proper operation:

1. Make sure that the sensor is connected.
2. Set the multi-meter to measure Vac, then measure the voltage across the input at the signal and common screw terminals.

   The measured voltage should be less than 0.1 Vac. If the voltage is greater than this, temperature readings may change erratically.
3. Set the multi-meter to measure Vdc, then measure the voltage across the input at the signal and common screw terminals.

   The measured voltage should be less than 0.1 Vdc. If the voltage is greater than this, temperature readings may be offset.

CAUTION

Equipment damage!

Continue to step 4 only if you completed steps 2 and 3 successfully. Measuring resistance may damage the meter if the voltage is too high.

4. Set the multi-meter to measure resistance. If you completed steps 2 and 3 successfully, measure the resistance across the input at the signal and common screw terminals.

   For a 375 platinum RTD, the resistance should be between 868 Ω and 1350 Ω, which translates to temperatures of –30°F and 200°F (–34°C and 93°C). Table 6 on page 28 shows appropriate ranges for other types of RTDs.

Checking linear resistance inputs

To check linear resistance inputs for proper operation:

1. Make sure that the sensor is connected.
2. Set the multi-meter to measure Vac, then measure the voltage across the input at the signal and common screw terminals.

   The measured voltage should be less than 0.1 Vac. If the voltage is greater than this, resistance readings may change erratically.
3. Set the multi-meter to measure Vdc, then measure the voltage across the input at the signal and common screw terminals.

   The measured voltage should be less than 0.1 Vdc. If the voltage is greater than this, resistance readings may be offset.

CAUTION

Equipment damage!

Continue to step 4 only if you completed steps 2 and 3 successfully. Measuring resistance may damage the meter if the voltage is too high.

4. Set the multi-meter to measure resistance. If you completed steps 2 and 3 successfully, measure the resistance across the input at the signal and common screw terminals.

   The resistance should be between 100 Ω and 20 kΩ.

Checking linear voltage 0–10 Vdc inputs

The following test works only for 0–10 Vdc inputs that have their own power supply.

To check linear voltage 0–10 Vdc inputs for proper operation:

1. Make sure that the sensor is connected and powered on.
2. Set the multi-meter to measure Vac, then measure the voltage across the input at the signal and common screw terminals.

   The measured voltage should be less than 0.1 Vac. If the voltage is greater than this, sensor readings may change erratically.
3. Set the multi-meter to measure Vdc, then measure the voltage across the input at the signal and common screw terminals.

   The measured voltage should be between 0 and 10 Vdc. If the voltage is greater than 10 Vdc, check the connections at the controller. If it is less than 0 Vdc, check the meter and input connections.
4. Force a change in the sensor reading.
5. Use the multi-meter to confirm that the change appears at the correct input on the terminal board.

Checking linear current 0–20 mA inputs

To check linear current inputs for proper operation:

1. Make sure that the sensor is connected and powered on.
2. Set the multi-meter to measure Vac, then measure the voltage across the input at the signal and common screw terminals.

   The measured voltage should be less than 0.1 Vac. If the voltage is greater than this, sensor readings may change erratically.
3. Set the multi-meter to measure mA, then measure the current across the input at the signal and common screw terminals.

   The measured current should be between 0 and 20 mA. If the current is greater than 20 mA, check the connections at the controller. If the current is less than 0 mA, check the meter and input connections.
4. Force a change in the sensor reading.
5. Use the multi-meter to confirm that the change appears at the correct input on the terminal board.

Checking binary inputs

To check binary inputs for proper operation:

1. Make sure that the sensor is connected and powered on.
2. Set the multi-meter to measure Vac, then measure the voltage across the input connections at the signal and common screw terminals.

   The measured voltage should be less than 0.1 Vac. If the voltage is greater than this, the input readings may change erratically.
3. Set the multi-meter to measure Vdc, then measure the voltage across the input at the signal and common screw terminals.

   The measured voltage should be less than 0.1 Vdc. If the voltage is greater than this, the input readings may be offset.

CAUTION

Equipment damage!

Continue to step 4 only if you completed steps 2 and 3 successfully. Measuring resistance may damage the meter if the voltage is too high.

4. Set the multi-meter to measure resistance. If you completed steps 2 and 3 successfully, measure the resistance across the input.

   The resistance should be less than 200 Ω when the binary input is closed and greater than 1 kΩ when it is open.

Checking outputs

Follow the procedures in this section to test outputs for proper operation.

IMPORTANT

Perform the tests in this section before providing power to the termination board or installing the main circuit board. Failure to do so will result in incorrect multi-meter readings.

To test outputs for proper operation, you need the following tools:

- Digital multi-meter
- Small flat-tip screwdriver

Checking binary outputs

To check binary outputs for proper operation:

1. Set the multi-meter to measure Vac, then measure the voltage across the binary output at the common and signal screw terminals.

   The measured voltage should be less than 0.1 Vac. If the voltage is greater than this, the load may turn on and off unexpectedly. Check for the following problems:

   - A shared power supply may be incorrectly connected. Check the wire to make sure that no additional connections have been made.
   - The wire may have an induced voltage somewhere along its length.

2. Set the multi-meter to measure Vdc, then measure the voltage across the binary output at the common and signal screw terminals.

   The measured voltage should be less than 0.1 Vdc. If the it is greater than this, a shared power supply may be incorrectly connected. Check the wire to make sure that no additional connections have been made.

CAUTION

Equipment damage!

Continue to step 3 only if you completed steps 1 and 2 successfully. Measuring resistance may damage the meter if the voltage is too high.

3. Set the multi-meter to measure resistance. If you completed steps 1 and 2 successfully, measure the resistance across the binary output to confirm that there are no shorts and no open circuits.

   Resistance is load dependent. Pilot relays have a relatively low resistance of less than 1 kΩ, but some actuators have a high resistance. Check to see what kind of binary output is connected before checking for open and short circuits.

Checking 0–10 Vdc analog outputs

To check 0–10 Vdc analog outputs for proper operation:

1. Make sure that the actuator is connected but powered off.
2. Set the multi-meter to measure Vac, then measure the voltage across the analog output at the signal and common screw terminals.

   The measured voltage should be less than 0.1 Vac. If the voltage is greater than this, the load may turn on and off unexpectedly. Check for the following problems:

   - A shared power supply may be incorrectly connected. Check along the wire to make sure that no additional connections have been made.
   - The wire may have an induced voltage somewhere along its length.
3. Set the multi-meter to measure Vdc, then measure the voltage across the analog output at the signal and common screw terminals.

   The measured voltage should be less than 0.1 Vdc. If the voltage is greater than this, a shared power supply may be incorrectly connected. Check along the wire to make sure that no additional connections have been made.

CAUTION

Equipment damage!

Continue to step 4 only if you completed steps 2 and 3 successfully. Measuring resistance may damage the meter if the voltage is too high.

4. Set the multi-meter to measure resistance. If you completed steps 2 and 3 successfully, measure the resistance across the analog output at the signal and common screw terminals.

   The resistance should be greater than 500 Ω. (The analog output will not be able to reach 10 Vdc if the load resistance is less than 500 Ω.)

Checking 0–20 mA analog outputs

To check 0–20 mA analog outputs for proper operation:

1. Make sure that the actuator is connected but powered off.
2. Set the multi-meter to measure Vac, then measure the voltage across the analog output at the signal and common screw terminals.

   The measured voltage should be less than 0.1 Vac. If the voltage is greater than this, the load may turn on and off unexpectedly. Check for the following problems:

   - A shared power supply may be incorrectly connected. Check along the wire to make sure that no additional connections have been made.
   - The wire may have an induced voltage somewhere along its length.
3. Set the multi-meter to measure Vdc, then measure the voltage across the analog output at the signal and common screw terminals.

   The measured voltage should be less than 0.1 Vdc. If the voltage is greater than this, a shared power supply may be incorrectly connected. Check along the wire to make sure that no additional connections have been made.

Chapter 6

Installing the pressure sensor

This chapter shows how to install a pressure sensor in the Tracer MP581 controller. To simplify installation of the pressure sensor, mount and wire it before wiring inputs and outputs.

Mounting the pressure sensor

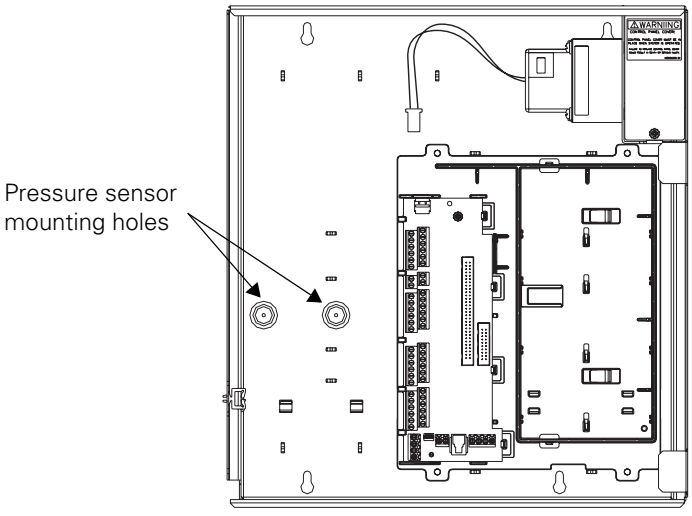
IMPORTANT

Use only pressure sensors with non-conductive plastic cases with the Tracer MP581 controller. Pressure sensors with conductive plastic cases may generate incorrect data. To ensure proper results, order the Trane pressure-differential 5 Vdc sensor kit (part number 4020 1159).

To mount the pressure sensor in the Tracer MP581 enclosure:

1. Open or remove the enclosure door.
2. Use the supplied #6 (3.5 mm) mounting screws to mount the pressure sensor to the mounting holes shown in Figure 18.

Figure 18. Mounting the pressure sensor

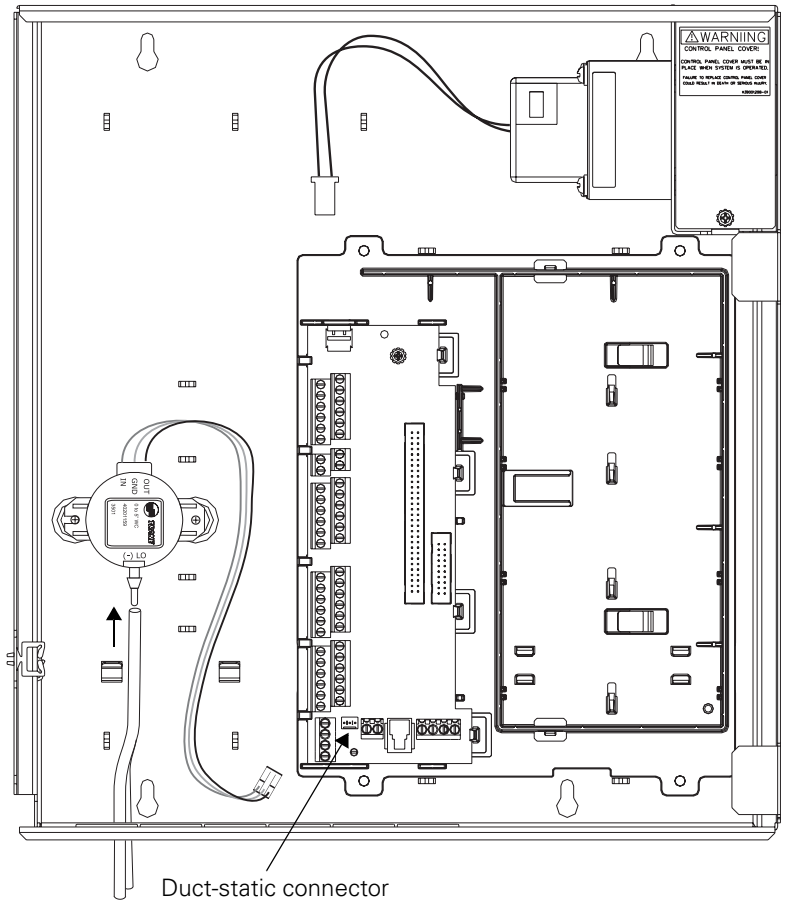


3. Connect the pressure-sensor cable to the duct-static connector on the termination board as shown in Figure 19 on page 36.

   The duct-static connector fits only one way. If you have difficulty connecting the cable, rotate it 180° and try again.

4. Run the high and low input tubes to an appropriate place in the duct.

Figure 19. Wiring the pressure sensor



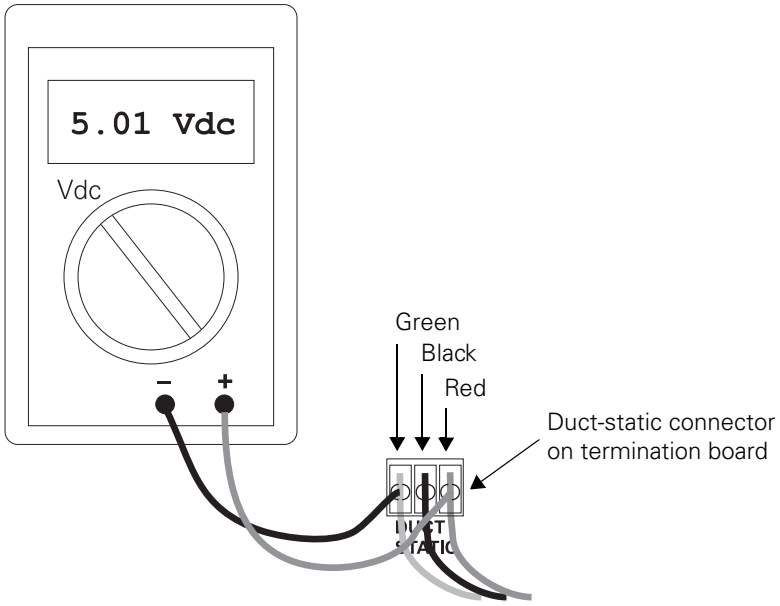
Checking the pressure sensor

You can check the pressure sensor for proper operation only after supplying power to the controller and installing the main circuit board. You will need a digital multi-meter to complete the check.

To check the pressure sensor for proper operation:

1. Make sure that the main circuit board has been installed and power has been provided to the controller.
2. Make sure that the pressure-sensor is connected to the duct-static input on the termination board.
3. Set the digital multi-meter to measure dc voltage.
4. Connect the multi-meter to the input as shown in Figure 20 and discussed in table Table 7.

Figure 20. Connecting the multi-meter to the duct-static input



5. Make sure that the multi-meter readings fall within the ranges shown in Table 7. If a reading is not within the expected range, check for faulty connections or a faulty pressure sensor.

Table 7. Expected voltages for the pressure sensor input

Multi-meter (–) lead at	Multi-meter (+) lead at	Measured dc voltage
Green (ground)	Red (in)	4.8–5.2 Vdc
Green (ground)	Black (out)	0.24–5.2 Vdc

Chapter 7

Wiring Comm5 links

The Tracer MP581 controller interacts with a Tracer Summit building automation system (BAS) and other LonTalk Comm5 controllers through a Comm5 communication link. This chapter describes how wire Comm5 links.

For more information on connecting a Tracer MP581 to a Tracer Summit BAS, see the *Tracer Summit Hardware and Software Installation* guide (BMTW-SVN01D-EN).

Wiring and topology recommendations

Trane GCS has updated its recommendations for Comm5 wiring and topology. These recommendations are different than originally published Comm5 installation practices. The following information summarizes the wiring and topology recommendations:

- 22 AWG Level 4 unshielded communication wire recommended for most Comm5 installations
- Shielded Level 4 wire is recommended for the Comm5 Tracker and for all communication wiring on the VariTrac CCP (see Appendix)
- Comm5 link limits: 4500 feet, 60 devices maximum (without repeater)
- Termination resistors are required
    - —105 ohms at each end for Level 4 wire
    - —82 ohms at each end for Trane “purple” wire
- Comm5 topology should be daisy chain
- Zone sensor communication stubs limited to 8 per link, 50 feet each maximum
- One repeater can be used for an additional 4500 feet, 60 devices, 8 communication stubs

Recommended wiring practices

Follow these guidelines when installing communication wire:

- All wiring must comply with the National Electrical Code (NEC) and local codes.
- Although Comm5 does not require polarity sensitivity, Trane GCS recommends keeping polarity consistent throughout the site.
- Make sure that 24 Vac power supplies are consistent in how they are grounded. Avoid sharing 24 Vac between Comm5 controllers.
- Avoid overtightening cable ties and other forms of cable wraps. This can damage the wires inside the cable.
- Do not run Comm5 cable alongside or in the same conduit as 24 Vac power. This includes the conductors running from triac-type inputs.
- In open plenums, avoid running wire near lighting ballasts, especially those using 277 Vac.
- Use a daisy chain configuration
- Use termination resistors as described in “Termination resistance placement for Comm5 links” on page 42
- Insulate termination-resistor leads.
- Use only one type of communication wire—do not mix different types of wire.

Wiring requirements

Twisted-pair wire

The recommended Comm5 communication-link wiring is 22-gauge, Level 4, twisted-pair wire. The wire can be either shielded or unshielded. However unshielded wire is recommended for most installations. You can also use low capacitance, 18-gauge, shielded, twisted-pair with stranded, tinned-copper conductors (Trane "purple" wire).

The maximum wire length for Comm5 communication links is 4,500 ft (1,400 m).

Recommended wiring configuration

Comm5 communication-link wiring must be installed in a daisy-chain configuration (see Figure 21 and Figure 22 on page 42).

Figure 21. Daisy chain configuration

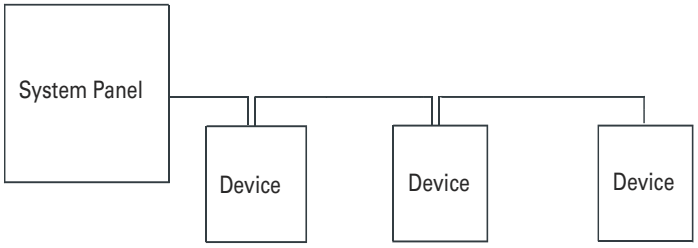


Figure Note:

- Maximum wire length for Comm5 is 4,500 ft (1,400 m). (Comm5 wire length limitations can be extended through the use of a link repeater. See "Comm5 physical link repeater" on page 44.)
- For termination resistor placement, see "Termination resistance placement for Comm5 links" on page 42.

Figure 22. Alternate daisy chain configuration

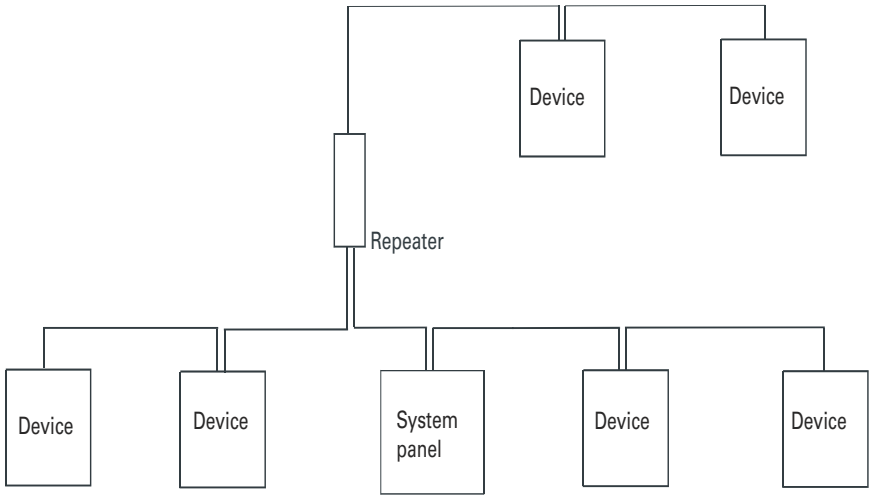


Figure Note:

- Repeater with system panel in the middle of the link
- Maximum wire length for Comm5 is 4,500 ft (1,400 m) on each side of the repeater
- For termination resistor placement, see "Termination resistance placement for Comm5 links" on page 42

Termination resistance placement for Comm5 links

Termination resistors are required at each end of Comm5 communication daisy chain links.

To correctly place termination resistors follow these guidelines:

- Terminate a daisy chain configuration with a resistor at each end of the link (see Figure 23 on page 43):
  - —22 AWG Level 4 wire 105 Ω, 1%, 1/4 Watt
  - —18 AWG Trane "purple" wire 82 Ω, 1%, 1/4 Watt
- If a repeater is used, each link of the configuration that is created by the repeater requires termination resistors (see Figure 24 on page 43).
- Trane recommends that only one type of wire be used for the Comm5 communication link.
- A set of as-built drawings or a map of the communication wire layout should be made during installation. Any sketch of the communication layout should feature the terminating resistor placement.

Figure 23. Daisy chain resistor placement

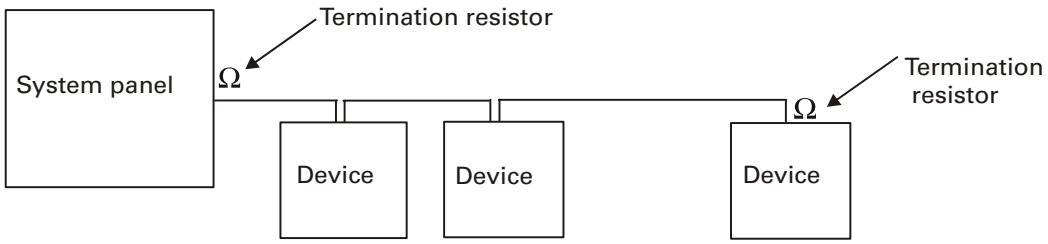


Figure Note:

- 105 Ω, 1%, 1/4 Watt for 22 AWG, Level 4
- 82 Ω, 1%, 1/4 Watt for 18 AWG, Trane "purple' wire

Figure 24. Alternate daisy chain resistor placement

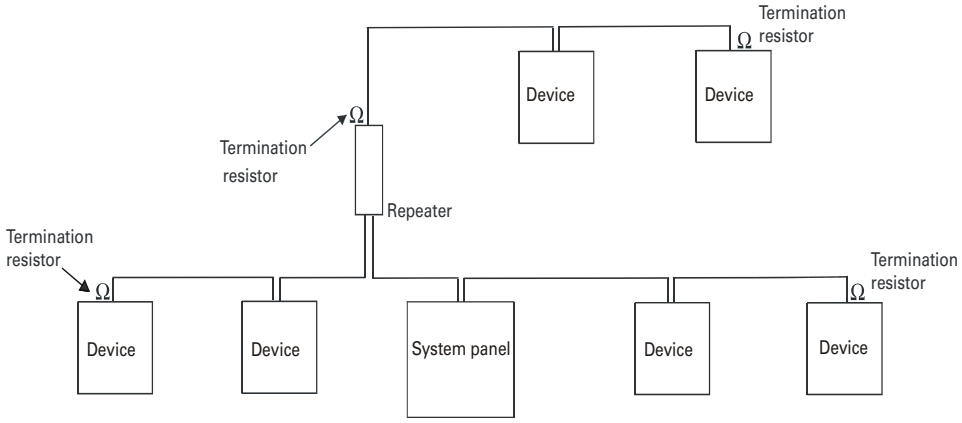


Figure Note:

- Maximum wire length for the entire configuration Comm5 is 4,500 ft (1,400 m)
- Maximum wire length for Comm5 is 4,500 ft (1,400 m) (Comm5 wire length limitations can be extended through the use of a link repeater, see "Comm5 physical link repeater" on page 44)

Comm5 physical link repeater

A Comm5 link repeater regenerates the signal on a Comm5 link. The configurations on either side of the repeater should be daisy chain. Both link segments require proper termination (see Figure 24).

When is the link repeater required?

A link repeater is required when:

- The total wire length is greater than the maximum wire run length of 4,500 ft (1400 m).
- More than 60 devices are connected to a link. This total does not include the BCU, the link repeater, and the temporary use of a service tool on the same link.
- More than eight zone sensor communication stubs (maximum 50 ft) are required on a Comm5 link (see “Comm5 zone sensor comm jack” on page 46).

Link repeater guidelines

Follow these guidelines when using link repeaters:

- Only one link repeater can be used on a link.
- The use of a repeater doubles the maximum allowable wire length. For example, when a repeater is used with a daisy chain configuration, the total wire length can be 9,000 ft (3,800 m) (with half the wire length on either side of the repeater).
- The link repeater is limited to 60 devices on either side of the link.
- The link repeater requires an earth ground. The installer should be aware of this before making any power connections.

Link repeater connections

The recommended shield connections are shown in Figure 25. Use these connections for instances where shielded communication wire is used. For an example of using a repeater to create an extended daisy chain configuration see Figure 26 on page 45.

Follow these guidelines when using a repeater:

- Read the *Comm5 repeater installation*, 3270 3285 information that comes with the link repeater.
- For information about terminating daisy chain configurations, see “Termination resistance placement for Comm5 links” on page 42.
- Shield-drain wires entering the repeater should be connected to a terminal marked with a capacitor symbol. The entering shield-drain wire must be connected to earth ground at the system panel.
- Shield-drain wires leaving the repeater should be connected to the repeater terminal marked with an earth ground symbol.

Figure 25. Comm5 shield repeater connection

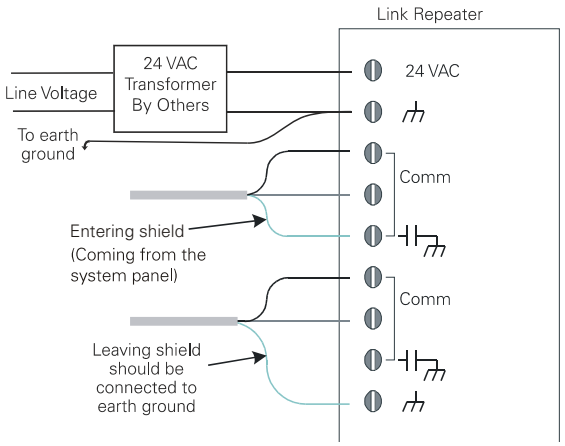
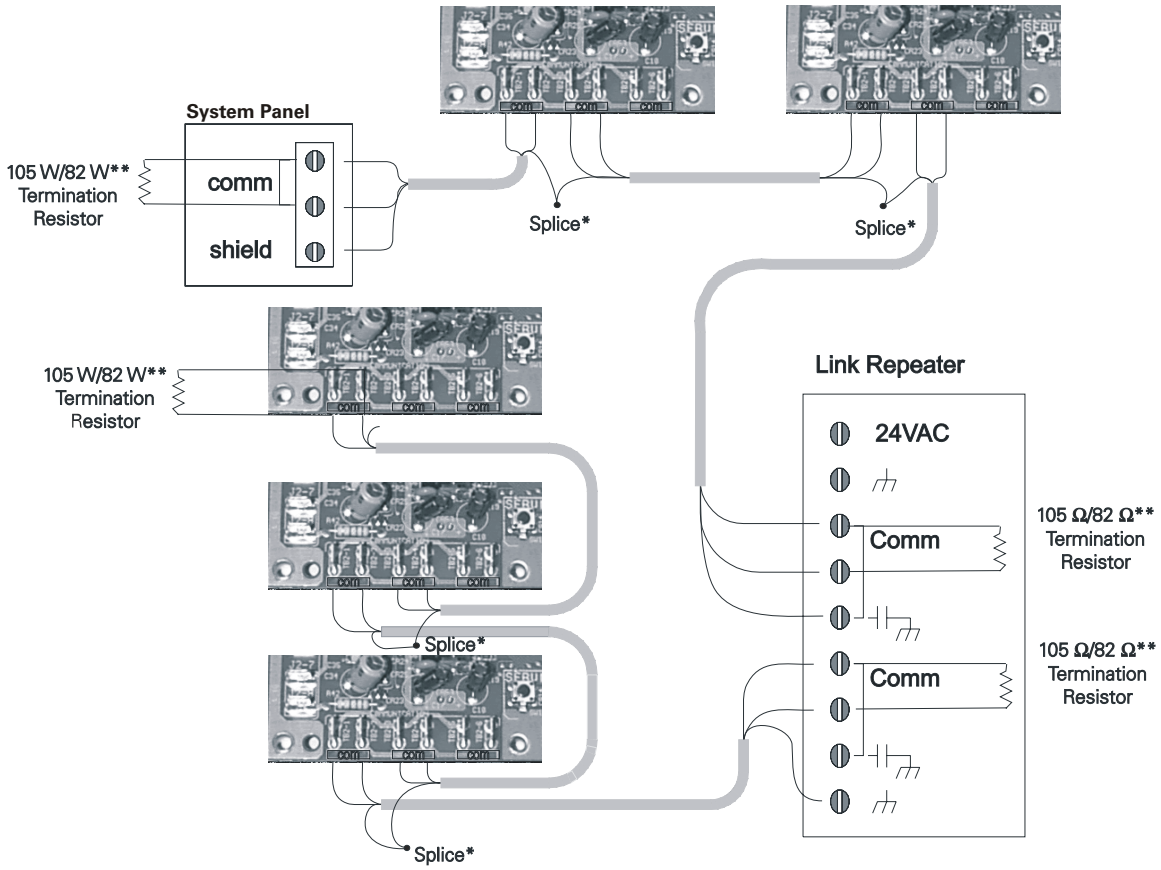


Figure 26. Comm5 daisy chain repeater connection and shielded wire



* A continuous shield is required
when shielded wire is used. If unshielded communication wire is used, no shield connections are necessary. At each controller, splice shield wire and tape back to prevent grounding. Connect shield wire to earth ground at system panel and repeater.
**The value of the termination resistor is dependent on the wire type: 105-ohm for 22 AWG, Level 4 wire and 82-ohm for 18 AWG, Trane "purple" wire.

Comm5 zone sensor comm jack

Many Trane zone sensor models include a communication jack. When properly wired to the communication terminals on the unit controller, the communication jack provides easy access to both the controller and the entire Comm5 link. This enables you to access the status and configuration information of any controller on the link using the Rover service tool.

The recommended wire between the controller and the communication jack is 22-gauge, Level 4 wire; or 18-gauge, shielded, twisted-pair with stranded, tinned-copper conductors (Trane “purple” wire). Thermostat wire is not recommended for the communication jack.

Zone sensor communication stubs

The wire that runs between the controller and zone sensor is commonly referred to as the communication stub. Figure 27 shows an example of communication stubs on a Comm5 link when a repeater is used.

Note:

- Only 8 stubs can be used per Comm5 link. To add more stubs to the link, a repeater is necessary. Up to 8 stubs may be used on each side of the repeater (16 total stubs).
- Each communication stub must not exceed 50 feet in length.

Figure 27. Communication stubs used with a repeater

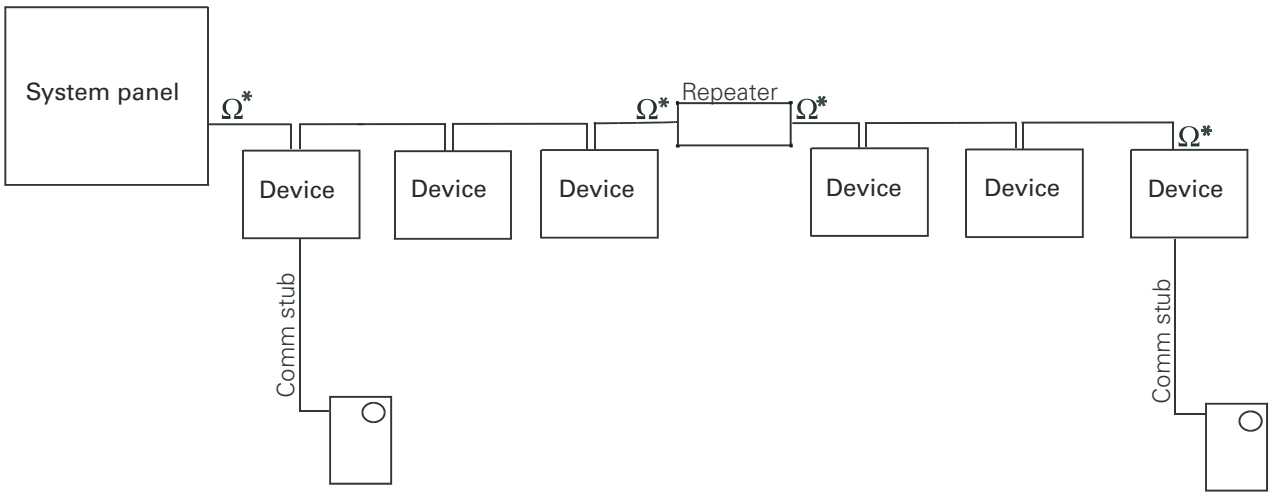


Figure Note:

- Maximum wire length on either side of the repeater is 4,500 ft (1,400 m).
- The link repeater is limited to 60 devices on either side of the link.
- *Termination resistors placed at the end of each link. The resistance value of the termination resistor is 105-ohm resistor for Level 4 wire at each end of the link. For Trane “purple” wire use an 82-ohm resistor at each end of the link.

Verifying communication status

The information in this section will help you to interpret LED status lights on the Comm5 system panel.

Comm LED

The yellow Comm LED indicates the communication status of the Comm5 controller. Table 8 describes Comm LED activity.

Table 8. Yellow Comm LED

LED activity	Explanation
LED is off continuously	The controller is not detecting any communication (normal for stand-alone applications).
LED blinks	The controller detects communication (normal for communicating applications, including data sharing).
LED is on continuously	An abnormal condition that may occur during discovery. The LED may flash fast enough to look as if it is on continuously. If this LED activity occurs at any other time, the site may have excessive radio frequency interference (RFI).

Wiring Comm5 to the Tracer MP581

IMPORTANT

When installing the Tracer MP581 controller in areas of high electromagnetic interference (EMI) and radio frequency interference (RFI), follow the additional installation instructions in "EMI/RFI considerations" on page 50.

Note:
Although Comm5 links are not polarity sensitive, we recommend that you keep polarity consistent throughout the site.

To wire the Comm5 link:

1. At the first Tracer MP581 on the link, complete the following steps:
   - Connect the shield wire to a ground, either at a common terminal on the termination board or on the main circuit board (see Figure 28 and Figure 29 on page 49).
     If you choose to ground the shield wire to the main board, use a #6 (3.5 mm) screw (not supplied) to secure the shield wire.
   - Connect the white wire to the first (or third) Comm5 screw terminal as shown in Figure 28.
   - Connect the black wire to the second (or fourth) Comm5 screw terminal.
   - If this is the first Comm5 controller on the daisy chain, place a 100 Ω termination resistor across the Comm5 screw terminals.

Figure 28. Grounding on the termination board

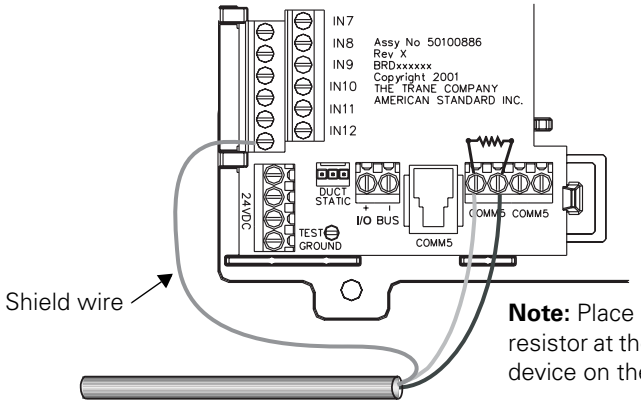
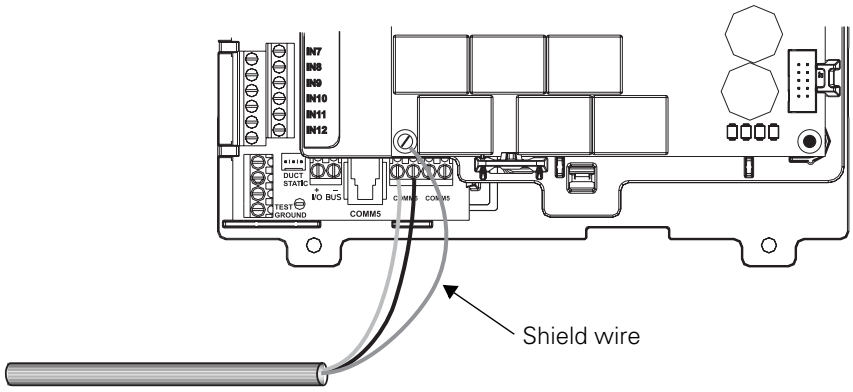
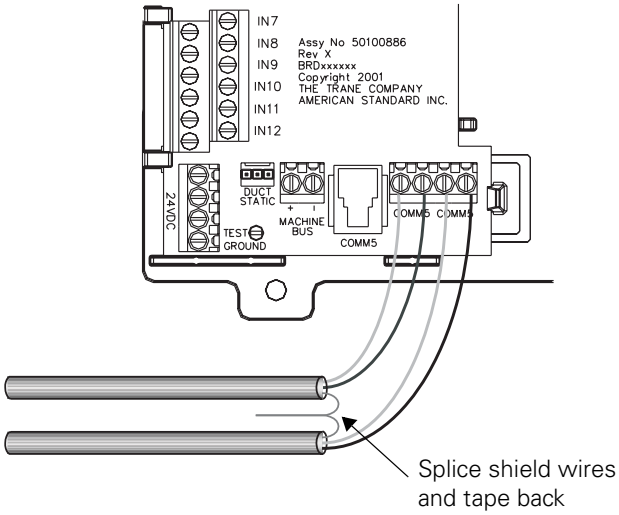


Figure 29. Grounding on the main circuit board



2. At the next Tracer MP581 (or other Comm5 controller) on the link:
   - Connect the white wires to the first and third Comm5 screw terminals as shown in Figure 30 on page 49.
   - Connect the black wires to the second and fourth Comm5 screw terminals.
   - Splice together the bare shield wires and tape them.
3. At the last controller on the Comm5 link:
   - Connect the white wire to the first Comm5 screw terminal.
   - Connect the black wire to the second Comm5 screw terminal.
   - Cut back and tape the shield wire to prevent grounding.
   - Place a 100 Ω termination resistor across the Comm5 screw terminals.

Figure 30. Connecting Comm5 wires at the Tracer MP581



EMI/RFI considerations

Take care to isolate HVAC controllers from electromagnetic interference (EMI) and radio frequency interference (RFI). Such interference can be caused by radio and TV towers, hospital diagnostic equipment, radar equipment, electric power transmission equipment, and so on. In addition, take care to prevent the Tracer MP581 controller from radiating EMI and/or RFI.

The Tracer MP581 is equipped with EMI/RFI filters that trap RFI to ground. In most situations, a good earth ground will reduce EMI/RFI problems by acting as a drain for EMI and RFI. If the Tracer MP581 is receiving or radiating interference, make sure that the earth ground is good. Do not assume that the building conduit is an adequate ground.

Checking the earth ground

Though a proper earth ground is especially important in areas of high EMI or RFI, always check the quality of the ground, regardless of location.

⚠WARNING

Hazardous voltage!

The cover plate must be in place when the controller is operating. Failure to replace the cover plate could result in death or serious injury.

⚠WARNING

Hazardous voltage!

If the earth ground has a voltage of more than 4 Vac, use a different ground. Failure to do so could result in death or serious injury.

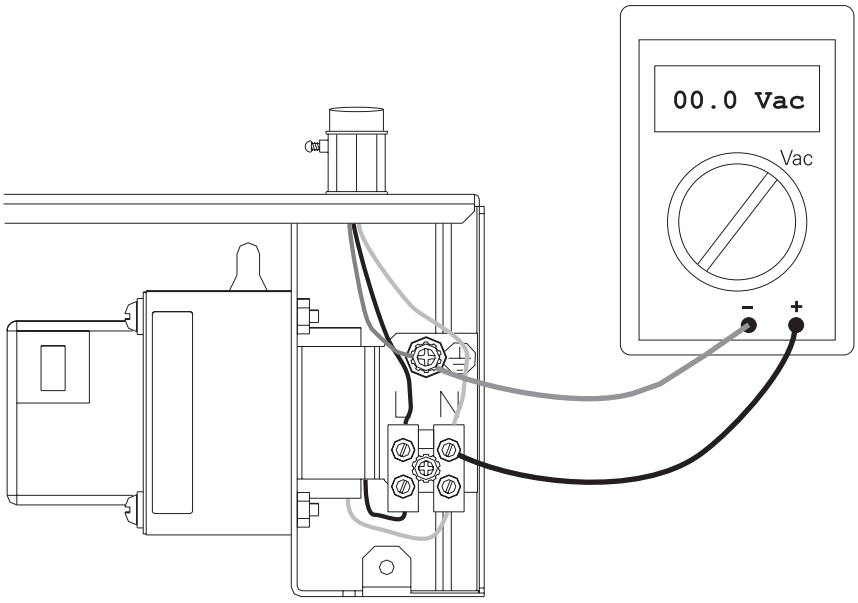
To check the quality of the earth ground:

1. Open the enclosure door.
2. Inside of the enclosure at the top-right corner, remove the high-voltage area cover plate.
3. Measure the ac voltage between the earth ground and the neutral terminal, as shown in Figure 31 on page 51.

   Ideally, the voltage should be 0 Vac. Find a different ground if the voltage exceeds 4 Vac. A higher voltage may result in:

   - Danger to people touching the enclosure
   - Erratic communications (Because the Comm5 shield connection, typically attached to the earth ground, becomes ineffective as a noise drain.)
   - Erratic equipment operation (Because noise may affect voltage levels at the inputs—the controller interprets input noise as changes in temperature, humidity, pressure, and so on.)
4. Replace the cover plate.

Figure 31. Checking the earth ground



Sectioning the shield on the Comm5 link

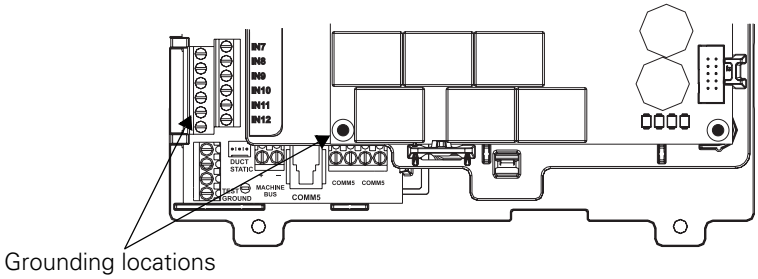
In areas with high RFI, you can section the Comm5 link shield between Comm5 devices to reduce interference in the link.

To section the Comm5 link shield:

1. At the first Comm5 controller on the link, ground the shield to an earth ground.
2. Where the link enters the Tracer MP581, cut back and tape the shield.
3. Where the link leaves the Tracer MP581, ground the shield to an earth ground.

   The earth ground can be either a common terminal for any of the universal inputs or the lower-left mounting hole of the circuit board (shown in Figure 32).

Figure 32. Grounding Comm5 wire



Chapter 8

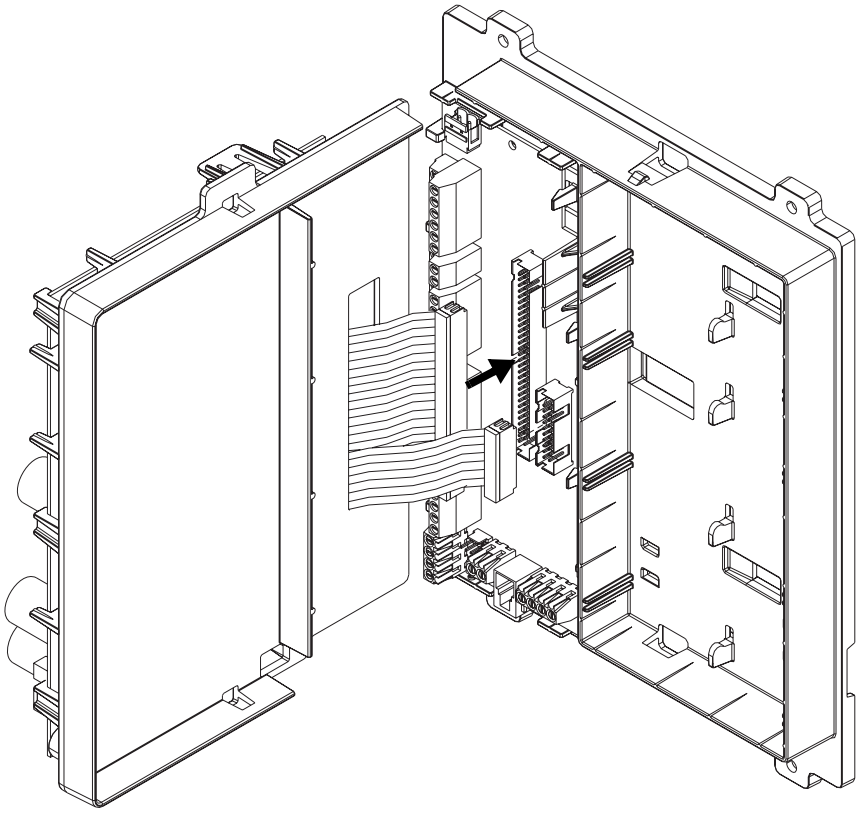
Installing the circuit board

The main circuit board is not installed in the Tracer MP581 enclosure when it ships. You can store the circuit board in the office while the enclosure is mounted and wired. After wiring has been completed, connect the circuit board to the termination board.

To install the circuit board:

1. Open the enclosure door.
2. Verify that the 24 Vac power cable is not connected to the termination board (see Figure 35 on page 55).
3. Hold the top plastic frame, which holds the circuit board, at a 90° angle to the bottom frame as shown in Figure 33.

Figure 33. Connecting the cables

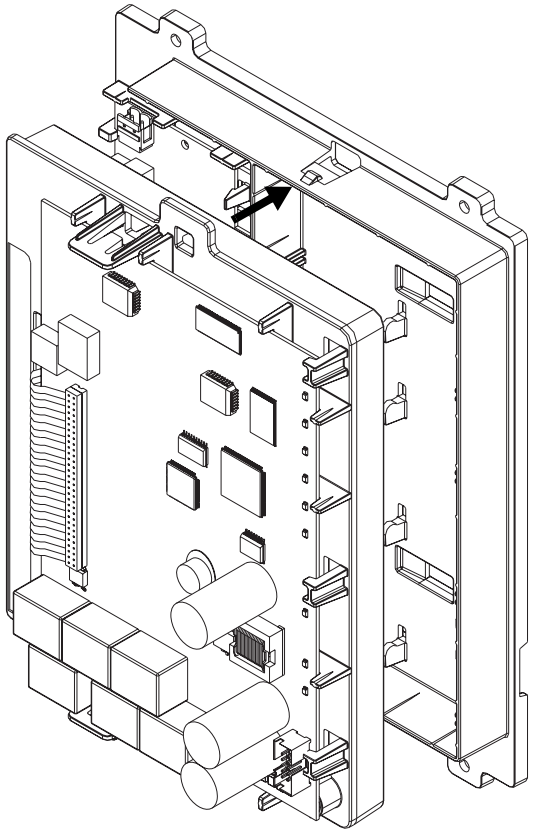


4. Connect the 60-pin cable to the 60-pin slot, then connect the 20-pin cable to the 20-pin slot (see Figure 33 on page 53).

   The connectors fit only one way. If you have difficulty connecting them, make sure that the plastic grooves line up with the slots.

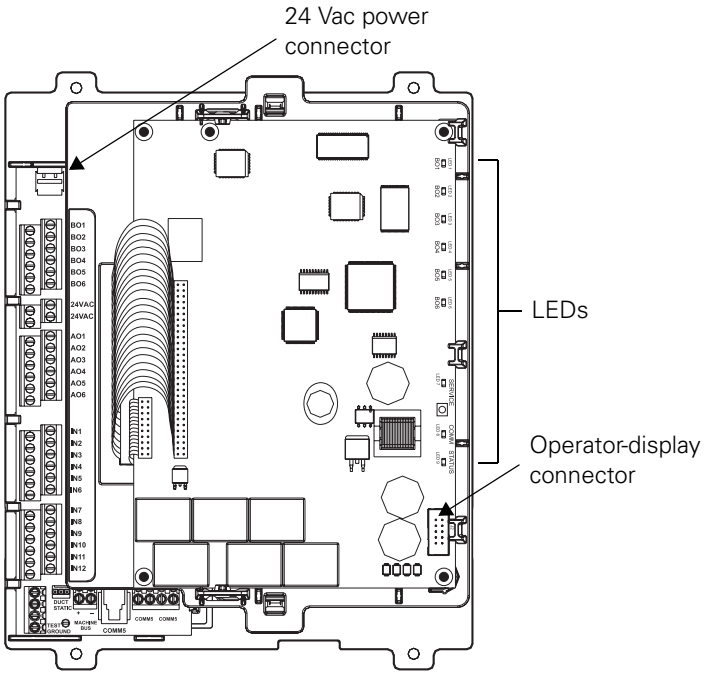
5. Align the snaps on the top frame with the mounting locks on the bottom frame, as shown in Figure 34, then push the two frames together. You will hear a click when the frames connect.

Figure 34. Connecting the frames



6. For controllers with an operator display, connect the operator-display cable to the circuit board (see Figure 35 on page 55).
7. Locate the 24 Vac power connector on the termination board (see Figure 35). Remove the mating plug with screw terminals.
8. Attach the 24 Vac power-supply cable to the screw terminals on the mating plug.
9. Connect the mating plug to the 24 Vac power connector on the termination board. The green status LED should light up.
10. Check status LEDs according to Chapter 14, “Verifying operation and communication.”

Figure 35. Cable termination and Status LED locations



Chapter 9

Installing the door

This chapter shows how to install and remove the enclosure door.

Installing the door

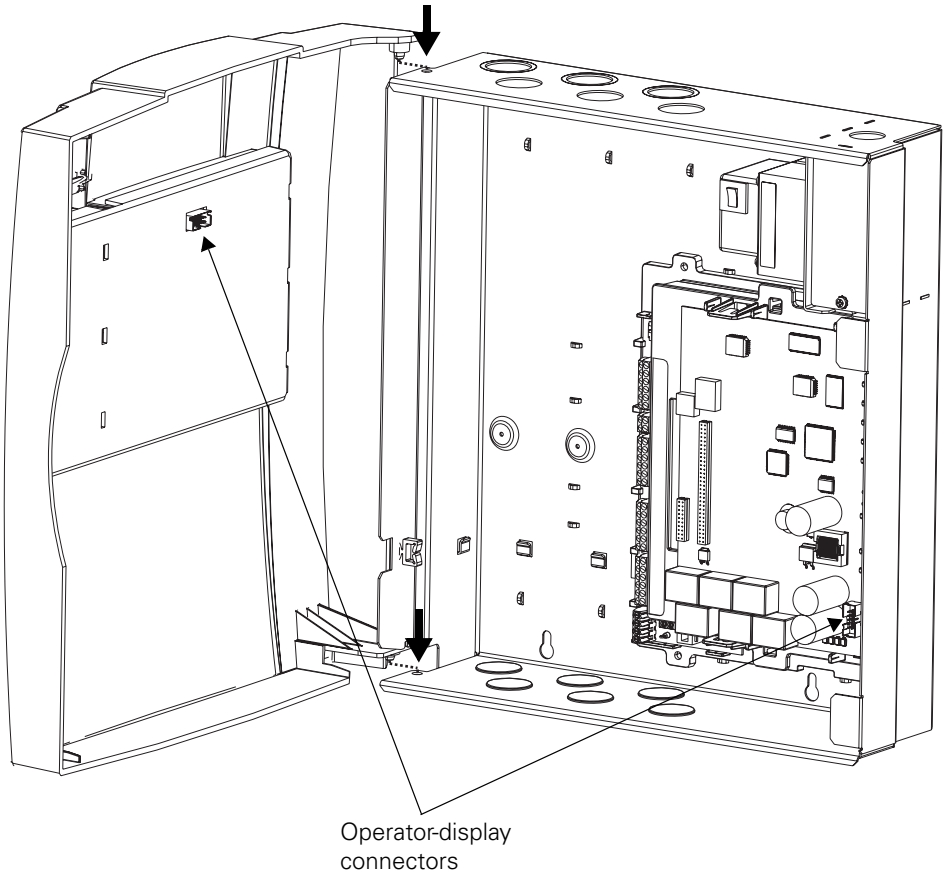
To install the enclosure door:

1. Unpack the door and check for missing or damaged parts.

   Check to make sure that the magnetic latches and touch screen (if ordered) are installed. Check for any cracks in the plastic.

2. Hold the door at a 90° angle from the enclosure as shown in Figure 36.

Figure 36. Aligning the enclosure door



3. Align the hinge pegs on the door with the hinge holes on the enclosure.
4. Gently lower the door until it rests securely in the hinge holes.
5. Verify that the door swings freely on the hinges and that the magnetic latches hold the door securely when it is closed.
6. For doors with an operator display, connect the operator-display cable to the operator-display connectors (see Figure 36 on page 57).

Removing the door

Remove the door to simplify wiring or when upgrading the controller with a door-mounted operator display.

To remove the enclosure door:

1. Open the door to a 90° angle from the enclosure.
2. For doors with an operator display, disconnect the operator-display cable from operator display.
3. Lift the door to pull the hinges from the hinge holes.

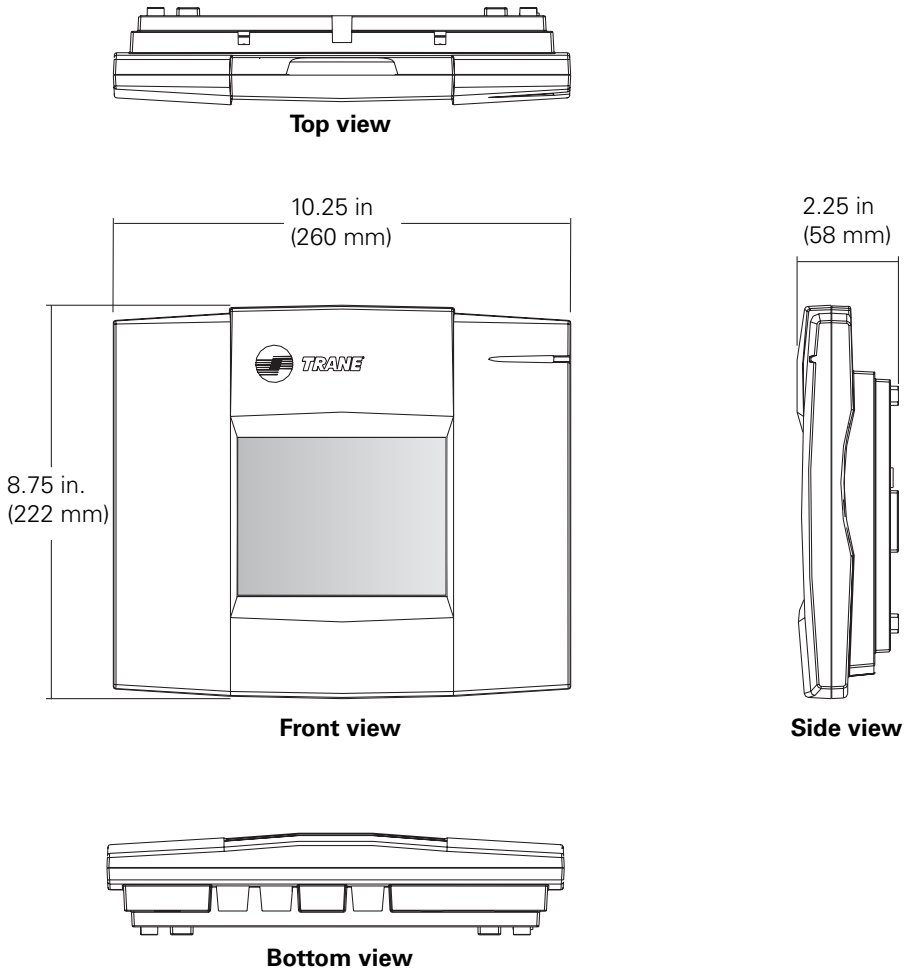
Chapter 10

Installing the stand-alone operator display

With the attached cable, the stand-alone operator display can be mounted up to 10 ft (3 m) from the Tracer MP581 controller. You can extend this distance up to 150 ft (46 m) using four-conductor wire and the included pig-tail connectors. See the installation sheet (3270 3338), which ships with the operator display, for instructions.

The dimensions of the stand-alone operator display are shown in Figure 37.

Figure 37. Stand-alone operator display dimensions



CAUTION

Equipment damage!

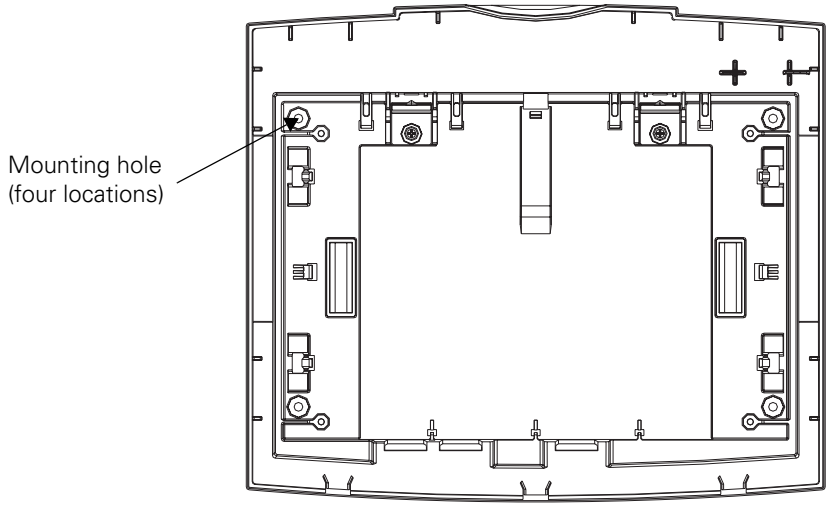
To clean the operator display, use a cloth dampened with commercial liquid glass cleaner. Spraying water or cleansers directly on the screen may result in equipment damage.

Note:
You do not need to power down the Tracer MP581 when connecting the operator display.

To install the stand-alone operator display:

1. Unsnap the gray plastic backing from the operator display.
2. Carefully disconnect the operator-display cable from the connector inside the operator display.
3. Use the plastic backing as a template to mark the position of the four mounting holes on the mounting surface (see Figure 38).

Figure 38. Operator-display mounting holes



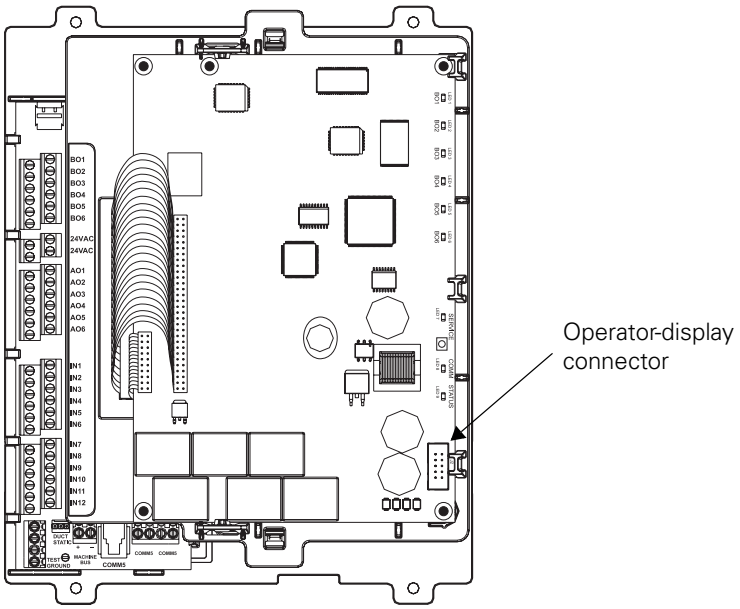
4. Set the plastic backing aside and drill holes for #8 (4 mm) screws or #8 wall anchors.
5. Secure the plastic backing to the wall with #8 (4 mm) mounting screws (not supplied).
6. Connect the operator-display cable to the operator display, then snap the operator display to the plastic backing.

   The connector fits only one way. If you have difficulty connecting it, rotate the cable 180° and try again.
7. Run the operator-display cable to the Tracer MP581, affixing it to the wall with wiring staples or wire mold.
8. Feed the cable into the Tracer MP581 enclosure.

9. Attach the operator-display cable to the operator-display connector on the circuit board (see Figure 39).

   The operator display receives power from the Tracer MP581 and turns on automatically when it is connected to the controller.

Figure 39. Operator-display connector on the Tracer MP581



Chapter 11

Connecting the portable operator display

The portable operator display is used for temporary connections to Tracer MP581 controllers. You do not need to power down the Tracer MP581 when connecting the operator display.

The portable operator display includes a 10 ft (3 m) cable with connector that is stored in the storage compartment of the carrying bag. The cable cannot be disconnected from the operator display.

CAUTION

Equipment damage!

To clean the operator display, use a cloth dampened with commercial liquid glass cleaner. Spraying water or cleansers directly on the screen may result in equipment damage.

IMPORTANT

You cannot use the portable operator display for time clock scheduling. To provide scheduling, you must use a permanently-connected door-mounted operator display, stand-alone operator display, or Tracer Summit system.

Using the carrying case

Always keep the operator display in its padded carrying bag. Close the protective display cover when the operator display is not in use. Feed the operator-display cable into the main compartment of the carrying case, then through the hole in the back of the carrying case into the storage compartment.

Connecting the operator display

To connect the portable operator display:

1. Open the Tracer MP581 enclosure door.
2. Attach the operator-display cable to the operator-display connector on the circuit board (see Figure 39 on page 61).

   The operator display receives power from the Tracer MP581 and turns on automatically when it is connected to the controller.

Chapter 12

Setting up the operator display

This chapter shows how to calibrate the operator-display touch screen and how to adjust the brightness and contrast. To set up the operator display screens and security, see the *Tracer MP580/581 Programmable Controller Programming* guide (CNT-SVP01C-EN).

CAUTION

Equipment damage!

To clean the operator display, use a cloth dampened with commercial liquid glass cleaner. Spraying water or cleansers directly on the screen may result in equipment damage.

Calibrating the operator display

To calibrate the operator display:

1. On the home screen, press the Setup button. The Setup menu appears.
2. Press the page down button to view the next screen.
3. Press the Calibrate Touch Screen button. A calibration screen appears.

CAUTION

Equipment damage!

Do not allow the operator display to come in contact with sharp objects.

4. Touch the target using a small, pliable, blunt object, such as a pencil eraser. Hold until the beeping stops. A second calibration screen appears.
5. Again, touch the target with the object. Hold until the beeping stops. The Setup menu appears.
6. Press the Home button. The home screen appears.

Setting up time and date

To change the time for the operator display:

1. On the home screen, press the Setup button. The Setup menu appears.
2. Press the Change Time button to view the next screen.
3. Using the buttons, type the time using the format *hh:mm*, where *hh* is the hour and *mm* is the minute. Press either the AM or PM button, as appropriate.
4. If you make a mistake, press Clear and start again. To accept the changes, press OK.

To change the date for the operator display:

1. On the home screen, press the Setup button. The Setup menu appears.
2. Press the Change Date button to view the next screen.
3. Press the forward and back arrows to move the cursor from day to month to year. Use the buttons to type the appropriate date.
4. If you make a mistake, press the Reset button. To accept the changes, press OK.

Adjusting brightness and contrast

To adjust the brightness and contrast of the operator display:

1. On the home screen, press the Setup button. The Setup menu appears.
2. Press the page down button to view the next screen.
3. Press the Adjust Brightness and Contrast button. The Brightness and Contrast screen appears.
4. To increase the brightness, press the buttons along the top row, in sequence, from left to right. To decrease the brightness, press the buttons from right to left.
5. To increase the contrast, press the buttons along the bottom row, in sequence, from left to right. To decrease the contrast, press the buttons from right to left.
6. Press the Home button. The home screen appears.

Note:
Contrast adjustment is not available on all computer display models.

Chapter 13

Installing EX2 expansion modules

The EX2 is a field-installed expansion module for the Tracer MP581 programmable controller. Up to four expansion modules can be connected to a Tracer MP581. Each EX2 adds the following inputs and outputs to a Tracer MP581:

- Six universal inputs
- Four binary outputs
- Four analog outputs

The EX2 is available in two different packages: frame-mount with plastic cover (4950 0499) or metal enclosure (4950 0500). (See Figure 40 and Figure 41 on page 68.)

The frame-mount package includes:

- EX2 circuit board fastened to a metal backplate
- Removable plastic cover

The enclosure package includes:

- EX2 circuit board fastened to the back piece of the metal enclosure
- Removable metal cover

Operating environment

Make sure that the operating environment conforms to the specifications listed in Table 9. Dimensions and clearances are illustrated in Figure 40 and Figure 41 on page 68.

Table 9. Operating environment specifications

Temperature	From –40°F to 158°F (–40°C to 70°C)
Humidity	5–95%, non-condensing
Power	19–30 Vac (24 Vac nominal) 50/60 Hz 10 VA main board and 12 VA max per binary output
Mounting Weight (frame-mount)	Mounting surface must be able to support 2 lb (1 kg)
Mounting Weight (metal enclosure)	Mounting surface must be able to support 8 lb (4 kg)
Altitude	6,500 ft (2,000 m)
Installation	Category 3
Pollution	Degree 2

Figure 40. Dimensions and clearances for frame-mount EX2

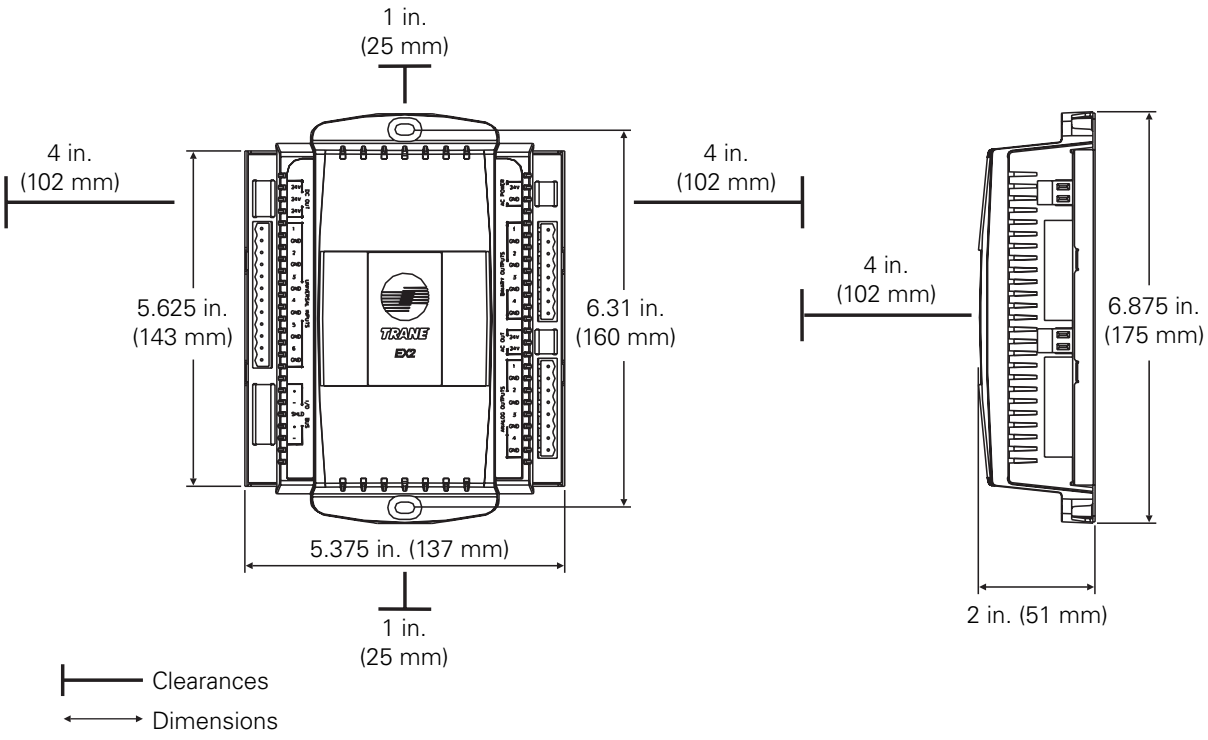
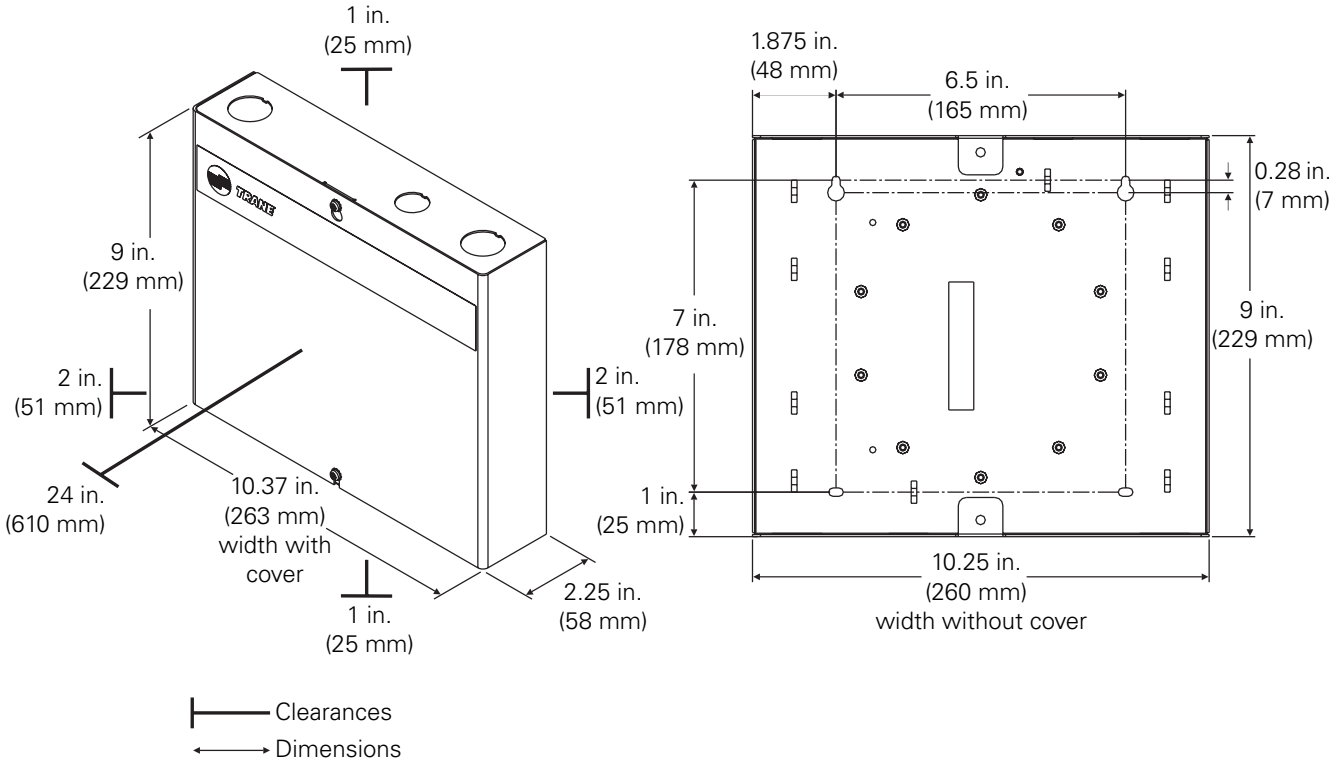


Figure 41. Dimensions and clearances for metal-enclosure EX2



Storage environment

The storage environment must meet the following requirements:

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

Mounting location

Trane recommends locating the EX2 module:

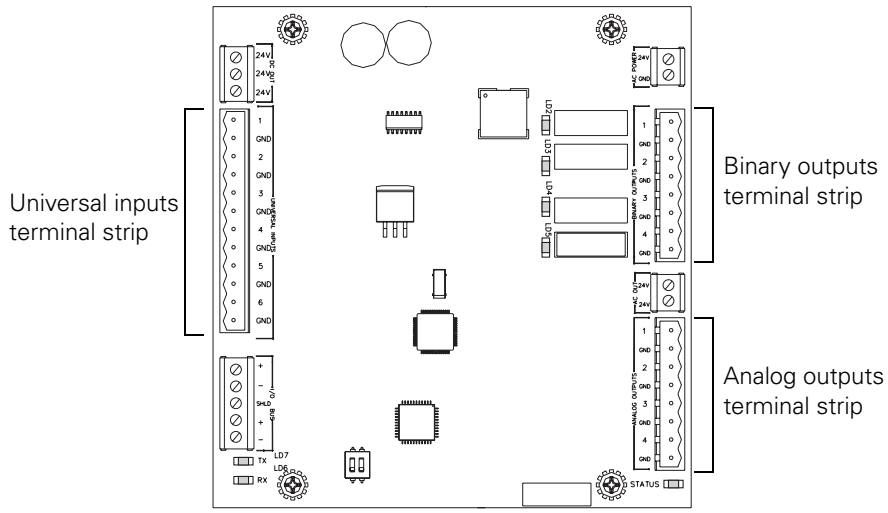
- In an environment protected from the elements
- Where public access is restricted to minimize the possibility of tampering or vandalism
- Near the controlled equipment to reduce wiring costs
- Where it is easily accessible for service personnel

Attaching the terminal strips

For both the frame-mount and metal-enclosure modules, attach the terminal strips to the circuit board. If you need to replace the circuit board, you can transfer the terminal strips to the new board without rewiring. To attach the terminal strips:

1. Make sure that the enclosed plastic bag contains three terminal strips.
2. Align the plastic guides on the terminal strips with the slots in the receptors, then push the terminal strips into place.

Figure 42. Terminal strip locations



Mounting the frame-mount module

CAUTION

Equipment damage!

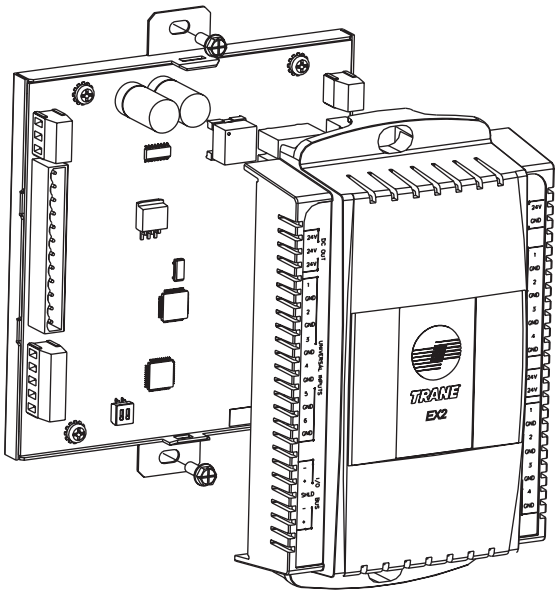
Mount the EX2 module with the cover on to avoid damaging the circuit board during installation.

To mount the frame-mount module:

1. Using the module as a template, mark the location of the two mounting holes on the mounting surface (Figure 43).
2. Set the module aside and drill holes for the screws at the marked locations.
3. Drill holes for #10 (5 mm) screws or #10 wall anchors. Use wall anchors if the mounting surface is dry wall or masonry.
4. Insert wall anchors if needed.
5. Secure the module to the mounting surface with #10 (5 mm) screws (not included).

Attach the frame-mount module securely so that it can withstand the vibrations of associated heating, ventilation, and air-conditioning (HVAC) equipment.

Figure 43. Mounting the frame-mount EX2

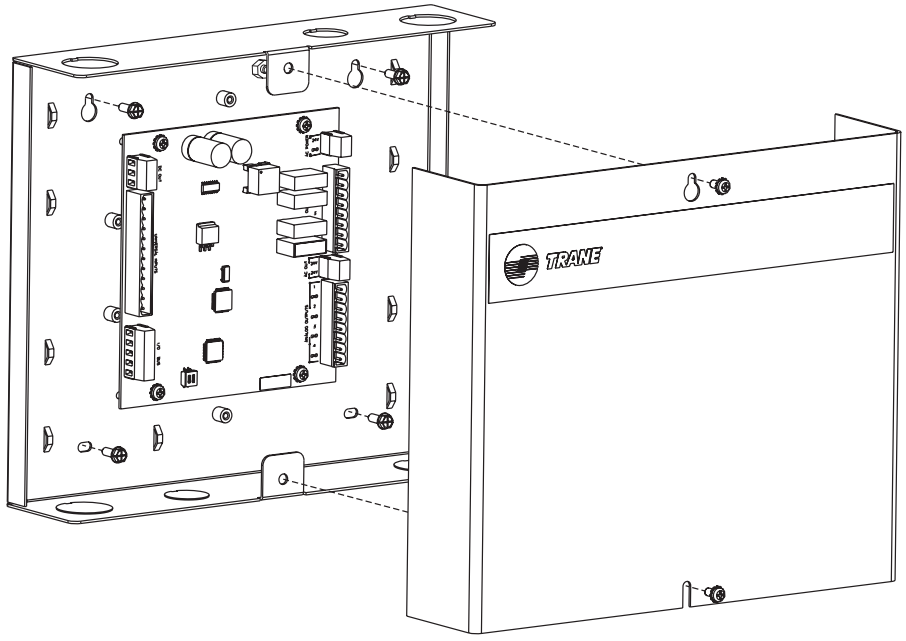


Mounting the metal-enclosure module

To mount the enclosure:

1. Unscrew the two screws on the front of the enclosure and remove the cover.
2. Using the enclosure as a template, mark the location of the four mounting holes on the mounting surface (Figure 44).
3. Set the enclosure aside and drill holes for the screws at the marked locations.
4. Drill holes for #10 (5 mm) screws or #10 wall anchors. Use wall anchors if the mounting surface is dry wall or masonry.
5. Insert wall anchors if needed.
6. Secure the enclosure to the mounting surface with #10 (5 mm) screws (not included).

Figure 44. Mounting the metal-enclosure EX2



AC-power wiring

Use 16 AWG copper wire for ac-power wiring. All wiring must comply with National Electrical Code and local codes. Use a UL-listed Class 2 power transformer supplying a nominal 24 Vac (19–30 Vac). The transformer must be sized to provide adequate power to the EX2 module (10 VA) and outputs (a maximum of 12 VA per binary output).

Please read the warnings and cautions before proceeding.

⚠WARNING

Hazardous voltage!

Before making line voltage electrical connections, lock open the supply-power disconnect switch. Failure to do so 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.

CAUTION

Equipment damage!

Complete input/output wiring before applying power to the EX2 module. Failure to do so may cause damage to the module or power transformer due to inadvertent connections to power circuits.

CAUTION

Equipment damage!

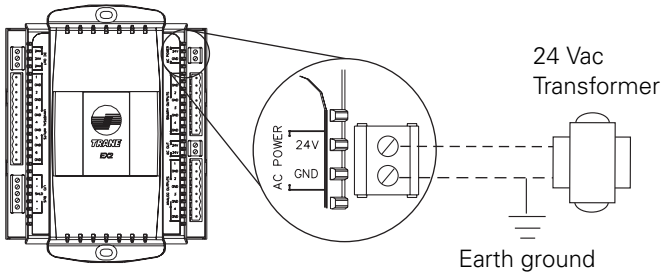
To prevent module damage, do not share 24 Vac between modules.

Wiring AC-power to the frame-mount module

Please read the preceding warnings and cautions. To connect ac-power to the frame-mount module:

1. Connect the ground wire from the 24 Vac transformer (not included) to the GND terminal shown in Figure 45.
2. Connect the power wire to the 24V terminal.

Figure 45. Power and ground terminals

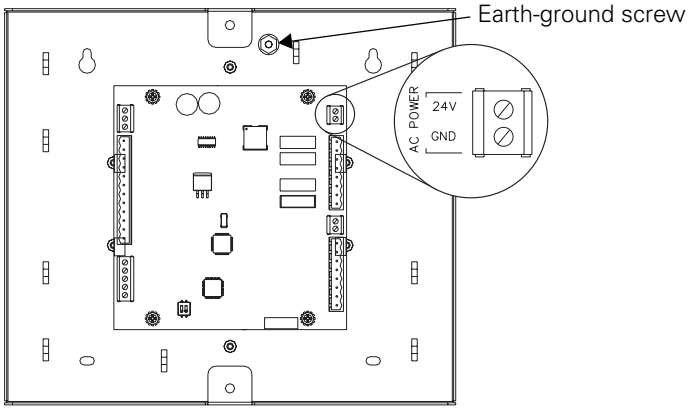


Wiring AC-power to the metal-enclosure module

Please read the preceding warnings and cautions. To connect ac-power wiring to the enclosure:

1. Remove the cover of the enclosure.
2. Remove the knockout for the 0.5 in. (13 mm) conduit from the enclosure and attach the conduit.
3. Feed the power wire into the enclosure.
4. When mounting on dry wall or other non-conductive surface, connect an earth ground to the earth-ground screw on the enclosure (Figure 46).
5. Connect the ground wire from the 24 Vac transformer (not included) to the GND terminal shown in Figure 46.
6. Connect the power wire to the 24V terminal.
7. Replace the cover of the enclosure.

Figure 46. Power and ground terminals



I/O bus wiring

The EX2 communicates with the Tracer MP581 and up to three other EX2 modules on an IEEE-485 link. This link must be a daisy chain. Typically, the Tracer MP581 is at one end of the daisy chain, but any device can be at the ends of the link (Figure 47 and Figure 48 on page 75).

Wiring for the I/O bus must meet the following requirements:

- All wiring must be in accordance with the National Electrical Code and local codes.
- Use level 4 unshielded wire
- Consistent polarity (the I/O bus is polarity sensitive).
- Total I/O wiring length cannot exceed 1000 ft (300 m).
- Do not use any terminating resistors on the I/O bus wiring.

Figure 47. I/O bus wiring example 1

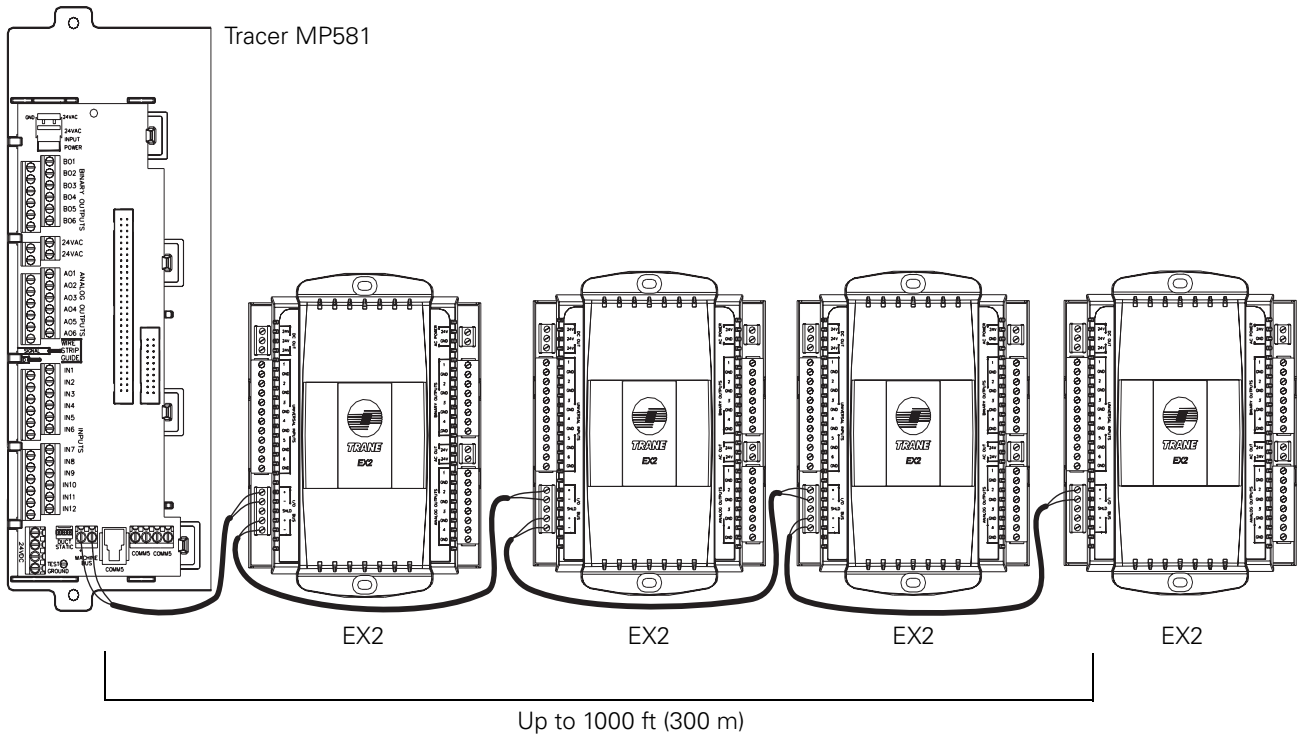
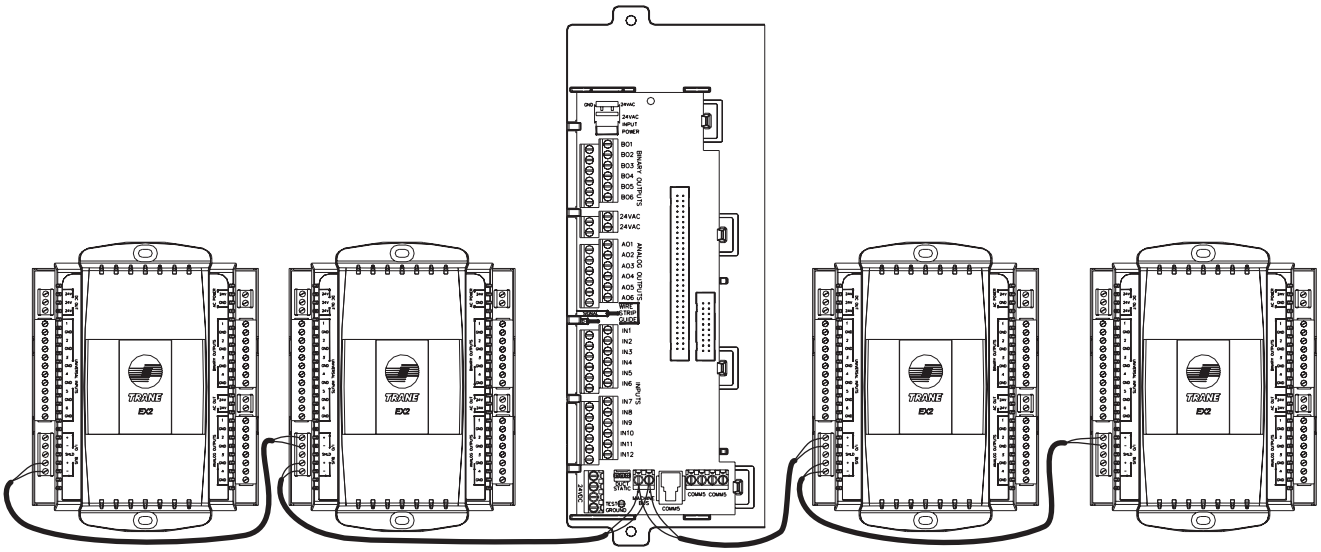


Figure 48. I/O bus wiring example 2



Setting the I/O bus addresses

Each EX2 on the link with the Tracer MP581 must have a unique address. Configure the address using the DIP switches on the EX2 circuit board (Figure 49, page 76). The address must match the expansion module number as specified on the Unit tab for the MP580/581 in Rover. Table 10 on page 76 shows the DIP switch settings for expansion modules 1 through 4.

Figure 49. DIP switch on board

.

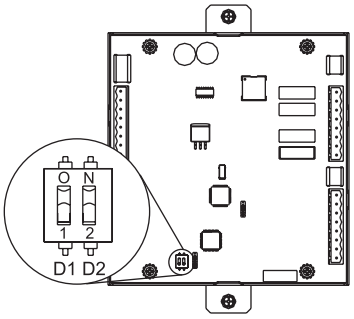


Table 10. EX2 DIP switch settings

EX2 module	D1	D2
1	Off	Off
2	Off	On
3	On	Off
4	On	On

Note:
Cyle power to the EX2 (dipswitches can only be read during power up).

Input/output terminal wiring

All input/output terminal wiring for the EX2 module must meet the following requirements:

- All wiring must be in accordance with the National Electrical Code and local codes.
- Use only 18–22 AWG, stranded, tinned-copper, shielded, twisted-pair wire.
- Binary output wiring must not exceed 1,000 ft (300 m).
- Binary input and 4–20 mA input wiring must not exceed 1,000 ft (300 m).
- Thermistor input, RTD input, and 0–10 Vdc input wiring must not exceed 300 ft (100 m).
- Analog and 24 Vdc output wiring distances depend on the specifications of the receiving unit. Use shielding for analog and 24 Vdc outputs.
- Do not run input/output wires in the same wire bundle with ac-power wires.

The EX2 module has four binary outputs, four analog outputs, and six universal inputs.

Universal inputs

Each of the six universal inputs may be configured as:

- Binary
- Thermistor
- 0–20 mA
- 0–10 Vdc
- Resistance temperature detectors (RTDs) (only inputs 1 and 2)

Table 11 shows the load the Tracer MP581 places on sensors.

Table 11. Load placed on sensors

Input type	Load on sensor
Vdc (linear)	21 kΩ
mA (linear)	221 Ω

Binary outputs

The four binary outputs are form A (SPST) relay outputs. These relays are not dry contacts; they switch 24 Vac. A pilot relay is required for any application using dry contacts. Relays connected to the binary outputs on the EX2 cannot exceed 12 VA or 0.5 A current draw at 24 Vac.

Analog outputs

Each of the four analog outputs may be configured as either of the following:

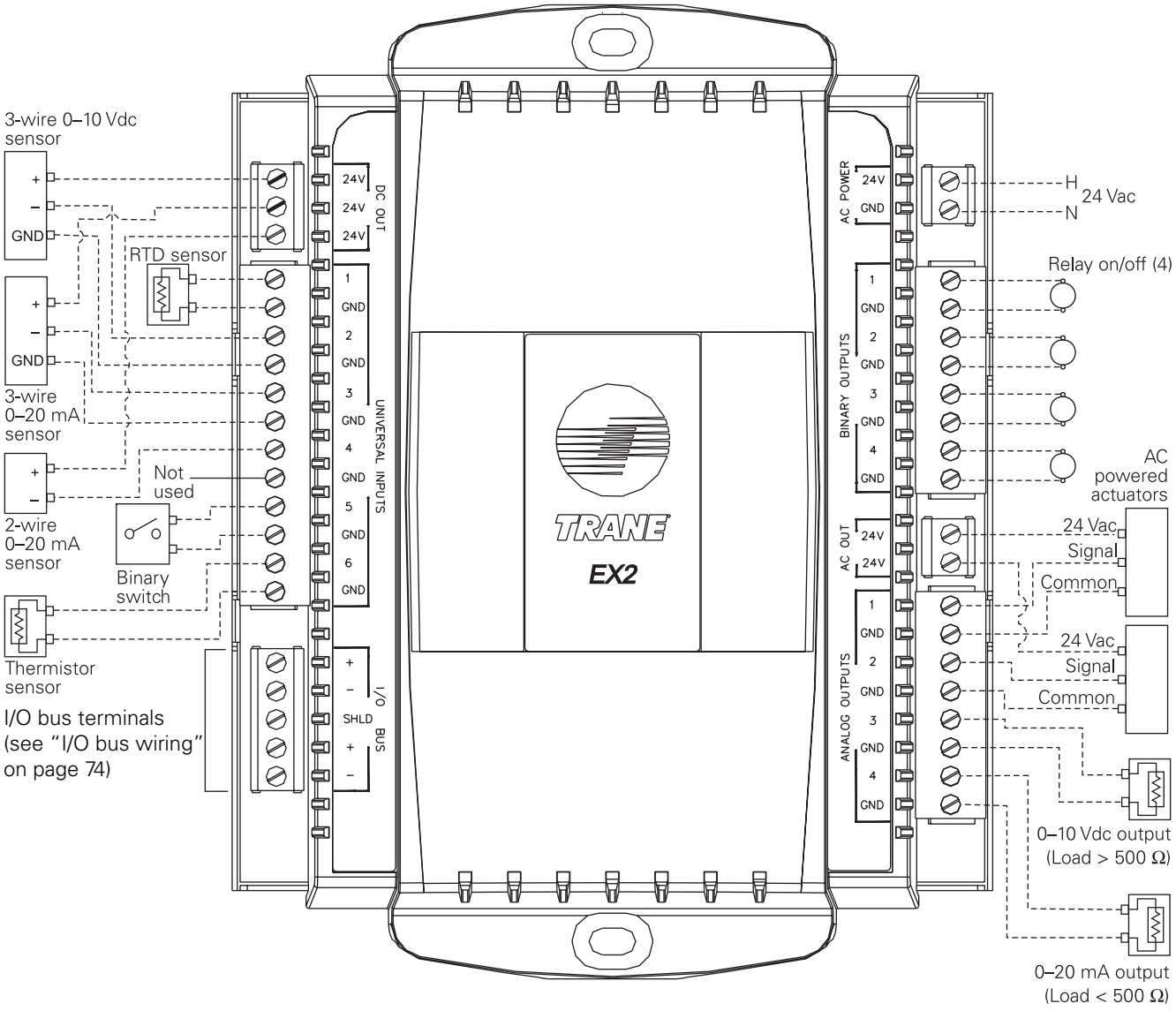
- 0–10 Vdc
- 0–20 mA

Analog output and universal input setup

Configure each analog output and universal input using a LonTalk service tool, such as Trane's Rover service tool. The service tool requires the Tracer MP581 software plug-in to configure an EX2. EX2 modules receive their configuration information from the Tracer MP581 controller they communicate with. You can do online configuration with the Rover Comm5 service tool, or you can do offline configuration with Rover Configuration Builder. In either case, the EX2 modules will not receive their configuration until they are communicating with a configured Tracer MP581 controller.

The inputs are factory configured to be thermistor. Analog outputs are configured for voltage. Figure 50 on page 78 shows how to wire some common sensor types and output devices.

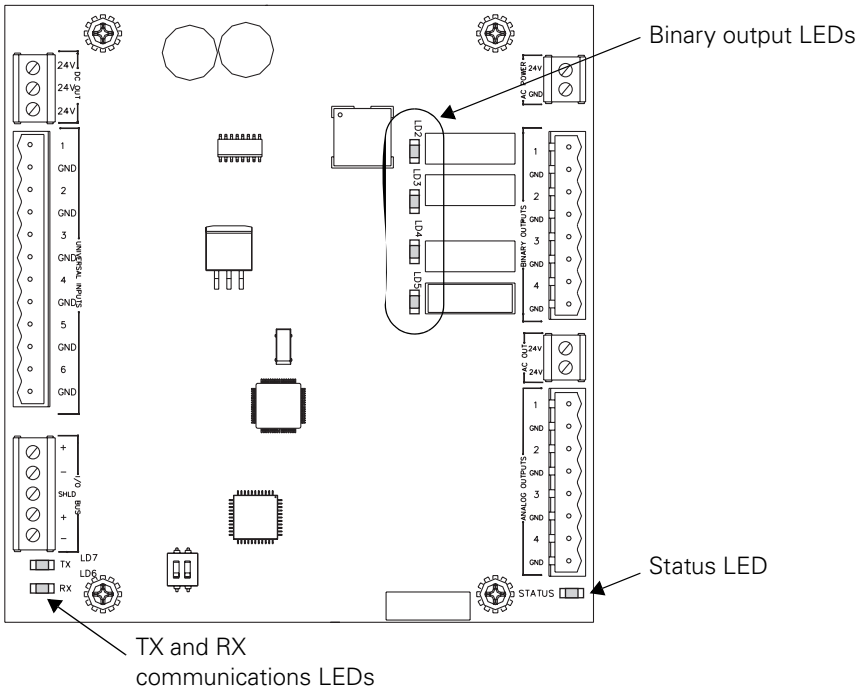
Figure 50. Typical input/output terminal wiring diagram for the EX2 expansion module



Interpreting EX2 LEDs

The information in this section will help you interpret LED activity on the EX2 expansion module. Figure 51 shows the location of each LED.

Figure 51. LED locations on the EX2



Binary output LEDs

The LEDs labeled LD2 through LD5 indicate the status of the four binary outputs. Table 12 describes binary output LED activity.

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 the state of the binary output LED also applies to the status of the end device. Table 12 describes the LED states.

Table 12. 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.

Status LED

The Status LED on the EX2 module operates differently from the status LED on Comm5 devices. Table 13 describes EX2 Status LED activity.

Table 13. Status LED

LED activity	Explanation
LED is on continuously	Power is on and the unit is operating normally.
LED blinks twice	The EX2 has not received its configuration from the Tracer MP580/581. Use the Rover service tool to make sure that the Tracer MP580/581 is correctly configured for use with the EX2 module. Check the I/O bus wiring.
LED blinks once	The EX2 is not communicating on the I/O bus. Check the communications LEDs described in Table 14 for more information.
LED is off continuously	Either the power is off or the controller has malfunctioned.

Communications LEDs

The LEDs labeled TX and RX indicate the communication status of the EX2 module. Table 14 describes the LED activity.

Table 14. Communications LEDs

LED activity	Explanation
Both LEDs blink regularly	The EX2 is communicating with the Tracer MP580/581 on the I/O bus. (If the LEDs blink normally but the EX2 is not working properly, make sure that I/O bus addresses are not duplicated.)
Both LEDs are off continuously	The EX2 is not communicating on the I/O bus. Either the I/O bus wiring is faulty or the Tracer MP580/581 has not been configured to use the EX2 module. Use the Rover service tool to configure the Tracer MP580/581 for use with the EX2 module.
RX LED blinks, TX LED is off	The EX2 is receiving communications from the Tracer MP581 (either for itself or another EX2) but cannot send communications. Either the module is not configured in the Tracer MP580/581 or its I/O bus address is incorrect. Use the Rover service tool to configure the Tracer MP580/581 for use with the EX2 module. Make sure the DIP switches are set for the correct I/O bus address (“Setting the I/O bus addresses” on page 75).
RX LED is on continuously, TX LED is off	Polarity is reversed on the I/O bus wiring. Swap the wires at the plus (+) and minus (–) I/O bus screw terminals on the EX2 module.

Chapter 14

Verifying operation and communication

This chapter describes the location and function of the Service Pin button and the light-emitting diodes (LEDs) on the Tracer MP581 controller.

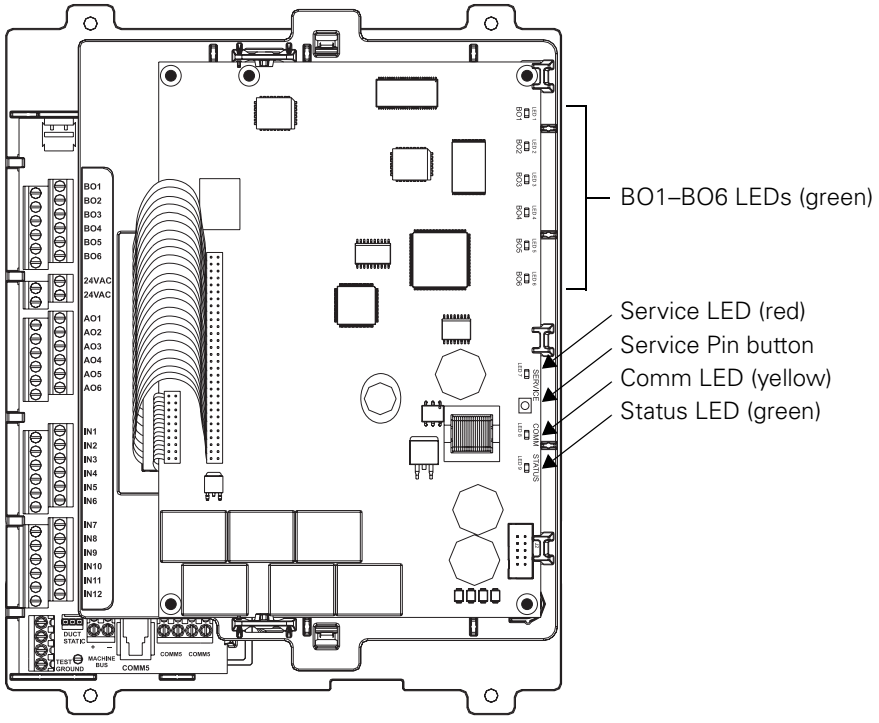
Service Pin button

The Service Pin button is located on the main circuit board as shown in Figure 52. Use the Service Pin button to:

- Identify a device
- Add a device to the active group
- Verify PCMCIA communications
- Make the green Status LED “wink” to verify that the controller is communicating on the link

Refer to the *Rover Operation and Programming* guide, EMTX-SVX01D-EN, for information on how to use the Service Pin button.

Figure 52. Service Pin button and LED locations



Interpreting LEDs

The information in this section will help you interpret LED activity. The location of each LED is shown in Figure 52 on page 81.

Binary output LEDs

The BO1–BO6 LEDs indicate the status of the six binary outputs. Table 15 describes binary output LED activity.

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 the state of the binary output LED also applies to the status of the end device. Table 15 describes the LED states.

Table 15. 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.

Service LED

The red Service LED indicates whether the controller is operating normally. Table 16 describes Service LED activity.

Table 16. Red Service LED

LED activity	Explanation
LED is off continuously when power is applied to the controller	The controller is operating normally.
LED is on continuously when power is applied to the controller	The controller is not working properly, or someone is pressing the Service Pin button.
LED flashes once every second	The controller is not executing the application software because the network connections and addressing have been removed.[1]

[1] Restore the controller to normal operation using the Rover service tool. Refer to EMTX-SVX01D-EN for more information.

Status LED

The green Status LED indicates whether the controller has power applied to it. Table 17 describes Status LED activity.

Table 17. Green Status LED

LED activity	Explanation
LED is on continuously	Power is on (normal operation).
LED blinks (¼ second on, ¼ second off for 10 seconds)	The auto-wink option is activated, and the controller is communicating.[1]
LED blinks rapidly	Flash download is being received.
LED is off continuously	Either the power is off or the controller has malfunctioned.

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

Comm LED

The yellow Comm LED indicates the communication status of the Tracer MP581 controller. Table 18 describes Comm LED activity.

Table 18. Yellow Comm LED

LED activity	Explanation
LED is off continuously	The controller is not detecting any communication (normal for stand-alone applications).
LED blinks	The controller detects communication (normal for communicating applications, including data sharing).
LED is on continuously	An abnormal condition that may occur during discovery. The LED may flash fast enough to look as if it is on continuously. If this LED activity occurs at any other time, the site may have excessive radio frequency interference (RFI).

LEDs on the EX2 expansion module

For an explanation of the LEDs on the EX2 expansion module, refer to "Interpreting EX2 LEDs" on page 79.

Chapter 15

Troubleshooting

This chapter outlines general troubleshooting steps that you should perform if there is a problem with the operation of the equipment controlled by the Tracer MP581 controller.

If you encounter operational problems with the Tracer MP581 controller, you must first perform initial troubleshooting steps; see “Initial troubleshooting” on page 86.

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 troubleshooting” on page 87.
- If an analog output is not working correctly, see “Analog output troubleshooting” on page 88.
- If you see a universal input value that appears incorrect, see “Universal input troubleshooting” on page 89.

Initial troubleshooting

Always perform the initial troubleshooting steps listed in Table 19 before moving on to the specific area of trouble. Perform the steps in the order they are listed.

Table 19. Initial troubleshooting steps

Step number	Action	Probable cause
Step 1	Look at the red Service LED. If it is flashing once per second, the controller is not executing the application software because the network connections and addressing have been removed. For a complete explanation of the behavior of this LED, see "Interpreting LEDs" on page 82. Use the Rover service tool to restore normal operation. See the *Rover Operation and Programming* guide, EMTX-SVX01D-EN, for more information.	Tracer MP581 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 Tracer MP581. For a complete explanation of the behavior of this LED, see "Interpreting LEDs" on page 82.	Tracer MP581 circuit board problem
Step 3	Set the multi-meter to measure ac voltage. Measure the voltage across the 24 Vac power terminals on the Tracer MP581 termination board (with ac power connected). The location of the 24 Vac power terminals is shown in Figure 11 on page 20. If you see approximately 24 V (20–30 V) on those terminals, the board is receiving adequate input power.	Tracer MP581 circuit board problem or programming error
Step 4	Disconnect the ac wires from the input power terminals. Set the multi-meter to measure ac voltage. Measure the voltage across the ac wires. If you see approximately 0 V, the board is not receiving the power it needs to run.	Input power problem

Binary output troubleshooting

If a binary output is not turning on the equipment wired to it, follow the troubleshooting steps in Table 20. 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 20. Binary output troubleshooting of external wiring

Step number	Action	Probable cause
Step 1	Perform the initial troubleshooting steps described in Table 19 on page 86 and verify 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. Check wire splices.	Wiring problem
Step 3	Set the multi-meter to measure ac voltage. Measure the voltage across the binary output terminals on the Tracer MP581. If you see approximately 24 V, the problem lies beyond the Tracer MP581. 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 you see 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 you see 24 V, there is a wiring or equipment problem external to the Tracer MP581. If you still see approximately 0 V, the Tracer MP581 is commanding the output to be off and you need to investigate the Tracer MP581 further. See Table 21.	Wiring problem

If the binary output is still not turning on the equipment wired to it, follow the additional troubleshooting steps in Table 21. These steps will help you assess the configuration and operation of the binary output.

Table 21. Binary output troubleshooting of configuration and operation

Step number	Action	Probable cause
Step 1	Connect the Rover service tool to the Comm5 communication link, start the Rover service tool, and select the Tracer MP581 that you are troubleshooting from the Active Group Tree. The device plug-in for the selected Tracer MP581 appears with the Active Device view screen displayed in the workspace. See the *Rover Operation and Programming* guide, EMTX-SVX01D-EN, for more information.	—
Step 2	If the binary output is on an EX2 expansion module, verify that communications are up between the Tracer MP581 and the expansion module. See the Unit tab in the Status display for the Tracer MP581 in Rover.	Communication failure with expansion board
Step 3	Check the operating status to determine what is controlling the binary outputs. If the operator display or Rover is controlling the binary output, release the override. If a program is controlling the binary output, use the debug mode to investigate the program.	Override or programming error

Analog output troubleshooting

If an analog output is not controlling the equipment wired to it, follow the troubleshooting steps in Table 22. Perform the steps in the order they are listed.

Table 22. Analog output troubleshooting of external wiring

Step number	Action	Probable cause
Step 1	Perform the initial troubleshooting steps described in Table 19 on page 86 and verify 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	For a 0–10 Vdc analog output, set the multi-meter to measure Vdc. Measure across the analog output terminals. The valid range is from 0 Vdc to 10 Vdc. Use either the operator display or the Rover service tool to override the analog output to a known value. For a 0–20 mA analog output, set the multi-meter to measure mA. This may require that the meter connections be changed. Measure across the analog output terminals. This effectively shunts all current through the multimeter. If controlling an actuator, it should move to the 0 mA position. The valid range is from 0 mA to 20 mA. Use either the operator display or the Rover service tool to override the analog output to a known value. For either type of output, set the multimeter to read Vac. Measure across the analog output. The multimeter should show less than 0.1 Vac.	Wiring problem

If the analog output is still not turning on the equipment wired to it, follow the additional troubleshooting steps in Table 23. These steps will help you assess the configuration and operation of the binary output.

Table 23. Analog output troubleshooting of configuration and operation

Step number	Action	Probable cause
Step 1	Connect the Rover service tool to the Comm5 communication link, start the Rover service tool, and select the Tracer MP581 that you are troubleshooting from the Active Group Tree. The device plug-in for the selected Tracer MP581 appears with the Active Device view displayed in the workspace. See the *Rover Operation and Programming* guide, EMTX-SVX01D-EN, for more information.	—
Step 2	If the analog output is on an EX2 expansion module, verify that communications are up between the Tracer MP581 and the expansion module. See the Unit tab in the Status display for the Tracer MP581 in Rover.	Communication failure with expansion board
Step 3	Check the operating status to determine what is controlling the analog outputs. If the operator display or Rover is controlling the analog output, release the override. If a program is controlling the analog output, use the debug mode to investigate the program.	Override or programming error

Universal input troubleshooting

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

- Table 24 describes steps you can take using the Rover service tool to troubleshoot inputs. You do not have to be at the controller to use the device plug-in to view the inputs; however, the Rover service tool must be communicating on the Comm5 link.
- Table 25 describes troubleshooting inputs with a multi-meter at the controller.

Table 24. Troubleshooting universal inputs using the device plug-in

Step number	Action	Probable cause
Step 1	Connect the Rover service tool to the Comm5 communication link, start the Rover service tool, and select the Tracer MP581 that you are troubleshooting from the Active Group Tree. The device plug-in for the selected Tracer MP581 appears with the Active Device view displayed in the workspace. See the *Rover Operation and Programming* guide, EMTX-SVX01D-EN, for more information.	—
Step 2	If the universal input is on an EX2 expansion module, verify that communications are up between the Tracer MP581 and the expansion module. See the Unit tab in the Status display for the Tracer MP581 in Rover.	Communication failure with expansion board
Step 3	On the Inputs tab, check the value of each universal input. The raw value is displayed for each input in the adjacent column. If the input does not show the value you expect, proceed to the next step to verify the input configuration.	—
Step 3	Click the Configuration button, then click the Inputs tab. For the universal input you are troubleshooting, view the Input Type. If it is not correct, select the correct type from the drop-down list and type values in the other configuration fields. Click the Download button, then click the Save button. If the configuration is correct for the input you are troubleshooting, proceed to Table 25.	Input configuration problem

Table 25. Troubleshooting universal inputs using a multi-meter at the controller

Step number	Action	Probable cause
Step 1	Perform the initial troubleshooting steps described in Table 19 on page 86 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	What type of universal input are you investigating? • For thermistor, proceed to Table 26 on page 90. • For binary, proceed to Table 27 on page 90. • For 0–20 mA, proceed to Table 28 on page 91. • For 0–10 Vdc, proceed to Table 29 on page 91.	—

Table 26. Universal input troubleshooting with a thermistor input

Step number	Action	Probable cause
Step 1	Set the multi-meter to read dc voltage. Measure the voltage across the terminals for the input you are troubleshooting. Verify the voltage you measured falls into the gray area of the curve in Figure 53 for the current temperature. If you do not see the voltage reading appropriate for the current temperature, you have a sensor wiring problem. If you do see the correct voltage for the current temperature, proceed to the next step.	Sensor wiring problem
Step 2	Disconnect the sensor wires from the input terminals. Set the multi-meter to read dc voltage. Measure the voltage across the terminals for the input you are troubleshooting. The voltage should be 4.75–5.25 Vdc (see Table 30 on page 92). If you do not see a reading in that range, the Tracer MP581 has a circuit board problem.	Circuit board problem

Figure 53. Voltage measured across terminals vs. temperature

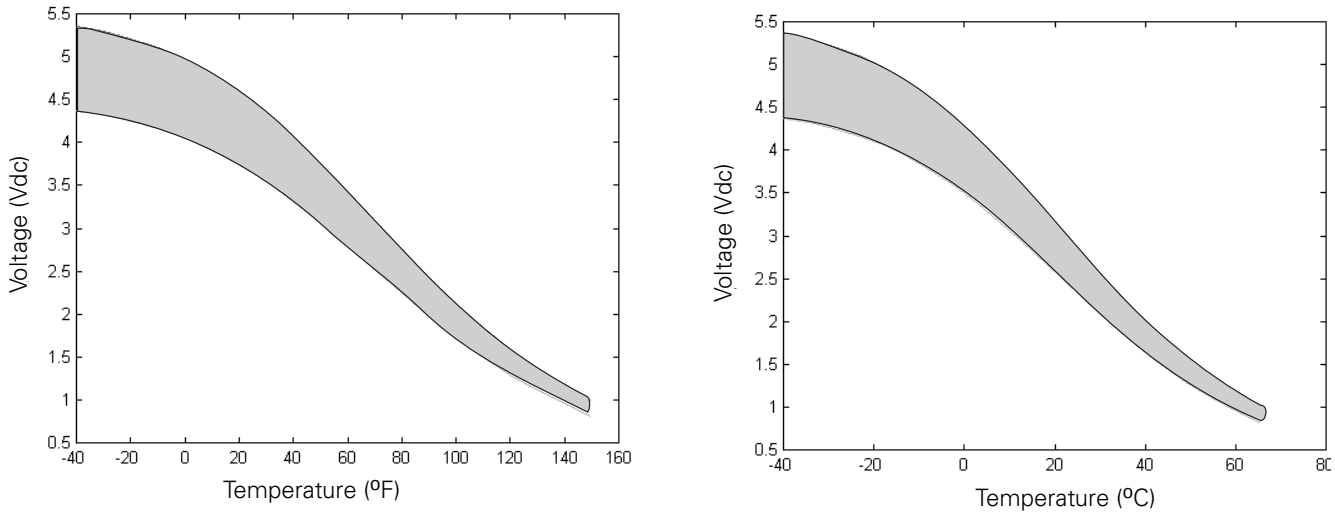


Figure Note:
The correct region is shown in gray. A range of measurements is shown due to the variability of reference voltages and thermistors.

Table 27. Universal input troubleshooting with a binary input

Step number	Action	Probable cause
Step 1	Disconnect the sensor wires from the input terminals. Set the meter to read dc voltage. Measure the voltage across the terminals for the input you are troubleshooting. The voltage should be 16.00–18.00 Vdc (see Table 30 on page 92). If you do not see a reading in that range, the Tracer MP581 has a circuit board problem.	Circuit board problem

Table 28. Universal input troubleshooting with a 0–20 mA input

Step number	Action	Probable cause
Step 1	Set the multi-meter to read dc voltage. Measure the voltage across the terminals for the input you are troubleshooting. Verify the voltage you measured falls on the curve shown in Figure 54 for the input current. If you do not see the voltage appropriate for the mA reading, you have a sensor wiring problem. If you do see the correct voltage for the mA reading, proceed to the next step.	Sensor wiring problem
Step 2	Disconnect the sensor wires from the input terminals. Set the multi-meter to read dc voltage. Measure the voltage across the terminals for the input you are troubleshooting. The voltage should be 0.10–0.13 Vdc (see Table 30 on page 92). If you do not see a reading in that range, the Tracer MP581 has a circuit board problem.	Circuit board problem

Figure 54. Voltage measured across terminals vs. input current

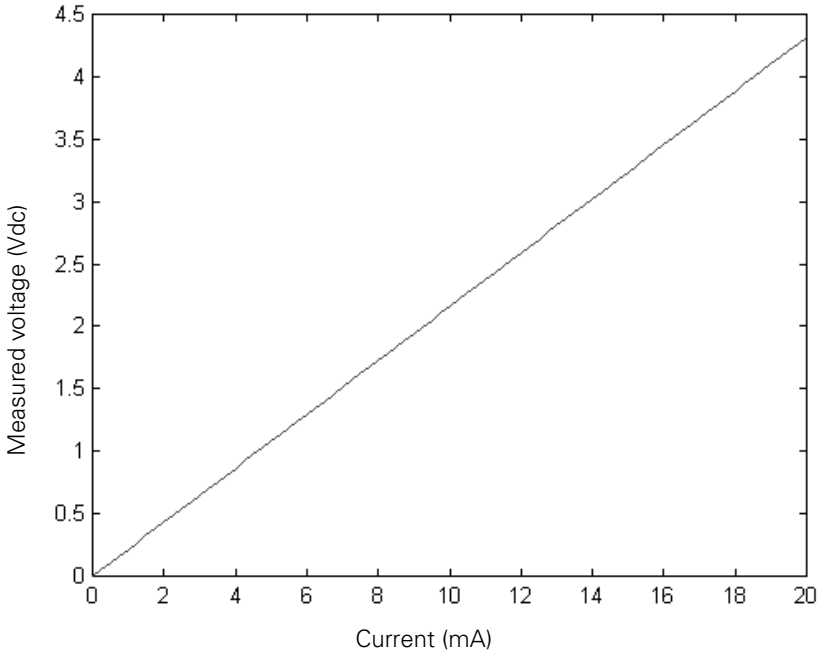


Table 29. Universal input troubleshooting with a 0–10 Vdc input

Step number	Action	Probable cause
Step 1	Disconnect the sensor wires from the input terminals. Set the multi-meter to read dc voltage. Measure the voltage across the terminals for the input you are troubleshooting. The voltage should be 3.1–3.8 Vdc (see Table 30 on page 92). If you do not see a reading in that range, the Tracer MP581 has a circuit board problem.	Circuit board problem

Table 30. 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
Current	0.116 Vdc	0.100 to 0.130 Vdc
Voltage	3.43 Vdc	3.10 to 3.80 Vdc

Chapter 16

Other literature

The below literature is available in electronic format through e-Library, a community page located on the My Standard intranet site. Unless otherwise stated, the literature is also available in hard copy format, which can be ordered through your local Trane office.

- *PID Control in Tracer Controllers Applications Guide*, CNT-APG002-EN. Describes how to set up proportional, integral, and derivative control loops and provides examples.
- *Rover Operation and Programming* guide, EMTX-SVX01E-EN. Describes how to install and use the Rover service software. Rover is required to configure a Tracer MP581 and to create and edit Tracer graphical programs. This document is available in electronic format only.
- *Tracer Graphical Programming Applications Guide*, CNT-APG001-EN. A tutorial for learning Tracer graphical programming.
- *Tracer MP580/581 Programmable Controller Programming* guide, CNT-SVP01C-EN. Describes how to assemble graphical programs, how to configure the controller, and how to create bindings with other Comm5 devices.
- *Tracer MP580/581 Programmable Controllers* product catalog, CNT-PRC002-EN. Describes the features and specifications of the controller.

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