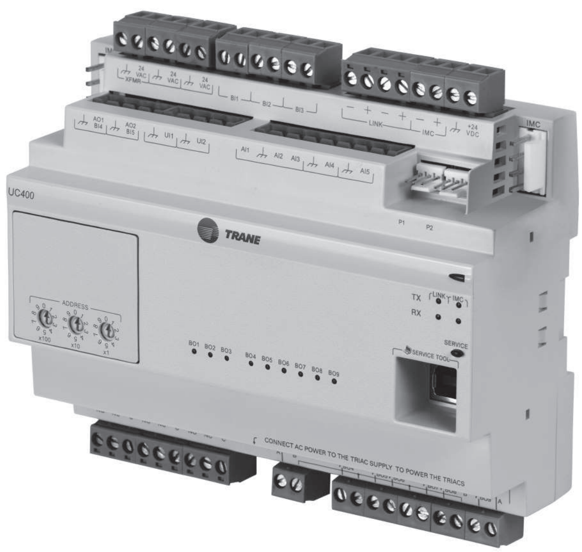
Installation, Operation, and Maintenance

# Tracer® UC400 Programmable Controller




BMUC400AAA0100011

**⚠ SAFETY WARNING**

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

April 2020

**BAS-SVX20K-EN**

# Introduction

The Tracer® UC400 Programmable Controller is a multi-purpose, programmable controller. Programming is done through the Tracer Graphical Programming (TGP2) Editor. This field-installed device is designed to control the following types of equipment:

- Single- and dual-duct variable-air-volume (VAV) units
- Fan coils
- Unit ventilators
- Blower coils
- Water-source heat pumps (WSHP)
- Small air handlers

This guide provides information on installing, operating, and maintaining the controller.

## Warnings, Cautions, and Notices

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

The three types of advisories are defined as follows:

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

**⚠ WARNING**

**Proper Field Wiring and Grounding Required!**

**Failure to follow code could result in death or serious injury.**

**All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state/national electrical codes.**

**⚠ WARNING**

**Personal Protective Equipment (PPE) Required!**

**Failure to wear proper PPE for the job being undertaken could result in death or serious injury.**

**Technicians, in order to protect themselves from potential electrical, mechanical, and chemical hazards, MUST follow precautions in this manual and on the tags, stickers, and labels, as well as the instructions below:**

- **Before installing/servicing this unit, technicians MUST put on all PPE required for the work being undertaken (Examples; cut resistant gloves/sleeves, butyl gloves, safety glasses, hard hat/bump cap, fall protection, electrical PPE and arc flash clothing). ALWAYS refer to appropriate Safety Data Sheets (SDS) and OSHA guidelines for proper PPE.**
- **When working with or around hazardous chemicals, ALWAYS refer to the appropriate SDS and OSHA/GHS (Global Harmonized System of Classification and Labelling of Chemicals) guidelines for information on allowable personal exposure levels, proper respiratory protection and handling instructions.**
- **If there is a risk of energized electrical contact, arc, or flash, technicians MUST put on all PPE in accordance with OSHA, NFPA 70E, or other country-specific requirements for arc flash protection, PRIOR to servicing the unit. NEVER PERFORM ANY SWITCHING, DISCONNECTING, OR VOLTAGE TESTING WITHOUT PROPER ELECTRICAL PPE AND ARC FLASH CLOTHING. ENSURE ELECTRICAL METERS AND EQUIPMENT ARE PROPERLY RATED FOR INTENDED VOLTAGE.**

**⚠ WARNING**

**Follow EHS Policies!**

**Failure to follow instructions below could result in death or serious injury.**

- **All Trane personnel must follow the company's Environmental, Health and Safety (EHS) policies when performing work such as hot work, electrical, fall protection, lockout/tagout, refrigerant handling, etc. Where local regulations are more stringent than these policies, those regulations supersede these policies.**
- **Non-Trane personnel should always follow local regulations.**

# Copyright



# Trademarks



# Revision History

Update to the 0–20 mA Analog Input wiring illustration.

# Table of Contents

# General Information

## Specifications

| | |
|---|---|
| **Storage** | |
| Temperature | -48°F to 203°F (-44°C to 95°C) |
| Relative humidity | Between 5% to 95% (non condensing) |
| **Operating** | |
| Temperature | -40°F to 158°F (-40°C to 70°C) |
| Humidity | Between 5% to 95% (nonconducting) |
| Power | 20.4–27.6 Vac (24 Vac, ±15% nominal) 50–60 Hz 24 VA<br>(24 VA plus binary output loads for a maximum of 12 VA for each binary output) |
| Mounting weight of controller | Mounting surface must support 0.80 lb. (0.364 kg) |
| Environmental rating (enclosure) | NEMA 1 |
| Altitude | Maximum 9,842 ft. (3,000 m) |
| Installation | UL 840: Category 3 |
| Pollution | UL 840: Degree 2 |

## Sensors

**⚠ WARNING**

**Electrical Shock Hazard!**

**Failure to follow instructions below could result in death or serious injury.**
**Do not mix Class 1 and Class 2 voltage wiring in an enclosure or on a controller without an approved barrier between wiring.**

The UC400 controller supports the following sensor types:

- Zone temperature sensors (resistive and thermistor)
- Linear 0–20 mA, such as humidity sensors
- Linear 0–10 Vdc, such as indoor air-quality sensors
- 3-wire pressure transducer inputs

The following table provides information about the different types of device connections:

<table>
<tr><th>Connection</th><th>Quantity</th><th>Types</th><th>Range</th><th>Notes</th></tr>
<tr><td rowspan="3">Analog input (AI1 to AI5)</td><td rowspan="3">5</td><td>Temperature</td><td>10 kΩ thermistor</td><td rowspan="2">AI1 to AI4 can be configured for timed override capability.</td></tr>
<tr><td>Setpoint</td><td>189 Ω to 889 Ω</td></tr>
<tr><td>Resistive</td><td>100 Ω to 100 kΩ</td><td>Typically used for fan speed switch.</td></tr>
<tr><td rowspan="7">Universal input (UI1 and UI2)</td><td rowspan="7">2</td><td>Linear</td><td>0–20 mA</td><td rowspan="5">These inputs may be configured to be thermistor or resistive inputs, 0–10 Vdc inputs, or 0–20 mA inputs.</td></tr>
<tr><td>Linear</td><td>0–10 Vdc</td></tr>
<tr><td>Temperature</td><td>10 kΩ thermistor</td></tr>
<tr><td>Setpoint</td><td>189 Ω to 889 Ω</td></tr>
<tr><td>Resistive</td><td>100 Ω to 100 kΩ</td></tr>
<tr><td>Binary</td><td>Open collector/dry contact</td><td>Low impedance relay contacts recommended.</td></tr>
<tr><td>Pulse</td><td>Solid state open collector</td><td>Minimum dwell time is 25 ms On and 25 ms Off. (Takes a maximum of 1048576 samples before the counter resets.)</td></tr>
<tr><td>Binary input (BI1 to BI3)</td><td>3</td><td></td><td>24 Vac detect</td><td>The UC400 controller provides (sources) 24 Vac for sensing contact closure by using the recommended connections.</td></tr>
<tr><td rowspan="2">Binary output (BO1 to BO3)</td><td>3</td><td>Relay</td><td>2.88 A @24 Vac pilot duty</td><td rowspan="2">Power needs to be wired to the binary output. All outputs are isolated from each other and from ground or power. Ranges given are per contact.</td></tr>
<tr><td>Other Ranges</td><td>• General purpose<br>• Motor<br>• Pilot duty<br>• Resistive</td><td>• General Purpose (Resistive)<br>– 10 A max up to 277 Vac<br>– 10 A max up to 30 Vdc<br>• Motor Duty (Inductive)<br>– 1/3 hp at 125 Vac (7.5 A max)<br>– 1/2 hp at 277 Vac (7.5 A max)</td></tr>
<tr><td>Binary output (BO4 to BO9)</td><td>6</td><td>TRIAC</td><td>0.5 A max @24-277 Vac, resistive and pilot duty</td><td>Use for modulating TRIAC. User determines whether closing high side (providing voltage to the grounded load) or low side (providing ground to the power load). Ranges given are per contact and power comes from TRIAC SUPPLY circuit.</td></tr>
<tr><td rowspan="4">Analog output/binary input(AO1/BI4 and AO2/ BI5)</td><td rowspan="4">2</td><td>Linear output</td><td>0–20 mA</td><td rowspan="4">Each termination must be configured as either an analog output or binary input.</td></tr>
<tr><td>Linear output</td><td>0–10 Vdc</td></tr>
<tr><td>Binary input</td><td>Dry contact</td></tr>
<tr><td>PWM output</td><td>80 Hz signal @ 15 Vdc</td></tr>
</table>

| Connection | Quantity | Types | Range | Notes |
|---|---|---|---|---|
| Pressure inputs (PI1 and PI2) | 2 | 3-wire | 0–5 in $H_2O$ | Pressure inputs supplied with 5 volts of power. Designed for Kavlico™ pressure transducers. |
| **Overall Point Total** | **23** | | | |

# Expansion Modules

If you need additional points, you can add up to eight (8) XM30 expansion modules.

***Important:*** *Two of the expansion modules can be powered directly by the UC400 power supply, but they must not exceed the 200 mA current limit of the IMC connector. Calculate the power requirements before attempting to power the expansion modules with the UC400 power supply. If the calculated load exceeds 200 mA or if you need more than two XM30 expansion modules, install separate DC power supplies. Refer to the section, "XM30/XM32/XM70/XM90 Expansion Modules," p. 12.*

# Agency Listing and Compliance

Below is a listing compliance with Conformity European (CE) and Underwriters Laboratories (UL) standards for the UC400 controller:

- UL916 PAZX- Open Energy Management Equipment
- UL94-5V Flammability
- CE Marked FCC Part 15, Subpart B, Class B Limit
- AS/NZS CISPR 22:2006
- VCCI V-3/2008.04
- ICES-003, Issue 4:2004

# Packaged Contents

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 immediately with the carrier. The following items are included in the UC400 package:

- UC400 controller
- DIN rail and DIN rail mounting screws
- Terminal connectors
- Installation guide

***Note:*** *For factory-mount controllers, the terminal connectors are part of the harness connector. For field-mounted controllers, the quantities will vary depending on user requirements.*

## Accessories

Two (2) accessory options are available for the UC400:

- Enclosure for remote mounting, P/N X13651534, which includes:
  – Pre-mounted DIN rail
  – Transformer (line voltage to 24 Vac)
  – Transformer to unit controller cable/harness
  – Convenience power outlet (available only on 115 V version)
  – Four #10 (5 mm) wall anchors and four #10 x 1.5 inch (5 x 40 mm) screws
- XM30 expansion module, which includes:
  – IMC cable
  – Pluggable terminal connectors (not installed)
  – Installation sheet

## Required Tools

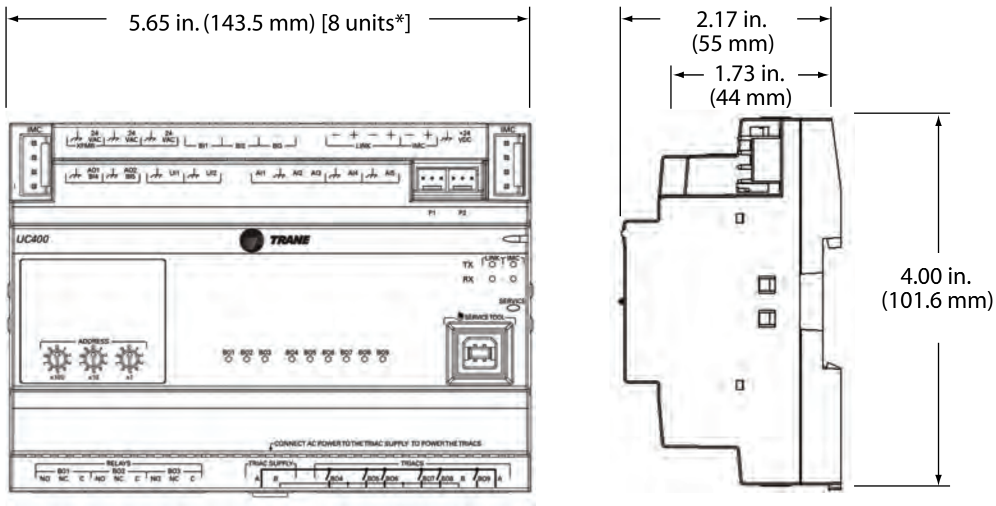
The following tools are required to install and initially test the UC400 controller:

- Drill and appropriate bits for DIN rail mounting
- A #2 Phillips-head screwdriver
- A 1/8 inch (3.2 mm) wide, flat-bladed screwdriver
- Digital multimeter

# Mounting the UC400

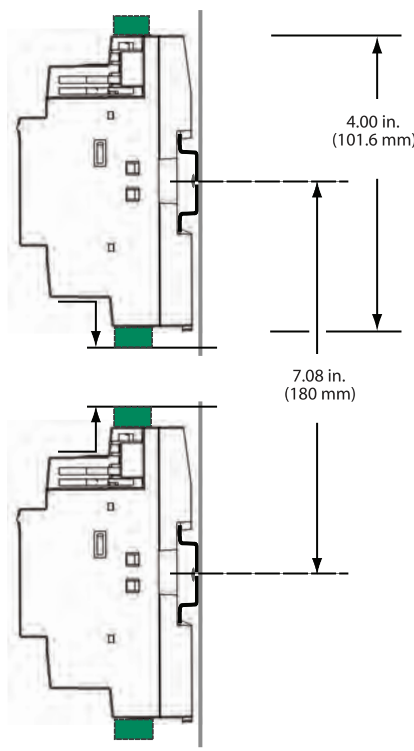
## Clearances

**Figure 1. Controller Dimensions**




***Note:*** *DIN Standard 43 880, Built-in Equipment for Electrical Installations, Overall Dimensions and Related Mounting Dimensions.*

**Figure 2. DIN Rail**

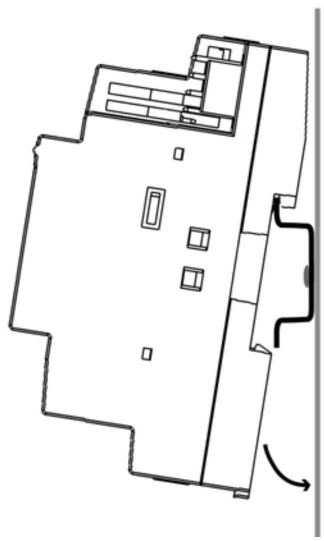



## DIN Rail

***Note:*** *Always install devices on a horizontally oriented DIN rail to allow proper ventilation.*

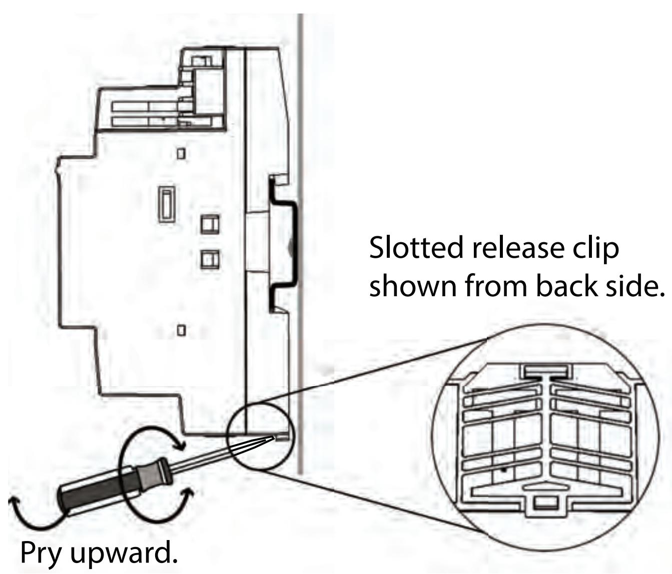
To mount controller:

1. Hook the controller over the top of the DIN rail.
2. Gently push on lower half of device in the direction of the arrow until the release clip locks into place.



To remove or reposition the controller:

1. Disconnect all connectors.
2. Insert a screwdriver blade into the slotted release clip (shown below) and gently pry upward to disengage the clip.
3. While holding tension on the clip, lift the controller upward to free it from the DIN rail.
4. Reposition the controller by sliding it sideways or by removing it completely and reattaching it.
5. Gently push on lower half of device in the direction of the arrow until the release clip locks into place.

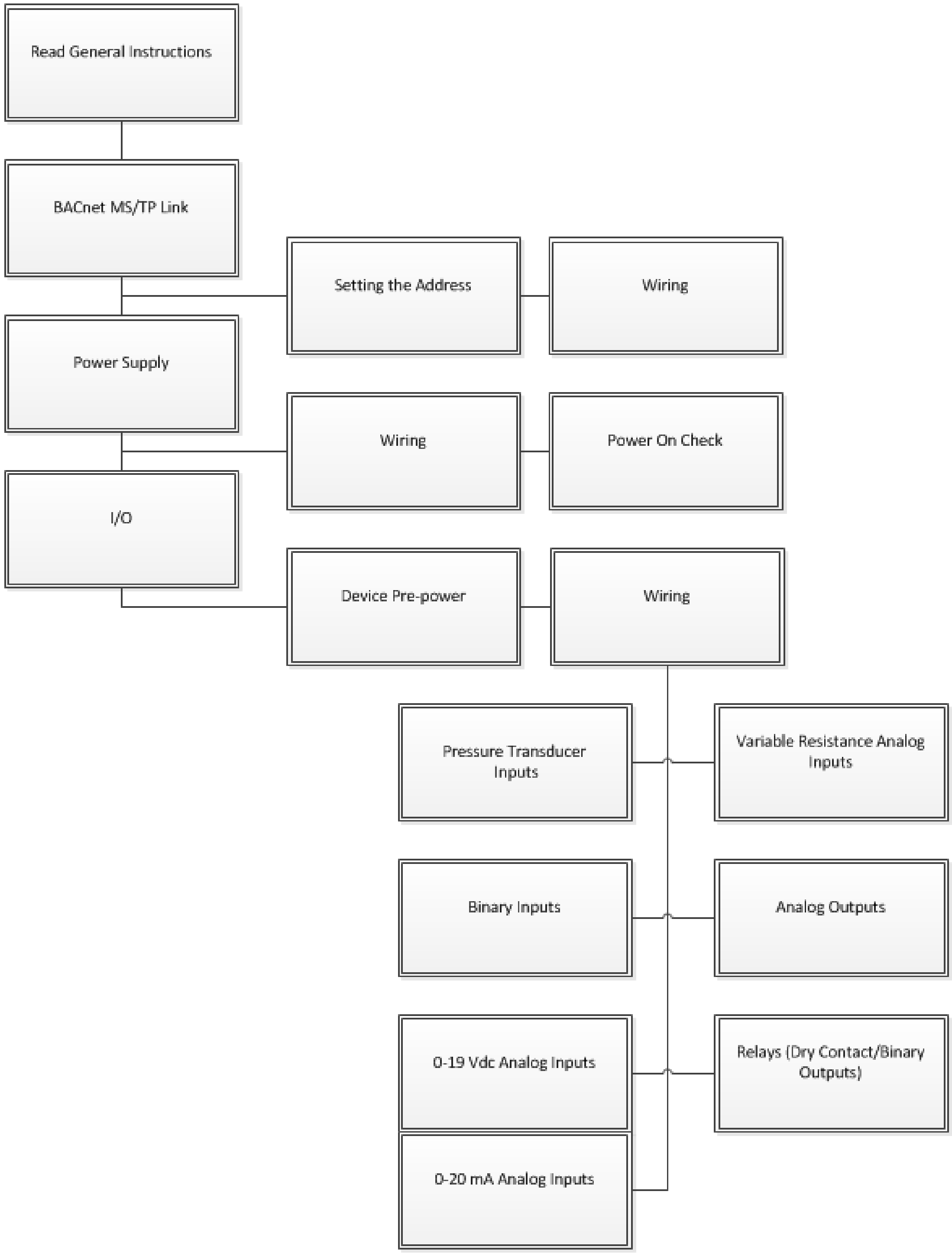


## XM30/XM32/XM70/XM90 Expansion Modules

The UC400 controller has 23 built-in points and supports up to eight (8) XM30 expansion modules. Each expansion module adds up to four (4) additional points. However, the controller can only supply up to 200 mA of electrical current, which is enough to power only two expansion modules. The third and all subsequent expansion modules must be powered by a (recommended) Trane PM014 power module or third-party equivalent. (For more information, refer to the Tracer XM30, XM32, XM70,and XM90 Expansion Modules Installation, Operations, and Maintenance, BAS-SVX46.

# Wiring

## Overview




## General Instructions

All wiring must comply with the National Electrical Code (NEC™ ) and local electrical codes.

To connect wires to terminals when connecting wires to the UC400 or XM30:

1. Strip wires to expose 0.28 inch (7 mm) of bare wire.
2. Insert the wire into a terminal connector.
3. Tighten the terminal screw to 0.5 to 0.6 N-m (71 to 85 ozf-in or 4.4 to 5.3 lbf-in.)
4. Tug on the wires after tightening the screws to ensure all wires are secure.

# BACnet MS/TP Link

***Note:*** *To set rotary dials for the XM30, refer to the Tracer XM30 Expansion Module Installation Instructions, X39641148.*

The rotary address dials on the UC400 serve one of two purposes, depending on the network:

- They are always used for the MAC address.
- The MAC address is sometimes all of part of the BACnet Device ID.

## MAC Address

The MAC Address is required by the RS-485 communication protocol on which BACnet operates. A UC400 controller can use a MAC Address from 001 to 120.

***Important:*** *Each device on the link must have a unique MAC Address/Device ID. A duplicate address or a 000 address setting will interrupt communications and cause the Tracer SC device installation process to fail.*

## BACnet Device ID

The BACnet Device ID is required by the BACnet network. Each device must have a unique number from 001 to 4094302.

- **BACnet networks without a Tracer SC system controller.** On BACnet networks without a Tracer SC system controller, the Device ID can be assigned one of two ways:
  – It can be the same number as the MAC Address, determined by the rotary address dials on the UC400 controller. For example, if the rotary address dials are set to 042, both the MAC Address and the BACnet Device ID are 042.
  – It can be soft set using Tracer TU service tool. If the BACnet Device ID is set using the Tracer TU service tool, the rotary address dials only affect the MAC Address, they do not affect the BACnet Device ID. (For more information, refer to the Tracer UC400 Controller Protocol Implementation Conformance Statement (PICS), BAS-PRG007.
- **BACnet networks with a Tracer SC system controller.** On BACnet networks with a Tracer SC system controller, the Device ID for the UC400 controller is always soft set by the system controller using the following scheme shown in the table below.

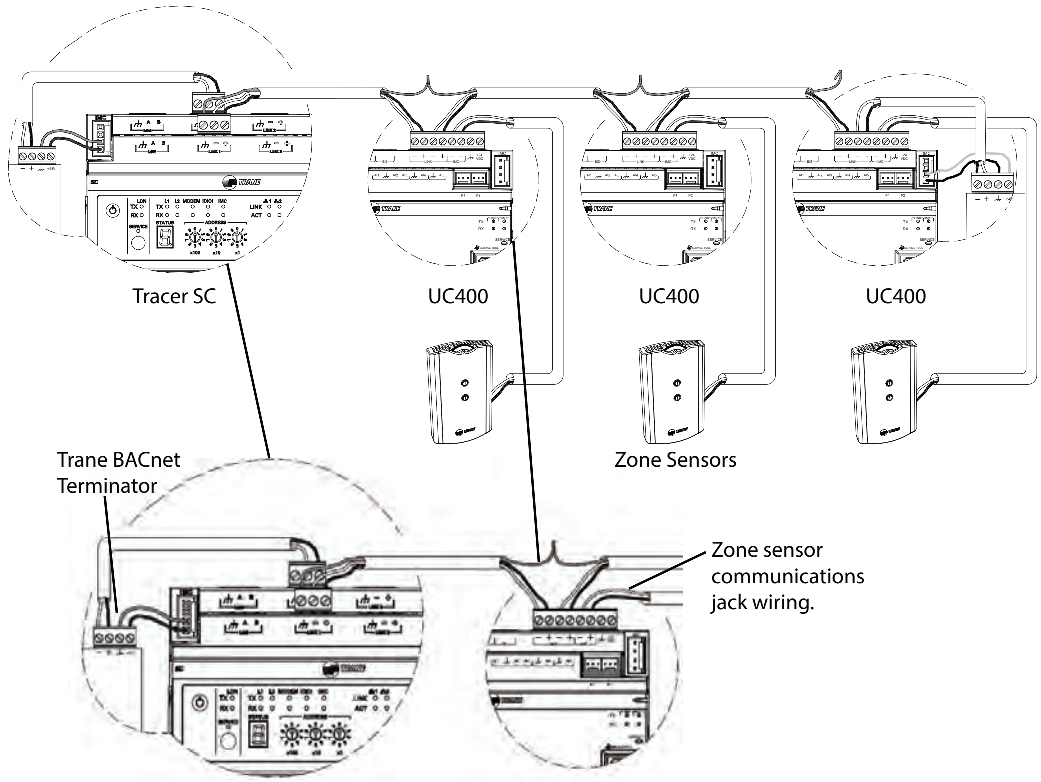
  ***Note:*** *The BACnet Device ID is displayed as the Software Device ID on the Tracer TU Controller Settings Page in the Protocol group.*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Tracer SC rotary switch value (21) | 0 | 2 | 1 | | | | |
| Tracer SC BACnet MS/TP link number (1) | | | | 1 | | | |
| Unit controller MAC address (38) | | | | | 0 | 3 | 8 |
| BACnet Device ID: 211038 | 0 | 2 | 1 | 1 | 0 | 3 | 8 |

  – The first three digits are determined by the address rotary dials on the Tracer SC system controller.
  – The fourth digit is determined by the link number to which the UC400 controller is attached.
  – The last three digits are determined by the rotary address dials on the UC400 controller.

## BACnet MS/TP Link Wiring

BACnet MS/TP link wiring must be field-supplied and installed in compliance with the National Electrical Code and local codes. The wire must be low-capacitance, 18-gauge, stranded, tinned-copper, shielded, twisted-pair. The illustration below is an example of BACnet link wiring with multiple UC400 controllers and zone sensors.




# Power Supply

**⚠ WARNING**

**Hazardous Voltage!**

**Failure to disconnect power before servicing could result in death or serious injury. Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Verify that no power is present with a voltmeter.**

**⚠ WARNING**

**Proper Ground Connection Required!**

**Failure to follow instructions below could result in death or serious injury.**
**After installation, ensure that the 24 Vac transformer is grounded through the controller. Measure the voltage between chassis ground and any ground terminal on the controller. Expected result: Vac <4.0 volt.**

***NOTICE***

**Equipment Damage!**

**Sharing 24 Vac power between controllers could result in equipment damage.**

A separate transformer is recommended for each UC400 controller. The line input to the transformer must be equipped with a circuit breaker sized to handle the maximum transformer line current. If a single transformer is shared by multiple UC400 controllers:

- The transformer must have sufficient capacity.
- Polarity must be maintained for every UC400 controller powered by the transformer.

***Important:*** *If the polarity is inadvertently reversed between two controllers powered by the same transformer, a difference of 24 Vac will occur between the grounds of each controller, which can result in:*

- *Partial or full loss of communication on the entire BACnet MS/TP link.*
- *Improper function of UC400 outputs.*
- *Damage to the transformer or a blown transformer fuse.*

## Transformer Recommendations

The UC400 controller can be powered with 24 Vac or 24 Vdc. You must use a 24 Vac power supply for proper operation of the binary inputs, which require 24 Vac detection, and also to use the spare 24 Vac outputs to power relays and TRIACS.

- **AC transformer requirements:** UL listed, Class 2 power transformer, 24 Vac ±15%, device max load 24 VA, BCI application 6 VA. The transformer must be sized to provide adequate power to the controller (21 VA) and outputs (maximum of 10A per relay output and 0.5A per TRIAC output).
- **DC power supply requirements:** UL listed, Class 2 power supply, 24 Vdc ±15%, device max load 420 mA, BCI application 90 mA.
- **CE-compliant installations:** The transformer must be CE marked and SELV compliant per IEC standards.

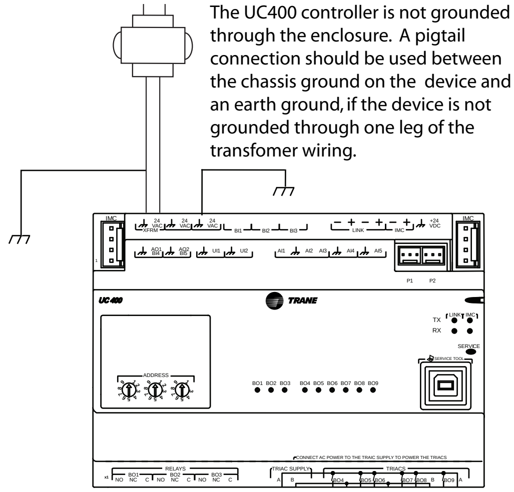
## Wiring Recommendations

To ensure proper operation of the UC400 controller, install the power supply circuit in accordance with the following guidelines:

- The controller must receive AC power from a dedicated power circuit; failure to comply may cause the controller to malfunction.
- A dedicated power circuit disconnect switch must be near the controller, easily accessible by the operator, and marked as the disconnecting device for the controller.
- DO NOT run AC power wires in the same wire bundle with input/output wires; failure to comply may cause the controller to malfunction due to electrical noise.
- 18 AWG (0.823 mm2) copper wire is recommended for the circuit between the transformer and the controller.

## Connecting Wires

Disconnect power to the transformer and then ground one of the terminals on the controller to the enclosure (if the enclosure is adequately grounded) or to an alternate earth ground.




## Power On Check

1. Verify that the 24 Vac connector and the chassis ground are properly wired.
2. Remove the lockout/tagout from the line voltage power to the electrical cabinet.
3. Energize the transformer to apply power to the UC400 controller.
4. Observe the UC400 controller when power is applied to verify the power check sequence:
   a. The power LED lights red for 1 second.
   b. The power LED lights green.
   c. If the sequence completes as described, the controller is properly booted and ready for the application code.
   d. If the power LED flashes red, a fault condition exists.

# Inputs/Outputs

## Pre-power Checks

Before connecting any inputs/outputs to the UC400, perform the following pre-power checks.

### Basic Checks

For devices with input/output types listed below, verify their basic functionality:

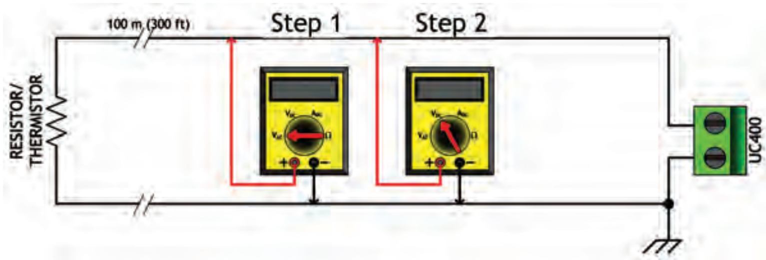
- Binary inputs: check that they are opening and closing. Also check for 24 Vac if they provide their own power. With a Trane-provided 24 Vac, check to make sure it is dry contact and working.
- Thermistors: check for 10K using a digital multimeter (DMM).
- Thumb wheels: verify mechanical operation.
- Binary outputs: check for any dead shorts.
- Analog outputs: check that no A/C voltage is present and that the load has no 24 Vac across it or 120 Vac.

## Point Check Diagram

This section shows diagrams and describes methods to check device input/output points before the connection to the UC400 controller has been made and power has been applied. The step numbers in each illustration correspond to the information in each table. (See Table 2, p. 5 for a list of device connections.)

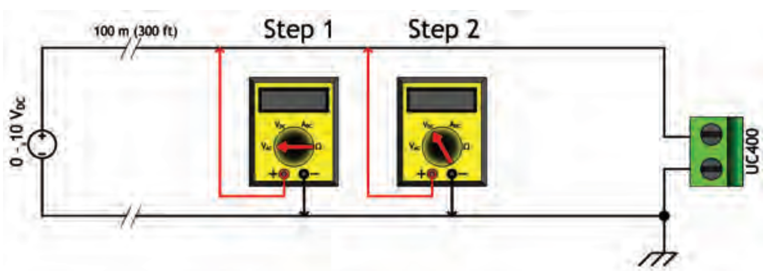
***Note:*** *The UC400 controller should not be connected to the input and output devices during the pre-power checks, so the controller is not shown in the diagrams.*

- **Resistive Inputs**



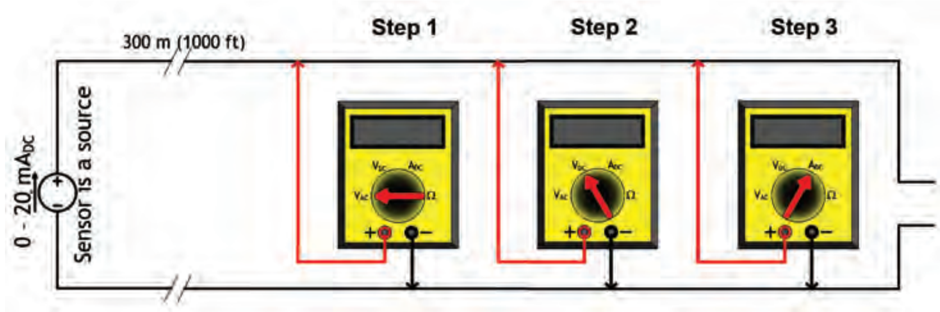

| Checkout Procedure | Measurement | Expected Value |
|---|---|---|
| Step 1 | Measure AC voltage across the resistive termination. | Vac ≈ 0.0 V<br>AC voltage will affect further measurement. |
| Step 2 | Measure DC voltage across the resistive termination. | Vdc ≈ 0.0 V<br>DC voltage will affect further measurement. |
| Step 3 | Measure the resistance across the resistive termination. | Compare the measured resistance with the expected value based on the manufacturer's specification and current conditions. |

- **Voltage Inputs**



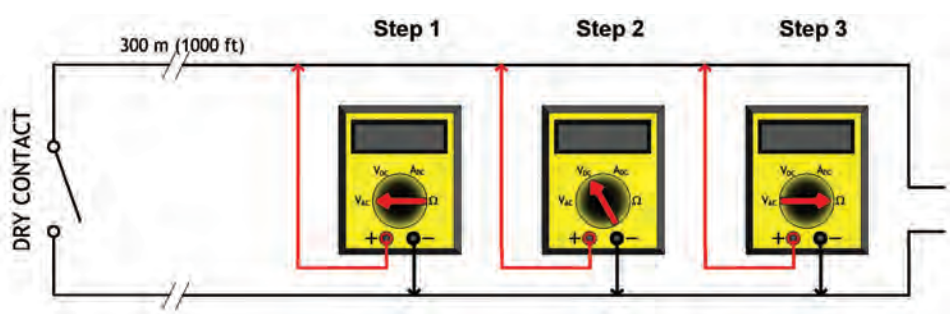

| Checkout Procedure | Measurement | Expected Value |
|---|---|---|
| Step 1 | Measure AC voltage across the voltage input. | Vac ≈ 0.0 V<br>AC voltage will affect further measurement. |
| Step 2 | Measure DC voltage across the voltage termination. | Compare the measured voltage with the expected value based on the manufacturer's specification and current conditions. |

- **Current Inputs**



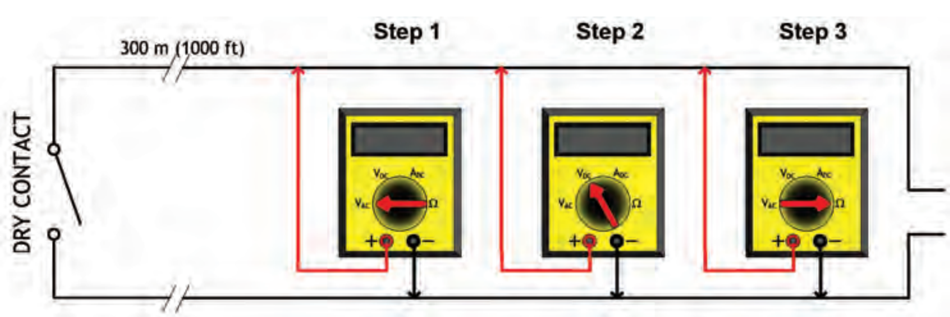

| Checkout Procedure | Measurement | Expected Value |
|---|---|---|
| Step 1 | Measure AC voltage across the current input. | Vac ≈ 0.0 V<br>AC voltage will affect further measurement. |
| Step 2 | Measure DC voltage across the current input. | Vdc ≈ 0.0 V |
| Step 3 | Measure the DC current across the current input. | Compare the measured current with the expected value based on the manufacturer's specification and current conditions. |

- **Binary Inputs, 24 Vac Detect**




| Checkout Procedure | Measurement | Expected Value |
|---|---|---|
| Step 1 | Measure AC voltage across the resistive termination. | Vac ≈ 0.0 V<br>AC voltage will affect further measurement. |
| Step 2 | Measure DC voltage across the resistive termination. | Vdc ≈ 0.0 V<br>DC voltage will affect further measurements. |
| Step 3 | Measure the resistance across the resistive termination. | |

- **Binary Inputs Based On Analog Output Connection**



| Checkout Procedure | Measurement | Expected Value |
|---|---|---|
| Step 1 | Measure AC voltage across the resistive termination. | Vac ≈ 0.0 V<br>AC voltage will affect further measurement. |
| Step 2 | Measure DC voltage across the resistive termination. | Vdc ≈ 0.0 V<br>DC voltage will affect further measurements. |
| Step 3 | Measure the resistance across the resistive termination. | |

## Wiring Requirements

**NOTICE**

**Equipment Damage!**

**Failure to follow instructions below could result in damage to the controller, power transformer, or input/output devices due to inadvertent connections to power circuits. Remove power to the controller before making input/output connections.**

| **Maximum Wire Lengths** | | |
|---|---|---|
| **Type** | **Inputs** | **Outputs** |
| Binary | 1,000 ft (300 m) | 1,000 ft (300 m) |
| 0–20 mA | 1,000 ft (300 m) | 1,000 ft (300 m) |
| 0–10 Vdc | 300 ft (100 m) | 300 ft (100 m) |
| Thermistor/Resistive | 300 ft (100 m) | Not Applicable |

**Notes:**

1. All wiring must be in accordance with the NEC and local codes.
2. Use only 18–22 AWG (1.02 mm to 0.65 mm diameter), stranded, tinned-copper, shielded, twisted-pair wire. Shielding is optional for binary inputs and analog 0 - 20 mA inputs.
3. 24 Vdc output wiring distances are dependent on the receiving unit specifications. Output wiring must comply with the receiving unit's wiring specifications.
4. DO NOT run input/output wires or communication wires in the same wire bundle with AC power wires.

## Providing Low-voltage Power for I/Os

The UC400 controller can provide low-voltage power to the inputs/outputs. More than one input or output can receive power from a given screw terminal as long as the total amount of power consumed does not exceed the terminal's limit. The UC400 controller requires 24 Vac, UL-listed, Class 2 power transformer. This section provides information about checking power budget consumption for the UC400 in an un-powered state.

### Calculating Power Consumption Rules

- Total available power is determined by the transformer rating. Use the following table as a guideline for the UC400 controller power consumption.
- Reserve 12 VA to power XM30 expansion modules.
- The total of the 24 Vac output and inputs should not exceed the remaining power. Refer to the following table for Power Budgets.

| Item | Sub[a] | VA Draw Per I/O (24 VAC) | Maximum Total VA Draw (24 Vac) |
|---|---|---|---|
| UC400 Board | UC400 controller (No input/output) | | 8 VA |
| | 5 x AI | 0.2 VA per AI | 1 VA |
| | 2 x UI | 0.13 VA per UI | 0.25 VA |
| | 2 x PI | 0.13 VA per PI | 0.25 VA |
| | 3 x BI | 0.17 VA per BI | 0.5 VA |
| | 2 x AO | 1 VA per AO | 2 VA |
| | 3 x BO (relay) | 1 VA per relay (no load) | 3 VA |
| | 6 x BO (TRIAC) | 0.34 VA per TRIAC (no load) | 1 VA |
| | **Subtotal for controller** | | **16 VA** |
| 24 Vdc Supply | 200 mA[b] | 1 VA per 25mA DC | 8 VA |
| | **Total for controller** | | **24 VA** |
| **Binary Outputs- Relay and TRIAC** | | | |
| BO1 to BO3 | Relay | Refer to the Device Connections table. | Refer to the Device Connections table. |
| BO4 to BO9 | TRIAC | 0.5 A - 12 VA@ 24 Vac | 12 VA Maximum |

(a) A: amp, AI: analog input, AO: analog output, BI: binary input, BO: binary output, PI: pressure input, UI: universal input, VA: voltage ampere, Vac: volts alternating current, Vdc: volts direct current

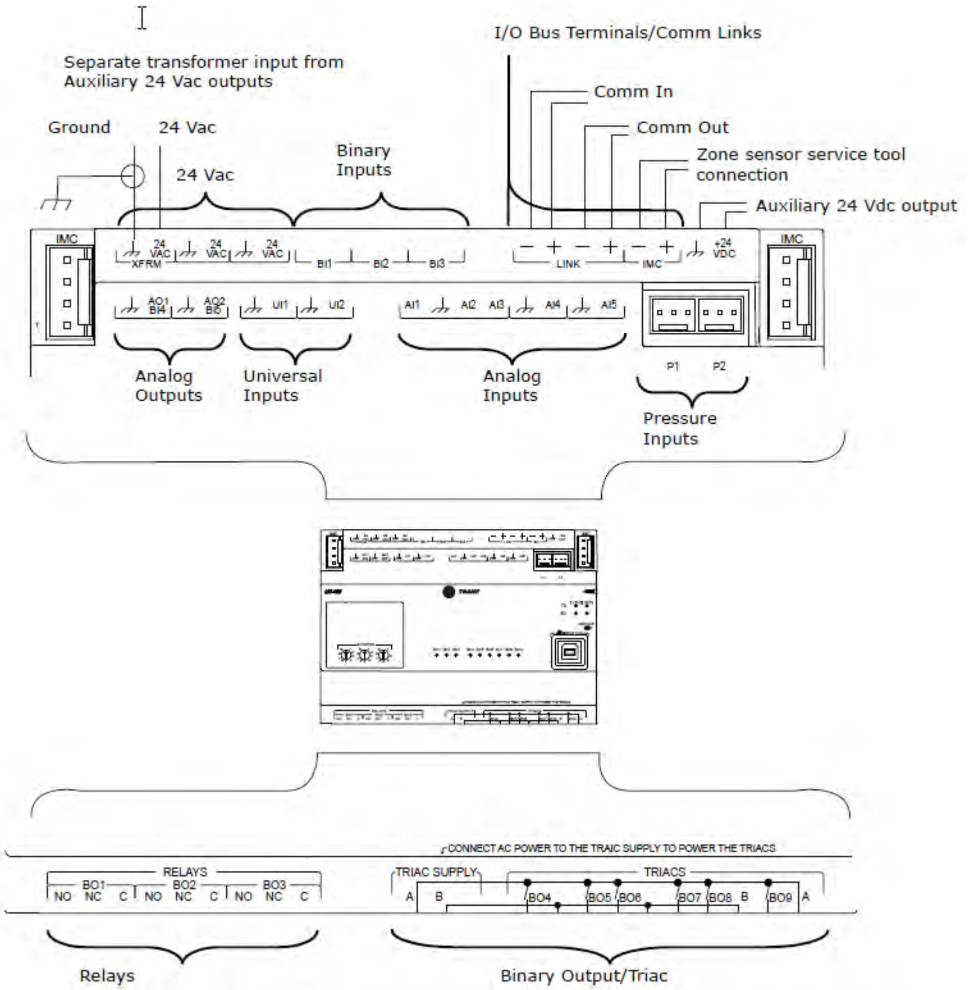
(b) Expansion Modules: If all analog outputs are configured for current and the devices are powered at the maximum current draw, then the XM30 maximum current draw is 115 mA. Do not exceed the UC400 controller 200 mA output limit.

## Terminal Locations

**NOTICE**

**Equipment Damage!**

**Failure to follow instructions below could result in damage to the controller, power transformer, or input/output devices due to inadvertent connections to power circuits. Remove power to the controller before making input/output connections.**




**Note:** The screw terminal blocks are not shown in this illustration, but they must be inserted before you can connect wires to the identified terminal locations.

## Pressure Transducer Inputs

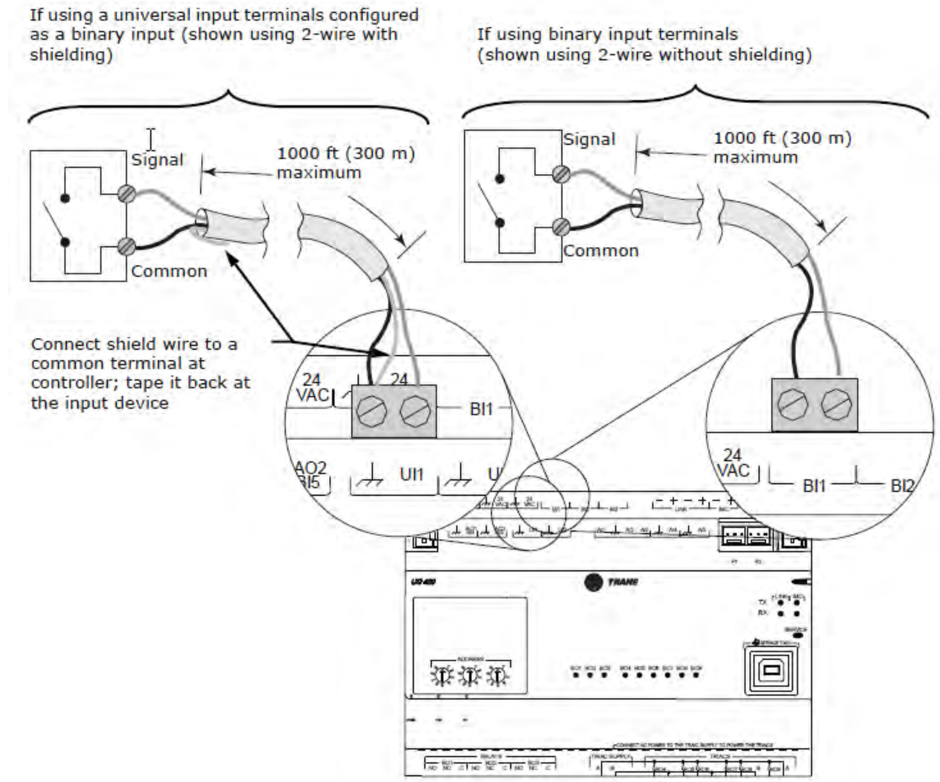
The pressure inputs P1 and P2 (shown in previous figure) are designed for 3-wire pressure sensor transducers, specifically Kavlico™ brand, which require 5 Vdc input.

***Important:*** *If using a different brand of pressure sensor transducer, contact Trane for help ensuring proper operation.*

- P1 is typically used alone in single-duct applications when only one pressure measurement is needed.
- P1 and P2 are typically used together in dual-duct applications when two pressure measurements are needed. Examples include dual-duct VAV control and duct pressure measurement.

## Binary Inputs

Connect to the binary inputs to monitor statuses such as fan on/off or alarm resets. The illustration below shows a typical wiring for binary inputs to either UI or BI terminals.



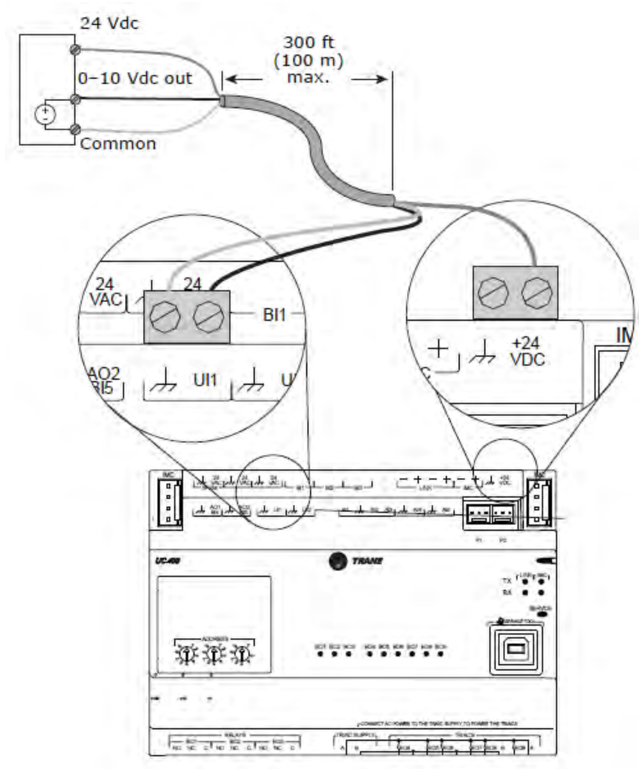

***Note:*** *Polarity is normally open (NO) or ON. However, you can use the Polarity control (toggle) on the Binary Input Point Configuration dialog box to reverse polarity to normally closed (NC) or OFF. For example, you might reverse polarity when using a binary input with a freeze stat to open the contacts to shut off power when a temperature declines to a given setpoint. Access the Point Configuration dialog box from either the Tracer TU Controller Settings Utility Binary point list screen or the right-click menus on the Tracer TU Status Utility Binary point list screen.*

1. Connect the common wire to a common terminal as shown below.

   ***Note:*** *Because the common terminals are in parallel, wiring can be made to any common terminal.*
2. Connect the shield wire (if present) 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.
4. Use the Tracer TU service tool to configure the input for binary operation.

## 0–10 Vdc Analog Inputs

The two universal inputs can be used to receive a 0–10 Vdc analog signal from sensors such as indoor air quality sensors and pressure sensors. The illustration below shows a typical wiring for analog inputs, 0–10 Vdc.

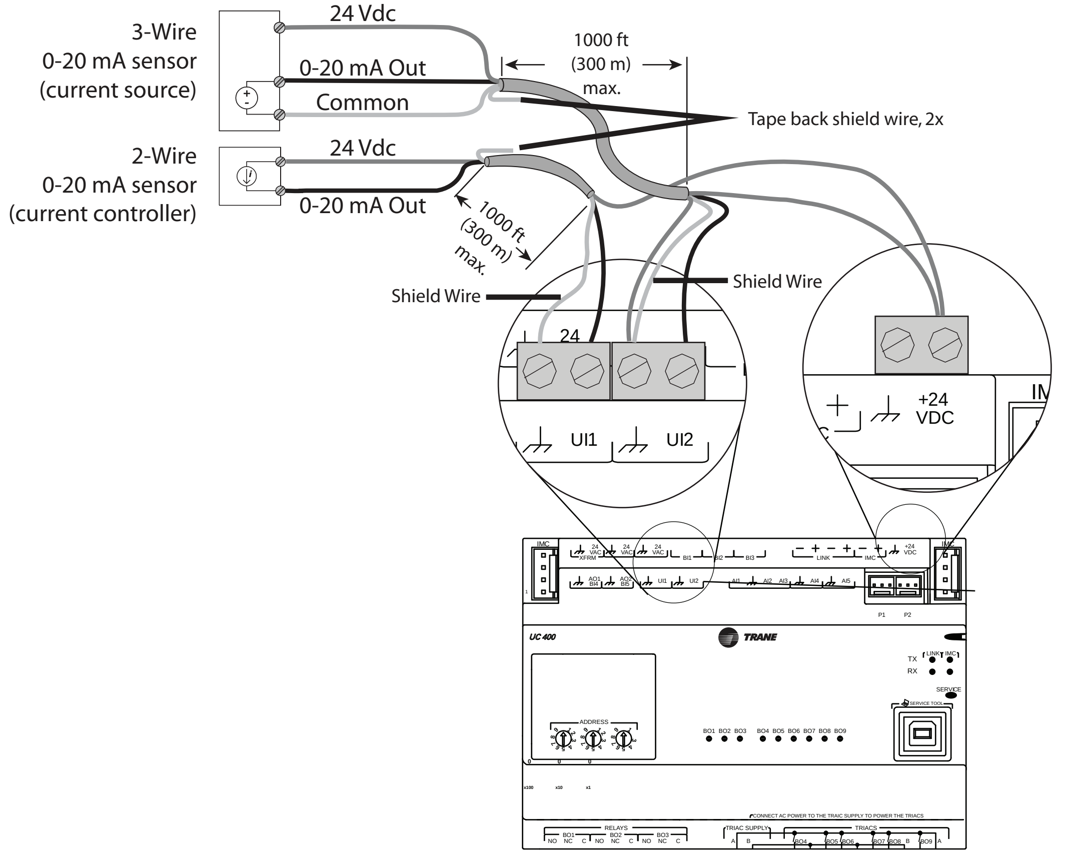



To wire a 0–10 Vdc analog input:

1. Connect the shield wire (as common connection) to a common terminal as shown in Figure 12.
2. Connect the signal wire to an available input terminal.
3. Connect the supply wire to a 24 Vdc or 24 Vac terminal as required.
4. Use the Tracer TU service tool to configure the universal input for analog operation.

## 0–20 mA Analog Inputs

The universal inputs can be used to receive a 0–20 mA analog signal from sensors such as humidity sensors and pressure sensors. The illustration below shows a typical wiring for analog inputs, 0–20 Vdc.




To wire a 0–20 mA analog input:

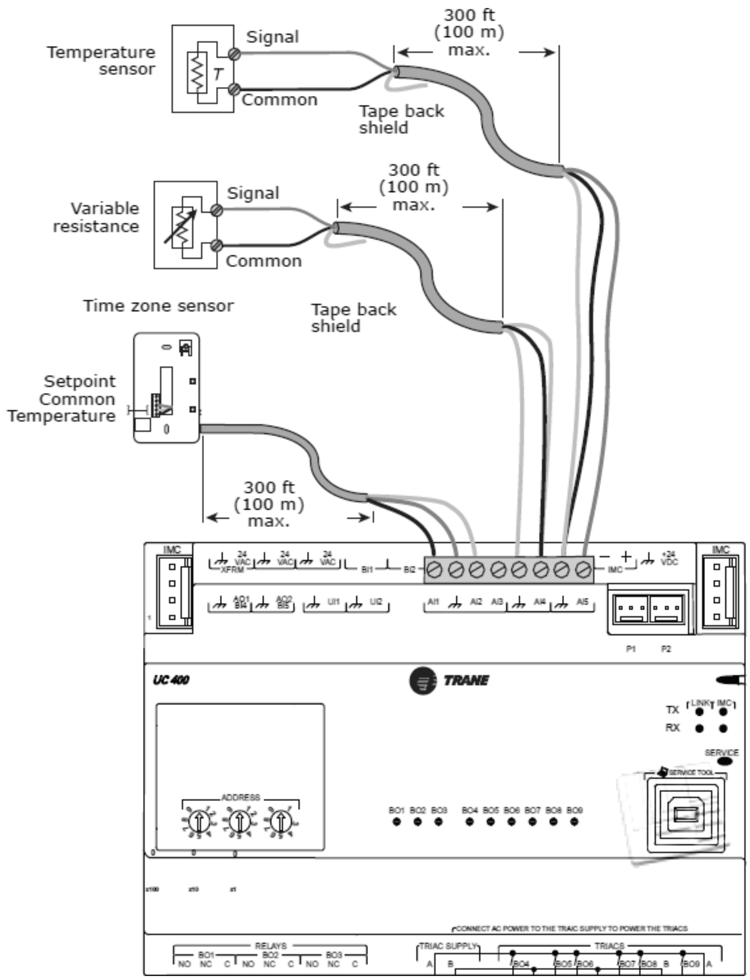
1. Connect the shield to a common terminal at the terminal board and tape it back at the input device.

   ***Note:*** *Do not use the shield as the common connection. For 3-wire applications, use a 3-conductor cable with shield and for 2-wire applications, use a 2-conductor cable with separate shield.*

2. Connect the signal wire to an available universal input terminal.
3. Connect the supply wire to a 24 Vdc or 24 Vac terminal as required.
4. Use the Tracer TU service tool to configure the universal input for analog operation.

## Variable Resistance Analog Inputs

Variable resistance analog inputs include 10K thermistors, resistive, and setpoint thumb wheels on zone sensors. The illustration below shows a typical wiring for analog inputs, variable resistance.




| Zone Sensor Output | UC400 Termination | Type | Range |
|---|---|---|---|
| Zone Temp | AI1 | Thermistor | 10k Ω |
| Zone Temp Setpoint | AI2 | Setpoint | 189 Ω-889 Ω |
| Fan Mode | AI3 | Resistive | 100 Ω-100k Ω |
| Comm+[a] | IMC+ | | |
| Comm- | IMC- | | |

(a) For Comm+/- wiring, use 18 AWG, shielded, twisted-pair wire.

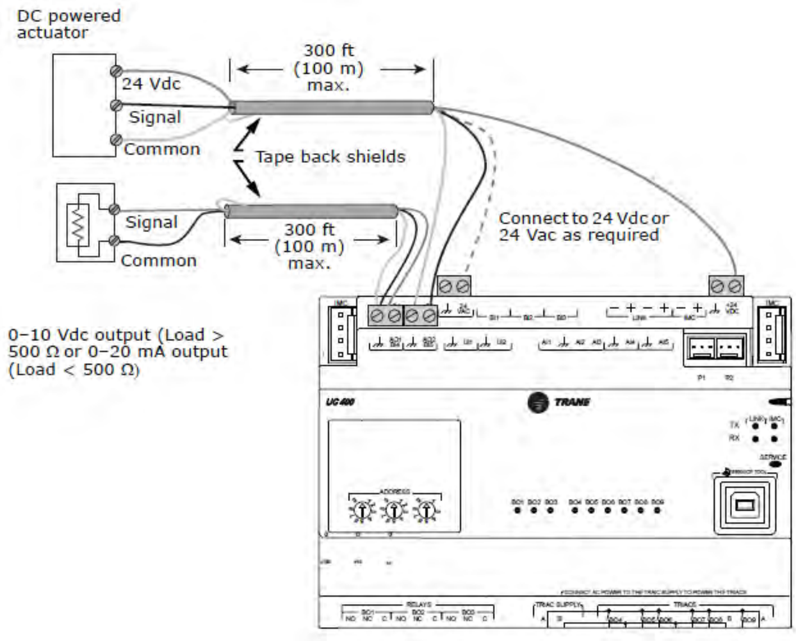
1. Connect the shield to a common terminal at the terminal board and tape it back at the input device.

   ***Note:*** *Do not use the shield as the common connection. For 3-wire applications, use a 3-conductor cable with shield and for 2-wire applications, use a 2-conductor cable with separate shield.*

2. Connect the signal wire to an available input terminal.
3. .Use the Tracer TU service tool to configure the input for analog operation.

## Analog Outputs

The UC400 has two analog outputs. These outputs can be used for 0–10 Vdc outputs or 0–20 mA outputs, which can control actuators or secondary controllers. Output wiring specifications must comply with the receiving device wiring requirements. The illustration below shows a typical wiring for analog outputs.



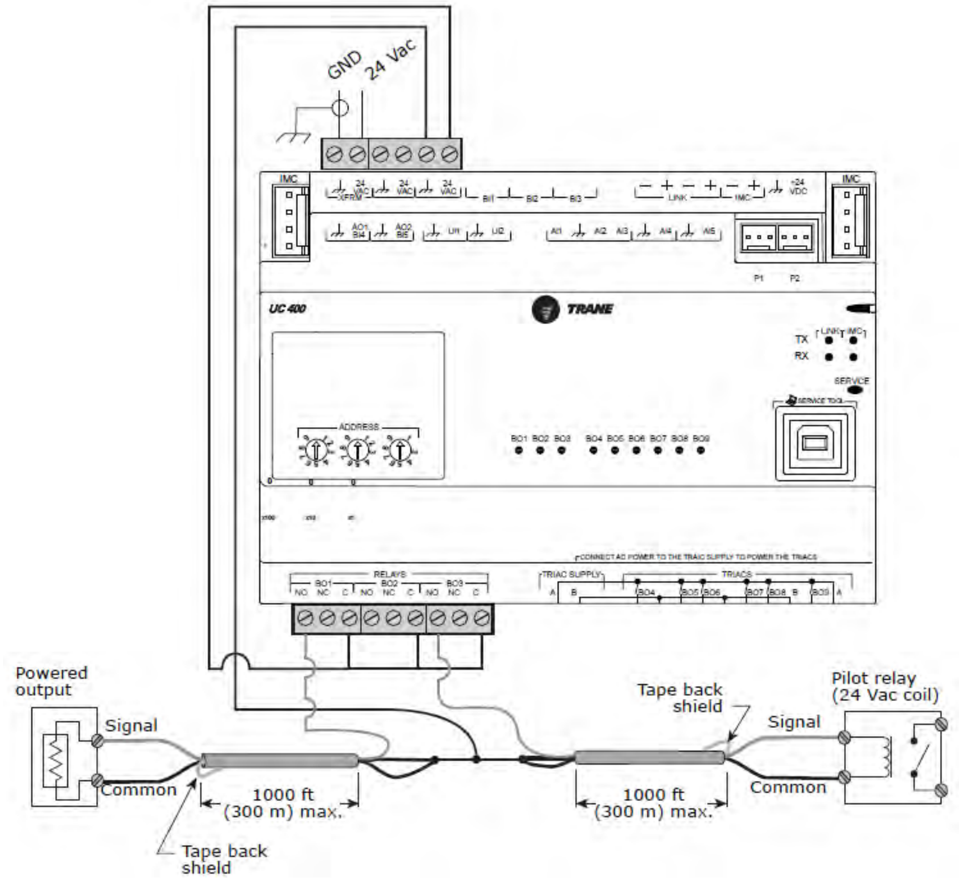

1. Connect the shield to a common terminal at the terminal board and tape it back at the input device.

   ***Note:*** *Do not use the shield as the common connection. For 2-wire applications, use a 2-conductor cable with separate shield.*

2. Connect the signal wire to an available output terminal.
3. Connect the supply wire to a 24 Vdc or 24 Vac terminal as required.
4. Use the Tracer TU service tool to configure the input for analog operation.

## Relay (Dry Contact/Binary Outputs)

The UC400 has three relay binary outputs used as powered outputs. All outputs are isolated from one another and from the ground and power. The illustration below shows a typical wiring for relays, binary outputs.




***Note:*** *Output wiring specifications must comply with the receiving device wiring requirements.*

***Important:*** *Inrush Current and Controlling Coil-based Loads: Inrush current (the initial surge of a current into a load before it attains normal operating condition) can be more that three times greater than the operating current.*

*Use pilot relays for dry contact outputs for load currents greater than 0.5 amperes and use powered outputs for load currents less than 0.5 amperes.*

To wire relay binary outputs:

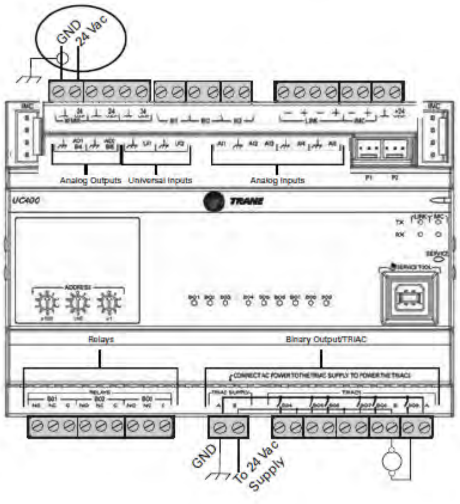
1. Connect the shield to a common terminal at the terminal board and tape it back at the output device.
2. Connect the signal wire to an available output terminal.
3. Use the Tracer TU service tool to configure the input for binary operation.

   ***Note:*** *Polarity is normally open (NO) or ON. However, you can use the Polarity control (toggle) on the Binary Output Point Configuration dialog box to reverse polarity to normally closed (NC) or OFF.*

## TRIAC Wiring

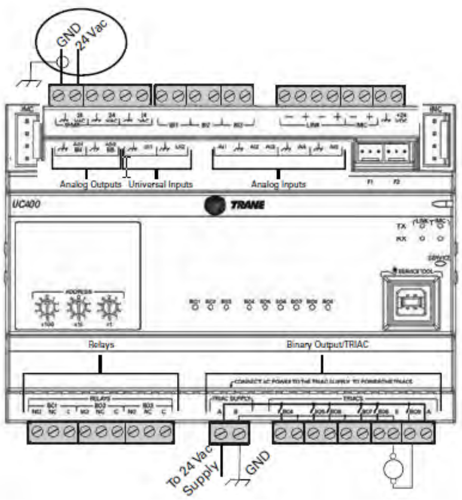
The UC400 has six (6) TRIAC binary outputs. The following illustrations show wiring to TRIAC binary outputs (low/high).

Low Side Switching




**Note:** *The benefit of using low side switching is to minimize the risk of burning up binary outputs due to inadvertent shorts to the ground* ⏚ .

High Side Switching

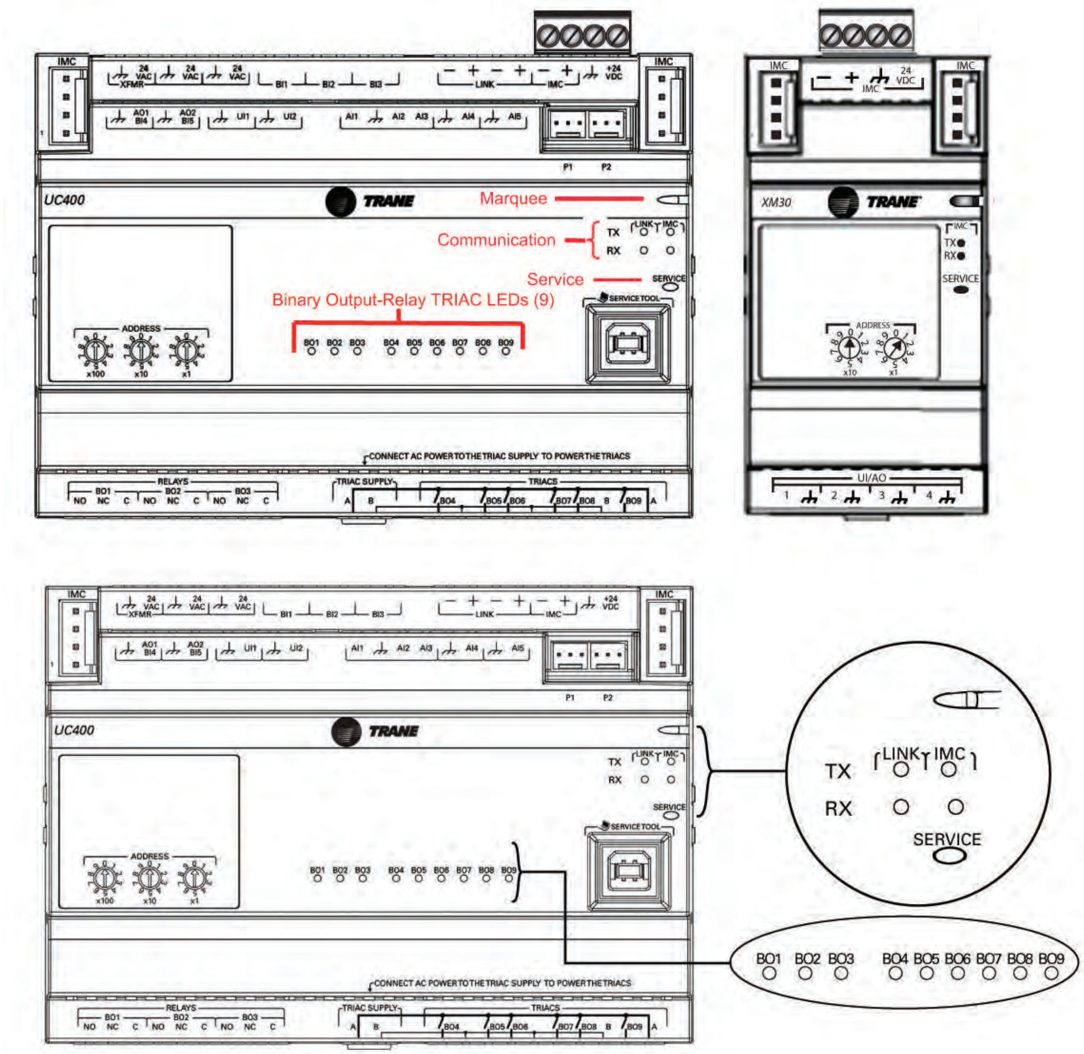


# Operation

## LED Locations

The UC400 and XM30 expansion module have the following LEDs located on the front (refer to the following illustration):

- Marquee LED
- Communication Status LEDs and IMC Status LEDs
- Service Button LED
- Binary Output Relay (3)/TRIAC (9) Status LEDs (only the UC400)




## LED Descriptions, Activities, and Troubleshooting

The following table provides a description of LED activity, an indication or troubleshooting tip for each, and any relative notes.

| LED Name | Activities | Indication and Troubleshooting Tips | Notes |
|---|---|---|---|
| Marquee LED | Shows solid green when the unit is powered and no alarm exists. | Indicates normal operation | When powering the UC400 and expansion module, the Marquee LED will blink RED, blink GREEN (indicating activated and controller/expansion module are communicating), and then stay GREEN CONTINUOUSLY (indicating normal power operation). |
| | Shows blinking green during a device reset or firmware download. | Indicates normal operation | |
| | Shows solid red when the unit is powered, but represents low power or a malfunction. | • If low power; could be under voltage or the microprocessor has malfunction. Follow the troubleshoot procedure "24 Vac Measurement," p. 46 to measure for the expected value range. In addition, see Table 4, p. 24, for a list of 24 Vac draws.<br>• If malfunction; un-power and then re-power unit to bring the unit back up to normal operation. | |
| | Shows blinking red when an alarm or fault exists. | An alarm or fault condition will occur if the value for a given point is invalid or outside the configured limits for the point. Alarm and fault conditions vary, and they can be configured by the programmer. | |
| | LED not lit. | Indicates power is OFF or there is a malfunction.<br><br>OFF or malfunction; cycle the power. | |
| Link and IMC | TX blinks green. | Blinks at the data transfer rate when the unit transfers data to other devices on the link. | TX LED: Regardless of connectivity or not, this LED will constantly blink as it continually looks for devices to communicate to.<br><br>LED not lit: Determine if, for example, a Tracer Synchrony or BACnet device is trying to talk to the controller or if it is capable of talking to the controller. Also determine if the communication status shows down all of the time. In addition, check polarity and baud rate. |
| | RX blinks yellow. | Blinks at the data transfer rate when the unit receives data from other devices on the link.<br><br>ON solid yellow; indicates there is reverse polarity. | |
| | LED is not lit. | Indicates that the controller is not detecting communication.<br><br>Not lit; cycle the power to reestablish communication. | |

| | | | |
|---|---|---|---|
| Service | Shows solid green when the LED has been pressed. | | When the UC400 is placed into boot mode, the system will not run any applications such as trending, scheduling, and TGP2 runtime. The controller will be placed into boot mode if the service pin is held in when power is applied. In boot mode, the controller is non-operational and is waiting for a new main application to be downloaded. |
| | LED not lit. | Indicates controller is operating normally. | |
| Binary B01 through B09 | Shows solid yellow. | Indicates a corresponding binary output has been commanded ON<br>• Relay coil; indicates that a command has been made to energize<br>• TRIAC; indicates that a command has been made to turn ON. | If the user is currently powering the UC400 from a USB port, the Led lights will turn ON. However, the binary outputs will not be activated.<br><br>Commanded ON; As an example of commanded ON, a command could be a manual command such as an override or a command could be from TGP2 based on a list of conditions that are met telling these outputs to turn ON.<br><br>LED not lit: Did the user command it to be ON? If yes, see the Marquee LED at the top of this table. |
| | LED not lit. | Indicates that a relay output is de-energized or no power to the board<br><br>Not lit; cycle power to reestablish communication. | |

# Configuration and Maintenance

The Tracer TU service tool is used to configure and maintain a UC400 (refer to the following Tasks 1 through 9). Because the UC400 is a self-serviceable unit, this device is not intended to be disassembled by the user for maintenance. This manual assumes the user has basic knowledge of using the Tracer TU service tool. Tracer TU operations, such as connecting to a controller directly using a USB cable or connecting indirectly using Tracer SC pass-through and starting a Tracer TU session are explained in the Tracer TU Getting Started Guide (TTU-SVN02). It is included on the Tracer TU installation CD. In addition, you can refer to the Tracer TU Connection Online Help.

## Task 1; Load Application Code on a Blank UC400

All UC400 controllers ship without application code.

1. Start the Tracer TU service tool to establish a connection with the UC400. If no firmware is present, the following message displays, *The UC400 controller has no application code loaded. Please launch File Transfer wizard and load an appropriate configuration*.
2. Click **OK**. To load or upgrade the firmware, follow the procedure in the topic *Upgrading Controller Firmware* under the *Managing Configurations, Firmware, and Programs* in the Online Help.

## Task 2; Choose a UC400 Configuration Option

1. Become familiar with the parts of a UC400 configuration. Refer to topic *The Main Parts of Device Setup and Configuration* in the *An Overview of Device Setup and Configuration* of the Tracer TU Online Help for Programmable Controllers.
2. Read *Point Configuration Overview* in the *Configuring and Managing Points* of the Online Help for an explanation of your configuration options. In addition, read the linked topics relevant to the approach you want to take.

   You have two main configuration options:

   - Use the Tracer TU Configuration Screen to create a factory configuration.

     ***Note:*** *You can make some modifications to Trane factory blower coil, fan coil, or unit ventilator configurations. Refer to the topic, An Overview of Editable Factory Configurations under the Configuring and Commission Equipment > Trane Factory Blower Coils, Fan Coils, and Unit Vents.*

   - Create or edit a custom (field programmed) configuration.

## Tack 3; Specify Controller Settings

Complete the following tasks:

- Configure units of measure.
- Specify controller date and time.
- Specify the baud rate, if other than the default (76800).

For procedural information, refer to the topic, *Modifying Controller Settings* in the Online Help.

## Task 4; Setup and Discover XM30, XM32, XM70, XM90 Expansion Modules

1. Mount, wire, address, and power the expansion module as described in the Installation Instructions that accompany the unit. Refer to the topic, Setting Up And Discovering Expansion Modules under the Modifying Controller Settings of the Online Help.
2. Set up the module(s) using the controls on the Expansion Modules box on the Controller Settings screen.

***Note:*** *If adding an expansion module on the Controller Settings page, but the module is not connected to the controller, you will have to discover it on the Controller Status screen after it is connected and powered.*

# Task 5; Specifying an Equipment Configuration

Go to the information sources supporting one of the following options that was chosen:

**Option 1: Use the Tracer TU Configuration screen to create a factory configuration.** Refer to the topics, *VAV Boxes*, *Trane Factory Blower Coils, Fan Coils, and Unit Vents*, or *Variable Speed Water Source Heat Pumps* in the Onlne Help.

**Option 2: Create a Custom Configuration.**

This option requires a thorough knowledge of the devices and the network you are installing, including an understanding of the TGP2 programs and the points they use.

1. Create points or open a previously created points file, make any edits, and save them to the UC400.

   ***Note:*** *You can create, edit, and load points, either in Tracer TU, or in the TGP2 Editor. (See the Configuring and Managing Points TOC book in the Tracer Graphical Programming (TGP2) Editor Help.)*

   Be aware of the maximum point counts as shown in the following table.

| Type | Number |
|---|---|
| Analog Input | 40 |
| Analog Output | 16 |
| Analog Value | 128 |
| Binary Input | 32 |
| Binary Output | 24 |
| Binary Value | 48 |
| Multistate Input | 8 |
| Multistate Output | 8 |
| Multistate Value | 32 |

2. Specify setpoint values and equipment parameters on the Setpoints and Setup Parameters screens (Equipment Utility).

   ***Note:*** *You will supply the necessary TGP2 programs after you commission the hard-wired points. Refer to the following Task 7.*

# Task 6; Commissioning the Hard-wired Points

After you have all points configured, saved, and downloaded to the controller, you are ready to commission or test them by overriding Output and Value points. Refer to the topics under the *Overriding, Comparing, and Changing the Service Status of Points* of the Online Help.

# Task 7; Modify and Create TGP2 Progams (As Needed)

Now that you have the hardware points in place and tested, you can create or edit TGP2 programs that will run the equipment according to the sequence of operations specified for your job. (See the topics under the “Developing and Managing TGP2 Programs” TOC book in the Tracer Graphical Programming (TGP2) Editor Help for programming procedures. Also see the “TGP2 Block Reference” TOC book to learn how the various blocks work and for information about their properties. For more information about TGP2 programming instruction, refer to the Tracer Graphical Programming (TGP2) Applications Guide, BAS-APG008-EN.

## Task 8; Monitoring/Viewing Point, Alarm, and Controller Status

Refer to the topics under *Viewing the Status of Points and Alarms* in the Online Help.

## Task 9; Backing Up/Restoring Files and Configurations

Upload, back up, replace, or update configuration files, controller firmware, and TGP2 programs using the File Transfer Utility and the Backup Utility. Refer to the topics under Managing Configurations, Firmware, and Files in the Online Help.

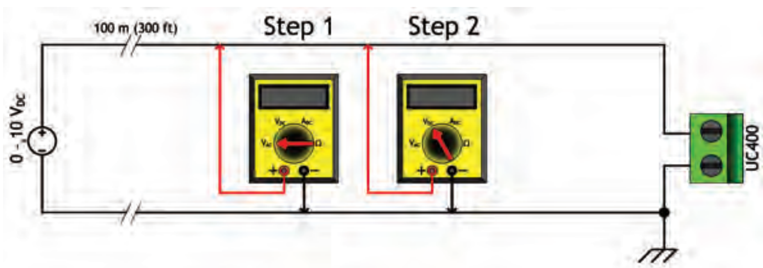
# Commissioning and Troubleshooting in Powered State

This section provides illustrations and methods about how to check the UC400 points after making connection and applying power (indicated in each illustration by the terminal connector and UC400 label). The step numbers or method numbers in each illustration correspond to the information in each table.

To test inputs/outputs requires a digital multimeter and a small flat-tip screwdriver.

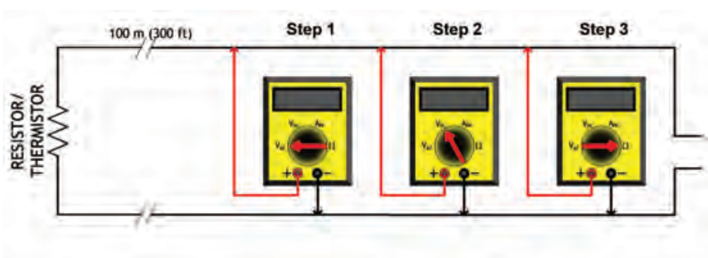
***Note:*** *The Out of Service and Override features in Tracer TU can be used to simulate operation for testing the input/output interaction. By placing a point out of service or overriding at the priority required for control, the user can enter a value for the point sufficient to trigger a reaction at the output based on the TGP2 logic controlling the output.*

## Voltage Inputs

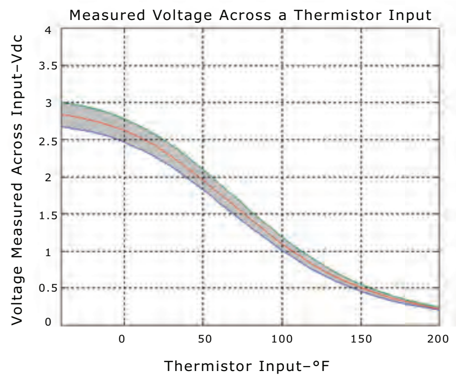


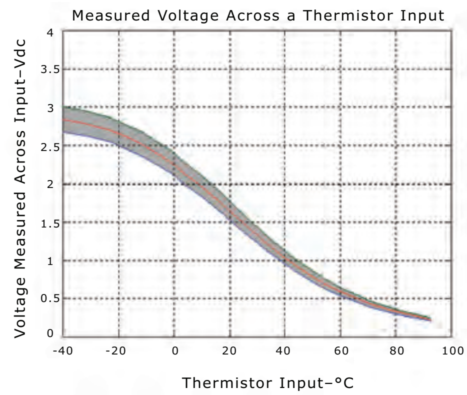

| Checkout Procedure | Measurement | Expected Value |
|---|---|---|
| Step 1 | Measure AC voltage across the voltage termination | Vac ≈ 0.0 V<br><br>AC voltage will affect further measurement |
| Step 2 | Measure DC voltage across the voltage termination | Compare to input status in Tracer TU |

## Resistive Inputs

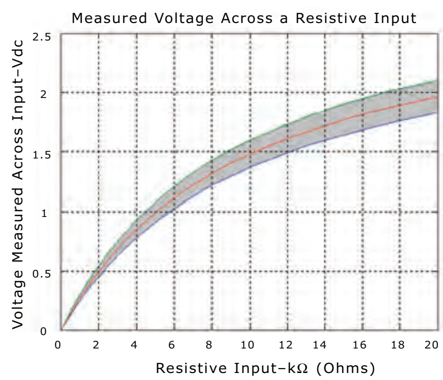



| Checkout Procedure | Measurement | Expected Value |
|---|---|---|
| Step 1 | Measure AC voltage across the resistive termination | Vac ≈ 0.0 V<br><br>AC voltage will affect further measurement |
| Step 2 | Measure DC voltage across the resistive termination | See the charts below |

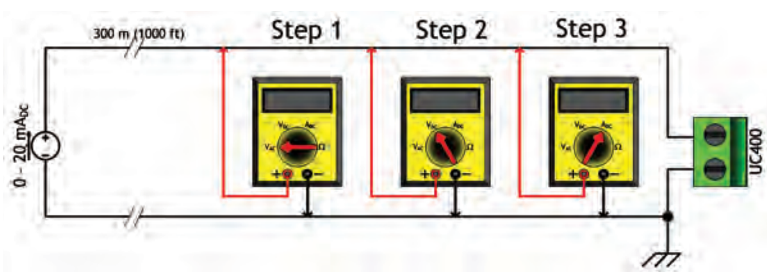


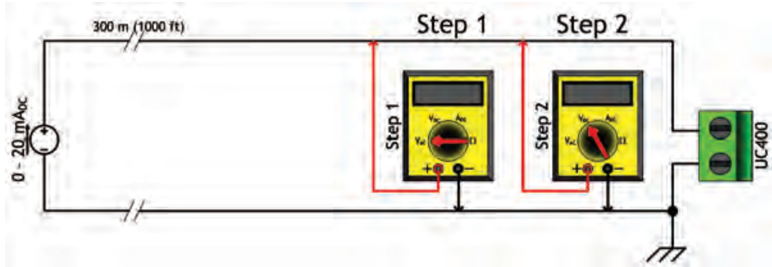

Charts showing measurements across thermistor input (Fahr/Celsius) and resistive input.



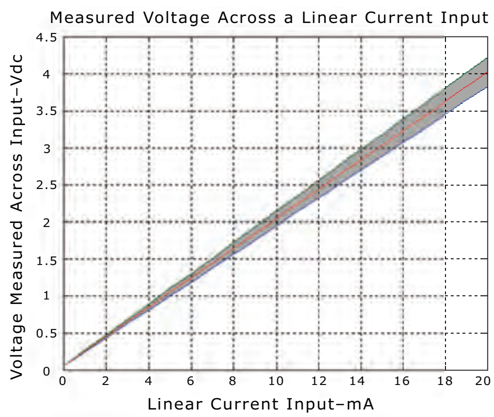

## Current Inputs, Methods 1 or 2



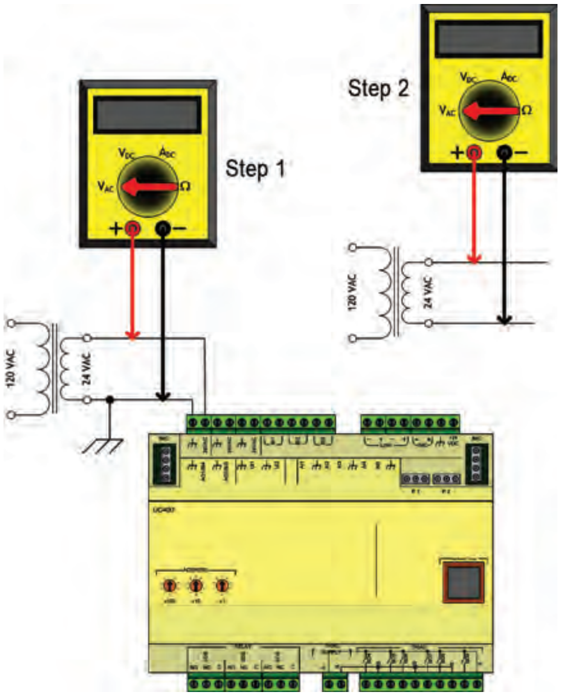

| General Information | Checkout Procedure | Measurement | Expected Value |
|---|---|---|---|
| Method 1 takes advantage of the very low input resistance of a DMM in current measurement mode. However, this method affects the value of the UC400 will use while controlling outputs. When the meter is set to current mode, the current flowing into the UC400 circuit will drop to zero or near zero. | Step 1 | Measure AC voltage across the current input | Vac ≈ 0.0 V<br><br>AC voltage will affect further measurement |
| | Step 2 | Measure DC voltage across the current input | Vdc ≈ 0.0 V |
| | Step 3 | Measure DC current across the current input | Compare to input status in Tracer TU |




| General Information | Checkout Procedure | Measurement | Expected Value |
|---|---|---|---|
| Method 2 interferes less in regards to the system. In voltage mode, the DMM affects the circuit less. Additional information is needed to translate the voltage measured to current flowing through the circuit. | Step 1 | Measure AC voltage across the voltage input | Vac ≈ 0.0 V<br><br>AC voltage will affect further measurement |
| | Step 2 | Measure DC voltage across the voltage termination | See the chart below |

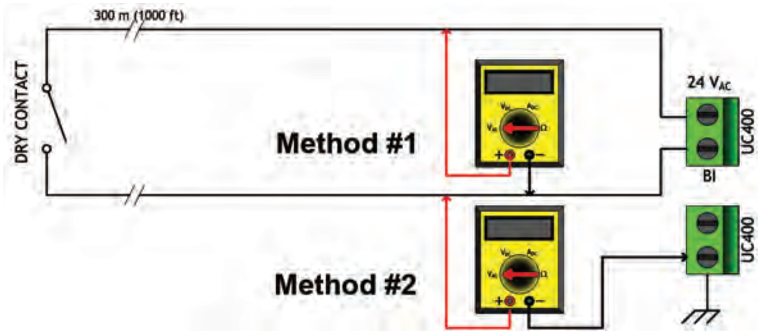


# 24 Vac Measurement



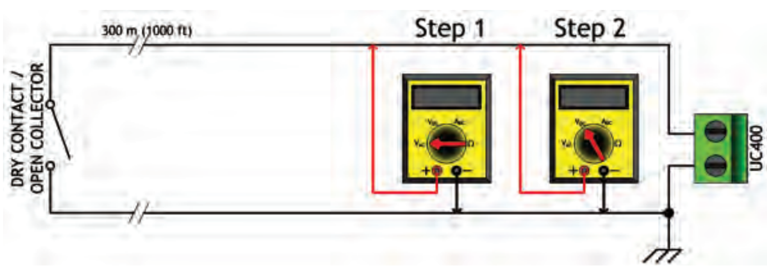

| General Information | Checkout Procedure | Measurement | Expected Value |
|---|---|---|---|
| Checking the voltage that is powering the UC400 is often a necessary step when commissioning or troubleshooting. Operational issues and LED operation may result in a need to measure the input power. When troubleshooting, it is faster to take measurements while the load is in place. If Step 1 indicates an out-of-specification voltage, disconnect the UC400 and measure the AC voltage across the transformer. These measurements can direct the technician towards the problem source. | Step 1 | Measure AC voltage with the UC400 connected. Perform this measurement while the unit is under load. | 20.0 Vac ≤ Vac ≤ 30.0 Vac |
| | Step 2 | Measure AC voltage with the UC400 unconnected. Perform this measurement while the unit is not under load. | 20.0 Vac ≤ Vac ≤ 30.0 Vac |

# Binary Inputs, 24 Vac Detect, Method 1 or 2



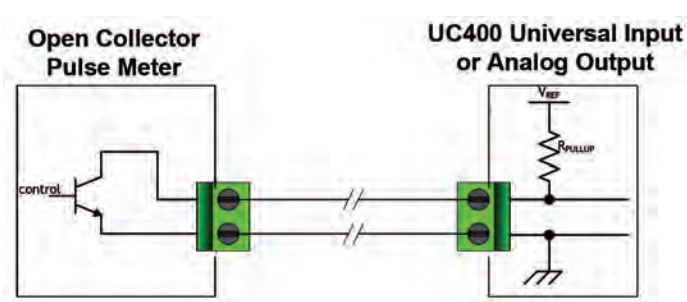

| General Information and Checkout Procedure | Measurement | Expected Value |
|---|---|---|
| Method 1: Voltage across binary input measured without reference to chassis ground. | Measure AC voltage across the binary input | Vac ≈ 24.0 V (state = OFF)<br>Vac ≈ 0.0 V (state = ON) |
| Method 2: Voltage across binary input measured with reference to chassis ground. Any connection with chassis ground symbol can serve as a ground reference for this method. | Measure DC voltage across the binary input | Vac ≈ 0.0 V (state = ON)<br>Vac ≈ 24.0 V (state = OFF) |

# Binary Inputs, Based on Analog Output Connection




| General Information | Checkout Procedure | Measurement | Expected Value |
|---|---|---|---|
| The UC400 analog output connections can be configured as binary inputs. This can be used only with dry contact or open collector-type sensors. | Step 1 | Measure AC voltage across the binary input | Vac ≈ 0.0 V<br>AC voltage will affect further measurement |
| | Step 2 | Measure DC voltage across the binary input | Vdc ≤ 2.0 V (state = ON)<br>Vfc ≤ 2.0 V (state = OFF) |

# Open-collector Based Binary Sensors



| Measurement Procedure | Expected Value |
|---|---|
| Measure DC voltage across the binary input | Vdc ≤ 0.2 V (BJT = ON)<br>UI: Vdc ≈ 3.3 V (BJT = OFF)<br>AO: Vdc ≈ 22.0 V (BJT = ON) |

Open-collector based binary sensors use a bipolar junction transistor (BJT; a three-terminal device in which emitter-to-collector current is controlled by base current) as the switching device in place of a relay. The term, open collector, refers to the collector connection on the transistor itself. Open-collector circuits are used for their low fatigue rate and quick response relative to relay-based outputs. The circuit within the pulse meter is completed when adding a pull-up resistance and reference voltage. On the UC400, both universal input (UI) and analog output (AO) circuits add the necessary resistance and voltage without external parts.

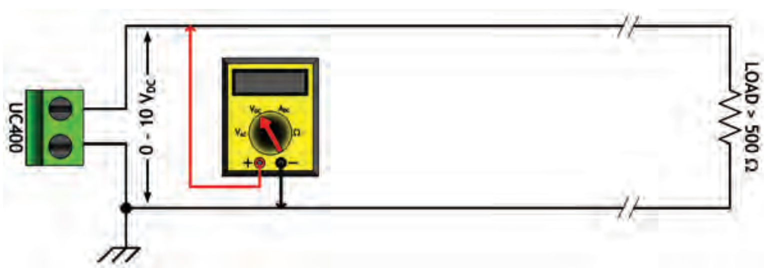
***Note:*** *The reference voltage must always be DC.*

The voltage across the pulse meter terminals will bounce between Vsat (saturation voltage) of the transistor in the pulse meter and the Vref (reference voltage) provided by the UI or AO circuits of the UC400. Most bipolar transistors have a Vsat of less than 0.2 Vdc.

The DMM sampling rate may be too slow to measure pulse meter output transitions.

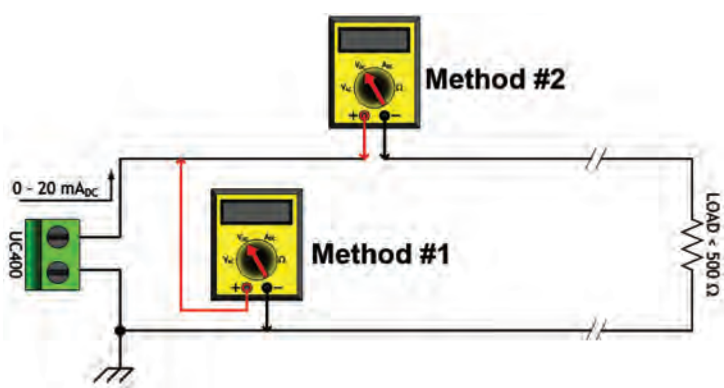
***Note:*** *Check the specifications of the DMM being used. It may be necessary to use an oscilloscope to measure the transition voltages.*

## Voltage Analog Output



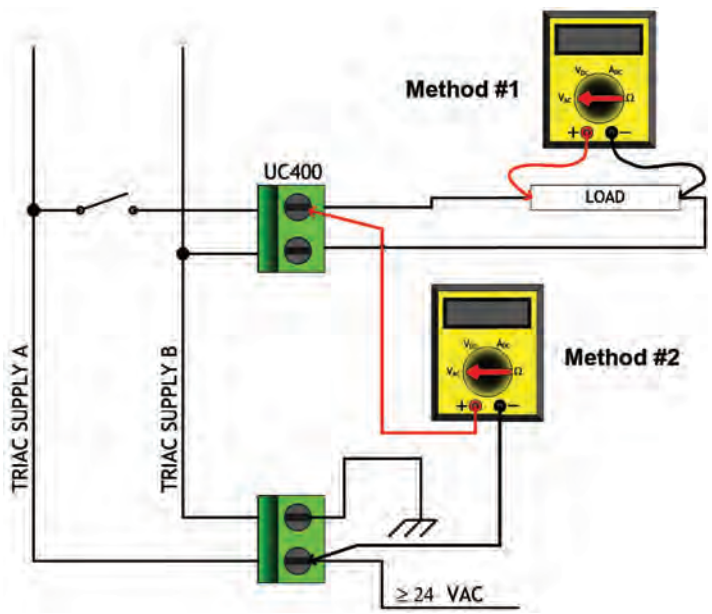

| Measurement Procedure | Expected Value |
|---|---|
| Measure DC voltage across the voltage termination | Compare to the expected value based on request from controller. This request may be based on an override of the output value. |

## Current Analog Output, Methods 1 or 2



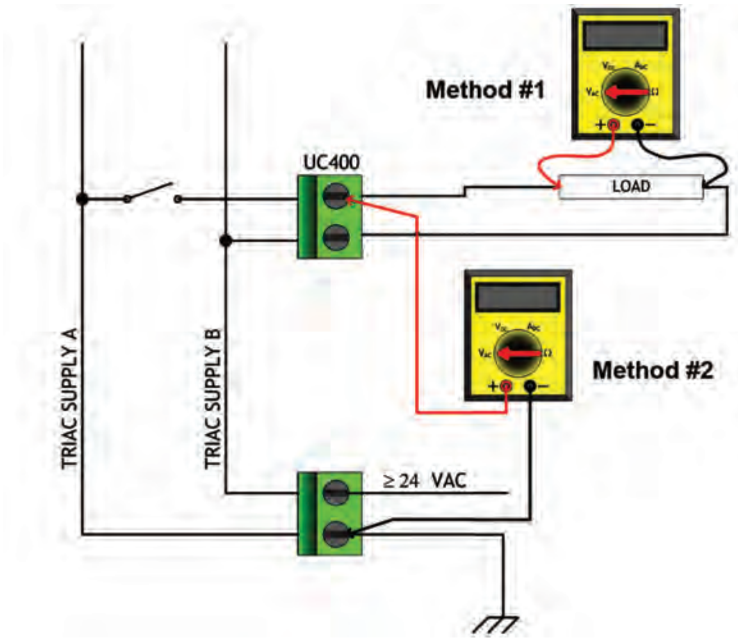
| General Information and Checkout Procedure | Measurement | Expected Value |
|---|---|---|
| Method 1: Shorting the current output- this method leaves the circuit intact, however, it will cause the vast majority of the current to flow through the meter instead of the load (NOTE LOAD RESISTANCE). | Measure DC current across the current termination | Compare expected value based on request from controller. This request may be based on an override of the output value. |
| Method 2: Measuring current directly- this method is most the typical way to measure current and has the advantage of leaving the load in the loop. However, the circuit must be broken when using this method. | Measure DC current across the current termination | Compare expected value based on request from controller. This request may be based on an override of the output value. |

# Binary Output, TRIAC High Side Switching, Methods 1 or 2



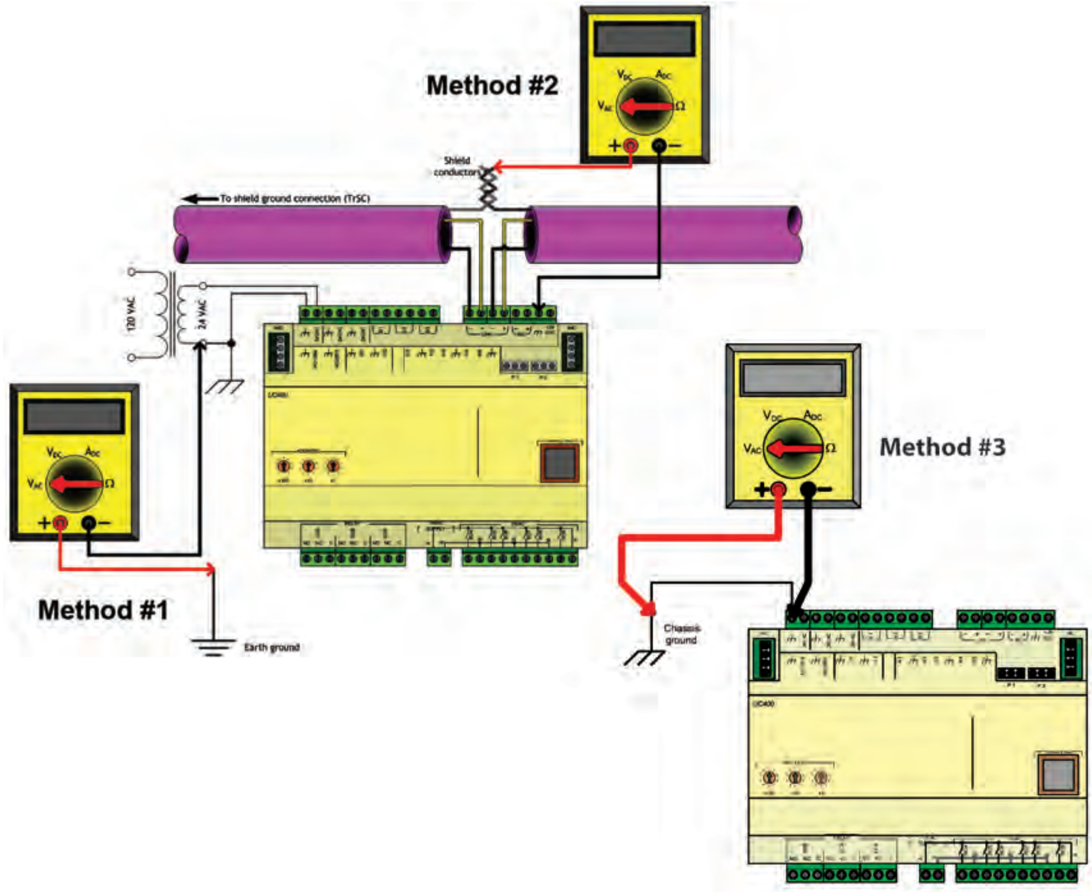

| Checkout Procedure | Measurement | Expected Value |
|---|---|---|
| Method 1 | Measure AC voltage across the binary output | Vac ≈ 0.0 V (TRIAC = OFF)<br>Vac ≥ 24.0 V (TRIAC = ON) |
| Method 2 | Measure AC voltage across the binary input | Vac ≈ 0.0 V (TRIAC = ON)<br>Vac ≥ 24.0 V (TRIAC = OFF) |

## Binary Output, TRIAC Low Side Switching, Methods 1 or 2




| Checkout Procedure | Measurement | Expected Value |
|---|---|---|
| Method 1 | Measure AC voltage across the binary output | Vac ≈ 0.0 V (TRIAC = OFF)<br>Vac ≥ 24.0 V (TRIAC = ON) |
| Method 2 | Measure AC voltage across the binary input | Vac ≈ 0.0 V (TRIAC = ON)<br>Vac ≥ 24.0 V (TRIAC = OFF) |

# Ground Measurements




| General Information and Checkout Procedure | Measurement | Expected Value |
|---|---|---|
| Method 1: AC voltage between shield conductors and device chassis ground- the voltage difference between BACnet MS/TP device chassis ground connections should be close to zero. If the voltage difference is greater that 4.0 Vac, there will be marginal communication or intermittent communication problems. If the voltage difference is greater that 7.0 Vac, some devices will no longer communicate. | Measure AC voltage across the voltage termination and confirm that only one end of the shield conductor is tied to the earth ground | Vac ≤ 2.0 V |

| | | |
|---|---|---|
| Method 2: AC voltage between earth ground and device chassis ground- the chassis ground of the UC400 needs to be connected to earth ground by some route.<br>Do not assume that the building frame is a valid earth ground. | Measure AC voltage across the voltage termination and confirm that only one end of the shield conductor is tied to the earth ground | Vac ≤ 4.0 V<br><br>(Must comply with National Electrical Code™ and local electrical codes) |
| Method 3: AC voltage between case (nominal chassis ground) and device chassis ground connector- in this illustration the connection appears as a short. However, it is possible that the chassis ground connection on the controller may actually be connected to the equipment metal some distance away. Use this measurement method if there are communication issues or input stability problems. | Measure AC voltage across the voltage termination. For this measurement, confirm that only one end of the shield conductor is tied to the earth ground. | Vac ≤ 4.0 V<br><br>(Must comply with National Electrical Code™ and local electrical codes)<br><br>Typically, this should be Vac ≤ 1.0 V |

# Resources

- Tracer SC System Controller Installation and Setup, BAS-SVX31
- BACnet Best Practices and Troubleshooting Guide, BAS-SVX51
- Tracer Graphics Editor Online Help
- Tracer Graphical Programming 2 (TGP2) Editor Online Help
- Tracer Graphical Programming (TGP2) Application Guide, BAS-APG008
- Tracer TU Online Help
- Tracer TU Service Tool Getting Started Guide, TTU-SVN01
- Tracer UC400 Enclosure Installation Sheet, X39641147-01
- Tracer UC400 Programmable BACnet Controller (For Factory Installation on VAV) Installation, Operation, and Maintenance, VAV-SVX07
- Tracer UC400 Protocol Implementation Conformance Statement (PICS), BAS-PRG007-EN
- Tracer XM30 Expansion Module Installation Sheet, X39641148-01
- Tracer XM32 Expansion Module Installation Instructions, X39641174-01
- Tracer XM70 Expansion Module Installation Sheet, X39641179-01
- Tracer XM90 Expansion Module Installation Sheet, X396413240-01

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