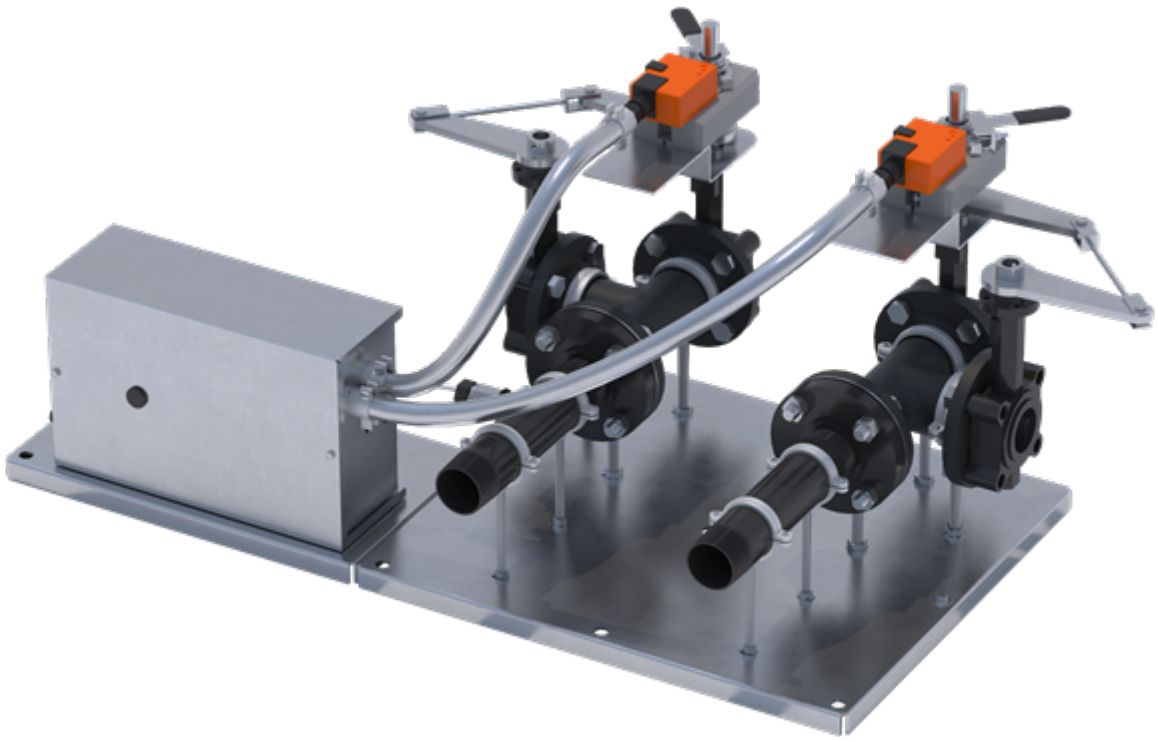
Installation, Operation, and Maintenance

Hydronic Branch Conductor



⚠ 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.

December 2024

TD-SVX001A-EN

Introduction

Read this manual thoroughly before operating or servicing this unit.

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.

Important Environmental Concerns

Scientific research has shown that certain man-made chemicals can affect the earth's naturally occurring stratospheric ozone layer when released to the atmosphere. In particular, several of the identified chemicals that may affect the ozone layer are refrigerants that contain Chlorine, Fluorine and Carbon (CFCs) and those containing Hydrogen, Chlorine, Fluorine and Carbon (HCFCs). Not all refrigerants containing these compounds have the same potential impact to the environment. Trane advocates the responsible handling of all refrigerants.

Important Responsible Refrigerant Practices

Trane believes that responsible refrigerant practices are important to the environment, our customers, and the air conditioning industry. All technicians who handle refrigerants must be certified according to local rules. For the USA, the Federal Clean Air Act (Section 608) sets forth the requirements for handling, reclaiming, recovering and recycling of certain refrigerants and the equipment that is used in these service procedures. In addition, some states or municipalities may have additional requirements that must also be adhered to for responsible management of refrigerants. Know the applicable laws and follow them.

⚠ 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

Table of Contents

General Information

Hydronic Branch Conductor Overview

The Hydronic Branch Conductor connects two-pipe branch area piping to a central, four-pipe distribution system that is connected to a central hydronic chilled water and hot water plant. The unit receives a call for either heating or cooling from the BAS, or binary input if no BAS is present.

The Hydronic Branch Conductor automatically determines which hydronic supply flow and corresponding return flow is sent and returned from the branch area. The Conductor sends the appropriate fluid flow to satisfy the call for heating or cooling while isolating the flow from the unused supply and return flows in the central, four-pipe distribution system.

The Conductor is a one-piece assembled unit with a factory-programmed unit controller and all the necessary sensors and control components wired. The unit control is self-contained, requiring only a request for cooling or heating. First, the Conductor continuously monitors the connected, followed by monitoring the supply lines and determining which line(s) have cooling fluid and heating fluid. The Conductor automatically adjusts if there is a change in what the central hydronic chilled water and hot water plant is providing.

The Conductor can communicate to a BAS system by BACnet® MS/TP, BACnet IP, and BACnet over ZigBee (Trane Air-Fi wireless communication with field-provided interface).

Unit Description

Standard features include:

- Belimo butterfly valves are wired back to the controller in conduit
- A 0% leakage valve
- A self-contained Trane controller, pre-programmed with the sequence of operation

  Note: *This can be used with BAS or standalone.*
- A thermowell on the supply to the branch
- Pre-wired temperature sensors for hot and cold supply piping
- Vertical or horizontal field mounting

Immersion Thermistor

Immersion thermistor features include:

- Water temperature sensor with a sensing element type thermistor at 10k ohms at 77ºF
- Operating ambient temperature limits of -40ºF to 302ºF
- 22 AWG – plenum-rated cable
- Humidity range of 10% to 95% RH, non-condensing
- Stainless steel probe

Thermal Sensors

Thermal sensor features include:

- Temperature sensor with stainless steel casing with 10k ohms at 77ºF
- Operating table limits of -40ºF to 149ºF
- 102-inch 22 AWG plenum-rated PVC cable
- Ships connected to the control box for field mounting

Air-Fi® Wireless Communications Interface (WCI) —Optional

Air-Fi® Wireless Communications Interface (WCI) features include:

- Provides wireless communications between the Tracer® SC and Tracer® unit controllers.
- Provides alternatives to a Trane BACnet® wire communication link.
- Eliminates the communication wire between thermal products, space sensors, and system controllers, providing the following benefits:
  - Reduced installation time and associate risks.
  - Completion of projects with fewer disruptions.
  - Easier and more cost-effective reconfigurations, expansions, and upgrades.

Pre-Installation

Receiving and Handling

Inspection

Upon delivery, thoroughly inspect all components for shipping damage. Confirm that the shipment is complete.

Note: *Delivery cannot be refused. All units are shipped F.O.B. origin. Trane is not responsible for any shipping damage.*

Packaging and Shipping

The hydronic branch conductor assemblies are shipped on skids.

Figure 1. Shipped unit example

Identification

Each unit includes a nameplate identifying the unit serial number and unit model number.

Handling

The unit ships on skids that provide forklift location at the front or rear.

The skids allow easy maneuverability of the unit during storage and transportation.

Trane recommends leaving units and accessories in the shipping package/skids for protection and handling until installation. Remove the skids using a forklift or jack before placing the unit permanently.

Receiving Checklist

Complete the following checklist immediately after receiving the unit:

- Confirm the shipment is complete. Smaller components may ship inside the unit or separately. Check the parts list to verify that all the components are present. If any component is missing, contact your local Trane sales office.
- Check all the units, components, connections, and piping for rattling sounds, bent corners, or other visible indications of shipping damage. Tighten any loose connections.
- If damage is identified, document all details on the freight bill, including pictures and/or video.

  Important: *Do not refuse delivery.*
- Notify your Trane sales representative of the damage immediately by phone and mail. Request an immediate joint inspection of the damage by the carrier and co-signee.
- Notify your Trane sales representative of the damage and arrange for repair.

  Important: *Do not attempt to repair the unit without consulting the Trane sales representative.*
- Inspect the unit for concealed damage as soon as possible after delivery. Report the concealed damage to the freight line. The receiver is responsible for providing reasonable evidence that the concealed damage did not occur after delivery. Include photos and/or video of the damaged material, if possible.

  Note: *Concealed damage must be approved with 30 days of receipt.*

Jobsite Storage

This unit should only be stored indoors and protected from the elements. The customer is responsible for providing the necessary protection from the weather and to prevent vandalism. Under no circumstances should the unit be stored outdoors or left unprotected from the elements.

The valve faces must be protected from abrasion, cutting, and nicking, as this will damage the face and may cause flange area leaks.

Important:

- *Electric actuators cannot be stored in wet, damp, or caustic areas.*
- *Do not store construction material on top of the valve assemblies.*

Unit Dimensions and Weights

Unit Dimensions

Figure 2. Operational footprint

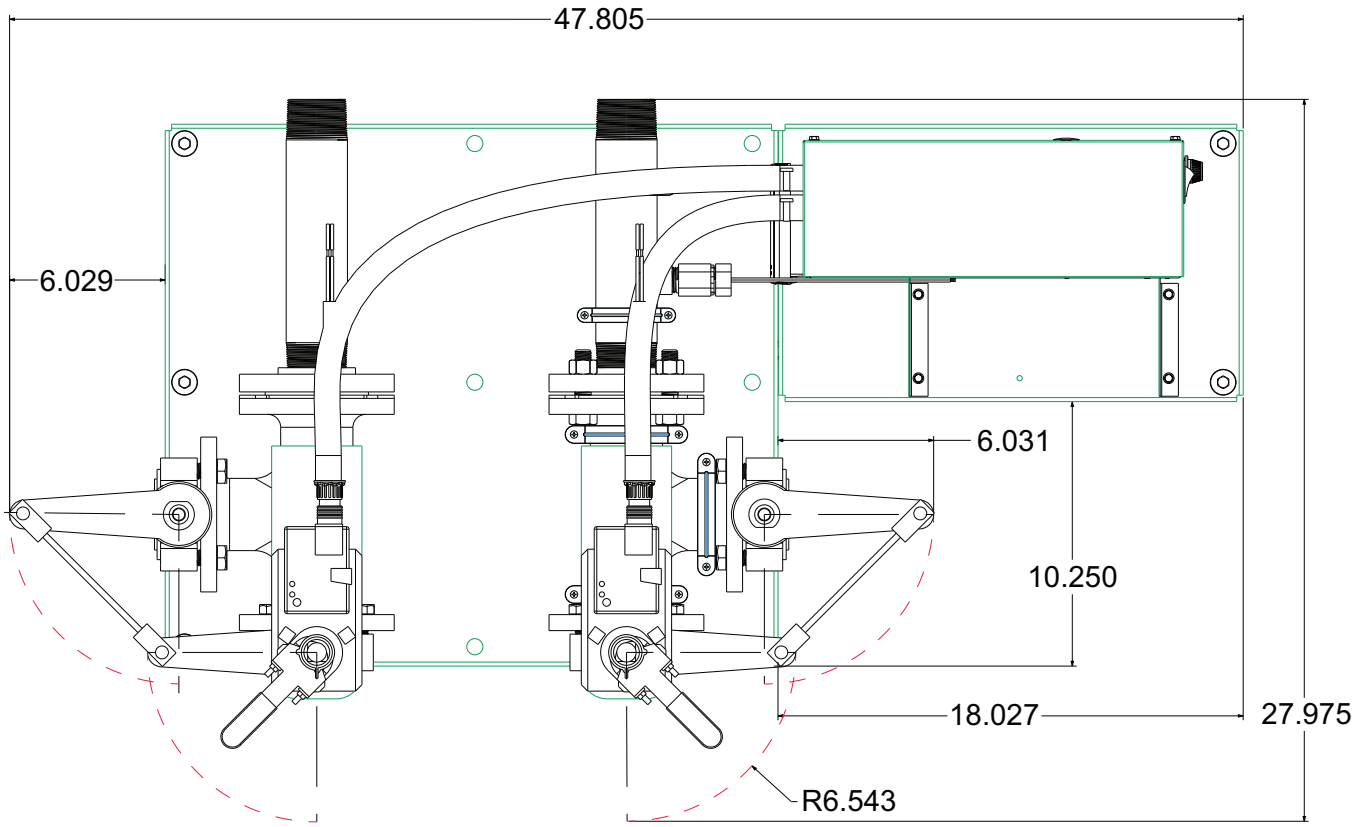


Figure 3. Mounting hole locations

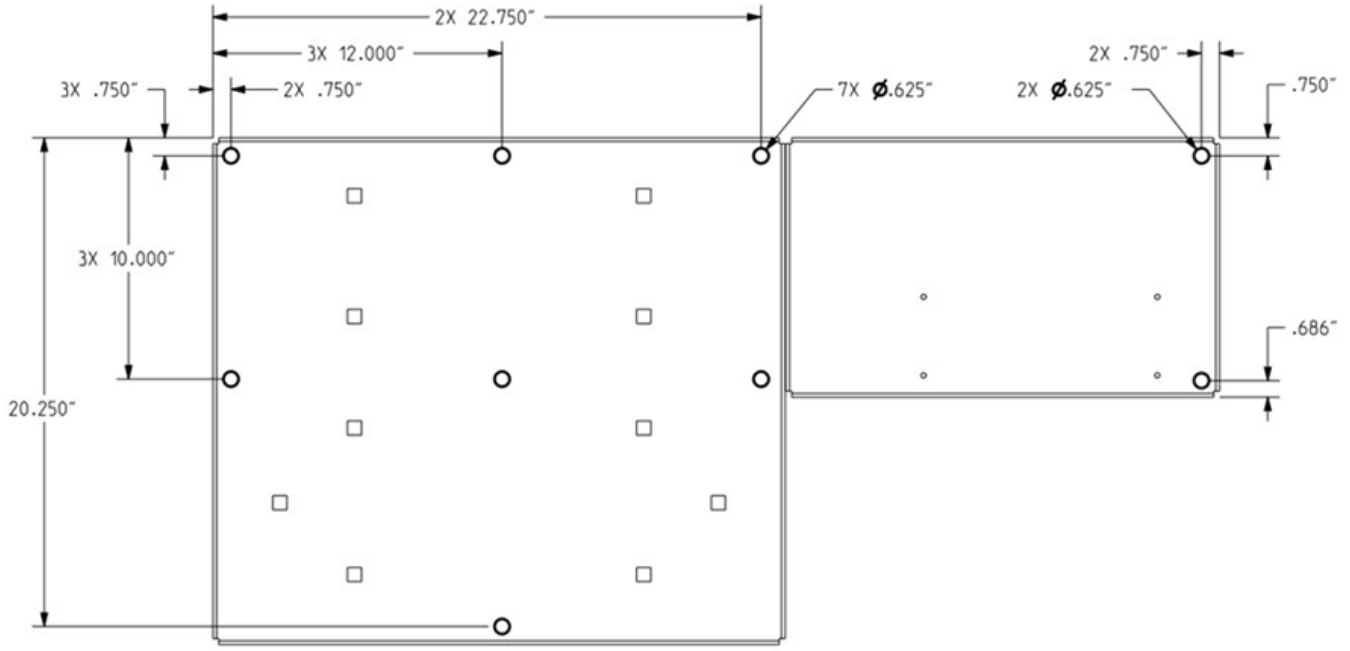


Figure 4. Side view dimensions

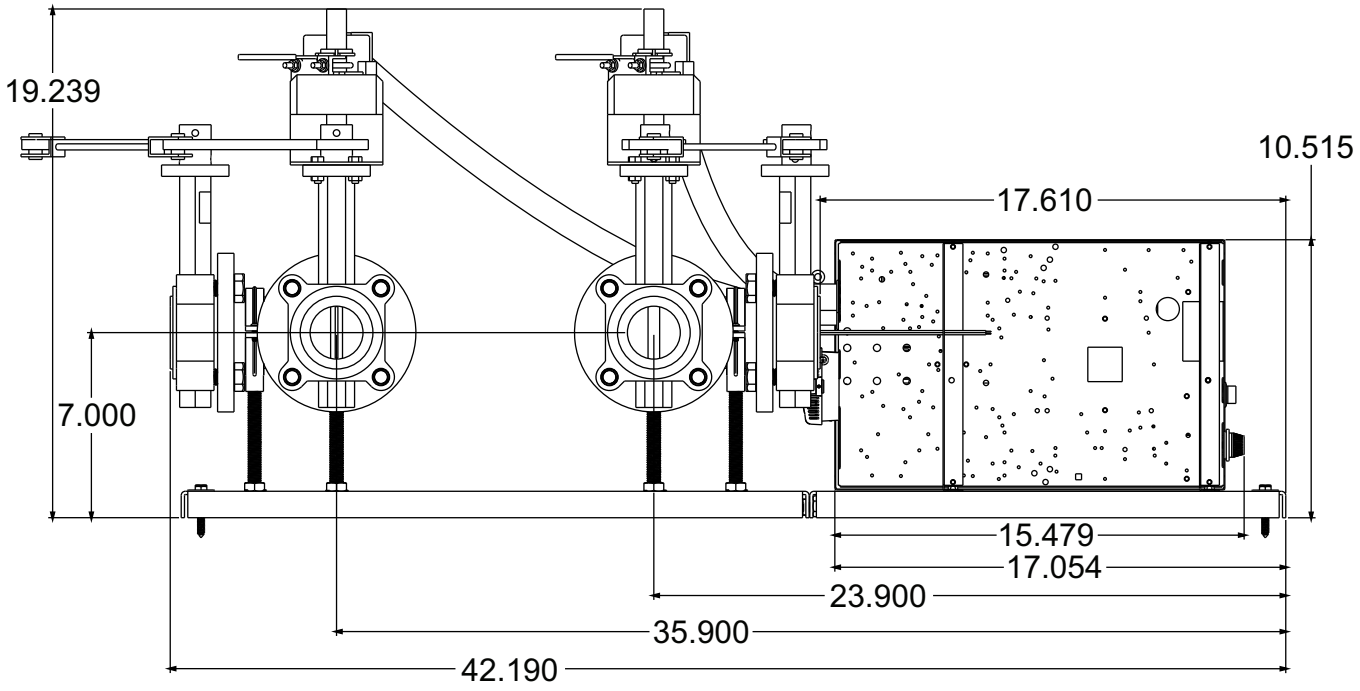
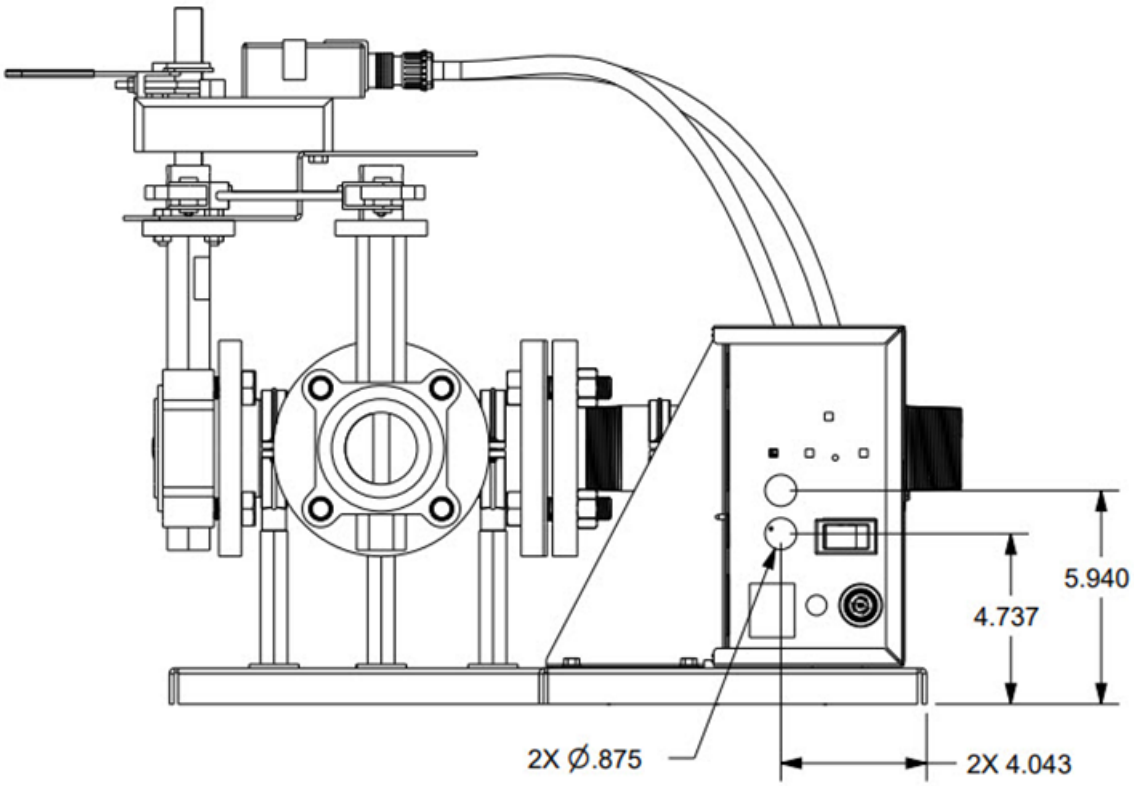


Figure 5. Electrical connections



Shipping Dimensions and Weights

Table 1. Weights

Unit — 150 lb
Shipping Weight — 225 lb

Table 2. Shipping dimensions

Length — 55 inches
Width — 32 inches
Height — 28 inches

Installation

Lifting

⚠ WARNING

Improper Unit Lift!

Failure to properly lift unit in a LEVEL position could result in unit dropping and possibly crushing operator/technician which could result in death or serious injury, and equipment or property-only damage.

Test lift unit approximately 24 inches (61 cm) to verify proper center of gravity lift point. To avoid dropping of unit, reposition lifting point if unit is not level.

⚠ WARNING

Heavy Object!

Failure to follow instructions below could result in unit dropping which could result in death or serious injury, and equipment or property-only damage.

Ensure that all the lifting equipment used is properly rated for the weight of the unit being lifted. Each of the cables (chains or slings), hooks, and shackles used to lift the unit must be capable of supporting the entire weight of the unit. Lifting cables (chains or slings) may not be of the same length. Adjust as necessary for even unit lift.

NOTICE

Equipment Damage!

Premature skid removal could result in equipment damage.

Keep skid in place until unit is ready to set. Do not move the unit or subassembly without the skid in place as shipped from the factory.

General lifting considerations:

- Confirm that the control box section of the unit is supported during lifting/hoisting.
- Before preparing the unit for lifting, estimate the approximate center of gravity for lifting safety. Because of the placement of components, the unit weight may be unevenly distributed.
- Prior to lifting, use a proper rigging method such as straps, slings, or spreader bars for protection and safety. Always test-lift the unit to determine the exact unit balance and stability before hoisting it to the installation location.
- Use a forklift with caution to prevent unit damage.

Rigging

⚠ WARNING

Proper Structural Support Required!

Failure to ensure proper structural ceiling support could result in unit falling from its location which could result in death or serious injury.

Ceiling structure must be strong enough to support the weight of the unit and any accessories. If unsure, check with a structural engineer.

⚠ WARNING

Heavy Object!

Inadequate structural support could result in unit falling, which could result in death or serious injury.

Verify wall structure can support the unit weight. Consult the structural plans, and have a structural engineer confirm wall rating is sufficient.

Wall-Mounted Installation

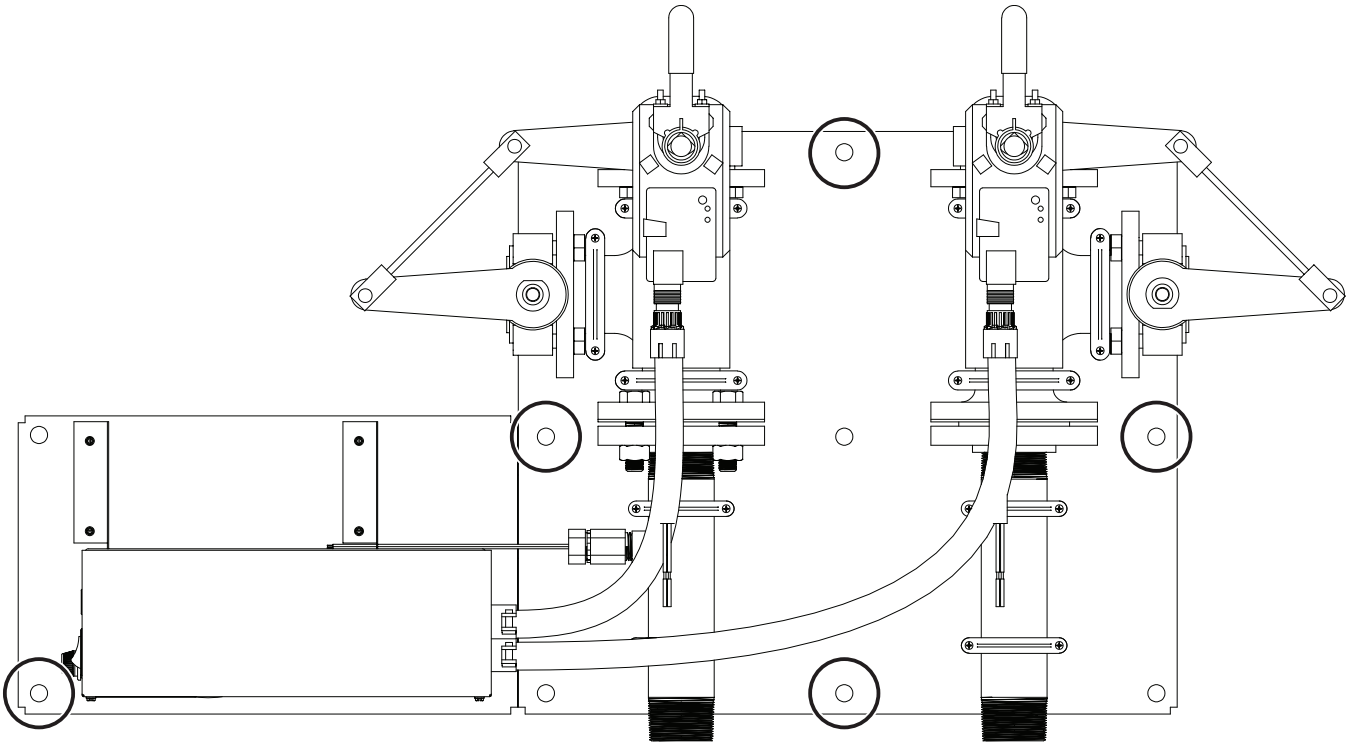
When considering installation location and orientation, verify the following requirements:

- Six feet of clearance between the unit and the floor
- Three feet from the ceiling to the unit
- Three feet from the control box to the wall for service access

To install the unit:

1. Identify the hole locations shown in Figure 3, p. 8.
2. Attach the unit to the wall using the appropriate hardware in at least five locations shown in Figure 6, p. 12 .

Figure 6. Recommended holes for mounting



Ceiling-Suspended Installation

Service Clearances

When selecting a location for ceiling-suspended installation, confirm that the service clearances shown in Figure 7, p. 13, Figure 8, p. 13, and Figure 9, p. 14 are met.

Figure 7. Service clearance—top view

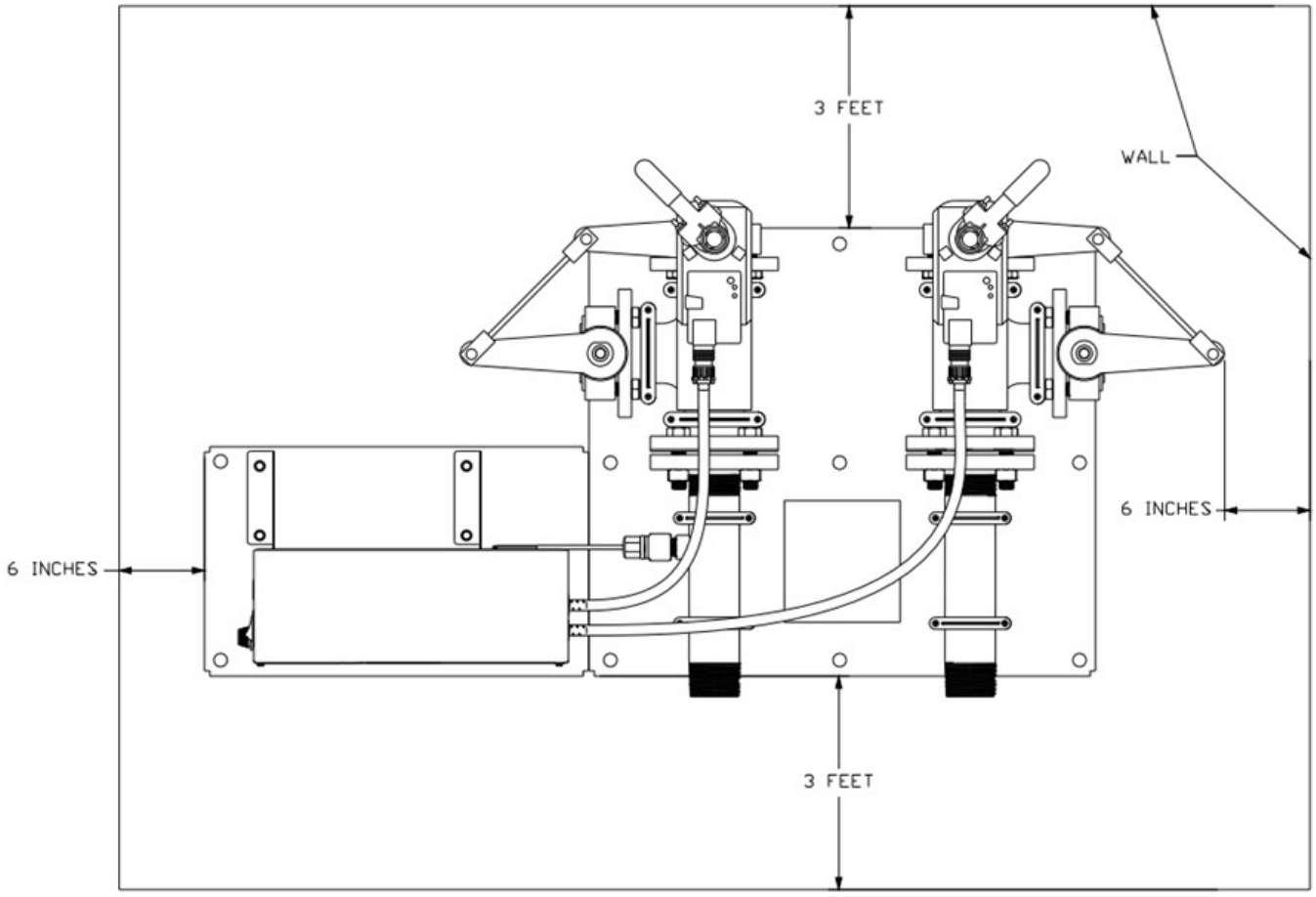


Figure 8. Service clearance—front view

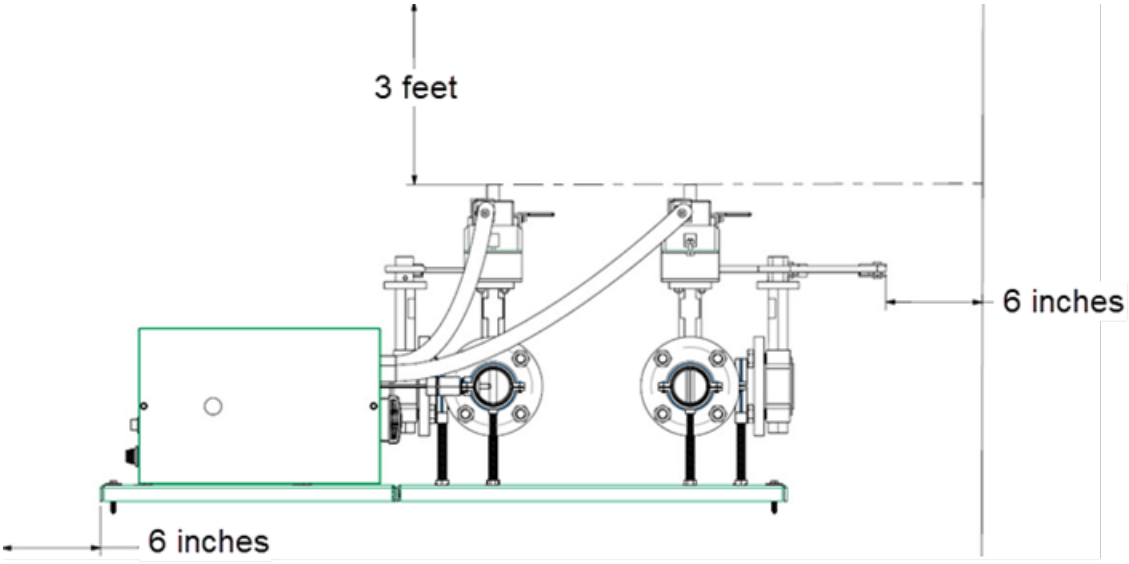
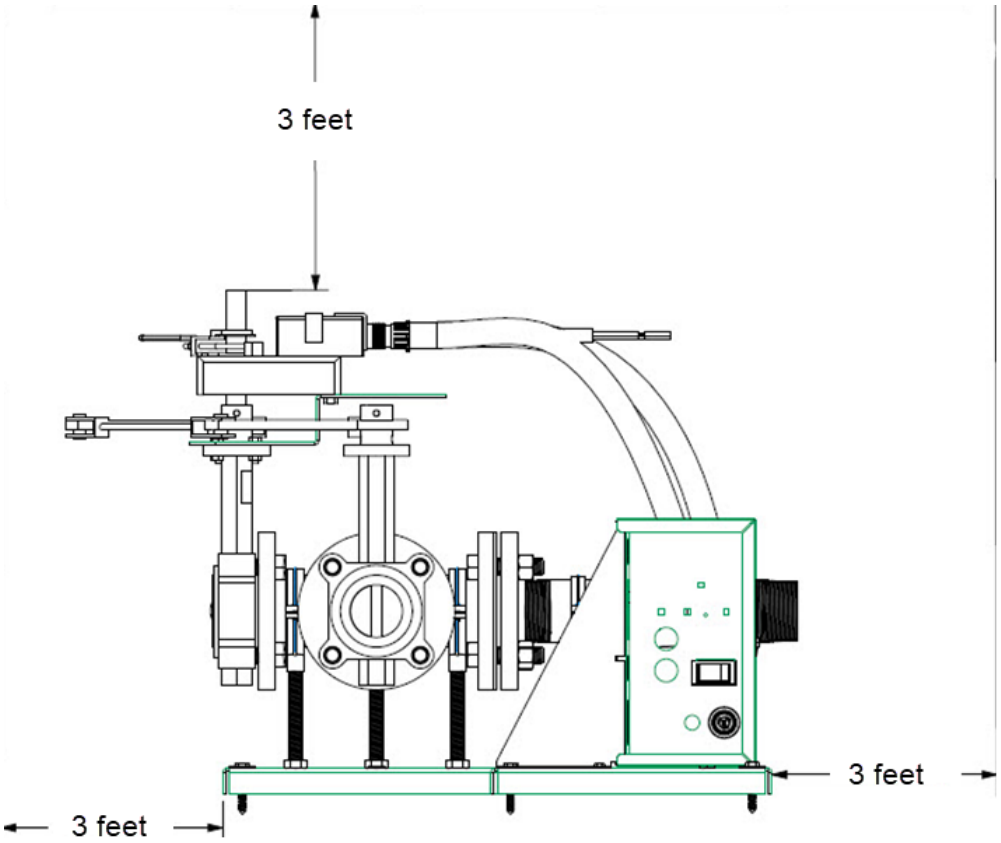


Figure 9. Service clearance—side view



Ceiling-Suspended Installation Options

Baseplate Mounting Holes and Threaded Rods

The unit baseplate provides 5/8-inch diameter mounting holes which can be used, along with threaded rods, to suspend the unit from the ceiling.

A minimum of five rods must be used:

- Four rods on the portion of the baseplate
- One rod on the control box area of the baseplate

See Figure 6, p. 12 for the mounting locations.

Without Baseplate Mounting Holes

If the baseplate mounting holes are not used, suspended installation must meet the following requirements:

- Unit is evenly supported
- Control box portion of the baseplate is supported
- Actuator linkages can fully traverse. See Figure 2, p. 7.

Piping Installation

NOTICE

Proper Water Treatment Required!

The use of untreated or improperly treated water could result in scaling, erosion, corrosion, algae or slime.

Use the services of a qualified water treatment specialist to determine what water treatment, if any, is required. Trane assumes no responsibility for equipment failures which result from untreated or improperly treated water, or saline or brackish water.

Pipe connections:

The hydronic branch conductor provides 2-inch NPT connections to the branch supply. The four connections from the main branch are 2-inch flanged connections.

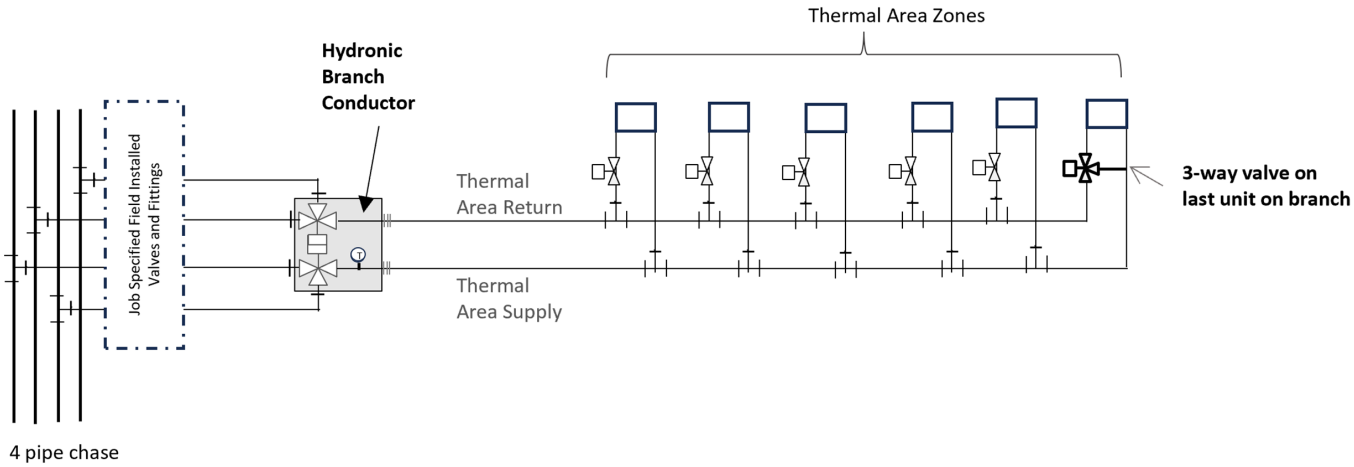
The hydronic branch conductor assembly should not be installed closer than six pipe diameters away from elbows, other vales, or pumps.

Conductor Placement

The Conductor is placed between a central, four-pipe chase and a two-pipe branch run. The unit does not take place of other valves that may be required in the distribution system.

Fan terminal units should have a three-way control valve on the last unit for minimum branch flow.

Figure 10. Hydronic branch conductor placement

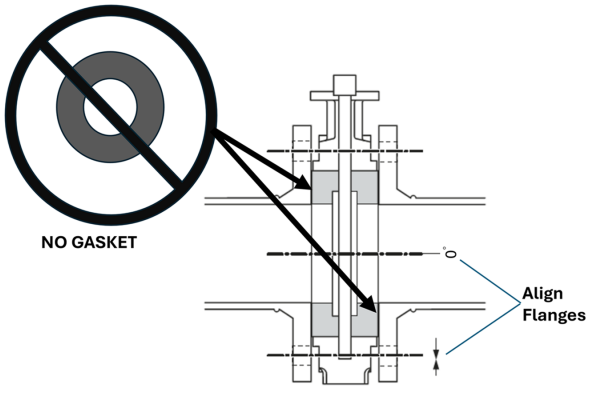


Flange Valve Installation

Position the connecting pipe flanges in the line to verify proper alignment prior to valve installation. Spread the pipe flanges apart enough to allow the valve body to be located between the flanges without actually contacting the flange surfaces. Be very careful when handling the valve to prevent possible damage to the disc or seat faces.

- When installing in Victaulic piping systems, use Victaulic 41 series flange nipples. 741 flanges are **not** recommended.
- Butterfly valves are designed to be installed between ANSI 125/150 flat-faced, raised-faced, slip-on, or weld-neck flanges.
- **Do not** use flange gaskets on the butterfly valves.

Figure 11. No flange gaskets on butterfly valves



- **For Lug style valves:**
  1. Place the valve between the flanges.
  2. Install all the bolts between the valve and the mating flanges.
  3. Tighten the bolts.
- Before completing the tightening of any bolts, the valve should be centered between the flanges and then carefully opened and closed to verify free, unobstructed disc movement.
- Each 2-inch flange connection requires four bolts (5/8 inch). Torque the bolts to 67 to 73 ft-lb.
- Using the sequence, tighten the flange bolts evenly to ensure uniform compression. Make multiple tightening rounds, 1st to 30%, then 60%, and finally 100%. By assembling flange joints, the resilient seating surface uniformly compresses. A small gap may be present if maximum torque is reached. Do not over-tighten bolts; otherwise, liner damage, liner shifting, or stripping may occur.

Electrical Installation

⚠ WARNING

Conform to All Applicable National, State, and Local Electrical Codes!

Failure to follow all applicable codes could result in an arc flash event, electrocution, explosion, or fire, which could result in death or serious injury.
Users MUST conform to all applicable national, state, and local electrical codes during the electrical installation and servicing of this product.

Notes:

- *Any modifications, additions, or changes to the control box could void the factory warranty and UL certification. Such modifications, additions, or changes is the responsibility of the modifying contractor.*
- *This unit is suitable for installation in plenums above hung (suspended) ceilings or equivalent.*

Unit Wiring Diagrams

Specific unit wiring diagrams, based on unit options ordered, are provided inside each unit. Use these diagrams for connections or trouble analysis.

Supply Power Wiring

- Refer to the unit nameplate to obtain the minimum circuit ampacity (MCA) and maximum overcurrent protection (MOP) to properly size field supply wiring and fuses or circuit breakers.
- Refer to the unit operating voltage listed on the unit wiring schematic, submittal, or nameplate.
- Refer to the wiring schematic for specific wiring connections.

Note: *All field wiring should conform to NEC and all applicable state and local code requirements.*

The unit has a disconnect switch with box lug terminals on the input of the switch that are tightened to the appropriate torque specifications.

Controls

Controller

The factory-installed Symbio™ 500 controller is a programmable, general-purpose BACnet®, microprocessor-based, direct digital controller (DDC). The controller is factory-set with the appropriate programs and configuration settings.

The unit can operate in stand-alone configuration or as part of a Tracer® SC+ building automation system.

In the stand-alone configuration, Symbio 500 controller receives operation commands from an external field-installed switch hard-wired to BI1 and controls the local heat-cool mode requests. The controller uses the temperature sensors to determine the required valve position to satisfy the heating or cooling request.

For optimal system performance, units can operate as part of a Tracer SC+ building automation system. The controller is linked directly to the Tracer SC+ using one of the supported communications protocols. The Tracer SC+ sends heat-cool mode requests to the unit via BACnet using Trim/Respond logic or other suitable logic.

Note: *For more details, see Symbio 500 Programmable Controller. Installation, Operation, and Maintenance (BAS-SVX090*).*

Supported Communication Protocols

The Symbio® 500 controller supports BACnet® MS/TP, BACnet IP, and Air-Fi® Wireless BACnet communications.

BACnet® MS/TP Communication Link

⚠ 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.

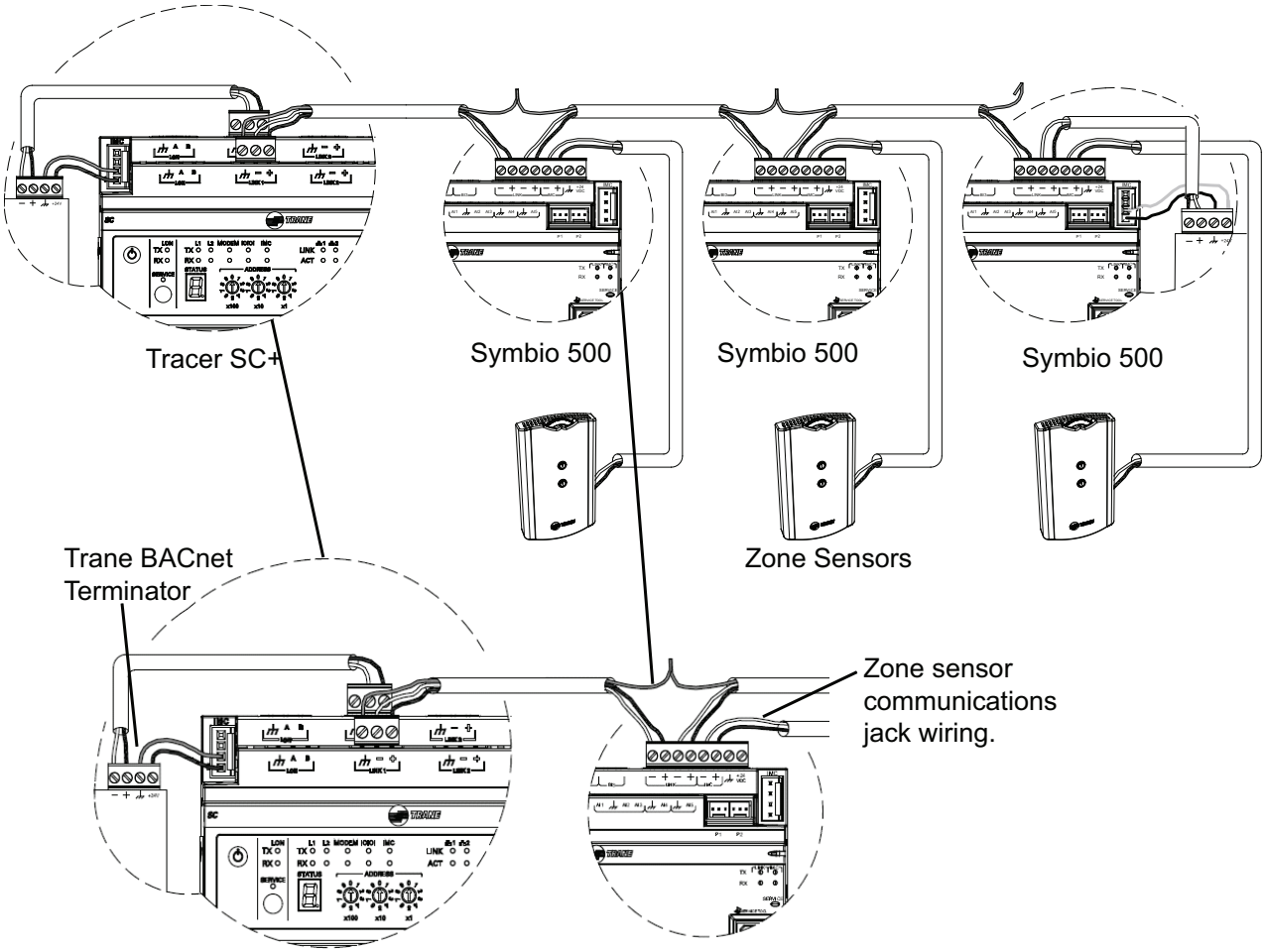
All wiring must comply with the National Electrical Code (NEC) and local electrical codes.

Installation requirements:

- 18 AWG Trane purple-shielded twisted-pair communication wire
- Link limits:4,000 ft and 60 devices maximum (without a repeater)
  - 4.000 ft (1.372m) distance maximum
  - 60 Trane devices per link maximum (fewer when combined with non-Trane devices)
- Trane BACnet® termination on each end of the link
- Daisy chain topology
- Maintain polarity

Note: *For more details, see BACnet MS/TP Wiring and Link Performance Best Practices and Troubleshooting Guide (BAS-SVX51*-EN).*

Figure 12. BACnet MS/TP link wiring — zone sensors are not required with this application



BACnet IP Over Wired Ethernet Communication

The Symbio™ 500 controller has two Ethernet ports, labeled 1 and 2, which are internally connected as one port. These ports enable BACnet® IP or support for a TD-7 display.

BACnet IP is supported in a daisy chain, star, or ring topologies.

Note: *For more details, see BACnet IP wiring, refer to the BACnet/IP Wiring and Best Practices Application Guide (BAS-APG046*).*

Air-Fi Wireless BACnet Communications

The Symbio™ 500 controller can communicate wirelessly to the Trane Tracer® SC+ through the Trane Air-Fi® Wireless system (BACnet®/ZigBee®[1]). Trane Air-Fi is a field-installed option.

Note: *For more details, see Air-Fi Wireless System IOM (BAS-SVX40*).*

Best Wiring Practices

For proper network communication, wiring installation must meet the following requirements:

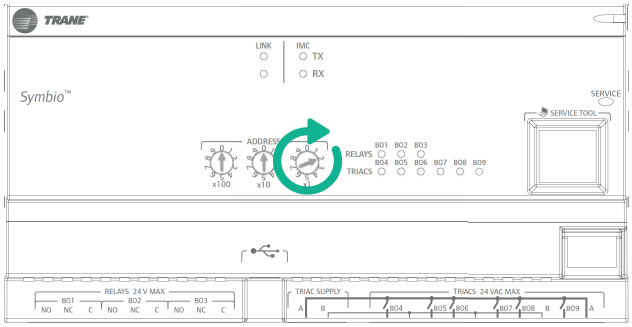
- All wiring must comply with the National Electrical Code™ (NEC) and local codes.
- Consistent grounding of 24 Vac power supplies
- Dedicated 24Vac power supply for each controller
- Do not over-tighten cable ties or other forms of cable wraps.
- Do not run communication cable, including conductors from TRIAC-type inputs, alongside or in the same conduit as 24 Vac power.
- In open plenums, do not route wire near lighting ballasts, especially those using 277 Vac.

1. *ZigBee® is a registered trademark of the ZigBee Alliance.*

Address Setting

The three rotary address dials on the controller serve one or two purposes, depending upon the network: they are always used for the MAC Address, which is sometimes all or part of the BACnet® device ID.

Figure 13. Setting the rotary address



Use a 1/8 inch (3.2 mm) flathead screwdriver to set rotary address dials. These dials rotate in either direction.

MAC Address

The MAC Address is required by the RS-485 communication protocol on which BACnet operates. Valid MAC addresses are 001 to 127 for BACnet.

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:

- Use the same number as the MAC Address, determined by the rotary address dials on the Symbio™ 500 controller. For example, if the rotary address dials are set to 042, both the MAC Address and the BACnet Device ID are 042.
- Soft set using Tracer TU service tool. If the BACnet Device ID is set using Tracer TU, the rotary address dials only affect the MAC Address. They do not affect the BACnet Device ID.

BACnet Networks With a Tracer SC+ System Controller

On BACnet networks with a Tracer SC system controller, the Device ID for the Symbio 500 controller can be soft set by the system controller using the following scheme.

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

Device ID Assignment for BACnet MS/TP Devices

Each unit controller must have a unique BACnet device ID. Tracer SC+ automates the process by calculating a unique device ID for each unit controller and then saving the device ID to memory in each device. BACnet MS/TP device IDs are calculated using the following three sets of values:

- The Tracer SC+ BACnet MS/TP network number
- The unit controller rotary switch value (1 to 127)

Example: The Tracer SC+ BACnet network number for MS/TP link 1 is 11 and the 3-digit rotary switch value of the unit controller is 001. Assigned device ID = 11001.

Table 3. Calculating the BACnet device ID

Tracer SC+ BACnet network number (11)	1	1			
Unit controller rotary switch value (001)			0	0	1
BACnet Device ID: 11001	1	1	0	0	1

For BACnet MS/TP Network numbers higher than 4190, **Tracer SC+ will not be able to follow this scheme** and will not propose a Device ID for the unit controller. The controller can be installed with the Device ID number previously assigned to it.

Device ID Assignment for BACnet IP Devices

For devices connecting over BACnet IP, Tracer SC+ calculates the device ID with the following:

- The BACnet network number for the BACnet IP link. (This number can be changed by the user).
- The unit controller rotary switch value. (The Tracer SC+ rotary address is not used to calculate BACnet IP device IDs).

The following table shows this process using a Tracer UC600 unit controller:

Table 4. Calculating the BACnet IP device ID

BACnet network number Eth port 1 (1)		1			
Unit controller rotary switch value (42)			0	4	2
BACnet IP Device ID: 01042	0	1	0	4	2

Note: *It is very important to avoid duplication of BACnet network numbers or device IDs.*

Device ID Assignment for Air-Fi Devices

For devices connecting over an Air-Fi®network, Tracer® SC+ calculates the device ID using the BACnet® network number and the rotary switch value of the wireless device.

The example in the following table illustrates this process.

Table 5. Calculating the Air-Fi device ID

BACnet network number of Tracer SC+ Air-Fi network (13)	1	3			
Wireless unit controller rotary switch value (001)			0	0	1

Table 5. Calculating the Air-Fi device ID (continued)

Wireless unit controller Device ID set by Tracer SC +(app): 13001	1	3	0	0	1

Field-Mounting Location of Supply Thermistors

Each Hydronic Branch Conductor includes two factory-wired temperature sensors that require field-mounting. The field-installed sensors are:

- Sensor in the First supply
- Sensor in the Second supply

The factory provides wiring for these sensors (correct color and distance of the cable provided).

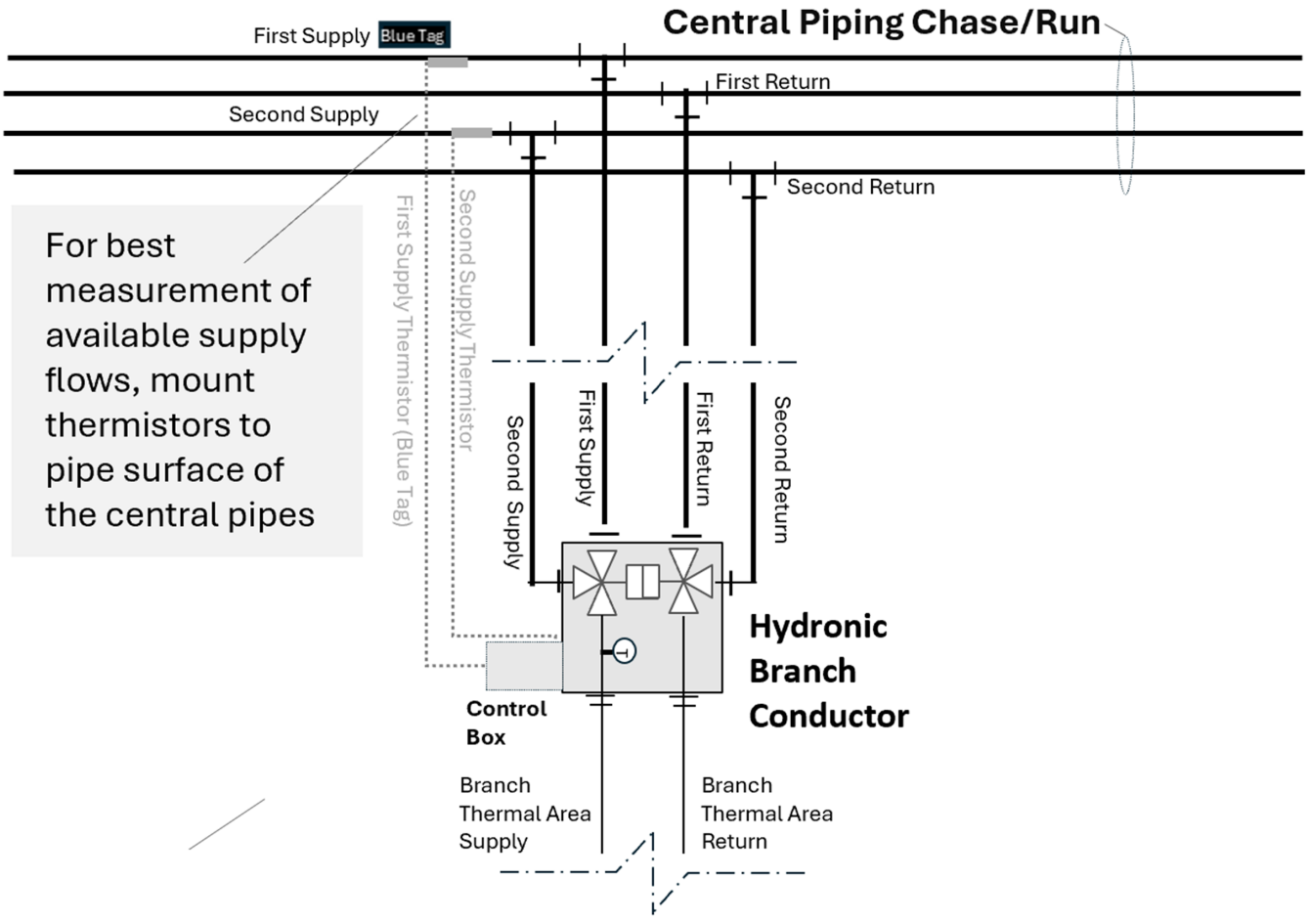
The sensors are found coiled and attached to the outside of the control box. For proper Hydronic Branch Conductor operation, unit sensors are required to be mounted on the surface of the incoming supply pipes as shown below.

Before mounting the sensors, identify each sensor as **First Supply** or **Second Supply**.

After installing the sensors, confirm that they are in the proper location by checking the labels versus the mounted location.

For the best measurement of available supply flows, mount the thermistors to the pipe surface of the central pipes. See Figure 14, p. 21.

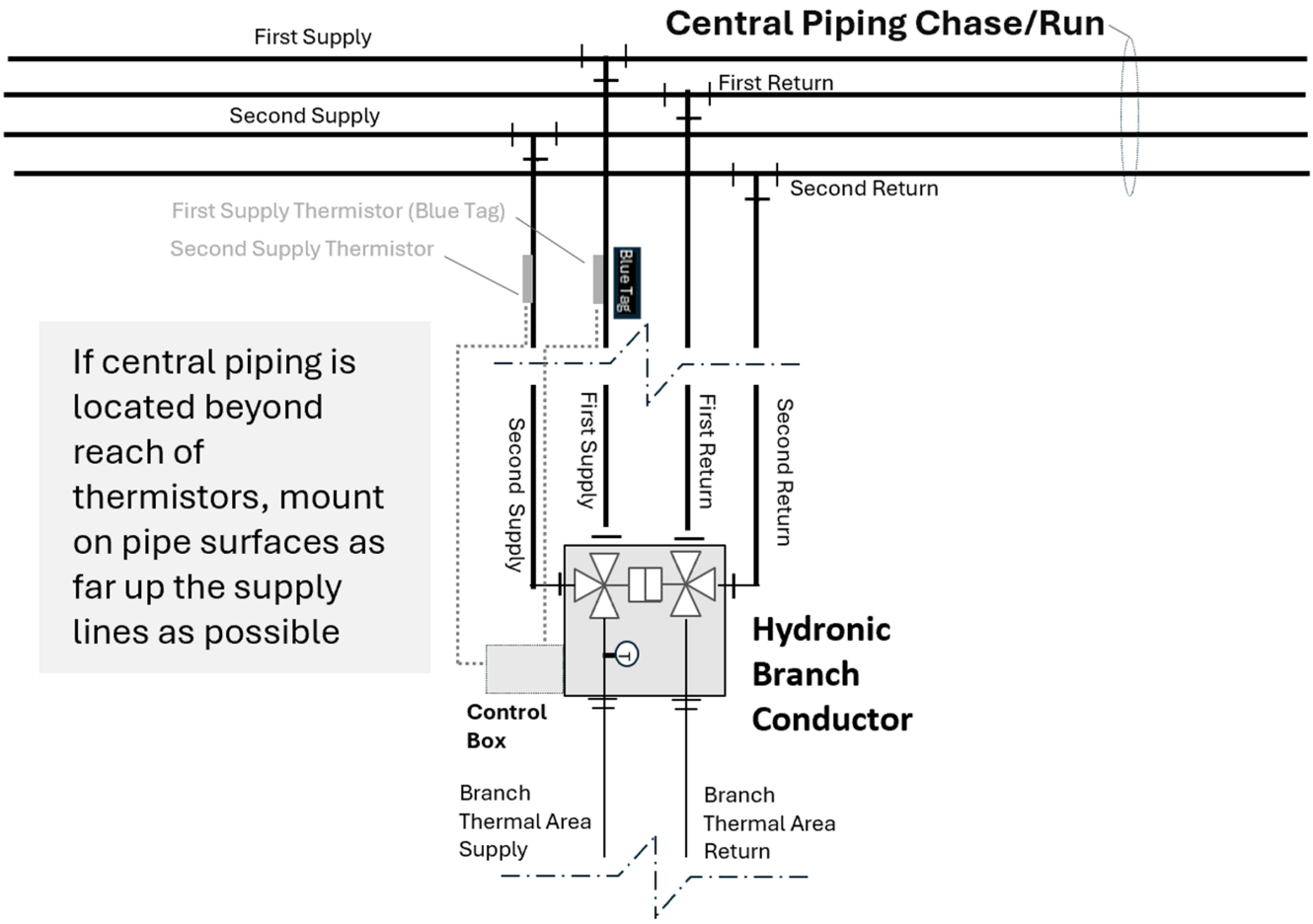
Figure 14. First and second supply mounting location



If the central piping is located beyond the reach of the thermistors, mount the thermistors on pipe surfaces as far up the supply lines as possible. See Figure 15, p. 22.

Field-Mounting Location of Supply Thermistors

Figure 15. Optional mounting location



Operating Principles

Note: *The Hydronic Branch Conductor is for use with systems with ≥90°F and ≤115°F hot water supply temperature.*

Note: *The Hydronic Branch Conductor is for placement between the central pipe chase and branch piping. This valve assembly is in addition and not a replacement to what may be required between the main lines and branch (balancing valves, shutoff valves, strainers, pressure ports, pressure reducers).*

The Hydronic Branch Conductor connects two-pipe branch area piping to a central, four-pipe distribution system that is connected to a central hydronic heat pump plant. The unit receives a call for either heating or cooling from the BAS, or binary input if no BAS is present.

The Hydronic Branch Conductor automatically determines which hydronic supply flow and corresponding return flow is sent and returned from the branch area. The Conductor sends the appropriate fluid flow to satisfy the call for heating or cooling while isolating the flow from the unused supply and return flows in the central, four-pipe distribution system.

The Conductor is a one-piece assembled unit with a factory-programmed unit controller and all the necessary sensors and control components wired. The unit control is self-contained, requiring only a request for cooling or heating. First, the Conductor continuously monitors the connected, followed by monitoring the supply lines and determining which line(s) have cooling fluid and heating fluid. The Conductor automatically adjusts if there is a change in what the central heat pump plant is providing.

The Hydronic Branch Conductor can communicate to a BAS system by BACnet® MS/TP, BACnet IP, and BACnet over ZigBee (Trane Air-Fi® wireless communication with field-provided interface).

Unit Controls

All temperature sensors and valve actuators required for the operation of the Conductor are factory-wired to the Symbio® 500 controller; however, the first and second supply water temperature sensors must be installed in the field according to the installation guidelines.

Both sensors are pre-wired to the Symbio 500 controller, but if required, to extend the factory-provided cable, they can be re-wired. Use 18 AWG twisted plenum cable to wire these sensors.

Follow all wiring recommendations for Analog inputs indicated in the *Symbio 500 Programmable Controller IOM (BAS-SVX090*)*.

The first pipe supply water temperature must be installed in the first main pipeline and wired back to the Symbio 500 controller at **AI4**.

The second pipe supply water temperature must be installed in the second main pipeline and wired back to the Symbio 500 controller at **AI5**.

Local Heat-Cool Mode Request Binary Input

An optional hard-wired switch can be used to locally control the heat-cool mode operation of the Hydronic Branch Conductor.

This optional local heat-cool mode request binary input must be wired to **BI1**. A contact closure input should be used. Follow all wiring recommendations for binary inputs indicated in the *Symbio 500 Programmable Controller IOM (BAS-SVX090*)*.

When the contact is open, a local heating request is generated; when the contact is closed, a local cooling request is generated.

Note: *Local control assumes that the BAS Heat-Cool mode request is not being used. The BAS Heat-Cool mode request value should remain at its default state of heating. Do not use both local and BAS controls in the same application.*

Local Binary Output Alarm (Optional)

An external visual and/or audible alarm can be installed to indicate a system malfunction. This alarm must be wired to the Symbio 500 controller at **BO1** and should be rated for 0.5A @ 24VAC pilot duty.

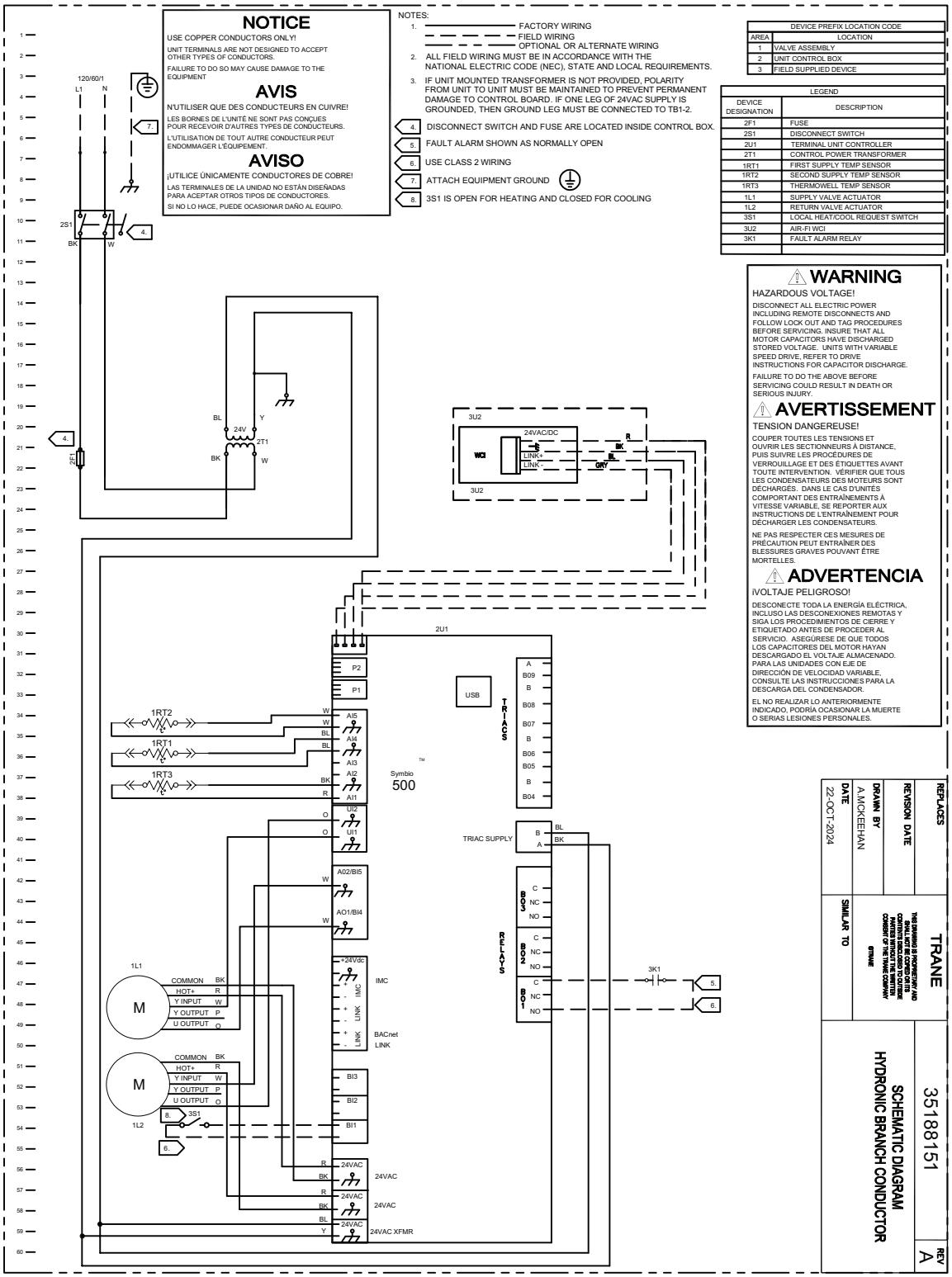
BO1 will close its contacts to trigger the alarm when there is a fault in the valve position, meaning that the supply and return valves are in different positions, or when the output temperature does not match the heat/cool mode request (whether local or BAS).

Follow all wiring recommendations for binary outputs indicated in the *Symbio 500 Programmable Controller IOM (BAS-SVX090*)*.

Unit Wiring Diagram

Refer to the following wiring diagram for details on end-device connections.

Figure 16. Unit wiring diagram



BAS Connection and Operation

The Trane Hydronic Branch Conductor can be operated as a stand-alone device by using **BI1** local Heat-Cool mode request, or BAS communicated heat-cool mode request.

Refer to "Local Heat-Cool Mode Request Binary Input," p. 24 for details on how to use the BI1 as the local heat-cool mode request source, and to the sequence of operations below in this section for details on operating the device.

When using BAS communicated heat-cool mode request, the Trane Tracer SC+ or third-party BAS controller determines the heating and cooling requests to send to the Hydronic Branch Conductor. The Tracer SC+ controller, trim-and-respond voting logic should be used to generate the heating or cooling request.

Tracer® SC+ Trim/Respond Setpoint Reset Logic

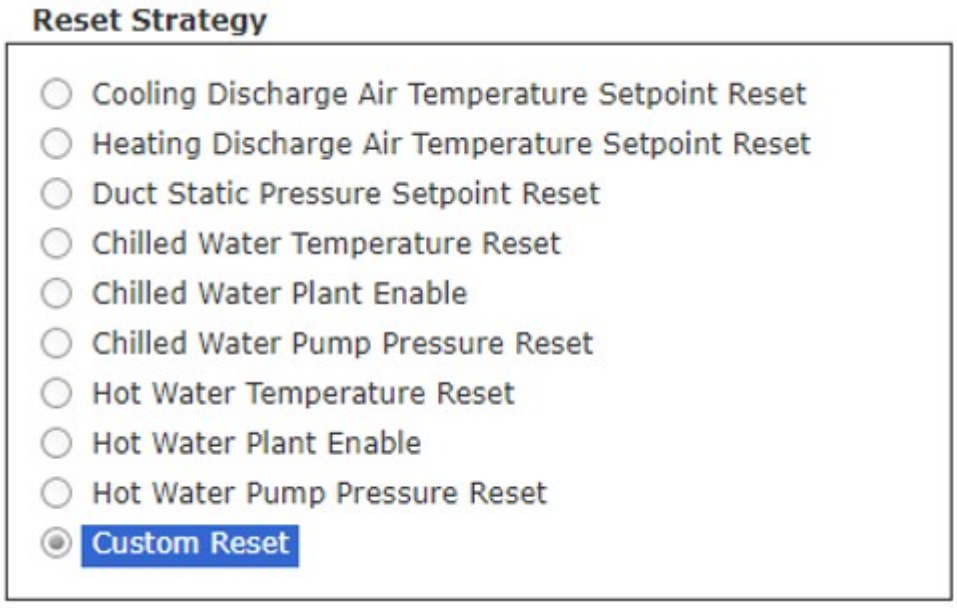
Trim/Respond (T/R) logic is an application that resets a setpoint for pressure, temperature, or any other variable in a system. It changes the setpoint at a fixed rate (Trim setpoint) until a downstream device is no longer satisfied and generates a request.

When a sufficient number of requests are present during a specific duration, the setpoint is adjusted in response (Respond setpoint). The importance of each zone's requests can be adjusted to ensure that critical zones are always satisfied (importance multiplier).

When a sufficient number of requests no longer exist, the setpoint resumes changing (Trim setpoint) at its fixed rate. A running total of the requests generated by each zone is kept to identify zones that are driving the reset logic. Trim/Respond logic is optimal for controlling a single variable that is subject to the requirements of multiple downstream zones and is prescribed by ASHRAE Guideline 36 as the method for resetting discharge air temperature, static pressure, hot water temperature, chilled water temperature, and others values in a system.

One instance of T/R is required per each Hydronic Branch Conductor. There is not a pre-defined solution for the Hydronic Branch Conductor, and the use of Custom Reset is required. T/R shall determine the Heat-Cool mode request to be sent to each Hydronic Branch Conductor in the building.

Figure 17. Trim/Respond reset selection



Tracer® SC+ Trim/Respond Configuration

- **Control Point:** Heat-Cool mode request of each Hydronic Branch Conductor (o r a controlled point connected to the Heat-Cool mode request BAS in the Hydronic Branch Conductor)
- **Requesting members to be monitored:** Terminal equipment connected to each Hydronic Branch Conductor
- **Ruleset:** Use a ruleset to determine the requests from the members. Rulesets can be reused, but for the first configuration, the user needs to create a new ruleset. As an example, see below a ruleset for transitioning from heating to cooling. Refer to the sequence of operations for more details.

Each Trim/Respond members needs a defined ruleset:

– If the Heat-Cool mode status = cool for five minutes, and if the space temperature is active > space temperature setpoint active by 4.0° for five minutes, generate three requests.

– If the Heat-Cool mode status = cool for five minutes, and if the space temperature is active > space temperature setpoint active by 2.5° for five minutes, generate two requests.

– If the Heat-Cool mode status = cool for five minutes, generate one request.

- **Importance Multiplier:** Each member has an importance multiplier so that critical zones receive more attention. The number of requests is multiplied by the importance multiplier and that result is the Net requests.

  Set this to 0 for zones you want to omit from the calculation.

- **Initial Setpoint Value:** Initial mode of operation—heating or cooling. This selection should match the Ruleset, so that the system starts in a predetermined, no-requests mode.

- **Trim Value:** This is the value that the system will trim every time step when Request value is less than or equal to Ignores. In this binary control application, this should be the same as the initial setpoint value.

- **Respond Value:** When the Requests value is greater than the Ignores value, the system responds. This value should be the opposite of the Trim value.

- **Startup Time Delay:** Time before the sequence starts after System OK becomes True.

- **Run Frequency:** How often the application will run after Startup Time Delay. It is recommended to run T/R at a frequency no lower than 10 to 20 minutes to avoid extra BACnet traffic. The Hydronic Branch Conductor only takes one valid heat-cool mode request command every 4 hours.

- **Ignored Requests Threshold:** The system will trim when the Request value is less than or equal to this value. The recommendation is to set this at 50% of the net-possible requests in the system generated by Rule 1.

  Note: *When switching modes, Rules 2 and 3 can be satisfied, so requests are no longer available.*

Refer to the *Air Systems Tracer SC+ System Controller Application Guide (BAS-APG036*)* and *Tracer SC+ System Controller IOM (BAS-SVX077*)* for more details on Trim and Response Application.

Hydronic Branch Conductor Unit Control Sequence

First and Second Supply Water Identification

The unit controller will monitor the first and second entering water temperatures using two sensors installed on the first and second pipes (see mechanical drawings for the precise locations).

These readings will be compared to a space temperature BAS setpoint of 72.5°F (adj.). If the water temperature exceeds the setpoint by more than 5°F, the controller will report the connection as **hot water**.

Conversely, if the water temperature decreases by more than 5° F below the setpoint, the controller will report it as **cool water**.

If the water temperature is within +/- 5°F of the setpoint, the controller will report the connection as **neutral**.

If the first or second temperature sensor fails, the controller will assign a fault status to that connection's water temperature.

Unit Control Factory Programming

The Symbio 500 controller has a single TGP2 program downloaded and defined in the factory as part of the factory commissioning process. This single program is the base program for valve control to satisfy the heat-cool mode request.

Hydronic Branch Conductor Supply Temperature

A factory-installed water immersion temperature sensor will measure the supply water temperature of the thermal area. The unit controller will report the supply water temperature to the BAS for the Hydronic Branch Conductor.

The Hydronic Branch Conductor supply temperature will be compared to a space temperature BAS setpoint of 72.5°F (adj.). When the Hydronic Branch Conductor is in Cool mode, the mode status will report as cool unless if it is for a period of more than 5 minutes and the water temperature exceeds the setpoint by more than 5°F, or if the water temperature is within +/- 5°F of the setpoint, the controller will report the mode status as a Fault.

Conversely, during Heat mode, the status will report as heat unless if it is for a period of more than 5 minutes, the water temperature decreases below the 5°F from the setpoint, or the water temperature is within +/- 5°F of the setpoint, the controller will report the mode status as a fault to the BAS.

If the temperature sensor fails, the controller will assign a fault status to the supply temperature.

Heat-Cool Command Response

Heat-Cool mode is determined by a BAS request or by an optional local hard-wired switch. The unit controller will only accept one Heat-Cool mode request every four hours(adj). A random 150-second delay will execute upon a new BAS or local Heat-Cool request to avoid having multiple Hydronic Branch Conductors in the plant changing operational mode at the same time.

During Cool mode, the Hydronic Branch Conductor will continuously monitor the first and second supply fluid—Heat, Cool, or Neutral status and send the appropriate fluid.

If both the first and second supply have Cool status, then the Hydronic Branch Conductor will send to the thermal area cooling fluid from the first supply. If the first supply has Hot or Neutral status and the Second Supply has Cool status, the Second Supply will be sent to the thermal area.

If the first supply has Cool status and second supply has a Hot or Neutral status, the first supply will be sent to the thermal area.

If the first supply is Neutral and the second supply is Hot, the Hydronic Branch Conductor will send first supply to the thermal area; if the thermal area supply status is not Cool after 5 minutes, an alarm will be sent to the BAS.

If the first supply is Hot and the second supply is Neutral, the Hydronic Branch Conductor will send the second supply to the thermal area; if the thermal area supply status is not Cool after 5 minutes, an alarm will be sent to the BAS.

During Heat Mode, the Hydronic Branch Conductor will continuously monitor the first and supply fluid—Heat, Cool, or Neutral status and send the appropriate fluid. If both the first and second supply have Heat status, then the Hydronic Branch Conductor will send to the thermal area heating fluid from the first supply.

If the first supply has Cool or Neutral status and the second supply has Heat status, the second supply will be sent to the thermal area; if the first supply has Heat status and the second supply has Cool or Neutral status, the first supply will be sent to the thermal area.

If the first supply is Neutral and the second supply is Cool, the Hydronic Branch Conductor will send the first supply to the thermal area; if the thermal area supply status is not Heat after 5 minutes, an alarm will be sent to the BAS.

If the first supply is Cool and the second supply is Neutral, the Hydronic Branch Conductor will send the second supply to the thermal area; if the thermal area supply status is not Heat after 5 minutes, an alarm will be sent to the BAS.

If there is an interruption of power to the Distribution Area Director Hydronic Branch Conductor,the valve positions will stay in place. When power is restored, the Hydronic Branch Conductor will resume with the last communicated mode. If

there is a change in mode request from the BAS, a random 150-second delay will execute before the valves change position.

The unit controller will communicate the actual Heat-Cool mode status, as well as all the valve positions and status to the BAS.

Alarms

The controller will deliver an alarm to the BAS when the following occurs:

- Any valve is faulty
- The valves are not all in the commanded position
- The system cannot satisfy a commanded position
- the system cannot satisfy a valid heat/cool request

If an alarm sounds, the controller will activate the hard-wired alarm output that will energize the optional valve fault external alarm connected at BO1.

Recommended BAS Sequence of Operations

Building Automation System Interface

During an optimal startup, if the average space temperature of the zones is below the occupied heating setpoint, a morning warm-up mode will be activated and Heat mode will be requested to the Hydronic Branch Conductor controller.

During an optimal startup, if the average space temperature of the zones is above the occupied cooling setpoint, Pre-Cool mode will be activated, and Cool mode will be requested to the Hydronic Branch Conductor controller.

BAS Heat-Cool Mode Request

During occupied periods, the BAS will continually monitor the terminal equipment Heat-Cool mode, and space temperature deviation from the setpoint. The BAS will determine the Hydronic Branch Conductor's mode of operation using a control methodology based on *ASHRAE Guideline 36 "Trim and Respond Logic"*.

At a frequency of once every 5 minutes (adj.), the control system will calculate the zone requests to determine when to transition between heating to cooling, using the following criteria.

Default Mode—Heating:

- The BAS will monitor the Heat-Cool mode status of each terminal unit within its given area, and if it is cool for 5 minutes (adj.), generate one request.
- If the Heat-Cool mode status of a terminal unit is cool and the space temperature is above the space temperature setpoint by 2.5°F (adj.) for 5 minutes (adj.), generate two requests.
- If the Heat-Cool mode status of a terminal unit is cool and the space temperature is above the space temperature setpoint by 4°F (adj.), or more, for 5 minutes (adj.), generate three requests.

The BAS will default to ignore a number of requests equal to 50% of the possible net requests generated, in case all zones violate Rule 1. The Ignore requests number are adjustable as required, per the application.

When Requests are greater than Ignores, the BAS will respond by sending a mode change request from heating to cooling.

Default Mode—Cooling:

- The BAS will monitor the Heat-Cool mode status of each terminal unit within its given area, and if it is cool for 5 minutes (adj.), generate one request.
- If the Heat-Cool mode status of a terminal unit is cool and the space temperature is above the space temperature setpoint by 2.5°F (adj.) for 5 minutes (adj.), generate two requests.
- If the Heat-Cool mode status of a terminal unit is cool and the space temperature is above the space temperature setpoint by 4°F (adj.), or more, for 5 minutes (adj.), generate three requests.

The BAS will default to ignore a number of requests equal to 50% of the possible net requests generated, in case all zones violate Rule 1. The Ignore requests number are adjustable as required, per the application.

Each served zone will have an importance multiplier that will impact the number of net requests generated per zone.

During unoccupied periods, the BAS will generate Heat-Cool requests according to the Heat-Cool mode status of the area that is being served. The BAS will use the average space temperature of the zones. The unoccupied heating setpoint of 60°F (adj.), the unoccupied cooling setpoint of 85°F (adj.), and the unoccupied differential of 4°F (adj.) to determine the Hydronic Branch Conductor's mode of operation.

The BAS will monitor the status of terminal units during unoccupied periods. When a terminal unit is in occupied bypass mode, the BAS will determine the Hydronic Branch Conductor mode of operation as if the area were occupied.

Pre-Start

- Close any field-installed drain valves in the branch piping circuit.
- Confirm that all field-supplied shutoff valves to the First Supply, Second Supply, First Return, and Second Return are open.
- Confirm that any field-installed shutoff valves to the branch are in the open position.
- De-energize the conductor circuit (if necessary).
- Inspect all the electrical connections to confirm that the terminals are secure.
- Inspect the fuse for overload trip.
- Confirm that the power is on for the chiller system.
- Confirm that the conductor power is in the On position.

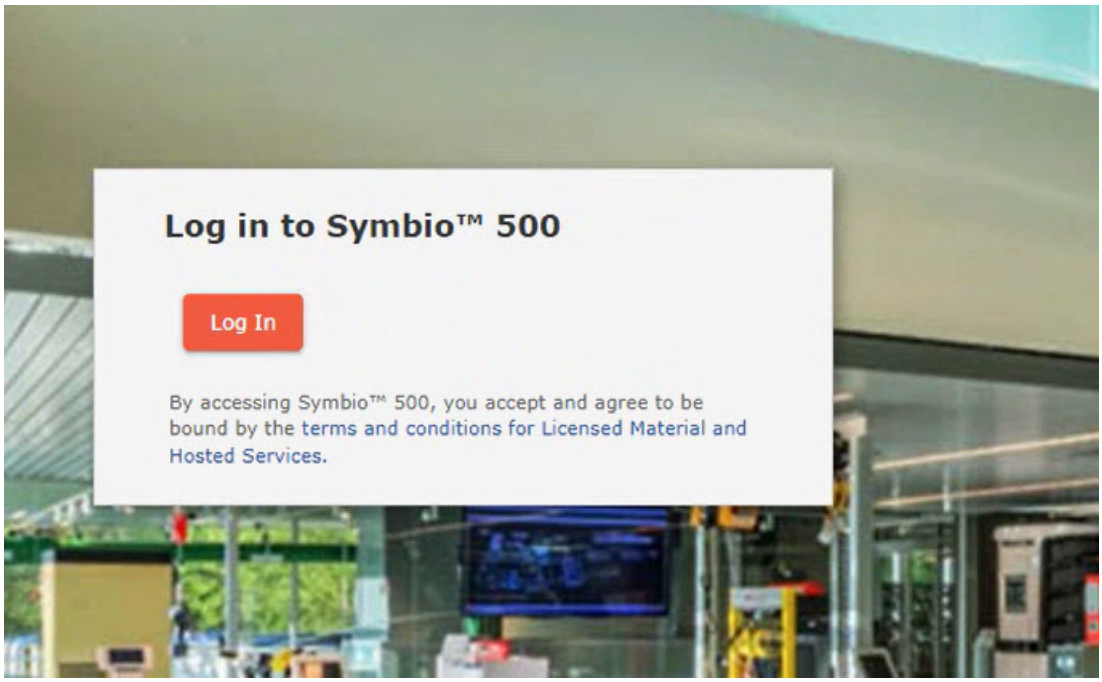
Start-up

1. Apply power to the control box.
2. Connect the USB to the Symbio 500 Service Tool USB connector.
3. The conductor will default to heat mode, using Symbio UI, Tracer TU, or a Test Utility.

Note: *When using Symbio UI, refresh the browser frequently to view the most up-to-date status.*

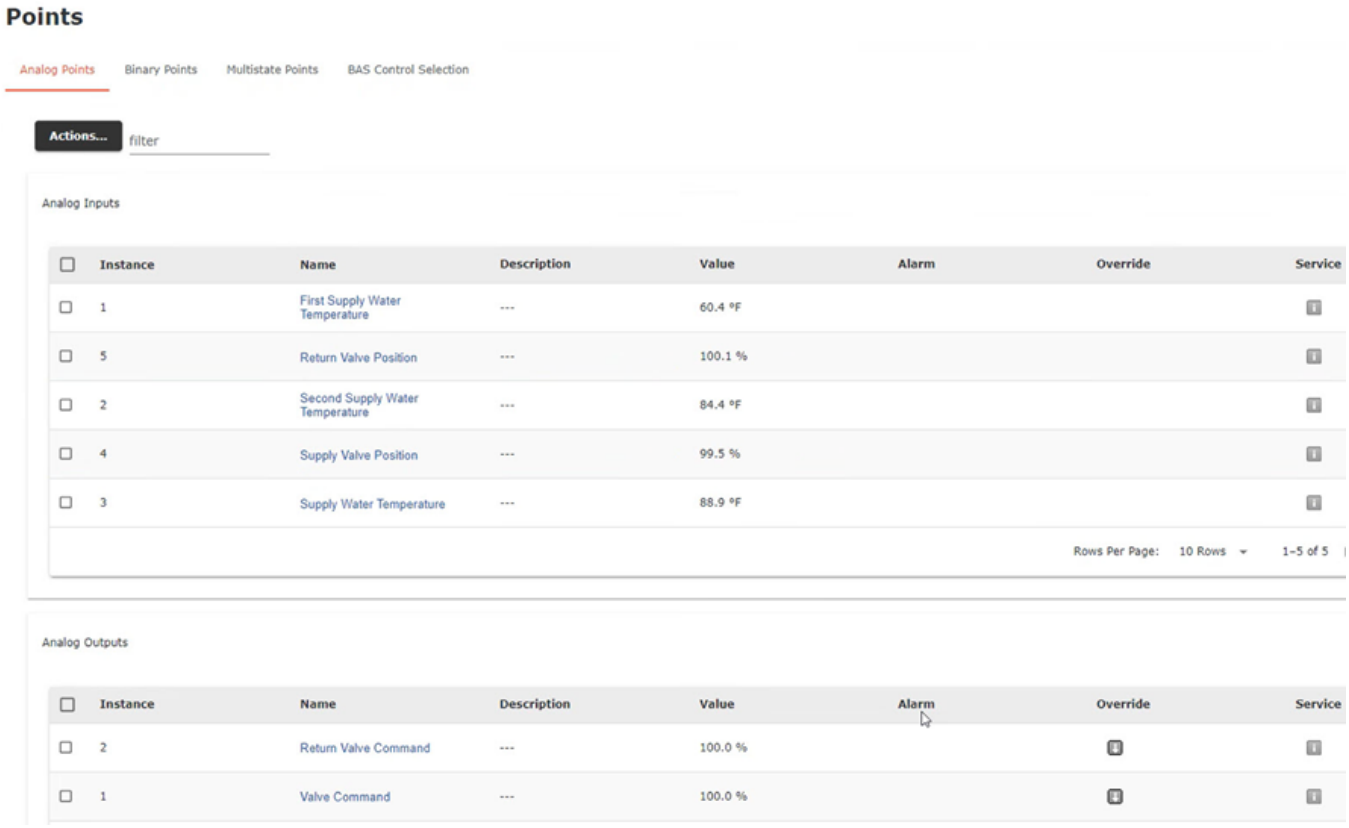
The HTML for the browser is **198.80.18.1**.

Figure 18. Symbio log-in screen



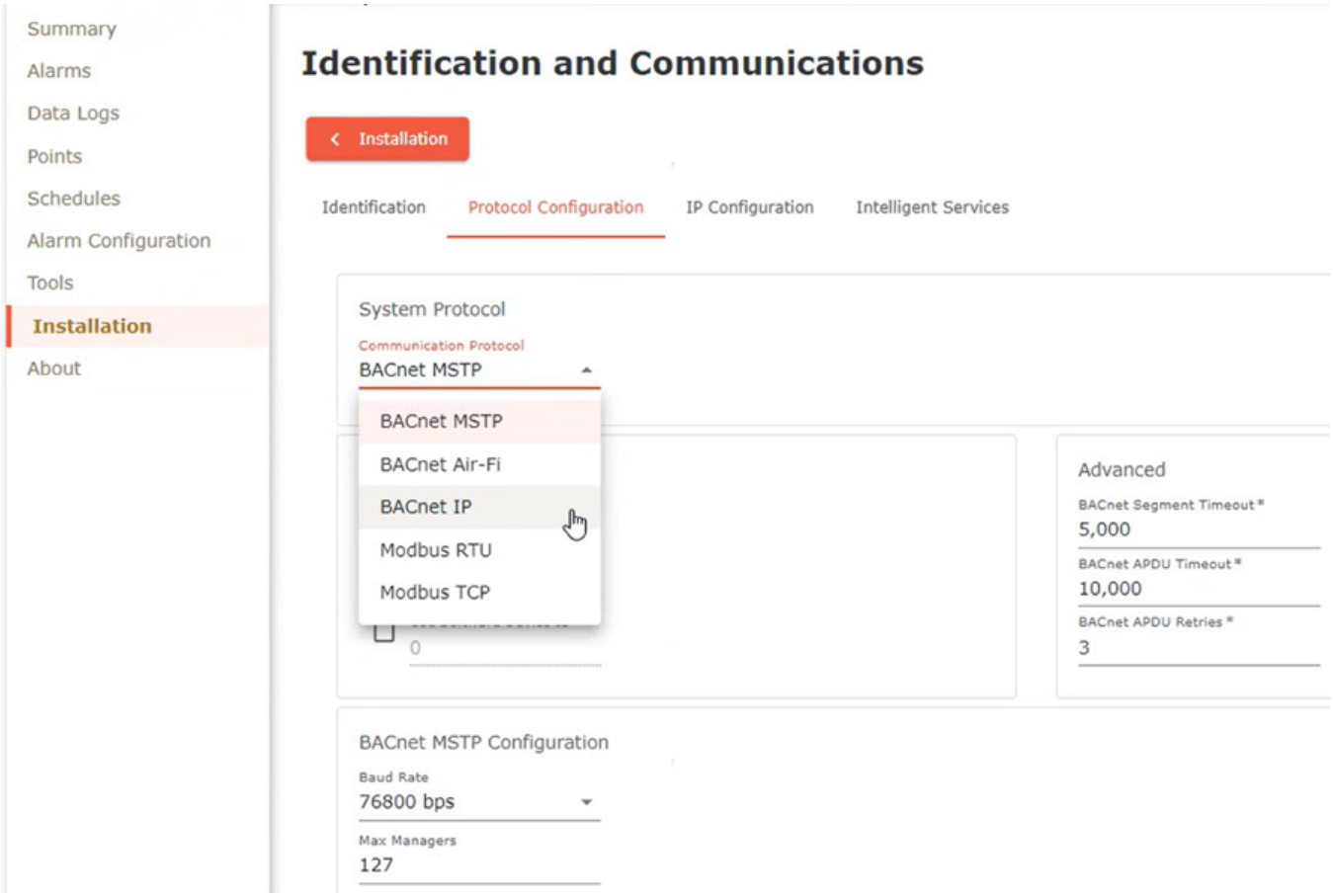
4. Confirm that the First Supply water temperature is reporting an appropriate Hot-Cold loop temperature.
5. Confirm that the Second Supply water temperature is reporting an appropriate Hot-Cold loop temperature.
6. Confirm that the Supply water temperature is reporting an appropriate Hot loop temperature.
7. Verify that the Supply Valve Position = 0% or 100%.
8. Verify that the Return Valve Position = 0% or 100%.

Figure 19. Points



9. Confirm valve actuation.
10. Using a Symbio UI, Tracer TU, or a Test Utility, under Override Heat Cool Mode Request to Cool.
11. Wait 150 seconds, then refresh the web page or tool.
12. Verify that the actuator positions have changed on the Supply and Return valves.
13. Verify that the Supply water temperature is reporting an appropriate Cold loop temperature.
14. Verify that the Supply Valve Position is now opposite of the reading before; either 0% or 100%.
15. Verify that the Return Valve Position is now opposite of reading before; either 0% or 100%.
16. Configure the communication protocol. The default is BACnet MSTP.

Figure 20. System protocol selection



Maintenance

The following periodic preventative maintenance practices are recommended for all butterfly valves:

1. Operate the valve from fully-open to fully-closed to ensure operation.
2. Check the flange bolting, actuator mounts, and hangers for loosening and correct, as needed.
3. Inspect the valve and surrounding area for previous or existing leaking at the flange faces or shaft connections.
4. Check the piping and/or wiring to the actuators and related equipment for looseness and correct, as needed.
5. If not in use, exercise the butterfly valve (fully open and close) at least once a month.

Regulary inspect the thermistor for signs of corrosion or damage, and schedule routine calibration to maintain accuracy.

Diagnostics

⚠ WARNING

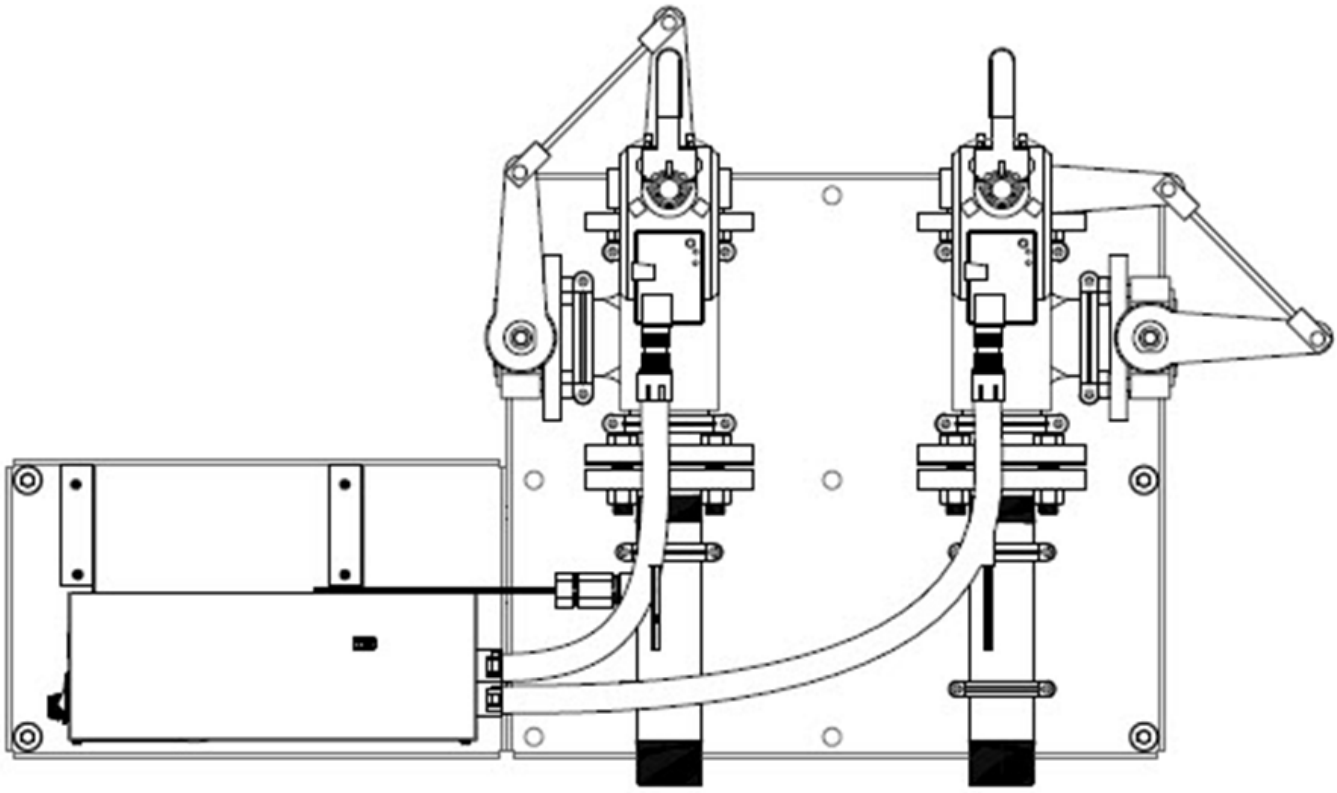
Hazardous Service Procedures!

Failure to follow all precautions in this manual and on the tags, stickers, and labels 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 following instructions: Unless specified otherwise, disconnect all electrical power including remote disconnect and discharge all energy storing devices such as capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. When necessary to work with live electrical components, have a qualified licensed electrician or other individual who has been trained in handling live electrical components perform these tasks.

Check for continuity to confirm that the control box and any of its components are working correctly.

Figure 21. Hydronic Branch Conductor



Troubleshooting

Symptom	Probable Cause	Recommended Action
The Service LED on the Symbio Controller will change from green to blinking Red if any points are in the Fault condition.	Temperature sensor malfunction	Inspect the sensor and wiring.
	Actuator malfunction (Figure 22, p. 38)	Inspect the actuator wiring and confirm that it is powered. Verify actuator operation by physically depressing the clutch and attempt to manually move the actuator arm.
The Tracer TU or BAS alarm is indicating the diagnostic valve position.	Something is preventing the correct valve position or reporting of the correct position.	Inspect the valve, actuator, and linkage. Look for obstructions or wiring issues. Confirm that both valves are in the same position (Figure 24, p. 39 and Figure 25, p. 39).
The Tracer TU or BAS alarm is indicating that the diagnostic is not satisfying the heat-cool request. The supply water temperature is not satisfying the heat-cool request.	Something is preventing the correct valve position or reporting of the correct position.	Inspect the valve, actuator, and linkage. Look for obstructions or wiring issues. Confirm that both valves are in the same position (Figure 24, p. 39 and Figure 25, p. 39).
	There is an actuator malfunction.	Inspect the actuator wiring and confirm that it is powered.
	There is a temperature sensor malfunction.	Verify that the requested water temperature meets the requirements.
The binary output 1 (valve fault) is active.	The diagnostic valve position is not satisfying the heat-cool request.	Inspect the valve, actuator, and linkage. Look for obstructions or wiring issues. Confirm that both valves are in the same position (Figure 24, p. 39 and Figure 25, p. 39).
	The temperature sensors are mounted incorrectly.	Verify that the requested water temperature meets the requirements.
The valve is not moving.	The valve is in a "hold" state.	Look at the binary value name: heat/cool postion hold. To bypass, press the service pin on the Symbio 500 (Figure 23, p. 38).
	Minimum cycle time	NEED INFO
The unit controller is not operating as indicated by the BAS heat-cool commands.	The unit controller lost communication.	Verify the controller wiring. Verify that the operation timer delays are off.
The Trim-and-Respond logic not showing requests from members.	Members without data specifc points, occupancy status.	Verify that all the voting members have occupancy status.
The unit is not operating.	There is a blown fuse.	Check for a blown fuse.

Figure 22. Actuator clutch

Figure 23. Service pin

Figure 24. Valve positions match

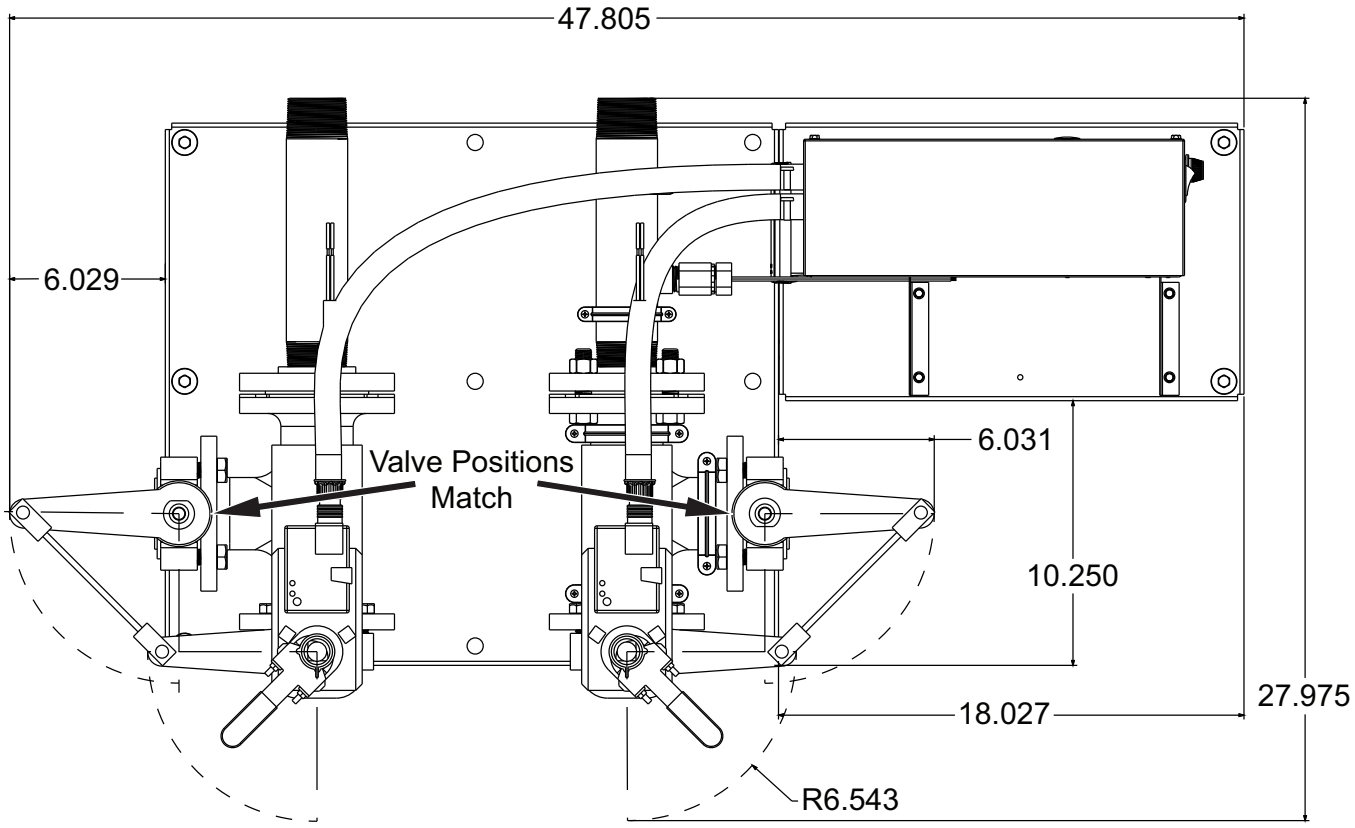
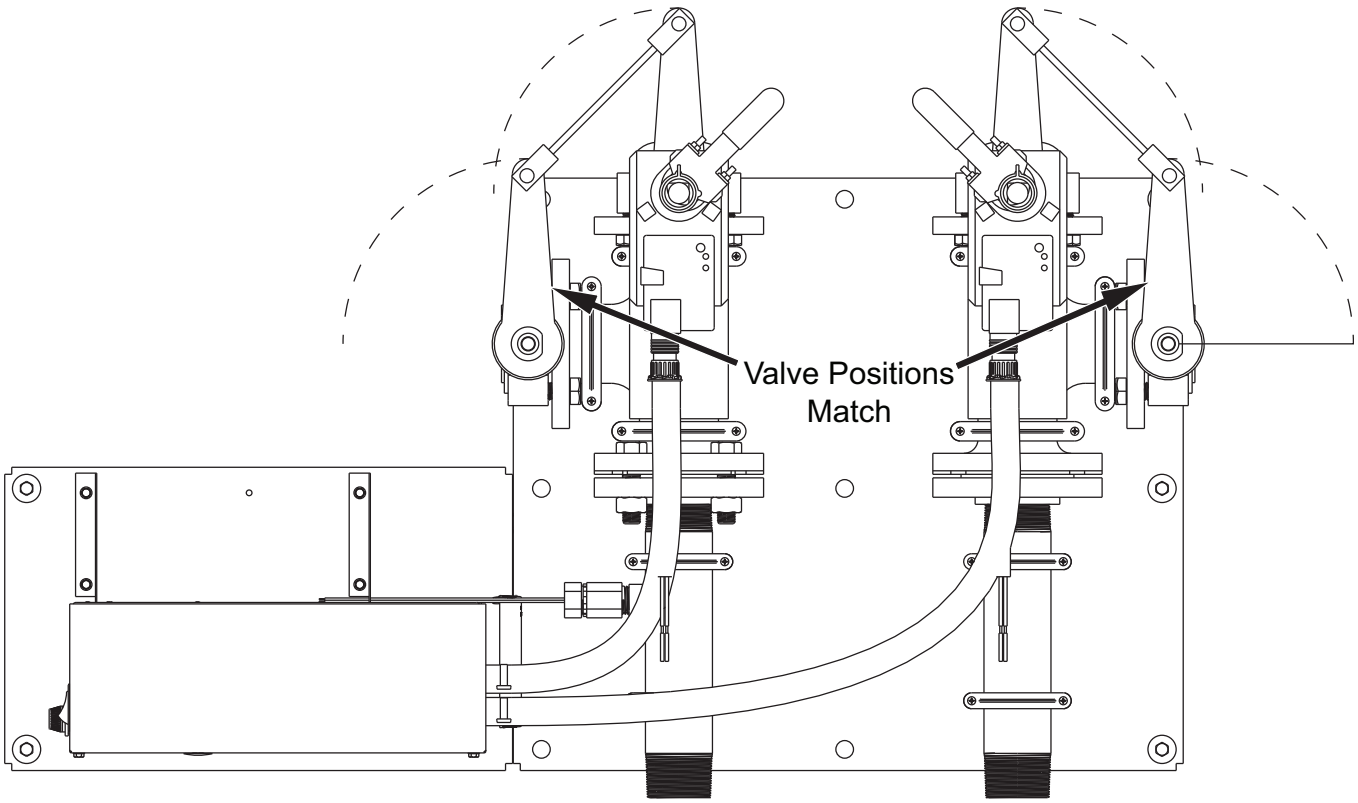


Figure 25. Valve positions match 2



Trane - by Trane Technologies (NYSE: TT), a global innovator - creates comfortable, energy efficient indoor environments for commercial and residential applications. For more information, please visit trane.com or tranetechnologies.com.

TD-SVX001A-EN 06 Dec 2024
Supersedes (New)