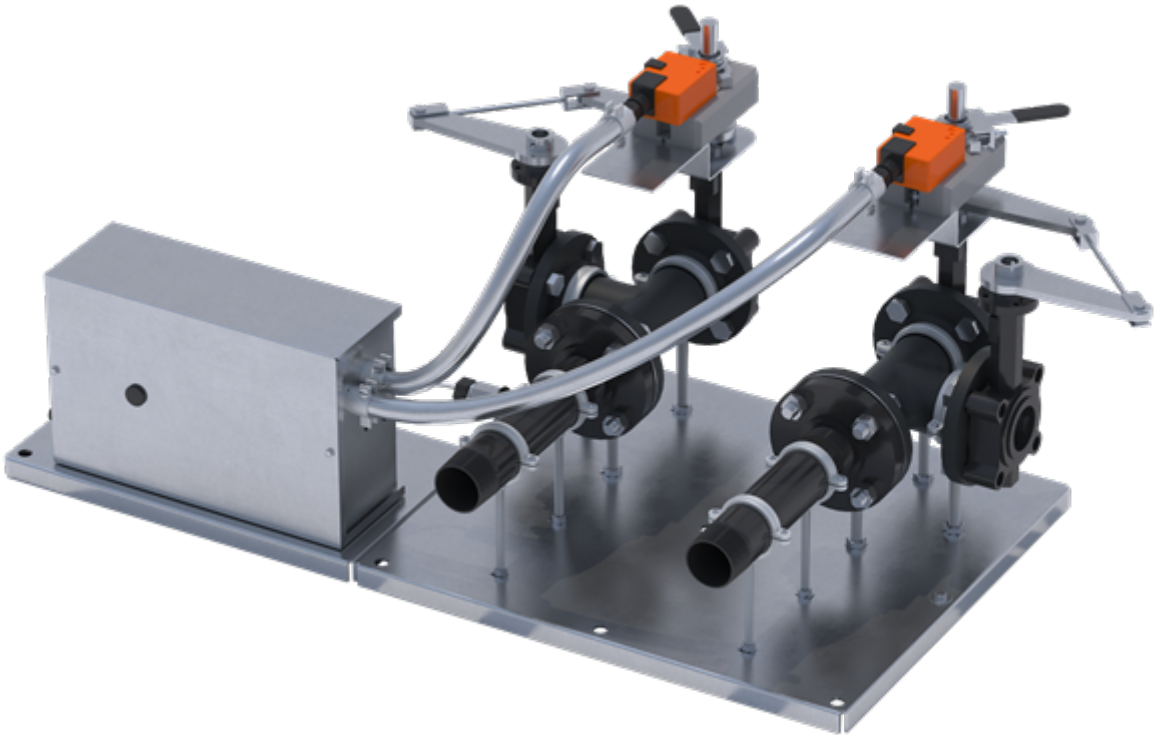
Product Catalog

Hydronic Branch Conductor



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Introduction

The Hydronic Branch Conductor is a self-contained valve assembly with integrated controls. This innovative system features advanced controller logic that detects both hot and cold water temperatures, seamlessly directing flow from the appropriate heat pump loops to either heat or cool specific thermal areas.

Trane's Hydronic Branch Conductor revolutionizes building climate control by enabling the use of dual-purpose coils within a four-pipe distribution system, while efficiently delivering heating or cooling through just two pipes. Unlike traditional two-pipe changeover systems that switch between hot and cold water seasonally for the entire building, this advanced system can adapt to varying heating and cooling demands in different areas multiple times throughout the day.

With a central four-pipe distribution system providing the benefits of year-round heating and cooling, and area branches utilizing a two-pipe setup, the Hydronic Branch Conductor offers reduced piping complexity and enhanced efficiency. Experience the best of both worlds with a heat pump system that combines the advantages of four-pipe and two-pipe configurations for optimal climate control.

Features and Benefits

Standard Features

- Belimo Butterfly Valves wired back to the controller in conduit
- 0% Leakage Valve
- Self-Contained Trane controller, pre-programmed with sequence of operation – can be used with BAS or standalone
- Thermal well on the supply to the Branch
- Pre-wired temperature sensors for hot and cold supply piping
- Mounted-on backplate for vertical or horizontal field mounting

Field-Installed Options

Air-Fi® Receiver

Energy Efficiency

- Using the same coil for both heating and cooling means milder hot water is sufficient for space heating (typically, 105°F or lower).
- Heat pump heating efficiency can be improved by more than 35% for every 20°F reduction in hot water setpoint.
- Each conductor delivers hot or cold fluid based on the changing needs of a thermal area throughout the year or the day. This allows for effective and efficient simultaneous heating and cooling throughout the building.
- The solution prevents system energy waste by stopping adjacent zones from fighting with each other. It also reduces air pressure drop at each zone by combining heating/cooling into a single coil.

Sustainable Comfort

- The Conductor adds zoned comfort benefits to all-electric hydronic heat pump systems.
- Grouping comfort zones into thermal areas allows for simultaneous heating and cooling throughout the building.
- The Conductor can be utilized with various types of airside equipment, including CoolSense, blower coils, unit ventilators, fan coils, small air handling units, and more, offering broad applicability across zone-level equipment.
- Milder-temperature hot water associated with hydronic heat pumps reduces hot spots/stratification with more even heat output.
- Unlike VRF heat pump systems, it provides precise temperature control and independent zone control.

Easier Installation and Retrofits

- Retrofits can use the existing cold-water piping for cooling and heating. This allows for retrofitting buildings with existing 140°F to 180°F hot water to 105°F or lower hot water heating by utilizing existing chilled water infrastructure.
- A single Conductor can be applied in lieu of six-way valves at each terminal unit on a branch.
- Works with existing factory controls for fan coils, blower coils, unit ventilators, CoolSense® terminal sensible-cooling units and small catalog air handlers with dual-purpose coils.
- Conductors can be installed in a central mechanical closet, eliminating the need for space in walls or ceilings and allowing them to be located outside the occupied areas.
- Using a single, dual-purpose coil (instead of separate heating and cooling coils) eliminates the need for larger, harder-to-fit casings on air handlers and air terminal units.

- Allows for significant reduction in mechanical installation cost by using two-pipe branch and zone piping.
- Reduces installation time of additional piping to a separate heating coil, which is critical for applications, such as a school renovation during summer break.
- Allows for the renovation or upgrade of two-pipe changeover systems to four-pipe control without disrupting the finished spaces at the zone level.

Application Considerations

- Hydronic heat pump systems with hot water supply temperatures between 90°F to 115°F
- System layout – for placement between central pipe chase and branch piping
- The Conductor does not control the zone-level terminal units. Each terminal unit is equipped with a unit controller that modulates its control valve to provide independent temperature control for the zone it serves.
- There is not a minimum number of terminal units (or zones) that comprise a thermal area; it could be as few as one. The maximum number of terminal units is dictated by the fluid flow limit of the Hydronic Branch Conductor valves and piping.
- For more details, see *Application Guide (APP-APG024*)*.

Performance Data

- The Hydronic Branch Conductor uses two 3-way butterfly valves (2 inches) with modulating, non-spring return, 24V actuators.

  The valves offer a 0% leakage bubble-tight shutoff, capable of handling flow rates of up to 12 feet per second (FPS), a cold working pressure (CWP) of 200 psi, and a maximum fluid temperature of 180°F.

  Additionally, the selected valves can accommodate up to 50% glycol concentration, making them suitable for a variety of systems.
- Each conductor assembly includes two 3-way butterfly valves, two modulating 24V actuators with linkage, flange fittings, and straight pipes for both supply and return.
- The fluid flow rates for the Hydronic Branch Conductor range from 25 GPM to 74 GPM for 2-inch pipes.

  See Table 1, p. 8 and Table 2, p. 8 for additional capacity limits and thermal area information.

  See Table 3, p. 9 for pressure-drop calculations.

Table 1. 1-1/2-inch pipe flow thermal area

Fluid Velocity (FPS)	Fluid Flow (GPM)	Thermal Area Cooling Tons(b) for 35% EG Fluid ΔT[a]			
		ΔT = 6°F	ΔT = 10°F	ΔT = 15°F	ΔT = 20°F
2.5	14	3	5	8	10
5	29	6	11	16	21
7.5	43	9	16	24	32

[a] Fluid flow and thermal area size

Table 2. 2-inch pipe flow thermal area

Fluid Velocity (FPS)	Fluid Flow (GPM)	Thermal Area Cooling Tons for 35% EG Fluid ΔT[a]			
		ΔT = 6°F	ΔT = 10°F	ΔT = 15°F	ΔT = 20°F
2.5	25	6	9	14	18
5	49	11	18	27	36
7.5	74	16	27	41	54

[a] Fluid flow and thermal area size

Table 3. Pressure-drop calculations

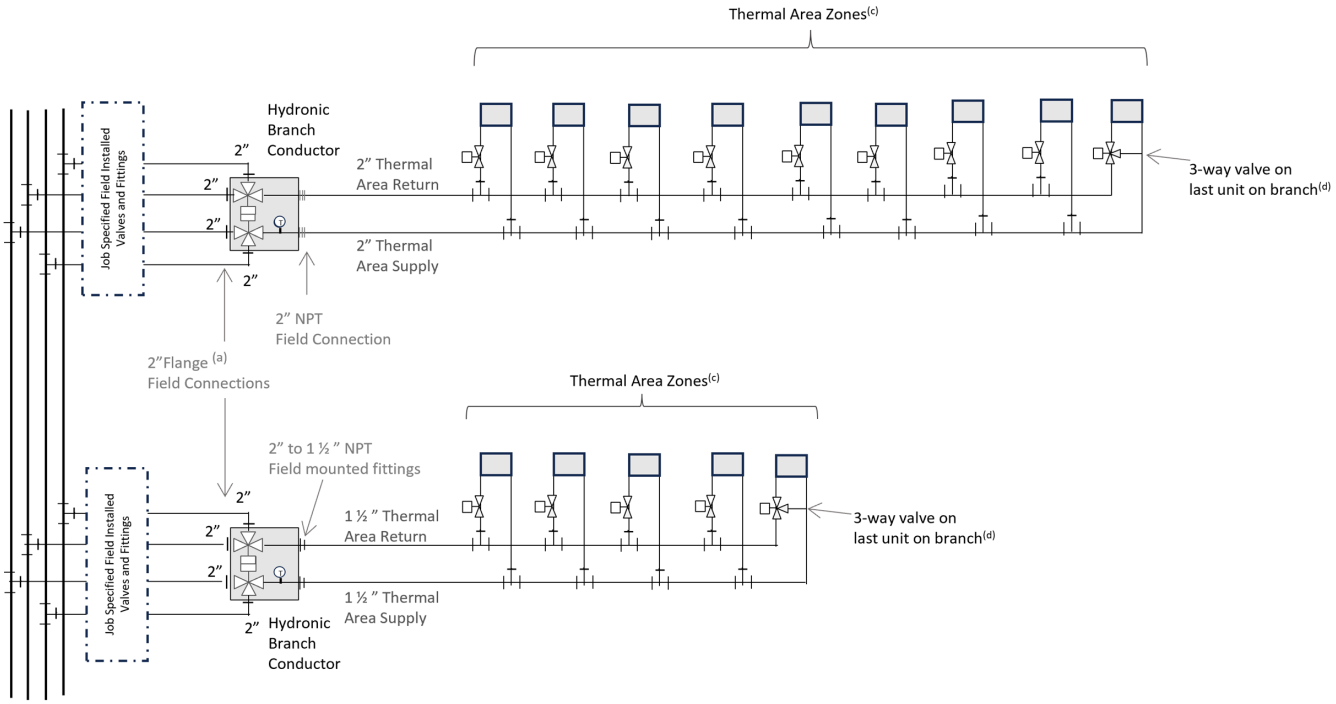
												Belimo		
	Water Flow (GPM)	Total WPD (feet)	Tube ID (inch)	Water Volume (feet/ second)	Area (ft^2)	W (lb/ hour)	Vis (lb/ hour-feet)	Re	F	Total Straight Length (inch)	Straight Tube WPD (feet)	CV	Number	WPD (feet)
Hydronic Branch Conduc-tor at 7.5 ps	74.00	1.03	2.07	7.08	0.0233	36985.2	3.185	85836	0.018462	11.00	0.076	115.0	1	0.96
Hydronic Branch Conduc-tor at 2.5 fps	25.00	0.12	2.07	2.39	0.0233	12495.0	3.185	28999	0.024215	11.00	0.011	115.0	1	0.11

Each zone unit in Figure 1, p. 10 is shown with the recommended two-way valves.

A three-way control valve should be installed on the terminal unit at the end of the branch piping run. This will allow a minimum flow to increase the response time between the transition from Cool Mode and Heat Mode often. This will result in a small amount of flow through the branch piping, reducing the time for the auto-sampling sequence by the terminal units.

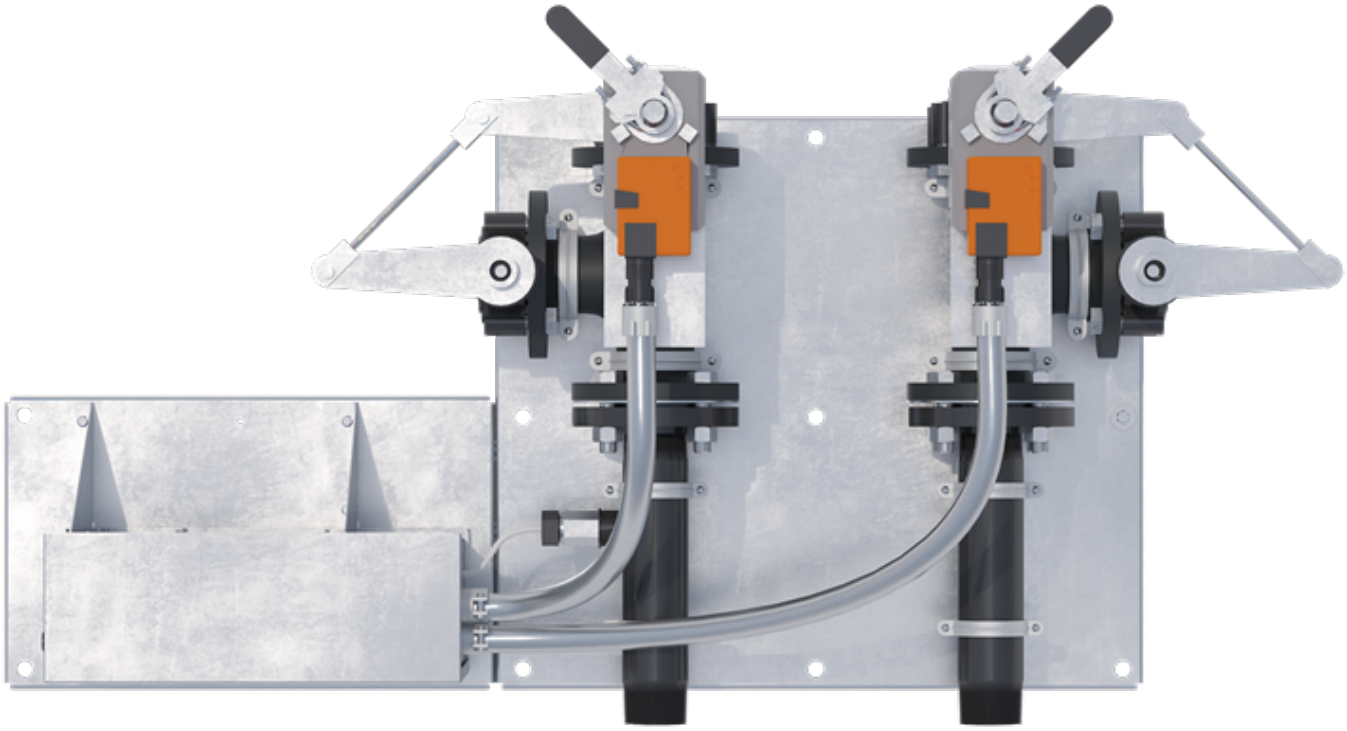
For more information, see *Application Guide (APP-APG024*-EN)*.

Figure 1. Thermal area/branch piping diagram



Notes:
(a) ANSI 125/150 flat-faced, raised face, slip-on or weld neck flanges-Do NOT use flange gaskets
(b) Field provided and installed fitting required for 1 ½" branch piping
(c) Thermal Area does not have a limit on total count of zones, the quantity limit is from fluid flow rate only.
(d) Three-way valve on last fan coil of a branch to improve mode switch response time by allowing a minimum flow

Figure 2. Top view of the hydronic branch conductor



Controls

Controller

The Hydronic Branch Conductor uses the Symbio™ 500 programmable controller, which is a multi-purpose, programmable, wireless sensor support device.

Features and Benefits

Feature	Benefit
BACnet® MS/TP	An open, standard building automation communications protocol which enables connections to other BAS systems and controllers.
Wireless BACnet communication using Trane Air-Fi®	Provides wireless communication between the Trane BACnet® unit, system controllers, and zone sensors. This allows for faster, easier, lower-risk installation and life-cycle savings due to future space re-configuration, upgrades, and expansions.
Configurable and fully programmable	Factory programs available through quick configuration for lowest set up time Field-programmable for flexibility to meet unique sequence or hardware needs
23 onboard input/output (I/O) points	Meets most terminal unit needs with extra built-in I/O available to network or additional programming on the controller. Analog inputs have RTD and additional thermistor type support.
Expandable to 133 points	Available expansion modules enable flexibility to meet unique equipment needs by adding 110 additional points (133 in total).
Data-logging	Easier investigation of equipment, zone, or building problems
Factory and field-mounting options	Options to best meet job schedule and bidding process
Removable connectors, DIN rail mounting, multiple service tool connections	Ease of installation and service
Built-in web interface	USB port to enable user interface (UI) for installation, integration, and serviceability
Ethernet-compatible	Ethernet ports for when wired BACnet/IP is specified or used to support the TD7 display. The Symbio 500 controller can support one or the other.

Feature	Benefit
Optional display	Optional TD7 display is available and can be used when BACnet/IP is not being used. See the notes on Ethernet compatibility above.
Built-in scheduling	Scheduling is accessed through the Web UI. This is used primarily when the SC+ controller has yet to be installed.
Trane Wi-Fi module support	Easy and secure connection to Trane Connect.

Note: *The Symbio™ 500 does not support LonTalk®.*

Specifications and Dimensions

Table 4. Storage

Temperature	-67°F to 203°F (-55°C to 95°C)
Relative humidity	Between 5% to 95% (non condensing)

Table 5. Operating

Temperature	-40°F to 158°F (-40°C to 70°C)
Humidity	Between 5% to 95% (non condensing)
Power	20.4 to 27.6 Vac (24 Vac, ±15% nominal) 50 to 60 Hz 24 VA
Mounting weight of the controller	Mounting surface must support 0.80 lb (0.364 kg)
Environmental rating (enclosure)	NEMA 1
Housing material	Polycarbonate/ABS blend UV protected U.L. 94–5VA flammability rating
Mounting	Mounts on EN 50 022 — 35 x 15 DIN rail that is included in the Conductor unit control box when the Symbio 500 is factory-mounted
Plenum rating	Not plenum-rated. The Symbio 500 must be mounted within a rated enclosure when installed in a plenum.

Table 6. Agency compliance

- UL60730-1 PAZX (Open Energy Management Equipment)
- UL94-5V Flammability
- CE Marked
- The European Union (EU) Declaration of Conformity is available from your local Trane® office.
- UKCA Marked
- FCC Part 15, Subpart B, Class B Limit
- VCCI-CISPR 32:2016: Class B Limit
- AS/NZS CISPR 32:2015: Class B Limit
- CAN ICES-003(B)/NMB-003(B)

Electrical Data

Control Box

- The control box uses a transformer that converts the 115V primary power supply to the 24V required by the controller.
- A toggle disconnect disengages the primary power to the terminal.
- A fuse is factory-installed in the primary voltage line.

Belimo Actuator

- AMX24-MFT-X1, 5-wire, 24 Vac/Vdc, floating-point, quarter-turn actuator with linkage-release button.
- Constant drive rate, independent of load, 150 second drive time, and non-spring return.
- Travel is terminated by end stops at the fully-opened and -closed positions.
- Internal electronic control prevents motor stall when the motor reaches end stops.

Immersion Thermistor

- Water temperature sensor with a sensing element type thermistor at 10k ohms at 77 ºF.
- 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

Dimensions and Weight

Length: 41.5 inches

Width: 20.5 inches

Height: 18.5 inches

Unit weight: 150 lb

Figure 3. Operational footprint

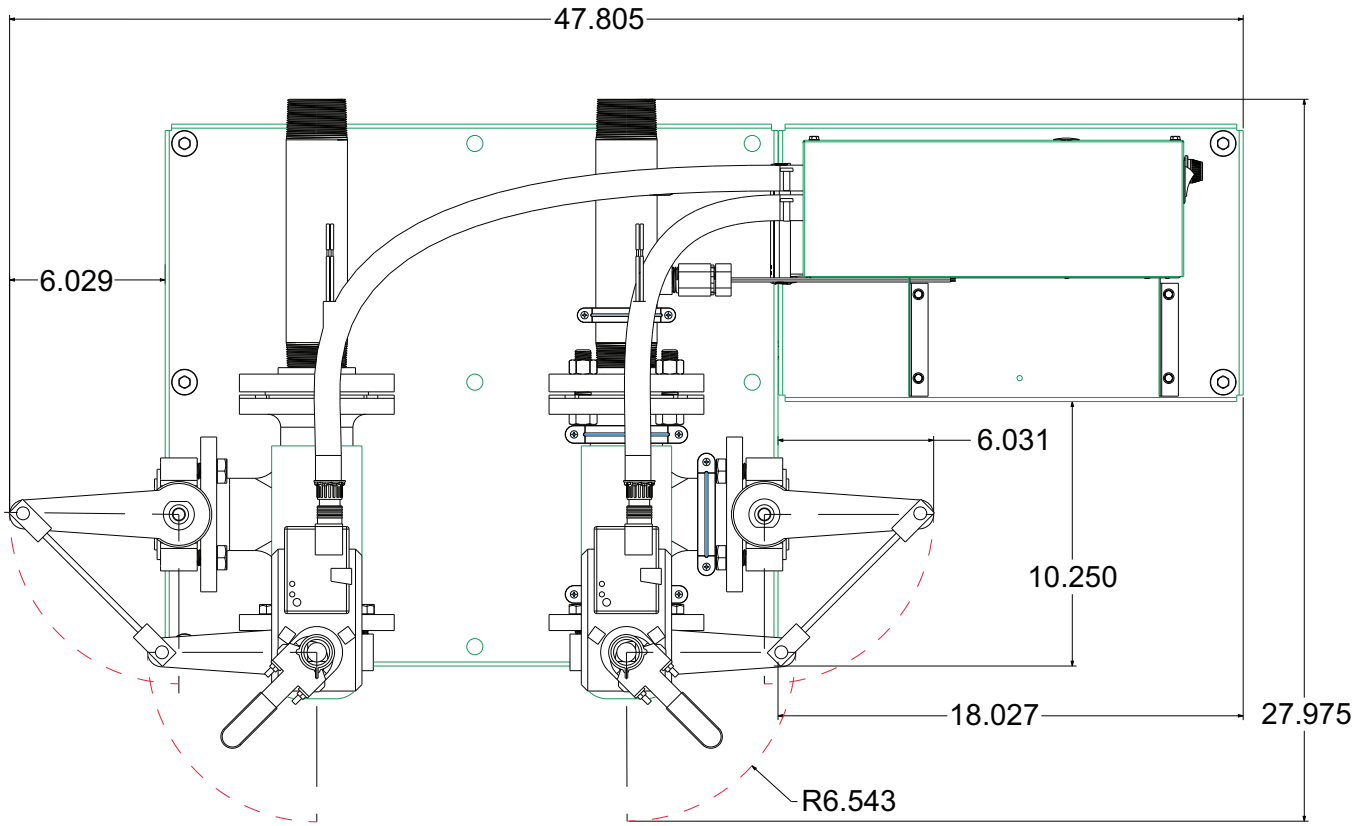


Figure 4. Side dimensions

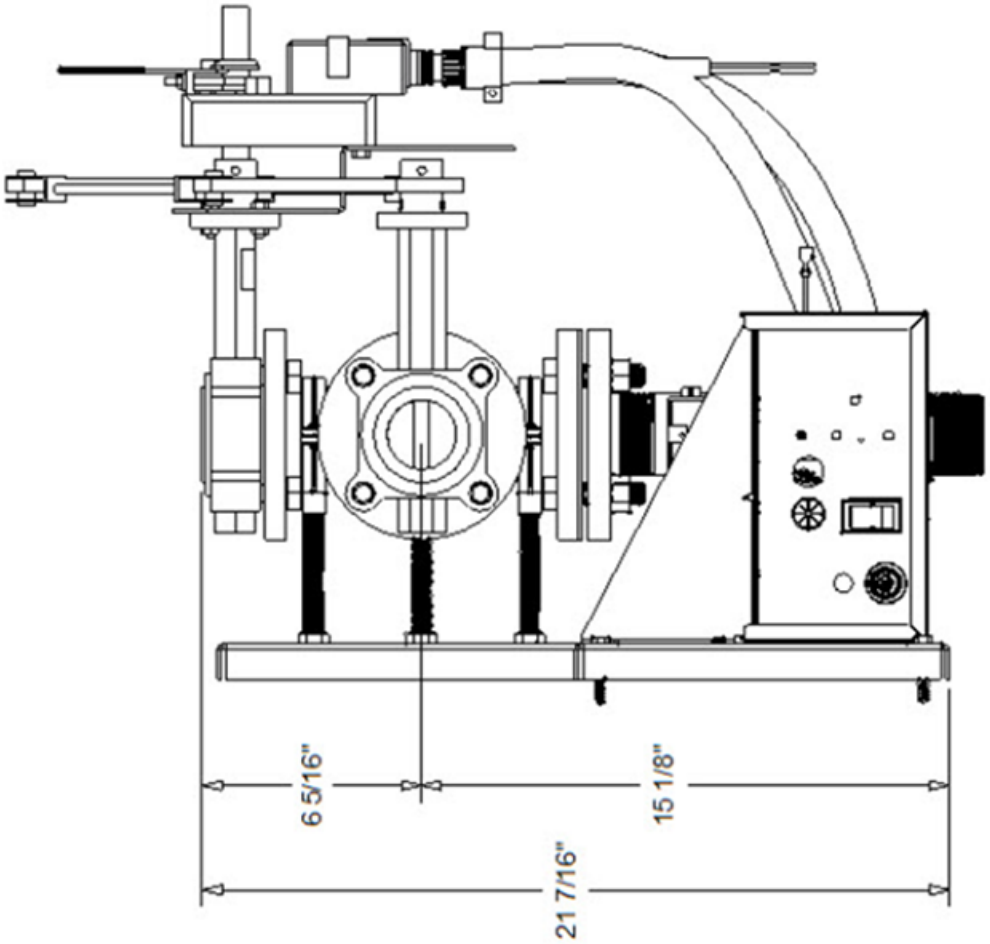
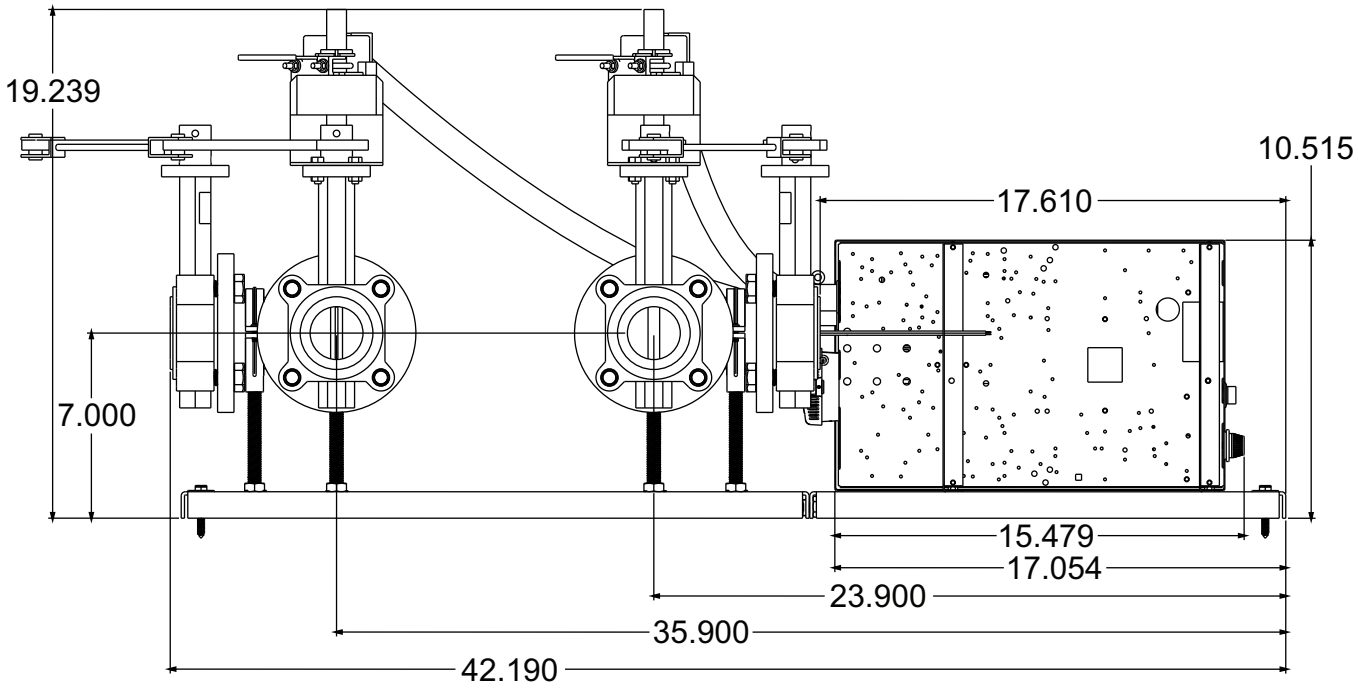


Figure 5. Side view dimensions



Mechanical Specifications

Hydronic Branch Conductor Controls

DDC Controller

Each Hydronic Branch Conductor includes a factory-mounted, tested, and wired unit controller. Each unit controller shall include a microprocessor-based controller and is an integral part of the equipment. Use the controller as a standalone application, or with a compatible building automation system.

The controller shall be located in a control box containing 120V line voltage to 24VAC transformer for the factory-installed powered control components. A toggle disconnect disengages the primary power to the Hydronic Branch Conductor. A fuse is factory installed in the primary voltage hot leg. The wires from the transformer are terminated in the factory on the control board. All end-devices are factory-mounted and installed with wires terminated on the control board.

BACnet® Communications

The controller communicates using BACnet MS/TP, BACnet IP, and BACnet over ZigBee (Trane Air-Fi Wireless communications with field provided interface).

User Interface

The controller is accessible with a web-based user interface (UI) used for installation, integration, and service tasks. UI is accessed over a USB connection and does not require proprietary software or cables.

Unit Controller Sequence of Operations

First and Second Supply Water Identification

The unit controller monitors the first and second entering water temperatures using two sensors installed on the first and second pipes (see mechanical drawings for precise locations). These readings will be compared to the space temperature BAS setpoint of 72.5°F (adj.).

If the water temperature exceeds the setpoint by more than 5.0°F, the controller will report the connection as **Hot** water.

Conversely, if the water temperature falls more than 5.0°F below the setpoint, the controller will report it as **Cool** water.

If the water temperature is within +/- 5.0°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.

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**. If the water temperature exceeds the setpoint by more than 5.0°F for more than five minutes, or if the water temperature is within +/- 5.0°F from the setpoint, the controller will report mode status as **FAULT**.

When the Hydronic Branch Conductor is in **Heat** mode, the mode status will report as **Hot**. If the water temperature exceeds the setpoint by more than 5.0°F for more than five minutes, or if the water temperature is within +/- 5.0°F from the setpoint, the controller will report mode status as **FAULT**.

Heat-Cool Mode

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 4 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 continuously monitors 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 areal.

If the first supply has **Cool** status and the second supply has **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 the first supply to the thermal area.

If the thermal area supply status is not **Cool** after five 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 five minutes, an alarm will be sent to the BAS.

During **Heat** 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 **Heat** status, 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 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 five 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 five minutes, an alarm will be sent to the BAS.

If there is an interruption of power to the Conductor, the valve positions will stay in place. When power is restored, the Conductor will resume the last communicated mode. If there is a change in mode request from the BAS, there will be a staggered delay of up to 150 second to prevent multiple units changing position simultaneously. 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 sends an alarm to the BAS if the following occur:

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

Hydronic Branch Conductor Electronic Actuator

The actuators are 24V motor-operated modulating actuators with analog position feedback through voltage signal. The actuators deliver torque required for continuous, uniform movement of the butterfly valves from limit to limit when operated at rated conditions. The actuators are capable of stopping at numerous points across full movement range and starting in either direction from any point in range.

The actuator drives proportional to input signal and modulates throughout its angle of rotation from the signal received from the Hydronic Branch Conductor Unit Controller. Actuators provide analog position

feedback through signal to the Hydronic Branch Unit Controller for proper control and remote monitoring.

A position indicator and graduated scale are on each actuator, indicating open and closed travel limits. Each actuator shall have electronic overload protection throughout the entire operating range in both directions.

Agency Listings

ISO 9001, UL 873 or UL 60730, CE and CSA

Temperature

Suitable for operating temperature range of -22°F to 122.0°F.

Humidity

Suitable for humidity range encountered by application; minimum operating range shall be from 5 to 95 percent relative humidity, non-condensing.

Enclosure

NEMA Type 2 for indoor and protected applications

Hydronic Branch Conductor Sensors

Supply Temperature Sensor

The Hydronic Branch Conductor has an immersion well that extends into the thermal area supply pipe downstream of the incoming supply butterfly valves. A threaded thermistor probe will be factory-installed and wired. The well is sealed with a tight-fitting immersion probe with thermal conductive compound for accurate readings.

A thermistor attached to the exterior of the pipe is not allowed.

First Supply and Second Supply Hot/Cold Detection Sensors

The Hydronic Branch Conductor has two factory-wired 10K thermistors. The sensors have a stainless steel probe and 22 AWG plenum-rated pvc cable with a maximum of 102 inches to allow for field-mounting upstream of the Hydronic Branch Conductor on the exterior of the first supply and second supply pipes.

Hydronic Branch Conductor Pipe Connections

The primary and secondary supply and return connections have 2-inch NPS ANSI Class 150 flanged connections, no gaskets required for the field connection to ANSI Class 125/150 flange connection.

The thermal area supply and return have 2-inch NPS male NPT connections. All connections are labeled First (or Cooling) supply, First (or Cooling) Return, Second (or Heating) Supply, Second (or Heating) Return, Area Supply, and Area Return.

General Information

The Conductor connects two-pipe branch area piping to a central four-pipe distribution system. The Conductor receives a call for either Heat or Cool and self-determines which hydronic supply flow and corresponding return flow is sent and returned from the branch area. It sends the appropriate fluid flow to satisfy the call for Heat or Cool while isolating this flow from the unused supply and return flows in the central four-pipe distribution system. The Conductor comes as a one-piece assembled unit with a factory-programmed unit controller and all its necessary sensors and control components wired. The control is self-contained, requiring only a request for cooling or heating from the BAS or binary input if there is no BAS present. The Conductor continuously monitors the connected first and second supply lines and determines which line(s) have cooling fluid and heating fluid, and automatically adjusts if there is a change. Valve positions, branch area supply temperature, and the available Heat and Cool status from the first and second supply are monitored and reported to the BAS.

Regulatory Requirements

The Conductor is manufactured to conform to UL 60335 2-40 and is listed as either UL/CUL or ETL. Units come with the listing agency label affixed to the unit.

Hydronic Branch Conductor Valves

The six-way valve assembly consists of two commercial-grade three-way butterfly valves. The Conductor supply piping has one 3-way butterfly valve arranged in a cast iron tee configuration, mechanically cross-linked for proper supply flow orientation. The Conductor return piping has one 3-way butterfly valve, arranged in a cast ion tee configuration, mechanically cross-linked for proper return flow orientation.

The supply and return butterfly valves actuators are electronically linked by the Hydronic Branch Conductor controller for proper flow orientation. The butterfly-style control valves material includes a ductile iron body, 304 stainless steel disc, 420 stainless steel shaft, reinforced EPDM seat, reinforced PTFE shaft bushing.

- **Media:** chilled water, hot water, 60% glycol
- **Performance:**
  - **Media temperature:** -22.0°F to 250.0°F
  - **Body pressure:** 232.00 psi cold working pressure (CWP)
  - **Close-off pressure:** 200.00 psi
  - **Maximum velocity:** 12 FPS
  - **Leakage:** 0% flow
  - **Flow characteristic:** linear

Notes

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.

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