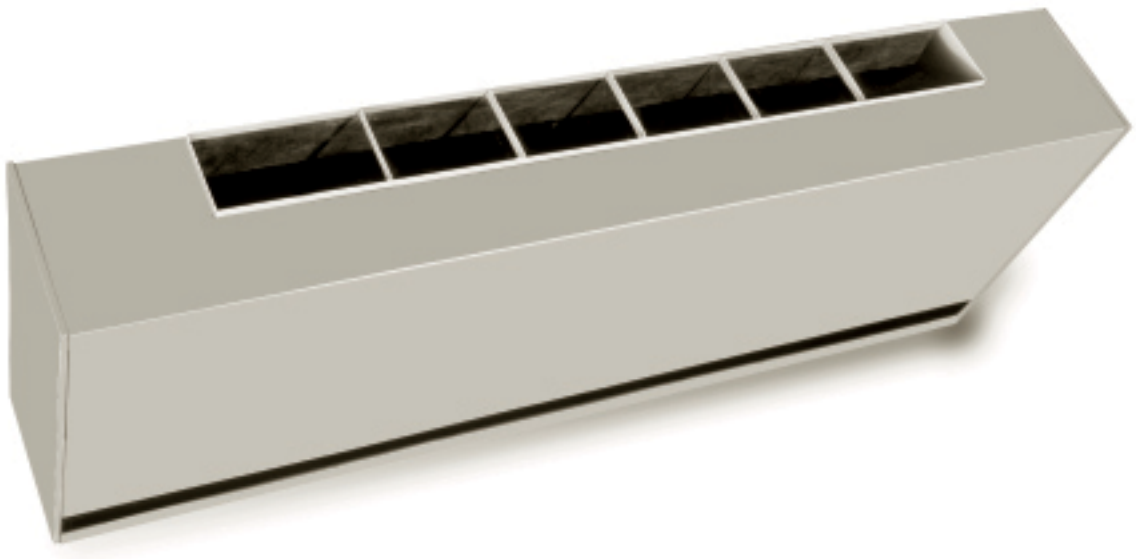
Installation, Operation, and Maintenance

Horizontal Classroom Unit Ventilator

Modul HUV

750 to 2000 CFM



⚠ 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.

November 2024

UV-SVX007A-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.**

⚠ WARNING

R-454B Flammable A2L Refrigerant!

Failure to use proper equipment or components as described below could result in equipment failure, and possibly fire, which could result in death, serious injury, or equipment damage.

The equipment described in this manual uses R-454B refrigerant which is flammable (A2L). Use ONLY R-454B rated service equipment and components. For specific handling concerns with R-454B, contact your local representative.

⚠ WARNING

Electrical Shock Hazard!

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

Properly connect the system's oversized protective earthing (grounding) terminal(s).

Copyright

Trademarks

All trademarks referenced in this document are the trademarks of their respective owners.

Product Safety Information

This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety. Children should be supervised to ensure that they do not play with the appliance.

Maximum altitude of use 3000 meters.

This appliance incorporates an earth connection for functional purposes only.

Table of Contents

Model Number Description

Digit 1, 2, 3 — Unit Configuration

HUV = Horizontal Unit Ventilator

Digit 4 — Development Sequence

C = Third generation

Digit 5, 6, 7 — Capacity; Nominal

075 = 750 CFM
100 = 1000 CFM
125 = 1250 CFM
150 = 1500 CFM
200 = 2000 CFM

Digit 8 — Voltage (Volt/Hz/Phase)

1 = 120V/60/1
2 = 208V/60/1
3 = 208V/60/3
4 = 240V/60/1
5 = 240V/60/3
6 = 277V/60/1
8 = 480V/60/3-phase 4-wire power supply

Digit 9 — Motor

0 = Free discharge ECM
7 = Free discharge ECM, low FLA
A = High static ECM
H = High static ECM, low FLA

Digit 10, 11 — Design Sequence

**** = Design sequence

Digit 12, 13 — Coil Letter Designation

(Single Coil Options)

AA = 2-row, 12 fpi chilled-water/hot - water changeover
AB = 2-row, 16 fpi chilled-water/hot - water changeover
AC = 3-row, 12 fpi chilled-water/hot - water changeover
AD = 4-row, 12 fpi chilled-water/hot - water changeover
AE = 4-row, 16 fpi chilled-water/hot-water changeover
H1 = 1-row, 12 fpi heating coil
H2 = 1-row, 14 fpi heating coil
H3 = 1-row, 16 fpi heating coil
H4 = 2-row, 12 fpi heating coil
H5 = 2-row, 14 fpi heating coil
H6 = 2-row, 16 fpi heating coil
K1 = 1-row low capacity steam coil
K2 = 1-row high capacity steam coil
G0 = 2-row, 12 fpi DX coil

Digit 12, 13 — Coil Letter Designation (continued)
(Coupled Coil Options)

DA = 1-row, 12 fpi hot-water coil with 2-row,12 fpi chilled-water coil
DC = 1-row, 12 fpi hot-water coil with 2-row, 14 fpi chilled-water coil
DD = 1-row, 12 fpi hot-water coil with 3-row, 12 fpi chilled-water coil
DE = 1-row, 14 fpi hot-water coil with 3-row, 14 fpi chilled-water coil
DK = 1-row steam coil with 3-row chilled-water coil
X3 = 3-element electric coil with 3-row chilled-water coil (2-row on size 125)
GK = 1-row steam coil with 2-row DX coil
GA = 1-row heating coil with 2-row DX coil
G3 = 3-element electric heat coil with 2-row DX coil
R1 = 3-row, 12 fpi chilled-water coil with 1-row, 12 fpi hot-water coil
R2 = 3-row, 14 fpi chilled-water coil with 1-row, 12 fpi hot-water coil

Digit 14 — Coil Connections

A = Right-hand supply
B = Left-hand supply
C = 2 coil LH cooling/RH heating
D = 2 coil RH cooling/LH heating

Digit 15 — Control Types

E = Symbio™ 400-B
F = Symbio 400-B with time clock
G = Symbio 400-B with Air-Fi Wireless Communications Interface (WCI)
N = CSTI fan status
8 = Customer-supplied terminal interface (CSTI)
9 = CSTI with low temp

Digit 16 — Face-and-Bypass/Electric Heat Stages

0 = None
1 = Face-and-bypass damper - field installed actuator
8 = Face-and-bypass damper - factory installed actuator
4 = Single-stage electric heat control
5 = Dual-stage electric heat control

Digit 17 — Refrigerant Types

A = No Refrigerant
B = R-410A VRF/replacement/international only
C = R-454B

Digit 18 — Damper Configuration

0 = Field-installed damper actuator
1 = 100% return air/no damper or actuator (Modulating ASHRAE Cycle II)

F = Return air/outside air damper and actuator (2–10 Vdc)
A = Return air/outside air damper and actuator (3-point modulating)
E = Return air/outside air damper and actuator with exhaust (3-point modulating)
(Two Position Control)

D = Damper with manual quad adjustment

Digit 19 — Zone Sensor/Fan Speed Switch

0 = No sensor - unit-mounted fan speed switch (CSTI)
A = Wall-mounted
J = Wall-mounted zone sensor (OALMH; setpoint dial; OCC/UNOCC
K = Wall-mounted zone sensor (OALMH; setpoint dial)
L = Unit-mounted zone sensor (OALMH; setpoint dial)
M = Wall-mounted display sensor with setpoint adjustment
P = Wall-mounted sensor (setpoint dial; OCC/UNOCC with unit mounted speed switch
Q = Wall-mounted sensor (setpoint dial) with unit speed switch
3 = Wireless display sensor (OALMH)
4 = Wireless sensor - ext adjustment
5 = Unit-mounted variable fan speed control (CSTI)

Digit 20 — Inlet Arrangement

A = Fresh air (FA) duct top/return air (RA) duct lower back
B = Fresh air duct top/return air duct bottom
C = Fresh air duct top/return air bar grille bottom
F = Fresh air duct upper back/return air duct lower back
G = Fresh air duct upper back/return air duct bottom
H = Fresh air duct upper back/return air bar grille bottom
J = Fresh air duct upper back/return air open bottom
K = 100% fresh air duct upper back
L = 100% return air duct lower back
M = 100% return air duct bottom
N = 100% return air bar grille bottom
P = 100% return air open bottom

Model Number Description

Digit 21 — Discharge Arrangement

1 = Bar grille discharge
2 = Duct collar discharge per submittal
3 = Duct collar discharge 3/4 in. from top
5 = Front double deflection grille discharge

Digit 22 — Unit Access Panel

0 = Standard horizontal access panel
1 = Safety chain/standard access panel
2 = Removable access panel
3 = Safety chain/removable access panel

Digit 23 — Recessing Flange

0 = No recessing flange
1 = Standard recessing flange

Digit 24 — Piping Package

0 = None
E = Basic - ball valve supply and return
F = Basic - ball valve supply and manual circuit setter return
G = Deluxe - ball valve supply and manual circuit setter return
H = Deluxe - ball valve supply and return with auto flow

Digit 25 — Filter

1 = Throwaway filters
2 = MERV8 filter
3 = MERV13 filter

Digit 26 — Color Selection

1 = Deluxe beige cabinet
2 = Cameo white cabinet
3 = Soft dove cabinet
4 = Stone gray cabinet
5 = Driftwood gray cabinet

Digit 27 — Motor Disconnect

A = Non-fused toggle
B = Circuit breaker

Digit 28 — Control Accessories

0 = None
A = CO_2 sensor control support
B = Wall-mounted relative humidity sensor (Options)

C = Air-Fi dehumidification and CO_2
D = Air-Fi dehumidification
E = Air-Fi CO_2

Digit 29 — Future Option

0 = None

Digit 30 — Cooling/Changeover Valve Type

0 = None
A = 2-way, 2-position N.C.
B = 2-way, 2-position N.O.
C = 3-way, 2-position N.C.
D = 3-way, 2-position N.O.
E = 2-way, modulating
F = 3-way, modulating
G = 2-way, analog (2-10 Vdc)
H = 3-way, analog (2-10 Vdc)
J = Field supplied, 2-position N.C.
K = Field supplied, 2-position N.O.
L = Field supplied, modulating
M = Field supplied, analog (2-10 Vdc)

Digit 31 — Cv Cooling/Changeover Valve

0 = None
A = 2-way 2.3 Cv
B = 2-way 3.3 Cv
C = 2-way 4.6 Cv
D = 2-way 6.6 Cv
E = 3-way 2.7 Cv
F = 3-way 4.6 Cv
G = 3-way 7.4 Cv

Digit 32 — Heating Valve Type

0 = None
A = 2-way, 2-position N.C.
B = 2-way, 2-position N.O.
C = 3-way, 2-position N.C.
D = 3-way, 2-position N.O.
E = 2-way, modulating
F = 3-way, modulating
G = 2-way, analog (2-10 Vdc)
H = 3-way, analog (2-10 Vdc)
J = Field supplied, 2-position N.C.
K = Field supplied, 2-position N.O.
L = Field supplied, modulating
M = Field supplied, analog (2-10 Vdc)

Digit 33 — Cv Heating Valve

0 = None
A = 2-way 1.4 Cv
B = 2-way 2.4 Cv
C = 2-way 3.4 Cv
D = 2-way 4.8 Cv
E = 2-way 5.9 Cv
F = 3-way 2.7 Cv
G = 3-way 4.6 Cv
N = 3-way 7.4 Cv
J = Steam 1.8 Cv valve only
K = Steam 4.6 Cv valve only
P = Steam 7.3 Cv valve only

Digit 34 — Cooling/Changeover Auto Flow GPM

0 = None
A = 4.0
B = 4.5
C = 5.0
D = 6.0
E = 6.5
F = 7.0
G = 8.0

Digit 35 — Heating Auto Flow GPM

0 = None
A = 1.0
B = 1.5
C = 2.0
D = 2.5
E = 3.0
F = 3.5
G = 4.0
H = 4.5
J = 5.0
K = 6.0

General Information

Unit Description

Configuration: This classroom unit ventilator is configured in a horizontal (ceiling mount) configuration. The units range from 750 cfm to 2000 cfm for the horizontal configuration.

Cabinet: The units are constructed of 14- and 16-gauge zinc coated steel. All steel surfaces are cleaned, phosphatized, rinsed and dried before application of final finish paint. The paint is applied by an electrostatic powder spray system, minimum thickness of 1.5 mil which results in an appliance grade finish.

Front Panels: The front panels are retained by Allen wrench operated locks which open with a 180° rotation. The bottom panel is constructed of heavy gauge material.

End Pockets: Unit Ventilators are equipped with end pockets to provide field installation of valves, piping, and controls. The units have a large pipe access opening in both end pockets and large knockouts for piping and electrical connections. All electrical connections are made in the lefthand end pocket, with exception of units equipped with the electric heating coil option.

Drain Pan: The drain pan is positively sloped in all planes to assure proper drainage and help eliminate the risk of microbial growth. To help ensure indoor air quality, the drain pan is insulated on the bottom to help prevent condensate formation. The drain pan can be easily removed for cleaning purposes. The drain pan is drilled-out and pitched toward the cooling coil connection during assembly per model number selection.

Fanboard: The fanboard assembly is acoustically designed in a single, rigid assembly that includes the fans, fan housing, bearings, fan shaft and motor. The fan motor is mounted on the fanboard. The fanboard is made from 14-gauge galvanized steel to resist corrosion and increase strength.

Electrically Commutated Motor (ECM): All motors are brushless DC (BLDC)/electronically commutated motors (ECM) factory-programmed and run-tested in assembled units. The motor controller is mounted in a control box with a built-in integrated user interface and LED tachometer. If adjustments are needed, motor parameters can be adjusted through momentary contact switches accessible on the motor control board.

Motors will soft-ramp between speeds to lessen the acoustics due to sudden speed changes. Motors can be operated at three speeds or with variable speed controller. The motor will choose the highest speed if there are simultaneous/conflicting speed requests.

All motors have integral thermal overload protection with a maximum ambient operating temperature of 104°F and are permanently lubricated. Motors are capable of starting at 50 percent of rated voltage and operating at 90 percent of rated voltage on all speed settings. Motors can operate up to 10 percent over voltage.

Filter: Standard units are equipped with a single 1-inch thick filter (MERV 8) that is accessible without removal of the unit front panel. Filter options include throwaway, MERV 8 and MERV 13 options.

OA/RA Damper: Trane unit ventilators are equipped with dual blade type mixing damper to ensure proper modulation and mixing of return and outdoor air designed in accordance to ARI 840. A splitter is placed between the damper blades to separate the fresh-air and return-air compartments to prevent draft blow-through.

Options

OA/RA Actuator: The OA/RA actuator provides true spring return operation for positive close-off of the OA/RA damper. The spring return system of the actuator closes the outside damper if power is lost to the building. When ordered with factory mounted controls, the actuator is 3-point floating. A 2 to 10 Vdc actuator is also available when other than Trane controls is required. See the following table for technical data of the OA/RA actuator.

Figure 1. Technical data for OA/RA actuator

Table 1. Technical data for OA/RA actuator

Power Supply	24 Vac ±20% 50/60Hz 24 Vac ±10%
Power	Running: 2.5W
Consumption	Holding: 1W
Transformer Sizing	5VA (class 2 power source)
Overload	Electronic throughout
Protection	0 to 95° rotation
Control Signal	2–10 Vdc 3 point floating with Trane controls
Rotation Angle	95° max. Adjustable with mechanical stop
Torque	35-inch/lb

Table 1. Technical data for OA/RA actuator (continued)

Rotation Direction	Spring return reversible with CW/CCW mounting
Position Indication	Visual indicator, 0 to 95°
Noise Level	Running: 30dB

Face and Bypass: The face and bypass option consist of an actuator, damper blade and 2-position water valve (option).

During bypass mode, the damper moves to prevent air from traveling through the coil. The damper blade is tightly sealed to eliminate heat pickup while in the full bypass mode.

A two-position isolation valve control (option) further enhances this system by closing off all water flow to the coil during full bypass operation. Two-pipe main steam systems utilize the face and bypass as part of the standard operation and may incorporate the optional isolation valve.

Face and Bypass Actuator: The face and bypass damper actuator incorporates a direct couple design for the horizontal configurations. The actuator is provided with electronic protection against overload. It does not contain, nor require a limit switch. When reaching the damper end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator housing.

Figure 2. Technical data for face and bypass actuator

Table 2. Technical data for face and bypass actuator

Power Supply	24 Vac ±20% 50/60Hz 24 Vac ±10%
Power Consumption	2W
Transformer Sizing	3VA (class 2 power source)
Manual Override	External push button
Control Signal	3-point floating with Trane controls
Rotation Angle	95° max. Adjustable with mechanical stop

Table 2. Technical data for face and bypass actuator (continued)

Torque	35-inch/lb
Rotation Direction	Reversible with switch L/R
Position Indication	Clip-on indicator
Noise Level	Less than 35dB

Unit Ventilator Controls (Options)

Customer Supplied Terminal Interface (CSTI): Units containing the end device control design will incorporate a pre-wired, selected control components to a terminal strip for wiring a field-provided controller and temperature sensor.

Entering water temperature sensor is factory mounted on the supply water pipe. If there are problems sensing accurate temperature for non-flowing water, move entering water temperature sensor as far down the supply line as possible to get accurate water temperatures.

Note: *Entering water temperature sensor is factory mounted on the supply water pipe. If there are problems sensing accurate temperature for non-flowing water, move entering water temperature sensor as far down the supply line as possible to get accurate water temperatures.*

Symbio 400-B Control Package: Symbio 400-B electronic digital controller is a factory installed, tested and commissioned BACnet® certified design. Symbio 400-B operates as a single zone VAV controller and ramps fan speed based on space load. It may be used in a stand-alone control scheme, or as part of a building automation system. The controller is mounted, pre-wired, and pre-programmed to selected control components best suited for room comfort.

When Trane controls are ordered for an installation, the controls are shipped already installed and factory-tested to ensure proper operation at start-up.

Note: *For more details on the controller, refer to the associated manual: Symbio™ 400-B/500 Programmable Controllers for Blower Coil, Fan Coil, and Unit Ventilator Installation, Operation, and Maintenance (BAS-SVX093*-EN).*

Automatic Controls

Regardless of type of controls, all Tracer systems provide a sequence of operation designed to provide rapid warm-up of the room and increase ventilation while offsetting overheating.

In addition, air conditioning installations will usually provide a means of system changeover from heating to cooling as well as provisions for drawing a pre-determined amount of outside air into the room.

Unit Switch

The unit **On-Off** switch, provided by Trane, is typically housed in the control box mounted in the left hand end pocket immediately below the discharge grille.

When Symbio 400-B unit controllers are used, the unit switch is located on the switch module in the end pocket behind the front panel rather than below the grille.

ECM Application Notes

The new Trane BLDC system has some notable differences to traditional designs.

RPM Mode

The motors are programmed from the factory to run in rpm mode and will not change rpm based on external static pressure, except at the performance limits of the motor/ controller. For ducted units, the units are shipped with the rpm set for 0.2 in. ESP for high, medium, and low speeds. The speeds can for high, medium, and low operation, but should not be changed for the electric heat actuation speeds.

Generally, the fans deliver less cfm for the same rpm, if the static is increased and the power will decrease. The fan will deliver more cfm for the same rpm, if the static is decreased and the fan power will increase. A unit with high static configuration should not be used to free-deliver air (i. e., with no ducting attached).

Field Power Wiring

Note: *This product uses an electronic variable speed motor control, which includes a line reactor to minimize power line harmonic currents. It is recommended that good wiring practices be followed to manage building electrical power system harmonic voltages and currents to avoid electrical system problems or other equipment interaction.*

Performance Boundaries

While the speeds of the fan motors can be adjusted, never program a fan speed higher than 1700 rpm, or lower than 450 rpm. In many cases, units configured for high-static operation will not achieve the desired rpm if the ESP of the unit is too low, or the unit is allowed to **free-discharge**. The ECM engine contains settings that will limit the output power of the motor under these overload conditions. If the motors cannot achieve rpm close to the target for a specific period of time, the unit will disable electric heat and fan-status indicators.

MCA/MOP and Power Draw

The Trane BLDC motors have variable output but are shipped at specific settings to deliver proper performance and reliability. The power draw indicated in the catalog indicates the power consumed when applied properly (as shipped and with the nominal ESP applied). However, the nameplate of the unit indicates the maximum input draw of the motor, as the motor settings can be changed to draw more power.

Troubleshooting Other Unit Functions

In some cases, the normal or abnormal operation of the BLDC system may interact with other components in the system. Generally, verification of the engine and adapter boards' wiring and configuration should be checked if there are unexplained abnormalities in other areas of the unit:

1. Valve operation
2. Electric heat operation
3. Entering water temperature sensor operation
4. Damper operation
5. Condensate overflow switch

A high degree of protection is provided on electric heat units. If electric heat fails to actuate, it may be because of one of the following events:

1. Fans are failing to meet target speed. If a second motor is not present, all settings for speeds for Motor 2 should be set to 0000.
2. Hot water may be available in the changeover coil.
3. The connection to analog input 1 on the Tracer ZN controller may be reversed in polarity.
4. Target speeds for motors may be set too high:
   a. The FPru parameter may be set incorrectly.
   b. The A iPU parameter may be set incorrectly.

Pre-Installation

Jobsite Inspection

Always perform the following checks before accepting a unit:

1. Verify that the nameplate data matches the data on the sales order and bill of lading (including electrical data).
2. Verify that the power supply complies with the unit nameplate specifications.
3. Visually inspect the exterior of the unit, for signs of shipping damage. Do not sign the bill of lading accepting the unit(s) until inspection has been completed. Check for damage promptly after the unit(s) are unloaded. Once the bill of lading is signed at the jobsite, the unit(s) are now the property of the SOLD TO party and future freight claims MAY NOT be accepted by the freight company.

Jobsite Storage

This unit is intended for indoor use only. To protect the unit from damage due to the elements, and to prevent possible IAQ contaminant sources from growing.

1. Place the unit(s) on a dry surface or raise above the ground to assure adequate air circulation beneath the unit.
2. Cover the unit(s) with a water proof tarp to protect them from the elements.

NOTICE

Microbial Growth!

Failure to follow instructions below could result in odors and damage to the equipment and building materials.

The floor or foundation must be level and the condensate drain at the proper height for proper drainage and condensate flow. Standing water and wet surfaces inside the equipment can become an amplification site for microbial growth (mold). If there is evidence of microbial growth on the interior insulation, it should be removed and replaced prior to operating the system.

3. Make provisions for continuous venting of the covered units to prevent moisture from standing on the unit(s) surfaces.
4. Do not stack units.

Dimensions and Weights

Unit Location and Clearances

Locate the unit in an indoor area. The ambient temperature surrounding the unit must not be less than 45°F. Do not locate the unit in areas subject to freezing.

NOTICE

Equipment Damage!

Failure to protect the unit from freezing could result in equipment damage.

If fluid has been added to the piping, the unit must be protected from freezing. Freeze damage from an unheated equipment room is not the Trane company's responsibility. These are indoor units.

Attention should be given to service clearance and technician safety. The unit should contain enough space for service personnel to perform maintenance or repair. Provide sufficient room to make water, and electrical connection(s).

⚠ 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.

A 36-inch clearance at the unit front is sufficient for maintenance and service of the equipment.

Note: *For electric heat, the minimum clearance from the appliance to combustible surfaces is 0 inches.*

Table 3. Weights and measurements: horizontal unit ventilators

Unit Size	075	100	125	150	200
Unit Length (in.)	70-1/4	82-1/4	94-1/4	106-1/4	106-1/4
Unit Height (in.)	16-5/8	16-5/8	16-5/8	16-5/8	17-5/8
Unit Width (Front Discharge) (in.)	35-5/8	35-5/8	35-5/8	35-5/8	43-1/8
Unit Width (Bottom Discharge) (in.)	48-3/4	48-3/4	48-3/4	48-3/4	57-1/4
Shipping Weight (lb)[a]	340*	375*	435*	500*	600*
Filter Size (inches-actual)	41-1/2 × 15-1/4 × 1	53-1/2 × 15-1/4 × 1	65-1/2 × 15-1/4 × 1	77-1/2 × 15-1/4 × 1	77-1/2 × 15-1/4 × 1

[a] Working weight is approximately 10% less than shipping weight. Trane recommends 3/8-inch rods for hanging suspension.

Table 4. Control methodology

	Fan Speed
CSTI	3 or infinite[a]
Symbio 400-B	Infinite

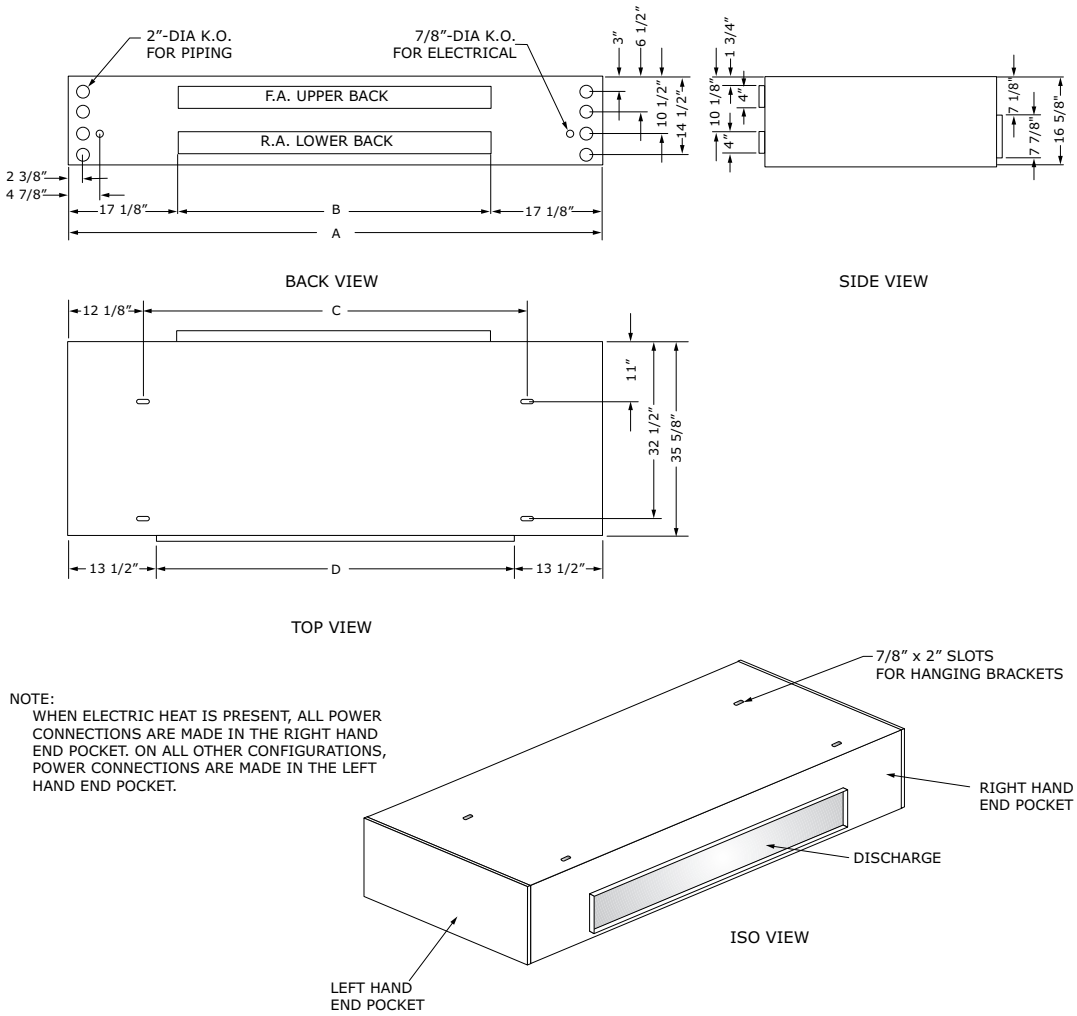
[a] With a field-supplied 2–10 Vdc controller.

Table 5. Control sequences

	Fan Speed
DX operation[a]	1
Electric heat operation[a]	1

[a] Fan speed during sequence operation.

Figure 3. Horizontal unit ventilator with ducted front discharge dimensional data; sizes 075 to 150 (dimensions in inches)



Size	A	B	C	D
75	70-1/4	36	46	43-1/4
100	82-1/4	48	58	55-1/4
125	94-1/4	60	70	67-1/4
150	106-1/4	72	82	79-1/4

Figure 4. Horizontal unit ventilator with ducted front discharge dimensional data; size 200 (dimensions in inches)

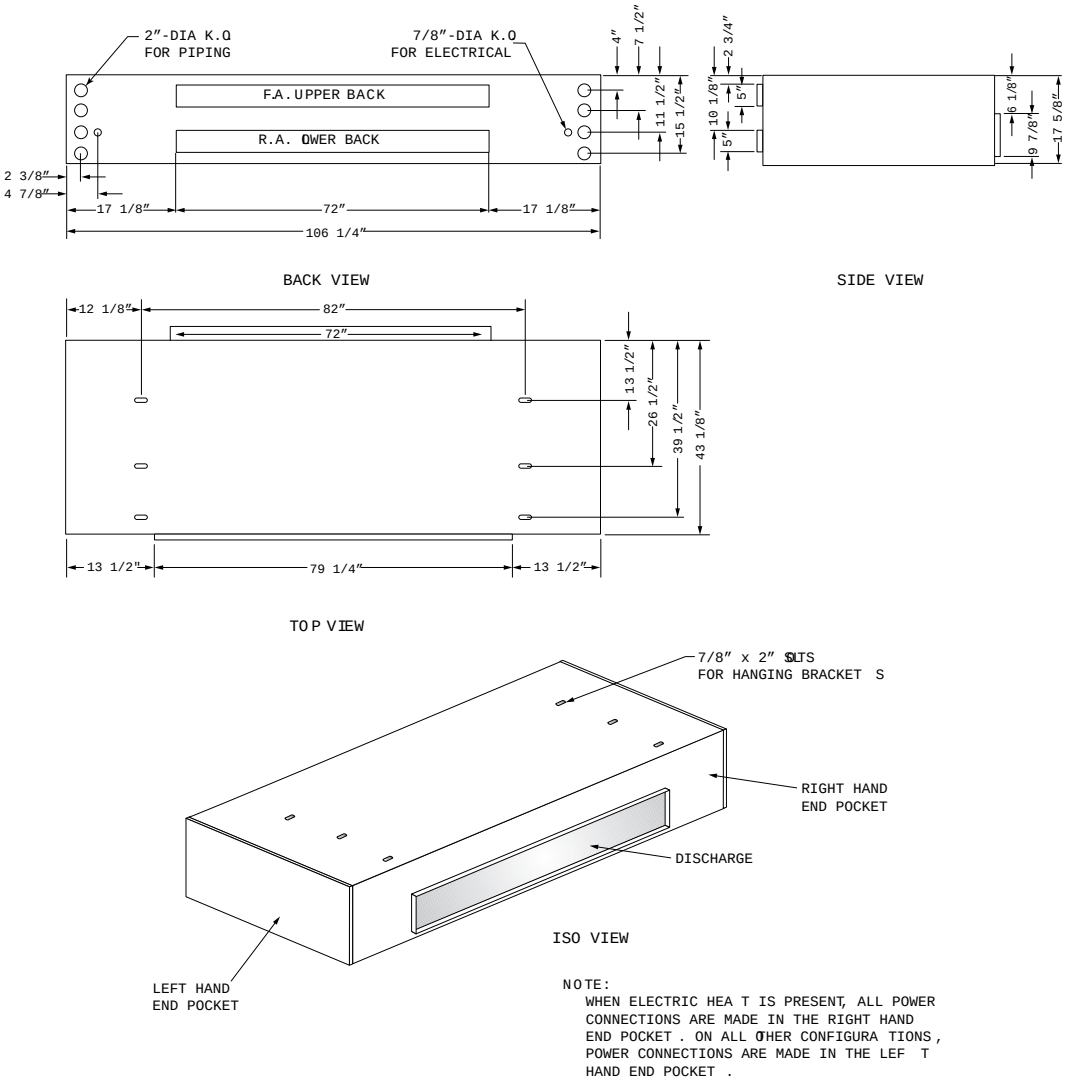
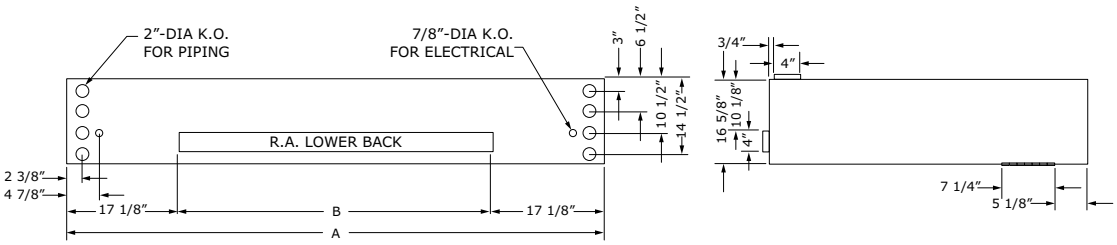
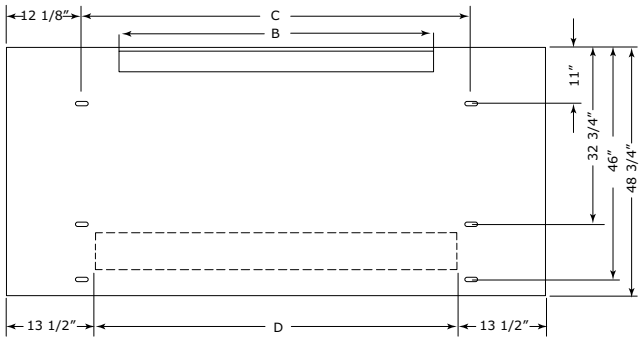


Figure 5. Horizontal unit ventilator with double deflection discharge dimensional data; sizes 075 to 150 (dimensions in inches)



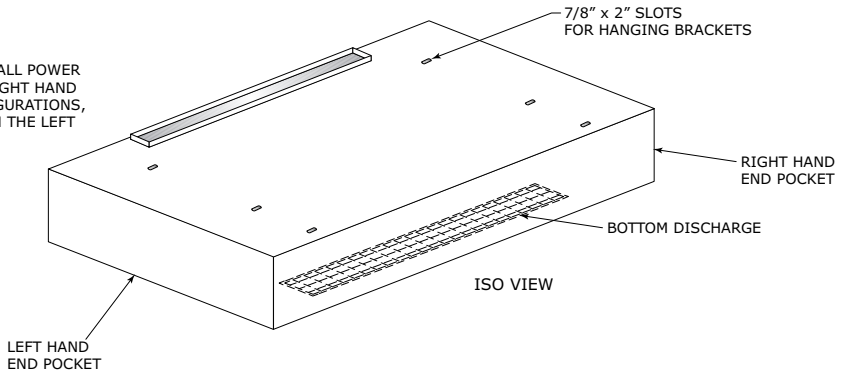
BACK VIEW

SIDE VIEW



TOP VIEW

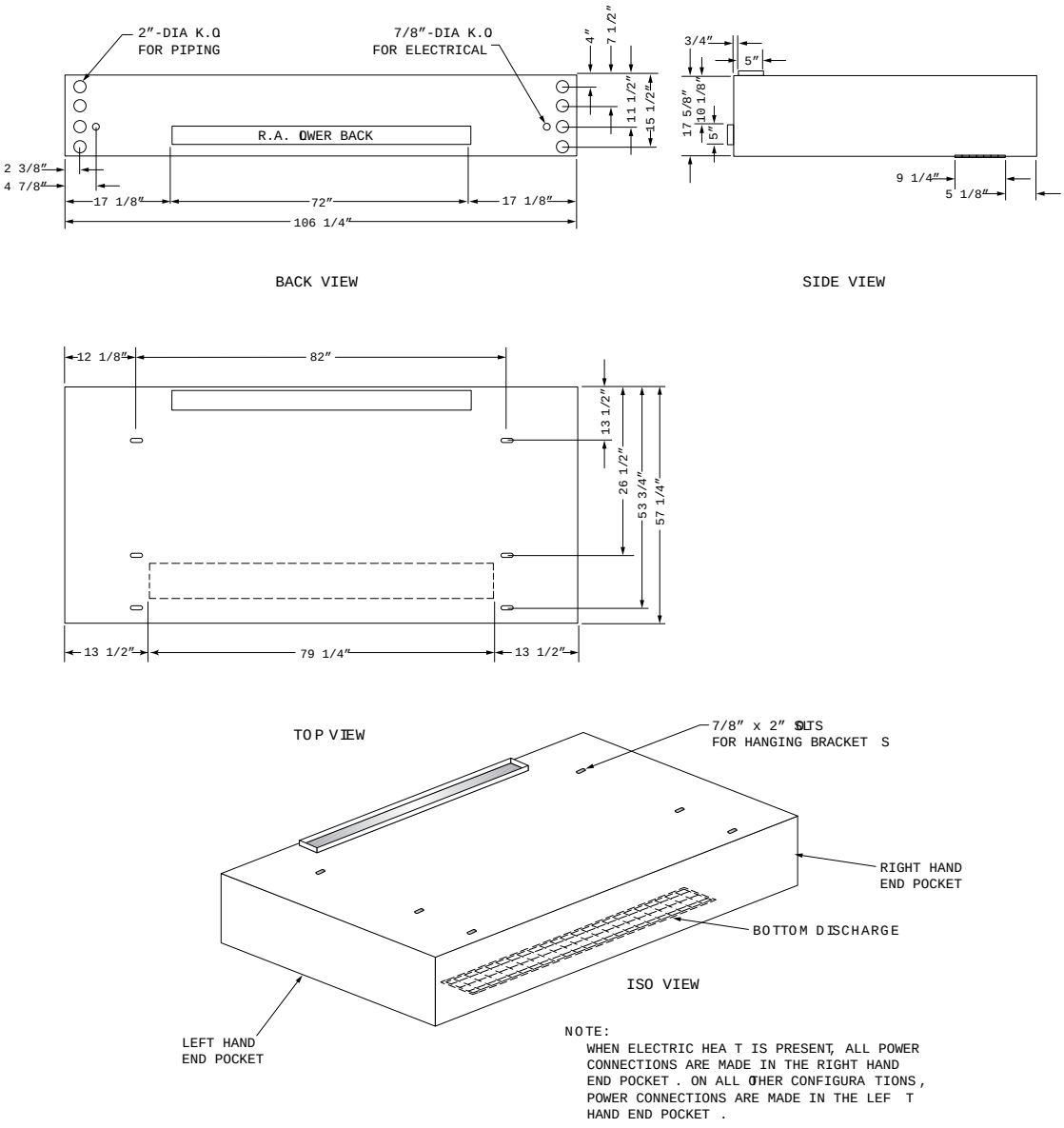
NOTE:
WHEN ELECTRIC HEAT IS PRESENT, ALL POWER CONNECTIONS ARE MADE IN THE RIGHT HAND END POCKET. ON ALL OTHER CONFIGURATIONS, POWER CONNECTIONS ARE MADE IN THE LEFT HAND END POCKET.



ISO VIEW

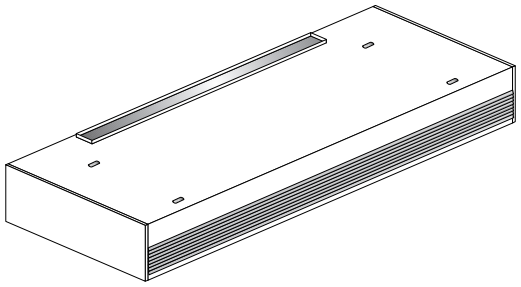
Size	A	B	C	D
75	70-1/4	36	46	43-1/4
100	82-1/4	48	58	55-1/4
125	94-1/4	60	70	67-1/4
150	106-1/4	72	82	79-1/4

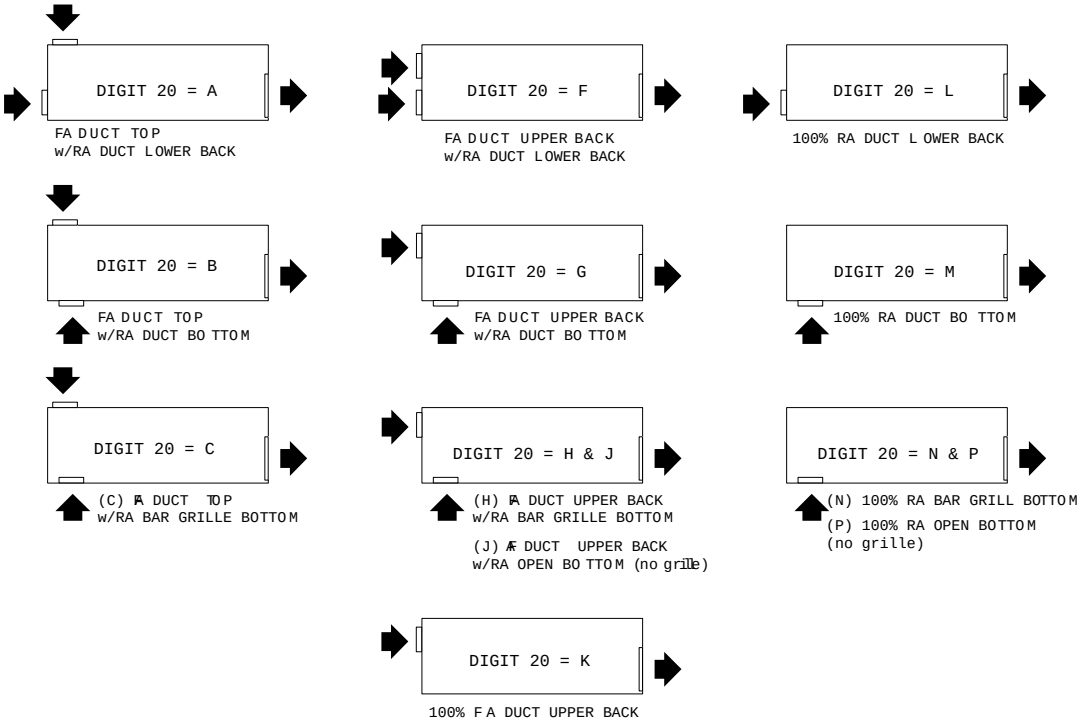
Figure 6. Horizontal unit ventilator with double deflection discharge dimensional data; size 200 (dimensions in inches)



NOTE:
WHEN ELECTRIC HEAT IS PRESENT, ALL POWER CONNECTIONS ARE MADE IN THE RIGHT HAND END POCKET. ON ALL OTHER CONFIGURATIONS, POWER CONNECTIONS ARE MADE IN THE LEFT HAND END POCKET.

Figure 7. Supply/return air arrangements for the horizontal unit ventilator





A2L Information

A2L Work Procedures

⚠ WARNING

Risk of Fire — Flammable Refrigerant!

Failure to follow instructions below could result in death or serious injury, and equipment damage.

- **To be repaired only by trained service personnel.**
- **Do not puncture refrigerant tubing.**
- **Dispose of properly in accordance with federal or local regulations.**

⚠ WARNING

Refrigerant under High Pressure!

Failure to follow instructions below could result in an explosion which could result in death or serious injury or equipment damage.
System contains refrigerant under high pressure. Recover refrigerant to relieve pressure before opening the system. See unit nameplate for refrigerant type. Do not use non-approved refrigerants, refrigerant substitutes, or refrigerant additives.

⚠ 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.

The units described in this manual use R-454B refrigerant. Use ONLY R-454B rated service equipment or components with these units. For specific handling concerns with R-454B, contact your local Trane representative.

Installation, repair, removal, or disposal should be performed by trained service personnel.

At all times, Trane's maintenance and service guidelines shall be followed. If in doubt, contact Trane technical support for assistance.

Servicing

Prior to initiating work on equipment, check the area with an appropriate refrigerant detector. Ensure the service personnel are properly trained regarding work in potentially toxic or flammable atmospheres. Ensure that the leak detection equipment being used is suitable for use with all applicable refrigerants, i.e. non-sparking, adequately sealed, or intrinsically safe. Be aware that the refrigerant does not contain an odor.

If any hot work is to be conducted on the refrigerating equipment or any associated parts, appropriate fire extinguishing equipment shall be available on hand. A dry powder or CO_2 fire extinguisher should be located adjacent to the charging area.

At all times, Trane's maintenance and service guidelines shall be followed. If in doubt, contact Trane technical support for assistance.

All maintenance staff and others working in the local area shall be instructed on the nature of the work being carried out. Work in confined spaces shall be avoided.

Ignition Source Mitigation

Do not use any sources of ignition when working on the refrigeration system.

Keep all ignition sources, including cigarette smoking, away from the site of installation, repair, removal or disposal, during which refrigerant can potentially be released to the surrounding space.

Survey the area around the equipment before initiating work to ensure no flammable hazards or ignition risks are present.

"No Smoking" signs shall be displayed.

Do not use devices that can be a source of ignition to accelerate defrosting of components. Use only defrost and cleaning procedures recommended by Trane. Do not pierce or burn.

Ventilation

Ensure that the area is in the open or that it is adequately ventilated before breaking into the system or conducting any hot work. A degree of ventilation shall continue during the period that the work is carried out. The ventilation should safely disperse any released refrigerant and preferably expel it externally into the atmosphere. If present, check that the ventilation system, including outlets, are operating adequately and are not obstructed.

Refrigerating Equipment

Refrigerant piping or components should not be installed in locations where substances which may corrode them are present.

Check that equipment hazard markings are visible and legible. Replace them if they are not.

For equipment using secondary fluids, like water or glycol, check that refrigerant is not present in the secondary fluid loop before conducting any hot work.

Electrical Devices

Do not apply power to the circuit if a fault exists which compromises safety. If the fault cannot be corrected immediately, but it is necessary to continue operation, an

adequate temporary solution shall be used. This shall be reported to the owner of the equipment, so all parties are advised.

Initial safety checks shall include:

- Cabling is not subject to wear, corrosion, excessive pressure, vibration, sharp edges, or any other adverse environmental effects. Account for the effects of aging or continual vibration from sources such as compressors or fans.
- Capacitors are discharged. This shall be done in a safe manner to avoid possibility of sparking.
- No live electrical components and wiring are exposed while charging, recovering, or purging the system.
- Verify continuity of earth bonding.
- Replace electrical components with Trane replacement parts, or those meeting the same ratings and qualified for flame arrest protection, UL LZGH2 category.

Leak Detection

Never use an open flame to detect leaks. A halide torch should not be used. Use only approved leak detection methods per this instruction manual.

The following leak detection methods are deemed acceptable for all refrigerant systems.

Electronic leak detectors may be used to detect refrigerant leaks but, in the case of flammable refrigerants, the sensitivity may not be adequate, or may need re-calibration. (Detection equipment shall be calibrated in a refrigerant-free area.) Ensure that the detector is not a potential source of ignition and is suitable for the refrigerant used. Leak detection equipment shall be set at a percentage of the LFL gas (25% maximum) is confirmed.

Leak detection fluids are also suitable for use with most refrigerants but the use of detergents containing chlorine shall be avoided as the chlorine may react with the refrigerant and corrode the copper pipe-work.

Examples of leak detection fluids are:

- Bubble method
- Fluorescent method agents

If a leak is suspected, all naked flames shall be removed/ extinguished.

If a refrigerant leak is found which requires brazing, all refrigerant shall be recovered from the system, or isolated (by means of shut off valves) in a part of the system remote from the leak.

Refrigerant Removal and Evacuation

Ensure that the correct number of cylinders for holding the total system charge is available. All cylinders to be used are designated for the recovered refrigerant and labeled for that refrigerant (special cylinders for the recovery of refrigerant, for example). Cylinders shall be complete with pressure-relief valve and associated shut-off valves in good working order. Empty recovery cylinders are evacuated and, if possible, cooled before recovery occurs.

When breaking into the refrigerant circuit to make repairs – or for any other purpose – conventional procedures shall be used. However, for flammable refrigerants it is important that best practice be followed, since flammability is a consideration.

The following procedure shall be adhered to:

1. Safely remove refrigerant following local and national regulations.
2. Evacuate.
3. Purge the circuit with inert gas.
4. Evacuate (optional for A2L).
5. Continuously flush or purge with inert gas when using flame to open circuit.
6. Open the circuit.

Prior to refrigerant removal, open all appropriate valves, including solenoid and electronic expansion valves (EXVs). Use control settings, where available. When not available, manually open all electronically controlled valves using acceptable service procedures.

The recovery equipment shall be in good working order with instructions available. Equipment shall be suitable for the recovery of the flammable refrigerant. For specific handling concerns, contact the manufacturer. Ensure all hose connections are checked for tightness to avoid refrigerant leaks.

The refrigerant shall be recovered into the correct recovery cylinders if venting is not allowed by local and national codes. Do not mix refrigerants in recovery unit and especially not in cylinders.

Refrigerant recovery unit should be purged with an inert gas after each use or before using with a different refrigerant Class – for example, A2L to A1.

If compressors or compressor oils are to be removed, ensure that they have been evacuated to an acceptable level to make certain that flammable refrigerant does not remain within the lubricant. The compressor body shall not be heated by an open flame or other ignition sources to accelerate this process. When oil is drained from a system, it shall be carried out safely.

The system shall be purged with oxygen-free nitrogen to render the appliance safe for flammable refrigerants. This process might need to be repeated several times. Compressed air or oxygen shall not be used for purging refrigerant systems.

The system shall be vented down to atmospheric pressure to enable work to take place.

The outlet for the vacuum pump shall not be close to any potential ignition sources, and ventilation shall be available.

Refrigerant Charging

In addition to conventional charging procedures, the following requirements shall be followed.

- Ensure that contamination of different refrigerants does not occur when using charging equipment.
- Hoses or lines shall be as short as possible to minimize the amount of refrigerant contained in them.
- Cylinders shall be kept in an appropriate position according to the instructions.
- Ensure that the refrigerating system is earthed prior to charging the system with refrigerant.
- Label the system when charging is complete (if not already).
- Extreme care shall be taken not to overfill the refrigerating system.

Prior to recharging the system, it shall be pressure-tested with the appropriate purging gas. The system shall be leak-tested on completion of charging but prior to commissioning. A follow up leak test shall be carried out prior to leaving the site.

Prior to refrigerant charging, open all appropriate valves, including solenoid and electronic expansion valves (EXVs). Use control settings, where available. When not available, manually open all electronically controlled valves using acceptable service procedures.

Decommissioning

Before carrying out the decommissioning procedure, it is essential that the trained service personnel is completely familiar with the equipment and all its details. It is recommended good practice that all refrigerants are recovered safely. Prior to the task being carried out, an oil and refrigerant sample shall be taken in case analysis is required prior to re-use of recovered refrigerant. It is essential that electrical power is available before the task is commenced.

1. Become familiar with the equipment and its operation.
2. Isolate system electrically.
3. Before attempting the procedure, ensure that:
    a. Mechanical handling equipment is available, if required, for handling refrigerant cylinders.
    b. All personal protective equipment is available and being used correctly.
    c. The recovery process is supervised at all times by a competent person.
    d. Recovery equipment and cylinders conform to the appropriate standards.
4. Pump down refrigerant system, if possible.
5. If a vacuum is not possible, make a manifold so that refrigerant can be removed from various parts of the system.
6. Make sure that cylinder is situated on the scales before recovery takes place.
7. Start the recovery machine and operate in accordance with instructions.
8. Do not overfill cylinders (no more than 80% volume liquid charge).
9. Do not exceed the maximum working pressure of the cylinder, even temporarily.
10. When the cylinders have been filled correctly and the process completed, make sure that the cylinders and the equipment are removed from site promptly and all isolation valves on the equipment are closed off.
11. Recovered refrigerant shall not be charged into another refrigerating system unless it has been cleaned and checked.
12. When equipment has been decommissioned, attach a signed label which includes the date of decommissioning.

A2L Application Considerations

This product is listed to UL standard 60335-2-40, Household and Similar Electrical Appliances – Safety – Part 2-40: Particular Requirements for Electrical Heat Pumps, Air-Conditioners and Dehumidifiers, which defines safe design and use strategies for equipment using A2L refrigerants. This standard limits the refrigerant concentration in a space in the event of a refrigerant leak. To meet the requirements, the UL standard defines minimum room area, refrigerant charge limit, minimum circulation airflow and/or ventilation airflow requirements, and limits the use of ignition sources in spaces. The standard may require a unit refrigerant leak detection system.

For equipment with R-454B and charge amounts less than or equal to 3.91 lbs per circuit, this UL standard does not prescribe a room area limit and does not require a refrigerant leak detection system or any circulation airflow or ventilation airflow mitigation strategies. However, ignition sources in ductwork must be evaluated.

Depending on the application, a specific requirement of ANSI/ASHRAE Standard 15, Safety Standard for Refrigeration Systems, could be more stringent than UL 60335-2-40 requirements. See *Refrigeration Systems and Machinery Rooms Application Considerations for Compliance with ASHRAE® Standard 15-2022 Application Engineering Manual* (APP-APM001*-EN) for more information.

Ignition Sources in Ductwork

Do not install open flames in the ductwork. Hot surfaces exceeding 700°C (1290°F) should not be installed in the ductwork unless the average airflow velocity is not less than 1.0 m\s (200 ft\min) across the heater and proof of airflow is verified before system is energized.

Electric heaters can exceed the surface temperature limit if airflow distribution is poor, or insufficient airflow is provided over the heater.

Surface temperatures of most gas heaters do not exceed the surface temperature limits due to ANSI construction requirements.

Ignition Sources in Unit

This unit does not contain any ignition sources. All potential ignition sources, (including factory or field installed accessory electric heaters, gas heaters, relays, and contactors) were evaluated during product UL listing.

Minimum Room Area Limits (Refrigerant charge greater than 3.91 lb per circuit)

Equipment with R–454B charge amounts greater than 3.91 lb per circuit may require additional circulation or ventilation airflow mitigation strategies. In this case, there are two minimum room area (A_{min}) thresholds.

- The first threshold defines when equipment serving a single room is required to provide circulation airflow, either continuous or activated by a leak detection system. A ducted system requires circulation airflow unless the smallest room it serves is larger than the adjusted A_{min} threshold. This product contains a leak detection system if a circuit charge is greater than 3.91 lbs. As a result, no further leak detection system evaluation is needed.
- The second threshold defines when additional ventilation airflow is required. If the room area, A or TA, is below the adjusted A_{min} or TA_{min} threshold, additional ventilation is required to remove refrigerant in the event of a leak. Refer to UL 60335-2-40 Clause GG.8 and ANSI\ASHRAE Standard 15 Section 7 for natural and mechanical ventilation requirements. See equipment nameplate and table below for minimum room area.

Split systems minimum room area requirements need to be determined after final field charging. Use the following figures and the largest final circuit charge to determine the systems A_{min} value. Record the final charge value on the label provided on the condensing unit.

Figure 8. Charge vs min room area (IP)

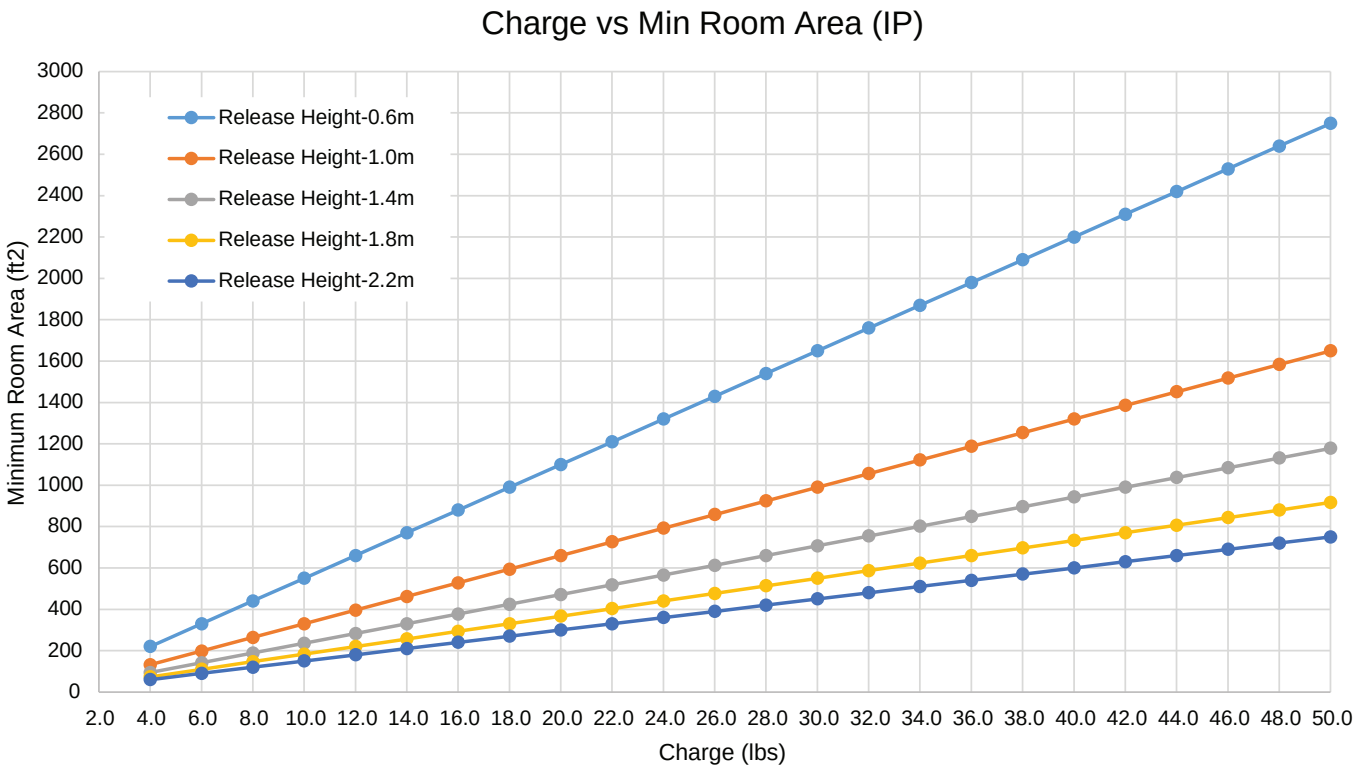
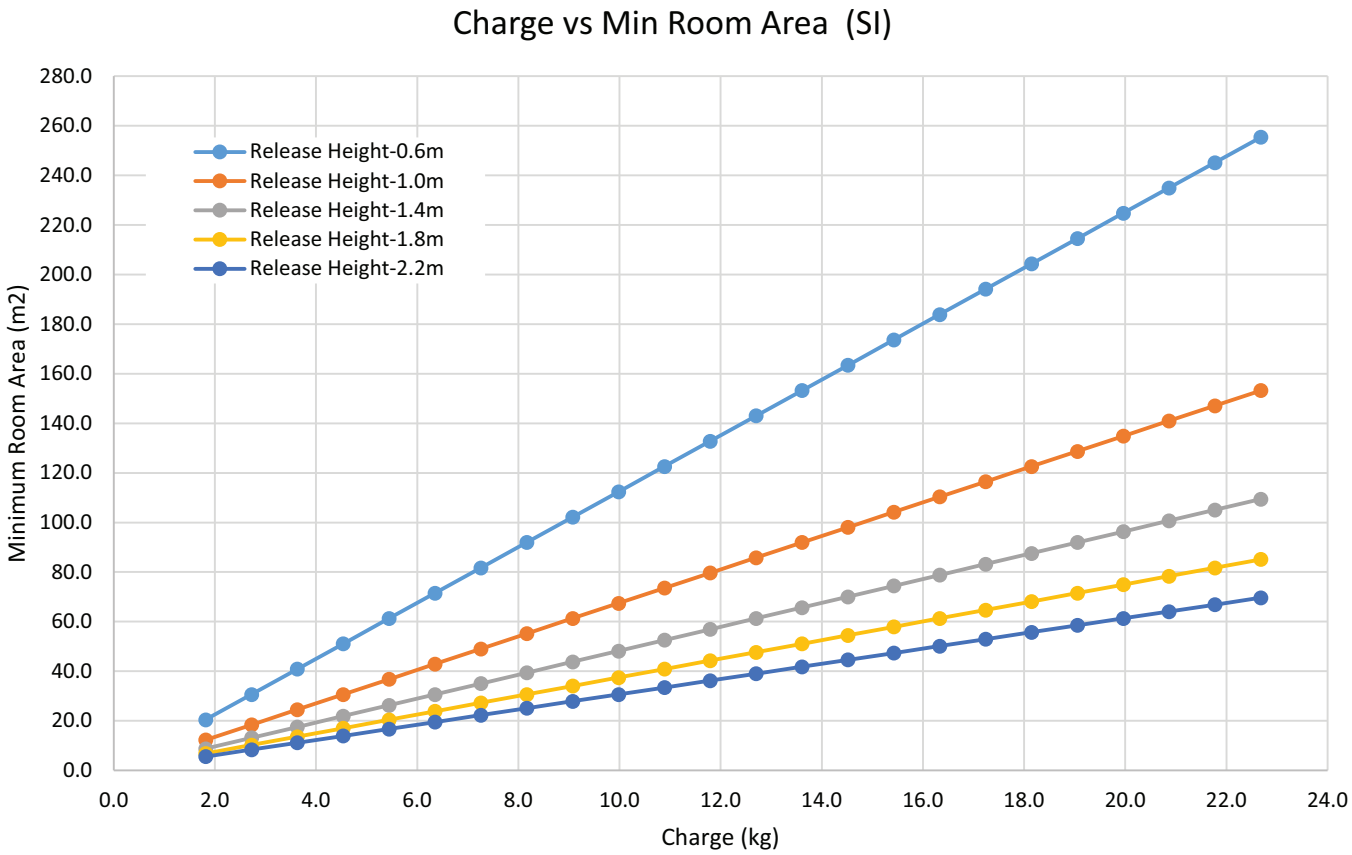


Figure 9. Charge vs min room area (SI)



Release height is the vertical distance from the floor to the lowest point in a space refrigerant would leak from first. The minimum value is 0.6 m from the floor. This point is typically the bottom of free return openings or supply diffusers. For fully ducted units, the release height is 2.2 meters.

Minimum Room Area (A_{min}) Adjustments

Use equation below to adjust the minimum room area, as applicable, based on the unit's installation height, altitude, and occupancy level it serves.

$$A_{min.adj} = \text{Nameplate } A_{min} \times \text{Altitude Adj} \times \text{Height Adj} \times F_{occ}$$

Multiply the altitude adjustment factor in the table below by A_{min} listed on the unit nameplate or in the Installation, Operation, and Maintenance (IOM) manual.

Table 6. Altitude adjustment factor

Altitude (ft)	Sea Level to 2000	2001 to 4000	4001 to 6000	6001 to 8000	8001 to 10000	10001 to 12000	12001 to 14000	14001 to 15000	Over 15000
A_{min} Adjustment	1	1.05	1.11	1.17	1.24	1.32	1.41	1.51	1.57

In addition, A_{min} can be adjusted if the unit is installed in a room at a height that is higher than the minimum height shown on the unit. To adjust A_{min}, multiply by the ratio of the unit minimum release height (in meters) / actual release height (in meters). Use 0.6 m in the ratio for unit minimum installation heights less than or equal to 0.6 m.

For institutional occupancies, ASHRAE Standard 15 applies an additional adjustment factor F_{occ} to the amount of a charge allowed in a space. To calculate the adjusted A_{min} for institutional occupancies, multiply the A_{min} on the nameplate by two.

EXAMPLE 1: 20 Ton Packaged Rooftop Multi-Zone VAV System Serving an Institutional Occupancy Space

The packaged unit serves 7600 ft² of a nursing home located at an attitude of 4000 ft. The unit has two equally charged 10 ton refrigeration circuits. Each circuit has 12 lbs

of refrigerant with a minimum room area requirement of 180 ft² with a 2.2 m release height.

$$TA_{min.adj} = 180\ ft^2 \times 1.05 \times 2 = 378\ ft^2$$

No additional ventilation is required.

EXAMPLE 2: 10 Ton Split System Serving a Single Commercial Occupancy Space

The split system serves a 1500 ft² manufacturing space at 5000 ft altitude. The final installed charge of the single circuit 10 ton unit is 20 lb. The unit has an open return with a release height of 1 m and ducted supply air. The unit A_{min} is 660 ft².

$$A_{min.adj} = 660\ ft^2 \times 1.11 = 733\ ft^2$$

No additional ventilation is required.

Determining Room Area (A or TA)

The room area (A) is the room area enclosed by the projection to the floor of the walls, partitions, and doors of the space that the equipment serves. For ducted systems, total room area (TA) of all rooms connected by ducts, may be used instead of A.

Rooms connected by drop ceilings only are not considered a single room.

Rooms on the same floor of the building, and connected by an open passageway, can be considered part of the same room if the passageway is a permanent opening, extends to the floor and is intended for people to walk through.

Adjacent rooms on the same floor of the building and connected by permanent openings in the walls and/or doors between rooms (including gaps between the wall and the floor), can be considered part of the same room if the openings meet the following criteria.

- The opening is permanent and cannot be closed.
- Openings extending to the floor, such as door gaps, need to be at least 20 mm above the floor covering surface.
- Natural ventilations opening areas must meet the requirements of ANSI\ASHRAE Standard 15-2022, Section 7.2.3.2.

Rooms that are connected by a mechanical ventilation system can be considered a single room area if the mechanical ventilation system meets the requirements of ANSI\ASHRAE Standard 15-2022, Section 7.6.4.

Leak Detection System (Refrigerant charge greater than 3.91 lb per circuit)

The leak detection system consists of one or more refrigerant detection sensors. When the system detects a leak, the following mitigation actions will be initiated until refrigerant has not been detected for at least 5 minutes:

- Energize the supply fan(s) to deliver a required minimum amount of circulation airflow.
- Disable compressor operation.
- Provide an output signal to fully open all zoning dampers, such as VAV boxes.
- Provide an output to energize additional mechanical ventilation (if needed).
- Units without airflow proving will disable electric heat sources.

Building fire and smoke systems may override this function.

If the refrigerant sensor has a fault, is at the end of its life, or is disconnected, the unit will initiate the mitigation actions. Mitigation actions may be verified by disconnecting the sensor.

The refrigerant sensors do not need service. Use only manufacturer-approved sensors when replacement is required.

Field Piping Installation and Charging

When refrigerant piping is routed indoors, protect from physical damage in operation or service, and verify installation complies with national and local codes. All joints must be accessible for inspection prior to being covered.

Follow the Refrigerant Charging procedure. Prior to refrigerant charging, check field-made indoor joints for leaks using an instrument with a sensitivity of 5 grams per year refrigerant. Pressurize the system to 25% of the maximum allowable pressure. Verify no leaks are detected.

Installation - Mechanical

Location Considerations

Selecting the appropriate location for installing a unit is very important. The following factors should be considered:

1. Ceiling hung design must be of sufficient structure to support the weight of the unit (refer to Table 7, p. 25). Figure 3, p. 14 through Figure 7, p. 18 show hanging rod location and placement.

   Note: *Isolator and suspension rods are to be provided by the installer. For hanging suspension, Trane recommends 3/8-in. rods.*

Table 7. Typical unit weights

Unit Size	lb	kg
075	340	154
100	375	170
120	435	197
150	500	227
200	600	272

Note: Weight at time of shipping. Subtract approximately 10% for actual hanging weight.

2. Service access is gained through the access panels on the bottom of the unit. Sufficient space should be allowed for panel removal. If the hinged panel option is ordered, allow for a swing radius of 14-in.
3. Sufficient free area around both the discharge and wall box should be maintained to ensure proper ventilation. If any part of the discharge is blocked off, unit performance may be affected. If the wall box is too small on the inlet, water or debris could be pulled into the unit (see the following table for minimum wall box free area requirements).

Table 8. Wall box free area requirements

Unit Size	Discharge (in^2)	Inlet (in^2)
075	232	169
100	296	217
120	364	265
150	430	313
200	576	391

4. Use the shortest and most efficient ductwork possible when ducting the discharge and/or return air grille. Units ordered with a duct collar discharge arrangement are equipped with a 1-in. duct flange.

   Note: *Ductwork for ducted units will be provided by the installer.*

5. If installing a split system, refer to the condenser installation instructions provided with that unit for special location considerations.

   Note: *Measurements in Figure 3, p. 14 through Figure 7, p. 18 do not include adjusted leveling legs. Adjustment of leveling legs should be done first. New measurements from the floor should be retaken before installation.*

Unit Mounting

The horizontal unit ventilator may be attached directly to the ceiling or suspended from the ceiling by hangers. Hanger rods should be at least 3/8-in. diameter steel to support unit weight.

⚠ 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.

Install the hanging devices before hoisting the unit. A forklift or other special lifting device is required to hoist the unit into mounting position.

Protect the unit finish by covering the lifting platform.

To hoist the unit into place, follow the instructions below:

1. Secure 2 × 4s to the lift forks. These two supports must be long enough and spaced properly on the forks to support the unit while it is being lifted and clear the duct flanges on the unit.
2. Tip the unit onto the supports and slide it toward the lift until the unit weight balances.
3. Lift the unit. Once in position, temporarily secure the unit to the hanger rods or mounting studs with nuts and washers.
4. Align the unit with the duct work. When in proper alignment, tighten the mounting nuts securely.
5. Recheck the unit alignment and make sure the unit is level.
6. Replace all covers, panels and filters before starting the unit.

Note: *Unit must be mounted level. Coils and drain pans inside unit are pitched properly for drainage before shipment.*

Horizontal Recessed Mounting

The recessing flange assembly ships in a box separate from the unit. The assembly includes pre-cut flanges,

corner transition pieces, mounting screws, filler pieces, and pressure sensitive gaskets. Refer through Figure 10, p. 26 to Figure 12, p. 26 for typical horizontal installation.

Figure 10. Recess flange installation around horizontal unit ventilator access panel and inlet

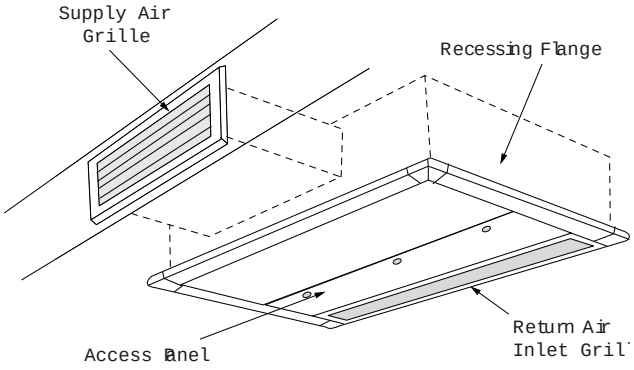
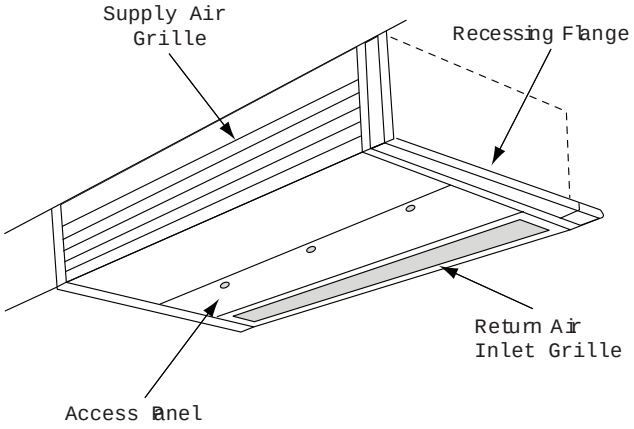
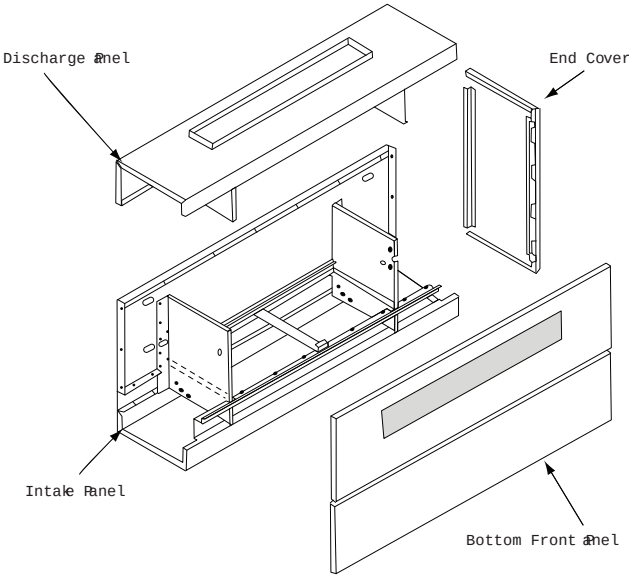


Figure 11. Recess flange installation around bottom and front of horizontal unit



1. Measure and cut the pressure sensitive gaskets to the correct lengths and attach to the flanges.
2. Starting at a corner, attach the top flange with the mounting screws provided.
3. Press the corner transition pieces onto the end of the flange and attach the adjoining flanges and filler pieces at the bottom of the unit. Work around the unit in this manner until all flanges and corners are installed.
4. Mounting holes are pre-drilled in the flanges. Use the assembled flanges as a template to drill all 7/32-in. mounting holes in the cabinet.
5. Attach the flange section to the unit cabinet with the mounting screws provided.
6. Open and remove the front access panel.
7. Tighten the mounting fastener, making sure that the unit is level.
8. Open the unit access panel and remove the bottom front panel.

Figure 12. Horizontal unit ventilator with front panel removed



9. Hoist the unit onto a forklift and mount in place as described previously, ensuring the unit is secured and aligned in place, and that the mounting nuts are tightly fastened.

   Note: *Unit must be mounted level. Coils and drain pans inside the unit are pitched internally for proper drainage.*

10. Replace all covers, panels and filters before starting the unit.

Coil Piping and Connections

The coil headers and drain connections are made within the unit chassis to allow a tight seal and help prevent air leakage around the coil. The connection sizes vary dependent upon type of coil combination specified.

Table 9. Operating limits

Description	Minimum	Maximum
Operating Pressure (psi)	10	400
Fluid Temperature (° F)	0	200

Piping Packages

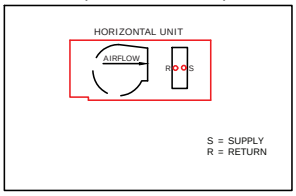
Control valves are mounted in all factory piping packages. All piping packages are factory installed and come in a variety of options:

- **Basic**: Union and shut-off ball valve on the supply line. Union, control valve and shut-off ball valve on the return line.

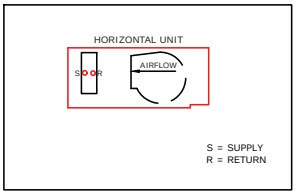
- **Basic with manual circuit setter**: Union, shut-off ball valve on the supply line. Union, control valve and manual circuit setter on the return line.
- **Deluxe with manual circuit setter**: Union, strainer, P/T port, and shut-off ball valve on the supply line. Union, control valve and manual circuit setter on the return line.
- **Deluxe with auto flow**: Union, strainer, P/T port, and shutoff ball valve on the supply line. Union, control valve, auto flow valve, P/T port and shut-off ball valve on the return line.

Figure 13. Coil piping chart

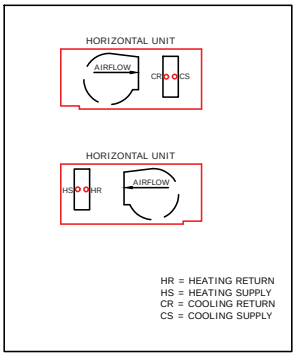
LEFT HAND 2 pipe
COOLING,HEATING, changeover ONLY



RIGHT HAND 2 pipe
COOLING, HEATING, changover ONLY



4 pipe: LH COOLING
RH HEATING



4 pipe: RH COOLING
LH HEATING

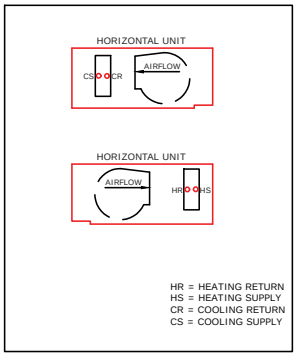
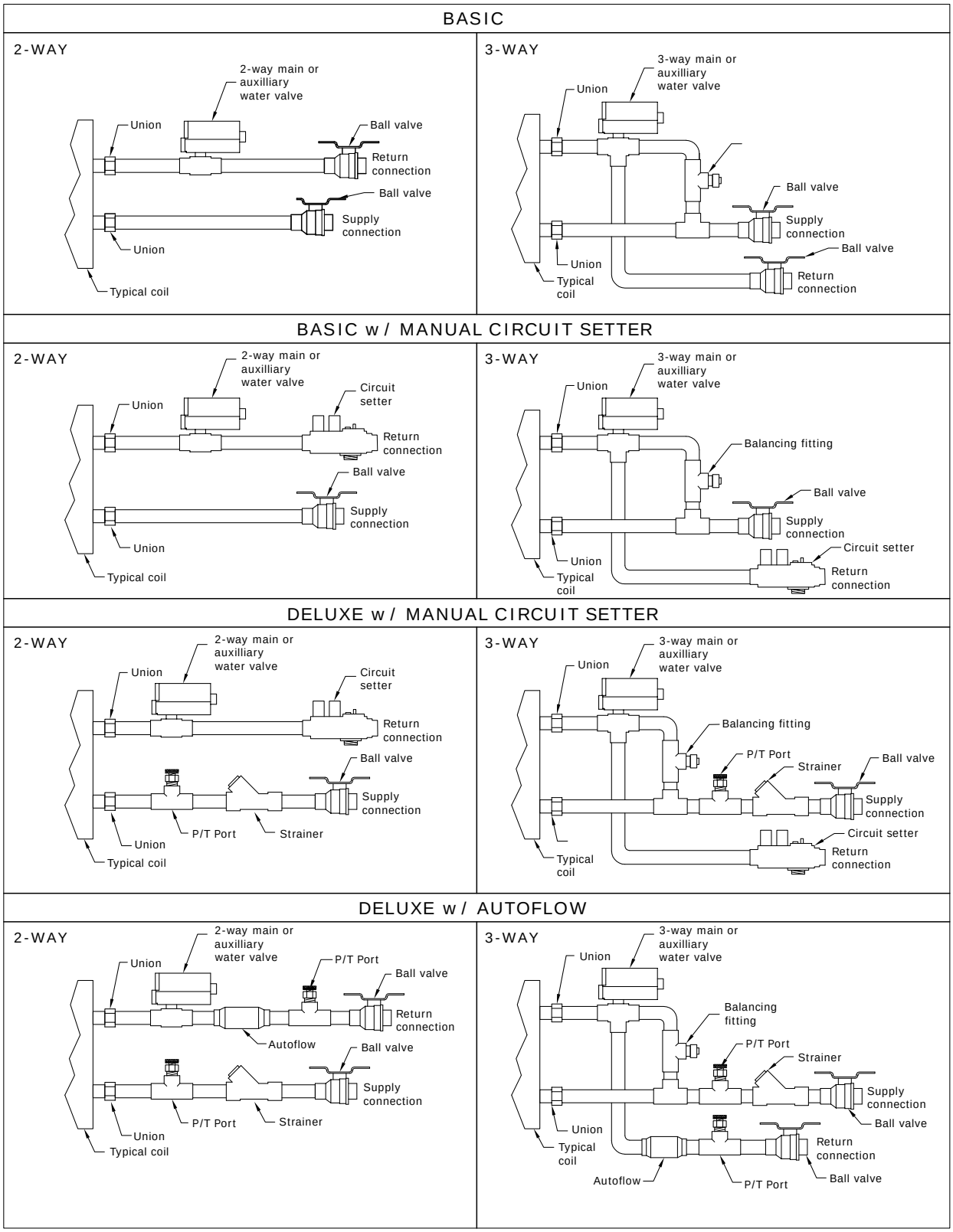


Figure 14. Piping package layout



Note: *Before installation of piping package, the shipping bracket holding the piping in place, must be removed.*

All union connections should be tightened in the field. Units are shipped with union connections hand-tightened only in the factory.

Proper installation of piping is necessary to provide efficient coil operation and to prevent damage during operation. Follow standard piping practices and include all accessories as necessary.

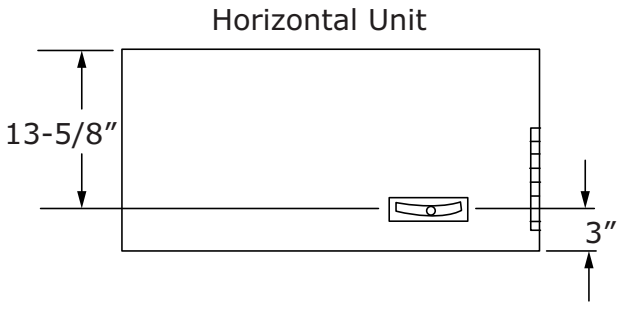
Piping connection knockouts are shown in Figure 3, p. 14 through Figure 7, p. 18. Field connection types and sizes for units without piping packages are listed below.

Table 10. Coil data for field piping

Coil Type	Connection Location	Field Connection Size
4-pipe chilled water/ hot water	Left or right (opposite ends)	7/8 in. OD / 7/8 in. OD
2-pipe changeover coil	Left or right	7/8 in. OD
Hot water only	Left or right	7/8 in. OD
Steam	Left or right	1 in. FPT
Chilled water / electric	Left cooling	7/8 in. OD
Chilled water / steam	Left or right	7/8 in. OD / 1 in. FPT
DX	Left	7/8 in. suction, 3/8 in.
DX / hot water	Left cooling/right heating	7/8 in. suction, 3/8 in. / 5/8 in. OD
DX / steam	Left cooling/right heating	7/8 in. suction, 3/8 in. / 1 in. FPT
DX / electric heat	Left cooling/right heating	7/8 in. suction, 3/8 in. / NA

A 3/4-in. OD condensate drain connection is provided on the chilled water supply end of the unit. Attach a flexible condensate drain hose over the drain pan connection and secure with a hose clamp.

Figure 15. Condensate drain pan location



The drain pan on the horizontal unit is internally pitched. To field reverse, remove the screws and drain pan, rotate the pan and reinstall.

After the condensate drain piping has been completed, check water flow to be sure the system properly carries and away all condensate accumulation.

A P-trap is recommended for installations that drain directly into a sewer system. A P-trap is not necessary for operation but will eliminate sewer gas door.

Notes:

- *All connections made in the field should be sweat connections.*
- *Piping packages are not shipped insulated. Any insulation should be provided in the field by the installing contractor.*

Valve and Actuator Operation

- NO and NC actuators are different parts. The 7.4 Cv 3-way actuator is spring return. All the other 2-position actuators are capacitor discharge return.
- Valves can be interchanged among the different actuator types.
- All actuators are clockwise to close and counterclockwise to open with wire harness facing you and looking at the top of the actuator.

Valve Stroke Time

Table 11. Valve stroke time

Valve Selection	End Stop Position	Stroke Time (Seconds)
1/2 in. 2-way Modulating Valve, 1.4 Cv	No end stop	75
1/2 in. 2-way Isolation Valve, 2.4 Cv	5	55
1/2 in. 2-way Modulating Valve, 3.4 Cv	6	62
1/2 in. 2-way Modulating Valve and 2-Position Valve, 4.8 Cv	N	68
1/2 in. 2-way Modulating Valve, 5.9 Cv	No end stop	75
3/4 in. 2-way Modulating Valve and 2-Position Valve, 2.3 Cv	4	49
3/4 in. 2-way Modulating Valve, 3.3 Cv	5	55
3/4 in. 2-way Modulating Valve and 2-Position Valve, 4.6 Cv	6	62
3/4 in. 2-way Modulating Valve, 6.6 Cv	N	68

Table 11. Valve stroke time (continued)

Valve Selection	End Stop Position	Stroke Time (Seconds)
1/2 in. 3-way Modulating Valve and 2-Position Valve, 2.7 Cv	No end stop	75
3/4 in. 3-way Modulating Valve, 4.6 Cv	No end stop	75
3/4 in. 3-way Modulating Valve and 2-Position Valve, 7.4 Cv	N/A	90

Balancing Manual Circuit Setter Valve

The manual circuit setter valve is an optional end valve supplied on the return pipe of the factory piping package. The valve allows the operator to regulate water flow through the hydronic coil, balance the water flow through the unit with other units in the piping system, and serves as a shutoff or end valve. See the figure below.

Figure 16. Manual circuit setter valve

Perform the following procedure to set maximum water flow through the coil:

1. Establish water flow through the coil. Perform an open override of the valve if the control valve is closed to the coil, either manually or by Tracer®.

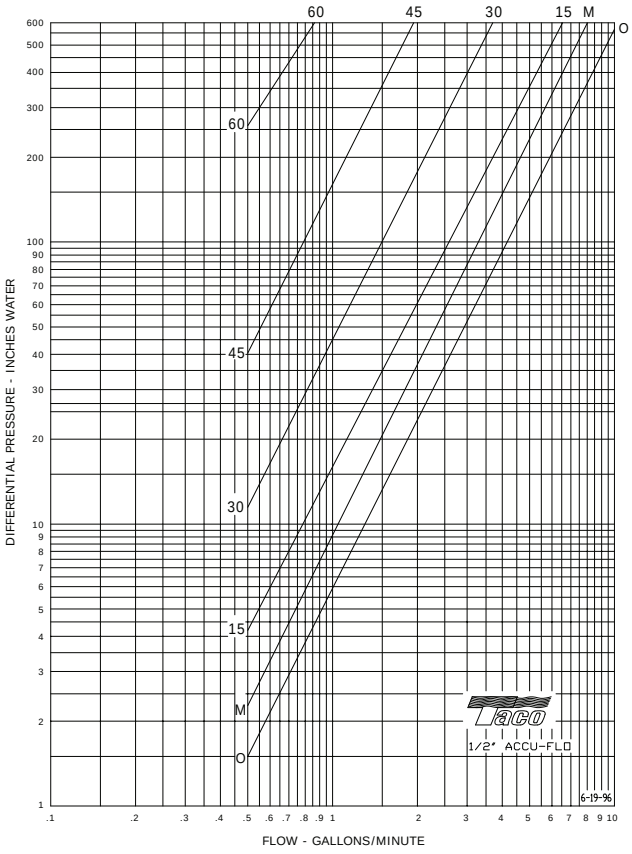
   If the piping package has 2-position, normally closed valves: Drive open the valve using a 24 V signal.

   If the piping package has 2-position, normally open valves: Manually drive open the valve by removing power to the valve.

   If the piping package has modulating valves: To manually drive the valve open, lift off the actuator and turn the valve stem. Actuator can be used to turn the valve stem.
2. For presetting, use the appropriate valve curve shown in Figure 17, p. 30 to determine which setting is necessary to achieve the appropriate pressure drop.
3. Carefully remove the Schrader pressure port connection caps on the manual circuit setter, since they will be at the same temperature as the pipeline.
4. Bleed all air from the hoses and meter before reading the pressure drop. Refer to the gauge operating instructions.
5. Adjust the circuit setter valve by turning the valve stem until the appropriate pressure drop is achieved.
6. After achieving the proper setting, slightly loosen the two socket head cap screws and rotate the memory stop around until it touches the back side of the indicator. Then tighten the screws to securely set the open memory position. The memory stop indicates the last set open position.
7. If using a 3-way valve: close the control valve to the coil, with the differential pressure meter still connected. This will divert flow to the bypass side of a 3-way valve.

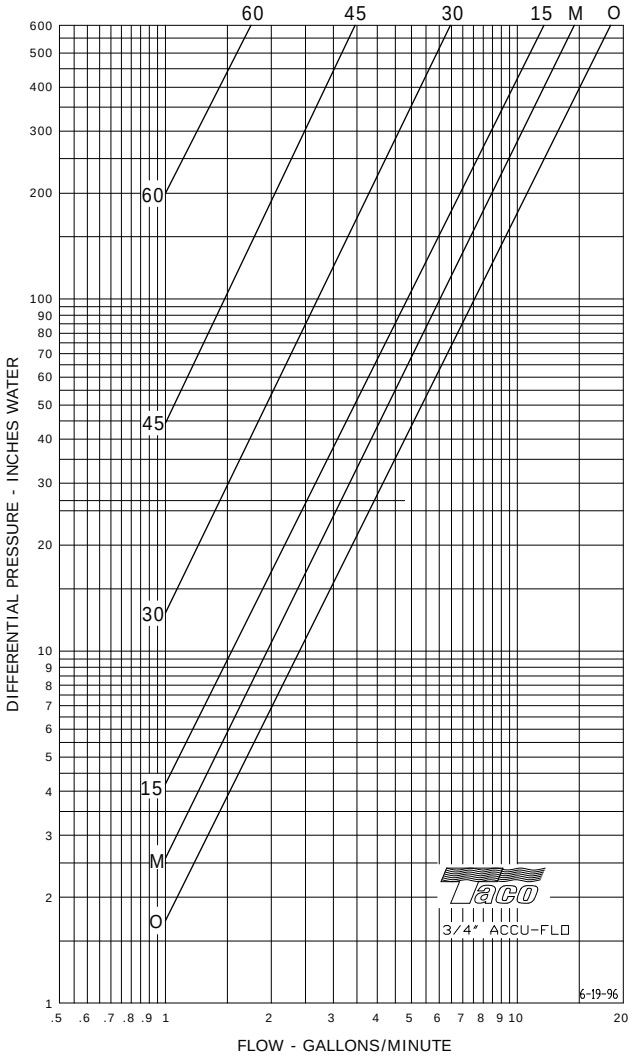
Adjust the balancing fitting to obtain the same pressure drop across the circuit setter valve as in step two when the control valve was open to the coil.

Figure 17. Manual circuit setter valve, differential pressure vs. flow - 1/2 in.



Note: *Instructions for using this chart appear on the preceding page. For the manual circuit setter provided the unit, use the M curve.*

Figure 18. Manual circuit setter valve, differential pressure vs. flow - 3/4 in.



Note: *Instructions for using this chart appear on the preceding page. For the manual circuit setter provided the unit, use the M curve.*

Split System Units

The following refrigerant piping and interconnecting wiring instructions apply to unit ventilators with direct expansion type cooling coils used in conjunction with air-cooled condensing units. Reference must also be made to the condensing unit installation and wiring manuals which are shipped with the condensing unit.

Note: *A UL listing mark applied to a unit ventilator does not apply to any associated refrigerant condensing unit.*

Refrigerant Piping

⚠ WARNING

Explosion Hazard and Deadly Gases!

Failure to follow all proper safe refrigerant handling practices could result in death or serious injury. Never solder, braze or weld on refrigerant lines or any unit components that are above atmospheric pressure or where refrigerant may be present. Always remove refrigerant by following the guidelines established by the EPA Federal Clean Air Act or other state or local codes as appropriate. After refrigerant removal, use dry nitrogen to bring system back to atmospheric pressure before opening system for repairs. Mixtures of refrigerants and air under pressure may become combustible in the presence of an ignition source leading to an explosion. Excessive heat from soldering, brazing or welding with refrigerant vapors present can form highly toxic gases and extremely corrosive acids.

Unit ventilators with direct expansion cooling are dehydrated and shipped with a dry air holding charge. Connections are pinched off at the factory.

To connect the condensing unit lines, cut off the stubouts and swage. The condensing unit lines can then be brought into the swage and brazed. Trane recommends the use of nitrogen purge when brazing refrigerant lines to prevent formation of oxides in the lines.

Install the refrigerant suction and liquid lines as described in the condensing unit installation instructions. The thermal expansion valve (TXV) is factory-installed on the Unit Ventilator.

Note: *The direct expansion (DX) refrigerant coil includes a factory-mounted adjustable thermal expansion valve (TXV) set to 90 psig superheat and an equalizing tube.*

Piping should be run straight out through the back of the unit. Access piping knockouts are located in the rear panels of the unit, as shown in Figure 3, p. 14 through Figure 7, p. 18.

Recommended refrigerant line connections for various unit combinations are given in Table 8, p. 25. Typical Superheat Charging Charts are shown in the Trane Service Facts. Refrigerant charge weights can also be determined with your local Trane account manager using a valid Trane Selection Program.

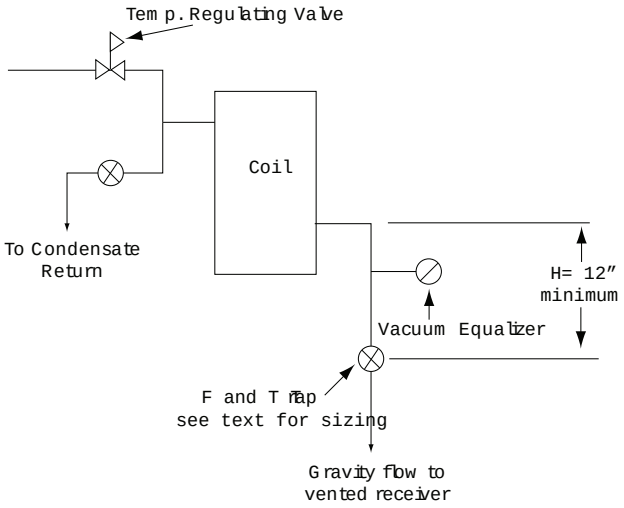
Steam Piping

When air, water or another product is heated, the temperature or heat transfer rate can be regulated by a modulating steam pressure control valve. Since pressure and temperature do not vary at the same rate as load, the steam trap capacity, which is determined by the pressure differential between the trap inlet and outlet, may be adequate at full load, but not some lesser load.

There are detailed methods for determining condensate load under various operating conditions. However, in most cases this is not necessary if the coils are piped as shown below.

Follow the procedure documented in the ASHRAE Systems Handbook, Steam Systems.

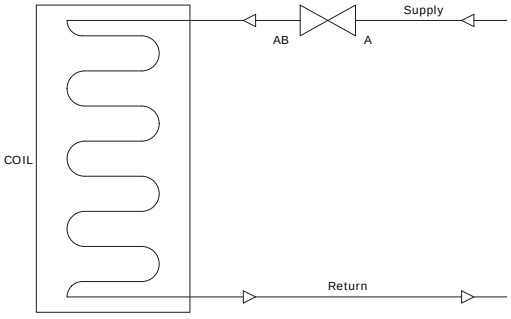
Figure 19. Steam piping



Modulating Steam Valves

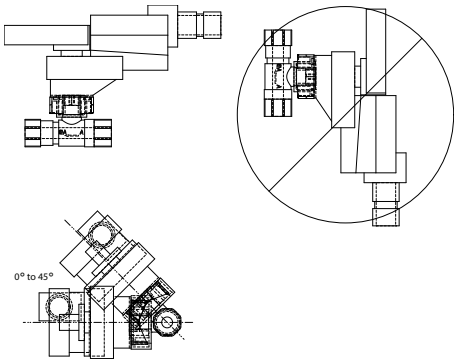
An optional 2-way modulating steam valve can be selected with steam coils. The valve is field installed. When plumbing the valve, the AB port must be connected to the coil.

Figure 20. Belimo steam



Note: *The actuator must be mounted between 0 and 45 degrees from horizontal. Do not install with actuator below pipe.*

Figure 21. Steam valve orientation



Note: *The actuator must be removed when soldering near the valve. High heat may cause damage to the actuator plastic body/mechanisms. The actuator can be removed from the valve by loosening the bolt going through the top of the actuator. When reinstalling the actuator, do not overtighten. Tighten bolt to 13.5 in-lb.*

Figure 22. Exploded valve assembly

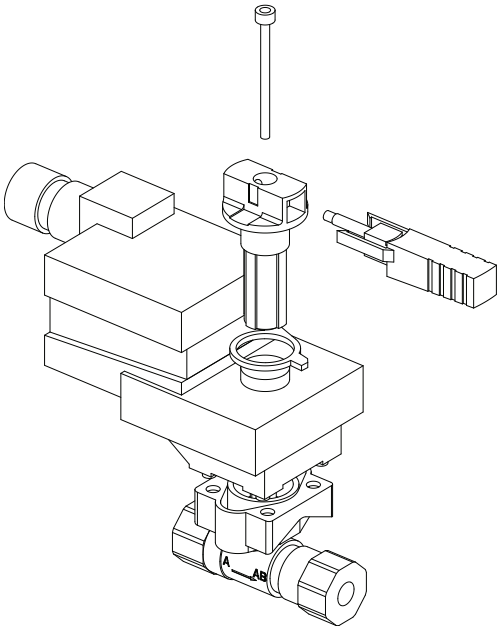
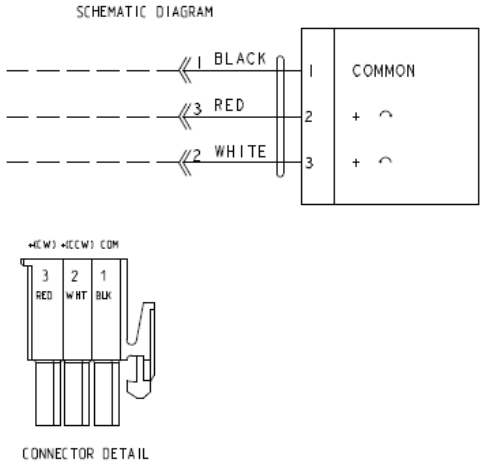


Figure 23. Wiring for modulating steam valve actuator



Installation - Controls

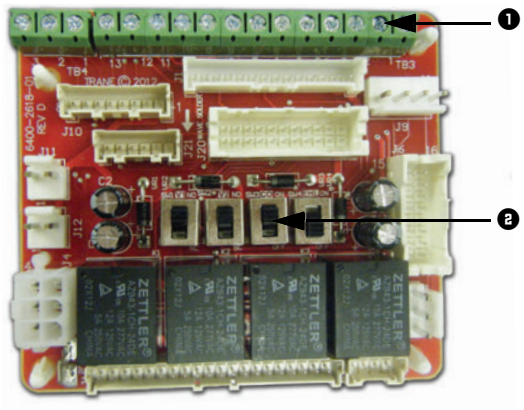
Control Options

Available control options:

- Customer-supplied terminal interface (CSTI)
- Symbio™ 400-B controller with Air-Fi® Wireless Communications Interface

Customer Supplied Terminal Interface (CSTI)

Figure 24. CSTI adapter board

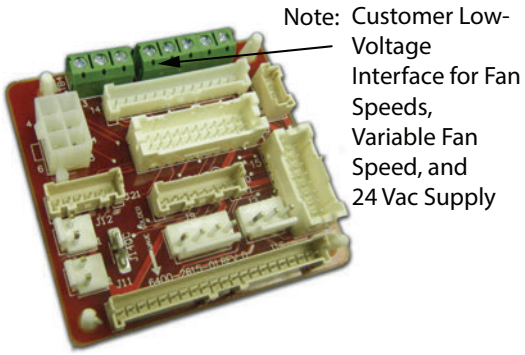


1. Customer Low-Voltage Interface for Valves, Electric Heat, Dampers, Fan Speeds, Variable Fan Speed, and 24 Vac Supply.
2. Valve(s), Electric Heat, and Changeover Configuration Switches (Factory-Set).

- Performs all the functions of the standard adapter module, but in addition, provides convenient field connections to factory mounted end devices, including:
  - Valves
  - Dampers
  - Electric Heat
- Performs courtesy inversion of thermostatic inputs to match selected valves:
  - Standard thermostats put out only on signals, however customer may select a normally open valve. A selectable switch allows the customer to invert the thermostat outputs for correct operation. These switches are set at the factory, but can be adjusted in the field.
  - Sophisticated changeover function when used with a thermistor, that replaces traditional bi-metallic disc temperature switches:
    - Board will automatically honor only the appropriate customer request (Heat/Cool) depending on sensed water temperature.
    - Feature can be enabled or disabled with a selector switch — however, it is set correctly at the factory, based on customer choice of coil.
    - The bi-metallic disc temperature switch emulation is programmable, and dead-band range can be adjusted.
    - Electric heat lockout circuits and fan proving circuits for electric heat are standard, and are preconfigured at the factory.

Standard Adapter Board

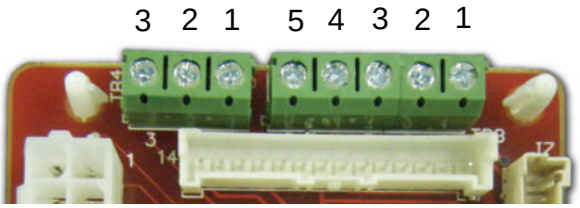
Figure 25. Adapter board



- The adapter allows direct customer interfacing through the use of terminal strips. Standard interfacing includes:
  - Fan Speeds (H, M, L) (for wall mounted fan speed switches)
  - Variable speed (0–10V) inputs
- The standard adapter board eliminates many separate wiring harnesses in the panel and allows simple, mistakeproofed single-plug interfacing of:
  - The ECM Engine Controller
  - Transformers
  - Motors
  - Valves
  - Dampers
  - Electric Heat Control
  - Fan Speed Switches
  - Main Power (except electric heat)
- Electric heat lockout circuits and fan proving circuits for electric heat are standard, and are pre-configured at the factory.

Standard Adapter Board Field Connections

Figure 26. Standard adapter board field connections



1. VSP 10V	1. 24 Vac Y (gnd)
2. VSP 0–10V	2. 24 Vac B (com)
3. VSP DC COM	3. High
	4. Medium
	5. Low

All customer connections to the two adapter boards are made to the terminal strips on both adapter boards.

Screw terminal blocks provide convenient access to fan controls for High, Medium, Low, and Variable speed. In addition, a courtesy 10 Vdc supply is provided for use with an external potentiometer or rheostat. The 10 Vdc supply supports up to 10 mA draw.

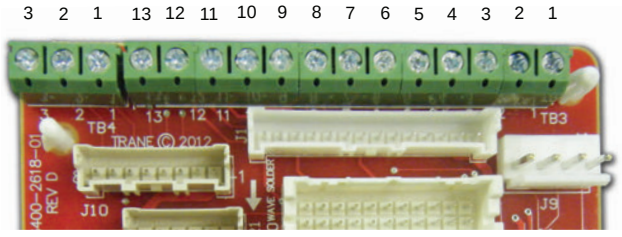
TB3 (right five positions) is normally used to provide 24V hookup to a wall mounted fan speed switch, and to accept the returns from the switch for High, Medium, and Low requests.

TB4 (left three positions) is normally used to control the system with a 0 to 10 Vdc output from a thermostat/controller, or a fan control rheostat/potentiometer.

The terminal block functional assignments and polarity are shown for reference only, and the schematics that ship with each unit should be consulted before wiring. Wiring assignments are configured for each unit.

CSTI Adapter Board Field Connections

Figure 27. CSTI adapter board field connections



1. VSP 10V	6. Low
2. VSP 0–10V	7. V1Op/Cooling
3. VSP DC COM	8. Not used
	9. Not used
1. 24 Vac Y (hot)	10. V1C1 (not std)
2. Damper Open	11. V2Op/EH1St/Heating
3. 24 Vac Y (gnd)	12. V2C1/EH2St (not std)
4. High	13. Dmp Cl (not std)
5. Medium	

The CSTI adapter board provides all the hookups of the standard adapter board, but in addition provides hookups for valve control (main and auxiliary coils), electric heat control and damper control.

Screw terminal blocks provide convenient access to fan controls and to end device control. In addition, a courtesy 10 Vdc supply is provided for use with an external potentiometer or rheostat. The 10 Vdc supply supports up to 10 mA draw.

TB3 (right 13 positions) is normally used to provide:

1. 24 Vac supply to a wall fan speed switch or
2. 24 Vac supply to a field-installed unit-mounted controller, or a wall-mounted controller or thermostat
3. Inputs (returns) for thermostatic fan control: High, Medium, and Low
4. Inputs (returns) for cooling/heating requests
5. Inputs (returns) for electric heat requests
6. Inputs (returns) for damper operation requests

TB4 (left three positions) is normally used to control the system with a 0 to 10 Vdc input from a thermostat/controller with a variable speed output, or a fan control rheostat.

The terminal block functional assignments and polarity are shown for reference only, and the schematics that ship with each unit should be consulted before wiring. Wiring assignments are configured for each unit.

Adjustment and Configuration of the CSTI Adapter Board

⚠ CAUTION

Burn Hazard!

Failure to follow this instruction could result in the unit overheating and becoming hot to the touch, which could result in minor or moderate injury, and/or equipment damage.

On electric heat units, certain parameter values are locked out to prevent overheating of the unit. These functions will appear to be saved; however, they will not be accepted if the Electric Heat Protection setting is "On". Do not change the Electric Heat Protection setting to "Off" and make changes to the protected settings unless you are programming an unconfigured service replacement board to match the unit settings on a ECM configuration label.

For CSTI units, the board mounted switches have to be set appropriately to enable the desired functionality.

Figure 28. CSTI adapter board: board-mounted switches

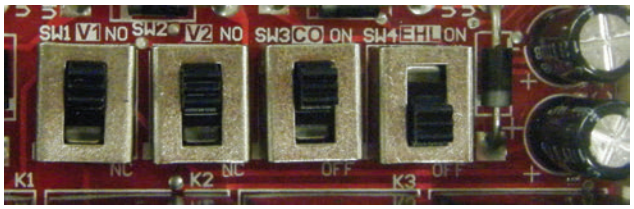


Table 12. CSTI adapter board: switch functions

Switch (L-R)	SW1	SW2	SW3	SW4
Function	Valve one operation logic	Valve two operation logic	Change-over Function	Electric Heat/Fan Proving Function
UP position (towards terminal strip)	Normally Open Valve	Normally Open Valve	Change-over Function ON	Electric Heat/Fan Proving Function
DOWN position (towards black relays)	Normally Closed Valve	Normally Closed Valve	Change-over Function OFF	Electric Heat/Fan Proving Function

Notes:

- *All switches are factory-set based on customer configuration of the unit model number. The unit will function correctly as shipped; however, the switch functions and positions are depicted for customer convenience and for service and troubleshooting aids.*
- *SW3 and SW4 work in conjunction with settings on the ECM engine controller. Simple activation of changeover and electric heat lockout function may not work correctly unless the ECM engine board is configured to perform these functions.*
- *Customers are advised to locate the changeover coil temperature sensor on the bypass line if possible, to avoid measuring standing water temperature.*
- *If a 4-pipe unit with changeover function is selected, the heating input will drive the main coil if hot water is detected, but will always drive the auxiliary coil or electric heat (where available).*
- *Where electric heat is available with a changeover coil, the electric heat is factory-configured to be deactivated if there is hot water available and if there is a fan failure.*

The CSTI board comes with courtesy valve inversion relays that allow both normally open and normally closed 2-position valves to be used with simple thermostats that do not have the configurability to adapt to the customer choice of valves. Independent switches, SW1 and SW2, are provided for 2-pipe or 4-pipe units, or 2-pipe units with an optional reheat coil. The functions of SW1 and SW2 is downstream of the changeover function (SW3 and ECM engine board). Decisions made by the changeover circuits will be flowed to the inversion circuits, if they are selected.

SW3 enables or disables the changeover function for 2-pipe changeover coil units, or 4-pipe units where the coil has both a heating/cooling circuit and a heating circuit piped internally. If SW3 is turned off, the changeover function will be disabled, and the unit will then be configured as a cooling only coil, a heating only coil, or a combination of cooling only/heating only coil. Thus, customer cooling requests will drive the main valve, and heating requests will drive the auxiliary valve.

The changeover function is designed to work with customer controllers that request heating or cooling (based on customer request), but have coil water temperatures that are changed over from heating to cooling (or cooling to heating) depending on the season and the building equipment available. Customer thermostats MUST be hooked to the correct terminal strip locations (V1 and V2) for the changeover function to work.

Cooling

In general, the (CSTI) changeover function will provide cooling if:

1. A unit is factory configured with a changeover coil (cooling/heating) as the only coil or as the main coil portion.
2. SW3 on the CSTI adapter board is turned on, and the FPrU parameter set to EHL or EhFS to use the changeover functions.
   a. Ehl parameter should be chosen if the unit has a changeover coil without electric heat.
   b. EhFS parameter should be chosen if the unit has a changeover coil with electric heat. Generally, this will perform the same as the Ehl parameter but will in addition, disable the heating function on electric heat and on the changeover coil heat if there are fan failures. The auxiliary heating coil valve will continue to respond to customer heating requests.
3. The ECM engine has sensed that there is cold water available on the supply/bypass line for the changeover coil. In this case, cold water is inferred by the ECM engine if:
   a. A 10K NTC thermistor (similar to Trane part number X13790374010) is wired properly to the engine board, through the crossover cables and CSTI adapter boards.
   b. The input impedance of the thermistor circuit must be set correctly (the AIPU parameter should be set to 10 for CSTI units).
   c. The temperature sensed is lower than the AI2T parameter.

d. The A 12b parameter is higher than the A 12C parameter.

e. The temperature is not in the dead-band between the A 12b parameter and the A 12C parameter (in this case, previous state will be retained).

4. The customer thermostat is properly hooked up the input strip 1TB3, and is requesting cooling input (V1) based on the customer cooling setpoint being lower than the space temperature.

Heating

In general, the (CSTI) changeover function will provide heating if:

1. A unit is factory-configured with a changeover coil (cooling/heating) as the only coil or as the main coil portion.
2. SW3 on the CSTI adapter board is turned on, and the FPru parameter set to EHL or EhFS to use the changeover functions.
   a. Eh L parameter should be chosen if the unit has a changeover coil without electric heat.
   b. EhFS parameter should be chosen if the unit has a changeover coil with electric heat. Generally, this will perform the same as the Eh L parameter but will in addition, disable the heating function on electric heat and on the changeover coil heat if there are fan failures. The auxiliary heating coil valve will continue to respond to customer heating requests.
3. The ECM engine has sensed that there is hot water available on the supply/bypass line for the changeover coil. In this case, hot water is determined if:
   a. A 10K NTC thermistor (similar to Trane part number X13790374010) is wired properly to the engine board, through the crossover cables and CSTI adapter boards.
   b. The input impedance of the thermistor circuit must be set correctly (the A IPU parameter should be set to in for CSTI units).
   c. The temperature sensed is higher than the A 12b parameter.
   d. The A 12b parameter is higher than the A 12C parameter.
   e. The temperature is not in the dead-band between the A 12b parameter and the A 12C parameter (in this case, previous state will be retained).
4. The customer thermostat is properly hooked up the input strip 1TB3, and is requesting heating input (V2) based on the customer heating set point being higher than the space temperature.
5. The heating input on 1TB3 will drive the main changeover coil IF conditions 1–4 are satisfied, but will always drive the auxiliary coil valve (if present). Electric heat will be locked out (where present) if hot water is available since SW4 will be factory set to **ON** in these units.

SW4 selects the electric heat lockout function, where we will lock out the electric heat circuit based on either:

1. The presence of hot water in the changeover coil section (if the FPru parameter is set to EHL).
2. Abnormal behavior of the fan/s (if the FPru parameter is set to FnSt).
3. Or a combination of both the presence of hot water or abnormal behavior of the fan/s (if the FPru parameter is set to EHFS).
4. The preceding three examples depend on the inference of the engine board that hot water is present. In this case, hot water is determined if:
   a. The temperature sensed is higher than the A 12b parameter.
   b. The A 12b parameter is higher than the A 12C parameter.
   c. The temperature is not in the dead-band between the A 12b parameter and the A 12C parameter (in this case, previous state will be retained).
   d. The input impedance of the thermistor circuit must be set correctly (the A IPU parameter should be set to in for CSTI units).

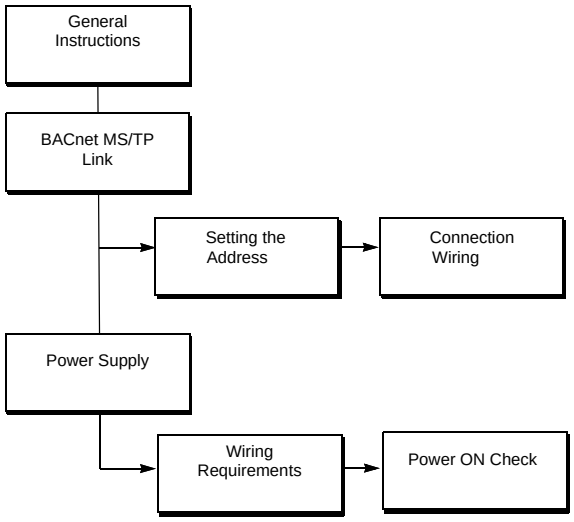
Device Addressing

Units with a Symbio™ 400-B WCI controller can be addressed in the factory. Check with the controls contractor for more information.

Symbio 400-B Controller

This section provides information about wiring the Symbio 400-B controllers. For more detailed information, refer to *Symbio™ 400-B/500 Programmable Controllers for Blower Coil, Fan Coil, and Unit Ventilator Installation, Operation, and Maintenance* (BAS-SVX093*-EN).

Wiring Overview Outline

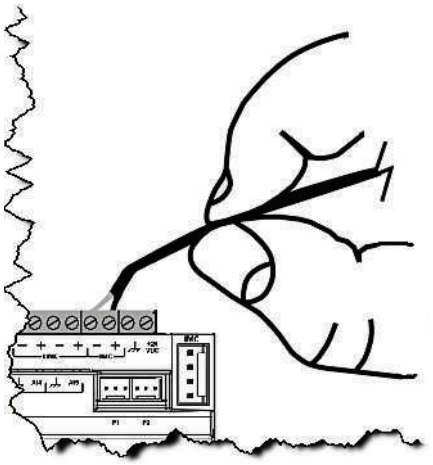


General Instructions

Conformance to Regulatory Standards

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

Connecting Wires to Terminals



To connect wires to the Symbio 400-B controller or the expansion modules:

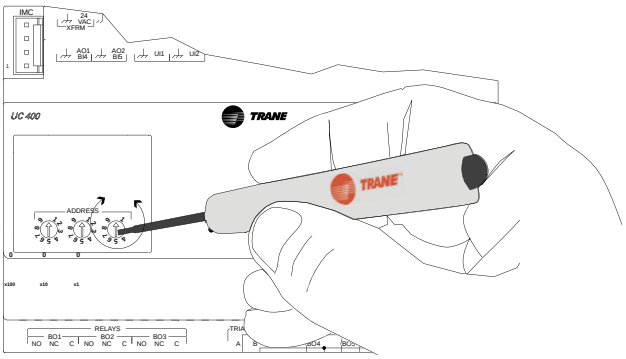
1. Strip the wires to expose 0.28 inch (7 mm) of bare wire.
2. Insert the wire into a terminal connector.
3. Tighten the terminal screw to 0.5 to 0.6 N-m (71 to 85 ozf-in. or 4.4 to 5.3 lbf-in.).
4. Tug on the wires after tightening the screws to ensure all wires are secure as shown on the right.

BACnet MS/TP Link

Setting the Address

Note: *Final addresses are subject to change based on final job requirements. For pre-addressed controllers and WCIs from the factory, verify addresses are set correctly prior to powering the device.*

The rotary address dials on the Symbio 400-B 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 (refer to the illustration below).



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

MAC Address: The MAC Address is required by the RS-485 communication protocol on which BACnet operates. A Symbio 400-B controller can use a MAC Address from 001 to 120.

Important: *Each device on the link must have a unique MAC Address/Device ID. The controller rotary addresses should be sequentially set, with no gaps in the numbering, starting with 001 on each link (for example 001, 002, 003, 004 and so on). 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:

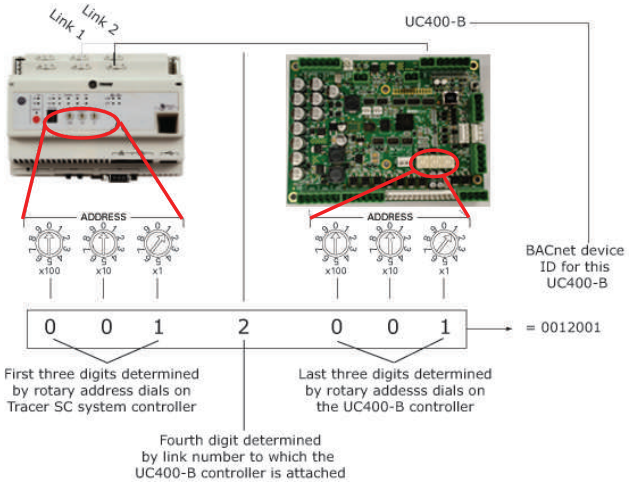
- It can be the same number as the MAC Address, determined by the rotary address dials on the Symbio 400-B controller. For example, if the rotary address dials are set to 042, both the MAC Address and the BACnet Device ID are 042.
- It can be soft set using the Tracer TU service tool. If the BACnet Device 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.

BACnet networks with a Tracer SC system controller

On BACnet networks with a Tracer SC system controller, the Device ID for the Symbio 400-B controller is always soft set by the system controller using the following scheme illustrated below.

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

Figure 29. BACnet® device ID

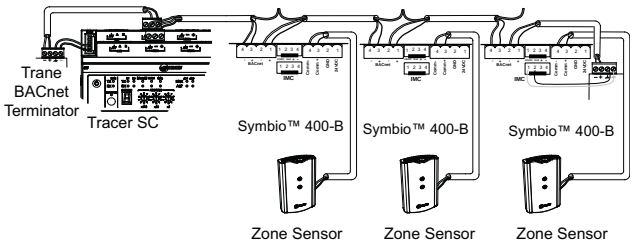


Connection Wiring

Field-supplied BACnet MS/TP link wiring must be installed in compliance with NEC and local codes. The wire must be lowcapacitance, 18-gauge, stranded, tinned-copper, shielded, twisted-pair. The illustration below shows an example of BACnet link wiring with multiple Symbio 400-B controllers.

Note: *For more details, refer: BACnet® MS/TP Wiring and Link Performance Installation, Operation, and Maintenance (BAS-SVX51*-EN).*

Figure 30. Example of BACnet link wiring with multiple Symbio™ 400-B controllers



Power Supply

Please read all of the warnings, cautions, and notices below before proceeding with this section.

⚠ 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 Symbio 400-B 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 Symbio 400-B controllers:

- The transformer must have sufficient capacity.
- Polarity must be maintained for every Symbio 400-B controller powered by the transformer.

Notes: *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 the Symbio 400-B controller outputs.*
- *Damage to the transformer or a blown transformer fuse.*

Transformer Recommendations

A 24 Vac power supply must be used for proper operation of the binary inputs, which requires 24 Vac detection. In addition, the spare 24 Vac outputs may be used to power relays and TRIACS.

- AC transformer requirements: UL listed, Class 2 power transformer, 24 Vac ±15%, device max load 24 VA. The transformer must be sized to provide adequate power to the controller (12 VA) and outputs (maximum 12 VA per binary output).
- CE-compliant installations: The transformer must be CE marked and SELV compliant per IEC standards.

Wiring Requirements

To ensure proper operation of the Symbio 400-B controller, install the power supply circuit in accordance with the following guidelines:

- 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.

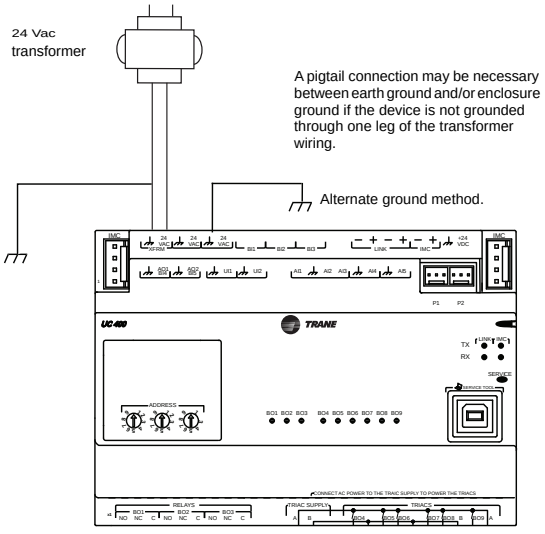
- 18 AWG (0.823 mm^2) copper wire is recommended for the circuit between the transformer and the controller.

Important: *The controller must receive AC power from a dedicated power circuit; failure to comply may cause the controller to malfunction. 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.*

Connecting Wires

To connect the wires:

1. Disconnect power to the transformer.
2. Connect the 24 Vac secondary wires from the transformer to the 24 Vac ⏚ and terminals on the Symbio™ 400-B controller (refer to the illustration below).
3. Do one of the following to ensure the controller is adequately grounded:
   - Connect a grounding pigtail at some point along the secondary wire that runs between the controller ⏚ terminal and the transformer.
   - 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

To perform a 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 Symbio 400-B controller.
4. Observe the Symbio 400-B controller when power is applied to verify the power check sequence as follows:
   a. The power LED lights red for 1 second
   b. The power LED lights green
   - If the sequence above is completed as described, the controller is properly booted and ready for the application code.

If the power LED flashes red, a fault condition exists.

Zone Sensor Options

Figure 31. Wireless temp sensor with display (SP, OALH, COMM)

Figure 32. Wireless temp sensor (SP, OALMH, COMM)

Figure 33. Wall mtd temp sensor (SP, OCC/UNOCC, OA, LMH, COMM)

Figure 34. Unit mtd temp sensor (SP, OALH, COMM)

Figure 35. Split mtd zone sensor, unit mtd fan speed switch, and wall mtd setpoint dial with On/Cancel

Figure 36. Split mtd zone sensor, unit mtd fan speed switch, and wall mtd setpoint dial

Figure 37. Wall mtd temp sensor (SP, OALMH, COMM)

Figure 38. Wall mtd display temp sensor (SP, OCC/UNOCC, OALMH, COMM)

Fan Mode Switch Installation

The fan mode switch ships loose inside the unit accessory bag. Follow the steps below to install the fan mode switch.

Items needed:
2 × 4 electrical junction box

1. Remove the brown wire if not using a field-supplied damper.

2. Remove the terminals, cut and strip wires as required for installation.
3. Level and position a 2 × 4 electrical junction box.
4. Follow the instructions given in Wall-Mounted Control Interconnection Wiring section of "Electrical Wiring," p. 55 and route the wires as shown in the wiring diagram. Refer to the typical wiring diagram or to the unit specific diagram on the unit.
5. Position the fan mode switch over the junction box with the two screws supplied.

Zone Sensor Installation

Location Considerations

When selecting a sensor location, avoid the following:

- Areas of direct sunlight
- Areas in the direct airstream of air diffusers
- Exterior walls and other walls that have a temperature differential between the two sides
- Areas that are close to heat sources such as sunlight, appliances, concealed pipes, chimneys, or other heatgenerating equipment
- Drafty areas
- Dead spots behind doors, projection screens, or corners
- Walls that are subject to high vibration
- Areas with high humidity
- High traffic areas (to reduce accidental damage or tampering)
- Metal barriers between the receiver and the sensor (for example, plastered walls with metal lathe or metal roof decks)
- Thick, solid concrete walls between the receiver and the sensor
- Placing the sensor inside metal enclosures

Location Considerations for Wireless Zone Sensors

Placement of the sensor is critical to proper operation (the receiver is factory mounted on fan-coil units). For most installations, barriers limit proper radio signal strength more than distance. For best radio transmission range and reliability, mount the receiver and sensor in line of sight. Where this is not possible, try to minimize the number of barriers between the pair of devices. In general, sheetrock walls and ceiling tiles offer little restriction to the transmission range for the sensor is as follows:

- Open range: 2,500 ft. (packet error rate = 2%)
- Usable range: 200 ft.
- Typical range: 75 ft.

Height Requirements

It is recommended that you mount the back plate a maximum distance of 54 inches above the floor. If a parallel approach by a person in a wheelchair is required, reduce the maximum height to 48 inches.

Note: *Consult section 4.27.3 of the 2002 ADA (Americans with Disability Act) guideline, and local building codes, for further details regarding wheelchair requirements.*

Mounting Surfaces

Using the hardware provided, mount the back plate of the sensor to a flat surface such as sheetrock or plaster, or an electrical junction box. The sensor must be mounted plumb for accurate temperature control and to ensure proper air movement through the sensor.

- If mounting onto sheetrock or plaster, use the plastic threaded anchors (pre-drilling holes is not usually necessary) and the two M3.5 × 20 mm mounting screws.
- For mounting onto an electrical junction box, use the two 6- 32 × 3/4 in. screws.

Before beginning installation, consider the location considerations below. Also, refer to the unit wiring schematic for specific wiring details and point connections.

Location Considerations

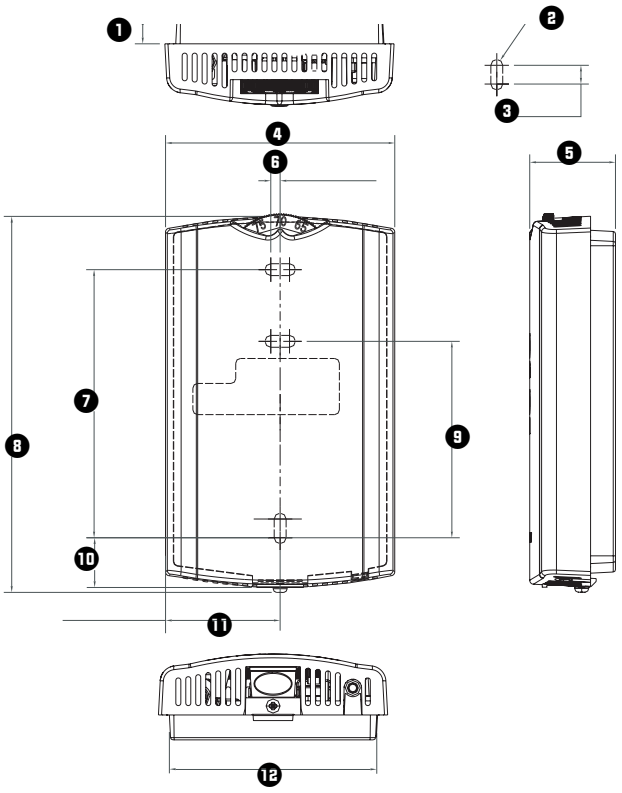
Avoid mounting the sensor in an area subject to the following conditions:

- Dead spots, such as behind doors or in corners that do not allow free air circulation.
- Air drafts from stairwells, outside doors, or unsectioned hollow walls.
- Radiant heat from the sun, fireplaces, appliances, etc.
- Airflow from adjacent zones or other units.
- Unheated or uncooled spaces behind the controller, such as outside walls or unoccupied spaces.
- Concealed pipes, air ducts, or chimneys in partition spaces behind the controller.

Zone Sensor Dimensions

Refer the wall-mounted zone sensor dimensions in Figure 39, p. 43. Position the sensor on an inside wall three to five feet above the floor and at least 18 inches from the nearest outside wall. Installing the sensor at a lower height may give the advantage of monitoring the temperature closer to the zone, but it also exposes the sensor to airflow obstructions. Ensure that air flows freely over the sensor.

Figure 39. Wall-mounted wired and wireless zone sensor dimensions



1. 0.31 in.	7. 3.39 in.
2. TYP R.07 in. (R1.9)	8. 4.68 in.
3. TYP 0.24 in.	9. 2.48 in.
4. 2.9 in.	10. 0.63 in.
5. 1.08 in.	11. 1.45 in.
6. 0.12 in.	12. 2.62 in.

Wired Zone Sensor

Follow the procedure below to install the wired zone sensor module.

1. Note the position of the setpoint adjustment knob and gently pry the adjustment knob from the cover using the blade of a small screwdriver.
2. Insert the screwdriver blade behind the cover at the top of the module and carefully pry the cover away from the base.
3. To mount the sensor back plate:
    a. Hold the back plate against the mounting surface and mark the screw locations.
    b. Secure the back plate against the mounting surface using included hardware.
4. To install the zone sensor module to a standard junction box:
    a. Level and install a 2 × 4-in. junction box (installer supplied) vertically on the wall.
    b. Pull the control wires through the cutout. Attach the module to the wall using the screws provided.
5. Strip the insulation on the interconnection wires back 0.25-inch and connect to TB1 (for wired sensors).
6. Screw down the terminal blocks (for wired sensors).
7. To replace the cover:
    a. Hook the cover over the top of the back plate. Apply light pressure to the bottom of the cover until it snaps in place.
    b. Install the security screw into the bottom of the cover (if desired).

Figure 40. Mounting zone sensor security screw

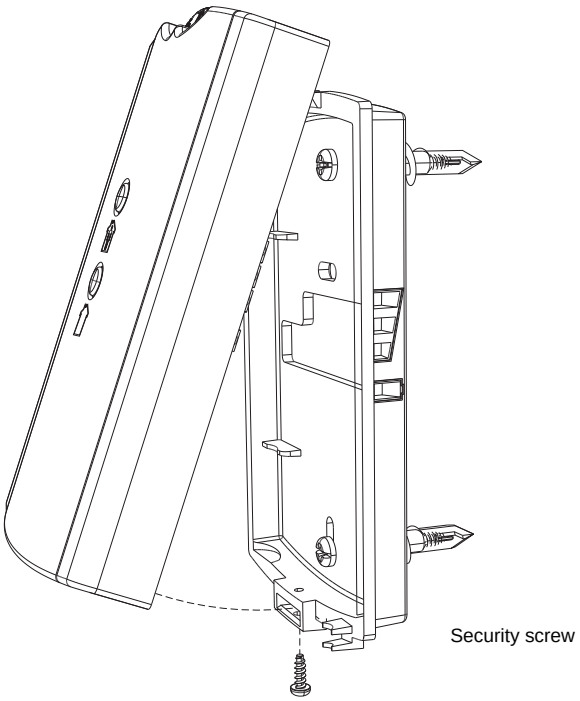
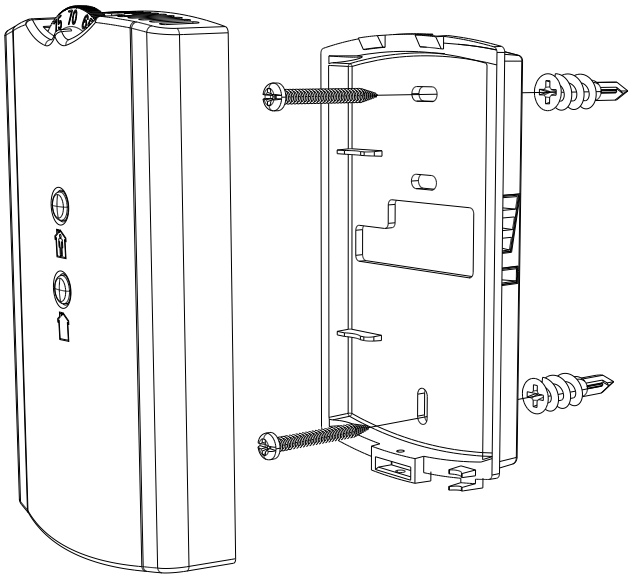


Figure 41. Mounting zone sensor base plate



Receivers

Note: *Receivers ship installed on the unit. To remove the receiver, press in the retention tabs on the underside of the receiver enclosure and push upward.*

Zone Sensor Setting

Address Setting

The process of establishing communication between a receiver and sensor is referred to as association. The following limitations apply:

- Each associated receiver/sensor set that communicates within the reception range of the wireless system must have a unique address.

It is not possible to associate more than one sensor to a receiver, nor is it possible to associate more than one receiver to a sensor.

To associate a receiver and sensor, the two devices must have their rotary address switches set to the same address.

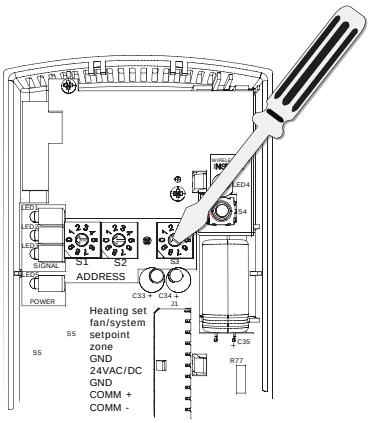
Important: *Set the addresses before applying power to the receiver and before removing the insulation strip (Figure 42, p. 44) from the sensor.*

To set the receiver and sensor addresses:

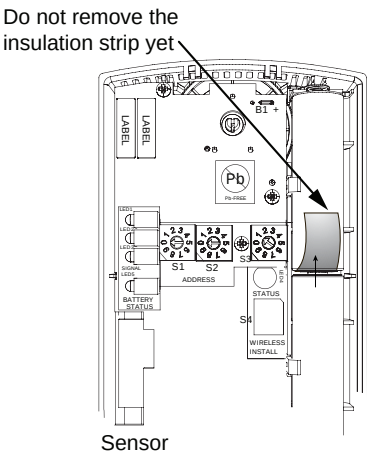
1. Using a small screwdriver, set the three rotary address switches (locations S1, S2, S3) on the receiver to an address between 001 and 999 (see Figure 42, p. 44). You do not have to remove the covers to access the rotary address switches.

Note: *Do not use 000 as an address. An address of 000 returns the receiver outputs to their factory defaults (zone temperature and setpoint outputs: 72.5°F, removes all association knowledge, and prevents association with a sensor.*

Figure 42. Setting the rotary address switches on the receiver and the sensor



Receiver



Sensor

2. Set the three rotary address switches (locations S1, S2, S3) on the sensor to the same address as the receiver (see Figure 42, p. 44).

   Note: *Do not use 000 as an address. An address of 000 removes all association knowledge, reverts the sensor to a low-power hibernation mode, and sends a disassociation request to the receiver.*

3. Record the address and location of the receiver and sensor pair.

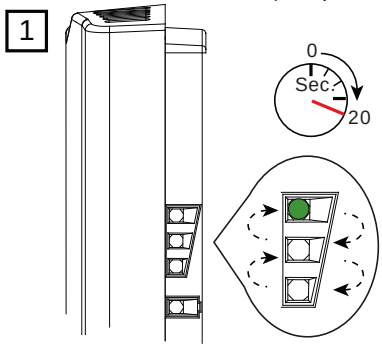
Observing the Receiver for Readiness to Associate

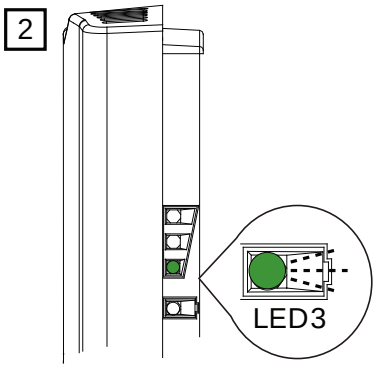
After initial power up, the receiver conducts a channel scan for 20 seconds. During this time, the receiver selects from 16 available channels the clearest channel on which to operate. LED1, LED2, and LED3 flash rapidly in

succession (roundrobin style) while the channel scan is in progress, as shown in part 1 of the illustration.

Important: *Do not attempt association (leave the insulation strip in place) until the channel scan is finished.*

After the channel scan is finished, LED3 begins blinking (one-blink pattern) to show that the receiver is ready to be associated with a sensor (see part 2 of the following figure).

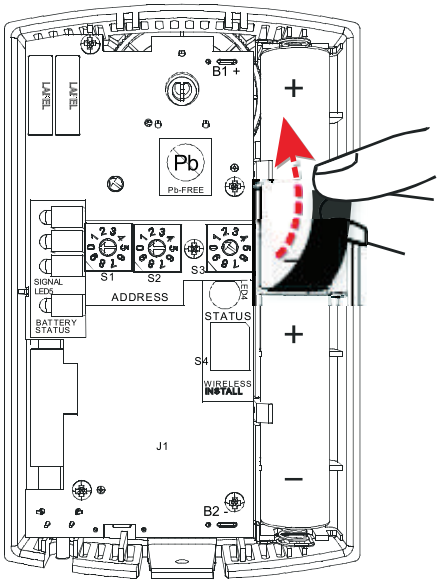




Associating the Sensor to the Receiver

To associate the sensor to the receiver:

1. Remove the sensor cover by firmly pressing the thumb tab at the bottom of the cover and pulling the cover away from the back plate.
2. Verify that the sensor is set to the same address as the receiver it is to be associated with.
3. Power the sensor by removing the insulation strip from between the two batteries.



Association is automatically initiated between the sensor and the receiver. When LED3 on the receiver stops blinking, association has been established.

If the first association attempt is unsuccessful, the sensor automatically re-attempts association with the receiver every 10 minutes.

Note: *An associated sensor that has lost communication with the receiver will transmit an association request every 50 minutes. You can manually initiate association (see "Manual Association," p. 94).*

Testing Signal Strength and Battery Status

To verify that the association process was successful and that the batteries have adequate charge:

1. Firmly press and release the Test button on the bottom of the sensor (as illustrated below).
2. For model WZS, view LED1, LED2, and LED3 to determine the signal strength. View LED5 to determine the battery status (see the following figure for model WZS sensors).

   Note: *The LEDs will turn Off after 5 seconds to conserve battery strength.*

   For model WDS, determine the signal strength and battery status by viewing the symbols on the sensor display (see the following figure for model WDS sensors).
3. Record the results in your commissioning statement.

Note: *For more information, see "Testing Signal Strength," p. 91 and "Testing Battery Status," p. 92.*

Figure 43. Model WZS sensor

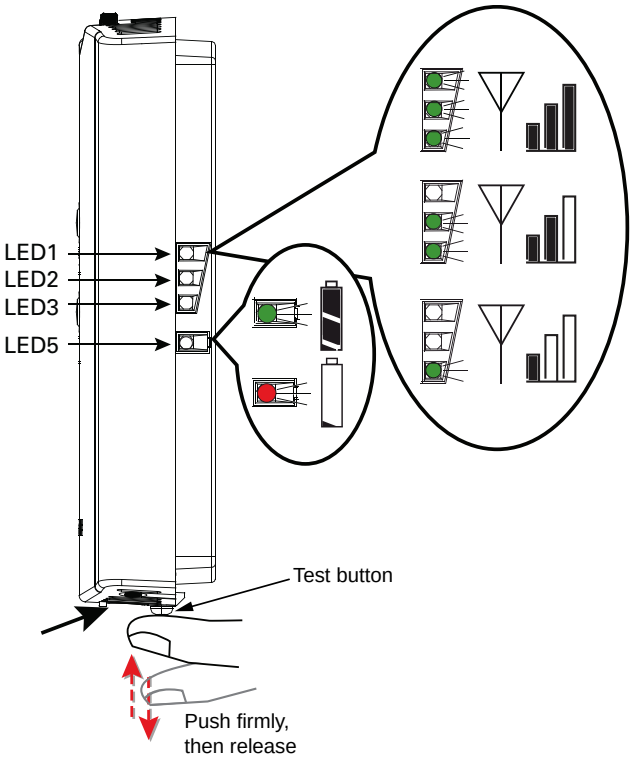
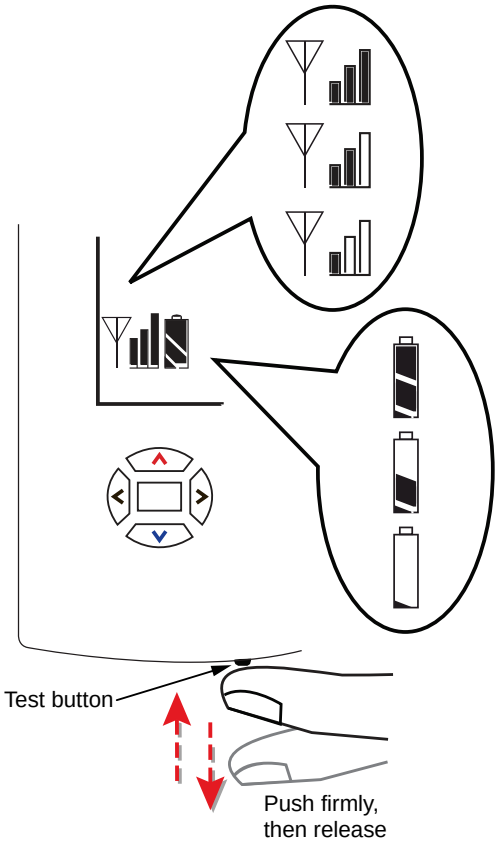


Figure 44. Model WDS sensor



Sensor Operations

Temporary Occupancy (Timed Override)

Temporary occupancy (timed override) is available on model WDS. Temporary occupancy is selected for after-business-hours adjustment of temperature setting, fan settings, or heat/cool settings, when the system has changed to unoccupied mode. System control will revert to unoccupied after a pre-determined time period.

Note: *Not all systems support the occupancy function.*

Model WDS Sensor

To request and cancel temporary occupancy on a model WDS sensor, see "Requesting Temporary Occupancy," p. 51.

End-of-Range Temperature Values

Receiver: The end-of-range temperature limits of the receiver for all models are 32°F to 122°F. The receiver cannot replicate temperature values outside this range. If the sensor transmits a temperature value to the receiver that is out of the receiver replication range, the receiver will freeze the output at the end-of-range values. This value will remain frozen until the transmitted temperature moves to between the end-of-range temperature limits.

Sensor: The end-of-range temperature setpoint limits for the model WDS sensor is 50°F to 89.6°F.

Receiver Power-up Sequence

When power is applied to the receiver, one of the following sequences occurs. The sequence is dependent on the address setting and the association status of the receiver.

Address set to 000 and receiver is not associated with a sensor

- LED5 is constantly On, indicating power is applied and the receiver is functional.
- All models: Zone temperature and cooling setpoint default to 72.5°F.

  WDS only: The heating setpoint defaults to 70.5°F and the fan/system output will be 2230 Ω. (see "Output Values — Failure and Default Modes of Operation," p. 95).
- Status LED3 will display a 2-blink pattern diagnostic.

Address set from 001 to 999 and receiver is not associated with a sensor

- LED5 is constantly On, indicating power is applied and the receiver is functional.
- All models: Zone temperature and cooling setpoint default to 72.5°F.

  WDS only: The heating setpoint defaults to 70.5°F and the fan/system output will be 2230 Ω. (see "Output Values — Failure and Default Modes of Operation," p. 95).

- The receiver conducts an energy scan for 20 seconds to determine the clearest channel on which to operate.
- LED3 flashes On every 2 seconds when it is ready to accept a sensor association request. When an association request is made by a sensor, the receiver instructs the sensor on which power level to operate. Then the receiver and sensor begin operation at the appropriate channel and power level (see "Observing the Receiver for Readiness to Associate," p. 44).

Address set from 001 to 999 (and not changed since most recent power-up) and receiver is associated with a sensor

- LED5 is constantly On, indicating power is applied and the receiver is functional.
- Zone temperature and setpoint default to 72.5°F. WDS only: Heating setpoint defaults to 70.5°F, Fan = Auto, System = Off.
- The receiver waits for a broadcast transmission from its associated sensor. When a transmission is received, the receiver positions its zone temperature and setpoint outputs appropriately.
- If the receiver does not receive a communicated signal from its associated sensor within 35 minutes, zone temperature and setpoint outputs fail, generating a unit controller alarm (see "Output Values — Failure and Default Modes of Operation," p. 95).

Note: *Once a receiver communicates to a WZS sensor, the receiver disables (opens) its zone setpoint output indefinitely.*

Sensor Transmission Time and Temperature Variables

Sensor transition time variables are as follows:

- The maximum time between sensor temperature transmissions is 15 minutes.
- The minimum time between sensor temperature transmissions is 30 seconds.
- The minimum time for transmitting temperature setpoint changes is 10 seconds.

Note: *If a sensor transmits a message to the receiver and the receiver does not reply, the sensor will retransmit the message to the receiver every 30 seconds until communication to the receiver is re-established.*

Sensor temperature time variables are as follows:

- The minimum change in zone temperature required to force a sensor transmission is:
  - 0.2°F when the temperature range is between 60°F and 80°F.
  - 0.5°F when the temperature range is between 32°F and 60°F or between 80°F and 122°F.
- The minimum change in temperature setpoint required to force a sensor transmission is:
  - 0.1°C for a model WDS sensor.

Wireless Sensor Specifications

The following table presents specifications for all models of the wireless sensor sets.

Table 13. Wireless sensor specifications

Component	Type
Sensor operating temperature	32°F to 122°F
Receiver operating temperature	-40°F to 158°F
Storage temperature	-40°F to 185°F
Storage and operating humidity range	5% to 95%, non-condensing
Accuracy	0.5°F over a range of 55ºF to 85°F.
Resolution	0.125°F over a range of 60°F to 80°F 0.25°F when outside this range
Setpoint functional range (WDS only)	50°F to 89.6°F
Receiver voltage	24 V nominal ac/dc ±10%
Receiver power consumption	<1 VA
Housing	Polycarbonate/ABS blend, UV protected, UL 94-5VA flammability rating, suitable for application in a plenum
Mounting	3.24 in (8.26 cm) for 2 mounting screws (supplied)
Sensor battery	(2) AA, 1.5 V, 2800 mAh, lithium, 5-year life, UL listed
Range[a]	Open range: 2,500 ft (762 m) (packet error rate = 2%) Usable: 200 ft (61 m) Typical: 75 ft (23 m)
Output power	100 mW
Radio frequency	2.4 GHz (IEEE Std 802.15.4-2003 compliant) (2405 to 2480 MHz, 5 MHz spacing)
Radio channels	16
Address range	000 to 999
Minimum time between transmissions	30 seconds
Maximum time between transmissions	15 minutes

[a] Range values are estimated transmission distances for satisfactory operation. Actual distance is job specific and must be determined during site evaluation.

Configuring the Wireless Display Sensor (Model WDS only)

Note: *Sensors shipped with the fan-coil are pre-configured for three speeds.*

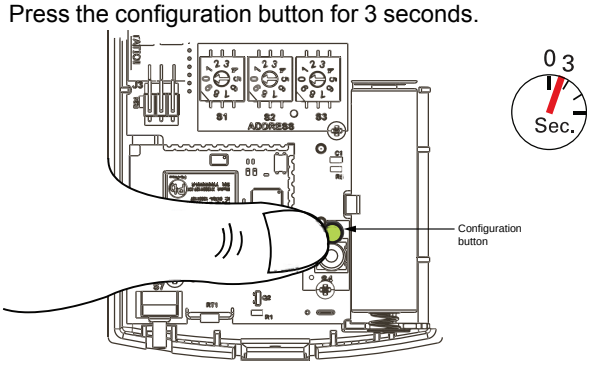
The configuration of the sensor determines which system features can be accessed and changes can be made by the tenant (for example, changes to cooling/heating mode, setpoint, or fan speed. Verify system and associated unit features before configuring the sensor.

The building owner or operator may choose to limit tenant access to certain features. This can be done through configuration. Or, if a sensor is configured to match all control capabilities of the building automation system, the locking feature can be used to restrict the tenant from making changes.

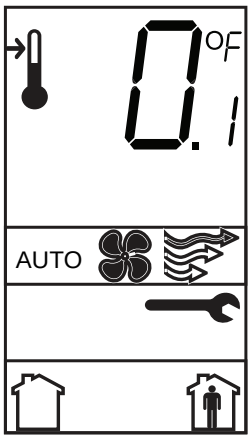
Configuration Procedure

To configure settings on the model WDS sensor, follow this procedure in the order presented.

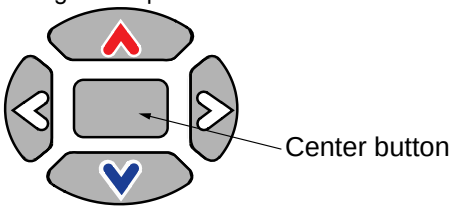
1. Press the configuration button for 3 seconds.



The display will change to configuration mode. When the sensor is in configuration mode, a wrench symbol appears on the display and the menus are separated by lines, as illustrated below.

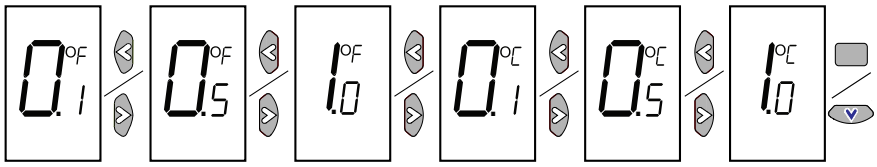
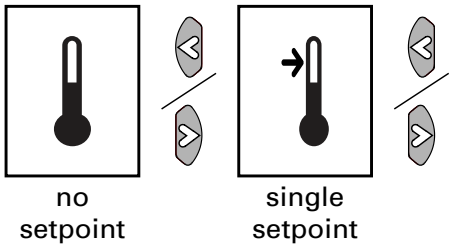
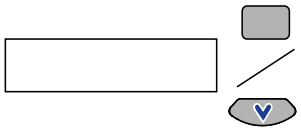


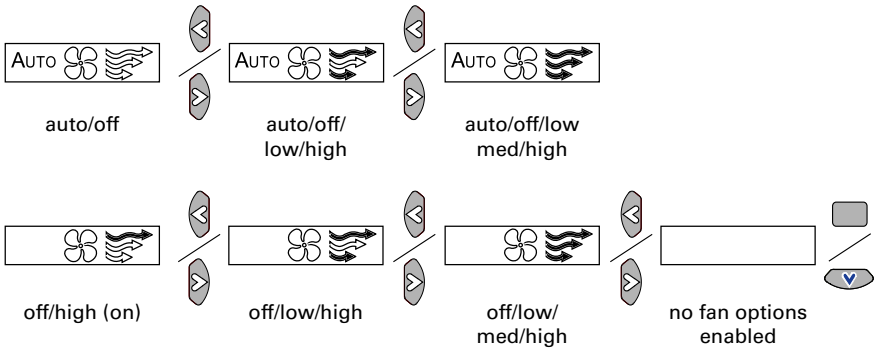
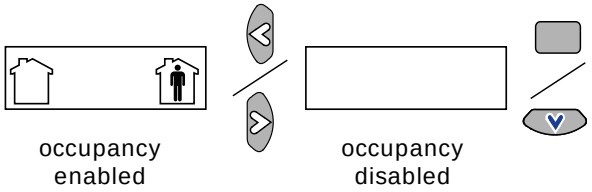
2. Press the center button on the keypad to begin the configuration process.



3. Configure the sensor options in the order shown in the table.

   - Press or to scroll to the next selection (as illustrated).
   - Press or to move to the next menu (as illustrated).

Setting	Configuration Options
Temperature • Choose Fahrenheit or Celsius • Choose the degree resolution (whole degrees, half degrees, or tenths of degrees).	
Setpoint	
System	

Setting	Configuration Options
Fan ***Note:*** *Not all fan options are available for all systems.*	
Occupancy (timed override)	

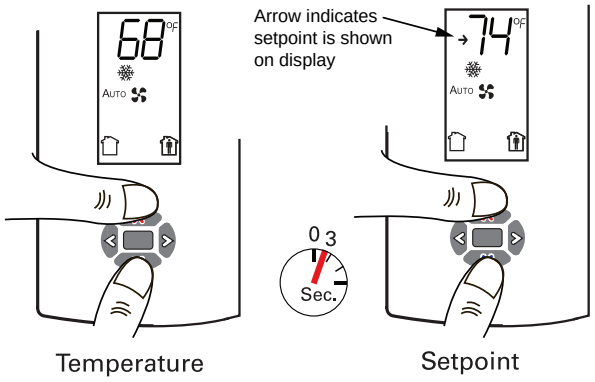
4. Review the display to ensure that you have selected the correct configuration.
5. To return the display to operating mode, press the configuration button (see Step 1.).

Note: *The sensor will revert to operating mode if no buttons are pressed for 10 minutes.*

Displaying Setpoint or Temperature

You can configure the sensor to display either the temperature (default) or setpoint. To select either option:

1. Verify that the sensor is in operating mode and at the home screen.
2. Press the up and down arrows for 3 seconds. The arrow indicates setpoint display, as shown in the figure.

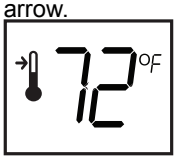


Locking or Unlocking Settings

You can lock or unlock the setpoint, system, or fan setting to prevent changes.

To lock or unlock a setting:

1. Verify that the sensor is in operating mode and at the home screen.
2. Choose a setting to lock or unlock:
   - Select the setpoint by pressing the up or down arrow.

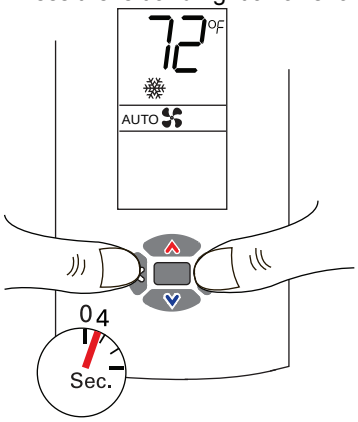


Setpoint

   - From the system menu press the down arrow to select the fan menu. Use the left or right arrow to choose the setting.

Fan menu

3. Press the left and right arrows for 4 seconds.

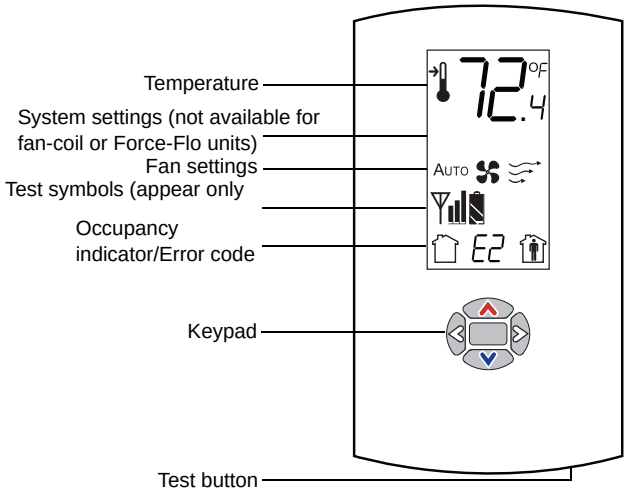


Note: *If you try to access a feature that is locked, the locked symbol will appear on the display. If you press a keypad button to try change a locked setting, the locked symbol will flash.*

WDS Operating Mode

This section describes how to operate the Trane wireless sensor, model WDS. Figure 45, p. 50 shows an example of a model WDS that has been configured and is in operating mode.

Figure 45. Wireless sensor (model WDS) in operating mode



Changing Room Temperature

72.4 °F When you select a setpoint, this symbol appears.	This symbol shows the current room temperature, or your setpoint selection while you are making an adjustment.	1. To increase the room temperature, press ▲. To decrease the room temperature, press ▼. 2. To confirm, press ▭ or wait 5 seconds. The display will return to the home screen.

Changing Heating and Cooling Room Temperature Settings

(applies to some systems)

	Some systems allow you to select both heating and cooling room temperature settings. If your system has this option, this symbol appears when you adjust the temperature setting.	1. Press ▲ or ▼ to select the heating/cooling setting. 2. If in cooling mode, press ◀ to change to heating mode. If in heating mode, press ▶ to change to cooling mode. 3. Press ▲ or ▼ to select the heating/cooling setting. 4. To confirm, press ▭ or wait 5 seconds. The home screen will appear.
	When you adjust the cooling setting, the top arrow and snowflake flash.	
	When you adjust the heating setting, the bottom arrow and flame flash.	

Changing the Fan Setting

AUTO	Indicates that the fan will operate as needed to reach the selected temperature.	1. From the home screen, activate the fan setting menu by pressing ▭ and then ▼. 2. Press ◀ or ▶ to choose the desired fan setting. 3. When the symbol for the desired setting appears, confirm your choice by • Pressing ▭ (the home screen will appear), or • Pressing ▲ or ▼ (the next menu will appear), or • Waiting five seconds.
	Indicates that the fan setting is On. The number of arrows indicates fan speed (3: high, 2: medium, 1: low). The example shown indicates a fan on high speed. Not all systems offer all three speeds.	
	Indicates that the fan setting is Off.	

Requesting Temporary Occupancy

	Select to request occupancy	• If you need heating or cooling after normal business hours, you can request temporary occupancy by pressing  and holding it for 2 seconds. The occupied symbol remains on the screen and the unoccupied symbol disappears. After 30 seconds, the unoccupied symbol will re-appear. • To cancel temporary occupancy, press  and hold for 2 seconds. The unoccupied symbol will remain on the screen and the occupied symbol will disappear. After 30 seconds, the occupied symbol will re-appear.
	Select to cancel occupancy	

Error Codes

	Indicates an error code	If an error code (E0–E7) is displayed, technical assistance may be required.

Lock Symbol

	Indicates that a setting is locked	The lock symbol appears if you try to adjust a setting that cannot be changed.

Testing Signal Strength

Indicates excellent signal strength 	Indicates satisfac-tor y signal strength 	Indicates poor signal strength 

Press the Test button to display the signal strength symbols.

Testing Battery Status

Indicates full battery power. 	Indicates 50% of battery life left. 	Indicates 25% of battery life left. Replace batteries. Flashing symbol indicates that approxi-mately 14 days of operation remain. 

Press the Test button to display the battery status symbols. Use only UL-listed non-rechargeable 1.5 V lithium AA batteries (Trane p/n X13770035010 or equivalent).

The following table presents agency compliance information for wireless sensor set models as shown.

United States compliance (all models)	UL listed: UL 94-5VA Flammability rating UL 916: Energy management equipment
	FCC CFR47, Section 15.247 & Subpart E Digital Modulation Transmission with no SAR (FCC Identification TFP-13651127) This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: 1. This device may not cause harmful interference, and 2. This device must accept any interference received, including interference that may cause undesired operation. Warning: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. 20 cm separation distance: To comply with FCCs RF exposure limits for general population/ uncontrolled exposure, the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

Canada compliance (all models)	CSA22.2 No. 205-M1983 Signal Equipment
	Industry Canada (Certification no: IC: 6178A-13651127) Industry Canada statement: the term IC before the certification/ registration number signifies only that the Industry Canada technical specifications were met. Section 14 of RSS-210: The installer of this radio equipment must ensure that the antenna is located or pointed such that it does not emit RF field in excess of Health Canada limits for the general population.
IEEE compliance for radio frequency range (all models)	IEEE 802.15.4-2003, IEEE Standard for Information Technology—Telecommunications and information exchange between systems—Local and metropolitan area networks—Specific requirements, Part 15.4: Wireless Medium Access Control (MAC) and Physical Layer (PHY) Specifications for Low Rate Wireless Personal Area Networks (LR-WPANs)

Time Clock

Setting the Time Clock

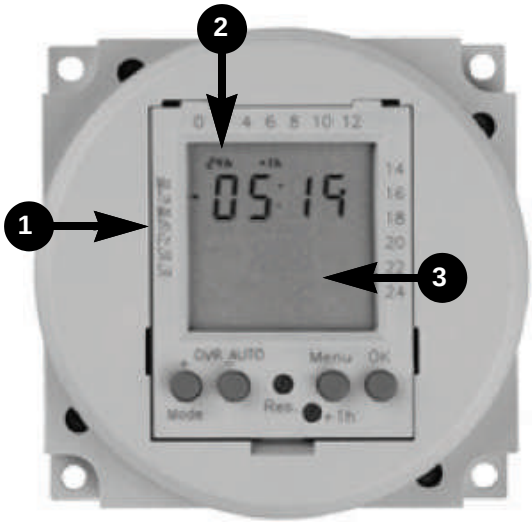
The Time Clock must be programmed for the unit to operate. If not programmed, the unit may not run in the correct occupied/unoccupied state until timing instructions are received from the Time Clock.

Note: *Power must be supplied to the unit for the time clock to be set.*

The following procedure covers:

- Setting the time format
- Setting the current time and day
- Setting the program ON/OFF settings (events)
- Pre set program selections
- Deleting programs
- Daylight savings setting
- Overriding programs (manually)

Figure 46. Time clock



1. Time format display
2. Day display
3. LED display

The time clock (see Figure 46, p. 53) is located behind the access door of a Unit Ventilator.

Reset the Time Clock

To clear any programs that may exist from the factory, press the reset button (**Res.**).

Note: *The time clock uses Standard Time. If you are programming during Daylight Savings Time, one hour should be subtracted from times needed (see "Daylight Savings Time," p. 54).*

For example, if the Daylight Savings Time is 2:30, the time setting for the clock should be 1:30.

Set the Time Format, Time, and Day

(Program to 24 hr or am/pm format.)

1. Press the **Menu** button until the display screen is blank (time not showing) and **24h** or **am/pm** is blinking in the upper left corner of the screen.
2. Use the **+** and/or **-** buttons to select the desired setting and then press **OK**.
3. The hour display begins to blink — use the **+** and/or **-** buttons to select the desired setting and then press **OK**.
4. The minute display begins to blink — use **+/-** to select the desired setting and press **OK**.
5. The day display (on the left side of the display screen) begins to blink — use **+/-** to select the desired setting and press **OK**.

Set the Program

Note: *The Time Clock should be used to program the unit for the UNOCCUPIED mode — the periods of time when the unit will not be in operation. The mode you are programming is shown on the LED display:*

: The Timer is in operation (ON). The unit is in UNOCCUPIED mode.

: The Timer is not in operation (OFF). The unit is in OCCUPIED mode.

Note: *Odd number programs activate the timer ON function (the unit is in UNOCCUPIED mode) and even number programs activate the timer OFF function (the unit is in OCCUPIED mode).*

Set the Switching ON Time

Figure 47. Setting the switching ON time

1. Press **OK** until **prog 01** is visible on the LED display (see Figure 47, p. 53).

   Note: *When **prog 01** is visible, **01** should be blinking and the ON symbol, , should be displayed in the LED window. Press **OK** again.*

2. The hour display begins to blink — use the **+** and/or **-** buttons to select the desired setting and then press **OK**.
3. The minute display begins to blink — use **+/-** to select the desired setting and press **OK**.
4. The day display (on the left side of the display screen) begins to blink—use **+/-** to select the desired setting and press **OK**.

Note: *After you set the switching **ON** time, the prog number should increase by one (for example, from **prog 01** to **prog 02**). The number should be blinking and the **OFF** symbol, ◯, should be displayed in the LED window. Set the switching **OFF** time.*

Set the Switching OFF Time

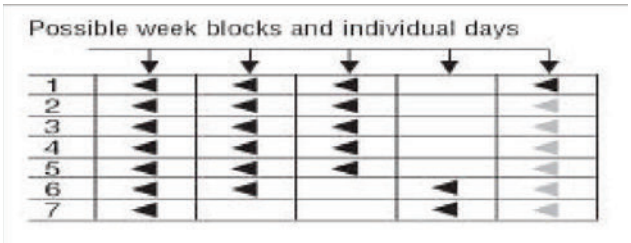
1. The hour display begins to blink—use the **+** and/or **-** buttons to select the desired setting and then press **OK**.
2. The minute display begins to blink—use **+/-** to select the desired setting and press **OK**.
3. The day display (on the left side of the display screen) begins to blink—use **+/-** to select the desired setting and press **OK**.

Note: *Repeat the steps for setting the switching **ON/OFF** times for each additional programming needed. You can set a maximum of 20 times: 10 switching **ON** times, and 10 switching **OFF** times.*

Preset Program Selections

When selecting daily programming, preset selections can be used.

Figure 48. Preset program selection options



Deleting Programs

1. Press the **Menu** button and then press **OK** until the ON hour time display of the program you want to delete is blinking.
2. Use the **+/-** to select – and then press **OK**.

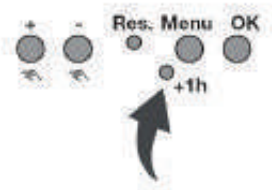
Important: *Switching programs **must** be deleted in ON-OFF pairs. When you delete a single ON instruction, you must also delete the corresponding OFF instruction.*

Daylight Savings Time

Note: *Use **+1h** button to make the change to and from Daylight Savings Time.*

Press the **+1h** button to add 1 hour to the current time. Press the **+1h** button again to subtract 1 hour from the current time.

Figure 49. Daylight savings time



Override Program (Manual)

To override the program, press the **OVR (+)** button.

Toggle between the unoccupied ◉ and occupied ◯ states by pressing the **OVR (+)** button.

Note: *When you override the program, the override remains in effect until the next programming event or until you press **OVR** again.*

Installation - Electrical

⚠ WARNING

Electrical Shock Hazard!

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

System contains oversized grounding terminal. 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.

Wiring

Electrical Wiring

Unit Wiring Diagrams: Specific unit wiring diagrams, based on unit options ordered, are provided inside each unit and can be easily removed for reference. Use these diagrams for connections or trouble analysis. Wiring diagrams are attached on the inside of the front panel of the unit.

Supply Power Wiring: Refer to the unit nameplate to obtain the minimum circuit ampacity (MCA) and maximum fuse size (MFS) or maximum circuit breaker (MCB) 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. Reference the wiring schematic for specific wiring connections.

Note: *All field wiring should conform to NEC and all applicable state and local code requirements. The control panel box is always on the end opposite the piping connections. Access the control box by removing the two screws that secure the front cover. This will allow the panel to be removed, to provide access to the electrical components.*

If the unit does not have a disconnect switch, the power leads and capped ground wire are inside the control panel. If the unit has a disconnect switch, the power leads are wired to the junction box switch on the control panel. Pull the capped ground wire into the junction box.

Electrical Grounding Restrictions: All sensor and input circuits are normally at or near ground (common) potential. When wiring sensors and other input devices to the Tracer® controller, avoid creating ground loops with grounded conductors external to the unit control circuit. Ground loops can affect the measurement accuracy of the controller.

All input/output circuits (except isolated relay contacts and optically isolated inputs) assume a grounded source, either a ground wire at the supply transformer to control panel chassis, or an installer supplied ground.

Wall-Mounted Control Interconnection Wiring: The installer must provide interconnection wiring to connect wall-mounted devices such as a fan mode switch or zone sensor module or thermostat. Refer to the unit wiring schematic for specific wiring details and point-to-point wiring connections. Dashed lines indicate field wiring on the unit wiring schematics. All interconnection wiring must conform to NEC Class 2 wiring requirements and any state and local requirements. Refer to the following table for the wire size range and maximum wiring distance for each device.

Table 14. Maximum wiring distances for low voltage controls (ft.)

Device	Wire Size	Range
Fan Control Switch	14–22 AWG	500
Zone Sensor/ Thermostat	16–22 AWG	200

Important: *Do not bundle or run interconnection wiring in parallel with or in the same conduit with any high-voltage wires (110 V or greater). Exposure of interconnection wiring to high voltage wiring, inductive loads, or RF transmitters may cause radio frequency interference (RFI). In addition, improper separation may cause electrical noise problems. Therefore, use shielded wire (Belden 83559/83562 or equivalent) in applications that require a high degree of noise immunity. Connect the shield to the chassis ground and tape at the other end.*

Note: *Do not connect any sensor or input circuit to an external ground connection.*

Supply Power: Power supply wiring is to be connected to terminals 1 and 2 at the junction box in the left end pocket, below the discharge air grille.

NOTICE

Use Copper Conductors Only!

Failure to use copper conductors could result in equipment damage as the equipment was not designed or qualified to accept other types of conductors.

⚠ WARNING

Electrical Shock Hazard!

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

Verify disconnect ability incorporated in fixed wiring in accordance with the requirements in NEC and local/state/national electric codes.

Electric Heat Units

Supply Power: Supply power wiring is to be connected to the following line terminals in the right-hand end pocket:

- 208V or 240V, 3-phase, 3-wire system: L1, L2, and L3
- 480V, 3-phase, 4-wire system: L1, L2, L3, and N (neutral)

Note: *The supply neutral wire must be connected to the neutral terminal block.*

Operational controls and an electric heating safety device are factory mounted. The safety device is a high temp cut-out which de-energizes electric heating elements through the K1 safety contactor.

⚠ WARNING

Fire Hazard!

Failure to follow instructions below could cause a fire, which could result in death or serious injury, and property damage.

- **DO NOT jumper factory wiring! Miswiring of safety circuits could cause a fire.**
- **Refer to the wiring diagram shipped with the unit for all wiring connections.**
- **When replacement wiring is required, use only material with temperature rating of at least 221° F (105°C).**

Heating Coils with Direct Expansion Cooling

⚠ 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.

Wiring: A typical unit ventilator with DX coil includes an low limit sensor, a frost preotection thermostat and a 24V transformer for condensing unit control.

Wire sizing is the same as given for the thermostat wiring in the condensing unit installation instructions, or may be obtained from the nameplate. The condensing unit must be controlled by the unit controller that also controls the Unit Ventilator.

Split System Start-Up: After all piping and wiring has been completed, follow the instructions provided with the condensing unit for control testing and system start-up. If sweat-type field-piped systems are being used, then pressure testing, evacuation and refrigerant charging will be required.

Two bulbs will also be shipped with a split system unit:

1. Frostat® bulb
2. TXV valve bulb

Both components are to be field installed. For complete installation instructions and locations, refer to the tag attached to the unit.

ECM Overview and Setup

Overview

This section addresses changes to unit ventilators, integrating new Trane Brushless DC motors and controllers. This exciting new series delivers outstanding comfort, safety, and performance with greatly reduced energy consumption compared to traditional units with permanent split capacitance AC motors.

The new series of units will provide a long service life with proper installation and operation. The new system provides a high degree of flexibility and configurability, but the simplicity of customized factory configuration appropriate to most installations.

Very little intervention is needed by service and installation personnel in most applications; however, installers must read through the entire document before beginning installation of the new equipment.

This literature focuses on unit motors and controls, including three new circuit modules developed specifically for this series.

General Information

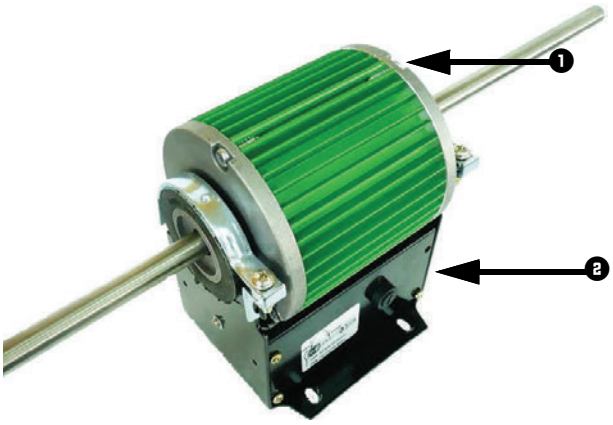
There are four primary components that enable the technology on your product:

1. Trane BLDC Motor
2. ECM Engine Board
3. Adapter Board
4. CSTI Adapter Board

The motors and modules are combined as systems, and cannot work without each other.

Trane BLDC Motor

Figure 50. Trane BLDC motor



- High Efficiency Brushless DC (BLDC) Motor Core
- Motor Base Housing Potted Electronics Package

The BLDC motor has integrated electronics, overload protection and short circuit protection. The motor contains no user-serviceable components inside.

NOTICE

Equipment Damage!

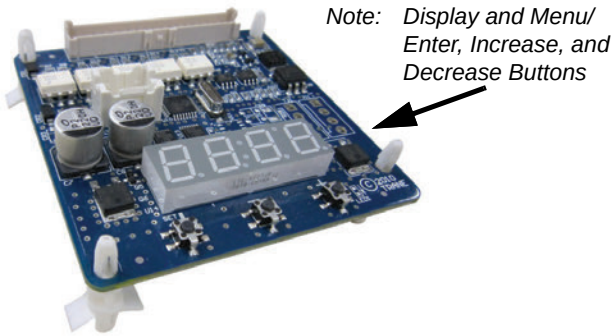
Failure to follow these instructions could result in equipment damage.

The motor harness attached to the single plug to which the motor mates contains the 115V motor voltage jumper. The motor harness should always be present for 115V units and should not be modified or substituted.

- The motor mates to the unit electrically via a single plug that contains both the operating voltage and the control signals that are needed for correct operation.
- The BLDC motor comes a single shaft configuration for all horizontal unit ventilator sizes (075, 100, 125, 150, 200).
- The BLDC motor has two voltage variations, 115/208-230V and 277V. Units with three-phase and neutral have motors wired to the L-N (as opposed to L-L). The 115/208-230V is configured for voltage by use of an external jumper. If the jumper is present the motor will be configured for use with 115V. The jumper must NOT be present for use with 208-230V.

ECM Engine Controller

Figure 51. ECM engine controller

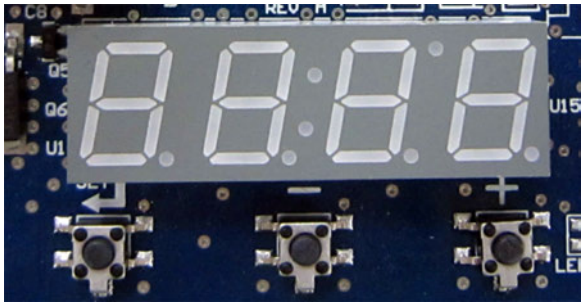


- The ECM engine controls and reports the performance of up to two Trane BLDC motors.
- The engine also co-ordinates the operation of the fan in response to electric heat behavior, and electric heat behavior in response to hydronic heat behavior and fan behavior.
- The engine incorporates a user interface that allows adjustment of certain unit parameters and provides constant feedback on motor operation.

- The engine integrates service and troubleshooting tools, including high-precision tachometers, fan status, and electric heat-enable indicators.
- The engine integrates a versatile configurable auxiliary temperature sensor.
- The engine incorporates various safety and lockout features, such as maintaining proper fan speeds, if electric heat is called for.

Status Display

Figure 52. Status display



The ECM engine board contains a four-digit, seven-segment display that is used to present information in a format close to real-world language, while having a small-form factor. Most characters are immediately recognizable; however, please refer to the following table for the graphical representation of each alphanumeric character.

Table 15. Screen representation of alphabetical characters

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
A	b	C	d	E	F	g	H	I	J	H	L	ñ	n	O	P	q	r	S	t	U	u	'	H	y	2

Table 16. Screen representation of numeric characters

1	2	3	4	5	6	7	8	9	0
1	2	3	4	5	6	7	8	9	0

Installation and Initial Setup

⚠ WARNING

Safety Alert!

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

BLDC motors contain capacitors which store residual energy. Stay clear of fan wheels for five minutes after power has been disconnected, as a power request with the motor powered off could result in a very short period of actuation. Unplug the motor to avoid a power request.

⚠ WARNING

Safety Alert!

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

All settings take effect immediately, including fan start and electric heat. Avoid hazardous voltage sources, moving parts, and electric heat elements when adjusting the motor control board. If avoiding these areas is not practical during motor control board adjustment, contact Trane Global Parts for configuration kit to power control board outside the unit with a 9-volt battery.

⚠ WARNING

Safety Alert!

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

Changes to switch settings on the CSTI adapter board take effect immediately. Disconnect power prior to changing CSTI configuration switches.

⚠ WARNING

Safety Alert!

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

Disconnect unit power prior to initial connections to the CSTI and standard adapter boards, including low voltage interconnections.

⚠ WARNING

Safety Alert!

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

Disconnect unit power prior to making or removing motor or adapter board connections.

⚠ WARNING

Safety Alert!

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

Do not manually free spin the fan wheels while the unit is powered on. The system is actively responding to operational status of the motors.

Note: *Normally, the Trane BLDC motors are configured for soft ramps and transitions between speeds. However, to aid in commissioning of the unit, for approximately 10 to 15 minutes, the ramps will be shortened to quickly observe proper unit behavior and response to speeds.*

For new installations, all boards and motors are pre-installed and pre-configured according to the unit configuration, indicated by its model number.

Under normal and intended operation, the only required intervention specific to the new BLDC units is the wiring of:

- Wall-mounted low-voltage fan speed switch inputs to the adapter boards terminal strips and 24 Vac tap to fieldinstalled fan speed switch.
- Field-supplied controllers/thermostats to the adapter boards' terminal strips and 24 Vac power tap to field-supplied controller/thermostat.

Otherwise, proceed with the mechanical, electrical and controls installations as defined in other sections of this manual, while obeying the warnings communicated in this section.

Proceed with the power on after installation, as defined in the other sections of *UniTrane™ Fan Coil and ForceFlo™ Cabinet Heater 200 to 1200 CFM Installation, Operation, and Maintenance* (UNT-SVX07*-EN).

Wall Mounted Low Voltage Fan Speed Switch/ Customer-Supplied Controller/ Thermostat Instructions

⚠ WARNING

Hazardous Voltage w/Capacitors!

Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

Disconnect all electric power, including remote disconnects and discharge all motor start/run capacitors before servicing. Follow proper lockout/ tagout procedures to ensure the power cannot be inadvertently energized. For variable frequency drives or other energy storing components provided by Trane or others, refer to the appropriate manufacturer's literature for allowable waiting periods for discharge of capacitors. Verify with a CAT III or IV voltmeter rated per NFPA 70E that all capacitors have discharged.

⚠ WARNING

Safety Alert!

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

- **Disconnect unit power before making connections to the adapter boards.**
- **For adapter boards that share a common with the unit mounted low-voltage transformer, connect only class 2 voltages to the terminal blocks on the boards.**

Note: *Specifications subject to change without notice. Consult the unit submittals and unit schematics before determining hookup requirements unit. Terminal block positions, polarities and assignments are determined for specific unit configurations only. Signal assignments are indicated, for reference only.*

Both adapter boards come equipped with integrated terminal blocks to hook up to the field supplied/mounted Fan Speed Switches and external controls. Connections should be made to the screw terminals with wires between 16 AWG and 24 AWG, with a ~4–5-mm wire strip length. The terminal blocks have 5-mm spacing, and are equipped with 3-mm screws. The field-supplied wires should have an insulation rating of 600V.

Adjustment and Configuration of the Engine Board

⚠ WARNING

Safety Alert!

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

All settings take effect immediately, including fan start and electric heat. Avoid hazardous voltage sources, moving parts, and electric heat elements when adjusting the motor control board. If avoiding these areas is not practical during motor control board adjustment, contact Trane Global Parts for configuration kit to power control board outside the unit with a 9-volt battery.

⚠ CAUTION

Burn Hazard!

Failure to follow this instruction could result in the unit overheating and becoming hot to the touch, which could result in minor or moderate injury, and/or equipment damage.

On electric heat units, certain parameter values are locked out to prevent overheating of the unit. These functions will appear to be saved; however, they will not be accepted if the Electric Heat Protection setting is "On". Do not change the Electric Heat Protection setting to "Off" and make changes to the protected settings unless you are programming an unconfigured service replacement board to match the unit settings on a ECM configuration label.

Note: *The engine board functions and unit specific settings are summarized on the ECM engine configuration label affixed to the back side of the control panel low voltage lid on every unit.*

The ECM engine board features a nested menu integrated user interface (UI) that supports:

1. Status display for instant touch-free confirmation of unit operation.
2. Configuration parameter and value display and modification changes (using integrated menu/set buttons).
3. Error code prioritized reporting.

Note: *Characters on the ECM engine board display appear in red, on a black background.*

The display contains decimal positions as well that change position with each parameter, as appropriate. Under normal conditions (i.e., with no error code displayed), the status will loop the following message:

Table 17. Operational status codes

RPM ModeRUNNING/ FAN STATUS CONTINUOUS LOOP Displayed when: 1. No error codes are present. 2. Motor has completed ramping.	ñtr 1	Indicates the current rpm of Motor 1 in the system. "0" rpm here indicate that no fan speed has been requested.
	0000 → 2000	
	ñtr2	Indicates the current rpm of Motor 2 in the system. "0" rpm here indicate a fan off condition OR a fan "missing" condition[a] .
	0000 → 2000	
	FSt 1	Indicates the status being calculated or Fan Motor 1. If **off**, this indicates that either: 1. No fan speed is being requested or 2. The fan performance is failing to meet the request; refer to "Electronically Commutated Motors (ECM)," p. 96 for additional information. If **on**, this indicates that the fan is performing correctly and will be used to report fan status correctly, depending on FPru mode.
	YES / no	
	FSt2	Indicates the status being calculated or Fan Motor 2. If **off**, this indicates that either: 1. No fan speed is being requested or 2. The fan performance is failing to meet the request; refer to "Electronically Commutated Motors (ECM)," p. 96 for additional information. 3. If the target speed for Motor 2 is 0, this is used to indicate a missing motor[a]. If **on**, this indicates that the fan is performing correctly and will be used to report fan status correctly, depending on FPru mode.
	YES / no	
	EhEn	Indicates that the temperature sensing circuit has calculated a logical "on" based on the settings of the following parameters: A i2ñ r A i2b r A iPU
	YES / no	

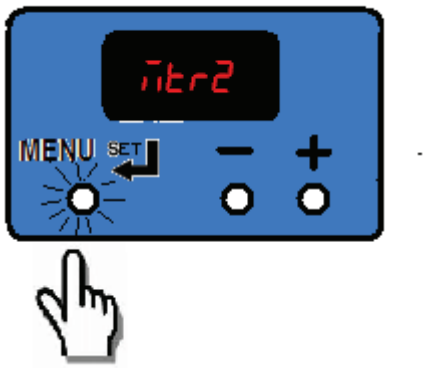
[a] Motor 1 is the only motor for all horizontal unit ventilator sizes (075, 100, 125, 150, 200).

Configuration Parameter and Value Display and Modification Changes

The ECM engine board's on-board user interface is easy to use and supports:

1. Verification/auditing of on-board parameter settings (read-only)
2. Adjustment of the on-board settings (write)

Figure 53. User interface input buttons



The user interface has three input buttons, from left to right:

1. **Menu/Set**
2. **Decrement**
3. **Increment**

Each button has several different actuation levels depending on length of press, and what the UI is currently displaying.

Table 18. Button actuation levels

Button	Menu/Set	
	Du-ra-tio-n	Action
Short Press in Status Display	<1 sec	None
Short Press in Configura-tion Display		Toggles between parameter name and value without saving (abandons value if changed).
Long Press/Hold in Status Display	>3 sec	Enters the configuration menu
Long Press/Hold in Configura-tion Display	>3 sec	If on a parameter name, toggles to the value. If on a parameter value, saves the value settings and returns to the parameter name as confirmation.

Table 18. Button actuation levels (continued)

Button	Menu/Set	
	Du-ra-tio-n	Action

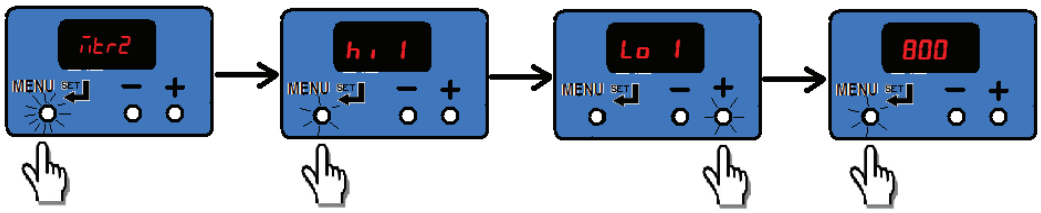
Button	Increment	
	Du-ra-tion	Action
Short Press in Status Display	<1 sec	None
Short Press in Configura-tion Display	<1 sec	Scrolls through parameter names, or decreases value of parameter.
Long Press/Hold in Status Display	>3 sec	n/a
Long Press/Hold in Configura-tion Display	>3 sec	Faster scroll through parameter name, or faster decrease of values of parameters.

Button	Decrement	
	Du-ra-tion	Action
Short Press in Status Display	<1 sec	None
Short Press in Configura-tion Display	<1 sec	Scrolls through parameter names, or increases value of parameter.
Long Press/Hold in Status Display	>3 sec	n/a
Long Press/Hold in Configura-tion Display		Faster scroll through parameter name, or faster increase of values of parameters.

Configuration Examples

Example 1: View the value of parameters without saving. Verify the low speed value for motor 1 is set to 800 rpm.

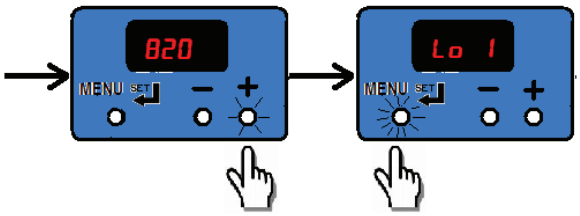
Start with the ECM engine scrolling status display and proceed as follows:



Example 2: Change the value of Low Speed to 820 rpm:

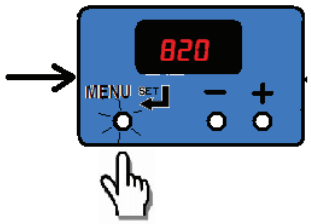
Continue from the previous example as shown below, using a long press to **save** the new desired value.

Note: *If the display has timed out and returned to the status loop, repeat Example 1 to arrive back at this example's starting point.*

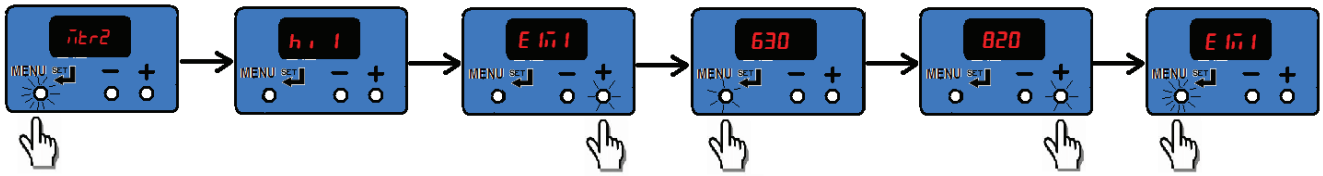


Example 3: Double-check the value of 820 rpm has been saved.

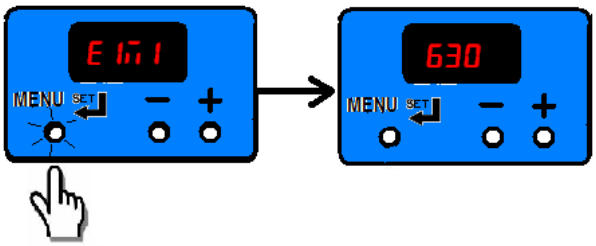
Note: *If the display has timed out and returned to the status loop, repeat Example 1 and Example 2 to arrive back at this example's starting point.*



Example 4: Change the value of a protected value on an electric heat unit.



It appears the value has been changed, but after checking the value, the original value has been retained.



Priority/Error Display

Under special conditions, the status display will interrupt briefly to prioritize display of events:

Notes:

- *During error displays, the user interface will be disabled, until the error is removed or resolved.*
- *If changes are made to parameters and saved, most settings take effect immediately. Any change to fan speeds will take effect and cause the configuration menu to exit immediately to begin tracking speeds via the on-board tachometer.*
- *Where practical, the unit will offer limp-in performance, but to ensure safe operation, certain unit functions will be disabled. For example, if one motor fails, the unit will display an error code, but the second motor (if present) will continue to operate. However, to ensure safe operation, the electric heat (if present) will be disabled.*
- *If a error occurs while the configuration menu is in effect, all unsaved values will be discarded and the error codes will be displayed.*

Displayed during abnormal operation.	mtr 1 LOCK	Indicates a locked rotor condition of Motor 1. The motor will be locked out until the cause has been resolved, and the power cycled; refer to refer to "Electronically Commutated Motors (ECM)," p. 96 for resolution details. Motor 2 will continue to operate, but will not be monitored. Fan Status function, if being used, will report an inoperative motor. Electric heat and changeover heat will be shut down.
	mtr2 LOCK	Indicates a locked rotor condition of Motor 2. The motor will be locked out until the cause has been resolved, and the power cycled; refer to refer to "Electronically Commutated Motors (ECM)," p. 96 for resolution details. Motor 1 will continue to operate, but will not be monitored. Fan Status function, if being used, will report an inoperative motor. Electric heat and changeover heat will be shut down.
	mtr 1 OSPd	Indicates that Motor 1 has experienced a run-away or over speed condition, and has been shutdown. The unit will offer limited limp-in performance, and Motor 2 will continue to operate, but will not be monitored. Fan Status function, if being used, will report an inoperative motor. Refer to "Electronically Commutated Motors (ECM)," p. 96 to reset, the cause must be resolved and the power to the unit cycled. Electric heat and changeover heat will be shut down.
	mtr2 OSPd	Indicates that Motor 2 has experienced a run-away or over speed condition, and has been shutdown. The unit will offer limited limp-in performance, and Motor 1 will continue to operate, but will not be monitored. Fan Status function, if being used, will report an inoperative motor. Refer to "Electronically Commutated Motors (ECM)," p. 96 to reset, the cause must be resolved and the power to the unit cycled. Electric heat and changeover heat will be shut down.
	rAMP 0000 → 2000 2000 → 0000	Indicates the motor is transitioning between speeds, ramping up or down. The message RAMP is briefly displayed, followed by the target speed for Motor 1 only. Once the target speed has been reached, the status display will resume operation.
	u 123	On power on, the version of software is briefly displayed, followed by the results of a **POST** (power on self test).

Note: Fan coil units have only Motor 1 installed.

Initial Setup and Configuration

After connections of power and hookup of customer installed controls/fan speed switches and under normal/operative conditions the only adjustments needed to be made to the ECM engine board during commissioning of the unit are:

- Adjustment and calibration of the variable speed inputs (VSP/0–10V) on the system, where applicable.
- Adjustment, calibration or disabling of the optional auto-changeover function on CSTI units, where applicable.

In addition, the CSTI adapter board offers configurability that can be used in special cases to adjust the following operation of the unit:

- Courtesy cooling/main valve logic inversion relays for use with normally open valves.
- Courtesy heating/auxiliary valve logic inversion relays for use with normally open valves.
- Changeover function for use with changeover coils (in conjunction with the ECM engine board).

The switches are factory-set based on the model number configuration as ordered; however, the information is provided below to aid in the understanding of the operation of the system.

Configuration

Configuring the ECM Engine Controller

Adjustment and Calibration of the Variable Speed Inputs (VSP/0–10V)

⚠ WARNING

Hazardous Voltage w/Capacitors!

Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

Disconnect all electric power, including remote disconnects and discharge all motor start/run capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power cannot be inadvertently energized. For variable frequency drives or other energy storing components provided by Trane or others, refer to the appropriate manufacturer's literature for allowable waiting periods for discharge of capacitors. Verify with a CAT III or IV voltmeter rated per NFPA 70E that all capacitors have discharged.

⚠ CAUTION

Burn Hazard!

Failure to follow this instruction could result in the unit overheating and becoming hot to the touch, which could result in minor or moderate injury, and/or equipment damage.

On electric heat units, certain parameter values are locked out to prevent overheating of the unit. These functions will appear to be saved; however, they will not be accepted if the Electric Heat Protection setting is "On". Do not change the Electric Heat Protection setting to "Off" and make changes to the protected settings unless you are programming an unconfigured service replacement board to match the unit settings on a ECM configuration label.

NOTICE

Equipment Damage!

Failure to follow instructions below could result in equipment damage.

- **A single 24 Vac supply system must be used.**
- **Ensure proper polarity and grounding when connecting the 0 to 10 V system.**

Notes:

- *The 0 to 10V (variable speed) inputs are available for use, but are not mandatory. The Trane Brushless DC system comes standard with three to five field-accessible thermostatic inputs (with adjustable speed), so the use of the 0 to 10V inputs is optional.*
- *All inputs are independently configurable and simultaneously accessible, and the ECM engine will choose the highest user (configured and requested) speed. However, care should be taken with customer controls to avoid contention of signals.*

The ECM engine and adapter boards offer standard, normalizing 0 to 10V Variable speed fan inputs for use with field supplied controllers or thermostats. These inputs can be used as the only input to the system, used in addition to the thermostatic (H, M, L) inputs, or not used at all. The inputs are accessible via 1TB4 on the adapter boards.

The ECM engine is factory configured to drive the unit to a minimum speed (catalog low speed value), defined as A_Lo1 and A_Lo2 once the analog (0 to 10V) input is honored. As a default, the noise floor/threshold is set to 3 percent (0.3V). At 0.3V, the system will drive the motors to the speeds defined in defined as A_Lo1 and A_Lo2. If the analog input goes to 10V, the ECM engine will drive the motor to maximum speed (normally catalog high speed value), defined as $Ahi1$ and $Ahi2$, and will change speed in response.

Although the ECM engine board ships with settings that will work with most 0–10 Vdc outputs, calibration should be performed to maximize response range and controller authority. Typically, the only settings needed for the VSP inputs are calibration of the signal to ensure that the system obeys the following rules:

1. The minimum output from the field supplied controller is met with a positive fan response. That is, we do not want the $uFLr$ setting on the ECM engine board to be higher than the minimum output of the field supplied controller, as the ECM engine will ignore a portion of the usable range of the customer fan variable speed output.
2. The minimum output from the field supplied controller is not significantly greater than the floor setting $uFLr$ floor. If the minimum output of the controller is significantly greater than the floor setting, the first point that the motor will turn on will be above the A_Lo1 and A_Lo2 value. The full range of motor control will not be fully utilized in this case, as the motor will never reach the low speed motor analog input scaling value for Motor 1 and Motor 2 (A_Lo1 and A_Lo2).
3. The maximum output of the controller needs to be 10V, or if lower, needs to be compensated using the analog input scaling value, $A.Sc$ to normalize the operational range. As a default, the scaling value is set to 1.00 (so a voltage of 5V will be graded as 5V); however, to compensate for long runs or lower max voltages (i.e., lower than 10.00), the scaling value can be increased accordingly to maximize operational range.

   For example, if the voltage is only reaching a value of 9.0V at the adapter boards, then the $A.Sc$ parameter should be set to (10/9=) 1.111. If left un-calibrated, the unit will never attain maximum speeds, defined as $Ahi1$ and $Ahi2$.
4. The ECM engine can accept slightly over-biased inputs up to 12 Vdc, and the $A.Sc$ parameter can be set to a value less than 1.0 to compensate.

VSP Setup Examples

Figure 54. Example 1: $uFLr$ set too high and $A.Sc$ set too high

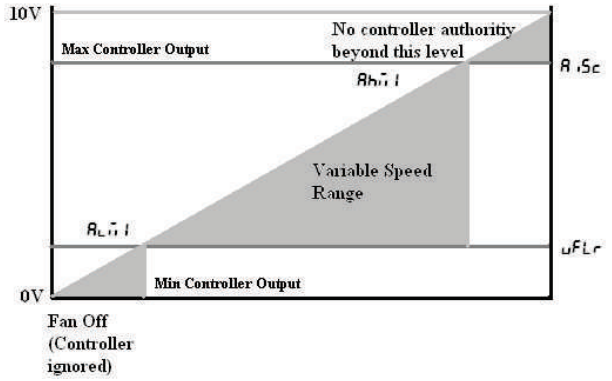


Figure 55. Example 2: $uFLr$ set too high but $A.Sc$ set correctly

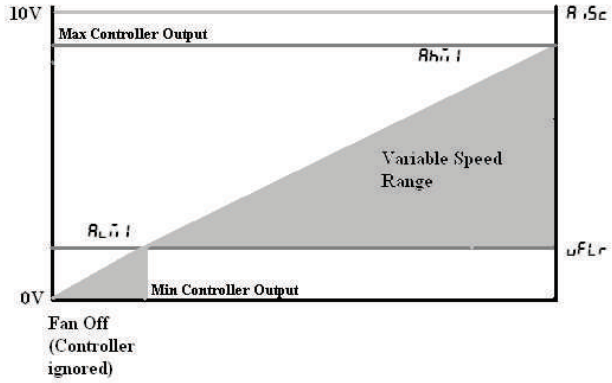
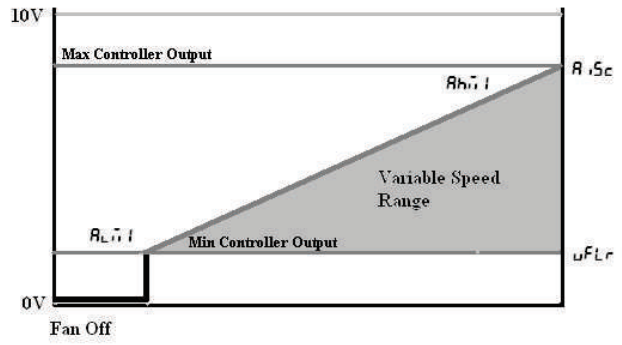


Figure 56. Example 3: uFLr set correctly and A.Sc set correctly



Use of Potentiometer/Rheostat For VSP

⚠ WARNING

Hazardous Voltage w/Capacitors!

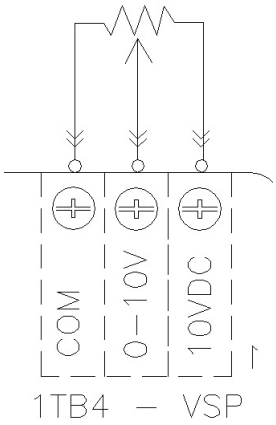
Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

Disconnect all electric power, including remote disconnects and discharge all motor start/run capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power cannot be inadvertently energized. For variable frequency drives or other energy storing components provided by Trane or others, refer to the appropriate manufacturer's literature for allowable waiting periods for discharge of capacitors. Verify with a CAT III or IV voltmeter rated per NFPA 70E that all capacitors have discharged.

A courtesy 10-Vdc supply is provided that can support a 10-mA draw. The use of a 1K or a 10K potentiometer is recommended, and only a stand-alone potentiometer (not shared with any other electrical system) should be employed. When a simple potentiometer is used as depicted in the following figure, the uFLr setting will define a null-zone (off).

The typical connection is depicted in the following figure; however, please consult the unit schematic for the most updated instruction.

Figure 57. Typical connection



Adjustment or Disabling of Optional Auto-Changeover Function on CSTI Units

⚠ WARNING

Hazardous Voltage w/Capacitors!

Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

Disconnect all electric power, including remote disconnects and discharge all motor start/run capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power cannot be inadvertently energized. For variable frequency drives or other energy storing components provided by Trane or others, refer to the appropriate manufacturer's literature for allowable waiting periods for discharge of capacitors. Verify with a CAT III or IV voltmeter rated per NFPA 70E that all capacitors have discharged.

⚠ WARNING

Safety Alert!

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

Disconnect unit power prior to initial connections to the CSTI and standard adapter boards, including low voltage interconnections.

⚠ WARNING

Safety Alert!

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

All settings take effect immediately, including fan start and electric heat. Avoid hazardous voltage sources, moving parts, and electric heat elements when adjusting the motor control board. If avoiding these areas is not practical during motor control board adjustment, contact Trane Global Parts for configuration kit to power control board outside the unit with a 9-volt battery.

The ECM engine board provides additional temperature controlled logic to help coordinate certain electric-heat and valve logic functions:

- On units with electric heat and a changeover coil, the engine board and adapter boards are pre-configured to cause hydronic heat and electric heat to be mutually exclusive:
  - On units with ComfortLink™ controls (Tracer ZN controllers), the Tracer® ZN board will serve as the primary logic to select the electric heat only if hot water is not available, but the engine board will service as a backup lockout.
  - On units with Customer Supplied Controllers (CSTI units), the engine board and CSTI board will serve as the primary lockout.
- On CSTI units selected with a changeover coil configuration, the engine board is factory configured to work in conjunction with the CSTI adapter board to provide a useful auto-changeover function. Traditionally, a fixed setpoint bi-metallic disc temperature switch is used to provide changeover with customer controls; however, the engine board has defeatable and configurable bi-metallic disc temperature switch emulation when combined with the CSTI adapter board. The ECM engine is preconfigured for typical values, so changeover settings do not necessarily need to be changed.

  Note: *CSTI board does not support changeover function with modulating valves.*

  - An NTC thermistor is supplied and affixed to the supply pipes where applicable. The ECM engine has several settings that affect the operation of the changeover function:
    - FPrU parameter should normally be set to EHL or EhFS to use the changeover functions.
    - EHL parameter should be chosen if the unit has a changeover coil without electric heat.
    - EhFS parameter should be chosen if the unit has a changeover coil with electric heat. Generally, this will perform the same as the EHL parameter but in addition, will disable heating function on electric heat and on the changeover coil if there are fan failures. The auxillary heating coil function will continue to operate and respond to the customer heating request.
    - AiPU parameter should be set to In for CSTI units and to OUt for ComfortLink controller units.
    - Ai2n parameter defines the temperature at which the engine board will close the triac onboard the ECM engine (if FPrU parameter is set correctly).
    - Ai2b parameter defines the temperature at which the engine board will open the triac onboard the ECM Engine (if FPrU parameter is set correctly). By leaving a gap between the make and break value, we will simulate hysteresis of a real bi-metallic disc temperature switch.
    - When combined with the CSTI adapter board, the bimetallic disc temperature switch emulation and the electric heat lockout function will work when the switches are set correctly.

      Note: *CSTI board does not support changeover function with modulating valves.*

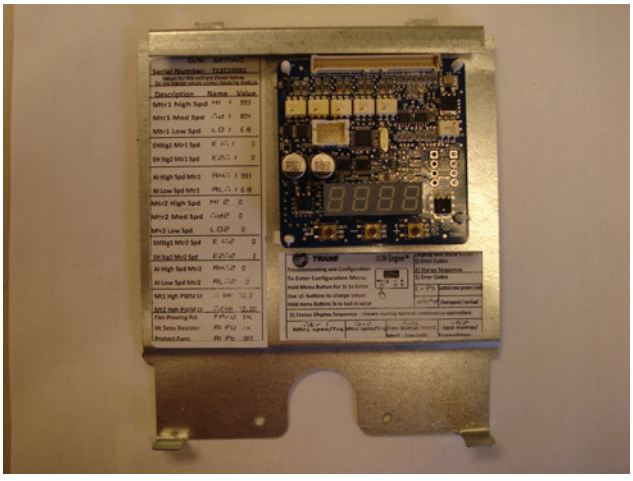
Configuring the ECM Engine Board

Every Trane unit with BLDC motors will have modules specifically configured at the factory for the operation of that unit. The ECM engine configuration label is affixed to the low-voltage access lid on the outside of the control panel. The ECM engine label may be on the back-side of the low voltage access lid, depending on the unit configuration.

The serial number of each unit and the custom configuration settings specific to that unit will be printed on the label for convenient matching of labels/settings to specific units. Programming a unit with the settings from another unit will result in abnormal operation. The label contains four important sections:

1. How to enter the configuration menu
2. The description and meaning of the Error Codes
3. The description and meaning of the status display
4. The parameter names and values specific to that unit

Figure 58. ECM engine label



1. To check status, configuration, or to change settings on the engine board with the power on the unit, detach the low voltage access lid and look or reach through the low voltage access panel.
2. The ECM engine label is affixed to the back or front of the low voltage access lid.

Configuration Settings of the ECM Engine Board

⚠ WARNING

Safety Alert!

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

All settings take effect immediately, including fan start and electric heat. Avoid hazardous voltage sources, moving parts, and electric heat elements when adjusting the motor control board. If avoiding these areas is not practical during motor control board adjustment, contact Trane Global Parts for configuration kit to power control board outside the unit with a 9-volt battery.

⚠ CAUTION

Burn Hazard!

Failure to follow this instruction could result in the unit overheating and becoming hot to the touch, which could result in minor or moderate injury, and/or equipment damage.

On electric heat units, certain parameter values are locked out to prevent overheating of the unit. These functions will appear to be saved; however, they will not be accepted if the Electric Heat Protection setting is "On". Do not change the Electric Heat Protection setting to "Off" and make changes to the protected settings unless you are programming an unconfigured service replacement board to match the unit settings on a ECM configuration label.

NOTICE

Motor Damage!

Failure to follow instructions below could result in motor damage.

Do not change PWM output voltage settings.

Note: *The engine board functions and unit specific settings are summarized on the ECM engine configuration label affixed to the back side of the control panel low voltage lid, on every unit.*

The following table lists the parameter names and typical settings of the ECM engine board, for reference only.

Additional Notes:

1. Do not change the electric heat protection settings if your unit has electric heat.
2. If the format setting for rpm values are not correct (i.e., not four-digit: XXXX), please check the operation mode of the ECM engine board Mod 1 and Mod 2 and motor signal output format SI 9 1and SI 92.

Table 19. Configuration settings of the motor control board (for reference only)

Description on Unit Label	User Interface Name	Typical User Interface Value	Description	
Mtr 1 High Spd	H i 1	1080	Sets the high-speed rpm for Motor 1.	Do not exceed 2300 rpm.
Mtr 1 Med Spd	Md 1	777	Sets the medium-speed rpm for Motor 1.	
Mtr 1 Low Spd	Lo 1	632	Sets the low-speed rpm for Motor 1.	Do not set under 600 rpm.
EHStg1 Mtr1 Spd	E H1 1	0	Assigns an rpm to be associated with a call for 1st stage electric heat, for Motor 1 (only on units equipped with electric heat).	E H1 1_ E H2_ E2H 1_ E2H2 settings are locked out on units with electric heat.
EH Stg 2 Mtr 1 Spd	E2H 1	0	Assigns an rpm to be associated with a call for 2nd stage electric heat, for Motor 1 (only on electric heat equipped units).	
AI High Spd Mtr 1	AHi 1	0	Sets the maximum rpm for Motor 1 for the maximum input value of the analog input.	Analog inputs below the uFLr setting will be rejected.

Table 19. Configuration settings of the motor control board (for reference only) (continued)

Description on Unit Label	User Interface Name	Typical User Interface Value	Description	
AI Low Spd Mtr 1	ALn1	0	Sets the minimum turn-on rpm for Motor 1, when the analog input becomes active.	
Mtr 2 Hgh Spd	H i2	0	Sets the high-speed rpm for Motor 2.	Blower coils have only one motor.
Mtr 2 Med Spd	nd2	0	Sets the medium-speed rpm for Motor 2.	
Mtr 2 Low Spd	Lo2	0	Sets the low-speed rpm for Motor 2.	
EHStg1 Mtr2 Spd	E1n2	0	Assigns an rpm to be associated with a call for 1st stage electric heat, for Motor 2 (only on electric heat equipped units).	If the unit has only one motor, all seven speed settings for the second motor (H i2_ nd2_ Lo2_ E1n2_ E2n2_ ALn2, AHn2) should be set to zero.
EH Stg 2 Mtr 2 Spd	E2n2	0	Assigns an rpm to be associated with a call for 2nd stage electric heat, for Motor 2 (only on electric heat equipped units).	
AI High Spd Mtr 2	AHn2	0	Sets the maximum rpm for Motor 2 for the maximum input value of the analog input.	
AI Low Spd Mtr 2	ALn2	0	Sets the minimum turn-on rpm for Motor 2, when the analog input becomes active.	
Op Mode Mtr 1	nod1	rPn	Sets the operational mode for Motor 1.	Must be set to rPn for blower coil units.
Op Mode Mtr 2	nod2	rPn	Sets the operational mode for Motor 2.	Must be set to rPn for blower coil units.
Mtr 1 Out Format	S i91	PWn	Sets the interface type for Motor 1.	Must be set to PWn for blower coil units.
Mtr 2 Out Format	S i92	PWn	Sets the interface type for Motor 2	Must be set to PWn for blower coil units.
Mtr 1/2 PWM Freq.	FrEQ	100	Sets the PWM frequency, for cases when the PWM outputs are used.	On blower coil units, the PWn must not be changed.
Mtr 1 PWM Volt	n1uL	5	Sets the PWM voltage, for cases when the PWM outputs are used.	This setting must NOT be changed, as damage to the motor may occur!
Mtr 2 PWM Volt	n2uL	5	Sets the PWM voltage, for cases when the PWM outputs are used.	This setting must NOT be changed, as damage to the motor may occur!
Mt1 Hgh PWM Lt	n1H i	90	Sets the maximum output percentage that the controller will request from Motor 1.	This envelope protection value should not be altered.
Mt1 Low PWM Lt	n1Lo	14_5	Sets the minimum maximum output percentage that the controller will request from Motor 1.	This envelope protection value should not be altered.
Mt2 Hgh PWM Lt	n2H i	90	Sets the maximum output percentage that the controller will request from Motor 2.	This envelope protection value should not be altered.
Mt2 Low PWM Lt	n2Lo	14_5	Sets the minimum maximum output percentage that the controller will request from Motor 2.	This envelope protection value should not be altered.
Mt1 Ovspd RPM	rPn1	2500	Selects the rpm above which the Motor 1 will be assumed to be in an overspeed condition and will need to be shutdown.	This envelope protection value should not be altered.
Mt2 Ovspd RPM	rPn2	2500	Selects the rpm above which the Motor 2 will be assumed to be in an overspeed condition and will need to be shutdown.	This envelope protection value should not be altered.
Fan Proving Fct	FPru	FnSt	Selects which mode should be assigned to the Binary output circuit, depending on unit type.	This setting has to be correct for proper unit operation of electric heat and changeover units.
AI Boost Amp	A iSc	1	Boosts or attenuates the analog input signal to compensate for long wire runs.	A value of 1 should be used if no voltage level compensation is needed (i.e., voltage peak is at 10 Vdc).

Table 19. Configuration settings of the motor control board (for reference only) (continued)

Description on Unit Label	User Interface Name	Typical User Interface Value	Description	
AI Floor	uFLr	0_5	Rejects noise on the analog input lines and sets up the motor control board to turn on if the thermostat or controller is commanding its analog outputs on.	
PulsePerRev	FdbH	18	Sets up the tachometer function to be compatible with the on-board motor and for correct speed calculation and calibration.	Do not change this setting as this is critical to proper unit operation.
P Value Mtr 1	PuL 1	0_03	Sets up the on board closed loop control to control Motor 1 with proper stability.	Do not change this setting.
I Value Mtr 1	I uL 1	0_03	Sets up the on board closed loop control to control Motor 1 with proper stability.	Do not change this setting.
P Value Mtr 2	PuL2	0_03	Sets up the on board closed loop control to control Motor 2 with proper stability.	Do not change this setting.
I Value Mtr 2	I uL2	0_03	Sets up the on board closed loop control to control Motor 2 with proper stability.	Do not change this setting.
Ht Sens Mk Val F	A i2n	85	Sets the make value for the motor control board triac output based on the thermistor input.	Operation also depends on FPru_ A i2b_ and A iPU settings.
Ht Sens Bk Val F	A i2b	90	Sets the break value for the motor control board triac output based on the thermistor input.	Operation also depends on FPru_ A i2b_ and A iPU settings.
Ht Sens Resistor	A iPU	out	Sets the input impedance of the thermistor input.	Should be pre-set to "OUT" for Tracer® ZN controllers.
Mt 1 Ramp %/sec	n 1rP	3	Sets the ramp rate for Motor 1, in % per second.	
Mt 2 Ramp %/sec	n2rP	3	Sets the ramp rate for Motor 2, in % per second	
EH Ramp Accel	EhrP	2	Sets the acceleration factor for the electric heat inputs.	Is used to force faster ramps when electric heat is requested.
Ramp MAX Time	nhrP	15	Sets the maximum ramp time for both Motor 1 and Motor 2 (in seconds).	Overrides the ramp rates n 1rP and n2rP if the calculated ramp time exceeds nhrP.
EH Fan off delay	EHdL	15	Selects how long the fan needs to stay on after an electric heat request has been turned off.	
Lck Rtr Protect	LrPt	on	Selects whether to use the on-board locked rotor protection function.	This will shutdown the affected motor, if rotational response is not detected.
Protect Funct	EhPt	on	This function protects settings on the board that affect the safety of the electric heat system.	Do NOT change this setting. This setting locks out the following parameters from being changed, for safe operation of the unit. A iPU FPru A inH A ibH E 1n 1 E 1n2 E2n 1 E2n2 S iG nod 1 nod2 n 1H 1 n 1Lo

Table 19. Configuration settings of the motor control board (for reference only) (continued)

Description on Unit Label	User Interface Name	Typical User Interface Value	Description	
Protect Funct	EhPt	FLA	This his function protects settings on the board that affect the safety of the electric heat system, and limit the maximum current the motor will draw under any operating condition.	Do NOT change this setting. This setting locks out the following parameters from being changed, for safe operation of the unit. E 1n 1 E2n 1 E 1n2 E2n2 n0d 1 n0d2 SI 9 1 SI 92 n 1HI n 1LO n2HI n2LO FPru A 12n A 12b AI PU
Rmp dft (auto rst)	rPdF	oFF	This function shortens the ramps for faster unit commissioning and auto-resets to off after approximately 15 minutes of power-on operation.	To aid in commissioning of the unit, for approximately 10–15 minutes, the ramps will be shortened to quickly observe proper unit behavior and response to speeds.
Soft Rev	SoFt	uH_HH	Displays the software version.	Module should be received with most recent version.

Fan Speed Response Verification

1. After performing controller specific commissioning, observe the display on the ECM engine board with the power on, to the unit. The ECM engine display should display a looping status indicator as follows:
   ntr 1 → 0 → ntr2 → 0 → FSt 1 → OFF → FSt2 → OFF → EhEn → On

   Notes:

   - *The EhEn indicator is unit-specific and may indicate **Off** at this point; refer to thermistor function for more information.*
   - *A representative fan speed of 1080 rpm are shown in the example below. Each unit is factory-configured differently and will have different settings for different fan speeds.*
2. While the unit remains on, exercise the fan controls on the unit, either directly or indirectly through request for unit heat/cool. Observe the fan spinning, and then observe the fan display on the ECM engine board. It should display a looping status indicator as follows: For any size unit (using typical unit operating fan speeds):
   ntr 1 → 1080 → ntr2 → 0 → FSt 1 → On → FSt2 → OFF → EhEn → On

   Note: *The EhEn indicator is unit-specific and may indicate **Off** at this point; refer to thermistor function for more information.*
3. OPTIONAL:
   While the fan is running, if practical, change the fan speeds and observe the display temporarily indicate:
   rAnP
   Exercise all fan speeds to confirm positive unit response and to validate any field wiring.

Pre-Start

Before energizing the unit, the following system devices must be checked:

- ☐ Is the high voltage power supply correct and in accordance with the nameplate ratings?
- ☐ Is the field wiring and circuit protection the correct size?
- ☐ Is the low voltage control circuit wiring correct per the unit wiring diagram?
- ☐ Is the piping system clean/complete and correct?
- ☐ Is unit serviceable? (see the Dimensions and Weights information).
- ☐ Are all the unit access panels secure and in place?
- ☐ Is the water flow established and circulating through all the units?
- ☐ Is the condensate line properly sized, run, trapped and pitched?
- ☐ Does the indoor blower turn freely without rubbing?
- ☐ Has all work been done in accordance with applicable local and national codes?
- ☐ Has heat transfer fluid been added in the proper mix to prevent freezing if required?

Start-Up

Unit Start-Up

Symbio™ 400-B Unit Start-Up

The factory pre-programs the Symbio 400-B unit ventilator with default values to control the temperature and unit airflow. Use Tracer SC building automation system or Tracer TU software to change the default values.

Follow the procedure below to operate the Symbio 400-B in a stand-alone operation:

1. Turn power on at the disconnect switch option.
2. Position the fan mode switch to either high, medium, low, or the auto position.
3. Rotate the setpoint dial on the zone sensor module to 55°F for cooling or 85°F for heating.

The appropriate control valve will actuate assuming the following conditions:

1. Room temperature should be greater than 55°F and less than 85°F.
2. For a 2-pipe fan-coil unit with an entering water temperature sensor, the water temperature input is appropriate for the demand placed on the unit. For example, cooling operation is requested and cold water (5° lower than room temperature) flows into the unit.
3. Select the correct temperature setpoint.

Note: *Select and enable zone sensor temperature settings to prevent freeze damage to unit.*

General Information

Fan Mode Switch Operation

OFF

Fan is turned OFF, 2-position damper option spring-returns closed.

Hi, Med, Lo

Fan runs continuously at the selected speed. The 2-position damper option opens to an adjustable mechanical stop position.

Symbio™ 400-B Controller Operation

OFF

Fan is **OFF**; control valve options and fresh air damper options close. The low air temperature detection option is still active.

Auto

Fan speed control in the auto setting allows the modulating (3-wire floating point) or 2-position control valve option and 1-, 2-, 3- or variable-speed fan to work cooperatively to meet precise capacity requirement, while minimizing fan speed (motor/energy/acoustics) and valve position (pump energy, chilled water reset). As the capacity requirement increases, the water valve opens. When the fan speed capacity switch points are reached, the fan speed ramps up and the water valve repositions to maintain an equivalent capacity. The reverse sequence takes place with a decrease in required capacity.

Low/Med/High

The fan runs continuously at the selected speed and the valve option will cycle to meet setpoint.

Symbio™ 400-B Sequence of Operation

Symbio 400-B controller will operate to maintain the space temperature setpoint. This section provides information about sequence of operations.

Power-up Sequence

When 24 Vac power is initially applied to the Symbio 400-B controller, the following sequence occurs:

1. The Power Marquee LED turns on as red, then flashes green, and then turns a solid green.
2. All outputs are controlled **OFF** and all modulating valves and dampers close.
3. The controller reads all input local values to determine initial values.
4. The random start timer begins.
5. The random start timer expires.
6. Normal operation begins, assuming there are no generated diagnostics. If any points are in fault or alarm mode, the Power Marquee LED flashes red.

Important: *Flashing red does not indicate that Symbio 400-B controller will fail to operate. Instead, the point(s) that are in fault or alarm mode should be checked to determine if the status of the point(s) is acceptable to allow equipment operation.*

Random Start

Random start is intended to prevent all units in a building from energizing at the same time. The random start timer delays the fan and any heating or cooling start-up from 5 to 30 seconds.

Occupancy Modes

Occupancy modes can be controlled in the following ways:

- The state of the local (hard wired) occupancy binary input BI1.
- A timed override request from a Trane zone sensor.
- A communicated signal from either a Tracer SC or BAS.

A communicated request, from either a Tracer SC or BAS, takes precedence over local requests. If a communicated occupancy request has been established, and is no longer present, the controller reverts to the default (occupied) occupancy mode after 15 minutes (if no hard wired occupancy request exists). The Symbio 400-B controller has the following occupancy modes:

- Occupied
- Unoccupied
- Occupied standby
- Occupied bypass

Occupied Mode

In Occupied Mode, the Symbio 400-B controller maintains the space temperature based on the occupied space temperature setpoint ± occupied offset. The controller uses the occupied mode as a default mode when other forms of occupancy request are not present and the fan runs continuously. The outdoor air damper, if present, will close when the fan is **OFF**. The temperature setpoints can be local (hard wired), communicated, or stored default values (configurable using the Tracer TU service tool).

Unoccupied Mode

In unoccupied mode, the Symbio 400-B controller attempts to maintain the space temperature based on the unoccupied heating or cooling setpoint. The fan will cycle between high speed and **OFF**. In addition, the outdoor air damper remains closed, unless economizing. The controller always uses the stored default setpoint values (configurable using the Tracer TU service tool), regardless of the presence of a hard wired or communicated setpoint value.

Occupied Standby Mode

The Symbio 400-B controller is placed in occupied standby mode only when a communicated occupied request is combined with an unoccupied request from occupancy binary input BI1. In occupied standby mode, the controller maintains the space temperature based on the occupied standby heating or cooling setpoints. Because the occupied standby setpoints have a typical temperature spread of 2°F (1.1°C) in either direction, and the outdoor air damper is closed, occupied standby mode reduces the demand for heating and cooling the space. The fan will run as configured (continuously) for occupied mode. The controller always uses the stored default setpoint values (configurable using the TU service tool), regardless of hard wired or communicated setpoint values. In addition, the outdoor air damper uses the economizer occupied standby minimum position setpoint to reduce the ventilation rate.

Occupied Bypass Mode

The Symbio 400-B controller is placed in occupied bypass mode when the controller is operating in the unoccupied mode and when either the timed override **ON** button on the Trane zone sensor is pressed or the controller receives a communicated occupied bypass signal from a BAS. In occupied bypass mode, the controller maintains the space temperature based on the occupied heating or cooling setpoints. The fan will run as configured (continuous or cycling). The outdoor air damper closes when the fan is OFF. The controller remains in occupied bypass mode until either the **CANCEL** button is pressed on the Trane zone sensor or the occupied bypass time (configurable using the Tracer TU service tool) expires. The temperature setpoints can configured as local (hard wired), communicated, or stored default values using the Tracer TU service tool.

Timed Override Control (Symbio 400-B)

If the Symbio 400-B controller has a timed override option (**ON/CANCEL** buttons), pushing the **ON** button initiates a timed override on request. A timed override on request changes the occupancy mode from unoccupied mode to occupied bypass mode. In occupied bypass mode, the controller controls the space temperature based on the occupied heating or cooling setpoints. The occupied bypass time, which resides in the Symbio 400-B controller and defines the duration of the override, is configurable from 0 to 240 minutes (default value of 120 minutes). When the occupied bypass time expires, the unit transitions from occupied bypass mode to unoccupied mode. Pushing the **CANCEL** button cancels the timed override request. In addition, it will end the timed override before the occupied bypass time has expired and transition the unit from occupied bypass mode to unoccupied mode.

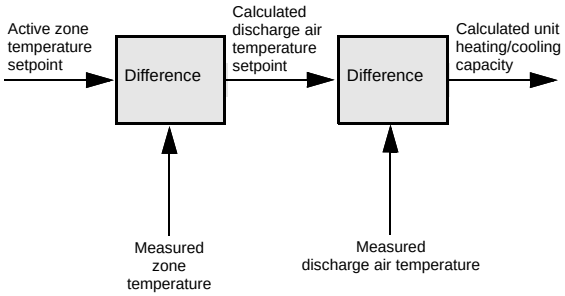
If the controller is in any mode other than unoccupied mode when the **ON** button is pressed, the controller still starts the occupied bypass timer without changing to occupied bypass mode. If the controller is placed in unoccupied mode before the occupied bypass timer expires, the controller is placed into occupied bypass mode and remains in this mode until either the **CANCEL** button is pressed on the Trane zone sensor or the occupied bypass time expires.

Zone Temperature Control (Symbio 400-B)

The Symbio 400-B controller has three methods of zone temperature control:

- **Cascade zone control** — used in the occupied, occupied bypass, and occupied standby modes. It maintains zone temperature by controlling the discharge air temperature to control the zone temperature. The controller uses the difference between the measured zone temperature and the active zone temperature setpoint to produce a discharge air temperature setpoint. The controller compares the discharge air temperature setpoint with the discharge air temperature and calculates a unit heating/ cooling capacity accordingly (refer to the illustration below). The end devices (outdoor air damper, valves, and so on) operate in sequence based

on the unit heating/ cooling capacity (0 to 100 percent).



If the discharge air temperature falls below the discharge air temperature low limit setpoint, (configurable using the Tracer TU service tool), and the cooling capacity is at a minimum, the available heating capacity is used to raise the discharge air temperature to the low limit (refer to the following section, (Discharge Air Tempering).

- **Simplified zone control** — if discharge air temperature failure occurs, then simplified zone controls runs. In the unoccupied mode, the controller maintains the zone temperature by calculating the required heating or cooling capacity (0 to 100 percent) according to the measured zone temperature and the active zone temperature setpoint. The active zone temperature setpoint is determined by the current operating modes, which include occupancy and heat/ cool modes.
- **Discharge air temperature control** — is the backup mode that runs only if there is not valid zone temperature. In this mode, the active space temperature setpoint is used as the discharge air temperature setpoint.

  Important: *This is not a normal operating mode. The source of the invalid zone temperature needs to be corrected to restore normal operation.*

Discharge Air Tempering (Symbio 400-B)

If the Symbio 400-B controller is in cooling mode, cascade zone control initiates a discharge air tempering function when:

- The discharge air temperature falls below the discharge air temperature low limit setpoint (configurable using the Tracer TU service tool).
- All cooling capacity is at a minimum. The discharge air tempering function allows the controller to provide heating capacity (if available) to raise the discharge air temperature to the discharge air temperature low limit setpoint.
- The cold outdoor air is brought in through the outdoor air damper and when the damper is at (high) minimum position. This causes the discharge air temperature to fall below the discharge air temperature low limit setpoint.

Heating or Cooling Mode (Symbio 400-B)

The heating or cooling mode can be determined in one of two ways:

- By a communicated signal from a BAS or a peer controller
- Automatically, as determined by the Symbio 400-B controller

A communicated heating signal permits the controller to only heat and a communicated cooling signal permits the controller to only cool. A communicated auto signal allows the controller to automatically change from heating to cooling and vice versa.

In heating or cooling mode, the controller maintains the zone temperature based on the active heating setpoint and the active cooling setpoint, respectively. The active heating and cooling setpoints are determined by the occupancy mode of the controller.

For 2-pipe and 4-pipe changeover units, normal heat/cool operation will not begin until the ability to conduct the desired heating or cooling operation is verified. This is done using the entering water temperature sampling function, for which a valid entering water temperature is required. When neither a hard wired nor a communicated entering water temperature value is present on changeover units, the controller operates in only heating mode and assumes the coil water is hot. The sampling function is not used.

The entering water temperature sampling function is used only for changeover applications and for information and troubleshooting. It does not affect the operation of the controller

Entering Water Temperature Sampling Function (Symbio 400-B)

The entering water temperature sampling function is used with 2-pipe and 4-pipe changeover units and requires a valid entering water temperature value. If the entering water temperature value is less than 5°F (2.8°C) above a valid zone temperature value for hydronic heating, and greater than 5°F (2.8°C) below a valid zone temperature value for hydronic cooling, the sampling function is enabled. When the sampling function is enabled, the Symbio 400-B controller opens the main hydronic valve to allow the water temperature to stabilize. After 3 minutes, the controller again compares the entering water temperature value to the zone temperature value to determine if the desired heating or cooling function can be accomplished. If the entering water temperature value remains out of range to accomplish the desired heating/ cooling function, the controller closes the main hydronic valve and waits 60 minutes to attempt another sampling. If the entering water temperature value falls within the required range, it resumes normal heating/cooling operation and disables the sampling function.

Fan Operation (Symbio 400-B)

The Symbio 400-B controller supports 1-, 2-, and 3-speed fans and variable-speed fans. The fan always operates continuously while either heating or cooling during occupied, occupied standby, and occupied bypass operation. During unoccupied operation, the fan cycles between **OFF** and **HIGH**, regardless of the fan configuration. When running in **AUTO** mode, the fan operates differently based on the mode and the type of fan.

For 1-, 2-, and 3-speed fans, each time the fan is enabled, the fan begins operation and runs on high speed for a period of time (0.5 seconds for fan coils and 3 seconds for unit ventilators and blower coils) before changing to another speed. Initially running on high speed provides adequate torque to start the fan motor from the **OFF** position.

Note: *In occupied mode, the Symbio 400-B controller requires continuous fan operation because of cascade zone control. In unoccupied mode, the fan cycles.*

Manual Fan Speed Control

Regardless of the fan type, the fan runs continuously at the desired fan speed during occupied, occupied standby, and occupied bypass operation as follows:

- When the controller receives a communicated fan speed signal (HIGH, MEDIUM, LOW).
- The associated fan speed switch is set to a specific fan speed.
- The Supply Fan Speed Request point is overridden.

During unoccupied operation, the fan cycles between **OFF** and **HIGH**, regardless of the communicated fan speed signal or fan speed switch setting (unless either of these is **OFF**, which in turn, will control the fan **OFF**).

The fan turns **OFF** when:

- The controller receives a communicated **OFF** signal.
- The fan speed switch is set to **OFF**.
- Specific diagnostics are generated.
- The default fan speed is set to **OFF** and the fan is operating in the **AUTO** mode.

Note: *The supply fan speed source can be configured for BAS, local, or default value control using the Tracer® TU service tool.*

AUTO Fan Operation; 1-, 2-, 3-speed Fans (Symbio 400-B)

When the controller receives a communicated auto signal (or the associated fan speed switch is set to **AUTO** with no communicated value present), the fan operates in the **AUTO** mode. In **AUTO** mode, the fan operates according to the fan default (configurable using the Tracer TU service tool). The fan speed has multiple speed configurations (default is **AUTO**) or set to **OFF** for both heating and cooling operation. When configured as **AUTO** (and with multiple speeds available), the fan changes based on the required capacity calculated by the control algorithm.

AUTO Fan Operation; ECM Energy Efficient Mode (Symbio 400-B)

When the controller is configured for **Energy Efficient Mode**, by means of the **Fan Operating Mode Request MV** point, the controller and daughter board will minimize energy use by running the fan at the lowest possible speed while maintaining space temperature. The controller will fully utilize valves, economizer, or electric heat which increases fan speed to meet space temperature (unless the fan has been manually controlled.

AUTO Fan Operation; ECM Acoustical Mode (Symbio 400-B)

When the controller is configured for **Acoustical Mode**, by means of the **Fan Operating Mode Request MV** point, the controller and daughter board will minimize acoustical nuisance by balancing changes in fan speed and total fan noise. The controller will fully **OPEN** cooling and heating valves before increasing fan speed to meet space temperature (unless the fan has been manually controlled. If multiple stages of electric heat exist the controller will use a single minimum air flow for each stage.

Exhaust Control (Symbio 400-B)

Exhaust control is achieved by a single-speed exhaust fan and controlled by binary output 2 (BO2). Exhaust control, if not present, can be enabled by selecting **Yes** under the **Exhaust Fan Selection** on the Tracer TU Configuration page under the Equipment Options group.

Note: *Exhaust fan configuration cannot be selected with 3-speed fan operation.*

Important: *If exhaust control is added to an existing configuration, all other configuration options should be verified to match the correct equipment options.Temperature and flow setpoints will revert to default values.*

The exhaust function is coordinated with the supply fan and outdoor/return air dampers as follows:

- The exhaust fan energizes when the fan is running and when the outdoor air damper position is greater than or equal to the exhaust fan enable position (or the outside air damper position at which the exhaust fan turns **ON**).
- The exhaust fan turns **OFF** when the fan either turns **OFF** or the outdoor air damper closes to 10 percent below the exhaust fan enable position.
- If the exhaust fan/damper enable setpoint is less than 10 percent, the exhaust output is energized if the outdoor air damper position is at the setpoint and de-energized at 0.

Valve Operation (Symbio 400-B)

The Symbio 400-B controller supports one or two modulating or two-position valves, depending on the

application. The controller opens and closes the appropriate valve(s) to maintain the active zone temperature setpoint at the heating setpoint in heating mode or the cooling setpoint in cooling mode (refer to Cascade Zone Control in "Zone Temperature Control (Symbio 400-B)," p. 73.

Modulating Valve Operation (Symbio 400-B)

The Symbio 400-B controller supports tri-state modulating valve control. Two binary outputs control each valve: one to drive the valve open and one to drive the valve closed. The stroke time for each valve is configurable using the Tracer TU service tool. The controller supports the following:

- Heating
- Cooling
- Heat/cool changeover with a single valve and coil for 2-pipe applications
- Cooling or heat, cool changeover with the main valve, and coil
- Only heating with the auxiliary valve and coil for 4-pipe applications

The controller moves the modulating valve to the desired positions based on heating or cooling requirements.

Modulating Valve Calibration (Symbio 400-B)

Modulating valve calibration is automatic. During normal controller operation, the Symbio™ 400-B overdrives the actuator (135 percent of the stroke time) whenever there is a request for a position of 0 percent or 100 percent. At either power-up, after a power outage, or when the occupancy status changes to unoccupied, the controller first drives all modulating valves (and dampers) to the closed position. The controller calibrates to the fully **CLOSED** position by over driving the actuator (135 percent of the stroke time). Thereafter, the controller resumes normal operation.

Two-position Valve Operation (Symbio™ 400-B)

The Symbio 400-B controller supports 2-position valves with a single binary output for each valve. Controllers used for 2-pipe applications support heating, cooling, or heat/cool changeover with a single valve/coil. A controller used for 4-pipe applications supports cooling or heat/cool changeover with a main valve/coil and heating only with an auxiliary valve/coil.

Modulating Outdoor/Return Air Damper (Symbio 400-B)

The Symbio 400-B controller operates the modulating outdoor/return air dampers based on the following:

- Occupancy mode
- Outdoor air temperature (communicated or hard wired sensor)
- Zone temperature
- Setpoint
- Discharge air temperature
- Discharge air temperature setpoint

The minimum position for an outdoor air damper is configurable using the Tracer TU service tool for both occupied mode and occupied standby mode and for low-speed fan operation. A controller can receive a BAS-communicated outdoor air damper minimum position.

A BAS-communicated minimum position setpoint has priority over all locally configured setpoints. When a communicated minimum position setpoint is not present, the controller uses the configured minimum position for low fan speed whenever the fan is running at low speed, regardless of the occupancy state. See below for more information about how the controller determines the position of the modulating outdoor air damper.

Table 20. Modulating outdoor air damper position setpoint determination (Symbio 400-B)

Occupancy	BAS-communicated Setpoint	Fan speed	Active Minimum Setpoint
Unoccupied	Any value	Any value	0% (closed)
• Occupied • Occupied bypass • Occupied standby	Valid	Any value	BAS-communicated
• Occupied • Occupied bypass • Occupied standby	Invalid	Low	Occupied low fan minimum
• Occupied • Occupied bypass	Invalid	Medium/high	Occupied minimum
Occupied standby	Invalid	Medium/high	Occupied standby minimum

Outdoor Air Temperature	Modulating outdoor air damper position		
	Occupied or Occupied Bypass	Occupied Standby	Unoccupied
No or invalid outdoor air temperature	Open to occupied minimum position	Open to occupied standby minimum position	Closed
Failed outdoor air sensor	Open to occupied minimum position	Open to occupied standby minimum position	Closed

Outdoor Air Temperature	Modulating outdoor air damper position		
	Occupied or Occupied Bypass	Occupied Standby	Unoccupied
Outdoor air temperature present and economizing possible (Refer to section, "Economizing (Free Cooling) (Symbio 400-B)," p. 77).	Economizing; damper controlled between occupied minimum position and 100%	Economizing; damper controlled between occupied standby minimum position and 100%	Open and economizing during unit operation; otherwise closed
Outdoor air temperature present and economizing not possible (Refer to section, "Economizing (Free Cooling) (Symbio 400-B)," p. 77).	Open to occupied minimum position	Open to occupied standby minimum position	Closed

Economizing (Free Cooling) (Symbio 400-B)

Cooling with outdoor air (during the times when the temperature is low enough to allow) is referred to as economizing (free cooling). The Symbio 400-B controller and applications with modulating outside air damper, support economizing. The modulating outdoor air damper provides the first source of cooling for the controller.

The controller initiates economizing if the outdoor air temperature is below the economizer enable point (configurable using the Tracer TU service tool). If economizing is initiated, the controller modulates the outdoor air damper (between the active minimum damper position and 100 percent) to control the amount of outdoor air cooling capacity. When the outdoor air temperature rises 5°F (2.8°C) above the economizer enable point, the controller disables economizing and moves the outdoor air damper back to its predetermined minimum position, based on the current occupancy mode or communicated minimum outdoor air damper position. If an outdoor air temperature value is not present, economizing is disabled.

Two-position Control Of A Modulating Outdoor Air Damper (Symbio 400-B)

The Symbio 400-B controller supports 2-position outdoor air damper actuators. However, a modulating outdoor/return air damper actuator can be used for 2-position control. 2-position control can be achieved by not providing an outdoor air temperature (neither hard wired nor communicated) to the controller, and by setting the damper minimum position (using the Tracer TU service tool) to the desired value, typically 100 percent.

Electric Heat Operation (Symbio 400-B)

The Symbio 400-B controller supports both SCR (modulating) and staged electric heat (1- or 2-stages). SCR heat is only a field-installed option. In a unit configured with staged electric heat, the electric heating circuit(s) are cycled **ON** and **OFF** appropriately to maintain the desired space temperature at the active heating setpoint. In a unit configured with SCR (modulating) electric heat, the Symbio 400-B will send a 0 to 10 Volt DC signal to adjust SCR capacity in order to maintain the desired space temperature.

In both staged and modulating electric heat applications, the simultaneous use of electric and hydronic heat is not supported and the Symbio 400-B will operate electric heat only when hot water is not available (for example, in a changeover unit).

In addition, the Symbio 400-B will run the supply fan for 30 seconds after electric heat is turned **OFF** in order to dissipate heat from the unit.

Note: *This delay does not apply to steam or hydronic heating.*

Factory-configured electric heat units have built-in mechanical protections to prevent dangerously high discharge air temperatures.

Dehumidification Operation (Symbio 400-B)

The Symbio 400-B controller supports space dehumidification when:

- Mechanical (DX or hydronic) cooling is available
- The heating capacity is located in the reheat position
- The space relative humidity is valid

The space relative humidity can be a BAS-communicated value or come directly from a wired relative humidity sensor. The controller begins to dehumidify the space when the space humidity exceeds the humidity setpoint. The controller continues to dehumidify until the sensed humidity falls below the setpoint minus the relative humidity offset.

Peer-to-peer Communication (Symbio 400-B)

Peer-to-peer communication is accomplished by means of custom TGP2 programming in the Tracer SC system controller or via hard wiring only between controllers.

Unit Protection Strategies (Symbio 400-B)

The following unit protection strategies are initiated when specific conditions exist in order to protect the unit or building from damage:

- Smart reset
- Low coil temperature protection

- Condensate overflow
- Fan status
- Fan off delay
- Filter maintenance timer
- Freeze avoidance
- Freeze protection (discharge air temperature low limit)

Smart Reset (Symbio 400-B)

The Symbio 400-B controller will automatically restart a unit that is locked out as a result of a Low Coil Temp Detection (BI3) diagnostic. Referred to as smart reset, this automatic restart will occur 30 minutes after the diagnostic occurs. If the unit is successfully restarted, the diagnostic is cleared. If the unit undergoes another Low Coil Temp Detection diagnostic within a 24-hour period, the unit will be locked out until it is manually reset.

Note: *Freeze protection will also perform a smart reset.*

Low Coil Temperature Protection (Symbio 400-B)

Refer to *Symbio™ 400-B/500 Programmable Controllers For Blower Coil, Fan Coil, and Unit Ventilator Installation, Operation, and Maintenance* (BAS-SVX093*-EN).

Condensate Overflow (Symbio™ 400-B)

Refer to *Symbio™ 400-B/500 Programmable Controllers For Blower Coil, Fan Coil, and Unit Ventilator Installation, Operation, and Maintenance* (BAS-SVX093*-EN).

Fan Status

In 1-, 2- and 3-speed fans, the status is based on the statuses of the supply fan output multistate and analog points dedicated to fan control. The fan status is reported as **HIGH, MEDIUM, LOW**, and as a percentage, whenever the fan is running. The fan status is reported as **OFF** whenever the fan is not running. In addition, a fan status switch can be connected to binary input 5 (BI5) to monitor the status of the fan for belt-driven or directdriven units (except Trane Macon factory ECM fan motor units). The fan status switch provides feedback to the controller as follows:

- If the fan is not operating when the controller has the fan controlled to **ON**, the controller generates a **Low Airflow-Supply** Fan Failure diagnostic.
- If the Symbio 400-B controller energizes the fan output for 1 minute, and the fan status switch indicates no fan operation, the controller performs a unit shutdown and generates a **Low Airflow-Supply Fan Failure** diagnostic.
- If the fan has been operating normally for one minute, but the fan status switch indicates no fan operation, the same diagnostic is generated.

This manual diagnostic discontinues unit operation until the diagnostic has been cleared from the controller. If a diagnostic reset is sent to the controller, and the fan condition still exists, the controller attempts to run the fan for 1 minute before generating another diagnostic and performing a unit shutdown. A diagnostic reset can be sent to the controller from the Tracer TU **Alarms** page or by temporarily overriding the **Reset Diagnostic Request** on the Tracer TU **Binary Status** page.

Note: *In the ECM fan application, the ECM engine board will monitor the status of the fan. In case of a failure, the engine board will disable the motor immediately, and the low airflow diagnostic is sent.*

Fan Off Delay

After heating has been controlled **OFF**, the Symbio 400-B controller keeps the fan energized for an additional 30 seconds in order to remove residual heat from the heating source.

Filter Maintenance Timer

The filter maintenance timer tracks the amount of time (in hours) that the fan is enabled. The Filter Runtime Hours Setpoint (configurable using the Tracer TU service tool) is used to set the amount of time until maintenance (typically, a filter change) is required. The timer can be enabled/disabled from the **Supply Fan** group on the **Setup Parameters** page in Tracer TU.

The Symbio 400-B controller compares the fan run time to filter runtime hours setpoint. Once the setpoint is reached, the controller generates a **Filter Change Required** diagnostic. When the diagnostic is cleared, the controller resets the filter maintenance timer to zero, and the timer begins accumulating fan run time again. The diagnostics can be cleared and the filter timer reset by temporarily overriding the **Filter Timer Reset Request** on the **Binary Status** page or by using the reset button on the **Alarms** page in Tracer TU.

Freeze Avoidance

Freeze avoidance is used for low ambient temperature protection. It is initiated only when the fan is OFF. The Symbio 400-B controller enters the freeze avoidance mode when the outdoor air temperature is below the freeze avoidance setpoint (configurable using the Tracer TU service tool). The controller disables freeze avoidance when the outdoor air temperature rises 3°F (1.7°C) above the freeze avoidance setpoint.

The following occurs when the controller is in freeze avoidance mode:

- Valves are driven open to allow water to flow through the coil.
- Fan is **OFF**.
- Economizing is disabled.
- The outdoor/return air damper is closed.
- DX cooling is **OFF**.
- Electric heat stages are **OFF**.

Freeze Protection (Discharge Air Temperature Low Limit)

The Symbio 400-B controller monitors the discharge air temperature with a 10 kΩ thermistor wired to AI4. The freeze protection operation is initiated whenever the discharge air temperature falls below the discharge air temperature low limit. The discharge air temperature low limit is configurable using the Tracer® TU service tool.

During freeze protection, the controller increases the heating capacity or decreases the cooling capacity in order to raise the discharge air temperature above the low limit. If the discharge air temperature remains below the low limit for 3 minutes, the controller generates a Discharge Air Temp Limit diagnostic.

Note: *Freeze protection will also perform a smart reset.*

Maintenance

⚠ 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.

Service Access

To access the unit for water balancing, motor access or other start-up and maintenance functions, use one of the following methods:

1. Remove the entire front panel and put a blockoff over the air chamber in the front.
2. Remove the return air grille by releasing the mounting screws.
3. If there is no shelving or other obstructions, removing the end panel may allow more access.

Periodic Maintenance

The following maintenance suggestions apply to all types of unit ventilators, chilled water, hot water, split systems and electric. Additional information for controls not supplied by The Trane Company should be obtained from the controls manufacturer.

Split system unit ventilators include a condensing unit and the instructions provided with the condensing unit will apply to the entire refrigerant system.

Filters

The air filters supplied with Trane unit ventilators are specially designed for high lint content. Depending upon room conditions, these filters will normally need to be replaced every four to eight weeks. To assure proper unit operation, inspect the filters monthly and clean or replace as required.

Overloaded filters will reduce unit air handling capacity, which may result in insufficient heating during the morning warm-up period and loss of natural cooling capacity during mild weather.

NOTICE

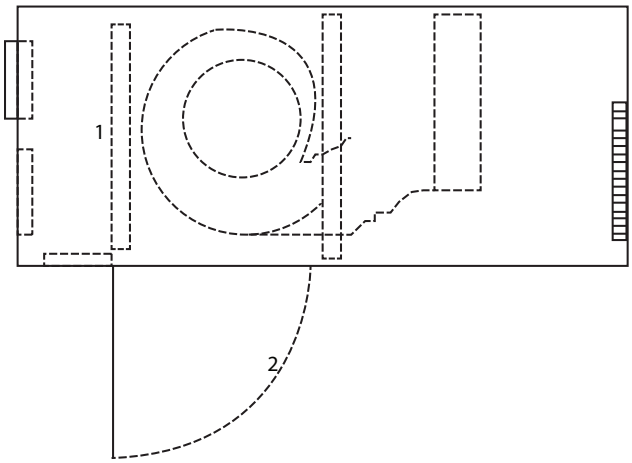
Equipment Damage!

Failure to follow instructions below could result in equipment damage.

Do not operate units for any length of time without properly installing all panels, filters, and grilles.

To replace the filter, lower the back access panel and lift the filter out of its channel and out of the unit.

Figure 59.



1. Filter
2. Hinged back access panel

Removal of the Drain Pan

The unit ventilator drain pan is removable for periodic cleaning or for easy access for maintenance/drainage issues. Refer to the following figure and the following steps for removing the drain pan:

1. Turn off power to the unit and remove the front panel by turning camlocks.
2. Disconnect the drain line from the drain spout.
3. Remove two screws from each side of the drain pan (four total) as shown.

Note: *The drain pan will drop straight down upon screw removal.*

Figure 60. Removal of screws holding drain pan in place

Note: *The drain pan is installed at an angle to allow drainage. For each end of the drain pan, remember the position (top or bottom slot) from which the fastener was removed.*

4. When reinstalling, use the same steps in reverse order, remembering the pitch of the drain pan.

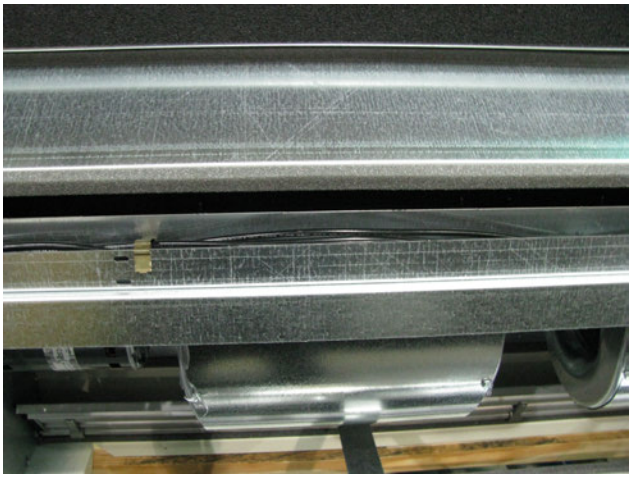
Removal of the Fanboard and Coil Cleaning

The unit ventilator fan board can be removed for service to the blower motor and fan wheels. The fan board must also be removed for easier access to the unit coils for cleaning and maintenance. Utilize the following steps for proper removal of the fanboard.

1. Turn off power to the unit and remove the front panel.
2. Remove the front air grille and filter from the unit.
3. Pick wires out of the cable chase and tie them out of the way (see Figure 61, p. 81).

   Note: *The cable chase is part of the fanboard assembly.*

Figure 61. Tie wires from the cable chase out of the way



4. Disconnect motor wires.
5. Loosen the four bolts (two on each side of the fanboard; see Figure 62, p. 81).

NOTICE

Equipment Damage!

Failure to follow instructions below could result in equipment damage.

Before removing bolts that support the fanboard, provide support to prevent the deck from falling out of the unit.

Figure 62. Loosen the two bolts (four total) at either end of the fanboard

6. For units with face and bypass options only: Before removing the fanboard, the drain pan must be removed (Figure 61, p. 81). After the drain pan has been removed, proceed to Step 2.
7. Remove the bolts and fanboard.
8. When reinstalling, use the same steps in reverse order.

Lubrication: Fan Shaft

One fan shaft bearing is mounted on the right end of the fan board. This sleeve-type bearing has an inner surface of sintered bronze which allows oil to flow from the built-in reservoir to the bearing surface without the use of grooves or holes in the inner bearing surface. Do not alter the inner bearing in any way.

Fill the bearing reservoir every six months with a No. 10 SAE, non- detergent, automotive type oil.

Motor

The fan motor is an electronically commutated motor.

To replace the fan motor, complete the following steps:

1. Turn off power to the unit and remove the front cover.
2. Complete steps for return air grille and filter removal.
3. Complete steps for removal of drain pan if face and bypass option is installed.
4. Complete steps for removal of fan board.
5. Disconnect the motor ground wire.
6. Using a 7/16-in. Allen wrench, loosen the coupling on the fan shaft.
7. Loosen the screw on the motor clamp until it allow the motor to be lifted off the base.
8. Lift the motor and pull forward until fan shaft separates from the motor.
9. Attach new motor to fan shaft and reverse steps to complete installation.

Preventive Maintenance

A comprehensive preventive maintenance program should be established for a unit ventilator system. The following are several key elements:

- Inspect the filters monthly.
- Inspect and clean the drain pans every three months.
- Check the coils for dirt accumulation every three to six months.
- Clean the coils at least once each year.
- Inspect the unit ventilator insulation every three months; thoroughly clean as needed.

Diagnostics and Troubleshooting

If operating difficulties are encountered, refer to the following table for probable causes and corrective measures. If suggested corrective measures have been taken, and the trouble still persists, contact the control supplier or the local Trane Sales Office.

⚠ WARNING

Hazardous Service Procedures!

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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.

Table 21. Troubleshooting recommendations

Symptom	Heat	Cool	Probably Cause	Recommended Action
Room too warm (outside air temperature is below 35°F)	X		Main power off	Check fuses.
	X		Room sensor is not properly set	Reset room sensor temperature.
	X		Room sensor is providing a false reading due to walls being cold from the night temperature setting	Start the warm-up cycle earlier in the morning to provide appropriate time-frame to increase room temperature prior to space occupation.
	X		Sensor is mounted on a block wall that is leaking cold air into the room through the mounting holes	Relocate sensor.
	X		Face-and-bypass damper, or coil valve is malfunctioning	Replace malfunctioning component, or contact the controls contractor, or if Trane controls, see *Tracer® ZN520 Unit Controller Installation, Operation, and Maintenance* (CNT-SVX04*-EN) for more information concerning Tracer controls.
Room too warm (outside air temperature is above 35°F)	X		Room sensor is not properly set	Reset room sensor temperature.
	X		Face-and-bypass damper or coil control valve is malfunctioning	Replace malfunctioning component, or contact the controls contractor, or if Trane controls, see *Tracer® ZN520 Unit Controller Installation, Operation, and Maintenance* (CNT-SVX04*-EN) for more information concerning Tracer controls.
	X		OA damper is in the closed position	Ensure OA damper is in the open position.
	X		Clogged filter	Replace filter.
Room too warm (outside air temperature is above 35°F) Unit utilizes Wall Fin auxiliary radiation	X		Control valve is malfunctioning	Check flow of hot water through the control valve.
	X		Boiler	Check the boiler reset schedule to determine if the loop temperature can be decreased.
	X		Steam	Check the operation of the control valves.
	X		Outside air temperature is above 60°F to 65°F	The economics of the unit ventilator selection dictate that, in most cases, the unit will be sized to provide adequate natural (ventilation) cooling without outside temperatures up to 60°F to 65°F. Above this point, a changeover should be made to the mechanical cooling cycle.

Table 21. Troubleshooting recommendations (continued)

Symptom	Heat	Cool	Probably Cause	Recommended Action
Room too cool		X	Room sensor is not properly set	Reset room sensor temperature.
		X	Clogged filter	Replace filter.
		X	Face-and-bypass damper, or coil valve is malfunctioning	Replace malfunctioning component, or contact the controls contractor, or if Trane controls, see *Tracer® ZN520 Unit Controller Installation, Operation, and Maintenance* (CNT-SVX04*-EN) for more information concerning Tracer controls.
		X	OA damper is in the open position	Ensure OA damper is in the closed or minimum outside air position.
		X	Boiler pressure or temperature design requirements not being met	On hot water and steam type units, check the boiler pressure or temperature to ensure that the requirements are being met.
Room too cool Unit utilizes Wall Fin auxiliary radiation		X	Radiation controls malfunctioning	Check the operation of the wall fin controls.
Room too hot		X	Room sensor is not properly set	Reset room sensor temperature.
		X	Clogged filter	Replace filter.
		X	Face and bypass damper, or coil valve is malfunctioning	Replace malfunctioning component, or contact the controls contractor, or if Trane controls, see *Tracer® ZN520 Unit Controller Installation, Operation, and Maintenance* (CNT-SVX04*-EN) for more information concerning Tracer controls.
		X	OA damper is in the open position	Ensure OA damper is in the minimum outside air position.
		X	Chiller temperature design requirements not being met	Check the temperature of the water leaving the chiller to ensure that it meets design requirements.
Motor		X	If the motor fails to start, and other motors on the same circuit are functioning	Check the unit switch to ensure it is in the ON position.
		X	If the motor fails to start, and other motors on the same circuit are functioning	Check for loose switch or motor connection.
265 and 460 volt unit	X	X	If the unit fails to start	Check fuse in right-hand end pocket inside the transformer mounting box. Replace with Trane fuse X1311057435 (ABC type 6A 250V).

Symbio™ 400-B

Output Testing and Diagnostics

This section provides information about the following:

- Output testing
- Diagnostics

Diagnostics

Diagnostics are informational messages that indicate the operational status of the Symbio™ 400-B controller. In response to most diagnostics, the controller attempts to protect the equipment by enabling/disabling, or by opening/closing specific outputs. Other diagnostics provide information about the status of the controller, but have no effect on outputs. Diagnostics are reported in the order in which they occur. Multiple diagnostics can be present simultaneously. Diagnostic messages are viewed using the Tracer TU service tool or through a BAS.

Note: *Tracer TU will report only active diagnostics.*

Diagnostics Types

Diagnostics are categorized according to the type of clearing method each uses and the type of information each provides. The diagnostic types are:

- Manual (latching) diagnostics
- Automatic (non-latching) diagnostics
- Smart reset diagnostics
- Informational diagnostics

Manual (Latching) Diagnostics

Manual diagnostics (also referred to as latching) cause the unit to shut down. Manual diagnostics can be cleared from the Symbio 400-B controller in one of the following ways:

- By using the Tracer TU service tool to reset latching diagnostics on the **Alarms Status** tab or by temporarily

overriding the **Reset Diagnostic Request** (bv/2) on the **Binary Status** tab.

- Through a building automation system
- By cycling power to the controller When the 24 Vac power to the controller is cycled OFF and then ON again, a power-up sequence occurs

Automatic (Non-latching) Diagnostics

Automatic diagnostics clear automatically when the problem that generated the diagnostic is solved.

Smart Reset Diagnostics

Smart Reset Diagnostics are latching diagnostics that will auto-recover if the condition is corrected. After the controller detects the first smart reset diagnostic, the unit waits 30 minutes before initiating the smart reset function. If another diagnostic of this type occurs again within 24 hours after an automatic clearing, clear the diagnostic manually by using any of the ways listed under the preceding section, “Manual (Latching) Diagnostics,” p. 84.

Informational Diagnostics

Informational diagnostics provide information about the status of the controller. They do not affect machine operation, but can be cleared from the controller using the BAS or Tracer SC.

Controller Diagnostics

The following table lists each diagnostic that can be generated by the Symbio 400-B controller, the diagnostic effect on outputs (consequences), and diagnostic type.

Table 22. Symbio 400-B controller diagnostics

Diagnostic	Probable Cause	Consequences	Diagnostic Type
Filter change required	Fan run hours exceed the time set to indicate filter change.	• Fan **Unaffected** • Valves **Unaffected** • Electric heat **Unaffected**	Informational
Condensate overflow	The drain pan is full of water.	• Fan **OFF** • Valves **Closed** • Outdoor air damper **Closed** • DX/electric heat **OFF**	Manual
Low coil temp detection	The leaving fluid temperature may be close to freezing.	• Fan **OFF** • Valves **Open** • Outdoor air damper **Closed** • DX/electric heat **OFF**	Smart reset/ Manual
Low airflow supply fan failure	The fan drive belt, contactor, or motor has failed.	• Fan **OFF** • Valves **Closed** • Outdoor air damper **Closed** • DX/electric heat **OFF**	Manual
Space temperature failure[a]	Invalid or missing value for zone temperature.	• Discharge air temperature control runs • Unit shuts **OFF** if both space temperature and discharge air temperature fail	Automatic
Entering water temp failure	Invalid or missing value for zone temperature.	• Fan **Unaffected** (enabled) • Valves **Unaffected** • Outdoor air damper **Unaffected** • DX/electric heat **Unaffected**	Automatic
Discharge air temp low limit	Discharge air temperature has fallen below the Discharge Air Temperature Low Limit.	• Fan **OFF** • Valves **Open** • Outdoor air damper **Closed** • DX/electric heat **OFF**	Smart reset/ manual
Discharge air temp failure(a)	Invalid or missing value for discharge air temperature.	• Simplified zone control algorithm runs • Unit shuts OFF if zone temperature fails	Automatic

Table 22. Symbio 400-B controller diagnostics (continued)

Diagnostic	Probable Cause	Consequences	Diagnostic Type
Outdoor air temp failure	Invalid or missing value for outdoor air temperature.	• Fan **Unaffected** • Valves **Unaffected** • Outdoor air damper **Minimum Position** • DX cooling/electric heat **unaffected**	Automatic
Humidity input failure	Invalid or missing value for relative humidity.	• Fan **Unaffected** • Valves **Unaffected** • Outdoor air damper **unaffected** • DX cooling/electric heat **unaffected**	Automatic
CO2 sensor failure	Invalid or missing value for CO_2.	• Fan **Unaffected** • Valves **Unaffected** • Outdoor air damper **unaffected** • DX cooling/electric heat **unaffected**	Informational
Generic AIP failure	Invalid or missing value for generic analog input.	• Fan **Unaffected** • Valves **Unaffected** • Outdoor air damper **unaffected** • DX cooling/electric heat **unaffected**	Informational
Local fan mode failure	Invalid or missing fan- speed switch *(reverts to default fan speed)*.	• Fan **Unaffected** • Valves **Unaffected** • Outdoor air damper **Unaffected** • DX cooling/electric heat **unaffected**	Automatic
Local setpoint failure	Invalid or missing value for zone temperature setpoint *(reverts to default setpoint)*.	• Fan **Unaffected** • Valves **Unaffected** • Outdoor air damper **Unaffected** • DX cooling/electric heat **unaffected**	Automatic

(a) For detailed information about zone temperature control methods, see Zone Temperature Control (Symbio 400-B), p. 73.

Troubleshooting

If encountering operational problems with the Symbio 400-B controller, refer to the following troubleshooting tables.

Fans with Symbio™ 400- Controller

Table 23. Fan does not energize

Probable Cause	Explanation
Unit wiring	The wiring between the controller outputs and the fan relays and contacts must be present and correct for normal fan operation. Refer to applicable wiring diagram.
Failed end device	The fan motor and relay must be checked to ensure proper operation.
Normal operation	The fan will turn **OFF** when: • The controller receives a communicated off signal. • The fan-speed switch is set to **OFF** if no communicated value is present. • Specific diagnostics are generated. • The default fan speed is set to **OFF** and the fan is operating in the Auto mode. If the controller is in unoccupied mode, the fan cycles between **OFF** and the highest fan speed.
No power to the controller	If the controller does not have power, the unit fan does not operate. For the controller to operate normally, it must have an input voltage of 24 Vac. If the Marquee/Power LED is **OFF** continuously, the controller does not have sufficient power or has failed.

Table 23. Fan does not energize (continued)

Diagnostic present	Several diagnostics affect fan operation. For detailed information about these diagnostics, refer to "Controller Diagnostics," p. 85.
Unit configuration	The controller must be properly configured based on the actual installed end devices and application. If the unit configuration does not match the actual end device, the fans may not work correctly.
Random start observed	After power-up, the controller always observes a random start from 5 to 30 seconds. The controller remains **OFF** until the random start time expires.
Cycling fan operation/ continuous	The controller continuously operates the fan when in the occupied, occupied standby, or occupied bypass mode. When the controller is in the unoccupied mode, the fan is cycled between high speed and **OFF** with capacity.
Unoccupied operation	Even if the controller is configured for continuous fan operation, the fan normally cycles with capacity during unoccupied mode. While unoccupied, the fan cycles **ON** or **OFF** with heating/cooling to provide varying amounts of heating or cooling to the space.
Fan mode off	If a local fan mode switch determines the fan operation, the **OFF** position controls the fan to off.
Requested mode off	The user can communicate a desired operating mode (*such as* **OFF**, heat, and cool) to the controller. If **OFF** is communicated to the controller, the unit controls the fan to off. There is no heating or cooling.

Valves with Symbio™ 400-B Controller

Table 24. Valves remain closed

Probable Cause	Explanation
Unit wiring	The wiring between the controller outputs and the valve(s) must be present and correct for normal valve operation. Refer to applicable wiring diagram.
Failed end device	The valves must be checked to ensure proper operation.
No power to the controller	If the controller does not have power, the unit valve(s) will not operate. For the controller to operate normally, apply an input voltage of 24 Vac. If the Marquee/Power LED is **OFF** continuously, the controller does not have sufficient power or has failed.
Diagnostic present	Several diagnostics affect valve operation. For detailed information about these diagnostics, refer to "Controller Diagnostics," p. 85.
Normal operation	The controller opens and closes the valves to meet the unit capacity requirements.
Unit configuration	The controller must be properly configured based on the actual installed end devices and application. If the unit configuration does not match the actual end device, the valves may not work correctly.
Random start observed	After power-up, the controller always observes a random start from 5 to 30 seconds. The controller remains **OFF** until the random start time expires.
Requested mode off	The user can communicate a desired operating mode (such as **OFF**, heat, and cool) to the controller. If **OFF** is communicated to the controller, the unit controls the fan to off. There is no heating or cooling.
Entering water temperature sampling logic	The controller includes entering water temperature sampling logic, which is automatically initiated during 2-pipe and 4-pipe changeover, if the entering water temperature is either too cool or too hot for the desired heating or cooling.
Valve configuration	Ensure the valves are correctly configured, using the Tracer® TU service tool, as normally open or normally closed as dictated by the application.

Table 25. Valves remain open

Probable Cause	Explanation
Unit wiring	The wiring between the controller outputs and the valve(s) must be present and correct for normal valve operation. Refer to applicable wiring diagram.
Failed end device	The valves must be checked to ensure proper operations.
Normal operation	The controller opens and closes the valves to meet the unit capacity requirements.
Diagnostic present	Several diagnostics affect valve operation. For detailed information about these diagnostics, refer to "Controller Diagnostics," p. 85.
Unit configuration	The controller must be properly configured based on the actual installed end devices and application. If the unit configuration does not match the actual end device, the valves may not work correctly.

Table 25. Valves remain open (continued)

Probable Cause	Explanation
Entering water temperature sampling logic	The controller includes entering water temperature sampling logic, which is automatically initiated during 2-pipe and 4-pipe changeover, if the entering water temperature is either too cool or too hot for the desired heating or cooling.
Valve configuration	Ensure the valves are correctly configured, using the Tracer® TU service tool, as normally open (NO) or normally closed (NC) as dictated by the application.
Freeze avoidance	When the fan is **OFF** with no demand for capacity (0%), and the outdoor air temperature is below the freeze avoidance setpoint, the controller opens the water valves (100%) to prevent coil freezing. This includes unoccupied mode when there is no call for capacity or any other time the fan is **OFF**.

DX Coils or Electric Heat with Symbio™ 400-B Controller

Table 26. DX or electric heat does not energize

Probable Cause	Explanation
Unit wiring	The wiring between the controller outputs and the end devices must be present and correct for normal operation. Refer to applicable wiring diagram.
Failed end device	Check the control contactors or the electric heat element, including any auxiliary safety interlocks, to ensure proper operation.
No power to the controller	If the controller does not have power, heat outputs do not operate. For the controller to operate normally, apply an input voltage of 24 Vac. If the Marquee/Power LED is **OFF** continuously, the controller does not have sufficient power or has failed.
Diagnostic present	Several diagnostics affect DX and electric heat operation. For detailed information about these diagnostics, refer to “Controller Diagnostics,” p. 85.
Normal operation	The controller controls compressor or electric heat outputs as needed to meet the unit capacity requirements.
Unit configuration	The controller must be properly configured based on the actual installed end devices and application. If the unit configuration does not match the actual end device, DX or electric heat may not operate correctly.
Requested mode off	The user can communicate a desired operating mode (such as **OFF**, heat, and cool) to the controller. If **OFF** is communicated to the controller, the unit shuts off the compressor or electric heat.
Freeze avoidance	When the fan is **OFF** with no demand for capacity (0%), and the outdoor air temperature is below the freeze avoidance setpoint, the controller disables compressors and electric heat outputs (100%) to prevent coil freezing. This includes unoccupied mode when there is no call for capacity or any other time the fan is **OFF**.

Outdoor Air Dampers with Symbio™ 400-B Controller

Table 27. Outdoor air damper remains closed

Probable Cause	Explanation
Unit wiring	The wiring between the controller outputs and the outdoor air damper must be present and correct for normal outdoor air damper operation. Refer to applicable wiring diagram.
Failed end device	Check damper actuator to ensure proper operation.
No power to the controller	If the controller does not have power, the outdoor air damper does not operate. For the controller to operate normally, apply an input voltage of 24 Vac. If the Marquee/Power LED is **OFF** continuously, the controller does not have sufficient power or has failed.
Diagnostic present	Several diagnostics affect outdoor air damper operation. For detailed information about these diagnostics, refer to “Controller Diagnostics,” p. 85.
Normal operation	The controller opens and closes the outdoor air damper based on the controller’s occupancy mode and fan status. Normally, the outdoor air damper is open during occupied mode when the fan is running and closed during unoccupied mode.

Table 27. Outdoor air damper remains closed (continued)

Probable Cause	Explanation
Unit configuration	The controller must be properly configured based on the actual installed end devices and application. If the unit configuration does not match the actual end device, the outdoor air damper may not work correctly.
Warm-up and cool-down sequence	The controller includes both a morning warm-up and cool-down sequence to keep the outdoor air damper closed during the transition from unoccupied to occupied. This is an attempt to bring the space under control as quickly as possible.
Requested mode off	The user can communicate a desired operating mode (such as **OFF**, heat, or cool) to the controller. If **OFF** is communicated to the controller, the unit closes the outdoor air damper.

Table 28. Outdoor air damper remains open

Probable Cause	Explanation
Unit wiring	The wiring between the controller outputs and the outdoor air damper must be present and correct for normal outdoor air damper operation. Refer to applicable wiring diagram.
Failed end device	Check damper actuator to ensure proper operation.
Normal operation	The controller opens and closes the outdoor air damper based on the controller occupancy mode and fan status. Normally, the outdoor air damper is open during occupied mode when the fan is running and closed during unoccupied mode.
Unit configuration	The controller must be properly configured based on the actual installed end devices and application. If the unit configuration does not match the actual end device, the outdoor air damper may not work correctly.

Troubleshooting (Wireless Controls)

Locations of LEDs, Test Button, Test Symbols, and Error Codes

The receiver for all models has four LEDs: LED1, LED2, LED3, and LED5.

Note: *To view LEDs on a flush mount receiver on a fan-coil unit, the front panel of the unit must be removed.*

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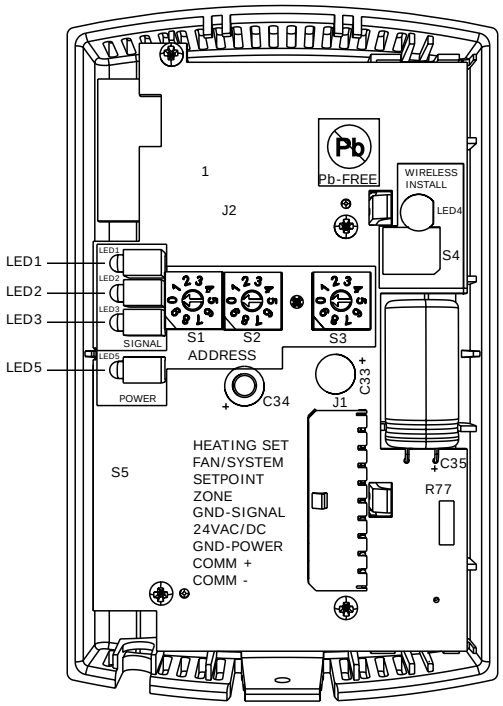
Figure 63. LED locations on the receiver



The sensor for model WZS have four LEDs: LED1, LED2, LED3, and LED5. The sensor for model WDS has test symbols and error codes that appear on the display. All three sensor models have a Test button.

Figure 64. WZS showing LED locations and test button

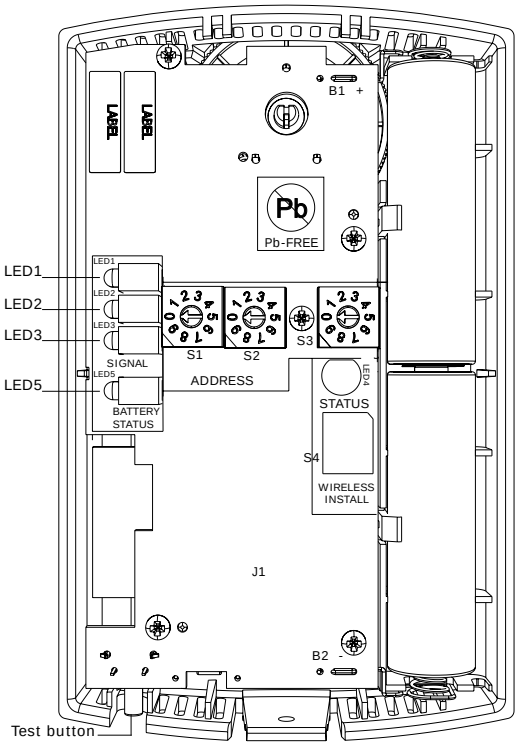
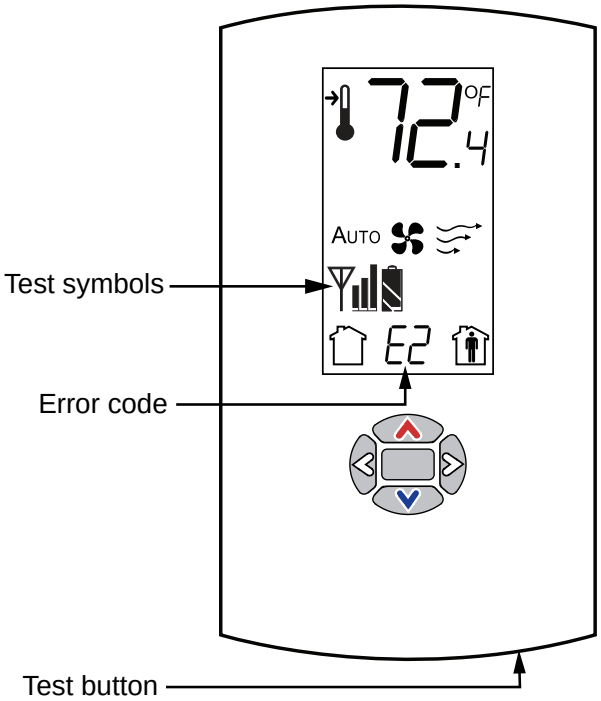


Figure 65. Wireless display sensor (WDS) shows test symbols, error code and test button



Sensor Diagnostics

LED1, LED2, and LED3, located on the WZS respond to diagnostics by exhibiting specific blinking patterns. View their response by pressing the Test button. Error codes appear on the WDS when diagnostics occur.

Table 29. Diagnostics for wireless zone sensors and error code shown on wireless display sensor

LED state when Test button is pressed on WZS	Error code shown on WDS	Indicates...
n/a	E0, E5, E7	Sensor failure Replace sensor
LED1: Off LED2: Off LED3[a]: 1-blink pattern repeated 3 times	E1	Disassociated Sensor is not associated with a receiver.
LED1: Off LED2: Off LED3[a]: 2-blink pattern repeated 3 times	E2	Address set to 000 Address not set to between 001–999.
LED1: Off LED2: Off LED3[a]: 3-blink pattern repeated 3 times	E3	Software error Replace sensor
LED1: Off LED2: Off LED3[a]: 4-blink pattern repeated 3 times	E4	Input voltage too high No RF transmission is permitted with an input battery voltage greater than 3.9 V.

[a] Blink pattern is On for 1/4 s, Off for 1/4 s, with 2 s Off between repetitions.

Receiver Diagnostics

LED1, LED2, and LED3, located on the receiver of all models respond to diagnostics by exhibiting specific blinking patterns. They respond independently of any user action.

Table 30. Diagnostics on the receiver

LED state	Indicates...
LED1: Off LED2: Off LED3: 1-blink pattern repeated continuously[a]	Disassociated Receiver is not associated, waiting for a sensor. Receiver lost communication with sensor. Receiver has no devices on its wireless personal area network. Association with a device has been manually removed.
LED1: Off LED2: Off LED3: 2-blink pattern repeated continuously[a]	Address set to 000. Address not set to between 001–999.
LED1: Off LED2: Off LED3: 3-blink pattern repeated continuously[a]	Not configured. Receiver configuration properties not properly set (defective receiver).

[a] Blink pattern is On for 1/4 s, Off for 1/4 s, with 2 s Off between repetitions.

Testing Signal Strength

To initiate a signal strength test, push the Test button on the sensor (see location of Test button in Figure 63, p. 89 and Figure 64, p. 90).

- **Models WZS:** LED1, LED2, and LED3 respond by indicating signal strength. You can view them on the sensor ("Testing Signal Strength," p. 91) and the receiver (Table 32, p. 92).
- **Model WDS:** Test symbols on the sensor display indicate signal strength (Table 31, p. 92). LED1, LED2, and LED3, on the receiver, respond by indicating signal strength (Table 32, p. 92).

Table 31. Observing signal strength on the wireless zone sensor

User action	LED state (WZS sensors)	Symbol displayed on WDS	Indicates
None	LED1: Off LED2: Off LED3: Off	No Test symbols appear	Normal state No Test button press.
Press Test button on the sensor	LED1: Off LED2: Off LED3: Off		Associated; no communication with receiver Associated, but no signal from the receiver after pressing Test button.
	LED1: On LED2: On LED3: On Displays for 5 seconds, then constantly Off		Excellent signal strength Good signal margin for reliable communication.
	LED1: Off LED2: On LED3: On Displays for 5 seconds, then constantly Off		Satisfactory signal strength Adequate signal strength for reliable communication. Moving sensor or receiver may improve signal strength. Increased channel switching may reduce battery life.
	LED1: Off LED2: Off LED3: On Displays for 5 seconds, then constantly Off		Poor signal strength Unreliable communication. Strongly recommend moving the sensor or receiver to a better location.

Table 32. Observing signal strength on the receiver

User action	LED state (receiver, all models)	Indicates
None	LED1: Off LED2: Off LED3: Off	Normal state No Test button press.
Press Test button on the sensor	LED1: On LED2: On LED3: On Displays for 5 seconds, then constantly Off	Excellent signal strength Good signal margin for reliable communication.
	LED1: Off LED2: On LED3: On Displays for 5 seconds, then constantly Off	Satisfactory signal strength Adequate signal strength for reliable communication. Moving sensor or receiver may improve signal strength. Increased channel switching may reduce battery life.
	LED1: Off LED2: Off LED3: On Displays for 5 seconds, then constantly Off	Poor signal strength Unreliable communication Strongly recommend moving the sensor or receiver to a better location

Testing Battery Status

Initiate a battery status test as follows:

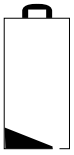
- On the WZS, push the Test button on the sensor (see location on Figure 64, p. 90). LED5 on the sensor responds by indicating the level of battery strength, as shown in Table 33, p. 93.
- On the WDS, push the Test button on the sensor (see location on Figure 65, p. 90). In response, a battery test symbol appears on the display. The symbol shown indicates battery life expectancy (see Table 34, p. 93).

Table 33. Battery status indicated by LED5 on the wireless zone sensors

User action	LED state	Indicates
Press Test button	Solid green for 5 seconds	Battery is adequate for proper operation.
	Solid red for 5 seconds	25% battery life left. Batteries should be replaced.
	No light	Batteries life expired or not installed properly, or sensor is defective.
None	Blinking red: 1-blink pattern[a] repeated 5 times. Cycle repeats every 15 minutes.	Approximately 14 days of operation remain before the battery is too weak to power the sensor.

[a] Blink pattern is On for 1/4 s, Off for 3/4 s, with 2 s Off between repetitions.

Table 34. Battery status shown on the wireless display sensor

User action	Battery test symbol	Indicates
Press Test button		Full battery power.
		50 percent battery life left.
		25 percent battery life left. Replace batteries. Flashing symbol indicates that approximately 14 days of operation remain before the battery is too weak to power the sensor.

24 V Power Status Indicator

LED5 on the receiver of all models (see Figure 63, p. 89) lights and stays constantly On when 24 V power is normal.

Check Signal Strength on a Site

Use the wireless sensor system to check the signal strength on a site.

1. Power up a receiver with a 24 V transformer (user supplied).
2. Associate the sensor to a receiver of the same model intended for the job.
3. Place the receiver at the desired location.
4. Place or hold the sensor at the desired location.
5. Press the Test button (S5) on the sensor and observe the signal strength as indicated by LED1, LED2, and LED3 on model WZS (see Figure 64, p. 90), and on the display on model WDS (see Figure 65, p. 90).

For more information on interpreting the LEDs and the display symbols that indicate signal strength, see "Testing Signal Strength," p. 91.

Replacing Sensor Batteries

Sensor battery type, length of life, and installation are addressed in this section.

Battery Type

NOTICE

Battery Damage!

Failure to follow instructions below could result in battery leakage and, in some cases, cause the safety release vent to open.

Do NOT attempt to recharge the batteries. The batteries are manufactured in a ready-to-use state and are NOT designed for recharging.

NOTICE

Sensor Damage!

Do not hook up the sensor to a power supply as it could result in sensor damage.

Use two non-rechargeable 1.5 V lithium AA batteries in the sensor. To maintain UL rating, use only UL-listed lithium batteries. The sensor ships with Energizer® L91 batteries already installed. Replacement batteries are available at Trane Service Parts Centers (Part number: X13770035010) or other local suppliers.

Battery Life

Battery life is five years under normal conditions. If the sensor is not used for an extended period of time, do one of the following:

- Set the sensor address to 000 to place the sensor into a low-power hibernation mode.
- Remove the batteries.

Notes:

- *If lithium batteries are temporarily unavailable, alkaline batteries can be used. However, alkaline battery life is very short by comparison.*
- *The battery life for model WDS may decrease with extended LCD display activity.*

Battery Installation

⚠ WARNING

Risk of Injury with Batteries!

Failure to follow handling instructions below could result in severe injury.

- **Do NOT install batteries backwards.**
- **Do NOT disassemble, charge, or expose batteries to water, fire, or high temperature.**
- **Keep batteries away from children. If swallowed, contact your local poison control center immediately.**

1. Observe the polarity indicators that are molded into the cover.
2. Install two batteries (of the type specified in "Battery Type," p. 93) in the battery-holding slot that is molded into the sensor cover.

The sensor has been designed to prevent damage if the batteries are installed backwards, to reduce the potential for injury.

Manual Association

Before attempting manual or automatic association, the receiver must indicate readiness to associate (one blink pattern of LED3 on receiver). See "Observing the Receiver for Readiness to Associate," p. 44.

At any time, the manual association method can be used to associate the receiver with the sensor. If an association was previously established between a receiver and a sensor and needs to be re-established, the manual association process may be used. If an association has not yet been established, the automatic association process is recommended (see "Observing the Receiver for Readiness to Associate," p. 44).

1. Using a small screwdriver, set the three rotary address switches (locations S1, S2, S3) on the receiver to an address between 001 and 999.

   Notes:

   - *An address can be changed without powering down the receiver or sensor.*
   - *An address can be changed at any time after initial association has been established.*
2. Set the three rotary address switches (locations S1, S2, and S3) on the sensor to the same address as the receiver.
3. Record the address and location of the receiver and sensor pair.
4. After verifying that the receiver and sensor are powered up, press the Test button on the sensor to establish that the signal strength ("Testing Signal Strength," p. 91) and the battery life "Testing Battery Status," p. 92) are adequate for proper functioning.

Disassociation

The receiver disassociates from the sensor (by removing all stored association information), conducts a channel scan, and restarts itself, if any of the following are true:

- The receiver address is changed from its current setting (001–999).
- The receiver receives a disassociation notification from its associated sensor.
- The receiver does not receive a communication from its associated sensor within 50 minutes.
- The sensor and receiver are associated and communicating at the time the sensor is set to 000 and the Test button is pressed.

  Note: *A disassociated sensor will transit an association request every 10 minutes.*

Sensor/Receiver Compatibility

Version 1.5 (part number: X13790854 and X13790855) and higher receivers are compatible with all sensors models and support all functions. Receivers released prior to version 1.5 are compatible with only model WZS.

Replacing a Failed Sensor or Receiver

Note: *Receivers ship installed on the unit. To remove the receiver, press in the retention tabs on the underside of the receiver enclosure and push upward.*

To replace a failed sensor or receiver:

1. Confirm that the device is disassociated (see Table 30, p. 91 and Table 29, p. 91).
2. Set the rotary address switch of the new device to match the address of the remaining sensor or receiver.

   Note: *There is no need to remove power from the remaining device.*
3. Apply power to the new device. Association between the new and the remaining devices will automatically occur.

   Note: *When replacing a WDS sensor, the receiver (version 1.5 or higher) will automatically configure the sensor to match the last stored configuration, if the sensor has not been placed into configuration mode and the factory default configuration is still valid. If the sensor configuration does not match the desired system features, it can be manually configured (see "Manual Association," p. 94).*

Servicing and Testing WZS

If the wireless sensor system is not working as expected, use the tools and procedure described in this section.

Servicing and Testing Tools

No special tools or software are necessary to service and test the wireless sensor system. Test the system by using:

- The LEDs on the receiver, LEDs on the model WZS sensor, and the display on the model WDS sensor
- The Test button on the sensor
- The address test mode on the receiver
- A common volt-ohm meter

Procedure for Testing the Wireless Sensor System

If the wireless zone sensor is not working as expected:

1. Observe LED5 on the receiver. LED5 is On solid green whenever the receiver is powered.
2. Verify that the receiver is properly grounded. Both the **GND-SIGNAL** (black) wire and the **GND-POWER** (yellow) wire must be grounded.
3. Press the Test button on the sensor.
   - Model WZS: LED5 should turn On solid green, indicating proper battery strength. LED1, LED2, and LED3 will indicate signal strength.

     Note: *When checking signal strength, both LED1 and LED3 on the receiver and sensor illuminate in unison if the sensor and receiver are associated. Use this feature to confirm association.*
   - Model WDS: Battery life ("Testing Battery Status," p. 92) and signal strength ("Testing Signal Strength," p. 91) are indicated on the display.

Procedure for Testing Receiver

If the receiver is not working as expected:

1. Verify that the receiver is powered.
2. Set the receiver address to 000 to force the zone temperature output and zone temperature setpoint output to their default mode values (see "Output Values — Failure and Default Modes of Operation," p. 95).
3. Measure the receiver output resistance (see "Measuring Output Resistance," p. 96).
4. When the test is complete, reset the receiver address to its previous setting.
5. Press the Test button on the sensor to force re-association.
6. Confirm association and communication by noting LED1, LED2, and LED3 as described in "Testing Signal Strength," p. 91.

Forcing a Sensor to Transmit

To force a wireless sensor to transmit during servicing, press the Test button on the sensor.

Output Power Level

The maximum output power level of a wireless sensor set is controlled by software and restricted by channel of operation and agency requirements per country or region. The sensor has a default maximum power level of 10 mW, but the receiver determines the ultimate output power level of the sensor.

Output Values — Failure and Default Modes of Operation

The following table provides output values for failure and default modes of operation, which can be used for troubleshooting.

Table 35. Output values

Situation	Zone temperature output	Zone setpoint output	Heating setpoint output	Fan/System output
Receiver address = 000	11.17 kΩ, 72.5°F (22.5°C), indefinitely	451 Ω, 72.5°F (22.5° C), indefinitely	501 Ω, 70.5°F (21.4° C), indefinitely	2320 Ω Fan = Auto System = Off
Receiver address = 001 to 999 and: Receiver is powered up, but not is associated, or Receiver has received a disassociation request from the associated sensor.	11.17 kΩ, 72.5°F (22.5°C) Hold for 15 minutes, then open	451 Ω, 72.5°F (22.5° C), Hold for 15 minutes, then open	501 Ω, 70.5°F (21.4° C), indefinitely	2320 Ω Fan = Auto System = Off
Receiver address = 001 to 999 and receiver has not received a communication within 35 minutes from the associated sensor.	Open	Open	Open	Open
Receiver has no power.	Open	Open	Open	Open
Thermistor in sensor has failed to either open or close.	Open	Normal value	Normal value	N/A
Setpoint potentiometer has failed to either open or close.	Normal value	Open	Open	N/A

Measuring Output Resistance

To measure the resistance of receiver outputs for zone temperature and setpoints for all models, and heating setpoint and fan/system for the WDS:

1. Ensure that the **GND-SIGNAL** (black) wire and the **GND-POWER** (yellow) wire are grounded to the transformer.
2. Disconnect the **ZONE** (white) and **SETPOINT** (RED) wires from the controller. Disconnect the **HEAT SETPOINT** (brown) and **FAN/SYSTEM** (green) wires from the controller, if applicable.
3. Measure resistance as follows:
   a. All models: Measure between the grounded **GND-SIGNAL** (black) wire and either the **SETPOINT** (red) or **ZONE** (white) wire. Compare resistance measurements to those in .

Table 36. Receiver resistance table for all models

Zone or setpoint temperature	Nominal zone temperature output resistance	Nominal setpoint/ heating setpoint output resistance
55°F (12.8°C)	17.47 KΩ	792 Ω
60°F (15.6°C)	15.3 KΩ	695 Ω
65°F (18.3°C)	13.49 KΩ	597 Ω
70°F (21.1°C)	11.9 KΩ	500 Ω
75°F (23.9°C)	10.5 KΩ	403 Ω
80°F (26.7°C)	9.3 KΩ	305 Ω
85°F (29.4°C)	8.25 KΩ	208 Ω

   b. WDS only: Measure between the grounded **GND-SIGNAL** (black) wire and the **FAN/SYSTEM** (green) wire. Compare resistance measurements to those given in .

Note: *The output circuits are not electrically powered; consequently, resistance can be measured without risk of damage to the volt-ohm meter.*

Table 37. Receiver resistance table for model WDS

Fan command	Nominal output resistance
High	16,130 Ω
Med	13,320 Ω
Low	10,770 Ω
Auto	2320 Ω
Off	4870 Ω

Cleaning the Sensor

NOTICE

Sensor Damage!

Do not spray glass cleaner or any other solution directly on the sensor as it could damage it.

You can clean the sensor by applying glass cleaner to a soft, non-abrasive cloth, and gently wiping the face, including the buttons and LCD display. Use of a pre-moistened towelette designed for lens or screen cleaning is also acceptable.

Avoid inadvertent pressing of the Occupied/Unoccupied buttons on the keypad on the WDS sensor as this may result in an unwanted timed override or settings change.

Electronically Commutated Motors (ECM)

⚠ WARNING

Hazardous Voltage w/Capacitors!

Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

Disconnect all electric power, including remote disconnects and discharge all motor start/run capacitors before servicing. Follow proper lockout/ tagout procedures to ensure the power cannot be inadvertently energized. For variable frequency drives or other energy storing components provided by Trane or others, refer to the appropriate manufacturer's literature for allowable waiting periods for discharge of capacitors. Verify with a CAT III or IV voltmeter rated per NFPA 70E that all capacitors have discharged.

⚠ WARNING

Safety Alert!

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

BLDC motors contain capacitors which store residual energy. Stay clear of fan wheels for five minutes after power has been disconnected, as a power request with the motor powered off could result in a very short period of actuation. Unplug the motor to avoid a power request.

⚠ WARNING

Safety Alert!

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

Disconnect unit power prior to initial connections to the CSTI and standard adapter boards, including low voltage interconnections.

⚠ WARNING

Safety Alert!

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

Disconnect unit power prior to making or removing motor or adapter board connections.

Notes:

- *The new Trane BLDC system is a closed loop system that has equipment protections and envelope enforcements. Do not assume that the motor has failed without first consulting the ECM engine status/diagnostics screen. In many cases, the engine shuts down the motor operation and locks it out to prevent equipment damage.*
- *Electric Heat operation and Changeover Coil control on CSTI units are co-coordinated by the ECM engine board. Changeover function on Tracer ZN units can also be affected by incorrect configuration of the ECM engine or improper wiring of terminals to analog input 1 on the Tracer ZN controller (polarity sensitivity).*
- *The mini-access lid on the front of the main control panel lid has the ECM engine troubleshooting/setup guide affixed to the back of the lid. This guide is unit-specific and should be consulted before determining the disposition of a unit.*

General Information

The ECM engine oversees and monitors all motor operations and changes to speed resulting from:

- Direct Fan Speed Requests
  - Customer Fan Speed Switches.
  - Thermostat Fan Speed, On or 0–10V requests.
  - Automatic Fan Request from Tracer® ZN / UC controllers.
- Indirect Fan Speed Requests
  - Electric Heat requests will bring the fan to the proper speed.
- Conflicting Fan Speed Requests
  - If two or more commands are received (direct or indirect), the fan will honor the higher speed requested.

Note: *In some cases, indirect requests will result in fan behavior change regardless of whether the end-device fails to actuate (due to device failure, or safety/downstream lockouts).*

The ECM engine board also coordinates the operation of Electric Heat, Electric/Hydronic Heat lockouts, and CSTI Changeover coil operation.

Troubleshooting Information

General System Troubleshooting Tips

- ECM engine configuration must perfectly match the factory-supplied ECM. See to “Overview,” p. 57for troubleshooting configuration of the engine board.
- The ECM engine will display troubleshooting information, and contains dual tachometers to aid in performance verification.
- Under normal circumstances, the ECM engine display will display the operational status of the motors and electric heat circuit/sensors, however, a malfunction will drive a priority display mode that will present the error code instantly to the screen. The error must be cleared by solving by powering down, removing the cause of the problem and restarting the engine board.
- Engine Label setup document (affixed to the back of the low voltage access lid) should be used to verify engine configuration settings.
- For proper operation of the system, all plugs must be firmly seated in all boards and motors. Insecure connections will cause malfunction and the system will shutdown.
- Do not unplug or plug-in motors or connectors while the system is receiving a speed request of any kind. The system must be powered down before plugging or unplugging connections to the adapter boards, engine boards or motors. Failure do so will register diagnostics or cause unsafe operation and reduction in the contact life of the connectors.
- The motor will not spin if plugged in while the ECM engine is requesting power.

Motor

Motor that does not Spin, or Spins too Slowly

The motor connections and motor plug connections to the adapter boards should be secure. Unit should be powered off to check the fit of the connectors.

When configured correctly, the system will always respond positively to direct, indirect, and conflicting speed requests with very few exceptions.

Table 38. Motor does not spin, spins too slowly

Situation	Probable Cause	Solution
Motor has been locked out due to engine locked rotor protection	Motor 1 has an obstruction. "Status Display" will be interrupted to display: LOCH ® mtr 1 ® LrPt	• Remove obstruction from the fan wheel. • Ensure that motor plugs and all plugs to adapter boards and the ECM engine board are secure. • Verify that the configuration does not specify a motor that is physically missing. Most units require only one motor. The controller is made aware of the missing motor by specifying all speeds related to Motor 2 to 0 rpm. • Verify that m1Lo and m2Lo, the low motor signal output limits, are set correctly.
Motor has been locked out due to overspeed or runaway condition	Motor 1 has an overspeed condition. The “Status Display” will be interrupted to display: OSPd → mtr 1 → OSPd	• Ensure that set-screw is attached firmly to the motor shaft. • Ensure that motor plugs and all plugs to adapter boards and the ECM engine board are secure. • Verify that the configuration does not specify a speed lower than 450 rpm for the affected motor. Speeds below 450 rpm are not supported on fan coil units.
VSP Inputs (0–10V inputs) are of the wrong polarity	Variable speed (VSP) inputs may not be properly wired to 1TB4	• Do not short the courtesy 10 Vdc supply to chassis or loads that require greater than 10 mA of DC current. • Observe proper polarity of 0–10 Vdc inputs. Failure to observe proper polarity can cause failure of the ECM engine board, the customer-supplied controller, or the Tracer® ZN controller.
Customer Controller output signal to VSP Inputs are too low[a] .	Noise floor is set too high.	• The ECM Engine board contains an adjustable noise floor parameter, uFLr that can be configured to reject signals below the noise floor. • The noise floor parameter is set too high, it can be lowered as long as there are acceptable noise levels on the inputs lines.

[a] If the customer supplied controller outputs signals that are below the noise threshold, they will be ignored by the ECM Engine.

Motor that Spins too Fast, or Spins Without any Apparent Speed Request

Typical equipment and controls design practice will ensure that the fans will come on if there is a call for heat, cool, or ventilation. In most cases, we will depend on the controller/thermostat to call for the fan to come on when appropriate, but during calls for electric heat, or calls for heat on CSTI units equipped with electric heat, as a call for the appropriate fan speed. This behavior, as described previously, is an indirect request.

When a call for electric heat is made, the system will positively drive the fan on to the correct speed, regardless of whether the controller has asked for fan operation or not. The unit design incorporates an interlock instead of a lock-out. (It does not lock out electric heat if the fan is set to off; it brings the fan on.)

Note: *In many cases, indirect requests will result in fan behavior change regardless of whether the end-device fails to actuate (due to device failure, or safety/downstream lockouts). If there is hot water available on CSTI units with changeover coils and electric heat, we will still drive the fan to the appropriate electric heat speed.*

If the preceding conditions do not describe the behavior of the unit, the following checks should be performed:

Table 39. Motor spins too fast or spins without any apparent speed request

Situation	Probable Cause
Motor not controllable	Verify that the voltage jumper on the motor plug harness is absent for 208-230V units and 277V units. If the jumper is present for these units, the motor electronics will be damaged, and the motor will not be controllable.
Fan speed request too low	Verify that the fan speed request is not below 450 rpm.

Table 39. Motor spins too fast or spins without any apparent speed request (continued)

Situation	Probable Cause
Inputs not of consistent polarity	Verify that the all binary inputs to the customer terminal blocks are of proper and consistent polarity. • For CSTI units, the fan inputs and end device inputs on TB3 must receive signals that are 24 Vac with respect to the unit chassis. • For Fan Speed Switch (FSS) units, that incorporate the Tracer® ZN/CSTI adapter board, all inputs to TB3 must be 24 Vac with respect to unit chassis. • For Tracer® ZN units, where there is a desire to use parallel fan inputs on the adapter board TB3 strip, the inputs must be COM (i.e., the inputs will honor only 0 V with respect to unit chassis). ***Note:*** *Do not short 24 Vac (pos 1 or pos 2) to chassis; refer to the unit schematic.*
Failure of motor control board	Verify that variable speed (VSP) inputs are properly wired to 1TB4. • Do not short the courtesy 10 Vdc supply to chassis or loads that require greater than 10 mA of DC current. • Please observe proper polarity of 0–10 Vdc inputs. Failure to observe proper polarity can cause failure of the ECM engine board, the customer-supplied controller or the Tracer® ZN controller.
Output signals being ignored	Verify that the signal on the VSP inputs is noise free. The ECM engine board contains an adjustable noise floor parameter, uFLr, that can be configured to reject signals below the noise floor. ***Note:*** *If the customer supplied controller outputs signals that are below the noise threshold, they will be ignored by the ECM engine.*
Motor spinning too fast	Verify that VSP input settings are correct. The ECM engine board contains an adjustable digital amplifier, A iSc, to compensate for long 10 Vdc cable runs. For normalized (0–10 Vdc) signals, this setting should be set to 1.000. If it is set too high, the motors will run faster than the requested ratio, and will hit the limit AhM1 before the input voltage has reached its upper limit.
Motor not controllable	Verify that M1LO and M2LO, the low motor signal output limits, are set correctly.

Replacing ECM Components

⚠ WARNING

Hazardous Voltage w/Capacitors!

Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

Disconnect all electric power, including remote disconnects and discharge all motor start/run capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power cannot be inadvertently energized. For variable frequency drives or other energy storing components provided by Trane or others, refer to the appropriate manufacturer's literature for allowable waiting periods for discharge of capacitors. Verify with a CAT III or IV voltmeter rated per NFPA 70E that all capacitors have discharged.

⚠ WARNING

Safety Alert!

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

BLDC motors contain capacitors which store residual energy. Stay clear of fan wheels for five minutes after power has been disconnected, as a power request with the motor powered off could result in a very short period of actuation. Unplug the motor to avoid a power request.

⚠ WARNING

Safety Alert!

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

Disconnect unit power prior to initial connections to the CSTI and standard adapter boards, including low voltage interconnections.

⚠ WARNING

Safety Alert!

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

Disconnect unit power prior to making or removing motor or adapter board connections.

⚠ WARNING

Safety Alert!

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

All settings take effect immediately, including fan start and electric heat. Avoid hazardous voltage sources, moving parts, and electric heat elements when adjusting the motor control board. If avoiding these areas is not practical during motor control board adjustment, contact Trane Global Parts for configuration kit to power control board outside the unit with a 9-volt battery.

⚠ WARNING

Safety Alert!

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

Replacement board configurations must match setup and switch configuration of previously installed boards.

NOTICE

Equipment Damage!

Failure to follow instructions below could result in equipment damage.

Confirm nylon standoffs are firmly seated on the metal panel, and new circuit modules are firmly seated standoffs.

NOTICE

Equipment Damage!

Failure to follow these instructions could result in equipment damage.

The motor harness attached to the single plug to which the motor mates contains the 115V motor voltage jumper. The motor harness should always be present for 115V units and should not be modified or substituted.

Notes:

- *Ensure that drip-loops are maintained on wiring on pipe end of unit to avoid wicking of water into the unit.*
- *Before assuming that any of the boards or components in the new system have failed, please ensure that the ECM engine board has been configured correctly and that the switches on the CSTI board (where applicable) are set correctly.*
- *It is necessary to configure the service replacement ECM engine board before commissioning the unit. The ECM engine board is pre-configured with safe values, but will NOT work correctly unless properly configured.*
- *Only genuine Trane® replacement components with identical Trane part numbers should be used.*
- *Unit fan assemblies contain concealed wires that should be removed before the fan-board is removed, to avoid nicking the wire.*
- *Care should be maintained to retain the order of the motors with respect to the motor plugs. On a unit with two motors, the double-shafted motor will always be to the left side, and will be designated as Motor 2 by the controller.*

Important:

- *Ensure that motor nameplate voltage is the same as unit voltage (for 3-phase/ 4-wire units with Neutral, motor voltage will be L-N, not L1-L2).*
- *Ensure that motor harness is correct (harness will have jumper installed for 115V units only).*
- *Ensure that configuration on ECM Engine matches the affixed label.*
- *Maintain correct plug/motor association. The plugs will have the motor number and shaft configuration printed on an affixed label.*
- *Ensure that configuration of switches on CSTI adapter board matches depiction of switches on the unit schematic.*
- *Ensure that all wires are plugged in securely.*
- *Ensure that edge protection on sharp edges, grommets, and wire management devices are maintained when replacing components.*
- *Ensure that blunt-tip screws are used when in the proximity of wire harnesses.*

Circuit Modules Replacement

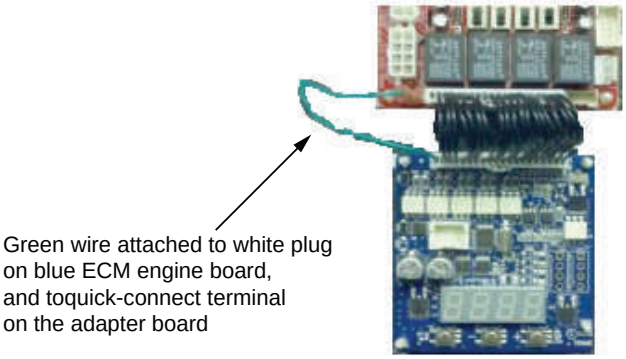
1. Circuit modules are equipped with nylon standoffs which can either be removed by squeezing the barbs at the rear of the control panel, or squeezing the latch above the circuit module. If the latter method is chosen, the standoffs will be retained on the metal panel. The new standoffs (affixed to the replacement modules) can be removed if necessary, so the new module circuit board can be attached to the retained standoffs.

Figure 66. Remove PCB

2. If replacing the ECM engine module, special care should be taken to avoid electro-static discharge damage. Use an ESD protection wrist-strap and frequently touch a grounded surface (with unit power off) to discharge any static buildup.
3. Replace connectors carefully onto the appropriate board. For units with a green wire attached to the CSTI

or standard adapter boards, confirm that the green wire is attached to the engine board white connector as shown below.

Figure 67. CSTI wiring

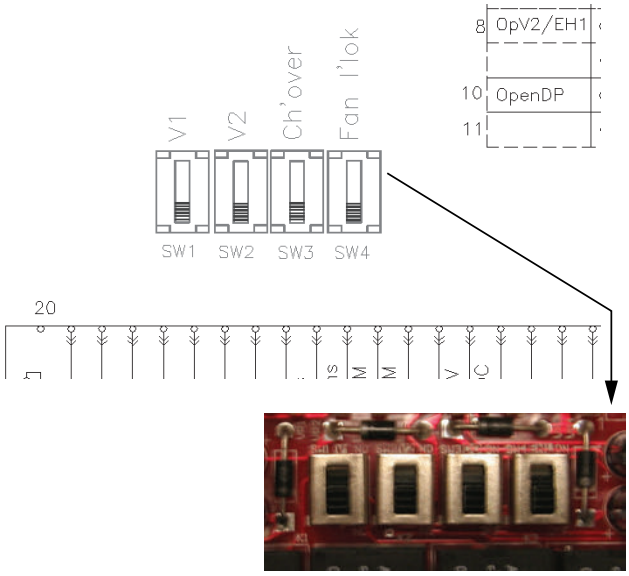


4. Verify that the new ECM engine controller is configured to match the ECM engine configuration label that is present on the unit. It is necessary to configure the ECM engine board to avoid improper operation of the unit, discomfort to the end user, and loud fan operation.

Figure 68. Configure ECM engine board

5. Verify that the CSTI adapter board switches are set correctly, as indicated on the attached unit schematic (where applicable).

Figure 69. CSTI adapter board switches are set correctly

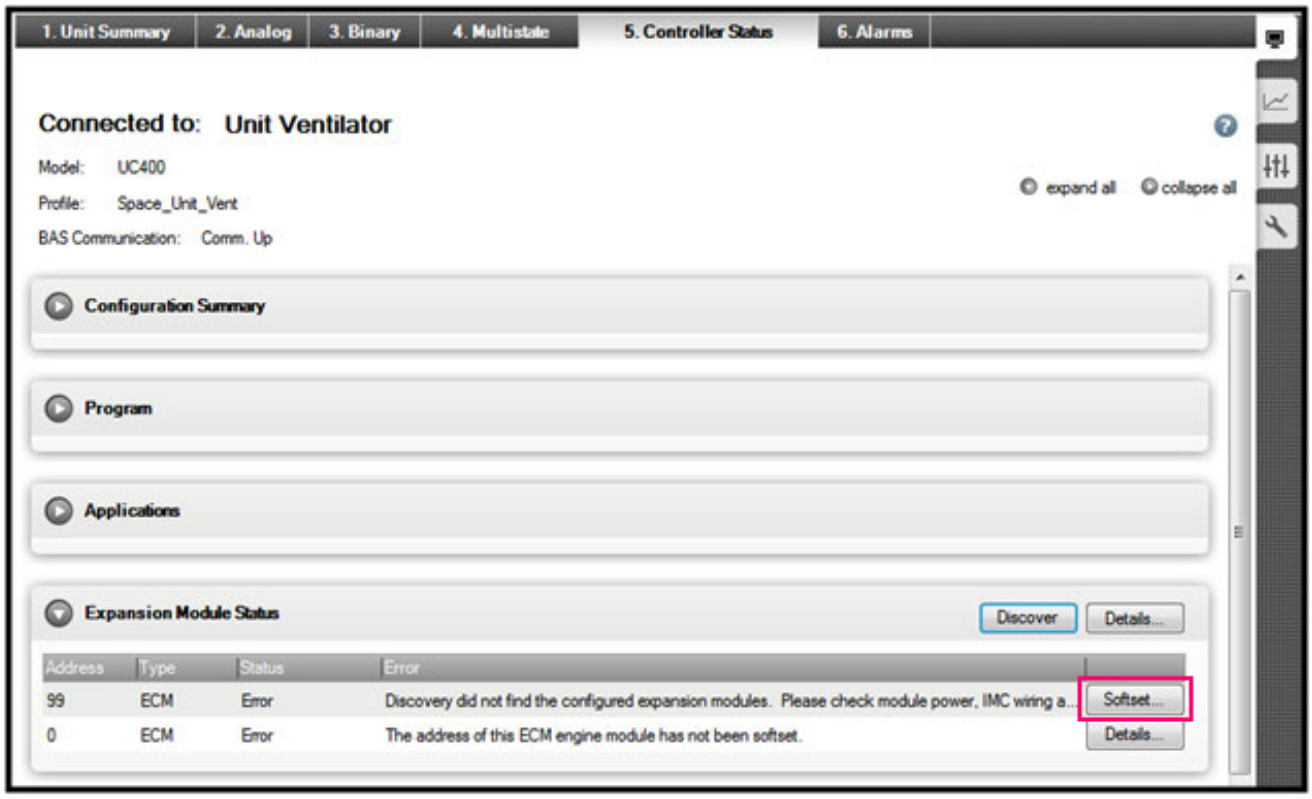


6. After replacing modules, commission the unit by performing at a minimum, “Fan Speed Response Verification,” p. 70.

Softsetting the IMC Address of an ECM Engine Module

requires an ECM engine module, the Symbio 400-B requires that the ECM engine module be configured at IMC address 99. If an engine module is found at an address other than 99 (as it will be in a field application / hardware replacement scenario), Tracer TU populates the Expansion Module box on the Controller Status screen as shown here.

Figure 70. Controller Status screen



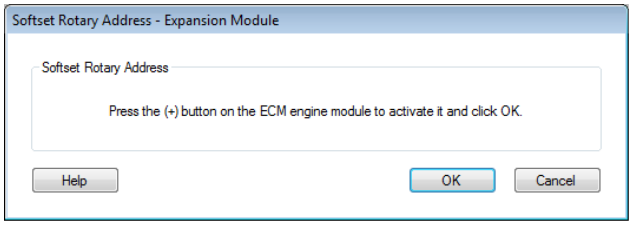
Notice one ECM type is configured at address 99, but no ECM is found at that address. Also, notice that another ECM has been found with an address of 0. When this situation occurs, Tracer TU displays a Softset… button you can use to configure the engine module address.

Complete the following steps to softset the engine module address:

1. Click the **Softset** button to initiate the softest procedure.

   Tracer TU displays the Softset Rotary Address - Expansion Module dialog box.

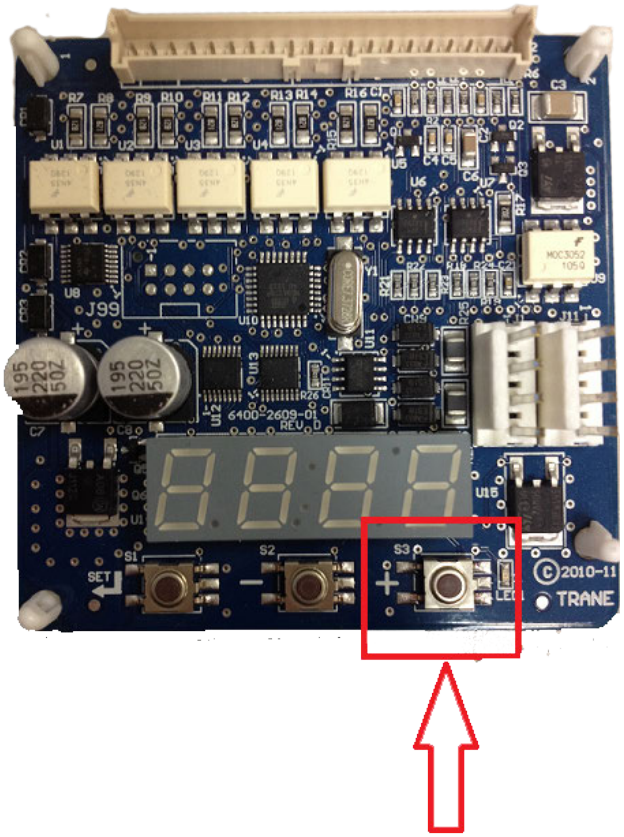
Figure 71. Softset Rotary Address - Expansion Module



2. Prior to clicking **OK**, activate the engine module using the **(+)** button on the ECM engine board in the control box.

   Once the engine module is activated, the LED to the right of the (+) button lights up.

Figure 72. Engine module on the ECM engine board



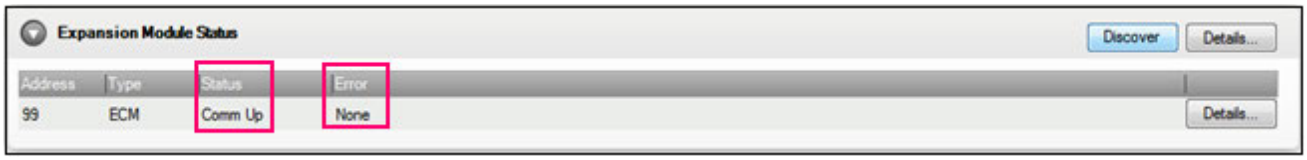
3. Once the light has been activated, click **OK** on the Softset Rotary Address - Expansion Module dialog box shown in

   When you click **OK**, Tracer TU softsets the engine module IMC address to 99 and the light on the module will turn off.

4. Return to the Expansion Module Status box, click **Discover** and wait five to ten seconds for Tracer TU to refresh the screen.

   Once complete, the value in the Error column updates to **None** and the **Status** column updates to **Comm Up**.

Figure 73. Expansion Module Status



Accessories

Wallboxes

The following instructions are general recommendations for installing wall intake boxes. Consult the architectural plans for specific requirements.

Additional materials required to complete any specific installations (such as duct connections, metal mounting plates, or flanges) are not furnished by Trane.

For best results, all air intake boxes should be removable from outside of the building. Weep holes must be at the bottom to permit free drainage. A positive air and moisture seal should be provided around all edges.

General Instructions

Trane wallboxes are illustrated below. Each lists the wall openings required for wallboxes.

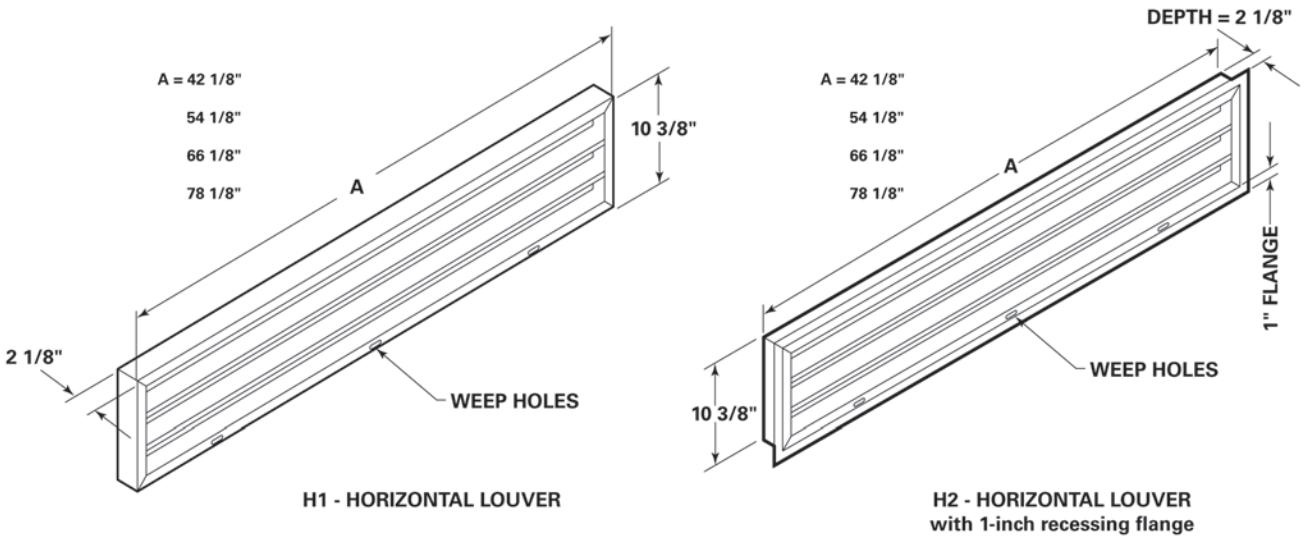
Vertical louvers in the wall intake box provide extra strength for a high load bearing capacity. The lintel may be omitted on masonry wall installations.

Weep holes are provided in the outside face of the bottom channel in the wallbox frame. Install all wallboxes to permit free drainage through the weep holes to the outside of the building.

All wallboxes are furnished with diamond pattern expanded aluminum bird screen.

Note: *H1 (horizontal) wall models are all unflanged. H2, V3, and V6 are flanged.*

Figure 74. Horizontal louver wallbox (H1 and H2) dimensions

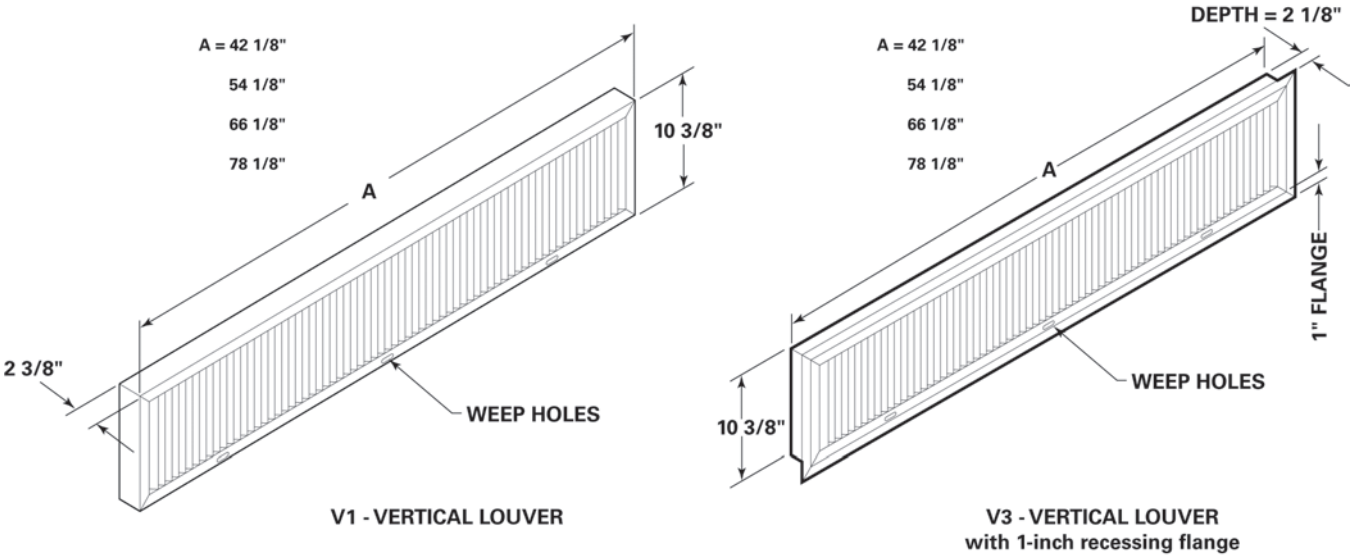


Unit Size	A	Square Feet of Free Area
075	42 1/8"	.81
100	54 1/8"	1.10
125	66 1/8"	1.39
150/200	78 1/8"	1.69

NOTE:
THE DIMENSIONS LISTED ABOVE ARE ACTUAL (NOT NOMINAL) DIMENSIONS.

THE HORIZONTAL BLADES OF THE H1 AND H2 WALL BOXES ARE SPACED 2" APART.

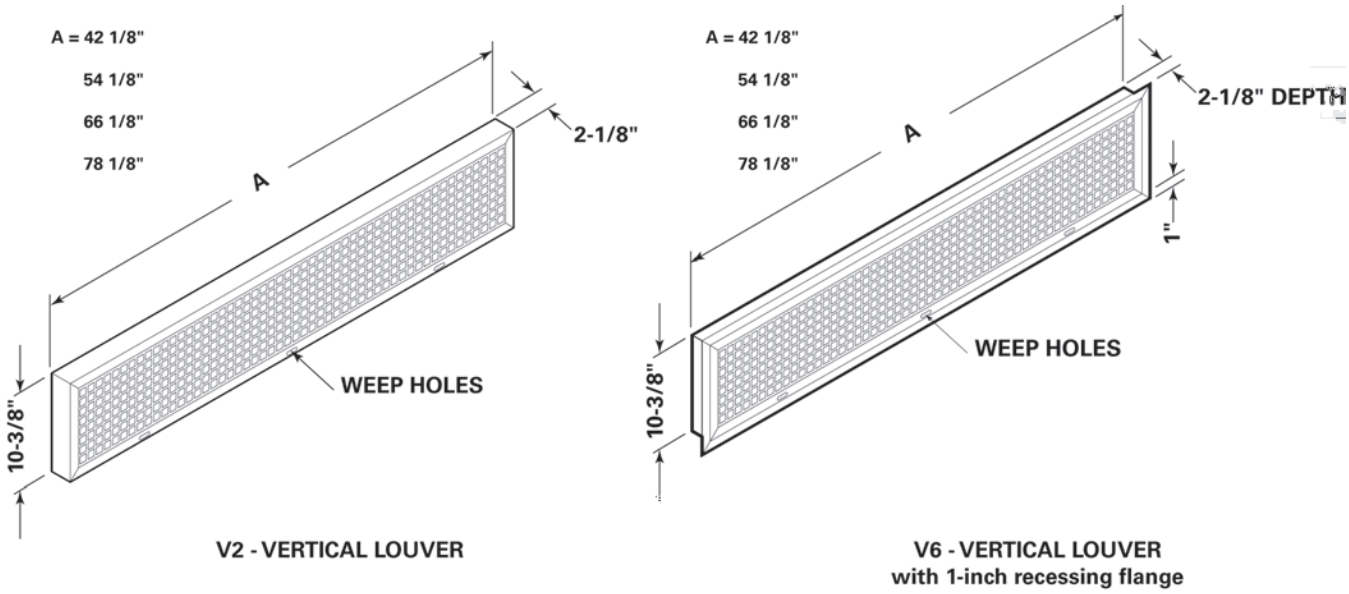
Figure 75. Vertical louver wallbox (V1, V3, V2, and V6) dimensions



Unit Size	A	Square Feet of Free Area
075	42 1/8"	1.39
100	54 1/8"	1.88
125	66 1/8"	2.37
150/200	78 1/8"	2.87

NOTE:
THE DIMENSIONS LISTED ABOVE ARE ACTUAL (NOT NOMINAL) DIMENSIONS.

THE VERTICAL BLADES OF THE V1 AND V3 WALL BOXES ARE SPACED 3/8" APART.



Unit Size	A	Square Feet of Free Area
075	42 1/8"	1.035
100	54 1/8"	1.345
125	66 1/8"	1.681
150/200	78 1/8"	1.992

NOTE:
THE DIMENSIONS LISTED ABOVE ARE ACTUAL (NOT NOMINAL) DIMENSIONS.

THE VERTICAL BLADES OF THE V2 AND V6 WALL BOXES ARE SPACED 3/8" APART.

Installation in Masonry Walls

A typical method of installing the wallbox in a masonry wall opening is illustrated below.

Grout the top and bottom of the wallbox frame as noted. A sloped water dam located in the space between the unit and wall facilitates moisture drainage. Grouting at the ends of the intake box will complete the seal between the wallbox frame and the masonry opening.

Installation in Curtain Walls

In all cases, the wall intake box should be caulked to provide a tight, weatherproof seal.

Note: *A minimum of 2-1/8 in. of clearance must be maintained between the exterior wall and back of the unit. Failure to provide this gap will not allow the wall box to fit properly.*

Figure 76. Wallbox installation in masonry wall

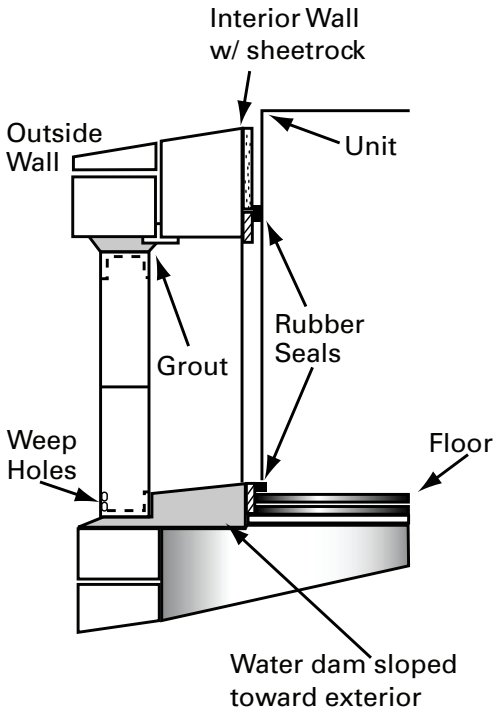
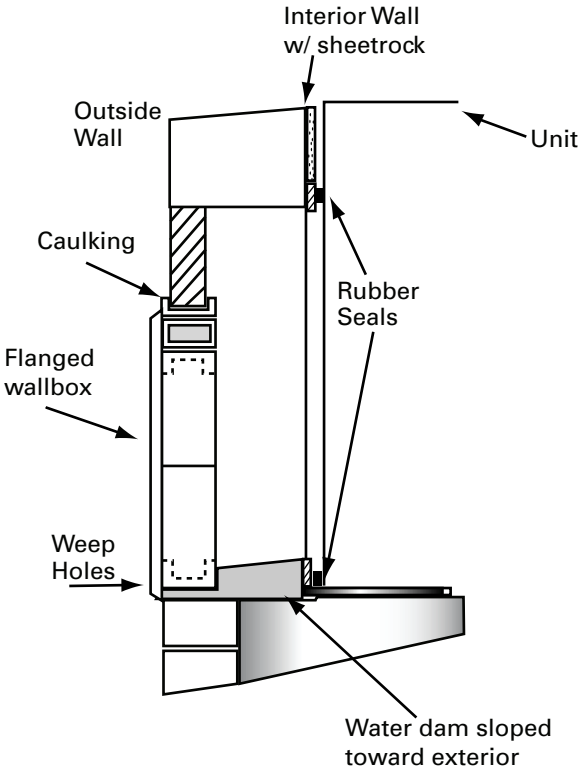


Figure 77. Flanged wallbox installation in 2-in. wall



Wiring Diagrams

Table 40. Wiring diagram matrix

Number	Description
Power	
2311-4198	Power Schematic, HUV - Symbio™ 400-B Without Electric Heat
2311-4276	Power Schematic, HUV - CSTI Without Electric Heat
4619-4482	Power Schematic, HUV - Symbio™ 400-B With Electric Heat
4619-4483	Power Schematic, HUV - CSTI With Electric Heat
Controls	
4619-3712	Controls Schematic, HUV - Symbio™ 400-B With Standard Coils
4619-3713	Controls Schematic, HUV - Symbio™ 400-BWith Isolation Valves and Face and Bypass
4619-3714	Controls Schematic, HUV - Symbio™ 400-B With DX Coils
4619-3720	Controls Schematic, HUV - CSTI With Standard Coils
4619-3721	Controls Schematic, HUV - CSTI With Isolation Valves and Face and Bypass
4619-3722	Controls Schematic, HUV - CSTI With DX Coils
4619-4499	Controls Schematic, HUV - Wall Mounted Thermostat
Zone Sensors	
2311-4274	Zone Sensors, HUV - Symbio™ 400-B
Electric Heat	
2311-4613	Electric Heat Schematic, 3PH-6EL-2STG-Factory Controls
2311-4614	Electric Heat Schematic, 1PH-3EL-2STG-Factory Controls
2311-4615	Electric Heat Schematic, 1PH-3EL-2STG-Factory Controls
2311-4616	Electric Heat Schematic, 1PH-4EL-2STG-Factory Controls
2311-4617	Electric Heat Schematic, 1PH-4EL-2STG-Factory Controls
2311-4618	Electric Heat Schematic, 1PH-4EL-2STG-Factory Controls
2311-4619	Electric Heat Schematic, 1PH-6EL-2STG-Factory Controls
2311-4620	Electric Heat Schematic, 1PH-6EL-2STG-Factory Controls
2311-4621	Electric Heat Schematic, 1PH-6EL-2STG-Factory Controls
2311-4623	Electric Heat Schematic, 3PH-3EL-2STG-Factory Controls
2311-4624	Electric Heat Schematic, 3PH-4EL-2STG-Factory Controls
2311-4625	Electric Heat Schematic, 3PH-4EL-2STG-Factory Controls
2311-4626	Electric Heat Schematic, 3PH-6EL-2STG-Factory Controls
2311-4627	Electric Heat Schematic, 3PH-3EL-2STG-Factory Controls
2311-4628	Electric Heat Schematic, 3PH-4EL-2STG-Factory Controls
2311-4629	Electric Heat Schematic, 3PH-6EL-2STG-Factory Controls
Component Layout	
2311-4560	Component Layout, HUV
Note: Wiring diagrams can be accessed using e-Library by entering the diagram number in the literature order number search field or by contacting technical support.	

Notes

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