Installation, Operation, and Maintenance

Vertical High Rise Fan Coil Units — FCV

0.75 to 3 Tons

⚠ 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.

September 2022 **UNT-SVX041F-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-including industry replacements for CFCs and HCFCs such as saturated or unsaturated HFCs and HCFCs.

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 Labeling 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.**

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Trademarks

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Revision History

- Updated Installation - Mechanical chapter fan coil unit installation information.
- Correction to Handling section in the Pre-Installation chapter.
- Correction to vertical high rise fan coil model number digit 35.

Table of Contents

Table of Contents

Model Number Description

Vertical High Rise Fan Coil

Digits 1, 2, 3 - Unit Type

FCV = Vertical High Rise Fan Coil

Digit 4 - Development Sequence

A = Development Sequence

Digits 5,6,7 - Unit Size

030 = 300 CFM
040 = 400 CFM
060 = 600 CFM
080 = 800 CFM
100 = 1000 CFM
120 = 1200 CFM

Digit 8 - Unit Voltage (Volts/Hz/Phase)

1 = 115/60/1
2 = 208/60/1
3 = 277/60/1
4 = 230/60/1

Digit 9 - Cabinet Options

A = Single Unit
B = Primary Unit
C = Secondary Unit

Digits 10, 11 - Design Sequence

** = Design Sequence

Digit 12 - Discharge

1 = Front Only
2 = Right Only
3 = Left Only
4 = Top Only
A = Front / Right
B = Front / Left
C = Right / Left

Digit 13 - Outside Air Type

0 = Plug Panel Only

Digit 14 - Discharge Grille

0 = None
1 = Single Deflection Grille Aluminum
2 = Double Deflection Grille Aluminum
3 = Single Deflection Grille White
4 = Double Deflection Grille White

Digit 15 - Return Air Panel Color

0 = No Front Panel
7 = White

Digit 16 - Return Air Panel

0 = None
A = Louvered Panel
B = Return Air Door

Digit 17 - Motor Type

A = ECM Free Discharge
B = ECM High Static
C = ECM Free Discharge Low FLA
D = ECM High Static Low FLA

Digit 18 - Main Coil/Aux Coil

A = 3 Row Cooling only
B = 4 Row Cooling only
C = 3 Row Changeover
D = 4 Row Changeover
E = 3 Row Cooling / 1 Row Reheat
F = 4 Row Cooling / 1 Row Reheat
G = 3 Row Cooling / 2 Row Reheat

Digit 19 - Drain Pan

1 = Stainless Steel
2 = PVC

Digits 20, 21, 22 - Electric Heat kW

000 = No Electric Heat
005 = 0.5 kW (208V 0.4 kW)
010 = 1 kW (208V 0.8 kW)
015 = 1.5 kW (208V 1.1 kW)
020 = 2 kW (208V 1.5 kW)
025 = 2.5 kW (208V 1.9 kW)
030 = 3 kW (208V 2.3 kW)
035 = 3.5 kW (208V 2.6 kW)
040 = 4 kW (208V 3 kW)
050 = 5 kW (208V 3.8 kW)
060 = 6 kW (208V 4.5 kW)
070 = 7 kW (208V 5.3 kW)
080 = 8 kW (208V 6 kW)
100 = 10 kW

Digit 23 - Disconnect Switch

0 = None
D = Disconnect Switch

Digit 24 - Filter Type

0 = No Filter
1 = 1-in. Throw Away or MERV 2 Filter
2 = 1-in. MERV 8 Filter
3 = 1-in. Throw Away Filter Plus 1 Extra
4 = 1-in. MERV 8 Filter Plus 1 Extra

Digit 25 - Main Control Valve Type

A = 2-Way 2-Position N.C. Valve
B = 2-Way 2-Position N.O. Valve
C = 3-Way 2-Position N.C. Valve
D = 3-Way 2-Position N.O. Valve
E = 2-Way Modulating
F = 3-Way Modulating
G = 2-Way Analog (2-10 VDC)
H = 3-Way Analog (2-10 VDC)

Digit 26 - Main Control Valve Cv

A = 2-Way 1.4 Cv
B = 2-Way 2.4 Cv
C = 2-Way 3.4 Cv
D = 3-Way 1.0 Cv
E = 3-Way 2.7 Cv
F = 3-Way 4.6 Cv

Digit 27 - Auxiliary Control Valve Type

0 = None
A = 2-Way 2-Position N.C. Valve
B = 2-Way 2-Position N.O. Valve
C = 3-Way 2-Position N.C. Valve
D = 3-Way 2-Position N.O. Valve
E = 2-Way Modulating
F = 3-Way Modulating
G = 2-Way Analog (2-10 VDC)
H = 3-Way Analog (2-10 VDC)

Digit 28 - Auxiliary Control Valve Cv

0 = None
A = 2-Way 1.4 Cv
B = 2-Way 2.4 Cv
C = 2-Way 3.4 Cv
D = 3-Way 1.0 Cv
E = 3-Way 2.7 Cv
F = 3-Way 4.6 Cv

Digit 29 - Piping Package

1 = Basic with Circuit Setter
3 = Deluxe with Circuit Setter
4 = Deluxe with Auto Flow

Digit 30 - Main Autoflow GPM

0 = None
A = 0.50 GPM
B = 0.75 GPM
C = 1.0 GPM
D = 1.5 GPM
E = 2.0 GPM
F = 2.5 GPM
G = 3.0 GPM
H = 3.5 GPM
J = 4.0 GPM
K = 4.5 GPM
L = 5.0 GPM
M = 6.0 GPM
N = 7.0 GPM
P = 8.0 GPM

Digit 31 - Auxiliary Autoflow GPM

0 = None
A = 0.50 GPM
B = 0.75 GPM
C = 1.0 GPM
D = 1.5 GPM
E = 2.0 GPM
F = 2.5 GPM
G = 3.0 GPM
H = 3.5 GPM
J = 4.0 GPM
K = 4.5 GPM
L = 5.0 GPM
M = 6.0 GPM
N = 7.0 GPM
P = 8.0 GPM

Digit 32 - Control Type

1 = CSTI
2 = CSTI with Fan Status
3 = UC400-B
4 = UC400-B with Air-Fi® WCI

Model Number Description

Digit 33 - Control Options

0 = None
A = Setpoint Dial Zone Sensor (3-in. pigtail)
B = Set Point Dial Zone Sensor with Comm (3-in. pigtail)
C = Setpoint Dial, On/Cancel with Comm (3-in. pigtail)
D = Digital Zone Sensor (3-in. pigtail)
E = Telkonet® (3-in. pigtail)
H = Setpoint Dial Zone Sensor (12-in. pigtail)
J = Set Point Dial Zone Sensor with Comm (12-in. pigtail)
K = Setpoint Dial, On/Cancel with Comm (12-in. pigtail)
L = Digital Zone Sensor (12-in. pigtail)
M = Telkonet® (12-in. pigtail)
Q = Air-Fi® Wireless Digital Display Sensor

Digit 34 - IAQ Options

0 = None
1 = Dehumidification
3 = Dehumidification with Sensor
5 = Air-Fi® Dehumidification

Digit 35 - Control Function 1

0 = None
1 = Condensate Overflow Detection

Digit 36 - Copper Riser Type

0 = No Risers / Ship Separate Riser
M = Type M Copper
L = Type L Copper

Digit 37 - Main Riser Insulation

0 = No Insulation / Ship Separate Riser
2 = 3/4-in. Closed Cell
4 = 1-in. Closed Cell

Digit 38 - DIA, Main Supply Riser

0 = No Main Risers / Ship Separate Riser
A = 0.75-in. Main Risers
B = 1.00-in. Main Risers
C = 1.25-in. Main Risers
D = 1.50-in. Main Risers
E = 2.00-in. Main Risers
F = 2.50-in. Main Risers

Digit 39 - DIA, Main Return Riser

0 = No Main Risers / Ship Separate Riser
A = 0.75-in. Main Risers
B = 1.00-in. Main Risers
C = 1.25-in. Main Risers
D = 1.50-in. Main Risers
E = 2.00-in. Main Risers
F = 2.50-in. Main Risers

Digit 40 - Auxiliary Riser Insulation

0 = No Insulation / Ship Separate Riser
2 = 3/4-in. Closed Cell
4 = 1-in. Closed Cell

Digit 41 - DIA, Auxiliary Supply Riser

0 = No Auxiliary Risers / Ship Separate Riser
A = 0.75-in. Auxiliary Risers
B = 1.00-in. Auxiliary Risers
C = 1.25-in. Auxiliary Risers
D = 1.50-in. Auxiliary Risers
E = 2.00-in. Auxiliary Risers
F = 2.50-in. Auxiliary Risers

Digit 42 - DIA, Auxiliary Return Riser

0 = No Auxiliary Risers / Ship Separate Riser
A = 0.75-in. Auxiliary Risers
B = 1.00-in. Auxiliary Risers
C = 1.25-in. Auxiliary Risers
D = 1.50-in. Auxiliary Risers
E = 2.00-in. Auxiliary Risers
F = 2.50-in. Auxiliary Risers

Digit 43 - DIA, Drain/Condensate Riser

0 = No Drain Riser / Ship Separate Riser
1 = 0.75-in. Type M Copper with 3/8-in. Insulation
2 = 1.25-in. Type M Copper with 3/8-in. Insulation

Digit 44 - Riser Location

0 = No Risers / Ship Separate Riser
1 = Left Riser Location
2 = Right Riser Location
3 = Back Riser Location

Digit 45 - Length of All Risers

0 = 0-in. (No Risers) / Ship Separate Riser
A = 100-in.
B = 101-in.
C = 102-in.
D = 103-in.
E = 104-in.
F = 105-in.
G = 106-in.
H = 107-in.
J = 108-in.
K = 109-in.
L = 110-in.
M = 111-in.
N = 112-in.
P = 113-in.
Q = 114-in.
R = 115-in.
S = 116-in.
T = 117-in.
U = 118-in.
V = 119-in.
W = 120-in.

Digit 46 - Unit Insulation Type

1 = 1/2-in. Matte-faced Insulation
2 = 1/2-in. Foil-faced Insulation

High Rise Fan Coil Accessories

Digit 1 - Cabinet Options

A = Single Unit
B = Primary Unit

Digit 2 - Copper Riser Type

M = Type M Copper
L = Type L Copper

Digit 3 - Main Riser Insulation

0 = No Insulation
2 = 3/4-in. Closed Cell
3 = 1-in. Closed Cell
4 = 1.5-in. Closed Cell

Digit 4 - Development Sequence

A = Development Sequence

Digit 5 - DIA, Main Supply Riser

0 = No Main Riser
A = 0.75-in. Main Risers
B = 1.00-in. Main Risers
C = 1.25-in. Main Risers
D = 1.50-in. Main Risers
E = 2.00-in. Main Risers
F = 2.50-in. Main Risers

Digit 6 - DIA, Main Return Riser

0 = No Main Riser
A = 0.75-in. Main Risers
B = 1.00-in. Main Risers
C = 1.25-in. Main Risers
D = 1.50-in. Main Risers
E = 2.00-in. Main Risers
F = 2.50-in. Main Risers

Digit 7 - Auxiliary Riser Insulation

0 = No Insulation
2 = 3/4-in. Closed Cell
4 = 1-in. Closed Cell
5 = 1.5-in. Closed Cell

Digit 8 - DIA, Auxiliary Supply Riser

0 = No Auxiliary Riser
A = 0.75-in. Auxiliary Risers
B = 1.00-in. Auxiliary Risers
C = 1.25-in. Auxiliary Risers
D = 1.50-in. Auxiliary Risers
E = 2.00-in. Auxiliary Risers
F = 2.50-in. Auxiliary Risers

Digit 9 - DIA, Auxiliary Return Riser

0 = No Auxiliary Riser
A = 0.75-in. Auxiliary Risers
B = 1.00-in. Auxiliary Risers
C = 1.25-in. Auxiliary Risers
D = 1.50-in. Auxiliary Risers
E = 2.00-in. Auxiliary Risers
F = 2.50-in. Auxiliary Risers

Digits 10, 11 - Design Sequence

** = Design Sequence
4 = 1-in. Closed Cell

Digit 12 - DIA, Drain/Condensate Riser

0 = No Drain Riser
1 = 0.75-in. Type M Copper with 3/8-in. Insulation
2 = 1.25-in. Type M Copper with 3/8-in. Insulation

Digit 13 - Length of All Risers

A = 100-in.
B = 101-in.
C = 102-in.
D = 103-in.
E = 104-in.
F = 105-in.
G = 106-in.
H = 107-in.
J = 108-in.
K = 109-in.
L = 110-in.
M = 111-in.
N = 112-in.
P = 113-in.
Q = 114-in.
R = 115-in.
S = 116-in.
T = 117-in.
U = 118-in.
V = 119-in.
W = 120-in.

Pre-Installation

Receiving and Handling

Inspection

Upon delivery, thoroughly inspect all components for any shipping damage that may have occurred, and confirm that the shipment is complete. See Receiving Checklist section for detailed instructions.

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

Packaging/Shipping

Fan coil units are typically shipped one to two units to a pallet. All units on the same pallet are typically installed on the same floor, but some pallets may contain units for multiple floors.

Smaller components may be shipped separately, or shipped inside the unit.

Identification

Each unit is tagged according to the customer's submittal. A label, pasted on the panel that shields the motor/blower, shows the information the customer specified for the tag. Customer should include floor and/or riser number when ordering the unit. This allows the unit to be taken directly to the assigned space for immediate installation.

Handling

Avoid dropping or jarring the unit during off-loading and moving the unit into position. Damage to the riser pipe(s), insulation, or connections resulting from improper handling is not covered under the manufacturer's limited warranty.

Receiving Checklist

Complete the following checklist immediately after receiving shipment to detect possible shipping damage.

- ☐ Check to ensure that the shipment is complete. Small components may ship inside the unit or ship separately. Check the parts list to ensure all materials are present.
- ☐ Check all units, components, connections, and piping. Check fan wheel for free rotation by spinning manually. Check all doors, latches and hinges. Inspect interior of each unit or section. Inspect coils for damage to fin surface and coil connections. Check for rattles, bent corners, or other visible indications of shipping damage. Tighten loose connections.
- ☐ If a unit is damaged, make specific notations concerning the damage on the freight bill. Do not refuse delivery.
- ☐ Notify the carrier's terminal of the damage immediately by phone and mail. Request an immediate joint inspection of the damage by the carrier and consignee.
- ☐ Notify your Trane sales representative of the damage and arrange for repair. Do not attempt to repair the unit without consulting the Trane representative.
- ☐ Inspect the unit for concealed damage as soon as possible after delivery. Report concealed damage to the freight line. It is the receiver's responsibility to provide reasonable evidence that concealed damage did not occur after delivery. Take photos of damaged material if possible.

  Note: *Concealed damage must be reported within 15 days of receipt.*

Jobsite Storage

This unit is intended for indoor use only. It is the sole responsibility of the customer to provide the necessary protection to prevent vandalism and weather protection of the equipment. Under no circumstance should the unit be left unprotected from the elements.

Note: *There have been instances of units being stood upright, unsecured on the edge of a building and being blown off the building during a windstorm.*

Site Preparation

Attention should be paid to the height of drywall which encapsulates ductwork in a bulkhead. Note the height of the side supply air opening shown in the submittals and ensure that the drywall does not interfere with the side wall grille. Make allowance for the one-inch flange around the grille.

Wall sleeves are not included, which might be needed to bridge a gap between the grille collar on the unit and the drywall surface. Also, floor sleeves, extension sleeves through shear walls, and extension of thermostat speed switch wiring through shear walls are not included.

It is important to accurately locate the floor sleeve relative to the fan coil and the drywall. If a wall sleeve is used because the unit is incorrectly located back from the face of the drywall, a problem with access for servicing can arise if the sleeve depth is too long (over four inches). Additionally, issues may arise with air bypass. Ensure proper installation to avoid this. Also note that the louver return air panel of the type which attaches with quarter-turn fasteners cannot be used with a sleeve and ½-inch drywall must be attached directly to the front of the unit.

Contractor's Responsibilities

Unless otherwise requested by the customer at the time of shop drawing approval, the cabinet insulation is cut for supply air openings.

Use solder to connect the risers. Do not use Silfos (brazing) as this will cause the pipe to overheat and the insulation to be damaged.

NOTICE

Equipment Damage!

Failure to follow instructions below could result in distortion of equipment.

Ensure the horizontal run-out from each riser is centered in the cabinet slot and at 90 degrees as it enters the cabinet prior to soldering the risers.

Ensure that the horizontal run-out from each riser is centered in the slot in the cabinet and that the run-out from the riser is at 90 degrees as it enters the cabinet, prior to soldering the risers. Anchoring the risers to the floor slabs is the responsibility of the contractor. Shim the unit plumb.

It is not necessary to use a pad under the unit. Fire stopping the floor opening and making good the riser insulation at the floor opening is the responsibility of the contractor.

NOTICE

Improper Operation!

Failure to follow instructions below could result in improper operation of equipment.

Ensure the drain hose is not kinked before soldering the riser.If risers have expansion compensation loops, remove support brackets after anchoring risers.

Check that the drain hose is not kinked before soldering the condensate riser. If the expansion compensation loops were added to the risers, remove the support brackets after anchoring the risers.

The fan coil unit has a threaded connection at the shut off valves. These connections must be tightened prior to pressure testing the system by the contractor as part of the installation procedure. Mechanical fittings can loosen during transportation and handling.

The coil is leak and proof tested at the factory.

NOTICE

Coil Freeze-up!

Failure to follow instructions below could result in coil damage. After testing on site with water, the fan coil unit must not be exposed to temperatures at or below freezing. The interior of the unit must be vacuumed clean before the unit is started up. This includes drain pan and the fan motor windings.

Two-way Control Valves

When two way valves are used, pump and chiller bypass or pump speed control must be included in the system. This is necessary to ensure that the close-off pressure rating of the valve is not exceeded. The maximum close-off pressure rating is given in the submittals.

Accessories

Do not install grilles or thermostats until after the walls have been painted. Caution the painter against spraying over the labels on the front cover of the unit.

Dimensions and Weights

Vertical High Rise Fan Coil Units

Top Discharge Units

Figure 1. Top discharge (short) unit

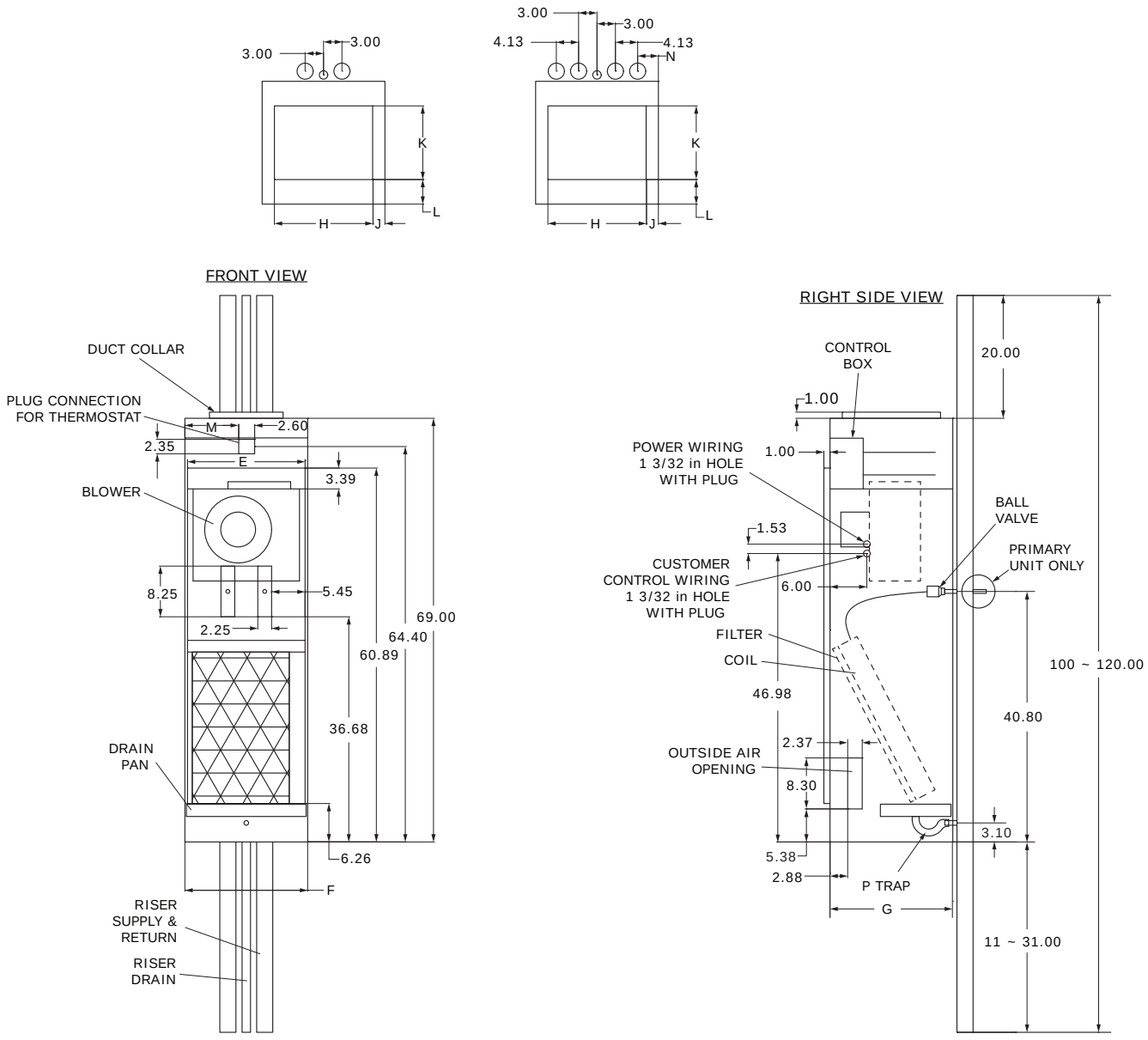


Figure 2. Front and side discharge unit

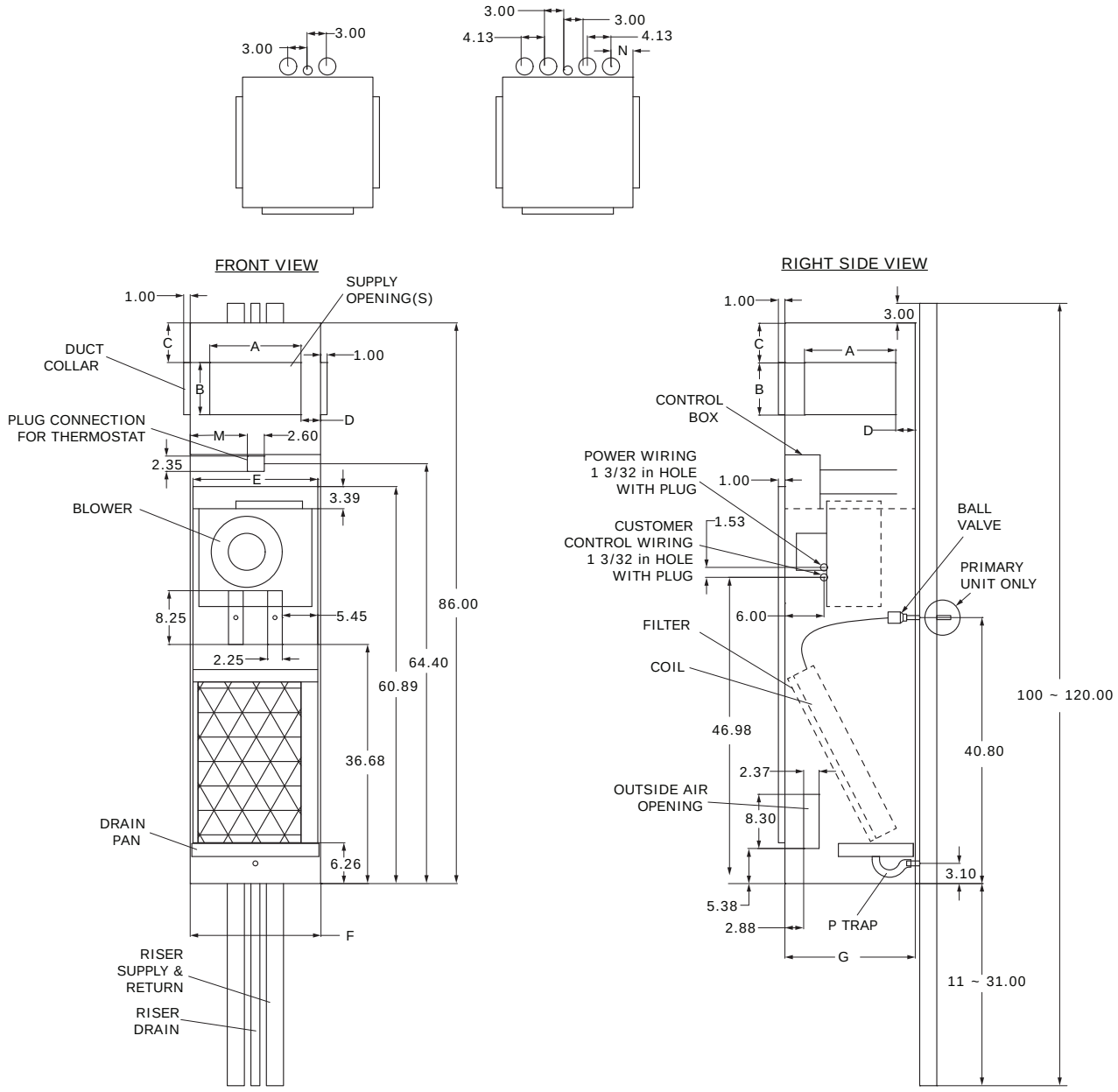


Table 1. Basic dimensions

Unit Size	Width (F) (in.)	Depth (G) (in.)	Height (in.)	Top Discharge Height (in.)
300	17	17	86	69
400	17	17	86	69
600	20	20	86	69
800	20	20	86	69
1000	24	24	86	69
1200	24	24	86	69

Table 2. Full dimensions

Size	Single Supply				Double Supply				Top Supply				E	F	G	M	N
	A	B	C	D	A	B	C	D	A	B	C	D					
300	14	8	5	1.5	14	6	6	1.5	14	10	3.5	1.5	16.15	17	17	7	1.88
400	14	12	3	1.5	14	6	6	1.5	14	10	3.5	1.5	16.15	17	17	7	1.88
600	17	13	3	1.5	17	7	6	1.5	16	12	4	2	19.15	20	20	8.5	3.38
800	17	13	3	1.5	17	7	6	1.5	16	12	4	2	19.15	20	20	8.5	3.38
1000	--	--	--	--	20	11	4	2	18	18	3	3	23.15	24	24	10.5	5.38
1200	--	--	--	--	20	11	4	2	18	18	3	3	23.15	24	24	10.5	5.38

Units Without Risers

Figure 3. Units without risers

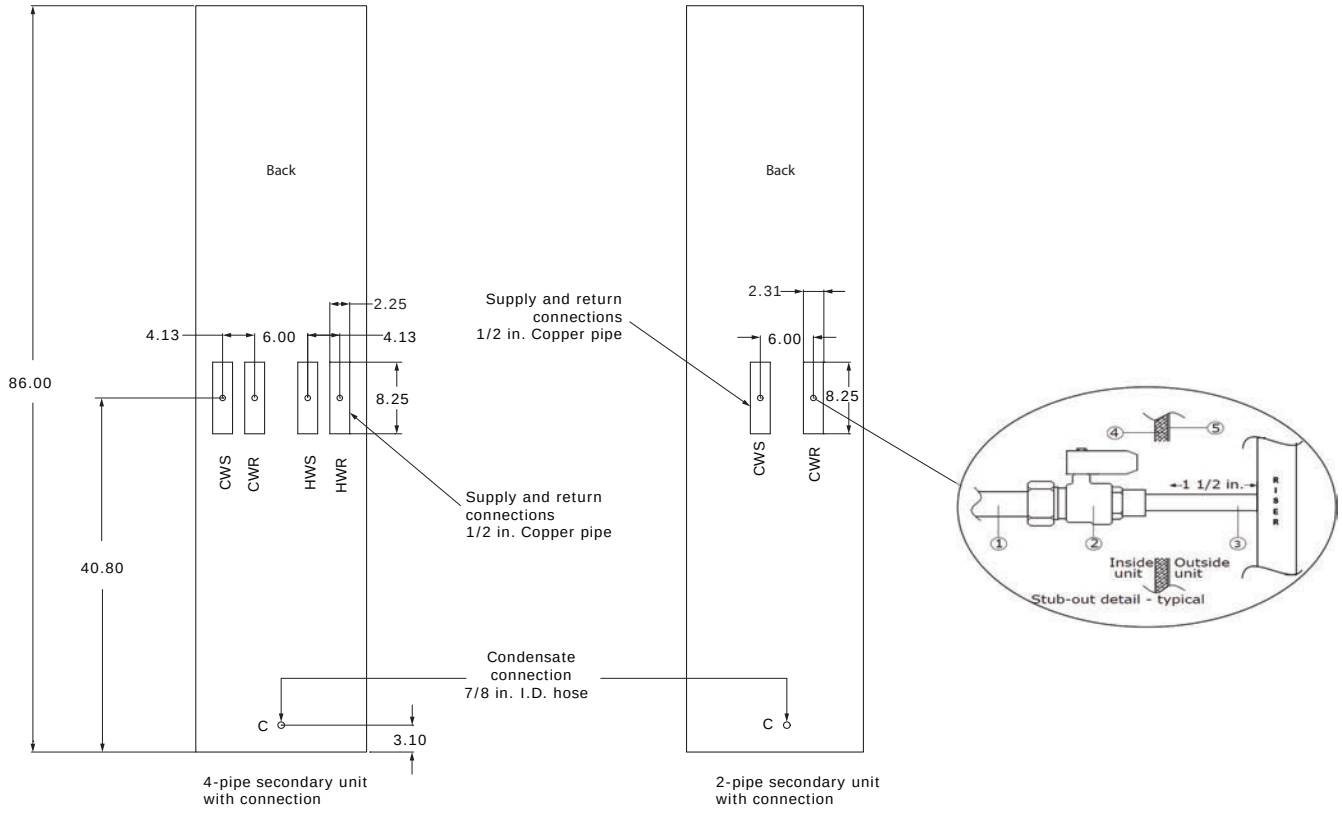


Table 3. Units without risers - 2-pipe and 4-pipe secondary units callouts

1	1/2-inch supply and return coil branch stainless steel braided hose
2	Ball valve (shut-off valve) with threaded connection
3	1/2-inch or 3/4-inch copper tail piece soldered into valve body at factory
4	Insulation lining on interior surface of fan coil cabinet
5	Fan coil cabinet

Fan Coil Weights

Table 4. Weights for fan coil units

Size	Weight
300	120
400	120
600	150
800	150
1000	190
1200	190

The weights are approximate. Risers, external sheet metal accessories and supply air grilles are not included in the weight.

Installation - Mechanical

Installation of the fan coil units should begin on the lowest floor and progress upward—floor-by-floor—to the top. Tip the unit over the riser hole in the building floor. As the unit is righted, align the risers with the unit below. Field-furnished isolator pads or shims, if required, should be positioned beneath the unit at this time.

Unit Handings

All unit handings for pipe connections and supply air grilles are described relative to the front of the unit, where the front of the unit is defined as the side where the return air/access panel is located.

Positioning and Fastening

Wide variations in floor-to-floor dimensions may necessitate cutting off or extending individual risers. Such modifications are the full responsibility of the installing contractor.

NOTICE

Equipment Damage!

Failure to allow for expansion and contraction could cause water leaks and result in equipment damage. Do not rigidly fasten the risers to the unit. Risers must be free to move within the pipe chase with normal vertical expansion and contraction movements.

Supplied with each riser is a 3-inch swaged portion on the top and sufficient extension at the bottom for an inserted length of approximately 2 inches. This unit-to-unit joint is not intended for full bottoming in the joint. This allows for variations in floor-to-floor dimensions and for correct riser positioning.

Some applications require that the risers be supplemented with “between-the-floor” extensions. These pieces should be assembled into position at this time. “Between-the-floor” extensions are field supplied.

Once the units are positioned, with the risers centered in the pipe chase, each unit should be positioned perfectly vertical (plumb) in two planes and anchored to the building structure.

NOTICE

Coil Damage!

Failure to follow instructions below could result in equipment damage. Condensate must flow freely from the coil at all times to prevent coil damage from water hammer, unequal thermal stresses, freeze-up and/or corrosion.

NOTICE

Equipment Damage!

Failure to follow instructions below could result in distortion of equipment. Ensure the horizontal run-out from each riser is centered in the cabinet slot and at 90 degrees as it enters the cabinet prior to soldering the risers.

It is imperative that the unit be properly leveled to assure condensate drainage and proper coil operation. Once all units are anchored, unit-to-unit riser joints may be made as follows:

- Each branch run-out in the coil section must be centered, in the expansion slot, on the side or back panel, before joining riser.
- Each riser joint must be vertically aligned, with a minimum 1-inch penetration (although 2 inches is preferable and allowed for), into each swaged joint. This condition will be met if floor-to-floor dimensions are as specified and each branch run out is properly centered. Riser joints must be made with phos-copper, silfos, or other high-temperature alloys. Soft solders (50-50, 60-40, and 85-15) or other low-temperature lead alloys are ***NOT*** suitable for this application.

Flushing and Testing

NOTICE

Excessive Pressure!

Do not exceed 300 psig, or that which the supplied components were designed. Sustained pressures in excess of 300 psig could cause leaks and result in equipment damage.

NOTICE

Equipment Damage!

Failure to follow these instructions could result in equipment damage. All field-supplied and installed riser insulation must have a vapor barrier cover or be closed-cell foam insulation. Properly seal all joints (with tape or glue) so no air can pass through to the cold riser pipe.

- If selected, the fan coil is equipped with ball valve type shutoff valves. Refer UNT-PRC028*-EN to confirm if valves are to be factory or field supplied.
- After checking mechanical fittings inside the unit for tightness, it is recommended that the units on each riser stack are pressure tested using compressed air. Check for audible air leaks.
- Close the ball valves and flush the riser system.
- Open the supply side ball valve and bleed air from the coils. The coil has a manual air vent for this purpose. The top of

each riser should also have an air vent (not provided by the factory).

- Test the units and risers hydrostatically. Open the return side ball valve after testing.
- Check that the strainer mesh is not choked, if there are strainers included with the unit.

Enclosing the Unit

⚠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. Verify with a CAT III or IV voltmeter rated per NFPA 70E that all capacitors have discharged.

The units are provided with piping support brackets which are used to secure and protect the piping package from vibration and damage during transit and handling.

Field-provide and install approved fire-stop material, after the units are installed, at points where piping penetrates the one-hour fire wall, ceiling and floor. The fire-stop is necessary on:

- Single unit at the ceiling and floor
- Primary unit at the floor, ceiling and where the piping penetrates an adjacent wall
- Secondary unit where the piping penetrates the wall

Applicable local installation codes may limit this unit to installation only in single-story residences.

The unit is suitable for 0-inch clearance to combustible materials.

Framing

Frame the unit using metal studs**.** The flange around the return air/access opening is one inch deep. It is preferable that the stud does not touch the fan coil cabinet so that any slight vibration which may exist is not transferred to the stud.

Before installing the thermostat and grilles, the walls must be painted. Instruct the painter not to spray over the labels on the unit. After installation, dust must be vacuumed from the coil surfaces, the drain pan, the motor windings and the cabinet insulation.

Drywall Installation

NOTICE

Equipment Damage!

Failure to follow these instructions could result in equipment damage. Do not install sheet metal screws or nails where they could puncture the coil, riser pipes, electrical junction box, control box, drain pan or raceways. Use care when installing screws near the control box and drain pan to avoid equipment damage. Do not attach drywall material to either the control box enclosure or the drain pain edges.

NOTICE

Equipment Damage!

Failure to follow these instructions could result in equipment damage. Do not apply sheet-metal screws or nails where they are subject to penetrating the coil, riser pipes, electrical junction box, and raceways. Extreme care is necessary when driving screws in the vicinity of the control box to prevent electrical shorts when power is applied to the unit. Use care when driving screws in the vicinity of the drain pan to prevent condensate pan leaks. Drywall material should not be screwed to either the control-box enclosure or the drain pan edges.

The fan coil unit has a cabinet designed to be concealed in a field-furnished drywall enclosure.

Direct Application

The louver return air panel which has quarter turn fasteners may be used. It is designed to fit the 1-inch drywall flange around the return air / access opening on the unit.

Use drywall screws no longer than 1 ¼ inch and follow the instructions on the page in the submittals which shows where the screws can be located to avoid damaging internal components. When using the panel which has quarter turn fasteners the drywall **must** be attached to the front. The sides and back can be framed.

Ducted Units

Attach the supply air duct to the open front/side/top.

Note: *1 inch supply air duct flanges are provided by the factory for front or side supply air.*

Close Up

After drywall is in place and rooms are prepared for final wall treatment, the supply and return-air openings and control compartment opening should be securely covered to prevent introduction of foreign material. If the wall texture and/or color are to be spray applied, it is imperative that none of the over spray contact the coil, fan or other unit parts.

NOTICE

Complete Enclosure Required!

Do not operate unit at any time without a complete enclosure, supply grille, return-air panel, and filter in place. Operation in any other condition could result in motor overload or burnout, clogging of the coil surface, motor ventilation openings, fan blades, or all of the preceding. Warranties are void if paint or foreign materials of any kind are present on coil, fan, piping, wiring, or other internal components.

Before installation of the return air panel, the following steps should be taken:

1. Rotate the fan wheel by hand to ensure that it is free and does not rub the housing. Handling during shipment may have caused the wheel to shift. Adjust if necessary.
2. Verify that the service valves are open and that the motorized control valve, if supplied, is set for automatic operation, if of such type.
3. Vent all air from the coil and related piping.
4. Check the drain line to see that it is not clogged and that it is properly secured and positioned in a downward pitch.
5. If the unit is equipped with a circuit setter valve in the return line, the proper flow through the coil should be set at this time.

Supply Air Grille Installation

The grille is a snap-in fit into the collar on the unit. The supply air grilles can be manually adjusted.

Louver Return Air Panel

1. The louver return air panel will ship with fasteners installed.
2. Hook the panel over the bottom collar of the fan coil unit, rotate the panel upright so that it is against the wall and turn the head of the fastener to the locked position.

Note: *This type of return air panel requires a 1-inch deep collar on the front of the fan coil unit. Drywall must be attached directly to the front of the unit when using this panel.*

Figure 4. Louver return air panel with quarter turn fasteners

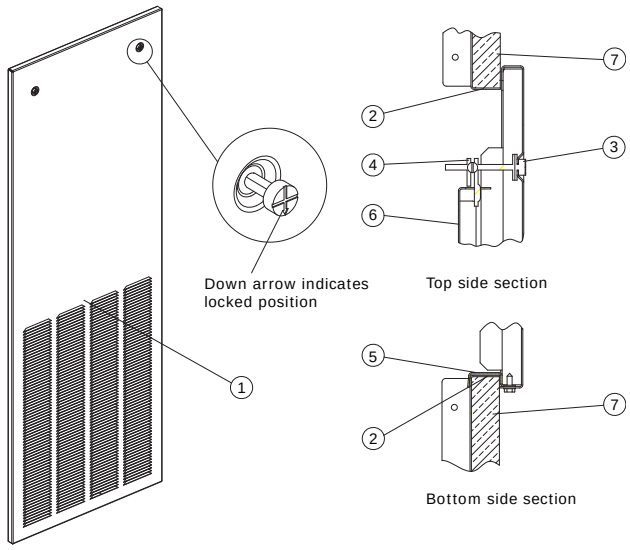


Table 5. Louver return air panel with quarter turn fasteners callouts

1	Louver return air panel with quarter turn fastener
2	1 inch deep collar around return air opening on fan coil unit
3	1/4 turn fastener with slotted head and square shaft
4	Latch of 1/4 turn fastener
5	Bottom hook of louver return air panel
6	Cover on fan coil unit
7	1 inch drywall

Table 6. Nominal louver panel size

Size	Louver panel size (inches)
300, 400	17 x 56
600, 800	20 x 56
1000, 1200	24 x 56

Return Air Panel (Perimeter Return Air Panel) with Cover

1. If the drywall has not been installed flush with the outer edge of the collar on the unit and if the gap between the inner surface of the drywall and the outer edge of the collar exceeds one-half inch, the opening will have to be sleeved (not provided by the factory).
2. The covers are shipped with the unit. Remove the control box and fan cover from the unit. Insert the return air panel and install six sheet metal screws as shown in Figure 5. Do not over-tighten the screws as this might distort the door frame.
3. Insert the fan cover into the frame of the return air door with 45 degree flanges and then secure it by fitting sheet metal screws in the frame.
4. Mount the control box cover in the same way as the motor cover.

Note: *This type of return air door requires a 1 inch deep collar on the front of the fan coil unit. Drywall can be attached directly to the front of the unit after mounting this door.*

Figure 5. Return air panel - framed out drywall

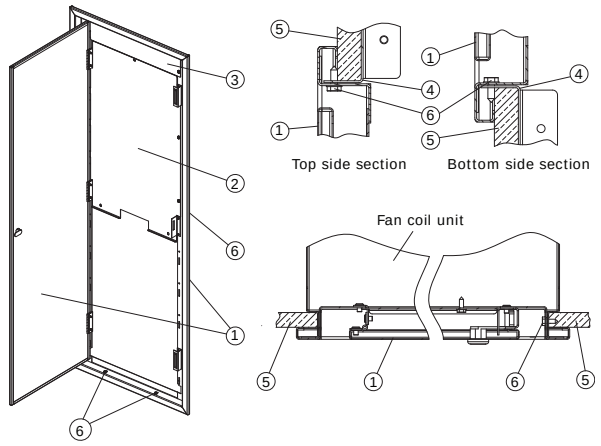


Table 7. Return air panel - framed out drywall callouts

1	Return air door
2	Fan cover for air blockoff
3	Control box cover for air blockoff
4	1 inch deep collar around return air opening on fan coil unit
5	1 inch drywall
6	Screw

Table 8. Nominal return air door size

Size	Door size (inches)
300, 400	18 x 56
600. 800	21 x 56
1000, 1200	25 x 56

Thermostat Installation

Unit mounted thermostat

Connect the wires from the thermostat to the wire harness inside the electrical box using the plug provided or by connecting directly to the terminal strip on the CSTI board. Mount the thermostat to the drywall using a standard mud flap or control box.

Remote mounted thermostat

Run low voltage wires from the 24V thermostat on the wall back to the thermostat plug inside the unit. Ensure that the guidelines described in the “Power Connection,” section on page 27 are followed when installing thermostats.

Unit Installation Sequence

Fan Coil Unit Installation

1. The rectangular opening is made in the floor slab, usually sleeved before pouring the floor. If not formed during the pour, then core drilling may be necessary. It may be necessary to x-ray the slab to avoid rebar.

NOTICE

Equipment Damage!

Failure to follow instructions below could result in equipment damage. Ensure the horizontal run-out from each riser is centered in the cabinet slot and at 90 degrees as it enters the cabinet prior to soldering the risers.

2. Install risers using the dimensions in the submittal for locating the riser stubs vertically and at the correct horizontal center lines. Anchor the risers and make good the insulation. Fit fire-stop into the opening in the floor slab. The risers can be pressure tested at this stage.
3. Riser anchoring is required for two main purposes. The risers are anchored to the floor slab at one or more points in the height of the building so that they do not slip down under gravity. The second reason is to spread the expansion in opposite directions from the anchor point. If there are expansion loops included in the riser, the anchor point will be at the mid point between two sets of loops. For example, in a 30-story building, typically there will be expansion loops on floors 10 and 20, with anchors on floors 5, 15, and 25. After anchoring, the risers are in effect attached to the building structure so it does not matter if the plastic straps holding the risers to the unit break off after installation.
4. Bring the fan coil into the room using a two-wheeled hand truck. Remove and discard the temporary branch loop support bracket. Push the fan coil into position so that the riser stubs and ball valves penetrate the back or side of the fan coil. Attach the stainless steel braided hose to the piping package and to the riser shut off valve. Cut the P-trap to the below size. Attach the flexible drain hose to the condensate stub. Shim the unit so that it is vertical.

5. If a riser expansion loop is required, add it in the field.
6. Make good the riser insulation between floors.
7. Fire stop the floor opening in accordance with code.

Figure 6. P-trap size

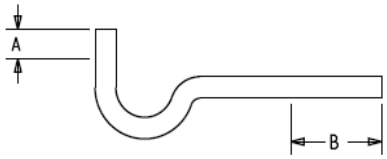


Table 9. P-trap size when installed on back of unit

Cutoff Dimension	A	B
Size 3.04	2.20-in.	8.50-in.
Size 6.08	2.20-in.	8.50-in.
Size 10.12	2.20-in.	2.00-in.

Table 10. P-trap size when installed on side of unit

Cutoff Dimension	A	B
Size 3.04	2.20-in.	5.90-in.
Size 6.08	2.20-in.	4.00-in.
Size 10.12	2.20-in.	2.00-in.

Figure 7. Fan coil installation

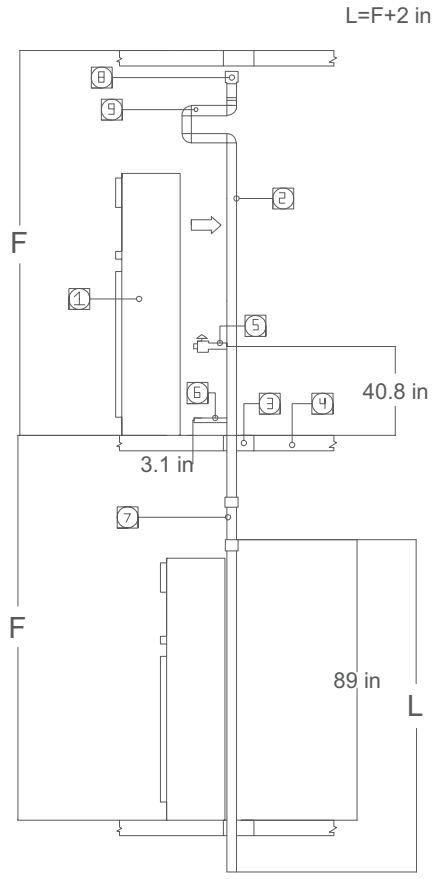


Table 11. Fan coil installation

1	Fan coil unit
2	Riser
3	Rectangular opening in case floor slab
4	Floor slab
5	Supply and return riser stubs with ball valves with threaded connection
6	Condensate riser stub
7	Field supplied spool piece (if required)
8	Top of riser pipe expanded. Two-inch insertion of pipe from above.
9	Riser expansion loop (field supplied)

Notes:

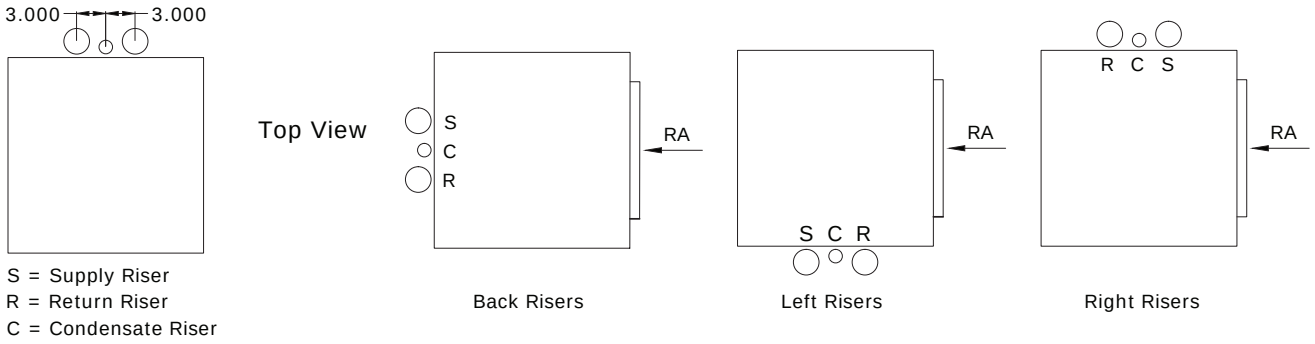
- *If dimension "F" exceeds nine feet, spool pieces between floors are required, field installed.*
- *Firestopping in the floor opening is by the contractor.*

Primary/Secondary Unit

1. Install primary unit and attach risers.
2. Solder field supplied extension piece or crossover piece to align with secondary unit.
3. Solder ball valve from secondary unit onto stub-out for primary unit or on to the extension piece.
4. Slide secondary unit into place over top of ball valve.
5. Connect the stainless steel braided hose to the piping package and the riser shut off valve.
6. Make condensate connection.
7. Cut P-trap to size.
8. Make condensate connection.

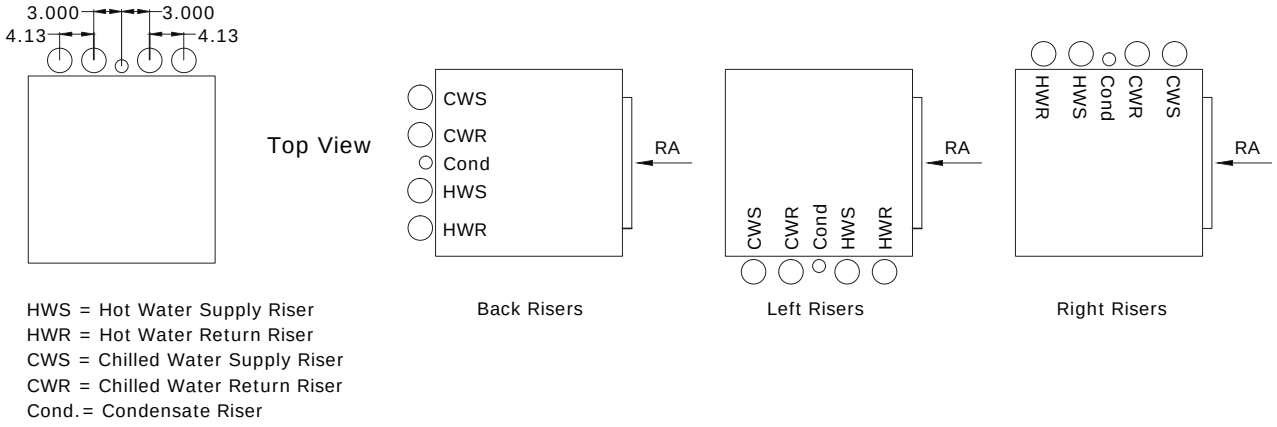
Riser Packages

Figure 8. Riser 2-pipe package



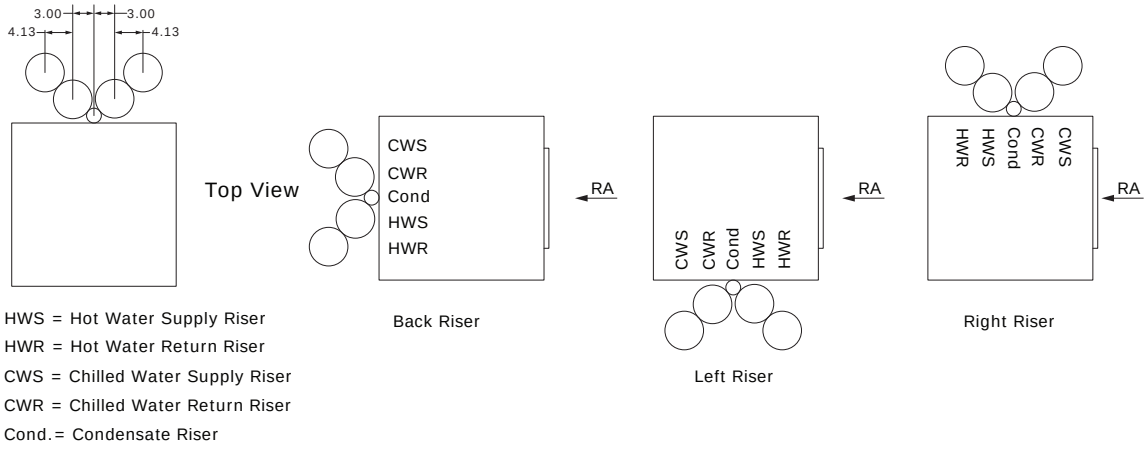
Note: *Distances provided in figures can vary based on riser selection. Refer to Table 12, p. 22 for information.*

Figure 9. Riser 4-pipe package



Note: *Distances provided in figures can vary based on riser selection. Refer to Table 12, p. 22 for information.*

Figure 10. Recommended installation layout for risers with thicker diameter/insulation



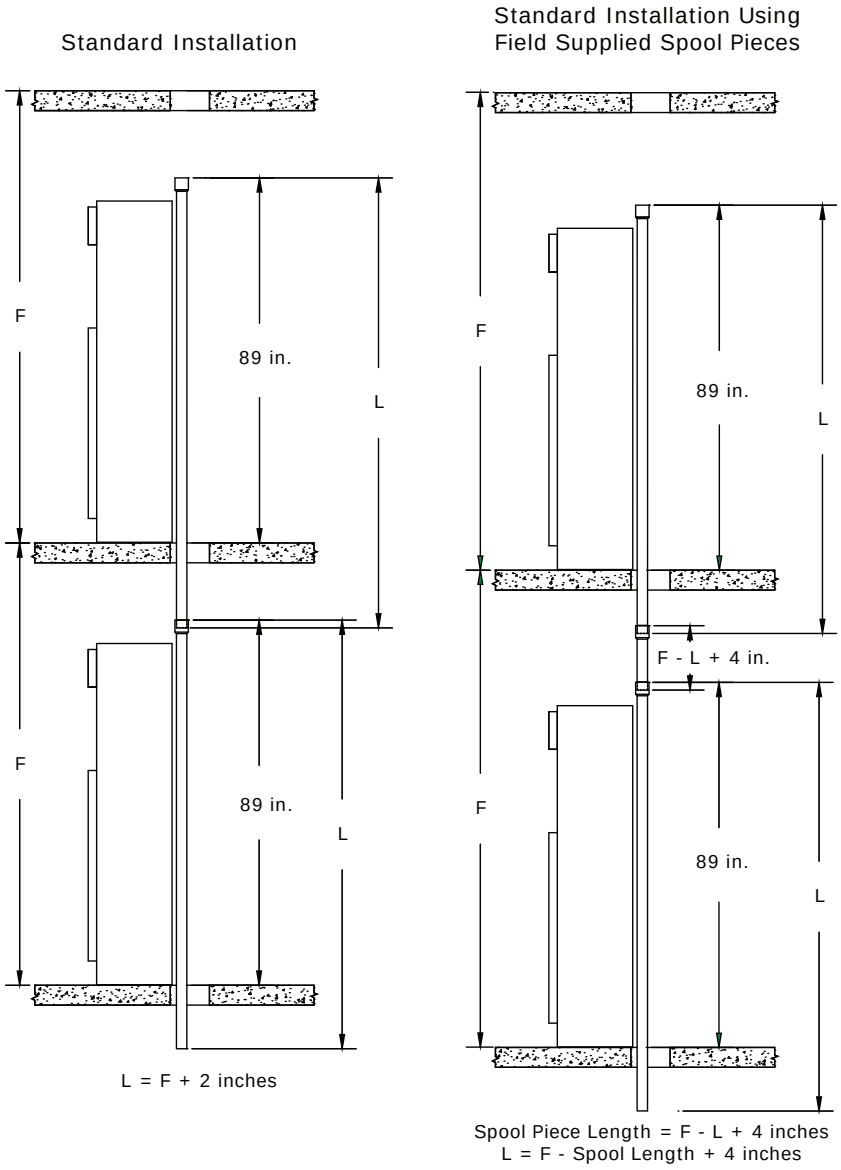
Notes:

- *3.1-inch long riser stub outs are provided from the factory for use with field installed risers. Depending on the riser diameter and insulation thickness selected, field provided and installed risers will require stub out extensions. Refer to the recommended installation diagram for details.*
- *Distances provided in figures can vary based on riser selection. Refer to Table 12, p. 22 for information.*

Table 12. Riser diameters and insulation thicknesses

Model Number	Main Riser Insulation (in)	DIA, Main Supply Riser (in)	DIA, Main Return Riser (in)	Aux Riser Insulation (in)	DIA, Aux Supply Riser (in)	DIA, Aux Return Riser (in)	DIA, Drain/Condensate Riser (in)
0	NA	NA	NA	NA	NA	NA	NA
A	0.75	0.75	0.75	0.75	0.75	0.75	0.75 w/ 0.375 insulation
B	1.0	1.0	1.0	1.0	1.0	1.0	1.25 w/ 0.375 insulation
C	NA	1.25	1.25	NA	1.25	1.25	NA
D	NA	1.5	1.5	NA	1.5	1.5	NA
E	NA	2.0	2.0	NA	2.0	2.0	NA
F	NA	2.5	2.5	NA	2.5	2.5	NA

Figure 11. Riser installation dimensions (inches)



Location of Floor Opening for Risers

Figure 12. Location of floor opening for risers

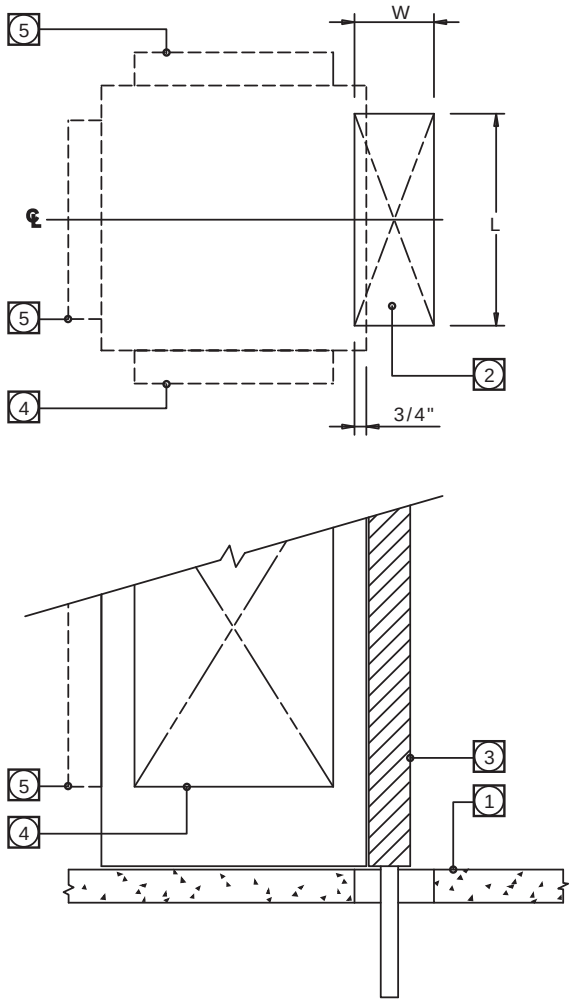


Table 13. Location of floor opening for risers callouts

1	Floor slab
2	Opening in floor slab
3	Insulated risers
4	Return air opening flange on front of unit
5	Alternative positions for return air opening

Table 14. Dimensions

Fan Coil Model	Width (inches)	Length (inches)
2-pipe unit	5.5	12
4-pipe unit	5.5	19

Note: When the project has riser pipe diameters two inches or larger, plus 3/4 inch thick insulation, dimension “W” should be increased to eight inches.

Installation - Piping

Coil Identification

Standard coil has the hot-water coil located in the reheat position. Because the circuiting varies by the specific coil design, the location of the inlet and outlet connections may vary up and down. However, use the following rule to be correct: The inlet is always the farthest away from the entering-air-side; the outlet connection is always closest to the entering-air-side.

Piping Arrangements for Chilled and Hot-Water Coils

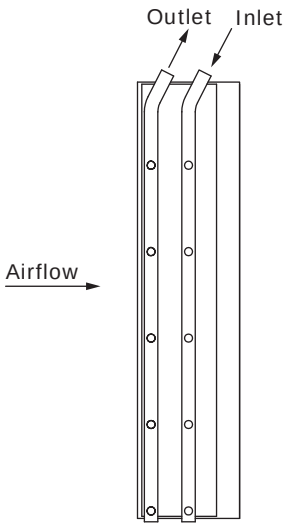
Two-Pipe Coils

Two-pipe coils have one inlet and outlet. Vertical high rise fan coil units may have three to four rows on each unit. The coil may be 100 percent chilled water, 100 percent hot water, or with the addition of a pipe sensor for changeover control, it may use chilled water when the chiller is operating, or hot water when the boiler is operating. A two-pipe system allows for the chiller or boiler to operate independently, one at a time.

The pipe sensor must be clamped onto the supply water line as close to the incoming water source as possible. Pipe sensors are factory installed, but should be checked at the time of installation for proper mounting. The pipe sensor ensures that the thermostat operates in a mode compatible with the water temperature in the coil.

All coils are piped so that the inlet is always on the row farthest downstream from the incoming air as shown in the following diagram.

Figure 13. Two-pipe coil arrangement



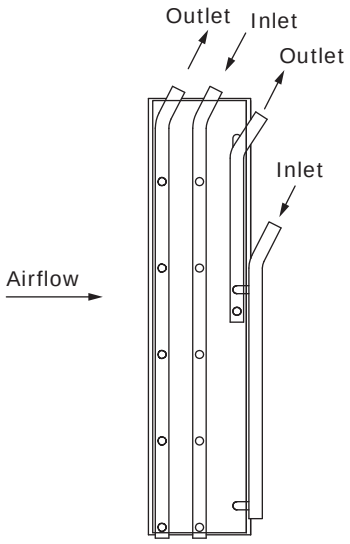
Note: Actual configuration may vary.

Four-Pipe Coils

Four-pipe coils have a dedicated, chilled-water coil, and a dedicated hot-water coil; each with its own inlet and outlet, equaling four pipes. Trane coils use a common tube sheet for four-pipe coils. Example: A four-row, chilled-water coil and a one-row, hot-water coil would use a five-row coil with four rows for chilled-water and one row for hot-water.

The one- or two-row hot-water coil is in the reheat position. The controls are wired so that either the chilled-water coil is operating or the hot-water coil is operating, but not both at the same time (when typical fan coil thermostats are used). When the conditioned space thermostat is satisfied, both the chilled- and hot-water control valves are closed. The same rule applies for inlet and outlet locations as explained in the previous “Two-Pipe Coils” section. Each chilled- and hot-water coil is controlled individually so a pipe sensor is not required.

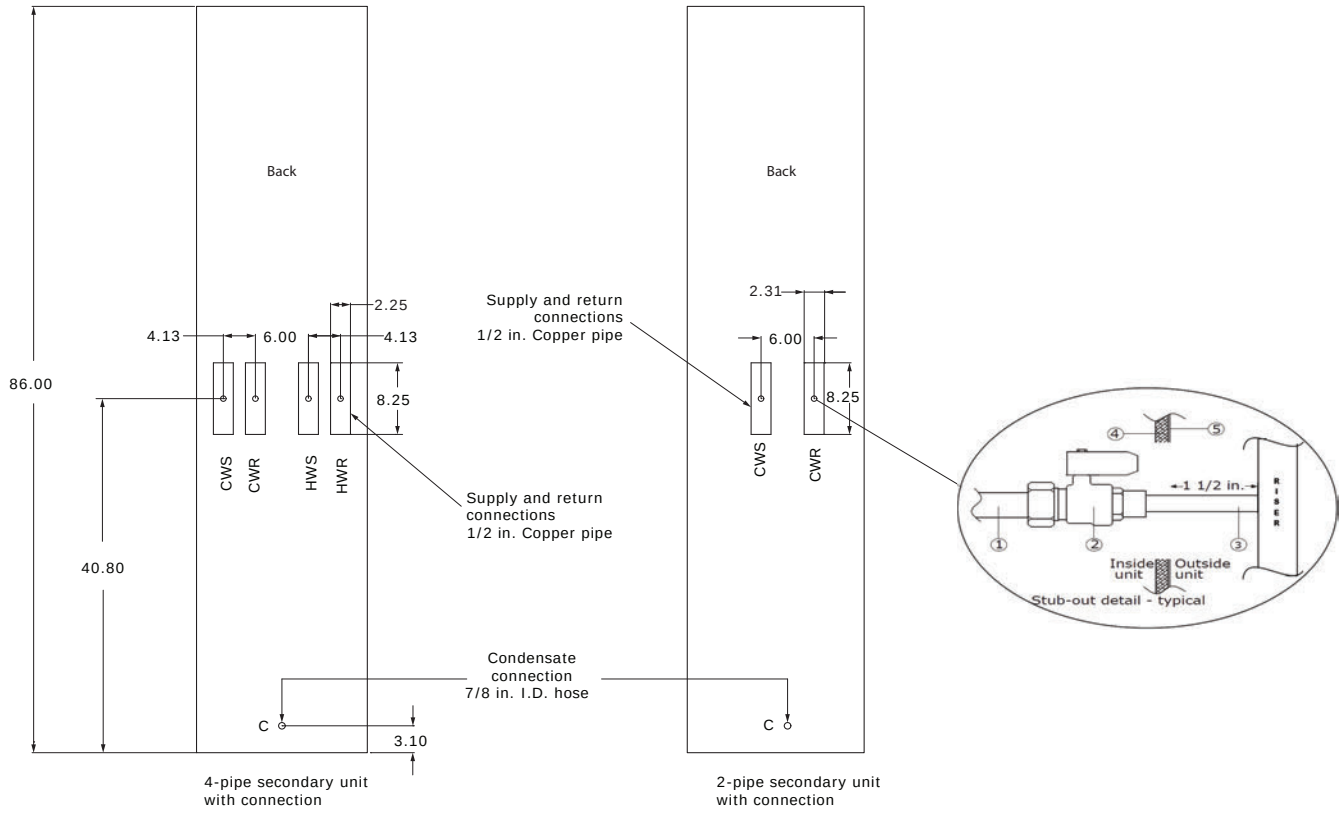
Figure 14. Four-pipe coil arrangement



Note: Actual configuration may vary.

Pipe Connections for Units Without Risers

Figure 15. Pipe connections for units without risers



1	1/2-inch supply and return coil branch stainless steel braided hose
2	Ball valve (shut-off valve) with threaded connection
3	1/2-inch or 3/4-inch copper tail piece soldered into valve body at factory
4	Insulation lining on interior surface of fan coil cabinet
5	Fan coil cabinet

Installation - Electrical

⚠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. Verify with a CAT III or IV voltmeter rated per NFPA 70E that all capacitors have discharged.

⚠WARNING

Live Electrical Components!

Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

When necessary to work with live electrical components, have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks.

Power Connection

Electrical power connection to the unit should be made at the junction box located inside the unit. The junction box is located on the right side of the unit behind the fan/motor shield. The fan/motor shield must be removed to gain access to the junction box. Power connections may enter the unit through the provided conduit openings on the right side of the unit, or on the left side of the unit. The conduit openings are 1-3/32 inch diameter holes with removable plugs. Power connections to the unit shall be made by a qualified electrician and must be made in accordance with the supplied wiring diagram and all applicable national and local codes.

All units include a single point power connection complete with an optional main disconnect. If a disconnect is selected, it is non fused.

When gaining access to the power junction box the unit shall be disconnected by opening the remote disconnect device prior to removing the fan/motor shield. Proper lock-out/tag-out procedures shall be followed during service.

Grounding

⚠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.

The unit must be properly grounded in accordance with the supplied wiring diagram and all applicable national and local codes.

Low-Voltage Field Connections

⚠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 cannot be inadvertently energized.

Per UL 1995/CSA C22.2 No. 236, Section 21 field connection of extra-low voltage circuits must be segregated from hazardous voltage circuits by barriers or by a minimum distance of five inches. Low voltage control wiring is to enter the unit only on the left hand side. Hazardous voltage power wiring is to enter the unit only on the right hand side.

An 1-3/32 inch diameter opening with a removable plug is provided on the left side of the unit for connection of low voltage control wiring. If the control wiring is not wired in conduit then a strain relief fitting must be provided to protect the wire as it enters the unit.

Power and Control Cable Entry Points

Figure 16. Power and control cable entry points

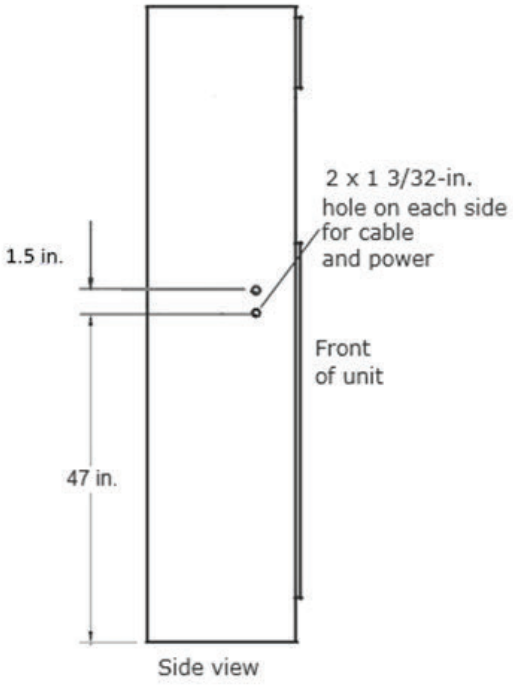


Table 15. Available control options

Letter/ Digit	Description
0	Control by others, installed by others, terminal strip provided.
A	Setpoint Dial Zone Sensor (3 inch)
B	Setpoint Dial Zone Sensor w/Comm (3 inch)
C	Setpoint Dial, On/Cancel w/Comm (3 inch)
D	Digital Zone Sensor (3 inch)
E	Telkonet® (3 inch)
H	Setpoint Dial Zone Sensor (12 inch)
J	Setpoint Dial Zone Sensor w/Comm (12 inch)
K	Setpoint Dial On/Cancel w/Comm (12 inch)
L	Digital Zone Sensor (12 inch)
M	Telkonet® (12 inch)
Q	Air-Fi® Wireless Digital Display Sensor

Electrical Data

Electric Heat

- An auto-reset high limit device is included. Back up protection is also provided.
- Power connection is single point.
- The heater is located in the reheat position relative to the cooling coil.
- The fan coil unit does not include a fuse or fusible type disconnect. Motor sub-fusing as per electrical code.

Amps = $\frac{\text{kW x 1000}}{\text{Volts}}$

Air temp. rise (Delta (Δ)T) = $\frac{\text{kW x 3160}}{\text{CFM}} = \frac{\text{MBh x 925}}{\text{CFM}}$

FLA = Motor Full Load Amps

MCA = Minimum Circuit Ampacity

= 1.25 x (heater amps + motor FLA)

MOP = Rating of maximum overcurrent protection device

= (2.25 x motor FLA) + Electric Heater Amps

Requirements of Standards: UL 1995 and CSA C22.2 No.236

- If the value of the calculated rating does not equal a standard current rating of overcurrent protective device, the marked maximum rating shall be the next lower standard rating.
- Exception No. 1: The marked maximum rating of the overcurrent protective device shall be the standard rating next higher than the computed value if the next lower standard ratings is less than 125 percent of the current rating of an electric heater load, when the unit includes an electric heater.
- Exception No. 2: If the computed value of the overcurrent protective device is less than the minimum ampacity of the supply circuit, the marked rating of the device shall be increased to the largest standard overcurrent protective device rating appropriate for the marked minimum circuit ampacity.
- Exception No. 3: If the marked minimum circuit ampacity does not correspond to a standard protective device rating, the next higher standard rating of the protective device may be marked.

Table 16. Electric heat - kilowatts (kW) and current draw (amps) per model for 300 unit size

Unit Size	Connection Voltage	EH Ratings (kW/Amps)									
	Volts/ph/Hz	kW	Amps	kW	Amps	kW	Amps	kW	Amps	kW	Amps
300[(a)]	120/1/60	0.5	4.2	1.0	8.3	1.5	12.5	2.0	16.7	2.5	20.8
	208/1/60	0.4	1.9	0.8	3.8	1.1	5.3	1.5	7.2	1.9	9.1
	240/1/60	0.5	2.1	1.0	4.2	1.5	6.3	2.0	8.3	2.5	10.4
	277/1/60	0.5	1.8	1.0	3.6	1.5	5.4	2.0	7.2	2.5	9.0

(a) Size 300 units are wired for single stage operation.

Table 17. Electric heat - kilowatts (kW) and current draw (amps) per model for 400 to 1200 unit size

Unit Size	Connection Voltage	EH Ratings (kW/Amps)																							
	Volts/ph/Hz	kW	Amps	kW	Amps	kW	Amps	kW	Amps	kW	Amps	kW	Amps	kW	Amps	kW	Amps	kW	Amps	kW	Amps	kW	Amps	kW	Amps
400[a]	120/1/60	0.5	4.2	1.0	8.3	1.5	12.5	2.0	16.7	2.5	20.8	3.0	25.0	3.5	29.2										
	208/1/60	0.4	1.9	0.8	3.8	1.1	5.3	1.5	7.2	1.9	9.1	2.3	19.2	2.6	21.7										
	240/1/60	0.5	2.1	1.0	4.2	1.5	6.3	2.0	8.3	2.5	10.4	3.0	25.0	3.5	29.2										
	277/1/60	0.5	1.8	1.0	3.6	1.5	5.4	2.0	7.2	2.5	9.0	3.0	25.0	3.5	29.2										
600[b]	120/1/60	0.5	4.2	1.0	8.3	1.5	12.5	2.0	16.7	2.5	20.8	3.0	25.0	3.5	29.2										
	208/1/60	0.4	1.9	0.8	3.8	1.1	5.3	1.5	7.2	1.9	9.1	2.3	19.2	2.6	21.7	3.0	14.4	3.8	18.3						
	240/1/60	0.5	2.1	1.0	4.2	1.5	6.3	2.0	8.3	2.5	10.4	3.0	25.0	3.5	29.2	4.0	16.7	5.0	20.8	6.0	25.0				
	277/1/60	0.5	1.8	1.0	3.6	1.5	5.4	2.0	7.2	2.5	9.0	3.0	25.0	3.5	29.2	4.0	14.4	5.0	18.1	6.0	21.7				
800[b]	120/1/60	0.5	4.2	1.0	8.3	1.5	12.5	2.0	16.7	2.5	20.8	3.0	25.0	3.5	29.2										
	208/1/60	0.4	1.9	0.8	3.8	1.1	5.3	1.5	7.2	1.9	9.1	2.3	19.2	2.6	21.7	3.0	14.4	3.8	18.3	4.5	21.6				
	240/1/60	0.5	2.1	1.0	4.2	1.5	6.3	2.0	8.3	2.5	10.4	3.0	25.0	3.5	29.2	4.0	16.7	5.0	20.8	6.0	25.0	7.0	29.2		
	277/1/60	0.5	1.8	1.0	3.6	1.5	5.4	2.0	7.2	2.5	9.0	3.0	25.0	3.5	29.2	4.0	14.4	5.0	18.1	6.0	21.7	7.0	25.3		
1000[b]	120/1/60	0.5	4.2	1.0	8.3	1.5	12.5	2.0	16.7	2.5	20.8	3.0	25.0	3.5	29.2										
	208/1/60	0.4	1.9	0.8	3.8	1.1	5.3	1.5	7.2	1.9	9.1	2.3	19.2	2.6	21.7	3.0	14.4	3.8	18.3	4.5	21.6				
	240/1/60	0.5	2.1	1.0	4.2	1.5	6.3	2.0	8.3	2.5	10.4	3.0	25.0	3.5	29.2	4.0	16.7	5.0	20.8	6.0	25.0	7.0	29.2	8.0	33.3
	277/1/60	0.5	1.8	1.0	3.6	1.5	5.4	2.0	7.2	2.5	9.0	3.0	25.0	3.5	29.2	4.0	14.4	5.0	18.1	6.0	21.7	7.0	25.3	8.0	28.9
1200[b]	120/1/60	0.5	4.2	1.0	8.3	1.5	12.5	2.0	16.7	2.5	20.8	3.0	25.0	3.5	29.2										
	208/1/60	0.4	1.9	0.8	3.8	1.1	5.3	1.5	7.2	1.9	9.1	2.3	19.2	2.6	21.7	3.0	14.4	3.8	18.3	4.5	21.6				
	240/1/60	0.5	2.1	1.0	4.2	1.5	6.3	2.0	8.3	2.5	10.4	3.0	25.0	3.5	29.2	4.0	16.7	5.0	20.8	6.0	25.0	7.0	29.2	8.0	33.3
	277/1/60	0.5	1.8	1.0	3.6	1.5	5.4	2.0	7.2	2.5	9.0	3.0	25.0	3.5	29.2	4.0	14.4	5.0	18.1	6.0	21.7	7.0	25.3	8.0	28.9

Unit Size	Connection Voltage	EH Ratings (kW/Amps)																							
	Volts/ph/Hz	kW	Amps	kW	Amps	kW	Amps	kW	Amps	kW	Amps	kW	Amps	kW	Amps	kW	Amps	kW	Amps	kW	Amps	kW	Amps	kW	Amps
400[a]	120/1/60																								
	208/1/60																								
	240/1/60																								
	277/1/60																								
600[b]	120/1/60																								
	208/1/60																								
	240/1/60																								
	277/1/60																								
800[b]	120/1/60																								
	208/1/60																								
	240/1/60																								
	277/1/60																								
1000[b]	120/1/60																								
	208/1/60																								
	240/1/60																								
	277/1/60																								
1200[b]	120/1/60																								
	208/1/60																								
	240/1/60																							10.0	41.7
	277/1/60																							10.0	36.1

(a) Size 400 units are wired for single stage operation.
(b) Sizes 600, 800, 1000, and 1200 are wired for 2 stage operation.

Motor Data

Table 18. Motor data

Unit Size	Motor (HP)	FLA 120V	FLA 208-240V	FLA 277V
300	0.24	3.6	2.1	1.6
400	0.24	3.6	2.1	1.6
600	0.5	7.5	4.3	3.8
800	0.5	7.5	4.3	3.8
1000	0.5	7.5	4.3	3.8
1200	0.5	7.5	4.3	3.8

Table 19. Motor data reduced FLA mode

Unit Size	Motor (HP)	FLA 120V	FLA 208-240V	FLA 277V
300	0.24	1.8	1.0	0.6
400	0.24	2.6	1.3	1.0
600	0.5	2.6	1.7	1.5
800	0.5	4.5	3.2	2.3
1000	0.5	6.2	3.3	2.9
1200	0.5	6.2	3.6	3.5

ECM Overview and Setup

Overview

This section addresses integrating the new Trane electronically commutated motor (ECM) and VelociTach™ motor control board. This exciting new series delivers outstanding comfort, safety, and performance with greatly reduced energy consumption compared to traditional units with induction 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.

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

- Trane ECM
- VelociTach motor control board
- CSTI adapter board

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

Electronically Commutated Motor (ECM)

Figure 17. Trane ECM motor

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

NOTICE

Equipment Damage!

Failure to follow this instruction could result in equipment damage. The motor harness attached to the single plug to which the motor mates contains the very important motor voltage jumper 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.

VelociTach Motor Control Board

The VelociTach™ motor control board controls and reports the performance of up to two Trane brushless DC (BLDC) motors.

Figure 18. VelociTach motor control board

The motor control board also:

- Coordinates the operation of the fan in response to electric heat behavior and electric behavior in response to hydronic heat behavior.
- Incorporates a user interface that allows adjustment of certain unit parameters and provides constant feedback on motor operation.
- Integrates service and troubleshooting tools.
- Integrates a versatile configurable auxiliary temperature sensor.
- Incorporates various safety and lockout features, such as maintaining proper fan speeds if electric heat is called for.

Status Display

Figure 19. Status display

The motor control 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, refer to the tables below for the graphical representation of each alphanumeric character.

Table 20. 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	m	n	O	P	q	r	S	t	U	u	W	H	y	2

Table 21. 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

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

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.

Safety Requirements

Follow all recommendations below. Failure to do so could result in death or serious injury.

- The ECM motors contain capacitors which store residual energy. Please keep clear of the fan wheels for 5 minutes after the power has been removed from the system, as a power request with the motor powered off, could result in a very short period of actuation.
- All settings take effect immediately, including fan startup and enabling of electric heat. Caution should be taken to stay clear of hazardous voltages, moving parts and electric heat elements while making adjustments to the VelociTach motor control board. If it is not practical to stay clear of these areas during adjustment of the motor control board, please contact Trane Global Parts for configuration kit that allows easy powering of the motor control board outside of the unit with a 9V battery.
- Changes to switch settings on the CSTI adapter board take effect immediately. Changes should be made to the CSTI configuration switches with the power off.
- Initial hookups to the CSTI and Standard Adapter board, including low voltage interconnections, must be made with the power off.
- Do not make connections to the motors or the adapter boards while power is ON. Do not remove connections to the motor or the adapter boards while the power is ON.
- Do not free spin the fan wheels with your hands while the unit is powered on. The system is constantly scanning and responding to the operational status of the motors.

Setup

Note: *Normally, Trane ECMs are configured for soft ramps and transitions between speeds. However, 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.*

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 ECM units is the wiring of:

- Wall-mounted low-voltage fan speed switch inputs to the adapter boards' terminal strips and 24 Vac tap to field-installed fan speed switch.
- Field-supplied controllers/thermostats to the adapter boards' terminal strips and 24 Vac power tap to field-supplied controller/thermostat.
- Adjustment and calibration of the variable speed inputs (VSP/0–10V) on the system.
- Adjustment, calibration or disabling of the optional auto-changeover function on CSTI units.

Otherwise, proceed with the mechanical, electrical and controls installations as defined in other sections of this manual, following all warnings and cautions.

After installation, turn power on.

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

The adapter board comes 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 600 V.

VelociTach Motor Control Board

⚠WARNING

Safety Alert!

You MUST follow all recommendations below. Failure to do so could result in death or serious injury.

All settings take effect immediately, including fan startup and enabling of electric heat. Caution should be taken to stay clear of hazardous voltages, moving parts and electric heat elements while making adjustments to the motor control board. If it is not practical to stay clear of these areas during adjustment of the motor control board, please contact Trane Global Parts for configuration kit that allows easy powering of the motor control board outside of the unit with a 9V battery.

⚠CAUTION

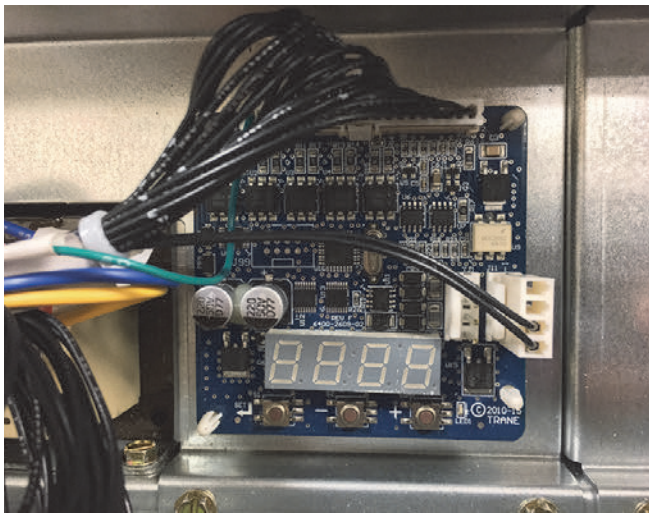
Burn Hazard!

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.

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

To check status, configuration, or to change settings on the motor control board with the power on the unit, remove the two screws at the top of the low voltage access lid and open.The motor control board will be visible. See the following figure.

Figure 20. VelociTach motor control board



The motor control board features a nested menu integrated user interface (UI) that supports:

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

Note: *Characters on the VelociTach motor control 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:

Figure 21. Operational status codes

RPM Mode RUNNING/ FAN STATUS CONTINUOUS LOOP	rtr 1	Indicates the current rpm of Motor 1 in the system. “0” rpm here indicate that no fan speed has been requested.
Displayed when:	0000 → 2000	
1) No error codes are present	rtr2	Indicates the current rpm of Motor 2 in the system. “0” rpm here indicate a fan off condition OR a fan “missing” condition[a].
2) Motor has completed ramping	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 “ECM Motors,” p. 83 for additional troubleshooting 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 “ECM Motors,” p. 83 for additional troubleshooting 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:
	YES / no	A i2Ci / A i2b / A iPU

(a) Motor 1 is the only motor in fan coil units.

User Interface

The VelociTach motor control board’s on-board user interface is easy to use and supports:

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

The user interface has three input buttons (see the figure below), from left to right:

- Menu/Set
- Decrement
- Increment

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

Figure 22. User interface input buttons

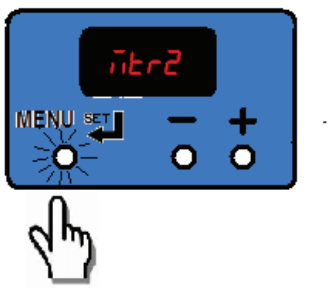


Table 22. Button actuation levels

Menu/Set		
Button	**Duration**	**Action**
Short Press in Status Display	<1 sec	None
Short Press in Configuration 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 Configuration 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.

Decrement		
Button	**Duration**	**Action**
Short Press in Status Display	<1 sec	None
Short Press in Configuration 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 Configuration Display	>3 sec	Faster scroll through parameter name, or faster decrease of values of parameters.

Increment		
Button	**Duration**	**Action**
Short Press in Status Display	<1 sec	None
Short Press in Configuration 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 Configuration Display		Faster scroll through parameter name, or faster increase of values of parameters.

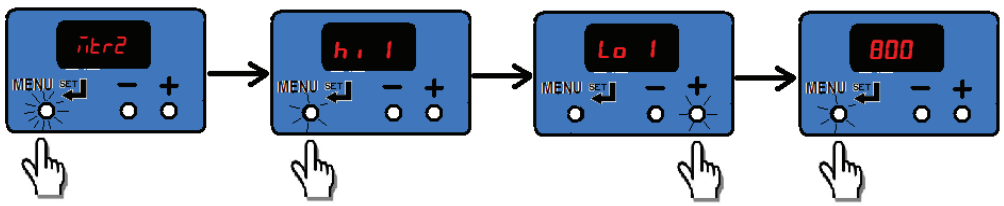
Configuration Examples

Example 1

To view the value of parameters without saving. In this case we wish to verify that the “Low Speed Value” for Motor 1 is set correctly to 800 rpm.

We start with the motor control board scrolling status display and proceed as follows:

Figure 23. Verify low speed value



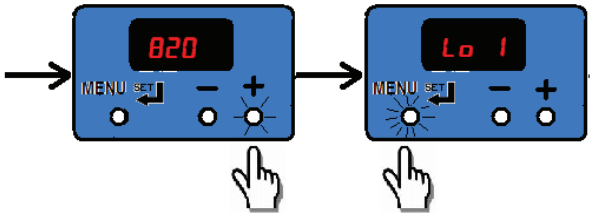
Example 2

We wish to change the change the value of Low Speed to 820 rpm:

We will continue from the previous example as shown below, using a long press to “save” the new desired value.

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

Figure 24. Change value of low speed value

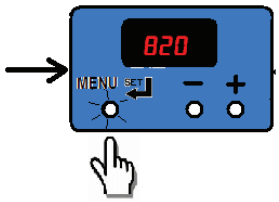


Example 3

We wish to double check to see if the value of “820 rpm” has been saved.

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.

Figure 25. Verify value of 820 rpm

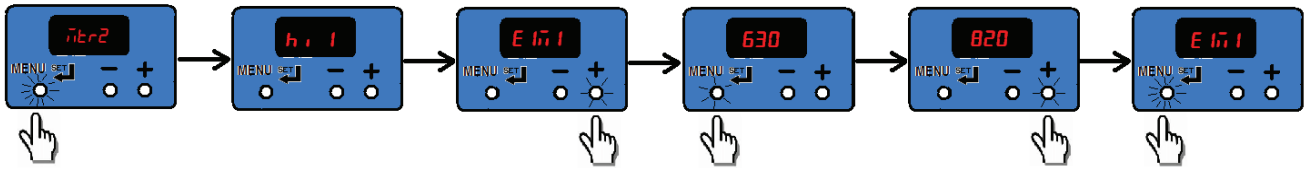


Example 4

We wish to change the value of a protected value on an electric heat unit. See Figure 26.

It would appear that the value has been changed, but if we check the value, we notice that the original value has been retained.

Figure 26. Change value on electric heat unit



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.*
- *If a error occurs while the configuration menu is in effect, all unsaved values will be discarded and the error codes will be displayed.*

Table 23. Error codes

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 "ECM Motors," p. 83 for resolution details. Fan Status function, if being used, will report an inoperative motor. Electric heat and changeover heat will be shutdown.
	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 "ECM Motors," p. 83 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 shutdown.
	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 "ECM Motors," p. 83 to reset, the cause must be resolved and the power to the unit cycled. Electric heat and changeover heat will be shutdown.
	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 "ECM Motors," p. 83 to reset, the cause must be resolved and the power to the unit cycled. Electric heat and changeover heat will be shutdown.
	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.*

Adjustments

After connections of power and hookup of customer installed controls/fan speed control and under normal operative conditions, the only adjustments needed to be made to the motor control 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 motor control 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.

Adjusting Variable Speed Inputs

⚠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!

You MUST follow all recommendations below. Failure to do so could result in death or serious injury. All settings take effect immediately, including fan startup and enabling of electric heat. Caution should be taken to stay clear of hazardous voltages, moving parts and electric heat elements while making adjustments to the motor control board. If it is not practical to stay clear of these areas during adjustment of the motor control board, please contact Trane Global Parts for configuration kit that allows easy powering of the motor control board outside of the unit with a 9V 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 motor control board configuration label.

NOTICE

Equipment Damage!

You MUST follow all recommendations below. Failure to do so could result in equipment damage.

- **Care should be taken in the system to use a single 24 Vac supply system to avoid damage to equipment.**
- **Care should be taken to observe proper polarity and grounding in the hookup of the 0–10V system to avoid damage to equipment.**

Note: *Configuration adjustments to the motor control board should be made through the SMALLER of the two low-voltage lids on the front of the control panel, through the low-voltage insulation/shielding.*

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

The motor control board and adapter boards offer standard, normalizing 0–10V 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 motor control board is factory configured to drive the unit to a minimum speed (catalogue "low speed" value), defined as ALn1 and ALn2 once the analog (0–10V) 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 ALn1 and ALn2. If the analogue input goes to 10V, the motor control board will drive the motor to maximum speed (normally catalogue "high speed" value), defined as AHn1 and AHn2, and will change speed in response.

Although the VelociTach motor control 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:

- 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 motor control board to be higher than the minimum output of the field supplied controller, as the motor control board will "ignore" a portion of the usable range of the customer fan variable speed output.
- 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 ALn1 and ALn2 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 analogue input scaling value for Motor 1 and Motor 2 (ALn1 and ALn2)
- 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 AHn1 and AHn2.
- The motor control board 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 27. Example 1: uFLr set too high and A 5c set too high

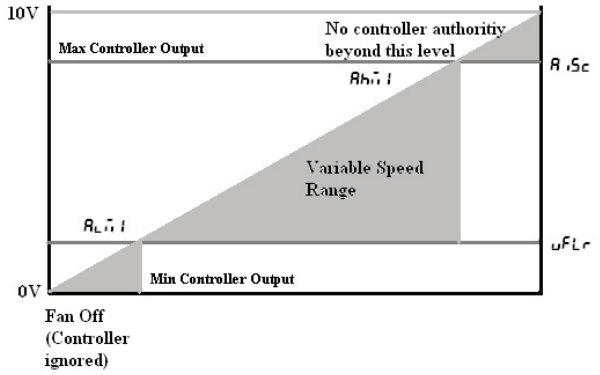


Figure 28. Example 2: uFLr set too high but A 5c set correctly

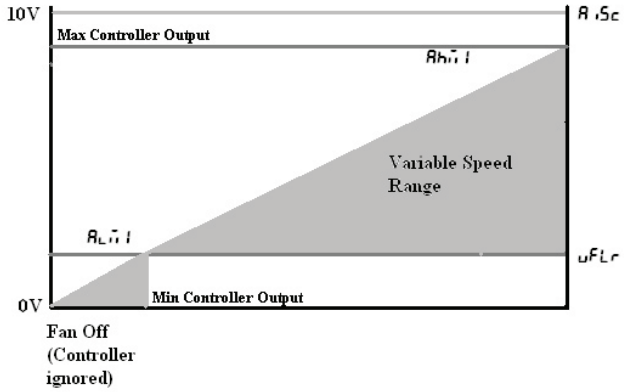
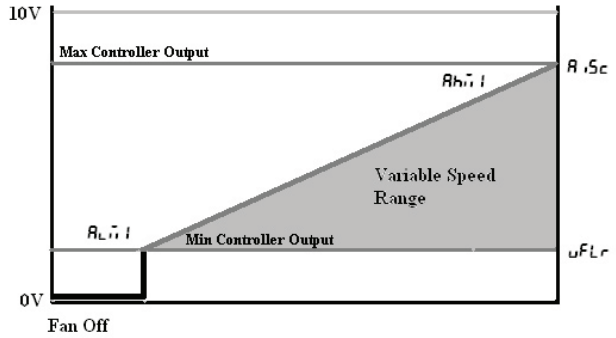


Figure 29. Example 3: uFLr set correctly and A 5c set correctly



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.

⚠WARNING

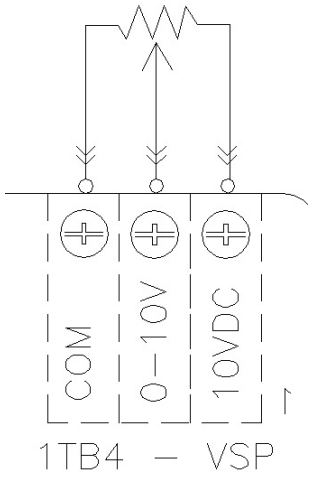
Safety Alert!

You MUST follow all recommendations below. Failure to do so could result in death or serious injury. All settings take effect immediately, including fan startup, enabling of electric heat. Caution should be taken to stay clear of hazardous voltages, moving parts and electric heat elements while making adjustments to the motor control board. If it is not practical to stay clear of these areas during adjustment of the motor control board, please contact Trane Global Parts for configuration kit that allows easy powering of the motor control board outside of the unit with a 9V battery.

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 Figure 30, the uFLr setting will define a null-zone (off).

The typical connection is depicted in Figure 30; however, please consult the unit schematic for the most updated instruction, as this is provided as reference only.

Figure 30. Typical connection



Adjusting 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.

The motor control 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 motor control board and adapter boards are pre-configured to cause hydronic heat and electric heat to be mutually exclusive:
  - On units with BACnet® controls (UC400-B), the Tracer® controller board will serve as the primary logic to select the electric heat only if hot water is not available, but the motor control board will service as a backup lockout.
  - On units with Customer Supplied Controllers (CSTI units), the motor control board and CSTI board will serve as the primary lockout.
- On CSTI units selected with a changeover coil configuration, the motor control 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 motor control board has defeatable and configurable bi-metallic disc temperature switch emulation when combined with the CSTI adapter board. The motor control board is pre-configured 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 motor control board 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 auxiliary heating coil function will continue to operate and respond to the customer heating request.
- A iPU parameter should be set to In for CSTI units and to OUt for ComfortLink or BACnet controller units.
- A i27 parameter defines the temperature at which the motor control board will close the triac onboard the motor control board (if FPrU parameter is set correctly).
- A i26 parameter defines the temperature at which the motor control board will open the triac onboard the motor control board (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 bi-metallic disc temperature switch emulation and the electric heat lockout function will work when the switches are set correctly.

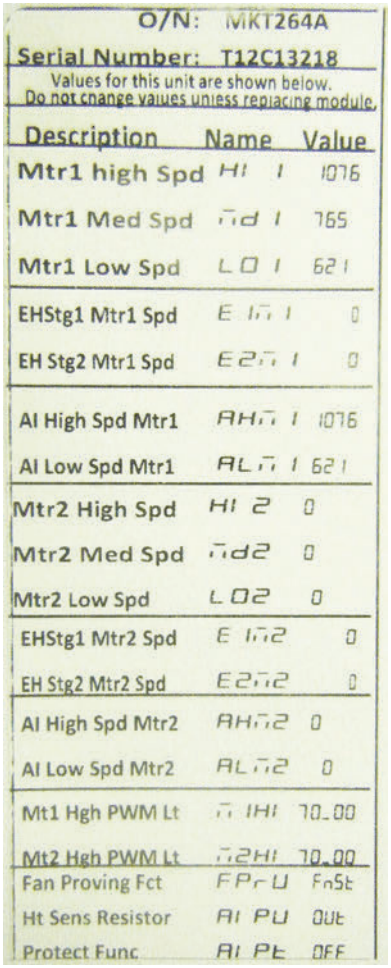
Configurations

Every Trane unit with ECM motors will have modules specifically configured at the factory for the operation of that unit. The motor control board configuration label is affixed to the sheet metal panel that covers the fan/motor (see Figure 20, p. 35 and Figure 31, p. 43).

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:

- How to enter the configuration menu
- The description and meaning of the error codes
- The description and meaning of the status display
- The parameter names and values specific to that unit

Figure 31. Motor control board label



Note: *This label is provided for reference only, as an example, and should not be used to configure the unit.*

Motor Control Board Settings

⚠WARNING

Safety Alert!

You MUST follow all recommendations below. Failure to do so could result in death or serious injury. All settings take effect immediately, including fan startup and enabling of electric heat. Caution should be taken to stay clear of hazardous voltages, moving parts and electric heat elements while making adjustments to the motor control board. If it is not practical to stay clear of these areas during adjustment of the motor control board, please contact Trane Global Parts for configuration kit that allows easy powering of the motor control board outside of the unit with a 9V 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

Equipment Damage!

Do not change the PWM output voltage settings as motor damage could occur.

Note: *The motor control board functions and unit specific settings are summarized on the motor control board configuration label on every unit.*

Table 24 lists the parameter names and typical settings of the motor control board, for reference only.

Do not change the electric heat protection settings if your unit has electric heat.

If the format setting for rpm values are not correct (i.e., not four-digit: XXXX), please check the operation mode of the motor control board Mod 1 and Mod 2 and motor signal output format SI 91 and SI 92.

Note: *The following notes are provided for reference only, and the motor control board label must be used as the ultimate guide for setting up an motor control board on specific units.*

Table 24. 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	E1n1	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).	E1n1,E1n2,E2n1,E2n2 settings are locked out on units with electric heat.
EH Stg 2 Mtr 1 Spd	E2n1	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	Ahn1	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.
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 i 2	0	Sets the high-speed rpm for Motor 2.	Blower coils have only one motor.
Mtr 2 Med Spd	Md 2	0	Sets the medium-speed rpm for Motor 2.	
Mtr 2 Low Spd	Lo 2	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 i 2,Md 2,Lo 2,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	nod 1	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	P_5n	Sets the interface type for Motor 1.	Must be set to P_5n for blower coil units.
Mtr 2 Out Format	S i92	P_5n	Sets the interface type for Motor 2	Must be set to P_5n 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 P_5n 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.

Table 24. Configuration settings of the motor control board (for reference only) (continued)

Description on Unit Label	User Interface Name	Typical User Interface Value	Description	
AI Boost Amp	A.Sc	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).
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.2n	85	Sets the make value for the motor control board triac output based on the thermistor input.	Operation also depends on FPru, A.2b, and A.PU settings.
Ht Sens Bk Val F	A.2b	90	Sets the break value for the motor control board triac output based on the thermistor input.	Operation also depends on FPru, A.2n, and A.PU settings.
Ht Sens Resistor	A.PU	oUt	Sets the input impedance of the thermistor input.	Should be pre-set to “OUT” for Tracer® UC400-B controllers.
Mt 1 Ramp %/sec	n1rP	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 n1rP 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.	Not used on fan-coil unit.
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.PU FPru A.nH A.bH E1n1 E1n2 E2n1 E2n2 S.9 nod1 nod2 n1H1 n1Lo

Table 24. Configuration settings of the motor control board (for reference only) (continued)

Description on Unit Label	User Interface Name	Typical User Interface Value	Description	
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 motor control board with the power on, to the unit. The motor control board display should display a looping status indicator as follows:

   ntr 1 → 0 → ntr2 → 0 → FSt 1 → 0 FF → 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 motor control board. It should display a looping status indicator as follows:

   For a size 200, 300, 400, 600, or 800 unit (using typical unit operating fan speeds):

   ntr 1 → 1080 → ntr2 → 0 → FSt 1 → On → FSt2 → OFF → EhEn → On

   For a size 1000 or 1200 unit (using typical unit operating fan speeds):

   ntr 1 → 1080 → ntr2 → 1080 → FSt 1 → On → FSt2 → on → EhEn → On

Note: *The* EhEn *indicator is unit-specific and may indicate "Off" at this point; refer to thermistor function for more information.*

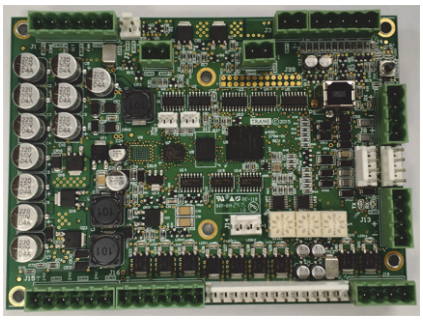
3. *OPTIONAL:*

   While the fan is running, if practical, change the fan speeds and observe the display temporarily indicate: rAnP

   Exercise all fan speeds to ensure positive unit response and to validate any field wiring.

Installation - Controls

Tracer® UC400-B Controller



The Tracer® UC400-B single-zone VAV controller can be used in a stand-alone application or as part of a Tracer® control system.

In the stand-alone configuration, Tracer® UC400-B receives operation commands from the zone sensor and/or the entering water temperature sensor (on auto changeover units).The reading from the entering water temperature sensor and determines if the unit is capable of cooling or heating. The zone sensor module is capable of transmitting the following information to the controller:

- Timed override on/cancel request
- Zone setpoint
- Current zone temperature
- Fan mode selection (off-auto-high-med-low)

For optimal system performance, units can operate as part of a Tracer® SC building automation system. The controller is linked directly to the Tracer® SC via a twisted pair communication wire, requiring no additional interface device (i.e., a command unit). The Tracer® control system can monitor or override Tracer® UC400-B control points.This includes such points as temperature and output positions.

Note: *For more detailed information, refer to:*

- BAS-SVX20*-EN *Tracer® UC400-B Programmable Controller Installation, Operation, and Maintenance manual*

Communication Wire Specifications

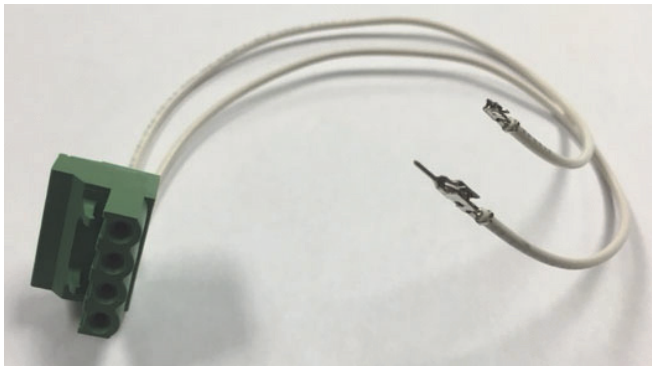
All wiring must comply with the National Electrical Code (NEC™) and local electrical codes.

Field-supplied BACnet MS/TP link wiring must be installed in compliance with NEC and local codes. The wire must be low-capacitance, 18-gauge, stranded, tinned-copper, shielded, twisted-pair.

Note: *For more details, refer to* Wiring Guide: Unit Controller Wiring for the Tracer® SC System Controller *(BAS-SVN03D-EN, or the most recent revision).*

General Wiring Guidelines

Figure 32. Connecting wires to terminal



To connect wires to the UC400-B controller or the expansion modules:

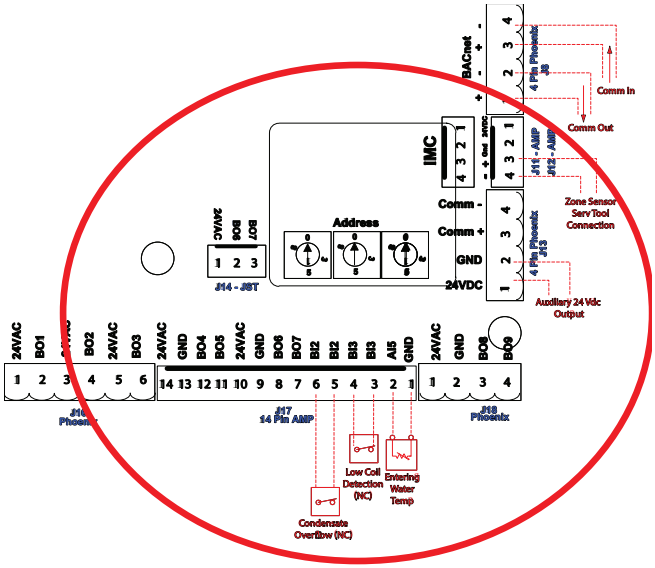
1. Strip the wires to expose 0.28 inch (7 mm) of bare wire.
2. Insert the wire into a terminal connector.
3. Tighten the terminal screw to 0.5 to 0.6 Nm (71 to 85 ozf-in or 4.4 to 5.3 lbf-in.).
4. Tug on the wires after tightening the screws to ensure all wires are secure as shown on the right.

Setting the Address

The rotary address dials on the UC400-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.

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

Figure 33. Setting rotary address dials



MAC Address

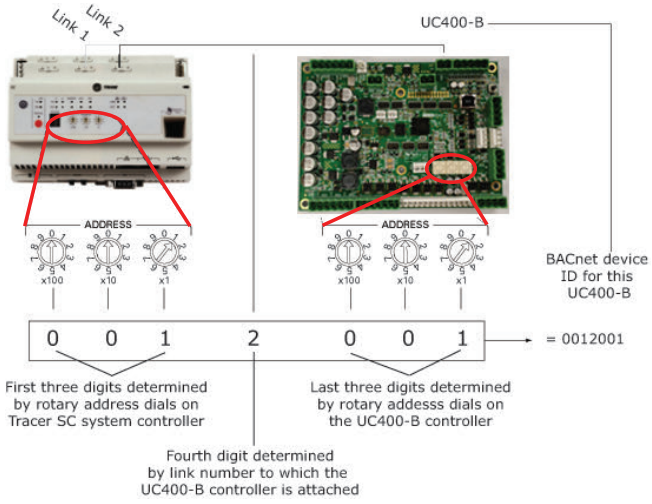
The MAC Address is required by the RS-485 communication protocol on which BACnet® operates. A UC400-B controller can use a MAC Address from 001 to 120.

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.

Figure 34. BACnet device ID



BACnet® networks without a Tracer® SC system controller

On BACnet® networks without a Tracer® SC system controller, the Device ID can be assigned one of two ways:

- It can be the same number as the MAC Address, determined by the rotary address dials on the UC400-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.

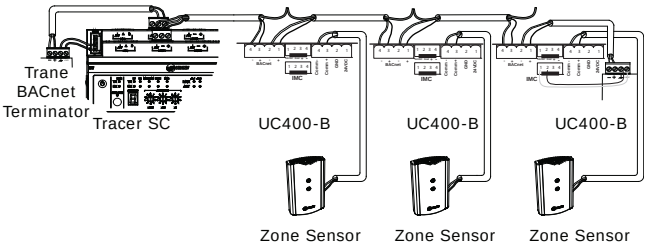
BACnet® networks with a Tracer® SC system controller

On BACnet® networks with a Tracer® SC system controller, the Device ID for the UC400-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 35 shows an example of BACnet® link wiring with multiple UC400-B controllers.

Figure 35. Example of BACnet link wiring with multiple UC400-B controllers



Air-Fi® Wireless Communications System

For more detailed information on Air-Fi® Wireless Communications system and devices, see:

- BAS-SVX40*: *Air-Fi® Wireless Installation, Operation, and Maintenance*
- BAS-PRD021*-EN: Air-Fi® *Wireless Product Data Sheet*
- BAS-SVX55*: *Air-Fi® Wireless Network Design*

Air-Fi® Wireless Communications Interface (WCI)

Figure 36.

A factory-installed Air-Fi® Wireless Communications Interface (WCI) provides wireless communication between the Tracer® SC and Tracer® unit controllers. The Air-Fi® WCI is the perfect alternative to a Trane BACnet® wired communication link. Eliminating the communication wire between terminal products, space sensors, and system controllers has substantial benefits:

- Reduced installation time and associated risks.
- Completion of projects with fewer disruptions.
- Easier and more cost-effective re-configurations, expansions, and upgrades.

Air-Fi® Wireless Communications Sensor (WCS)

Figure 37.

Communicates wirelessly to a Tracer® unit controller. A WCS is an alternative to a wired sensor when access and routing of communication cable are issues. A WCS allows flexible mounting and relocation.

Wireless Zone Sensor (WZS) Set

A wireless zone sensor (WZS) set (sensor and receiver) communicates wirelessly to a Tracer® unit controller. A wireless zone sensor set is an alternative to a wired sensor when access and routing of communication cable are issues. The sensor allows flexible mounting and relocation.

Note: *A wireless zone sensor set is not compatible with an Air-Fi® wireless system.*

The Wireless Comm Interface (WCI) enables wireless communication between system controls, unit controls, and wireless sensors for the new generation of Trane control products.The WCI replaces the need for communication wire in all system applications.

Note: *For more detailed information, refer to:*

- BAS-SVX40*-EN - Wireless Comm Installation, Operation and Maintenance manual
- BAS-SVX55*-EN - Wireless Comm Network Design Best Practices Guide

Quantity of WCIs per Network

Each Trane wireless network can have a total of 31 WCIs (30 member WCIs plus one coordinator WCI). Each network requires one WCI to function as network coordinator.

Quantity of Networks per Tracer® SC

A Tracer® SC can support up to eight wireless networks.

Automatic Network Formation

When a WCI is connected to a Tracer® SC, it is auto-assigned as the coordinator.To enable the coordinator, Tracer® SC must be configured for wireless communication.The coordinator WCI opens the network to allow all WCIs having matching addresses to automatically join the network. If no Tracer® SC is present, a centrally located WCI must be designated to act as the coordinator.You can manually set the coordinator WCI so all WCIs having matching addresses automatically join the network.

Wireless Zone Sensors

The WCI also communicates with Trane wireless zone sensors, eliminating the need for analog receivers.

Wired Zone Sensors

Systems using WCI can also use wired zone sensors.

Specifications

Operating Temperature: -40 to 158ºF (-40 to 70ºC)

Storage temperature: -40 to 185ºF (-40 to 85°C)

Storage and operating humidity range: 5 percent to 95 percent relative humidity (RH), non-condensing.

Voltage: 24 Vac/VDC nominal ± 10 percent. If using 24 Vac, polarity must be maintained.

Receiver power consumption: <2.5 VA

Housing material: Polycarbonate/ABS (suitable for plenum mounting), UV protected, UL 94: 5VA flammability rating.

Mounting: Snaps into sheet metal opening.

Range: Open range: 2,500 ft (762 m) with packet error rate of 2 percent.

Indoor: Typical range is 200 ft (61 mm); actual range is dependent on the environment. See BAS-SVX55*-EN for more detail.

Note: *Range values are estimated transmission distances for satisfactory operation. Actual distance is job specific and must be determined during site evaluation. Placement of WCI is critical to proper system operation. In most general office space installations, distance is not the limiting factor for proper signal quality. Signal quality is affected by walls, barriers, and general clutter. For more information, see os available at www.trane.com.*

Output power: North America: 100 mW

Radio frequency: 2.4 GHz (IEEE Std 802.15.4-2003 compliant) (2405–2480 MHz, 5 MHz spacing)

Radio channels: 16

Address range: Group 0–8, Network 1–9

Mounting

Fits a standard 2 x 4-inch junction box (vertical mount only). Mounting holes are spaced 3.2-inch (83 mm) apart on vertical center line. Includes mounting screws for junction box or wall anchors for sheet-rock walls. Overall dimensions: 2.9 inch (74 mm) by 4.7 inch (119 mm).

Wireless protocol

ZigBee PRO—ZigBee Building Automation Profile, ANSI/ASHRAE Standard 135-2008 Addendum q (BACnet®/ZigBee)

Installation - Zone Sensors

Zone Sensor Options

Control sensor options include both unit-mounted (factory-installed) and wall-mounted sensors. Tracer® controller options available for the zone sensors are:

- Tracer® UC400-B delivers single zone VAV control in a stand-alone operation or as part of a building automation system using BACnet® communications.

Zone sensors have an internal thermistor and operate on 24 Vac. Options with setpoint knobs are available in Fahrenheit or Celsius. See Figure 38 through Figure 41 for available options and model number references.

UC400-B Controller Options

Figure 38. Wall-mounted temperature sensor (SP, OALMH, OCC/UNOCC)

Figure 39. Wall-mounted display temperature sensor (SP, OCC/UNOCC, OALMH, COMM)

Figure 40. Wall-mounted temperature (OCC/UNOCC, COMM)

Figure 41. Wall-mounted temperature sensor (SP, OCC/UNOCC, OALMH, COMM)

Zone Sensor Installation

Location Considerations

When selecting a location for the zone sensor, avoid the following:

- Dead spots, such as behind doors, projection screens, or in corners that do not allow free air circulation.
- Air drafts from stairwells, outside doors, or unsectioned hollow walls.
- 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.
- 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 heat-generating equipment.
- 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.

Location Considerations for Wireless Zone Sensors

Placement of the sensor is critical to proper operation (the receiver is factory mounted). 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

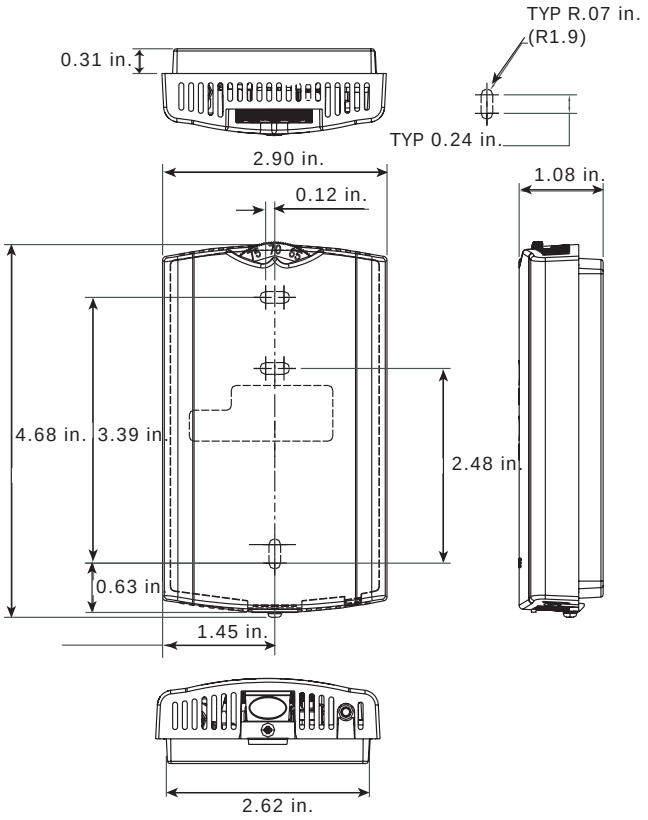
Using the hardware provided, mount the back plate of the sensor to a flat surface such as sheetrock or plaster, or an electrical junction box. The sensor must be mounted plumb for accurate temperature control and to ensure proper air movement through the sensor.

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

Zone Sensor Dimensions

Refer the wall-mounted zone sensor dimensions in the figure below. 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 42. Wall-mounted wired and wireless zone sensor dimensions

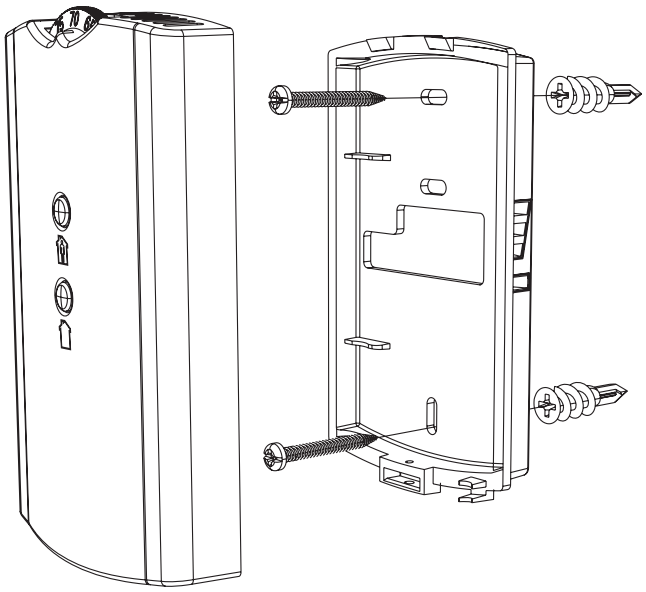


Wired Zone Sensor

Refer to the unit wiring schematic for specific wiring details and point connections.

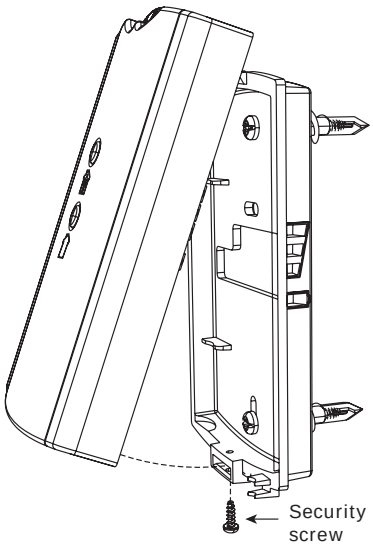
1. Note the position of the setpoint adjustment knob and gently pry the adjustment knob from the cover using the blade of a small screwdriver.
2. Insert the screwdriver blade behind the cover at the top of the module and carefully pry the cover away from the base.
3. To mount the sensor back plate: (see the figure below).
   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.

Figure 43. Mounting zone sensor base plate



4. To install the zone sensor module to a standard junction box:
   a. Level and install a 2 x 4-inch 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 (see the following figure).

Figure 44. Mounting zone sensor security screw



Wireless Zone Sensors

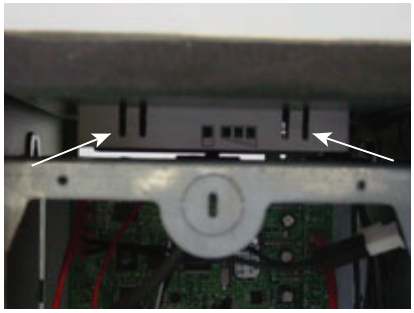
1. Note the position of the setpoint adjustment knob and gently pry the adjustment knob from the cover using the blade of a small screwdriver.
2. Insert the screwdriver blade behind the cover at the top of the module and carefully pry the cover away from the base.
3. To mount the sensor back plate: (see Figure 43)
   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 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 (see Figure 44).

Note: *For more detailed information for wireless sensors, please see BAS-SVX04*-EN.*

Receivers

Receivers ship installed on the unit. To remove the receiver, press in the retention tabs on the underside of the receiver enclosure (see Figure 45) and push upward.

Figure 45. Retention tabs on underside of receiver enclosure



Zone Sensor Settings

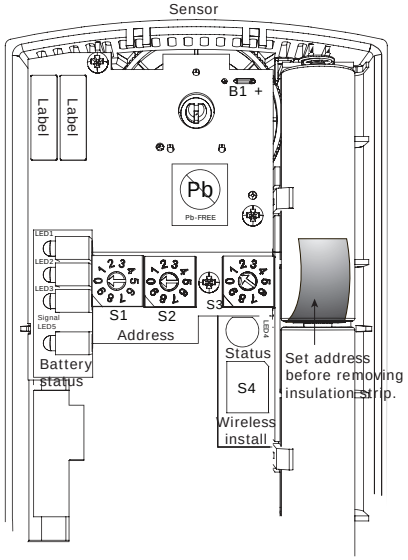
Address Setting

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 below) from the sensor.*

Figure 46. Set address before removing insulation strip from the sensor.

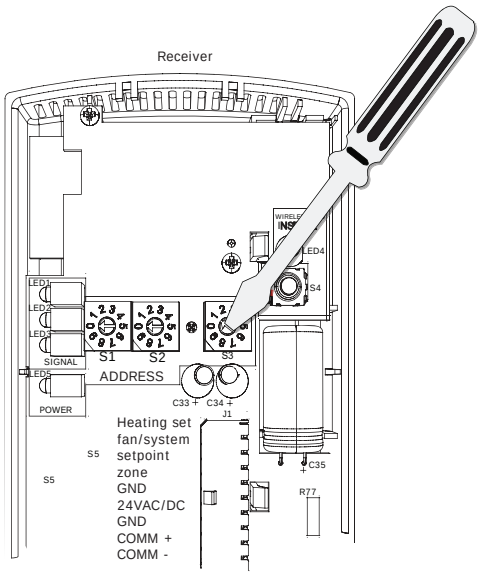


To set the receiver and sensor addresses:

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 the figure below). 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 47. Set the rotary address switches on the receiver



2. Set the three rotary address switches (locations S1, S2, S3) on the sensor *to the same address as the receiver*.

   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.*

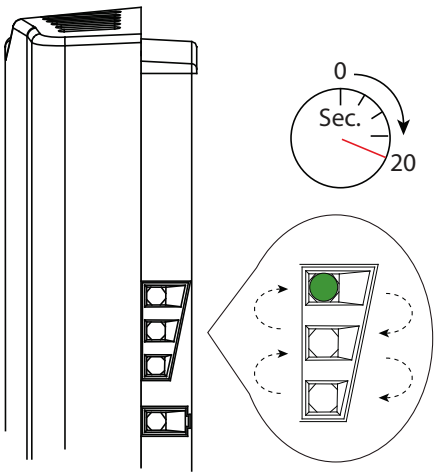
3. Record the address and location of the receiver and sensor pair.

Observing Receiver for Readiness

After initial power up, the receiver conducts a channel scan for 20 seconds. See the figure below. 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 (round-robin style) while the channel scan is in progress.

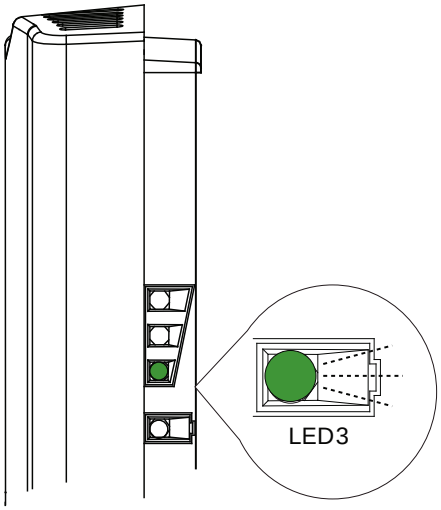
Important: *Do not attempt association (leave the insulation strip in place) until the channel scan is finished.*

Figure 48. Receiver conducts 20 second channel scan



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.

Figure 49. LED3 blinks after channel scan to show receiver is ready

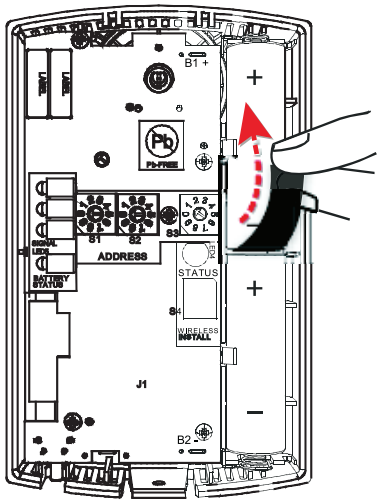


Associating Sensor to Receiver

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.

Figure 50. Power sensor by removing insulation strip



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. 76).*

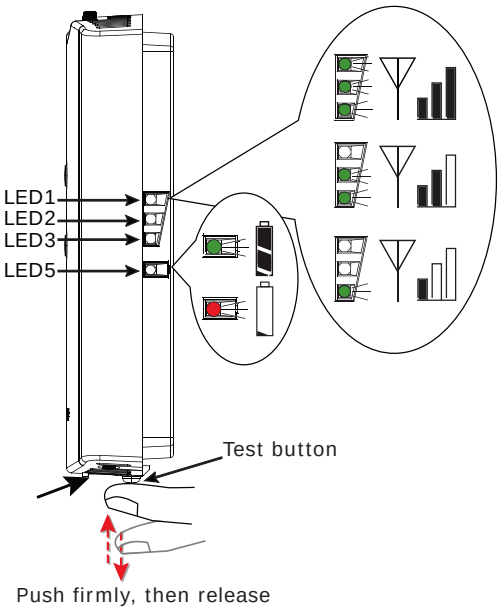
Testing Signal Strength and Battery

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 in the figure below.
2. For model WZS, view LED1, LED2, and LED3 to determine the signal strength. View LED5 to determine the battery status (see the figure below for model WZS sensors).

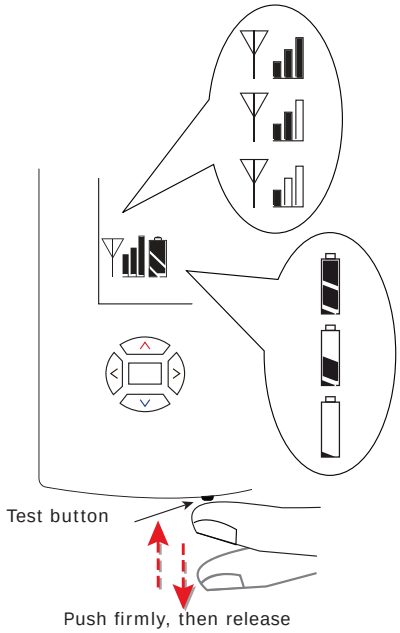
   Note: *The LEDs will turn Off after 5 seconds to conserve battery strength.*

Figure 51. Wireless Zone Sensor (WZS) with LED lights to test for battery strength



3. For model WDS, determine the signal strength and battery status by viewing the symbols on the sensor display. Record the results in your commissioning statement.

Figure 52. Wireless Display Sensor (WDS) showing battery strength



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.*

To request and cancel temporary occupancy on a model *WDS* sensor, see "Requesting Temporary Occupancy," p. 62.

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 *WDS* is 50°Fto 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 "Failure and Default Modes," p. 77).
- 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 "Failure and Default Modes," p. 77).
- 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 Receiver for Readiness,” p. 53).

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 “Failure and Default Modes,” p. 77).

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

Transmission Variables

Sensor transmission 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 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.

Component Specifications

Table 25. 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 percent) 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.

Table 26. Telkonet EcoInsight thermostat specifications

Item	Description	Specification
GENERAL INFORMATION		
EcoInsight	Part Number	SS6000-B
	Power	18-32VAC
Dimensions — in (cm)	Height	4.0 (10.2)
	Width	6.0 (15.2)
	Depth	1.5 (3.8)
Display	Size — in (cm)	3 (7.62)
	Type	Liquid Crystal Display (LCD)
Customization	Case Color	Any Pantone® color, including metallic finishes
	Display Blacklight	Blue or Orange
	Soft Buttons	Select from °F/°C, Heat, Cool, Heat/Cool or Backlight
Operational Temperature — °F/°C	Min	35 (2)
	Max	120 (49)
INTERCONNECTIVITY AND CERTIFICATIONS		
I/O Connections	NTC Temperature Probe	1 Input
	Current Transformer Input	Up to 3 available
	Dry Contact Input	2 Inputs
	Analog Valve Control Output	2 Outputs, 0-10V, 4-20mA (optional)
Internal High Power Mesh Network Radio (disabled)	Part Number	SS-6KC-RMHP
	Specification	ZigBee® IEEE 802.15.4[(a)]
	Radio Band	2.4 GHz ISM Band
	Radio Power	16dBM = 40W
Maximum Current Draw	1st Output	10A
	2nd and 3rd Outputs	5A each
	4th - 6th Outputs	3A each
Functional Wattage	Max	2.5W

(a) ZigBee is a registered trademark of the ZigBee Alliance.

Agency Compliance

Table 27. Agency compliance information for wireless sensors

Agency	Compliance
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 FCC's 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)

Wireless Display Sensor (WDS)

Configuration Procedure

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

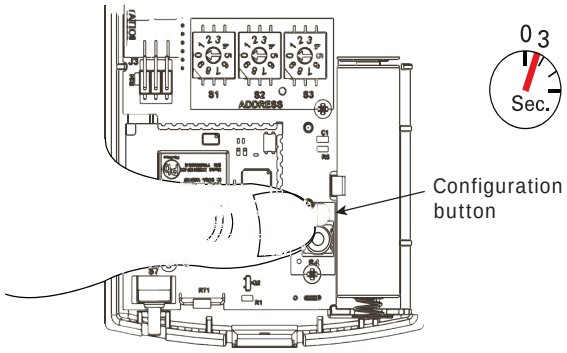
The configuration of the sensor determines which system features can be accessed and changes can be made by the tenant (for example, changes to cooling/heating mode, setpoint, or fan speed. Verify system and associated unit features before configuring the sensor.

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.

To configure settings on the wireless display sensor (WDS), follow this procedure in the order presented.

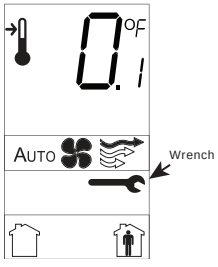
1. Press the configuration button for three seconds.

Figure 53. Configuration button



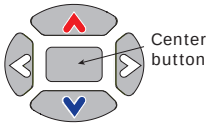
The display will change to configuration mode. When the sensor is in configuration mode, a wrench symbol appears on the display and the menus are separated by lines, as shown in the figure below.

Figure 54. Wrench is shown in configuration mode



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

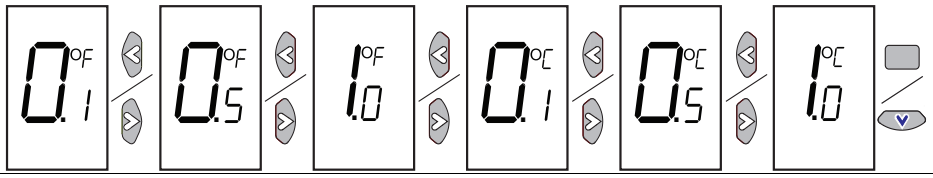
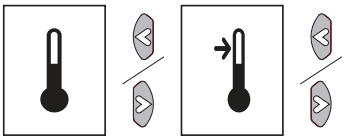
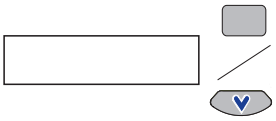
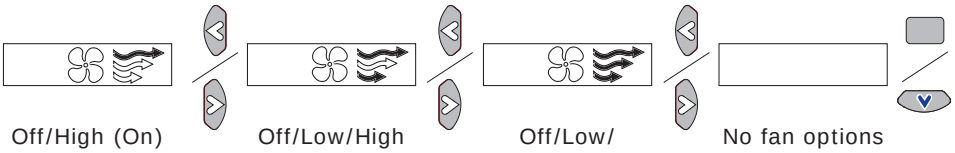
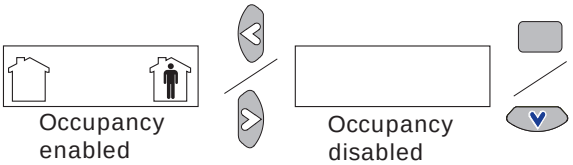
Figure 55. Center button of keypad



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 in the table below).
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 on p. 59).

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

Table 28. Configuration options for wireless display sensors

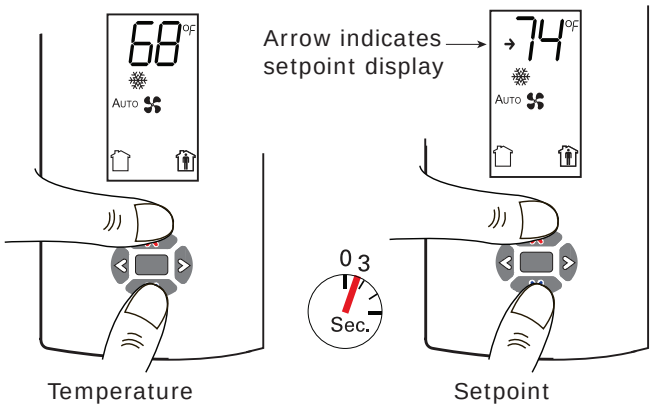
Setting	Configuration Options
Temperature • Choose Fahrenheit or Celsius • Choose the degree resolution (whole degrees, half degrees, or tenths of degrees).	
Setpoint	 No setpoint Single setpoint
System	 No system options enabled
Fan **Note:** Not all fan options are available for all systems.	 Auto/Off Auto/Off/ Low/High Auto/Off/Low Med/High  Off/High (On) Off/Low/High Off/Low/ Med/High No fan options enabled
Occupancy (timed override)	 Occupancy enabled Occupancy disabled

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 below.

Figure 56. Displaying setpoint or temperature

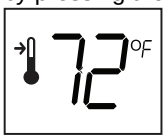


Locking or Unlocking Settings

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

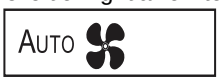
1. Verify that the sensor is in operating mode and at the home screen.
2. Choose a setting to lock or unlock:

- Select the setpoint by pressing the up or down arrow.



Setpoint

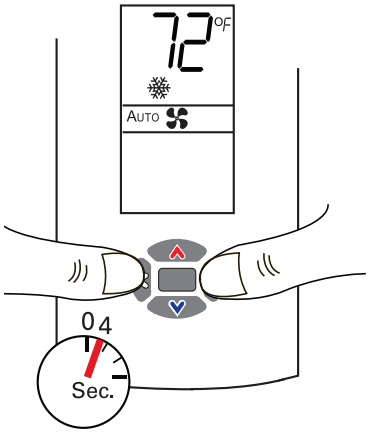
- From the system menu press the down arrow to select the fan menu. Use the left or right arrow to choose the setting.



Fan Menu

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

Figure 57. Locking and unlocking settings

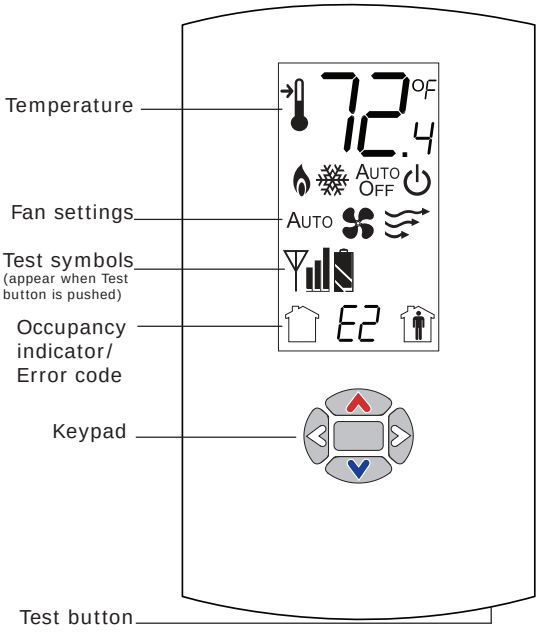


Note: *If you try to access a feature that is locked, the locked symbol will appear on the display. If you press a keypad button to try change a locked setting, the locked symbol will flash.*

WDS Operating Mode

This section describes how to operate the wireless display sensor (WDS). Figure below shows an example of a WDS that has been configured and is in operating mode.

Figure 58. Wireless display sensor (model WDS) in operating mode



Changing Room Temperature

	This symbol shows the current room temperature, or your setpoint selection while you are making an adjustment.
	When you select a setpoint, this symbol appears.

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/Cooling Settings

(does not apply to all 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.

When you adjust the cooling setting, the top arrow and snowflake flash.

When you adjust the heating setting, the bottom arrow and flame flash.

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.

Changing Fan Settings

Indicates that the fan will operate as needed to reach the selected temperature.

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.

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).

Requesting Temporary Occupancy

Select to request occupancy

Select to cancel occupancy

- If you need heating or cooling after normal business hours, you can “request” temporary occupancy by pressing or 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.

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 satisfactor 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 percent of battery life left.

Indicates 25 percent of battery life left. Replace batteries. Flashing symbol indicates that approximately 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).

Start-Up

Units are limited to 200°F maximum water temperature on the heating cycle.

NOTICE

Equipment Damage!

Failure to follow these instructions could result in equipment damage. After installation and before start-up, ensure filter is clean and free of construction debris. Operating the unit with a dirty or clogged filter could affect unit performance and/or cause equipment damage.

Prior to start-up, check entire unit for construction debris and dust. Clean the unit. Change dirty filters.

NOTICE

Coil Freeze-up!

Failure to follow instructions below could result in coil damage. Drain and vent coils when not in use. Trane recommends glycol protection in all possible freezing applications. Use a glycol approved for use with commercial cooling and heating systems and copper tube coils.

If unit is installed during winter months, ensure the unit is not subject to freezing temperatures while filled with water during construction. Coils damaged due to freezing are not covered under warranty.

NOTICE

Coil Damage!

Failure to follow instructions below could result in coil damage. Do not operate unit during construction or renovation with windows open. Outside air can impose high cooling and dehumidifying loads on the unit, causing the unit to sweat.

In hot, humid climates, do not operate the unit during construction or renovation with doors and windows open, allowing outside air to enter the building. When outside air enters into the building, it imposes high cooling and dehumidifying loads on the unit. These conditions could cause the unit to sweat, which could damage property.

After electrical connections are complete, prior to turning on the remote disconnect (i.e. circuit breaker), ensure the disconnect switch inside the unit is set to “ON”. Install the motor cover and return air grilles/access panels. After this is complete, turn on the remote disconnect and the unit will run.

Tracer® UC400-B Controller

Tracer® UC400-B controller delivers single zone VAV control in a stand-alone operation or as part of a building automation system using BACnet® communications.

UC400-B Stand-Alone Operation

The factory pre-programs the Tracer® UC400-B 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. For more information, refer to:

- BAS-SVX48*-EN Tracer® UC400/UC400-B Programmable Controllers for Blower Coil, Fan Coil, and Unit Ventilator Installation, Operation, and Maintenance guide

Follow the procedure below to operate the Tracer® UC400-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:

- Room temperature should be greater than 55°F and less than 85°F.
- 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.
- Select the correct temperature setpoint.

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

UC400-B Operation

Controller

Off - Fan is off; control valves and fresh air damper option close. 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.

Sequence of Operation

Power-Up Sequence

When 24 Vac power is initially applied to the 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 (refer to the following section, Random Start).
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 the 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 (see "Timed Override Control," p. 64).
- 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 controller has the following occupancy modes:

- Occupied
- Unoccupied
- Occupied standby
- Occupied bypass

Occupied Mode

In Occupied Mode, the 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 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 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 Tracer® 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 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

If the 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 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.

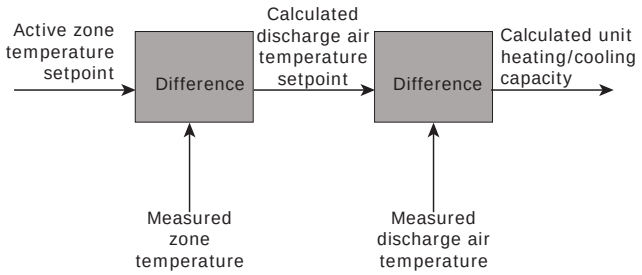
If the controller is in any mode other than unoccupied mode when the **ON** button is pressed, the controller still starts the occupied bypass timer without changing to occupied bypass mode. If the controller is placed in unoccupied mode before the occupied bypass timer expires, the controller is placed 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

The 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 (0–100 percent).

Figure 59. Cascade zone control



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 Control”).

- **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 (0–100%) 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

If the 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

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 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. (For more information, refer to the Water Temperature Sampling Function section.)

Water Temperature Sampling Function

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 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

The controller supports 1-, 2-, 3-speed fans and variable-speed fans. The fan operates in fan cycling or continuous fan 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.

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

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

When the controller is configured for *Energy Efficient Mode,* by means of the *Fan Operating Mode Request MV* point, the controller 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. Refer to the preceding section, "Manual Fan Speed Control").

AUTO Fan Operation; ECM Acoustical Mode

When the controller is configured for *Acoustical Mode*, by means of the *Fan Operating Mode Request MV* point, the controller 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. Refer to the preceding section, "Manual Fan Speed Control"). If multiple stages of electric heat exist the controller will use a single minimum air flow for each stage.

Exhaust Control

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

The 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," p. 65).

Three-Wire Modulating Valve Operation

The controller supports tri-state 3-wire 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.

Three-Wire Modulating Valve Calibration

Modulating valve calibration is automatic. During normal controller operation, the controller 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

The controller supports two-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.

Electric Heat Operation

The controller supports staged electric heat (1- or 2-stages). 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 staged electric heat applications, the simultaneous use of electric and hydronic heat is not supported and the controller will operate electric heat *only* when hot water *is not* available (for example, in a changeover unit). In addition, the controller 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

The controller supports space dehumidification when:

- Mechanical (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

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

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

- Smart reset
- Condensate overflow
- Fan status
- Fan off delay
- Filter maintenance timer
- Freeze avoidance

Smart Reset

The controller will automatically restart a unit that is locked out as a result of a **Low Coil Temp Detection** 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.*

Condensate Overflow

For more information, refer to:

- BAS-SVX48*-EN Tracer® UC400-B Programmable Controller for Blower Coil, Fan Coil, and Unit Ventilator Installation, Operation, and Programming Guide

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.

- 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 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 VelociTach 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 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 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 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
- Electric heat stages are **OFF**

Routine Maintenance

Safety

⚠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

Rotating Components!

Failure to disconnect power before servicing could result in rotating components cutting and slashing technician which 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.

- Always isolate the fan coil unit electrically before removing the front access panel. Do this by opening the circuit breaker (or other switching device) on the distribution panel in the suite. There is a high risk of electrocution if the unit is improperly isolated. If in doubt have a qualified electrician perform the service work.
- Ensure that the fan has stopped rotating before proceeding to work within the unit.
- If the unit is equipped with a fuse or circuit breaker, do not change out either of these devices with ones of a higher Amp rating. The purpose of a fuse or circuit breaker is to protect the power wiring to the unit. The fuse class, voltage, and amp ratings are marked on the electrical wiring diagram.
- Take care when working inside the unit. Sheet metal components may have sharp edges.

⚠CAUTION

Sharp Edges!

Failure to follow instructions below could result in minor to moderate injury.

The service procedure described in this document involves working around sharp edges. To avoid being cut, technicians MUST put on all necessary Personal Protective Equipment (PPE), including gloves and arm guards.

- If the black acrylic coating on the fiberglass cabinet liner is damaged, it must be patched to prevent fiberglass particles entering the air stream.

Maintenance Checklist

Table 29. Maintenance checklist

Frequency	Maintenance
Every three months	• Replace filter. The filter can be one of two types: a cardboard framed type or a wire frame with filter media attached.Under certain operating conditions, it may be necessary to change or clean the filter more frequently to obtain maximum unit performance. For flush mounted panels, remove panel by rotating fastener head with a 1/4 turn. Pull the top edge of the panel forwards and unhook the bottom edge. Slide out the filter. Fit a new filter and replace the panel. For hinged panels, open the door forward. The filter is now accessible and is removed by sliding it upwards out of the channels behind the door.
Annually (before the start of the cooling season)	• Remove the return air/access panel from the wall. Remove the sheet metal screws which secure the panel that shields the fan assembly. Pull the shield panel sharply downward and remove.
	• Vacuum the drain pan and check that the drain outlet is not blocked. Pour water into the pan and check that it drains quickly. If it appears to be partly blocked, remove and clean the drain hose beneath the pan.
	• If the coil surface is dirty, vacuum the surface which faces the room. Take care not to damage the aluminium fins on the coil. If the fins are flattened, the performance of the unit will be reduced
	• Inspect the surface of the cabinet liner for evidence of dampness. The liner should be completely dry in all areas. Vacuum excessive dust from the liner, taking care not to damage the black acrylic coating on the liner. Do not run the unit if the liner is damp as this can promote mold growth. Determine the cause of the dampness. If there is evidence of mold growth it might be necessary to replace part or all of the liner. If in doubt consult a remediation specialist.
	• Replace the thermostat battery if it is a seven-day programmable type

The following components do not require routine maintenance:

- Fan, fan motor, control valve, electric heater, units with electric heat, thermostat.

Note: *Fan motors have sealed bearings and do not require additional lubrication.*

Replacement Parts

When ordering replacement parts, refer to model and serial number located on the unit nameplate, which is located on the fan/motor cover.

Table 30. Filter size

Filter Size (1 inch thick)		
Unit Size	**Width (in.)**	**Height (in.)**
300	12.15	18.375
400	12.15	18.375
600	15.15	26.375
800	15.15	26.375
1000	19.15	30.375
1200	19.15	30.375

Diagnostics and Troubleshooting

This section is intended to be used as a diagnostic aid only. For detailed repair procedures, contact your local Trane service representative.

⚠ 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.

Fan Coil

Table 31. Fan coil troubleshooting recommendations

Symptom	Probable Cause	Recommended Action
Motor fails to start	Blown fuse or open circuit breaker	Replace fuse or reset circuit breaker.
	Overload trip	Check and reset overload.
	Improper wiring or connections	Check wiring with diagram supplied on unit.
	Improper current supply	Compare actual supply power with motor nameplate recommendations. Contact power company for adjustments.
	Mechanical failure	Check that fan rotates freely.
Motor stalls	Low line voltage	Check across AC line. Correct voltage if possible.
Excessive vibration	Poor fan alignment	Check motor bracket screws. Check fan position on shaft. Align bearing set screws. Loosen and retighten bearing set screws.
	Shipping spacers not removed	Remove shipping spacers and/or bolts.
Motor runs and then dies down	Partial loss of line voltage	Check for loose connections. Determine adequacy of main power supply.
Motor does not come up to speed	Low voltage at motor terminals	Check across AC line and correct voltage loss if possible.
	Line wiring to motor too small	Replace with larger sized wiring.
Motor overheats	Overloaded motor	Reduce load or replace with a larger motor.
	Motor fan is clogged with dirt preventing proper ventilation	Remove fan cover, clean fan and replace cover.
Excessive motor noise	Motor mounting bolts loose	Tighten motor mounting bolts.
	Rigid coupling connections	Replace with flexible connections.
	Fan rubbing on fan cover	Remove interference in motor fan housing.
Low water coil capacity	Incorrect airflow	Check fan operating condition.
	Incorrect water flow	Inspect the water pumps and valves for proper operation and check the lines for obstructions.
	Incorrect water temperature	Adjust the chiller or boiler to provide the proper water temperature.
	Coil is piped incorrectly	Verify coil piping.
	Dirty fin surface	Clean the fin surface.
	Incorrect glycol mixture	Verify glycol mixture and adjust if necessary.
Low steam coil capacity	Incorrect airflow	Check fan operating condition.
	Coil is piped incorrectly	Verify coil piping.
	Incorrect steam pressure	Verify steam pressure and adjust if necessary.
	Excessive steam superheat	Check steam superheat. Steam superheat should not exceed 50ºF.
	Failure of steam line/condensate return components	Verify component operation
	Boiler failure	Verify boiler operation
	Dirty fin surface	Clean the fin surface.
Drain pan is overflowing	Plugged drain line	Clean drain line
	Unit not level	Level unit
	Improper trap design	Design trap per unit installation instructions
Standing water in drain pan	Improper trap design	Design trap per unit installation instructions
	Unit not level	Level unit
	Plugged drain line	Clean drain line
Wet interior	Coil face velocity too high	Reduce fan speed
	Improper trap design	Design trap per unit installation instructions
	Drain pan leaks/overflows	Repair leaks
	Condensation on surfaces	Insulate surfaces
Excess dirt in unit	Missing filters	Replace filters
	Filter bypass	Reduce filter bypass by ensuring all blockoffs are in place.

Table 31. Fan coil troubleshooting recommendations (continued)

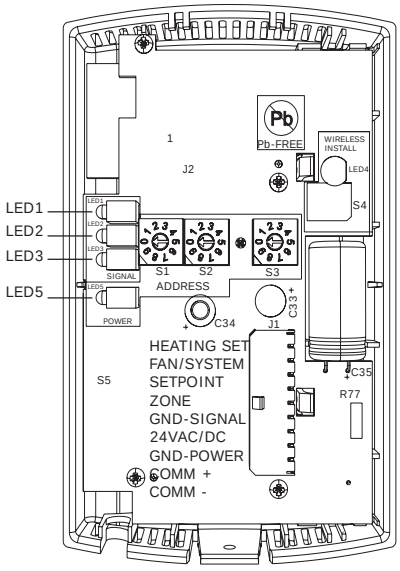
Symptom	Probable Cause	Recommended Action
Microbial growth (mold) inside air handler	Standing water in drain pan	See “Standing water in drain pan” above.
Low refrigerant coil capacity	Incorrect airflow	Check fan operating condition.
	Expansion valve is not operating properly or is sized incorrectly	Check sensing bulb temperature. Verify valve operation. Verify proper valve size.
	Incorrect refrigerant charge	Verify refrigerant charge and adjust if necessary.
	Condensing unit failure	Verify condensing unit operation.
	Coil is piped incorrectly	Verify coil piping
	Clogged refrigerant line filter	Change filter core.
	Failure of suction/liquid line components	Verify component operation.
	Dirty fin surface	Clean the fin surface. Do not use steam to clean refrigerant coils.
	Fin frosting	Verify defrost cycle operation. Verify frostat operation. Verify refrigerant charge.

Wireless Zone Sensors (WZS)

The receiver for all models has four LEDs: LED1, LED2, LED3, and LED5. Figure below shows their locations.

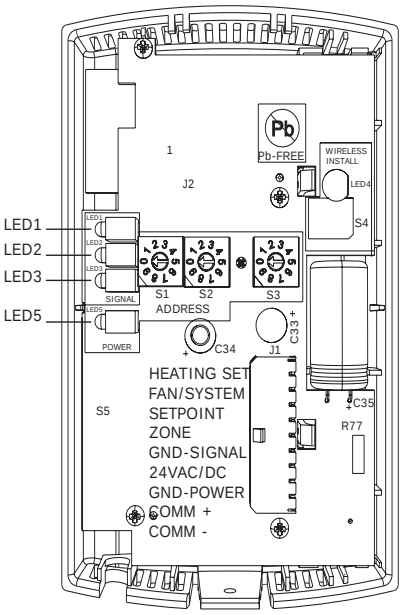
Note: *To view LEDs on a flush mount receiver on a fan coil unit, the front panel of the unit must be removed.*

Figure 60. Receiver for all fan coil models showing LED locations



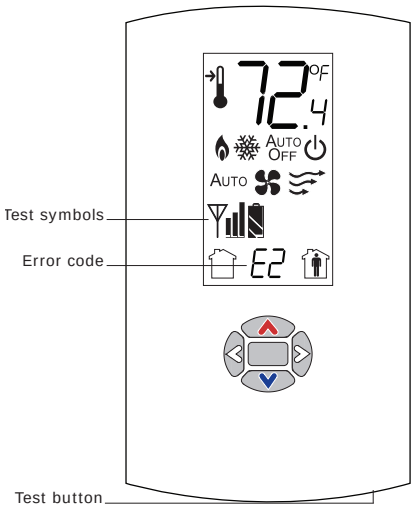
The sensor for a wireless zone sensor (WZS) has four LEDs: LED1, LED2, LED3, and LED5 and a test button. Figure below shows their locations.

Figure 61. WZS showing LED locations and test button



The sensor for a wireless display sensor (WDS) has test symbols and error codes that appear on the display, and a test button. See the figure below.

Figure 62. WDS shows test symbols and error codes



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 (see the table below).

Table 32. 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.

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 (see the table below).

Table 33. 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.

Testing Signal Strength

To initiate a signal strength test, push the Test button on the sensor (see location of Test button in Figure 61 and Figure 62).

- **Models WZS:** LED1, LED2, and LED3 respond by indicating signal strength. You can view them on the sensor and the receiver (tables below).
- **Model WDS:** Test symbols on the sensor display indicate signal strength. LED1, LED2, and LED3, on the receiver, respond by indicating signal strength. See the tables below for symbol displays.

Table 34. Observing signal strength on the wireless zone sensor

User action	LED state	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 35. Observing signal strength on the receiver

User action	LED state on receiver	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 61). LED5 on the sensor responds by indicating the level of battery strength, as shown in the table below.
- On the WDS, push the Test button on the sensor (see location on Figure 62). In response, a battery test symbol appears on the display. The symbol shown indicates battery life expectancy (see Table 37).

Table 36. 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 37. Battery status shown on the wireless display sensor

User action	Battery test symbol	Indicates...	Battery test symbol	Indicates...	Battery test symbol	Indicates...
Press Test button		Full battery power.		50percent 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 60 , page 72) 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 61), and on the display on model WDS (see Figure 62 , page 73).

For more information on interpreting the LEDs and the display symbols that indicate signal strength, see “Testing Signal Strength,” page 74.

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 attempt to 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 (p/n 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," page 75) 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). Refer to "Observing Receiver for Readiness," p. 53.

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 "Associating Sensor to Receiver," p. 54).

1. Using a small screwdriver, set the three rotary address switches (Figure 47, p. 53, locations S1, S2, S3) on the receiver to an address between 001 and 999.

Note: *An address can be changed at any time after initial association has been established. It is not necessary to power down the receiver or sensor.*

2. Set the three rotary address switches (Figure 47, p. 53, locations S1, S2, 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," page 74) and the battery life "Testing Battery Status," page 75) 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 (p/n 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 (see Figure 45, p. 53) and push upward.*

To replace a failed sensor or receiver:

1. Confirm that the device is disassociated (see Table 32 and Table 33, p. 73).
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").*

Servicing/Testing Wireless Zone Sensors

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 Zone Sensor

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," page 75) and signal strength ("Testing Signal Strength," page 74) 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 "Failure and Default Modes").
3. Measure the receiver output resistance (see "Measuring Output Resistance").
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," page 74.

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.

Failure and Default Modes

The following table provides output values for failure and default modes of operation, which can be used for troubleshooting.

Table 38. Output values - failure and default modes of operation

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 below.

Table 39. 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 the table below.

   Note: *The output circuits are not electrically powered; consequently, resistance can be measured without risk of damage to the volt-ohm meter.*

Table 40. 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.

Tracer® UC400-B Controller

LED Activity

LEDs are located on the front of the Tracer® UC400-B controller. The following table provides a description of LED activity, an indication or troubleshooting tip for each, and any related notes.

Table 41. LED activity and troubleshooting tips for Tracer® UC400-B controller

LED Name	Activities	Indication and Troubleshooting Tips	Notes
Marquee LED	Shows solid green when the unit is **powered** and no alarm exists	Indicates normal operation	When powering the UC400-B and expansion module, the Marquee LED will blink **RED**, blink **GREEN** (indicating activated and controller/expansion module are communicating), and then stay **GREEN CONTINUOSLY** (indicating normal power operation).
	Shows blinking green during a device reset or firmware download	Indicates normal operation	
	Shows solid red when the unit is **powered**, but represents low power or a malfunction	**If low power**; could be under voltage or the microprocessor has malfunction. Measure for the expected value range. For more information, refer to *Installation, Operation, and Maintenance: Tracer® UC400-B Programmable Controller* (BAS-SVX20C-EN, or the most recent version). **If malfunction**; un-power and then re-power unit to bring the unit back up to normal operation.	
	Shows blinking red when an **alarm** or fault exists	An alarm or fault condition will occur if the value for a given point is invalid or outside the configured limits for the point. Alarm and fault conditions vary, and they can be configured by the programmer.	
	LED not lit	Indicates power is OFF or there is a malfunction **OFF** or **malfunction**; cycle the power. For more information, refer to *Installation, Operation, and Maintenance: Tracer® UC400-B Programmable Controller* (BAS-SVX20*-EN, or the most recent version).	
Link and IMC	TX blinks green	Blinks at the data transfer rate when the unit transfers data to other devices on the link	TX LED: Regardless of connectivity or not, this LED will constantly blink as it continually looks for devices to communicate to. LED not lit: Determine if, for example, a Tracer® SC or BACnet device is trying to talk to the controller or if it is capable of talking to the controller. Also determine if the communication status shows down all of the time. In addition, check polarity and baud rate. For more information, refer to *Installation, Operation, and Maintenance: Tracer® UC400-B Programmable Controller* (BAS-SVX20*-EN, or the most recent version).
	RX blinks yellow	Blinks at the data transfer rate when the unit receives data from other devices on the link **ON solid yellow**; indicates there is reverse polarity	
	LED is not lit	Indicates that the controller is not detecting communication **Not lit**; cycle the power to reestablish communication	
Service	Shows solid green when the LED has been pressed		***When the UC400-B is placed into boot mode, the system will not run any applications such as trending, scheduling, and TGP2 runtime. The controller will be placed into boot mode if the service pin is held in when power is applied. In boot mode, the controller is non-operational and is waiting for a new main application to be downloaded.***
	LED not lit	Indicates controller is operating normally	
Binary B01 through B09	Shows solid yellow	Indicates a corresponding binary output has been *commanded* **ON** **Relay coil**; indicates that a command has been made to energize **TRIAC**; indicates that a command has been made to turn ON	If the user is currently powering the UC400-B from a USB port, the Led lights will turn **ON**. However, the binary outputs ***will not*** be activated. **Commanded ON**; As an example of commanded ON, a command could be a manual command such as an override or a command could be from TGP2 based on a list of conditions that are met telling these outputs to turn ON. LED not lit: Did the user command it to be ON? If yes, see the Marquee LED at the top of this table. For more information, refer to *Installation, Operation, and Maintenance: Tracer® UC400-B Programmable Controller* (BAS-SVX20*-EN, or the most recent version).
	LED not lit	Indicates that a relay output is de-energized or no power to the board **Not lit**; cycle power to reestablish communication	

Overriding Outputs

Analog and multistate value request points are included in order to safely override outputs without disrupting TGP2 program operation. To override valves and dampers for commissioning or testing purposes, access the following points on the Tracer® TU analog or multistate status pages:

- Cool valve request
- Heat valve request
- Electric heat request
- Supply fan speed active

For more information, refer to: *BAS-SVX20*-EN Tracer® UC400-B Programmable Controller Installation, Operation, and Maintenance.*

Diagnostics

Diagnostics are informational messages that indicate the operational status of the 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

Note: *Clearing diagnostics refers to deleting diagnostics from the software; it does not affect the problem that generated the message.*

Manual (Latching) Diagnostics

Manual diagnostics (also referred to as latching) cause the unit to shutdown. Manual diagnostics can be cleared from the UC400-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 24Vac 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.”

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.

Building Automation System

Some building automation systems can reset diagnostics in the controller. For more complete information, refer to the product literature for the building automation system.

Trane Service Tools

Tracer® TU can be used to reset diagnostics present in a Tracer® UC400-B controller.

Controller Diagnostics

The table below lists each diagnostic that can be generated by the UC400-B controller, the diagnostic effect on outputs *(consequences)*, and diagnostic type.

Note: *The generic binary output is unaffected by diagnostics.*

Table 42. Diagnostics generated by UC400-B controller

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** • 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** • 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** • 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** • 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** • 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
Outdoor air temp failure	Invalid or missing value for outdoor air temperature.	• Fan **Unaffected** • Valved **Unaffected** • Outdoor air damper **Minimum Position** • Electric heat **unaffected**	Automatic
Humidity input failure	Invalid or missing value for relative humidity.	• Fan **Unaffected** • Valves **Unaffected** • Outdoor air damper **Unaffected** • Electric heat **Unaffected**	Automatic
CO_2 sensor failure	Invalid or missing value for CO_2.	• Fan **Unaffected** • Valves **Unaffected** • Outdoor air damper **Unaffected** • Electric heat **Unaffected**	Informational
Generic AIP failure	Invalid or missing value for generic analog input.	• Fan **Unaffected** • Valves **Unaffected** • Outdoor air damper **Unaffected** • 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** • 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** • Electric heat **Unaffected**	Automatic

(a) For detailed information about zone temperature control methods, refer to "Zone Temperature Control," p. 65.

Fans with UC400-B Controller

Table 43. 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.
Diagnostic present	Several diagnostics affect fan operation. For detailed information about these diagnostics, refer to Table 42, p. 81.
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.

Fans with UC400-B Controller

Table 43. Fan does not energize (continued)

Probable Cause	Explanation
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 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 UC400-B Controller

Table 44. 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 Table 42, p. 81.
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. For modulating valves, ensure the stroke time is set correctly.

Table 45. 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 Table 42, p. 81.
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.
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. For modulating valves, ensure the stroke time is set correctly.
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**.

Electric Heat with UC400-B Controller

Table 46. 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 electric heat operation. For detailed information about these diagnostics, refer to Table 42, p. 81.
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, 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**.

ECM Motors

⚠ 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.

An electronically commutated motors (ECM) is a closed loop system that has equipment protections and envelope enforcements. Do not assume that the motor has failed without first consulting the VelociTach 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 coordinated by the VelociTach motor control board.

The mini-access lid on the front of the main control panel lid has the VelociTach 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.

The adapter boards contain high voltage. Configuration adjustments to the VelociTach board should be made through the SMALLER of the two low-voltage lids on the front of the control panel, through the low-voltage insulation/shielding.

⚠ 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.

General Information

The VelociTach motor control board 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® 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/down-stream lockouts).*

The VelociTach motor control board also coordinates the operation of electric heat, electric/hydronic heat lockouts, and CSTI changeover coil operation.

Troubleshooting Tips

- VelociTach motor control board configuration must perfectly match the factory-supplied ECM.
  - Refer to "Adjustments," p. 39 for configuration of the motor control board.
- The VelociTach motor control board will display troubleshooting information, and contains dual tachometers to aid in performance verification.
- Under normal circumstances, the VelociTach 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.
- VelociTach label (see "Motor control board label," p. 43) 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

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 47. 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 500 rpm for the affected motor. Speeds below 500 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 VelociTach motor control board, the customer-supplied controller.
Customer Controller output signal to VSP Inputs are too low. **Note:** If the customer supplied controller outputs signals that are below the noise threshold, they will be ignored by the ECM Engine.	Noise floor is set too high.	• The VelociTach motor control 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.

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/down-stream 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 48. 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 500 rpm. Speeds below 500 rpm are not supported on the fan coil product.
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. **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 VelociTach motor control 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 VelociTach motor control board contains an adjustable noise floor parameter, uFLr, that can be configured to reject signals below the noise floor. • 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 motor control board contains an adjustable digital amplifier, AISc, 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 AHi1 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. Verify with a CAT III or IV voltmeter rated per NFPA 70E that all capacitors have discharged.

Replacement Guidelines

- ECM motors contain capacitors which store residual energy. Please keep clear of the fan wheels for five minutes after the power has been removed from the system, as a power request with the motor powered off, could result in a very short period of actuation. Unplugging the motor is adequate to ensure that there will be no power request.
- Configuration adjustments to the VelociTach motor in accordance with the parameters that are printed on the label adjacent to the VelociTach board. These parameters reflect the factory settings for the unit. Subsequent changes to parameters made during commissioning will not be reflected in the printed parameters.
- Initial hookups to the CSTI and standard adapter board, including low voltage interconnections, must be made with the power off.
- Do not make connections to the motors or the adapter boards while power is ON. Do not remove connections to the motor or the adapter boards while the power is ON.
- Caution should be taken to stay clear of hazardous voltages, moving parts and electric heat elements while making adjustments to the VelociTach motor control board. If it is not practical to stay clear of these areas during adjustment, please contact Trane Global Parts for configuration kit that allows easy powering of the engine board outside of the unit with a 9V battery.
- For safe operation, it is necessary to configure replacement boards to match the setup/switch configuration of the previously installed boards.
- Ensure that new circuit modules are firmly seated on the nylon standoffs, and that the nylon standoffs are firmly seated on the metal panel
- 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 VelociTach motor control 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 VelociTach motor control board before commissioning the unit. The board is pre-configured with safe values, but will NOT work correctly unless properly configured. The factory shipped parameter settings are on the label adjacent to the VelociTach.
- 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.

Replacement Checklist

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.

☐	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 the VelociTach motor control board 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 Module 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.

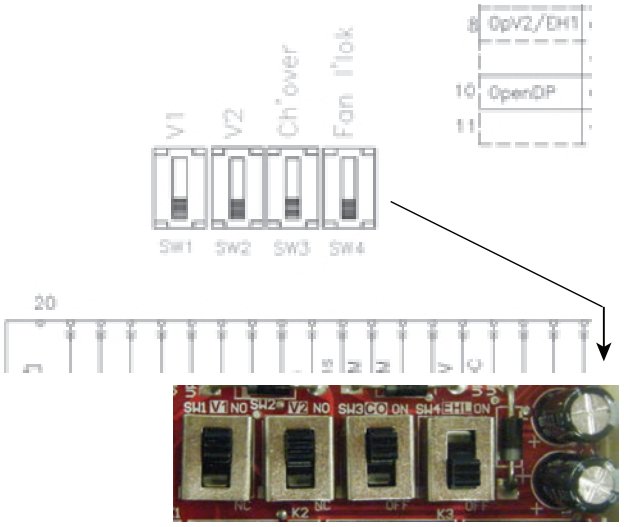
Figure 63. Remove PCB

2. If replacing the VelociTach motor control board, special care should be taken to avoid electro-static discharge damage. Please 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.
4. Ensure that the new VelociTach motor board controller is configured to match the configuration label that is present on the unit. It is necessary to configure the VelociTach board to avoid improper operation of the unit, discomfort to the end user, and loud fan operation.

Figure 64. Configure VelociTach board

5. Ensure that the CSTI adapter board switches are set correctly, as indicated in the unit schematic (where applicable) shown in Figure 65.

Figure 65. Ensure CSTI adapter board switches are set correctly



6. After replacing modules, commission the unit by performing at a minimum, "Fan Speed Response Verification," p. 46.

Application Notes

The ECM motor 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 inches ESP for High, Medium, and Low speeds. The speeds can be manually changed for high, medium, and low operation, but shall 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

This motor 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 1500 rpm, or lower than 500 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 VelociTach motor control board 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.

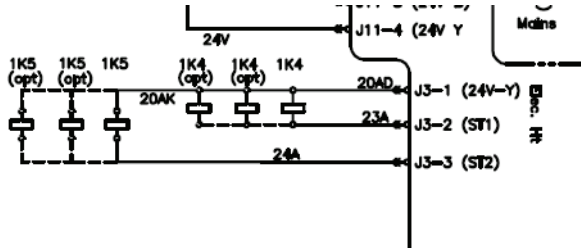
MCA/MOP and Power Draw

ECM 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.

Electric Heat Relays

For quiet operation, units employ power relays instead of definite purpose contactors for electric heat actuation. The coils of multiple relays are hooked in parallel to simulate a multi-pole contactor, as shown in Figure 66. In Figure 66, two sets of three relays are used to perform the function of a two 3-pole contactors.

Figure 66. Sample arrangement: electric heat relay



Troubleshooting Other Unit Functions

In some cases, the normal or abnormal operation of the ECM 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:

- Valve operation
- Electric heat operation
- Entering water temperature operation
- 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:

- Fans are failing to meet target speed. A second motor is never present, all settings for speeds for Motor 2 should be set to 0000.
- Hot water may be available in the changeover coil.
- Target speeds for motors may be set too high:
  - The FPru parameter may be set incorrectly.
  - The A iPU parameter may be set incorrectly.

Wiring Diagrams

Figure 67. CSTI wiring diagram

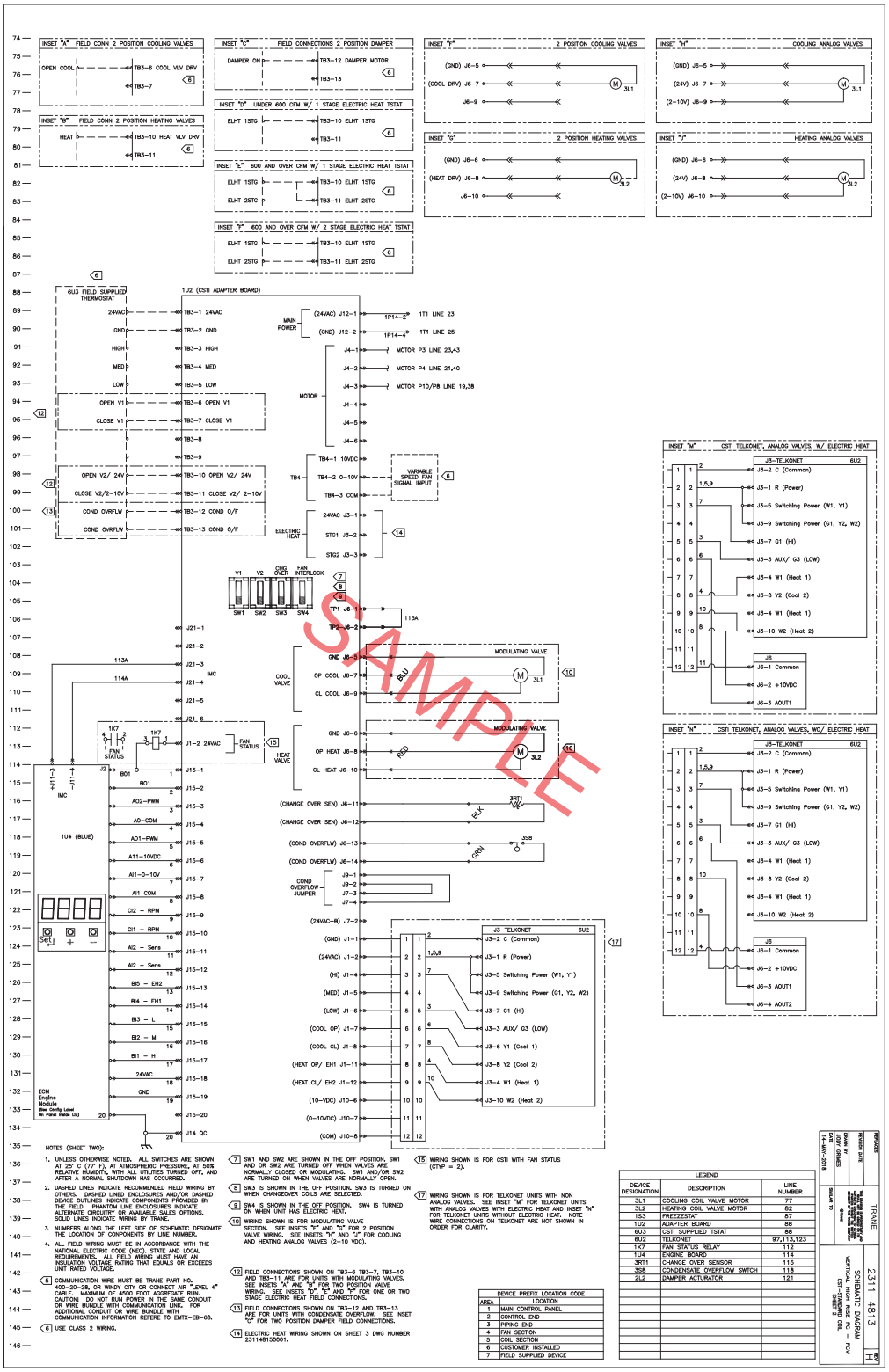
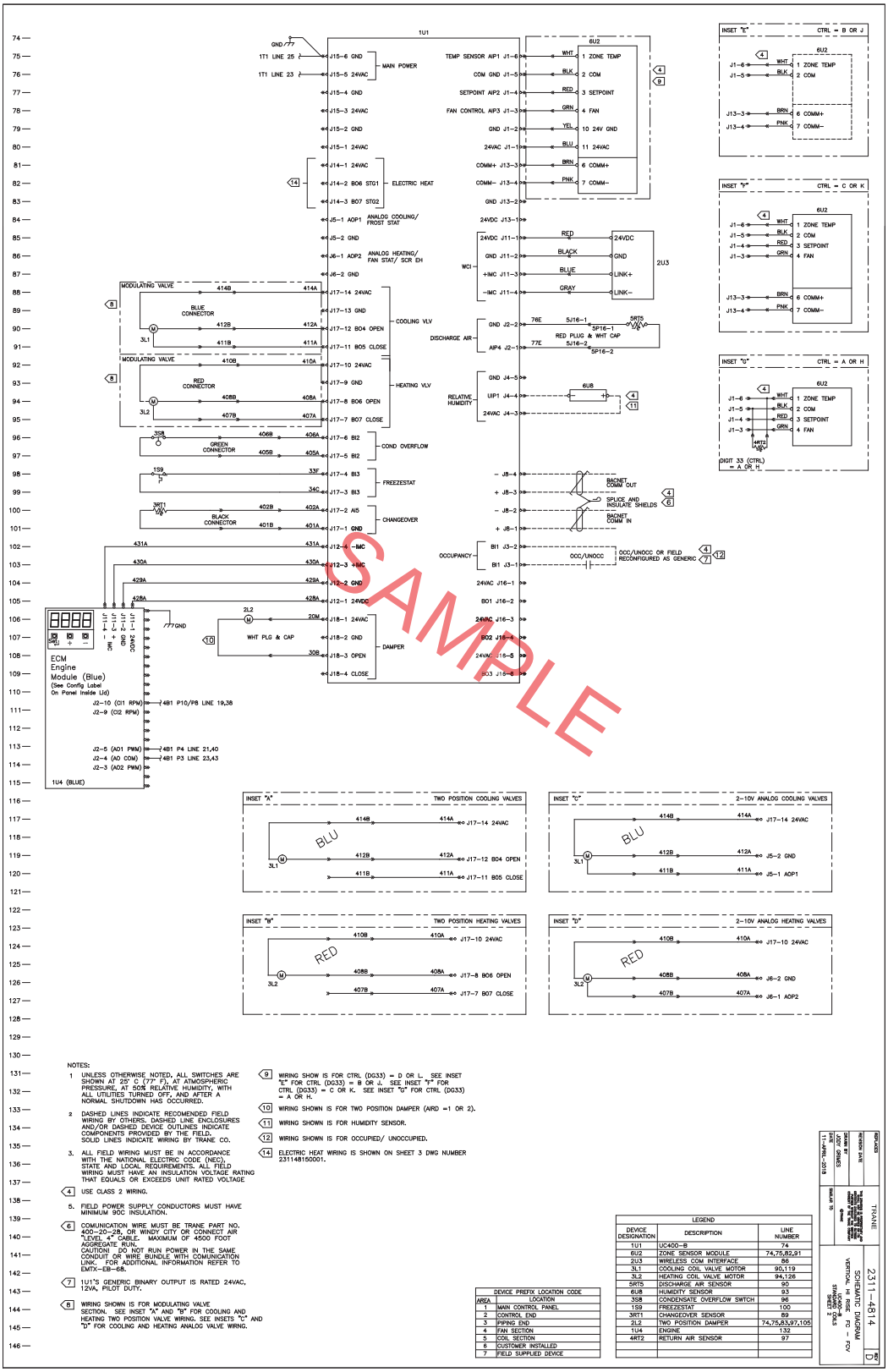


Figure 68. UC400-B wiring diagram



NOTES:

1. UNLESS OTHERWISE NOTED, ALL SWITCHES ARE SHOWN AT 25° C (77° F), AT ATMOSPHERIC PRESSURE, AT 50% RELATIVE HUMIDITY, WITH ALL UTILITIES TURNED OFF, AND AFTER A NORMAL SHUTDOWN HAS OCCURRED.
2. DASHED LINES INDICATE RECOMENDED FIELD WIRING BY OTHERS. DASHED LINE ENCLOSURES AND/OR DASHED DEVICE OUTLINES INDICATE COMPONENTS PROVIDED BY THE FIELD. SOLID LINES INDICATE WIRING BY TRANE CO.
3. ALL FIELD WIRING MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE (NEC), STATE AND LOCAL REQUIREMENTS. ALL FIELD WIRING MUST HAVE AN INSULATION VOLTAGE RATING THAT EQUALS OR EXCEEDS UNIT RATED VOLTAGE
4. USE CLASS 2 WIRING.
5. FIELD POWER SUPPLY CONDUCTORS MUST HAVE MINIMUM 90C INSULATION.
6. COMUNICATION WIRE MUST BE TRANE PART NO. 400-20-28, OR WINDY CITY OR CONNECT AIR "LEVEL 4" CABLE. MAXIMUM OF 4500 FOOT AGGREGATE RUN. CAUTION! DO NOT RUN POWER IN THE SAME CONDUIT OR WIRE BUNDLE WITH COMMUNICATION LINK. FOR ADDITIONAL INFORMATION REFER TO EMTX-EB-68.
7. 1U1'S GENERIC BINARY OUTPUT IS RATED 24VAC, 12VA, PILOT DUTY.
8. WIRING SHOWN IS FOR MODULATING VALVE SECTION. SEE INSET "A" AND "B" FOR COOLING AND HEATING TWO POSITION VALVE WIRING. SEE INSETS "C" AND "D" FOR COOLING AND HEATING ANALOG VALVE WIRING.
9. WIRING SHOW IS FOR CTRL (DG33) = D OR L. SEE INSET "E" FOR CTRL (DG33) = B OR J. SEE INSET "F" FOR CTRL (DG33) = C OR K. SEE INSET "G" FOR CTRL (DG33) = A OR H.
10. WIRING SHOWN IS FOR TWO POSITION DAMPER (AIRD =1 OR 2).
11. WIRING SHOWN IS FOR HUMIDITY SENSOR.
12. WIRING SHOWN IS FOR OCCUPIED/ UNOCCUPIED.
14. ELECTRIC HEAT WIRING IS SHOWN ON SHEET 3 DWG NUMBER 2311481S0001.

DEVICE PREFIX LOCATION CODE	
AREA	LOCATION
1	MAIN CONTROL PANEL
2	CONTROL END
3	PIPING END
4	FAN SECTION
5	COIL SECTION
6	CUSTOMER INSTALLED
7	FIELD SUPPLIED DEVICE

LEGEND		
DEVICE DESIGNATION	DESCRIPTION	LINE NUMBER
1U1	UC400-B	74
2U2	ZONE SENSOR MODULE	74,75,82,91
2U3	WIRELESS COM INTERFACE	86
3L1	COOLING COIL VALVE MOTOR	90,119
3L2	HEATING COIL VALVE MOTOR	94,126
5RT5	DISCHARGE AIR SENSOR	90
6U8	HUMIDITY SENSOR	93
3S8	CONDENSATE OVERFLOW SWITCH	96
1S9	FREEZESTAT	100
3RT1	CHANGEOVER SENSOR	89
2L2	TWO POSITION DAMPER	74,75,83,97,105
1U4	ENGINE	132
4RT2	RETURN AIR SENSOR	97

Figure 69. Electric heat wiring diagram

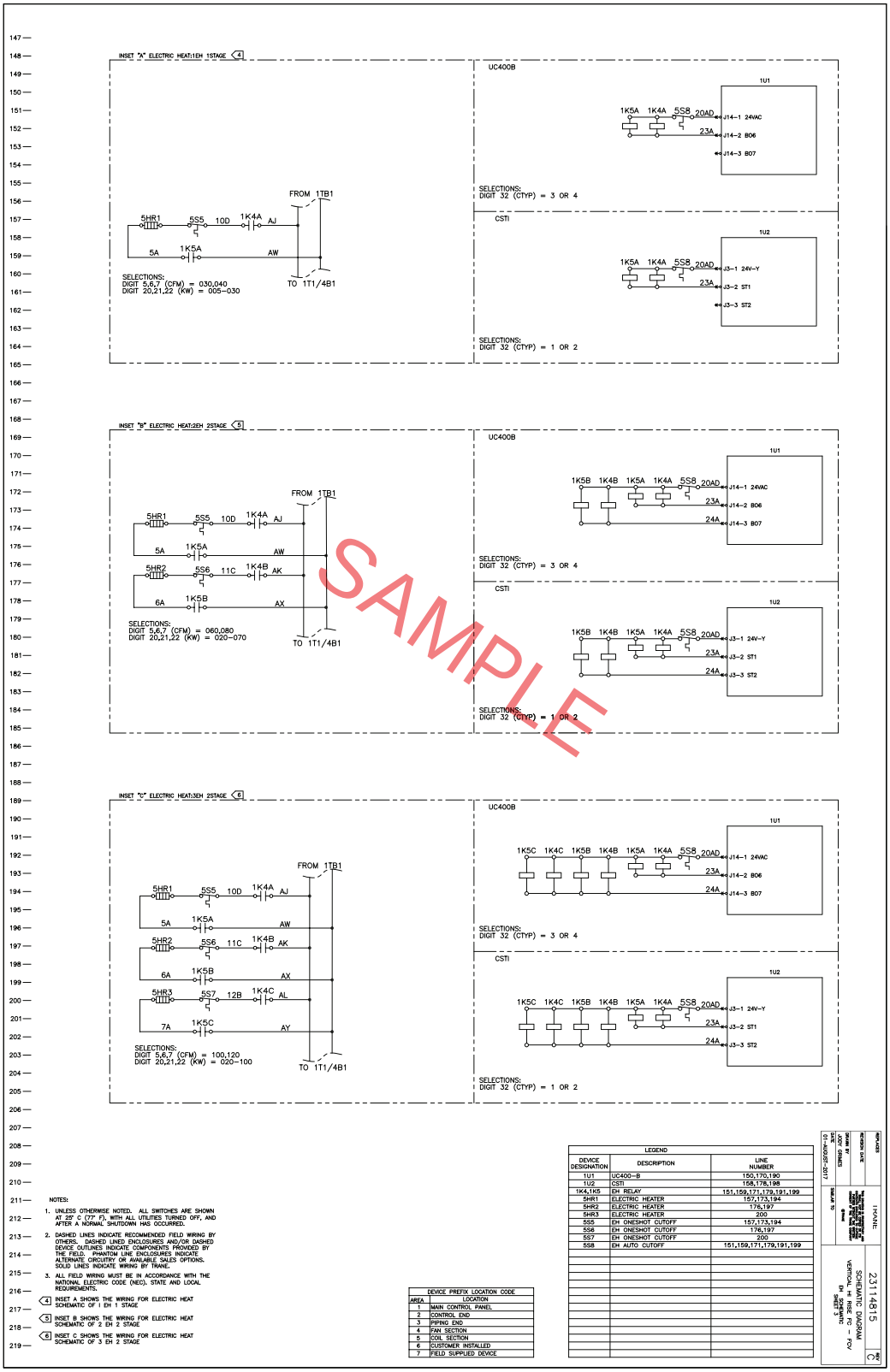


Figure 70. UC400-B component layout

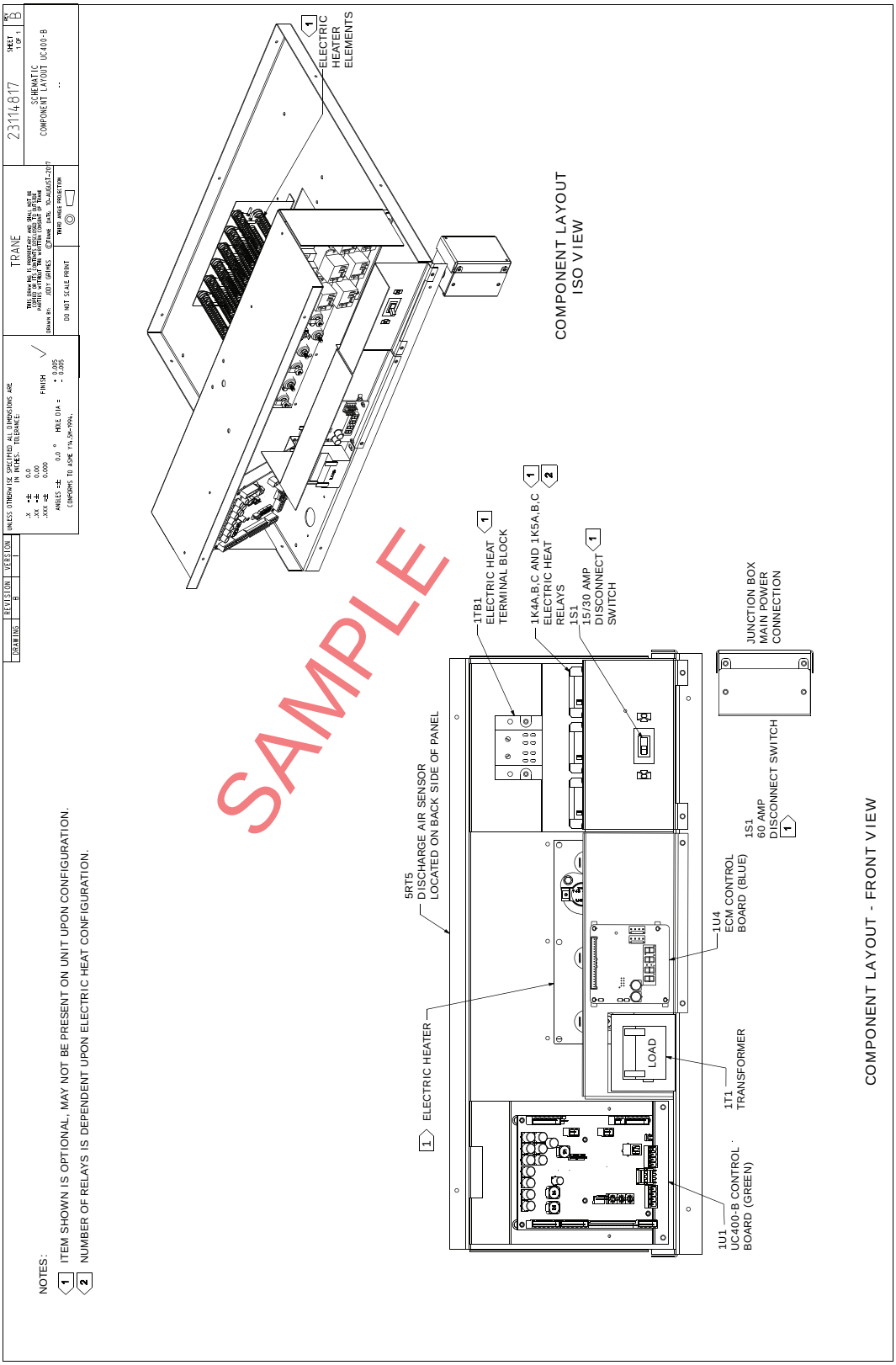
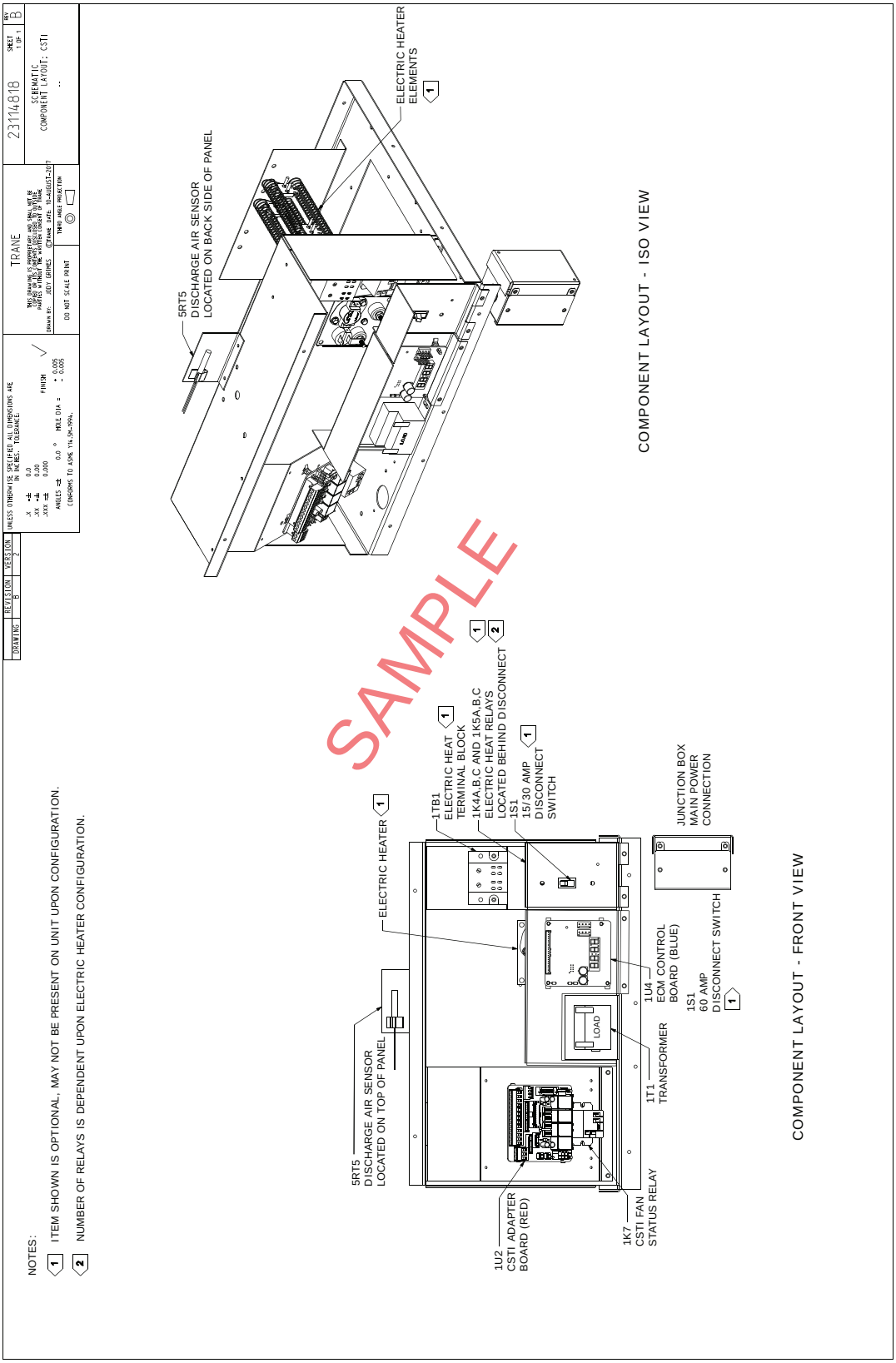


Figure 71. CSTI component layout



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