Installation, Operation, and Maintenance

Vertical Unit Ventilator

Classroom Unit Ventilator—Model VUV

Models	"A" and later Design Sequence
VUVE	750 cfm—1500 cfm

⚠SAFETY WARNING

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

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UV-SVN03F-EN

Warnings, Cautions and Notices

Warnings, Cautions, and Notices. Note that warnings, cautions, and notices appear at appropriate intervals throughout this manual. Warnings are provide to alert installing contractors to potential hazards that could result in death or personal injury. Cautions are designed to alert personnel to hazardous situations that could result in personal injury, while notices indicate a situation that could result in equipment or property-damage-only accidents.

Your personal safety and the proper operation of this machine depend upon the strict observance of these precautions.

Read this manual thoroughly before operating or servicing this unit.

ATTENTION: Warnings, Cautions, and Notices appear at appropriate sections throughout this literature. Read these carefully:

⚠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

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 such as HCFCs and HFCs.

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. 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

Contains Refrigerant!

System contains oil and refrigerant under high pressure. Recover refrigerant to relieve pressure before opening the system. See unit nameplate for refrigerant type. Do not use non-approved refrigerants, refrigerant substitutes, or refrigerant additives.

Failure to follow proper procedures or the use of non-approved refrigerants, refrigerant substitutes, or refrigerant additives could result in death or serious injury or equipment damage.

⚠WARNING

Proper Field Wiring and Grounding Required!

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

⚠WARNING

Personal Protective Equipment (PPE) Required!

Installing/servicing this unit could result in exposure to electrical, mechanical and chemical hazards.

- **Before installing/servicing this unit, technicians MUST put on all PPE required for the work being undertaken. ALWAYS refer to appropriate MSDS sheets and OSHA guidelines for proper PPE.**
- **When working with or around hazardous chemicals, ALWAYS refer to the appropriate MSDS sheets and OSHA guidelines for information on allowable personal exposure levels, proper respiratory protection and handling instructions.**
- **If there is a risk of arc or flash, technicians MUST put on all PPE in accordance with NFPA 70E or other country-specific requirements for arc flash protection, PRIOR to servicing the unit.**

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

⚠ WARNING

Hazard of Explosion and Deadly Gases!

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

Introduction

Important: *Equipment is shipped FOB (Free On Board) at the manufacturer. Therefore, freight claims for damages against the carrier must be initiated by the receiver.*

Table of Contents

Model Number Descriptions

Vertical Unit Ventilator Model Number

Digits 1, 2, 3 — Unit Configuration

VUV= Vertical Unit Ventilator

Digit 4 — Development Sequence

E

Digits 5, 6, 7 — Nominal Airflow

075 = 750 cfm
100 = 1000 cfm
125 = 1250 cfm
150 = 1500 cfm

Digit 8 — Voltage (Volts/Hz/Phase)

0 = 115/60/1
1 = 208/60/1
2 = 230/60/1
3 = 208/60/3
4 = 460/60/3
7 = 277/60/1
8 = 230/60/3

Digit 9 — Open Digit = 0

Digits 10, 11 — Current Design Sequence

Digit 12 — Face & Bypass

Y = Yes, Include Damper
N = No Damper

Digit 13 — Unit Arrangement

1 = Return Air Front / Fresh Air Back
2 = 100% Return Air Front
3 = 100% Fresh Air Back
4 = Dynamic Air Barrier
5 = ERS-Compatible w/RH Connection
6 = ERS-Compatible w/LH Connection

Digit 14 — Preheat / Reheat / Changeover

A = 4-Pipe Preheat (RH Clg/LH Htg)
B = 4-Pipe Preheat (LH Clg/RH Htg)
C = 4-Pipe Reheat (RH Clg/LH Htg)
D = 4-Pipe Reheat (LH Clg/RH Htg)
E = 2-Pipe (RH Connections)
F = 2-Pipe (LH Connections)

Digit 15 — Cooling / 2-Pipe Coil

0 = None
B = 2-Row, 12 F.P.I.
C = 2-Row, 16 F.P.I.
D = 3-Row, 12 F.P.I.
E = 3-Row, 16 F.P.I.
F = 4-Row, 12 F.P.I.
G = 4-Row, 14 F.P.I.
H = 3-Row, 16 F.P.I, EarthWise™ Coil
J = 3-Row, DX (R-410A) Cooling Coil

Digit 16 — Heating Coil

0 = None
A = 1-Row, 12 F.P.I.
B = 2-Row, 12 F.P.I.
C = 2-Row, 16 F.P.I.
D = 3-Row, 12 F.P.I.
E = 3-Row, 16 F.P.I.
F = 4-Row, 12 F.P.I.
G = 4-Row, 14 F.P.I.
H = 3-Row, 16 F.P.I, EarthWise Coil
K = Steam Low
L = Steam High
M = Electric Heat - Low
N = Electric Heat - Med
P = Electric Heat - High

Digit 17 — Motor

0 = ECM
1 = ECM & Low Acoustic Option
2 = ECM & Low FLA Option
3 = ECM & Low Acoustic & Low FLA Option

Digit 18 — Other Motor Items

A = None
B = Toggle
C = Circuit Breaker

Digit 19 — 2- or 3-Way Valve - Cooling Changeover Coil

0 = None
2 = 2-Way; 3-Point Floating
3 = 3-Way; 3-Point Floating
4 = 2-Way; 2–10 Volt
5 = 3-Way; 2–10 Volt
6 = Isolation Valve; 2-Way
7 = Isolation Valve; 3-Way

Digit 20 — CV - Cooling or Changeover Coil

0 = None
L = Low Cv
M = Medium Cv
H = High Cv

Digit 21 — 2- or 3-Way Valve - Preheat or Reheat Heating Coil

0 = None
2 = 2-Way; 3-Point Floating
3 = 3-Way; 3-Point Floating
4 = 2-Way; 2–10 Volt
5 = 3-Way; 2–10 Volt
6 = Isolation Valve; 2-Way
7 = Isolation Valve; 3-Way

Digit 22 — CV - Preheat or Reheat Heating Coil

0 = None
L = Low Cv
M = Medium Cv
H = High Cv

Digit 23 — Discharge Arrangement

0 = Opening Only, No Grille
A = Discharge Grille
B = Double Deflection Discharge Grille
C = Grille Discharge with Wire Mesh

Digit 24 — Outside Air Damper Control

0 = None
A = 3-Wire Actuator
B = 2–10 Volt Actuator

Digit 25 — Face and Bypass Damper Control

0 = None
A = 3-Wire Actuator
B = 2–10 Volt Actuator

Digit 26 — Controls

0 = None, Unit-Mounted Speed Switch
2 = Customer Supplied Terminal Interface (CSTI)
3 = CSTI w/Low Temp Detection
4 = Tracer™ ZN520
5 = Tracer ZN520 w/Time Clock
6 = Tracer ZN520 w/Fan Status
7 = Tracer UC400
8 = Tracer UC400 w/Time Clock

Digit 27 — Unit- or Wall-Mounted Controls

0 = None
1 = Unit-Mounted
2 = Wall-Mounted
3 = Unit-Nounted Fan Speed Switch & Wall-Mounted Temperature Sensor
4 = Wireless Zone Sensor

Note: *The wall-mounted room sensor is ordered as separate line item in Job Configurator.*

Digit 28 — Internal or External Set Point

0 = None
1 = Internal
2 = External
3 = Digital Display

Digit 29 — Timed Override

0 = No
1 = Yes

Digit 30 — Exhaust Control

A = No Exhaust Control with 3-Speed Supply Fan
B = Exhaust Control with 2-Speed Supply Fan
C = No Exhaust Control with 1-Speed Supply Fan (DX/EH Units)
D = Exhaust Control with 1-Speed Supply Fan (DX/EH Units)

Digit 31 — DDC Programming

0 = None
1 = Humidity Sensor Programming
2 = CO_2 Sensor Programming

Note: *The humidity and CO_2 sensor must be ordered as a separate line item in Job Configurator.*

Model Number Descriptions

Digit 32 — Unit Depth

A = Standard (16-5/8 in.)
B = 21-1/4 in. Depth with Baffle
C = 21-1/4 in. Depth with Full Sheet Metal Back and Baffle
D = 21-1/4 in. Depth with 25 in. High Falseback
E = 21-1/4 in. Depth with 26 in. High Falseback
F = 21-1/4 in. Depth with 27 in. High Falseback
G = 21-1/4 in. Depth with 28 in. High Falseback
H = 21-1/4 in. Depth with 29 in. High Falseback
J = 21-1/4 in. Depth without Baffle

Note: *Selection "J" should be applied if OA opening is raised above standard baffle location.*

Digit 33 — End Covers

0 = None
1 = 16-5/8 in. Depth without Cutouts
2 = 16-5/8 in. Depth with 3 x 7-1/4 in. Cutout
4 = 21-1/4 in. Depth without Cutouts
5 = 21-1/4 in. Depth with 3 x 7-1/4 in. Cutout
6 = 21-1/4 in. Depth with 3-1/4 in. x 16-7/8 in. Cutout

Digit 34 — Front Panel

1 = Standard Front Panel
2 = Heavy Gauge Front Panel

Digit 35 — Subbase

0 = No Subbase
2 = 2 in. Subbase
4 = 4 in. Subbase
6 = 6 in. Subbase

Digit 36 — Piping Package

0 = None
1 = Ball Valves & P/T Ports
2 = Ball Valve & Circuit-Setter with P/T Ports
3 = Ball Valve, Circuit-Setter with P/T Ports & Strainer

Digit 37 — Flow Control - Cooling/Changeover Coil

0 = None

Digit 38 — Flow Controls - Heating Coil

0 = None

Digit 39 — Auxiliary Drain Pan - Piping

Y = Yes, Auxiliary Drain Pan
N = No Auxiliary Drain Pan

Digit 40 — Crossover Piping

0 = None
1 = Internal
2 = External 1-3/8 in. Crossover Piping
3 = External 2-1/8 in. Crossover Piping

Digit 41 — Filter

1 = Standard Throwaway Filter
2 = MERV 8 Filter
3 = MERV 13 Filter

Digit 42 — Color

1 = Deluxe Beige
2 = Cameo White
3 = Soft Dove
4 = Stone Gray
5 = Driftwood Gray

General Information

Unit Description

Unit Nameplate. The unit nameplate is located in the left hand end pocket, behind the control box. It includes the unit model number, serial number, electrical characteristics, and other pertinent unit data.

Factory Shipment. Before shipment, each unit is leak-tested and run-tested for proper control operation.

Access. A three-panel front access of the unit ventilator allows for speedy set-up during field commissioning. This design allows for the end pocket of the unit ventilator to be open while the fan (airside) section stays closed.

End Pockets. Access for piping and controls is made through the unit ventilator's end pockets.

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

Coil type	Size (in.)
Hydronic cooling (main) coil **or** Heating/cooling changeover coil	3/4 in. nominal 7/8 in. ID
Heating (auxiliary) coil	1/2 in. nominal 5/8 in. ID
Steam heating coil	1 in. FNPT
Direct expansion coil	3/8 in. OD liquid 7/8 in. OD suction

Unit Drain Pan. The drain pan is dual-sloped for effective condensate removal. It is made from a non-corrosive material to help eliminate issues associated to leaking or standing water. It may be easily removed for cleaning. The drain pan connection size for all Trane VUVE models is 7/8 in. OD.

Motor. Motors for the VUVE model do not include an external fan bearing on the end of the fan shaft. This helps avoid issues related to fan bearing maintenance (oiling is not needed), and/or bearing replacement.

Filters. Filter sizing for the unit ventilator are an off-the-shelf design to reduce or help eliminate local stocking of the filters. Options include throwaway filters, MERV 8, and MERV 13 filters.

Sliding Fan Deck. Convenient access to the fan motor and wheels for maintenance and serviceability may be made through Trane's easy-slide fan deck design.

Note: *Ground wire must be reconnected if removed for service of fan deck.*

Outside-Air/Return-Air Dampers. The outside-air/return-air damper is a one piece, linkage free design resulting in a superior air-tight seal.

Options

Field-Installed Controls *(Option)*. The unit comes equipped with a fan speed switch, damper blade (only), and an optional low temperature detection.

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

Note: *For controller operation malfunction of any non-Trane, field installed controls, consult the literature or technical support of the controls manufacturer.*

Tracer ZN520 Control Package *(Option)*. The Tracer ZN520 electronic digital controller is a factory installed, tested and commissioned LonTalk® certified design. It may be used in a stand-alone control scheme, or as part of a building automation system. The controller is pre-wired to Trane selected control components best suited for room comfort. For more information on the Tracer ZN520 unit controller operation and service issues, refer to CNT-SVX04A-EN (*Installation, Operation, and Programming Guide: Tracer ZN520 Unit Controller*), or the most recent version.

Tracer UC400 Control Package (Option). The Tracer UC400 electronic digital controller is a factory installed, tested and commissioned BACnet® certified design. The Tracer UC400 operates as a single zone VAV controller and ramps fan speed based on space load. It may be used in a stand-alone control scheme, or as part of a building automation system. The controller is mounted, pre-wired, and pre-programmed to selected control components best suited for room comfort. For more information on the Tracer UC400 unit controller operation and service issues, refer to BAS-SVX48B-EN *(Installation, Operation, and Programming Manual: Tracer UC400 Programmable Controller)*, or the most recent version.

OA/RA Actuator *(Option)*. The OA/RA actuator provides true spring-return operation for positive close-off of the OA/RA damper. The spring return system of the actuator closes the outside damper if power is lost to the building. When ordered with factory controls, the actuator is a 3-point floating design. A 2 to 10 Vdc actuator is available when other than Trane controls are specified. Refer to Table 1, p. 9 for OA/RA technical data.

Note: *Because the damper actuator is a spring return type an inner spring will close the damper upon loss of power. If the need to service or replace the actuator is required, the spring must be "loaded" for the damper to function properly. The term loaded means that the blade must be held in the return air position upon replacement of the actuator.*

Face and Bypass Actuator *(Option)*. The face and bypass damper actuator incorporates a direct couple design. It provides electronic protection against overload. A limit switch is not included, nor required as part of the design. When reaching the damper end position, the actuator automatically stops. The gears can be manually disengaged with a button on the housing. Refer to Table 2, p. 9 for face and bypass actuator specifications.

Modulating Water Valves *(Option)*. The modulating control valve provides optimum control of hot and chilled water flow in various heating and cooling applications. They are designed to provide sinusoidal valve actuator travel and operate silently, resisting water hammer.

The actuator on the valve is a 24V, 3-point floating type. Refer to Table 3 for modulating water valve specifications.

Isolation Valve *(Option)*. The isolation valve is a two position 24V, spring return type valve. It provides added control in heating and cooling applications when used in conjunction with the face and bypass damper.

On heating coils, and two-pipe changeover applications, the valve is normally open to help prevent the coil from freezing in-case of power loss.

For cooling, the valve is normally closed and opens when there is a call for cooling. Refer to Table 4, p. 9 for isolation valve specifications.

Table 1. OA/RA actuator specification

Power supply	24 Vac ±20% 50/60 Hz 24 Vac ±10%
Power consumption	Running: 2.5 W Holding: 1 W
Transformer sizing	5 VA (class 2-power source)
Overload protection	Electronic throughout 0° to 95° rotation
Control signal	2 to 10 Vdc 3-point floating with Trane controls
Angle of rotation	Maximum 95° Adjustable with mechanical stop
Torque	35 in·lb
Direction of rotation	Spring return reversible with cw/ccw mounting
Position indication	Visual indicator, 0° to 95°
Noise level	Running: 30 dB

Table 2. Face-bypass actuator specification

Power supply	24 Vac ± 20% 50/60 Hz 24 Vac ± 10%
Power consumption	2 W
Transformer sizing	3 VA (class 2-power source)
Angle of rotation	Maximum 95-degree Adjustable with mechanical stop
Torque	35 in./lb
Direction of rotation	Reversible with switch L/R
Position indication	Clip-on indicator
Manual override	External push button
Noise level	Less than 35 dB
Control signal	3-point floating

Table 3. Mod. water valve specification

Power supply	24 Vac - 50/60 Hz
Power consumption	4 W
Max. duty cycle	15%
Operating ambient temp.	0 to 65°C 32 to 150°F
Min./max. fluid temp.	1 to 95°C 34 to 203°F
Operating pressure differential	Max. - 4 bar (60 psi)
Pressure rating	Static - 20 bar (300 psi) Burst - 100 bar (1500 psi)
Flow characteristic	Linear

Table 4. Isolation valve specification

Power supply	24 Vac - 50/60 Hz
Power consumption	5 W
Max. fluid temp.	94°C 200°F
Min. fluid temp.	1°C 34°F
Max. operating pressure	300 psi
Max. close-off pressure	1/2 in. = 30 psi 3/4 in. = 20 psi 1 in. = 15 psi

ECM Application Notes

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

RPM Mode

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

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

Field Power Wiring

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

Performance Boundaries

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

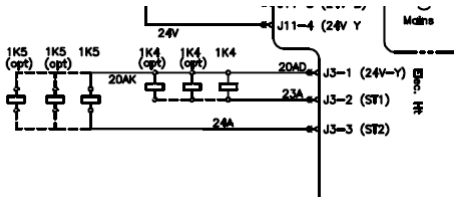
MCA/MFS and Power Draw

The Trane BLDC motors have variable output but are shipped at specific settings to deliver proper performance and reliability. The power draw indicated in the catalogue 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, the new BLDC 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 1. In Figure 1, two sets of three relays are used to perform the function of a two 3-pole contactors.

Figure 1. Sample arrangement: electric heat relay



Troubleshooting Other Unit Functions

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

1. Valve operation
2. Electric Heat operation
3. Changeover sensor operation
4. Damper operation
5. Condensate overflow switch

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

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

Dimensions and Weights

Unit Location and Clearances

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

NOTICE:

Equipment Damage!

Do not locate the unit in areas subject to freezing. Pipes could burst at lower temperature resulting in equipment damage.

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

⚠WARNING

Electrocution and Fire Hazards with Improperly Installed and Grounded Field Wiring!

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

Failure to follow these requirements could result in death or serious injury.

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

Table 5. VUVE general data

	Unit size			
Description	**0750**	**1000**	**1250**	**1500**
Unit length w/o end covers (in.)	69	81	93	105
Unit depth - standard (in.)	16-5/8	16-5/8	16-5/8	16-5/8
Unit depth - with false back (in.)	21-1/4	21-1/4	21-1/4	21-1/4
Unit height - standard (in.)	30	30	30	30
Shipping weight (lb)	320	405	450	470
Nominal filter size (in.) and quantity	14 x 20 x 1 (2)	14 x 24 x 1 (1)	14 x 20 x 1 (2)	14 x 24 x 1 (2)
		14 x 30 x 1 (1)	14 x 24 x 1 (1)	14 x 30 x 1 (1)
Dynamic air filter nominal size (in.) and quantity	7 x 42 x 1 (1)	7 x 54 x 1 (1)	7 x 66 x 1 (1)	7 x 78 x 1 (1)
Drain connection size (in.)	7/8 I.D. hose	7/8 I.D. hose	7/8 I.D. hose	7/8 I.D. hose
Fan type / quantity	FC / 2	FC / 2	FC / 4	FC / 4
Motor data				
Quantity	1	1	2	2
Horsepower (each)	1/4	1/4	1/4	1/4
Coil volume (gal)				
Coil type A	0.178	0.228	0.277	0.327
B	0.311	0.410	0.510	0.610
C	0.311	0.410	0.510	0.610
D	0.444	0.571	0.704	0.931
E	0.444	0.571	0.704	0.931
F	0.610	0.809	1.014	1.213
G	0.610	0.809	1.014	1.213
H	0.395	0.593	0.742	0.837

Table 6. Control Methodology

	Fan Speed
FSS	3 or infinite[a]
CSTI	3 or infinite[a]
ZN520	3
UC400	Infinite

(a) With a field-supplied 2–10 Vdc controller.

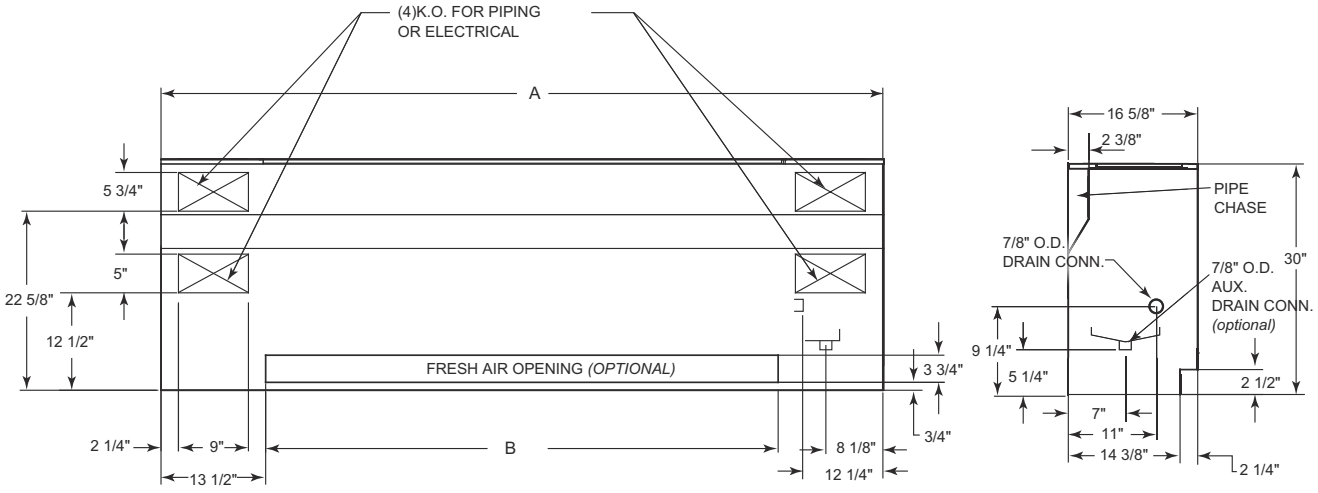
Table 7. Control Sequences

	Fan Speeds
DX operation[a]	1
Electric heat operation[a]	1
Sidewall Exhaust[b]	2
ERSA[b]	2

(a) Fan speed during sequence operation.
(b) Unit Ventilator when operating with option.

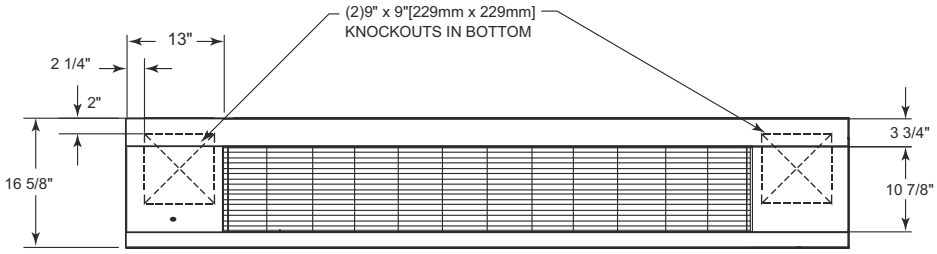
Dimensions and Weights

Figure 2. Standard depth unit

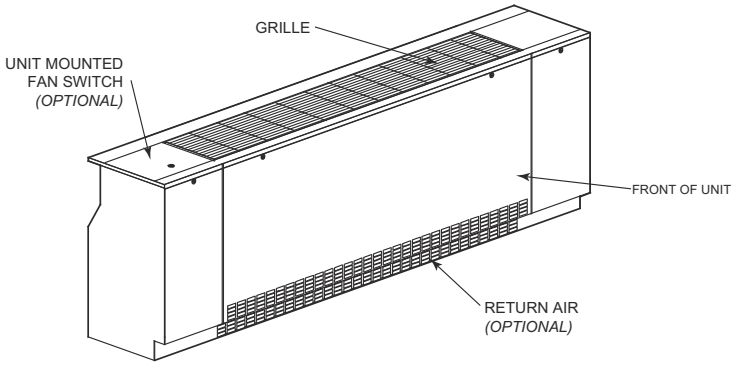


BACK VIEW

SIDE VIEW



TOP VIEW



UNIT SIZE	NO. FANS	A	B
075	2	69"	42"
100	2	81"	54"
125	4	93"	66"
150	4	105"	78"

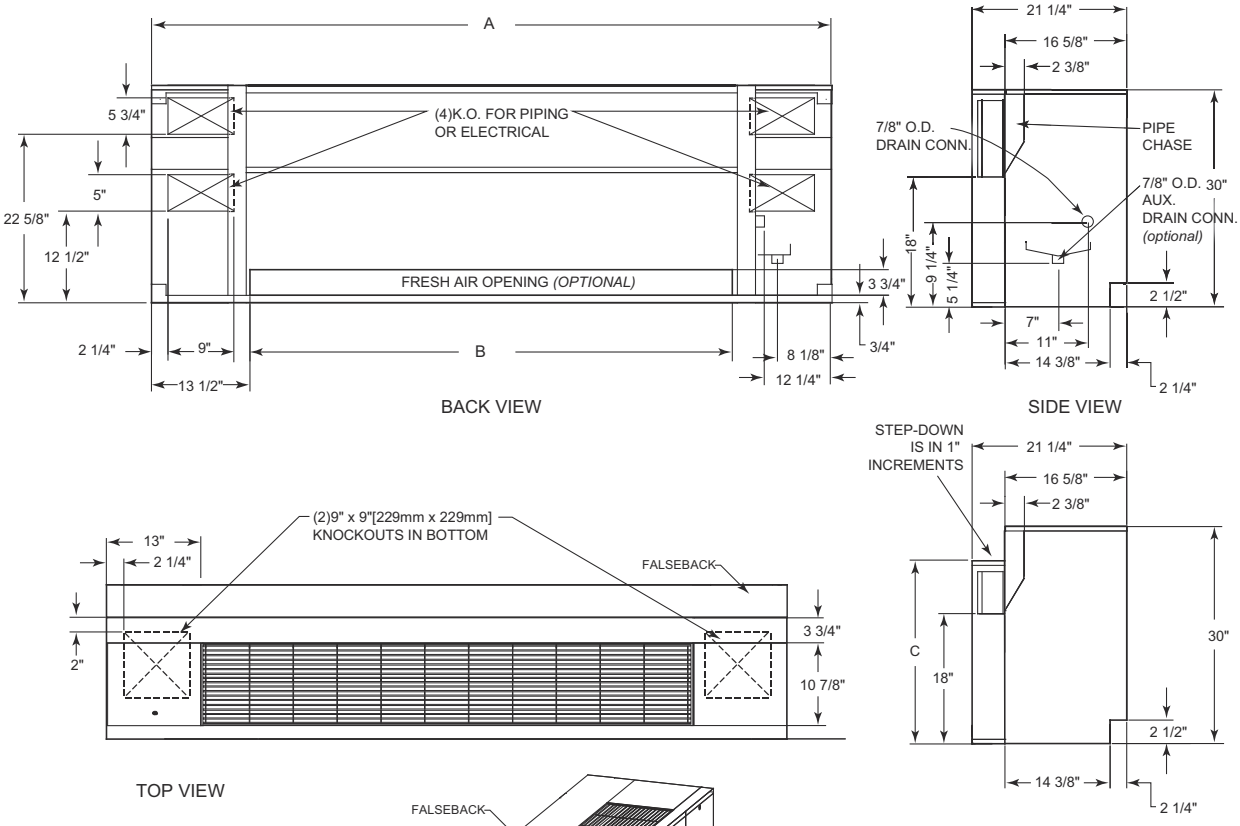
NOTE:

1. THE UNIT LENGTH DOES NOT INCLUDE 5/8" END PANELS.

2. THE POWER CONNECTION IS MADE IN THE LEFT HAND END POCKET FOR ALL OPTIONS BUT ELECTRIC HEAT.

3. THE POWER CONNECTION FOR ELECTRIC HEAT OPTION IS MADE IN THE RIGHT HAND END POCKET.

Figure 3. Falseback unit



UNIT SIZE	NO. FANS	A	B	C
075	2	69"	42"	25" to 29"
100	2	81"	54"	25" to 29"
125	4	93"	66"	25" to 29"
150	4	105"	78"	25" to 29"

NOTE:

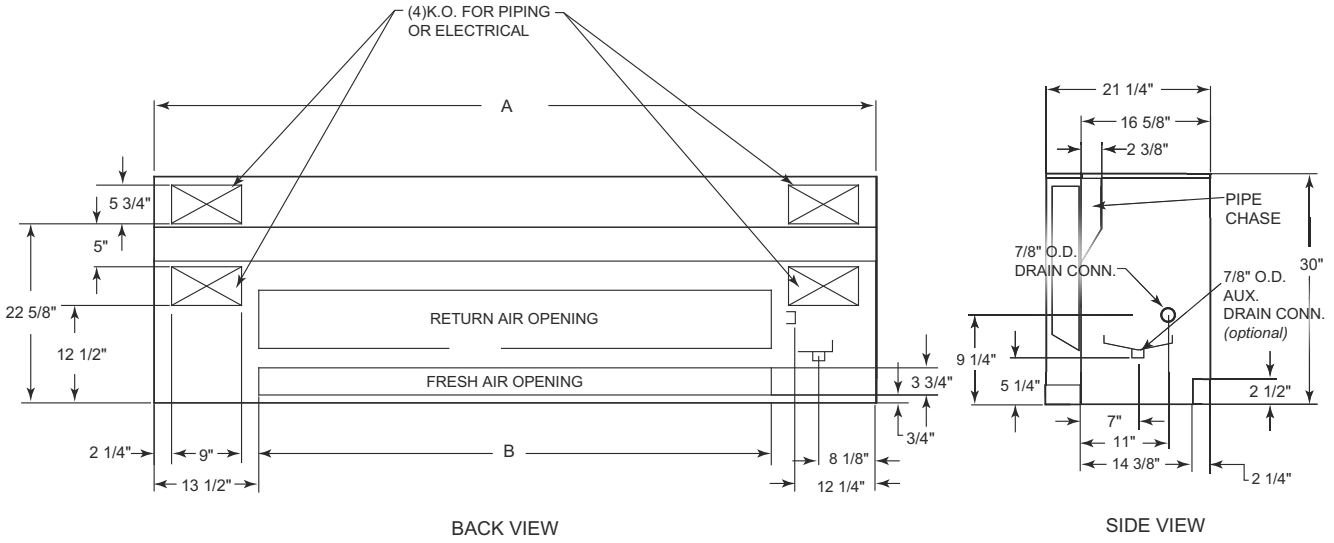
1. THE UNIT LENGTH DOES NOT INCLUDE 5/8" END PANELS.

2. THE POWER CONNECTION IS MADE IN THE LEFT HAND END POCKET FOR ALL OPTIONS BUT ELECTRIC HEAT.

3. THE POWER CONNECTION FOR ELECTRIC HEAT OPTION IS MADE IN THE RIGHT HAND END POCKET.

4. THE UNIT SHOWN INCLUDES THE INSULATED HORIZONTAL BAFFLE OPTION.

Figure 4. Dynamic air barrier unit



UNIT SIZE	NO. FANS	A	B
075	2	69"	42"
100	2	81"	54"
125	4	93"	66"
150	4	105"	78"

NOTE:

1. THE UNIT LENGTH DOES NOT INCLUDE 5/8" END PANELS.

2. THE POWER CONNECTION IS MADE IN THE LEFT HAND END POCKET FOR ALL OPTIONS BUT ELECTRIC HEAT.

3. THE POWER CONNECTION FOR ELECTRIC HEAT OPTION IS MADE IN THE RIGHT HAND END POCKET.

Figure 5. End covers

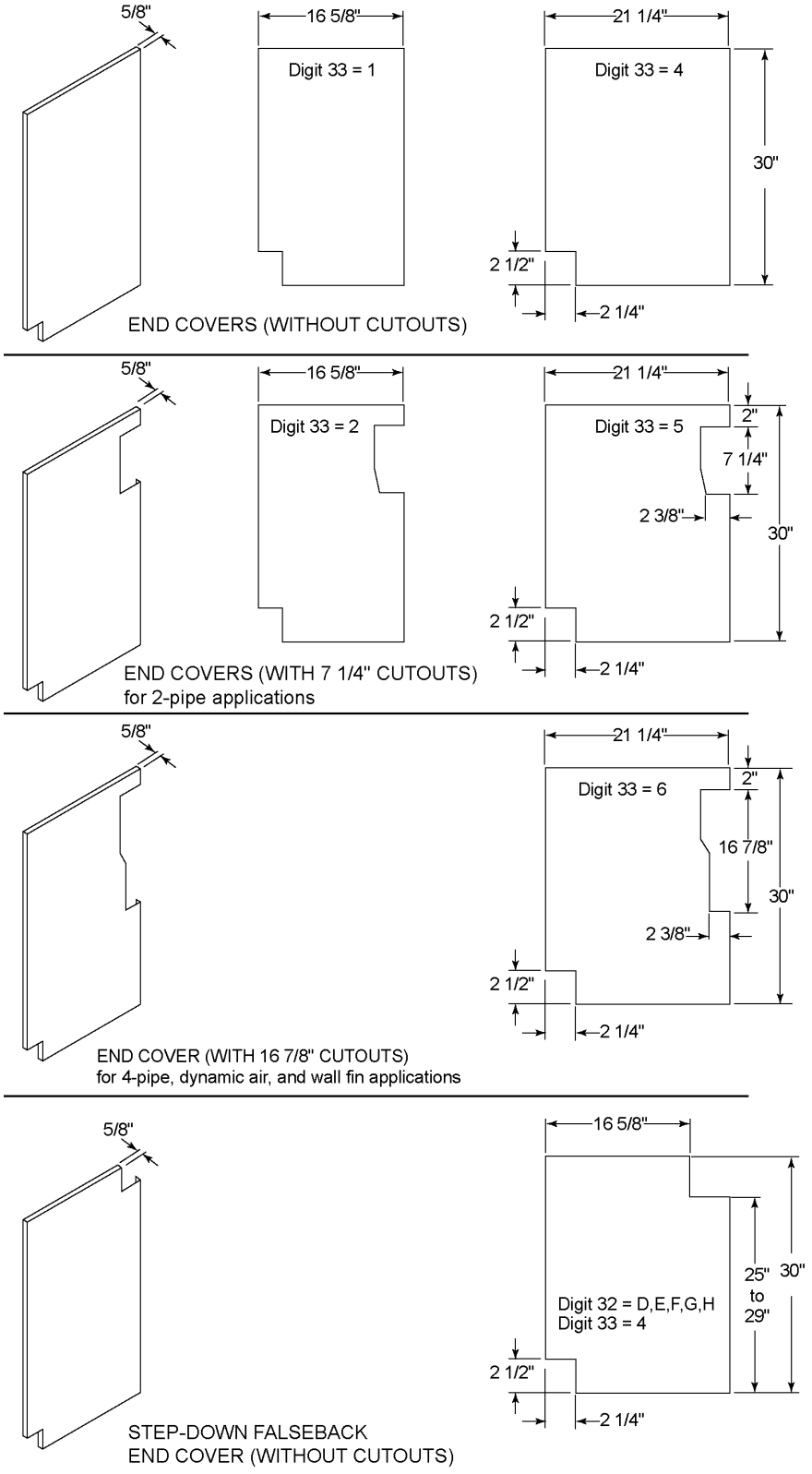
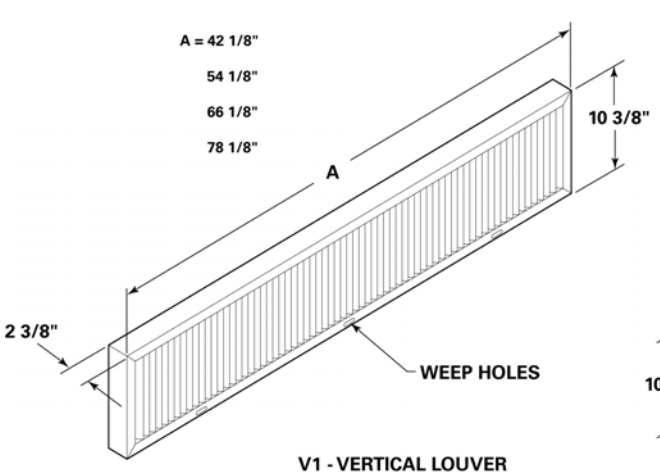
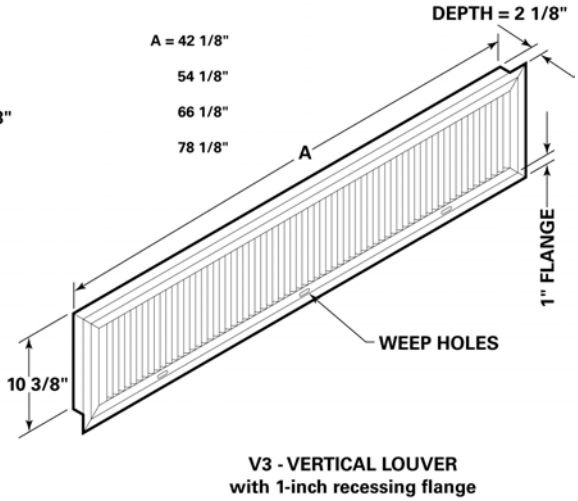


Figure 6. Wall boxes



V1 - VERTICAL LOUVER

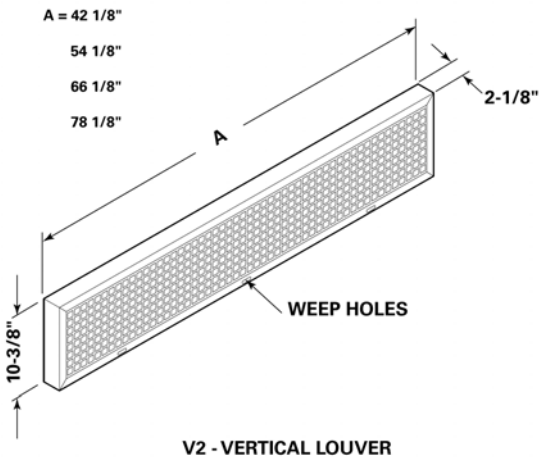


V3 - VERTICAL LOUVER
with 1-inch recessing flange

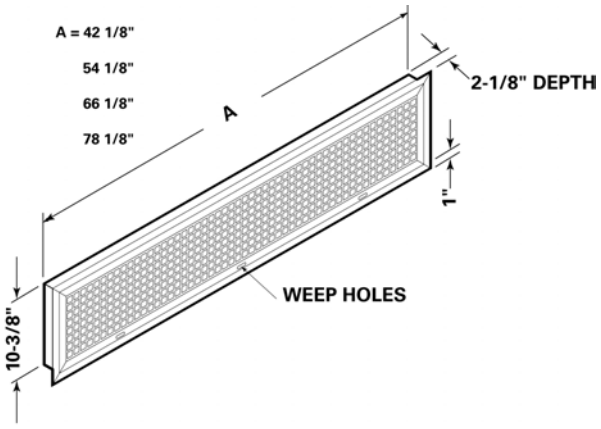
Unit Size	A	Square Feet of Free Area
075	42 1/8"	1.39
100	54 1/8"	1.88
125	66 1/8"	2.37
150/200	78 1/8"	2.87

NOTE:
THE DIMENSIONS LISTED ABOVE ARE ACTUAL (NOT NOMINAL) DIMENSIONS.

THE VERTICAL BLADES OF THE V1 AND V3 WALL BOXES ARE SPACED 3/8" APART.



V2 - VERTICAL LOUVER



V6 - VERTICAL LOUVER
with 1-inch recessing flange

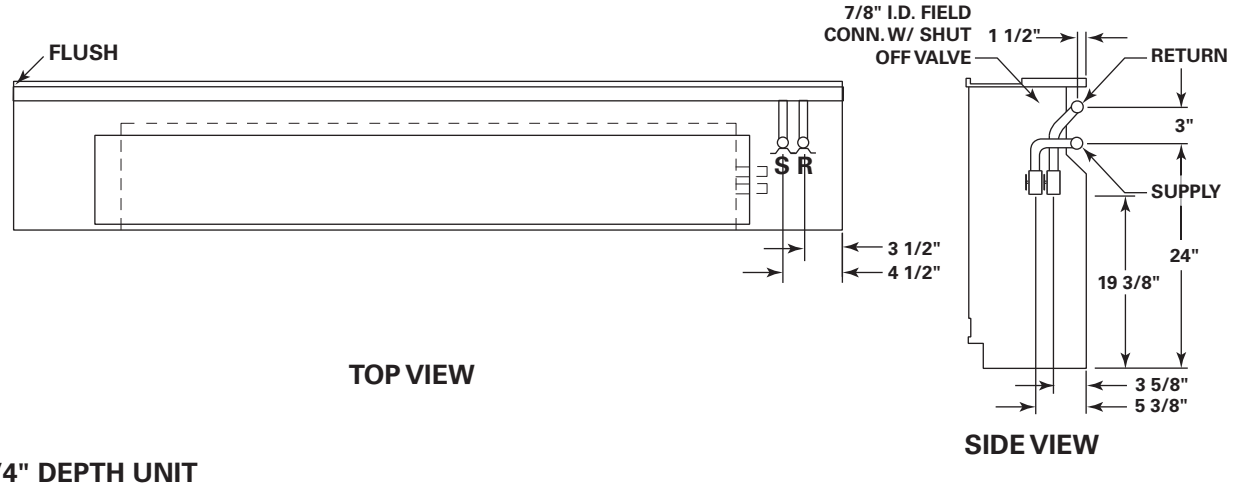
Unit Size	A	Square Feet of Free Area
075	42 1/8"	1.035
100	54 1/8"	1.345
125	66 1/8"	1.681
150/200	78 1/8"	1.992

NOTE:
THE DIMENSIONS LISTED ABOVE ARE ACTUAL (NOT NOMINAL) DIMENSIONS.

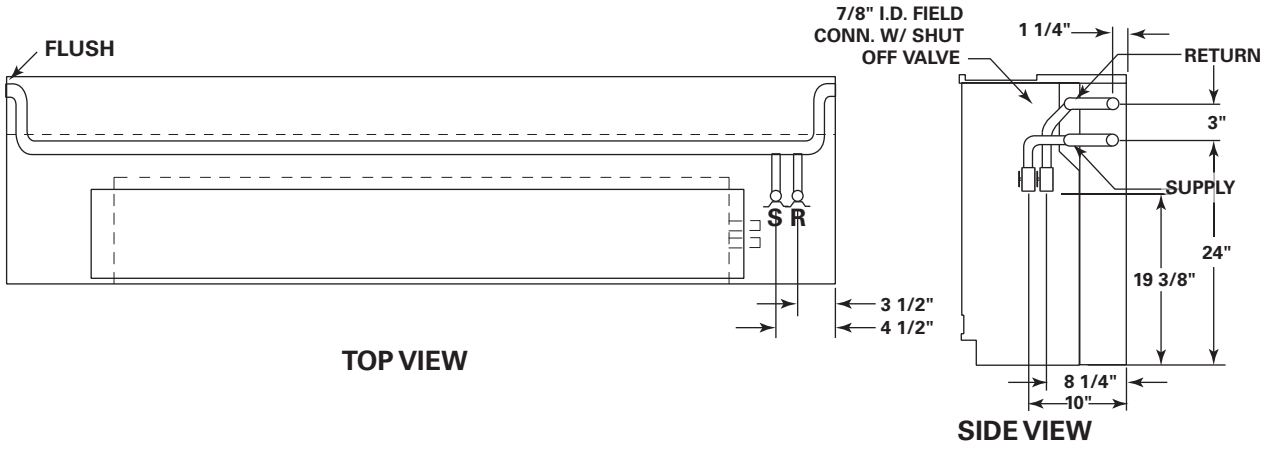
THE VERTICAL BLADES OF THE V2 AND V6 WALL BOXES ARE SPACED 3/8" APART.

Figure 7. Crossover piping

16 5/8" DEPTH UNIT



21 1/4" DEPTH UNIT



Note: *1-3/8 in. OD and 2-1/8 in. ID crossover piping*

1. Crossover piping is available for all 2- or 4-pipe coils selections. Trane provides the crossover for the hot water only. The crossover pipe is factory insulated with 3/8 in.-thick insulation.
2. Expansion compensation between the factory piping package and the crossover piping is achieved using a flex hose rated at 250 psi working pressure. Flex hose is only available with factory mounted piping packages.
3. Expansion compensation for the crossover piping must be handled external to the unit ventilator.
4. Crossover connections terminate in the same end pocket as the heating coil on all 2- and 4-pipe coils.

Receiving and Handling

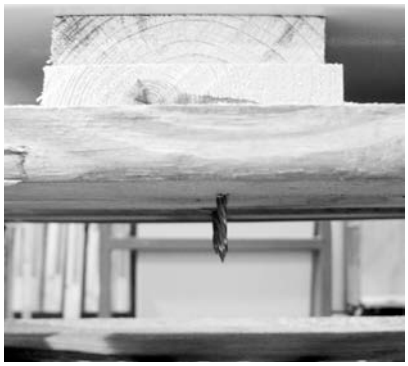
The unit ventilator is packaged in clear stretch wrap and protective cardboard.

Note: *Before unwrapping, make a visual inspection of the unit for any damage that may have occurred during shipping. All orders are shipped FOB (Freight on Board) from the factory, therefore any claims must be made with the delivering carrier.*

Following visual inspection, carefully begin the following procedures:

1. Carefully remove the stretch wrap and the top cardboard cover.
2. Remove remaining cardboard blocking.
3. Remove the bottom access panel with a 7/32-in. Allen wrench.
4. Verify nameplate sales order number is correct.
5. Remove shipping bracket from the lower rear corners of the unit and shipping skid. Access to the screws holding unit to the skid is obtained inside the unit.

Figure 8. Shipping skid removal



6. Rotate fan wheels manually. Wheels should move freely and be in proper alignment. Visually inspect the fan area for obstructions or shipping damage.
7. Remove all applicable knock-outs for coil piping and electrical connections (see Figure 2, p. 12 through Figure 4, p. 14).

Pre-Installation

Jobsite Inspection

Always perform the following checks before accepting a unit:

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

Jobsite Storage

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

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

NOTICE:

Microbial Growth!

Wet interior unit insulation can become an amplification site for microbial growth (mold), which may cause odors and damage to the equipment and building materials. If there is evidence of microbial growth on the interior insulation, the insulation should be removed and replaced prior to operating the system.

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

Installation—Mechanical

Wall Box Installation

The following instructions are general recommendations for installing wall intake boxes. Consult the architectural plans for specific requirements.

Additional materials required to complete any specific installations (such as duct connections, metal mounting plates, or flanges) are not furnished by Trane.

For best results, all air intake boxes should be removable from outside of the building. Weep holes must be at the bottom to permit free drainage. A positive air and moisture seal should be provided around all edges.

General Instructions. Trane wall boxes are illustrated in the dimensional section of this manual. Dimensions are actual, and may be used to define the wall opening.

Vertical louvers in the wall intake box provide extra strength for a high load bearing capacity. The lintel may be omitted on masonry wall installations.

Weep holes are provided in the outside face of the bottom channel in the wallbox frame. Install all wall boxes to permit free drainage through the weep holes to the outside of the building.

All wallboxes are furnished with diamond pattern expanded aluminum bird screen.

Note: *V1 and V2 (vertical) wall models are all unflanged. H2, V3, and V6 are flanged.*

Installation in Masonry Walls. A typical method of installing the wall box in a masonry wall opening is shown in Figure 9.

Grout the top and bottom of the wall box frame as noted. A sloped water dam located in the space between the unit and wall facilitates moisture drainage. Grouting at the ends of the intake box will complete the seal between the wall box frame and the masonry opening.

Installation in Curtain Walls. In all cases, the wall intake box should be caulked to provide a tight, weatherproof seal (see Figure 10).

Note: *A minimum of 2-1/8 in. of clearance must be maintained between the exterior wall and back of the unit. Failure to provide this gap will not allow the wall box to fit properly.*

Figure 9. Masonry wall installation

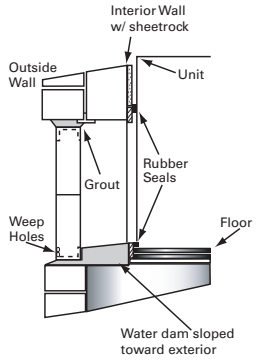
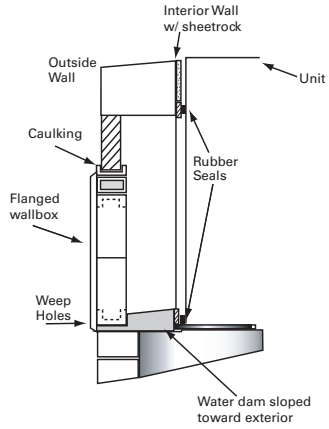


Figure 10. Flanged wall box installation in 2-in. curtain wall



General Installation Checks

The checklist below is a summary of the steps required to successfully install a unit. This checklist is intended to acquaint the installing personnel with procedures required in the installation process. It does not replace the detailed instructions called out in the applicable sections of this manual.

1. Carefully remove the stretch wrap and top cardboard cover. Check the unit for shipping damage and material shortage; file a freight claim and notify appropriate sales representation. *If end panels have been ordered, the panel will already be mounted to the unit.*

   Note: *The unit ventilator is packaged in clear stretch wrap to allow for immediate visual inspection. A protective cardboard cover helps prevent scratching and other cosmetic blemishes during transport.*

2. Remove remaining cardboard blocking.
3. Remove the unit's left front panel to verify nameplate/ sales order number is correct. It is located behind the control box.

4. Remove shipping bracket from the lower rear corners of the unit to separate the unit from the skid. Access to the screws holding the bracket to the skid is obtained inside the unit.
5. Rotate the fan wheels manually. The wheels should move freely and be in proper alignment. Visually inspect the fan area for obstructions or shipping damage.
6. Remove all applicable knockouts for coil piping and electrical connections.

Location Considerations

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

⚠WARNING

Heavy Object!

Floor structure must be strong enough to support the weight of the unit. Consult the structural plans, and have a structural engineer ensure the floor can withstand the weight of the unit. Inadequate structural support could result in unit falling.

Failure to follow recommendations could result in death or serious injury.

1. Floor design must have sufficient structure to withstand the weight of the unit while allowing for openings in the floor for a return air duct, electrical and piping supply lines fed through the floor. Refer to "Dimensions and Weights," p. 11 for unit weights.
2. Wall space design should allow the unit to be mounted to the wall securely. The wall surface behind the unit should be smooth and level. Wall and floor moldings should be removed prior to installation. A wall slightly out of level may cause problems with unconditioned air leaking into the room. Remove any object projecting more then 1/8 in. (0.3175 cm) from the wall surface.

   Note: *Additional gasket or furr strips may be installed to accommodate for an uneven wall.*
3. There are two removable knock-outs in the rear of the unit, on either end, for piping and electrical supply lines. A pipe chase is located in the upper back portion of the unit for crossover piping. The outside air opening is located in the lower back of the unit and the path to the wallbox on the outside wall should be unobstructed.
4. The physical layout of the room should accommodate any accessories ordered with the unit. Conditioned air is distributed through the grille on top of the unit and returned through the return air grille on the bottom of the unit. Avoid placing any objects that may obstruct either grille or interfere with airflow.
5. Internal access to the unit is provided by the removable front panel. Sufficient space should be allowed to lift the panel for maintenance purposes.
6. Ensure the floor surface is level.

   Note: *The unit leveling legs can be adjusted to accommodate slight out-of-level installation surfaces.*

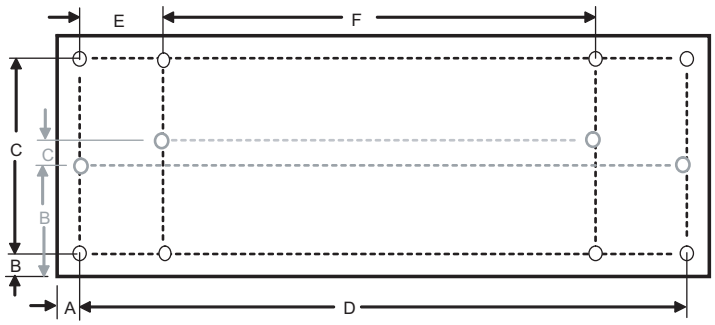
Unit Mounting

Note: *All wall intake boxes should be installed prior to mounting the unit ventilator. Refer to p. 20 for wall box installation instructions.*

The 1/2 in. mounting or anchoring holes are located on the back of the unit on each end (see Figure 11, p. 22).

Note: *All mounting fasteners are to be provided by the installer.*

Figure 11. Mounting hole location



		A	B	C	D	E	F
075	Standard unit (no falseback)	1.31	13.50	2.75	66.39	10.38	45.64
	Standard falseback	1.00	2.13	26.00	67.00	10.00	47.00
	29 in. stepdown falseback	1.00	2.13	24.44	67.00	10.00	47.00
	28 in. stepdown falseback	1.00	2.13	23.44	67.00	10.00	47.00
	27 in. stepdown falseback	1.00	2.13	22.44	67.00	10.00	47.00
	26 in. stepdown falseback	1.00	2.13	21.44	67.00	10.00	47.00
	25 in. stepdown falseback	1.00	2.13	20.44	67.00	10.00	47.00
100	Standard unit (no falseback)	1.31	13.50	2.75	78.39	10.38	57.64
	Standard falseback	1.00	2.13	26.00	79.00	10.00	59.00
	29 in. stepdown falseback	1.00	2.13	24.44	79.00	10.00	59.00
	28 in. stepdown falseback	1.00	2.13	23.44	79.00	10.00	59.00
	27 in. stepdown falseback	1.00	2.13	22.44	79.00	10.00	59.00
	26 in. stepdown falseback	1.00	2.13	21.44	79.00	10.00	59.00
	25 in. stepdown falseback	1.00	2.13	20.44	79.00	10.00	59.00
125	Standard unit (no falseback)	1.31	13.50	2.75	90.39	10.38	69.64
	Standard falseback	1.00	2.13	26.00	91.00	10.00	71.00
	29 in. stepdown falseback	1.00	2.13	24.44	91.00	10.00	71.00
	28 in. stepdown falseback	1.00	2.13	23.44	91.00	10.00	71.00
	27 in. stepdown falseback	1.00	2.13	22.44	91.00	10.00	71.00
	26 in. stepdown falseback	1.00	2.13	21.44	91.00	10.00	71.00
	25 in. stepdown falseback	1.00	2.13	20.44	91.00	10.00	71.00
150	Standard unit (no falseback)	1.31	13.50	2.75	102.39	10.38	81.64
	Standard falseback	1.00	2.13	26.00	103.00	10.00	83.00
	29 in. stepdown falseback	1.00	2.13	24.44	103.00	10.00	83.00
	28 in. stepdown falseback	1.00	2.13	23.44	103.00	10.00	83.00
	27 in. stepdown falseback	1.00	2.13	22.44	103.00	10.00	83.00
	26 in. stepdown falseback	1.00	2.13	21.44	103.00	10.00	83.00
	25 in. stepdown falseback	1.00	2.13	20.44	103.00	10.00	83.00

⚠WARNING

Improper Unit Lift!

Test lift unit approximately 24 inches to verify proper center of gravity lift point. To avoid dropping of unit, reposition lifting point if unit is not level. Failure to properly lift unit could result in death or serious injury or possible equipment or property-only damage.

7. Set the unit into selected location and adjust leveling legs if necessary to ensure level fit.

   Note: *Care should be taken when handling the unit to ensure that the front return air grille does not bend.*

8. Push the unit tightly against the wall to compress the seal on the back edge of the unit and intake opening. Anchor the unit by using the 1/2 in. mounting holes in both end pockets.

   Units containing a falseback: The falseback unit ventilator contains mounting holes located on the falseback metal. Use these holes rather than the holes located in the unit's end pockets.

   Note: *Ensure the unit is level. Coils and drain pans inside the unit are pitched properly for draining before shipment.*

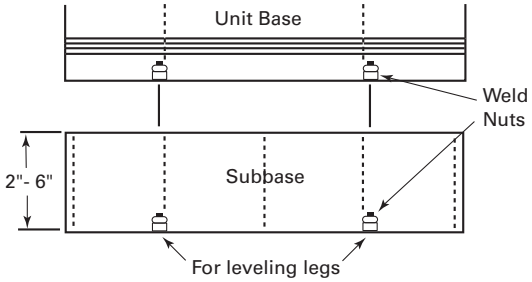
9. Ensure the unit rests tightly against the wall. Check for proper seal and that air does not leak underneath the unit.

Subbase *(Option)*

A subbase may be used to increase the unit height and aid in leveling the unit. The subbase is shipped separately for field installation. Slots and leveling screws are provided on the subbase.

1. Remove the leveling legs provided with the unit (see Figure 12).

Figure 12. Subbase with leveling legs



2. Set the unit on the subbase and fasten with four, 3/8 in. x 16 ft x 1 in. hex head cap screws and 3/8 in. lock washers.

   Note: *Hex screws and lock washers are provided by the factory. They are located in a baggy and are used to attach the base to the unit ventilator. Pre-drilled slots in the subbase flange will line up with the weld nuts in the bottom of the unit.*

3. The bottom of the subbase has weld nuts in four slots. Place the leveling legs in those slots and level the unit.

End Panels

When ordered as an option, end covers ship already attached to the vertical unit ventilator. The following section is for installing end covers purchased as an add-on.

It is recommended end panels be installed on the unit ventilator after all piping, wiring and accessory installation is completed. To install the end panel:

1. Insert the four factory provided metal studs into the four pre-mounted nuts on the inside of the panel.
2. Align each stud with the four pre-drilled holes on the side of the unit.
3. Secure the panel to the unit by fastening with the four factory provided nuts.
4. Do not overtighten screws.

NOTICE:

Equipment Damage!

Do not run units for any length of time without all panels and filters properly installed. Failure to do so could result in equipment failure.

Installation—Piping

Piping Installation

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

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

Piping connection knockouts are shown in "Dimensions and Weights," p. 11. Field connection types and sizes for unit coils are listed in Table 8. These sizes are provided for field piping connection.

Table 8. Coil data for field piping

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

A 7/8 in. OD condensate drain connection is provided on the chilled water supply end of the unit.

1. Attach a flexible condensate drain hose over the drain pan connection and secure with a hose clamp.

   The drain pan on the vertical is vacuum-molded with a drain connection and P-trap on the cooling coil, connection side.

   Note: *Condensate removal to the main system should be made through the bottom of the unit ventilator. If other location for condensate removal is desired, a specific field cut-out for the connection should be made in the back of the unit ventilator. To help avoid cold air infiltration, the field cut-out should only be large enough to allow for the condensate hose to exit the unit.*

   To field reverse the slope of a vertical unit drain pan:

2. Slide out fan deck *(disconnecting the condensate line and fan plug will release fan deck for sliding)*.
3. Remove pipe clamp that hold the p-trap to the drain pan.
4. Remove clips that hold the drain pan in-place.
5. Lift and rotate the drain pan.
6. Reconnect p-trap to the drain pan and replace clips to secure the pan to the fan deck.
7. After the condensate drain piping has been completed, check water flow to ensure the system properly carries and away all condensate accumulation.

Note: *A P-trap is factory supplied in every vertical unit ventilator.*

Trane Piping Packages *(Option)*. Trane Standard Piping Package includes a 2- or 3-way valve with bypass balance valve, ball valves, Pete's plugs and unions. A strainer and circuit balancing valve are optional.

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

Note: *All connections made in the field should be sweat connections.*

Piping packages are not shipped insulated. Any insulation should be provided in the field by the installing contractor.

The auxiliary drain pan *(optional)* is the main condensate connection to the unit when specified. The chilled water or DX coil drain pan will empty into the auxiliary drain pan if a factory-installed, auxiliary pan is ordered. All field-piping condensate connections should be made at the auxiliary drain pan.

Installation Crossover Piping

Crossover piping is available for all hydronic coils. It is either 1-3/8 in. \[34.9\] or 2-1/8 in. \[54\] in diameter (OD) as specified by the customer. Crossover piping can be found in either the left or right hand end pocket. Refer to "Dimensions and Weights," p. 11 for dimensional data.

On 4-pipe coils, crossover piping connects to the main cooling coil.

Factory insulation is provided on all crossover piping.

When a Trane piping package is ordered, it is installed with the connections made to the supply and return of both the coil and the crossover piping. However, supply and return connections must be made in the field when a piping package is furnished by the installer.

The crossover piping is located at the back of the unit along the wall and the ends of the piping are flush with the end of the unit.

Expansion compensation between the piping package and the crossover piping is achieved using flex hoses rated at 250 psi working pressure. Expansion compensation for the crossover piping must be handled external to the unit ventilator.

Split System Units

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

the condensing unit installation and wiring manuals which are shipped with the condensing unit.

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

Refrigerant Piping

⚠WARNING

Hazard of Explosion and Deadly Gases!

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

Unit ventilators with direct expansion cooling contain a nitrogen holding charge in the evaporator coils. Connections are "pinched-off" at the factory.

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

Install the refrigerant suction and liquid lines as described in the condensing unit installation instructions. The TXV is factory installed on the unit ventilator. Piping should be run straight out through the back of the unit. Access piping knockouts are located in the rear panels of the unit, as shown "Dimensions and Weights," p. 11.

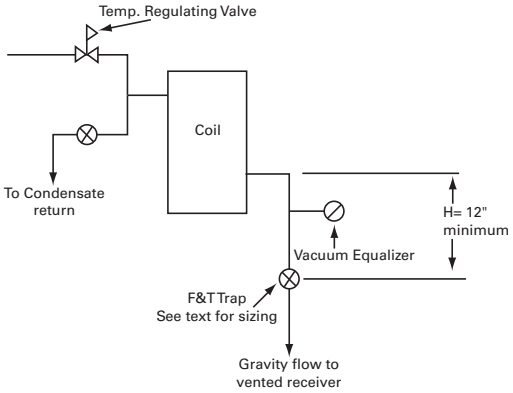
Recommended refrigerant line connections for various unit combinations are given in Table 8, p. 24. Typical Superheat Charging Charts are shown in the Trane Service Facts found in the condensing unit section manual. Refrigerant charge weights can also be determined with your local Trane sales engineer using a valid Trane Selection Program.

Steam Piping

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

There are detailed methods for determining condensate load under various operating conditions. However, in most cases this is not necessary if the coils are piped as shown in Figure 13. Follow the procedure documented in the ASHRAE Systems Handbook, Steam Systems.

Figure 13. Steam piping



Modulating Water Valves *(Option)*

The actuator on the valve is a 24V, 3-point floating valve. The actuator can be easily removed from the valve body by pressing in on the locking tab and rotating the actuator 45° counter-clockwise (see Figure 14). The 2-way valves are bi-directional flow; the 3-way valves can be mixing or diverting (see Figure 15, p. 26).

Note: *The actuator must be removed if soldering is being conducted near the valve. High heat may cause damage to the actuator's plastic body/ mechanisms.*

Figure 14. Remove modulating valve actuator by pressing in tab (inset) and turning actuator 45° counterclockwise

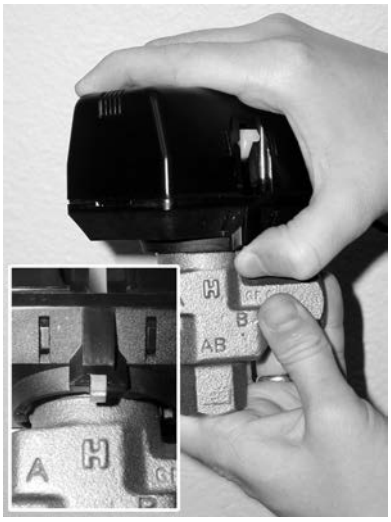
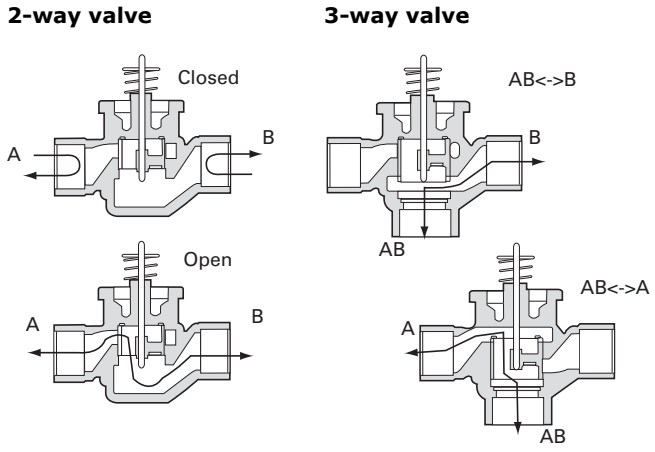
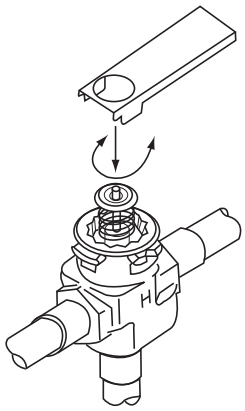


Figure 15. Steam piping: 2- and 3-way valves



On applications without the optional, factory installed piping packages, it is important to remove the cartridge assembly from the valve body with the provided tool (see Figure 16).

Figure 16. Cartridge removal tool



Use the following steps to complete cartridge assembly removal:

1. Remove valve actuator.
2. Remove the cartridge assembly from the valve body with the enclosed tool.
3. Solder the valve in accordance with normal soldering practices.
4. Re-install the cartridge after soldering by tightening until it bottoms out. The top surface of the cartridge will be flush with the top edge of the body casting.

NOTICE:

Over-tightening!

Do not over-tighten. Maximum torque is 40 in·lb. Overtightening could result in equipment damage.

5. Replace valve actuator and wire in accordance with instructions.

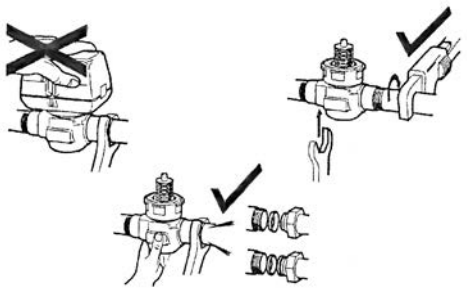
Plumbing the Valve

The valve may be plumbed in any angle but preferably not with the actuator below horizontal level of the body. Make sure there is enough room around the actuator for servicing or replacement.

For use in diverting applications, the valve is installed with the flow water entering through the bottom AB port and diverting through end ports A or B. In mixing applications the valve is installed with inlet to A or B and outlet through AB.

Mount directly to the tube or pipe. Do not grip the actuator while making or tightening plumbing connections. Either hold valve body by hand or attach an adjustable spanner (38 mm/1-1/2") across the hexagonal or flat faces on the valve body (see Figure 17).

Figure 17. Proper plumbing technique for modulating valves



Manually Opening Valve

The manual opener can be manipulated only when in the up position. The A port can be manually opened by firmly pushing the white manual lever down to the midway position and pushing the lever in. In this position, both A and B ports are open. This "manual open" position may be used for filling, venting and draining the system or opening the valve during power failure.

The valve can be closed by depressing the white lever lightly and then pulling the lever outward. The valve and actuator will return to the automatic position when power is restored.

Note: *If the valve is powered open, it cannot be manually closed, unless the actuator is removed.*

Wiring the Valve

⚠WARNING

Electrocution and Fire Hazards with Improperly Installed and Grounded Field Wiring!

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

Failure to follow these requirements could result in death or serious injury.

A controller and a separate transformer is required to operate each valve (see Figure 18 and Figure 19, p. 27). Port A "open" and "closed" denote valve open and closed positions.

Figure 18. Wiring for modulating valve actuator

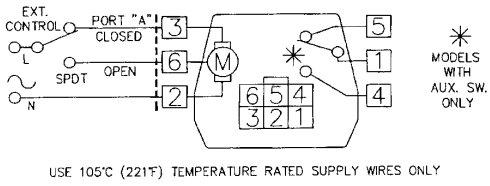
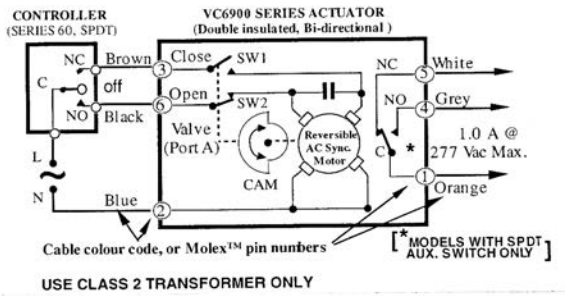


Figure 19. Wiring for modulating valve actuator



The typical floating controller is an SPDT controller with a center-off position. On a change in temperature from the set point, the controller will close the normally open (NO) or normally closed (NC) contacts, driving the valve to an intermediate position until a further change at the controller.

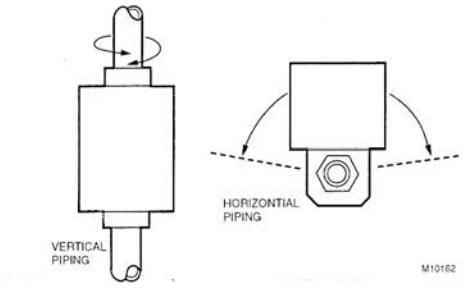
The valve is set between the limits of the controller to satisfy various load requirements. In the event of power failure, the valve will stay in the position it was in before loss of power. When power is restored, the valve will again respond to controller demand.

Isolation Valves Installation

The valve can be mounted in any position on a vertical line. If the valve is mounted horizontally, the actuator must be even with or above the center line. Make sure there is enough room to remove actuator cover for servicing. Mount the valve on the tube or pipe.

Note: *Ensure the flow through the valve is in the direction indicated by the arrow stamped on the valve body.*

Figure 20. Proper mounting for isolation valves



Servicing/Removal of Valves

The actuator can be removed from the valve body. Removing the actuator is recommended if soldering is being conducted near the valve. To remove the actuator:

1. Place the manual operating lever to the Open position (see Figure 21, p. 27).
2. Depress the locking button and lift actuator until it separates from the valve body.

To install the actuator to the valve body:

3. Align the slot on the shaft of the valve with the valve body notch on side of body (see Figure 22, p. 28).

Figure 21. Removing valve actuator

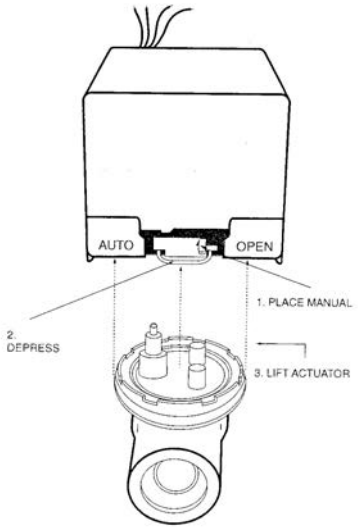
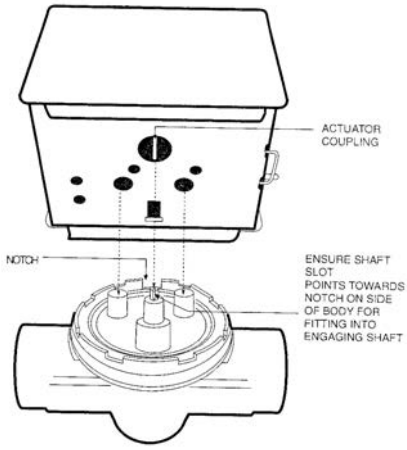


Figure 22. Installing isolation valve



4. Install body valve into pipe.

⚠WARNING

Electrocution and Fire Hazards with Improperly Installed and Grounded Field Wiring!

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

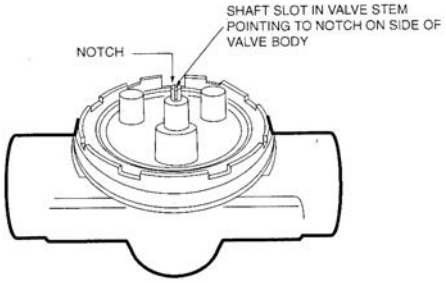
Failure to follow these requirements could result in death or serious injury.

5. Wiring connections may be made either before or after actuator installed on body.
6. Place the manual operating lever on the actuator in the OPEN position.
7. Align actuator coupling to slot on the shaft of the valve body and fit the head onto the valve body to ensure the shaft seats correctly (see Figure 20, p. 27).
8. Press the actuator and valve body until it secures together.

Soldering Procedures

1. Remove actuator as stated earlier.
2. Place valves on the pipe. Rotate valve stem so the shaft slot points at the notch in the side of the body (90° to flow direction). This protects the plug inside the valve by removing it from the seat (see Figure 23).

Figure 23. Preparation for soldering



3. Sweat the joints, keeping outer surface free from solder.

   Note: *Do not use silver solder due to high temperature requirements.*

Heating Coils with Direct Expansion Cooling

Heating options for direct expansion cooling in the unit ventilator are hot water, steam or electric heat.

These coils facilitate direct expansion cooling with standard capacities. The supply and return connections are located in the right-hand end pocket. Hot water field connections are made with a 5/8 in. \[15.9\] OD male sweated joint, while steam coils have a 1 in. \[25.4\] male pipe thread (MPT) connection. Refer to Table 8, p. 24 for coil connection sizes.

Electric heat coils provide a third way to supply heating to the direct expansion cooling. The coil utilizes three to six preheat elements which are factory-wired.

Installation—Sensors

Control Options

Figure 24. Unit mtd temp sensor (SP, OCC/UNOCC, OALMH) (Electric heat with auto and off speeds)

X13790844-01 (unit)

Figure 25. Unit mtd display sensor (SP, OCC/UNOCC, COMM)

X13790886-04 (unit; 3-speed)

Figure 26. Unit mtd display sensor (SP, OCC/UNOCC, COMM)

X13790886-03 (unit; 2-speed)

Figure 27. Wall mtd temp sensor (SP, OCC/UNOCC, OALMH, COMM)

X13790842-02 (wall)
X13651467-01 (comm)

Figure 28. Wall mtd display sensor (SP, OCC/UNOCC, COMM)

X13790886-04 (wall; 3-speed)

Figure 29. Wall mtd display sensor (SP, OCC/UNOCC, COMM)

X13790886-03 (wall; 2-speed)

Figure 30. Unit mtd FSS (OALMH), wall mtd temp sensor (SP, OCC/UNOCC, COMM)

X13511527-01 (wall)
X13790849-01 (unit)
X13651467-01 (comm)

Figure 31. Unit mtd FSS (OALMH), wall mtd display temp sensor (SP, OCC/UNOCC, COMM)

X13790886-04 (wall)
X13790841-02 (unit)

Figure 32. Unit mtd FSS (OLH), wall mtd display temp sensor (SP, OCC/UNOCC, COMM)

X13790886-03 (wall)
X13790475-01 (unit)

Figure 33. Wireless temp sensor (SP, OCC/UNOCC, OALMH, COMM)

X13790492-01 (wall)
X13790855-01 (unit)

Figure 34. Wireless temp sensor with display (SP, OCC/UNOCC, COMM)

X13790822-04 (wall)
X13790855-01 (unit; 3-speed)

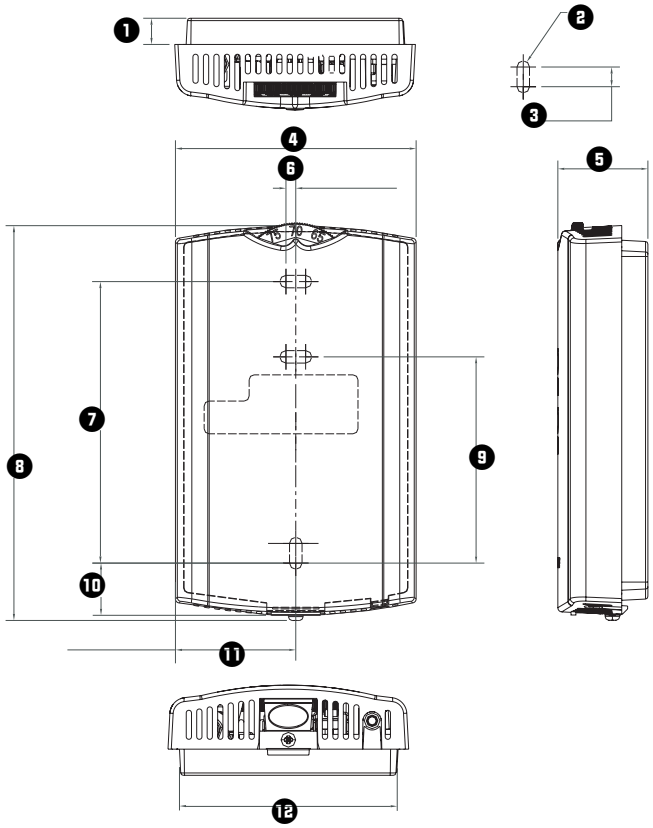
Figure 35. Wireless temp sensor with display (SP, OCC/UNOCC, COMM)

X13790822-01 (wall)
X13790855-01 (unit; 2-speed)

Installing Wall-Mounted Wired Sensors

Reference the wall-mounted zone sensor dimensions in Figure 36, p. 30. 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 36. Wall-mounted wired and wireless zone sensor dimensions



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

Sensor

When selecting a sensor location, avoid the following:

- Areas of direct sunlight
- Areas in the direct airstream of air diffusers
- Exterior walls and other walls that have a temperature differential between the two sides

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

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 in. screws.

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

Location Considerations

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

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

Location Considerations for Wireless zone sensors

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

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

Fan Mode Switch Installation

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

Items needed:

2 x 4 electrical junction box

1. Remove the brown wire if not using a field-supplied damper.
2. Remove the terminals, cut and strip wires as required for installation.
3. Level and position a 2 x 4 electrical junction box.
4. Follow the instructions given in "Wall-Mounted Control Interconnection Wiring," p. 42 and route the wires as shown in the wiring diagram. Refer to the typical wiring diagram or to the unit specific diagram on the unit.
5. Position the fan mode switch over the junction box with the two screws supplied.

Zone Sensor Installation

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

1. Note the position of the setpoint adjustment knob and gently pry the adjustment knob from the cover using the blade of a small screwdriver.
2. Insert the screwdriver blade behind the cover at the top of the module and carefully pry the cover away from the base.
3. To mount the sensor back plate:
   a. Hold the back plate against the mounting surface and mark the screw locations.

b. Secure the back plate against the mounting surface using included hardware.

4. To install the zone sensor module to a standard junction box:
   a. Level and install a 2 x 4-in. junction box (installer supplied) vertically on the wall.
   b. Pull the control wires through the cutout. Attach the module to the wall using the screws provided.
5. Strip the insulation on the interconnection wires back 0.25-inch and connect to TB1 (for wired sensors).
6. Screw down the terminal blocks (for wired sensors).
7. To replace the cover:
   a. Hook the cover over the top of the back plate. Apply light pressure to the bottom of the cover until it snaps in place.
   b. Install the security screw into the bottom of the cover (if desired).

If installing a Tracer ZN520 zone sensor, see "Control Options," p. 29 for more information.

Figure 37.

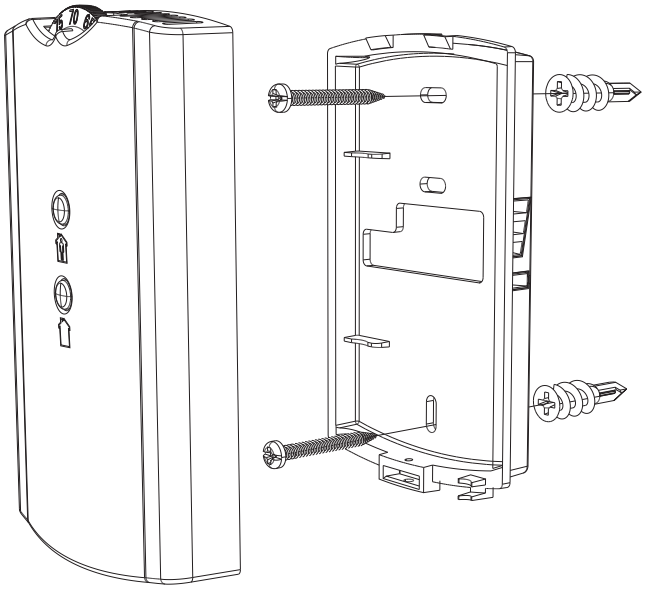
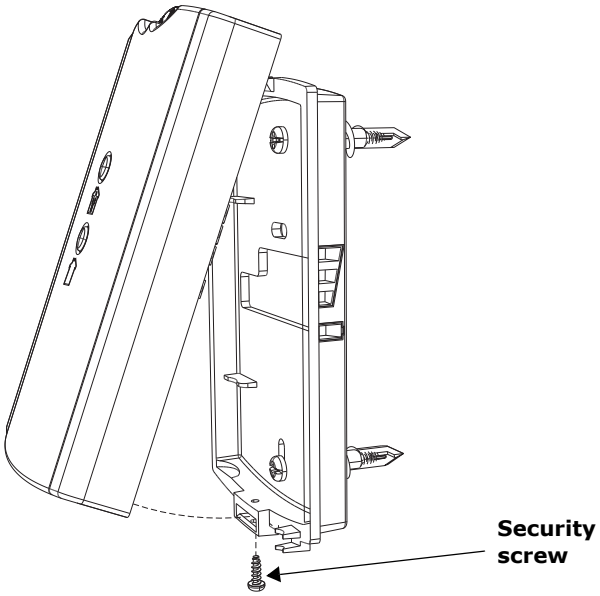


Figure 38.



Wireless Sensors

Notes:

- *Receivers ship installed on the unit. To remove the receiver, press in the retention tabs on the underside of the receiver enclosure and push upward.*
- *For more detailed information for wireless sensors, please refer to BAS-SVX04E-EN* (Installation, Operation, and Maintenance: Wireless Sensors, Models WTS, WZS, and WDS), *or the most recent revision.*

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 39) from the sensor.*

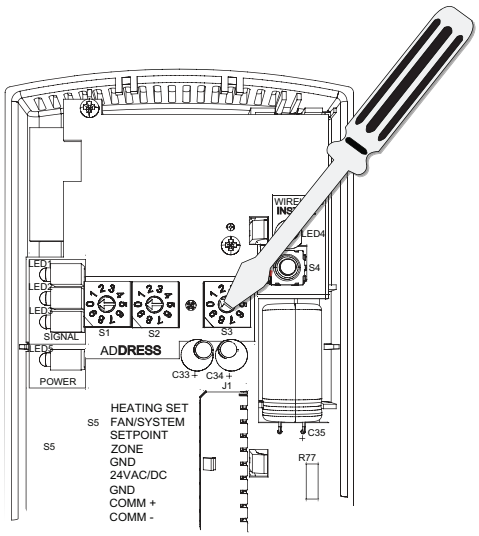
To set the receiver and sensor addresses:

1. Using a small screwdriver, set the three rotary address switches (locations S1, S2, S3) on the receiver to an address between 001 and 999 (see Figure 39). You do

not have to remove the covers to access the rotary address switches.

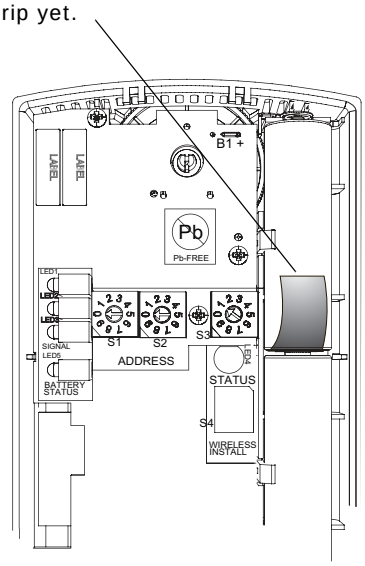
Note: *Do not use 000 as an address. An address of 000 returns the receiver outputs to their factory defaults (zone temperature and setpoint outputs: 72.5°F, removes all association knowledge, and prevents association with a sensor.*

Figure 39. Setting the rotary address switches on the receiver and the sensor



Receiver

Do not remove the insulation strip yet.



Sensor

2. Set the three rotary address switches (locations S1, S2, S3) on the sensor *to the same address as the receiver* (see Figure 39).

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

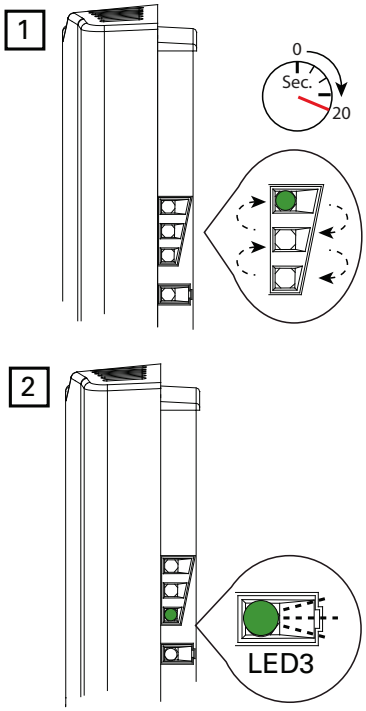
3. Record the address and location of the receiver and sensor pair.

Observing the Receiver for Readiness to Associate

After initial power up, the receiver conducts a channel scan for 20 seconds. During this time, the receiver selects from 16 available channels the clearest channel on which to operate. LED1, LED2, and LED3 flash rapidly in succession (round-robin style) while the channel scan is in progress, as shown in part 1 of the illustration.

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

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

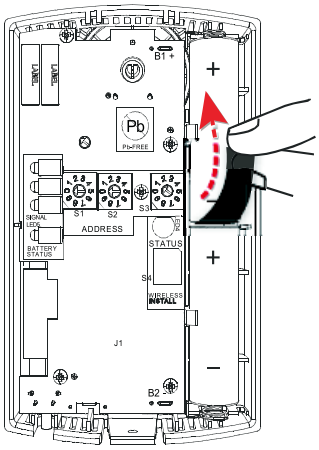


Associating the Sensor to the Receiver

To associate the sensor to the receiver:

1. Remove the sensor cover by firmly pressing the thumb tab at the bottom of the cover and pulling the cover away from the back plate.

2. Verify that the sensor is set to the same address as the receiver it is to be associated with.
3. Power the sensor by removing the insulation strip from between the two batteries.



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

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

Note: *An associated sensor that has lost communication with the receiver will transmit an association request every 50 minutes. You can manually initiate association (see "Manual Association (Wireless Controls)," p. 99").*

Testing Signal Strength and Battery Status

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

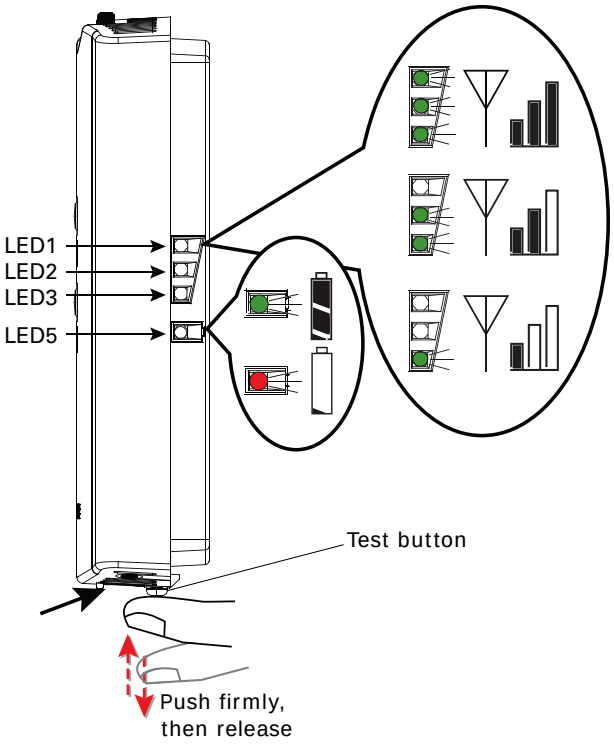
1. Firmly press and release the Test button on the bottom of the sensor (as illustrated below).
2. For model WZS, view LED1, LED2, and LED3 to determine the signal strength. View LED5 to determine the battery status (see the following figure for model WZS sensors).

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

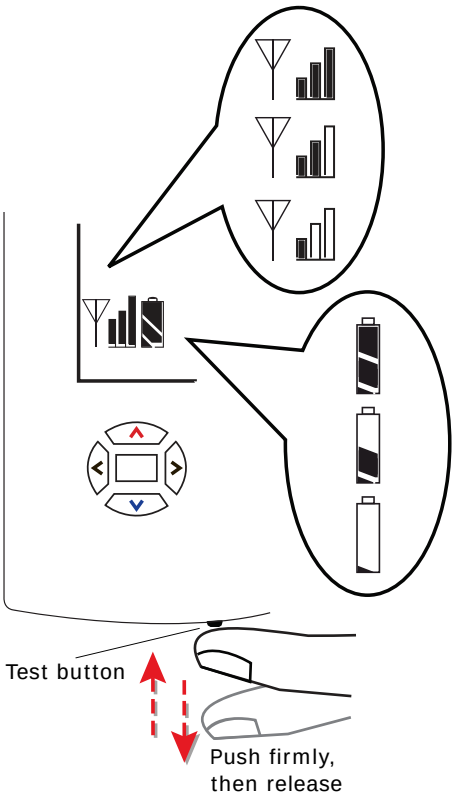
   For model WDS, determine the signal strength and battery status by viewing the symbols on the sensor display (see the following figure for model WDS sensors).
3. Record the results in your commissioning statement.

Note: *For more information, see "Testing Signal Strength (Wireless Controls)," p. 97 and "Testing Battery Status (Wireless Controls)," p. 98.*

Model WZS sensor



Model WDS sensor



Configuring the Wireless Display Sensor (Model WDS only)

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

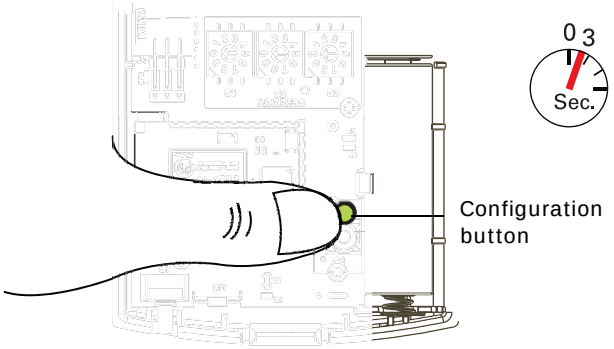
The configuration of the sensor determines which system features can be accessed and changes can be made by the tenant (for example, changes to cooling/heating mode, setpoint, or fan speed. Verify system and associated unit features before configuring the sensor.

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

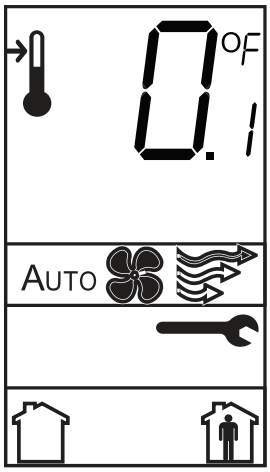
Configuration Procedure

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

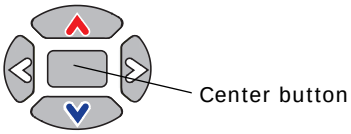
1. Press the configuration button for 3 seconds.



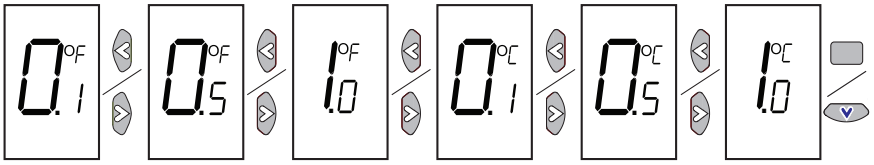
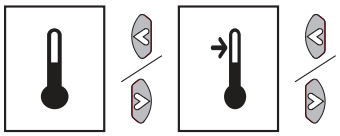
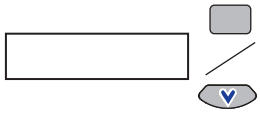
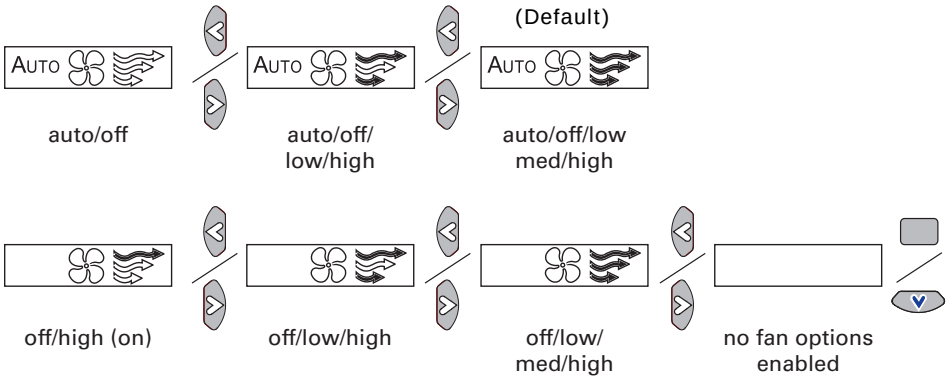
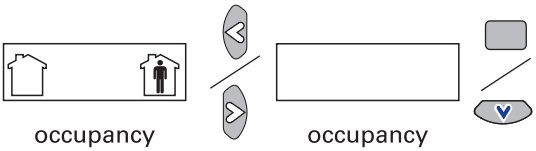
The display will change to configuration mode. When the sensor is in configuration mode, a wrench symbol appears on the display and the menus are separated by lines, as illustrated below.



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



3. Configure the sensor options in the order shown in the table.
   - Press or to scroll to the next selection (as illustrated).
   - Press or to move to the next menu (as illustrated).

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

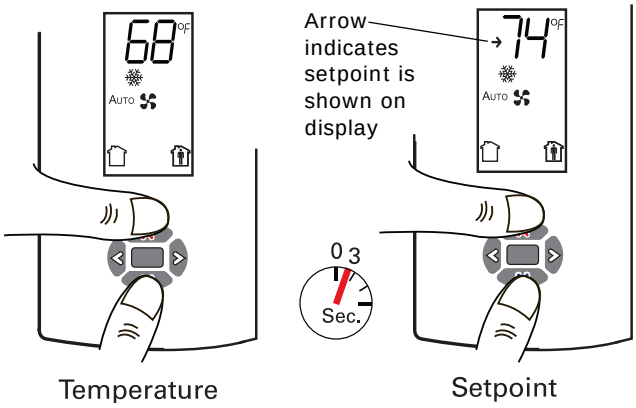
4. Review the display to ensure that you have selected the correct configuration.
5. To return the display to operating mode, press the configuration button (see Step 1, p. 35).

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

Optional Features

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

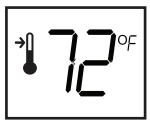
1. Verify that the sensor is in operating mode and at the home screen.
2. Press the up and down arrows for 3 seconds. The arrow indicates setpoint display, as shown in the figure.



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

To lock or unlock a setting:

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

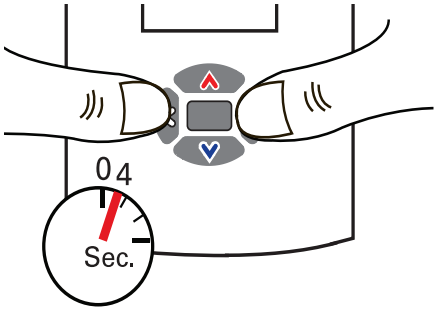


Setpoint

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

Fan menu

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



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

Sensor Operations

Temporary Occupancy (Timed Override)

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

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

Model WDS Sensor

To request and cancel temporary occupancy on a model WDS sensor, see "Requesting Temporary Occupancy," p. 39.

End-of-Range Temperature Values

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

Sensor: The end-of-range temperature setpoint limits for the *model WDS sensor* is 50°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 "Output Values—Failure and Default Modes of Operation (Wireless Controls)," p. 101).
- Status LED3 will display a 2-blink pattern diagnostic (Table 35, p. 97).

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

- LED5 is constantly On, indicating power is applied and the receiver is functional.
- All models: Zone temperature and cooling setpoint default to 72.5°F.
  WDS only: The heating setpoint defaults to 70.5°F and the fan/system output will be 2230 Ω (see "Output Values—Failure and Default Modes of Operation (Wireless Controls)," p. 101).

- The receiver conducts an energy scan for 20 seconds to determine the clearest channel on which to operate.
- LED3 flashes On every 2 seconds when it is ready to accept a sensor association request. When an association request is made by a sensor, the receiver instructs the sensor on which power level to operate. Then the receiver and sensor begin operation at the appropriate channel and power level (see "Observing the Receiver for Readiness to Associate," p. 33).

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

- LED5 is constantly On, indicating power is applied and the receiver is functional.
- Zone temperature and setpoint default to 72.5°F. WDS only: Heating setpoint defaults to 70.5°F, Fan = Auto, System = Off.
- The receiver waits for a broadcast transmission from its associated sensor. When a transmission is received, the receiver positions its zone temperature and setpoint outputs appropriately.
- If the receiver does not receive a communicated signal from its associated sensor within 35 minutes, zone temperature and setpoint outputs fail, generating a unit controller alarm (see "Output Values—Failure and Default Modes of Operation (Wireless Controls)," p. 101).

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

Sensor Transmission Time and Temperature Variables

Sensor transition time variables are as follows:

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

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

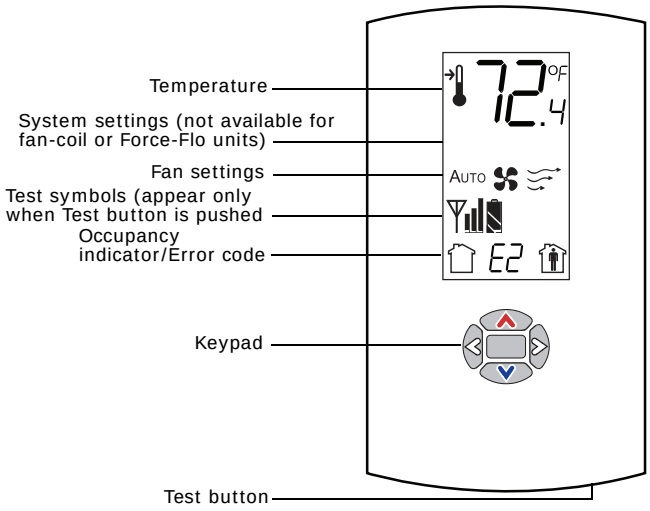
Sensor temperature time variables are as follows:

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

Operating Mode (Model WDS)

This section describes how to operate the Trane wireless sensor, model WDS. Figure 40 shows an example of a model WDS that has been configured and is in operating mode.

Figure 40. Wireless sensor (model WDS) in operating mode



Changing Room Temperature

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

Changing Heating and Cooling Room Temperature Settings (applies to some systems)

Some systems allow you to select both heating and cooling room temperature settings. If your system has this option, this symbol appears when you adjust the temperature setting.

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 the Fan Setting

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), or
   - Pressing ▲ or ▼ (the next menu will appear), or
   - Waiting five seconds.

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 ▶ 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 satisfactory signal strength 

Indicates poor signal strength 

Press the Test button to display the signal strength symbols.

Testing Battery Status

Indicates full battery power 

Indicates 50% of battery life left. 

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

Wireless Sensor Specifications

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

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

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

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

United States compliance (all models)	UL listed: UL 94-5VA Flammability rating UL 916: Energy management equipment
	FCC CFR47, Section 15.247 & Subpart E Digital Modulation Transmission with no SAR (FCC Identification TFP-13651127) This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: 1. This device may not cause harmful interference, and 2. This device must accept any interference received, including interference that may cause undesired operation. Warning: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. 20 cm separation distance: To comply with 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)

Installation—Electrical

Wiring

Motor data can be found in Table 5, p. 11.

⚠WARNING

Electrocution and Fire Hazards with Improperly Installed and Grounded Field Wiring!

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

Failure to follow these requirements could result in death or serious injury.

⚠WARNING

Hazardous Voltage!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

NOTICE:

Equipment Damage!

Wiring diagrams provided in this manual are for reference only. Actual wiring for particular options/units could vary. Refer to the diagram provided on the equipment for specific information. Failure to follow recommendations above could result in premature motor failures or equipment damage.

Do not remove or alter the wiring of the time delay relay (DL). Failure to do so could result in equipment failure.

⚠WARNING

Fire Hazard!

When installing field provided controls, do not alter or remove any built-in unit safeties. Tampering with unit safeties could cause unit overheating and possible fire hazard which could result in death or serious injury.

Control Power. Unit ventilator controls and control wiring can be factory mounted or field installed.

Wiring diagrams illustrate the standard unit motors with one or more speed controls. Terminal wiring is provided by Trane and the actual components used for a particular installation may differ. Control and line diagrams for the exact control system used are provided with each unit.

NOTICE:

Use Copper Conductors Only!

Unit terminals are not designed to accept other types of conductors. Failure to use copper conductors could result in equipment damage.

Electrical Wiring

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

Supply Power Wiring. Refer to the unit nameplate to obtain the minimum circuit ampacity (MCA) and maximum fuse size (MFS) or maximum circuit breaker (MCB) to properly size field supply wiring and fuses or circuit breakers. Refer to the unit operating voltage listed on the unit wiring schematic, submittal, or nameplate. Reference the wiring schematic for specific wiring connections.

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

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

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

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

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

and local requirements. Refer to the following table for the wire size range and maximum wiring distance for each device.

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

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

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

NOTICE:

Use Copper Conductors Only!

Unit terminals are not designed to accept other types of conductors. Failure to use copper conductors could result in equipment damage.

Electric Heat *(Option)*

⚠WARNING

Hazardous Voltage!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

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

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

See "Wiring Diagrams," p. 84 for a typical unit line and interconnecting wiring diagram for electric heat coils.

NOTICE:

Equipment Damage!

480 V/3-Wire is NOT compatible with Trane Classroom Unit Ventilator equipment. There must be a 4-wire system with a separate ground. Failure to provide a 4-wire system could result in equipment damage.

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

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

DX System

A typical unit ventilator with DX coil includes an outside air thermostat, a frost prevention thermostat, and a 24 V transformer for condensing unit control.

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

Split System Start-Up

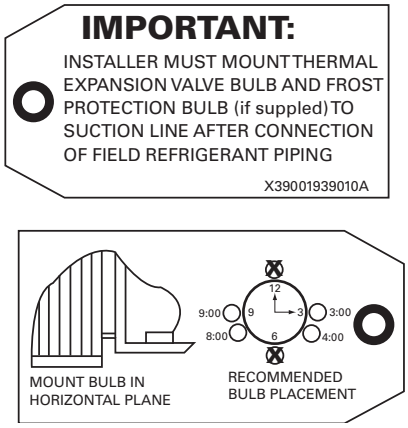
After all piping and wiring has been completed, follow the instructions provided with the condensing unit for control testing and system start-up. If sweat type field-piped systems are being used, then pressure testing, evacuation, and refrigerant charging will be required.

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

- Frost stat bulb
- TXV valve (used with R-410A)

Both components are to be field installed using the installation kit shipped with the unit. For complete installation instructions and locations, refer to the tag attached to the coil. Refer to Figure 41, p. 44 for an example of the installation tag.

Figure 41. Frost stat / TXV valve installation tag



Note: *Depending on the controls package ordered with the unit, not all installations will require mounting the frost stat bulb.*

ECM Overview and Setup

Overview

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

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

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

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

General Information

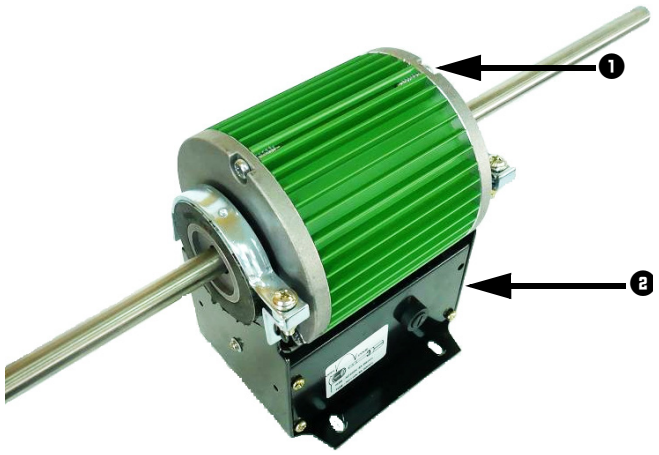
There are four primary components that enable the technology on your product:

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

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

Trane BLDC Motor

Figure 42. Trane BLDC motor



1. High Efficiency Brushless DC (BLDC) Motor Core
2. Motor Base Housing Potted Electronics Package

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

NOTICE:

Equipment Damage!

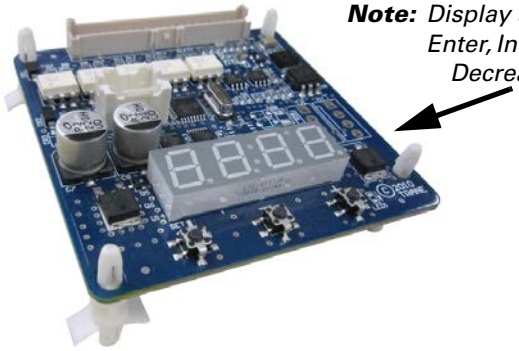
The motor harness attached to the single plug to which the motor mates contains the very important motor voltage jumper and should not be modified or substituted. Failure to follow this instruction could result in equipment damage.

- The motor mates to the unit electrically via a single plug that contains both the operating voltage and the control signals that are needed for correct operation.
- The BLDC motor comes in a double shaft configuration for all vertical unit ventilator sizes (075, 100, 125, 150).

  Note: *Sizes 125 and 150 have two motors installed.*
- The BLDC motor has two voltage variations, 115/208-230V and 277V. Units with three-phase and neutral have motors wired to the L-N (as opposed to L-L). The 115/208-230V is configured for voltage by use of an external jumper. If the jumper is present the motor will be configured for use with 115V. The jumper must NOT be present for use with 208-230V.

ECM Engine Controller

Figure 43. ECM engine controller

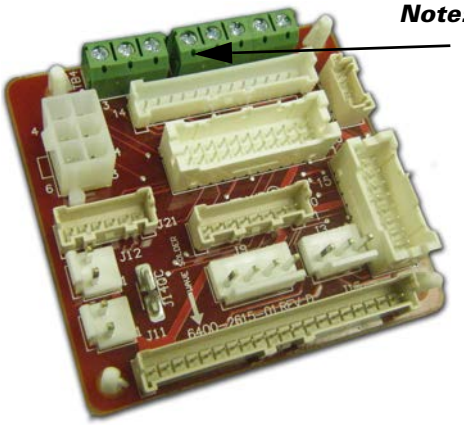


- The ECM engine controls and reports the performance of up to two Trane BLDC motors.
- The engine also co-ordinates the operation of the fan in response to electric heat behavior, and electric heat behavior in response to hydronic heat behavior and fan behavior.
- The engine incorporates a user interface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

- The engine integrates a versatile configurable auxiliary temperature sensor.
- The engine incorporates various safety and lockout features, such as maintaining proper fan speeds, if electric heat is called for.

Standard Adapter Board

Figure 44. Adapter board

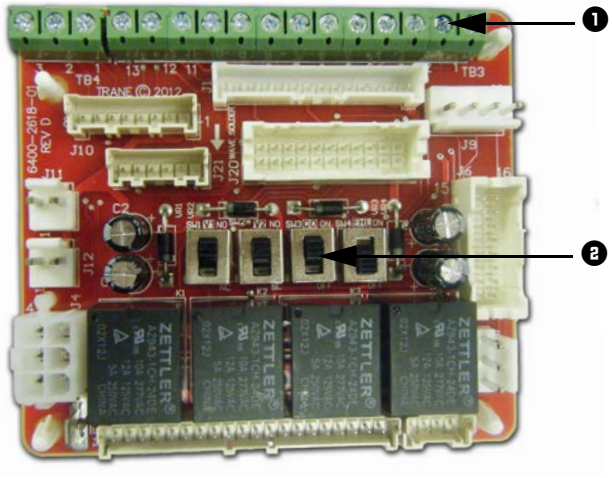


Note: *Customer Low-Voltage Interface for Fan Speeds, Variable Fan Speed, and 24 Vac Supply*

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

CSTI Adapter Board

Figure 45. CSTI adapter board



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

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

Installation and Initial Setup

⚠WARNING

Hazardous Voltage w/Capacitors!

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 an appropriate voltmeter that all capacitors have discharged. Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

⚠WARNING

Safety Alert!

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

- **The BLDC 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 ECM engine board. If it is not practical to stay clear of these areas during adjustment of the ECM engine board, please contact Trane Global Parts for configuration kit that allows easy powering of the engine board outside of the unit with a 9V battery.**
- **The adapter boards contain high voltage. Configuration adjustments to the ECM engine 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.**
- **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.**

Installation and Initial Setup

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

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

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

- Wall-mounted low-voltage fan speed switch inputs to the adapter boards' terminal strips and 24 Vac tap to 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

Proceed with the power on after installation, as defined in the other sections of this manual.

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

⚠WARNING

Hazardous Voltage w/Capacitors!

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 an appropriate voltmeter that all capacitors have discharged. Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

⚠WARNING

Safety Alert!

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

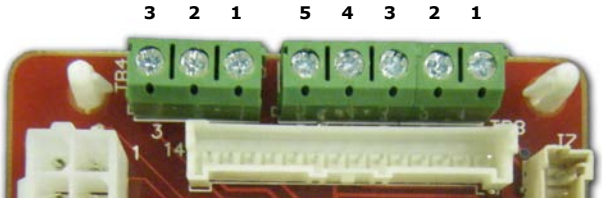
- **Hook ups to the adapter boards should be made only with the power off to the unit.**
- **Only connect Class 2 voltages to the terminal blocks on the adapter boards that share a common with the unit mounted low-voltage transformer.**
- **Secure low voltage connections firmly to terminal strips, and strain-relieve all low voltage connection to prevent accidental detachment and possible short-circuiting of high voltage components. Care should be taken to avoid contact of low voltage wiring to the back side of the adapter boards, which contain high voltage.**

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

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

Standard Adapter Board Field Connections

Figure 46. Standard adapter board field connections



1. VSP 10V
2. VSP 0–10V
3. VSP DC COM

1. 24 Vac Y (gnd)
2. 24 Vac B (com)
3. High
4. Medium
5. Low

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

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

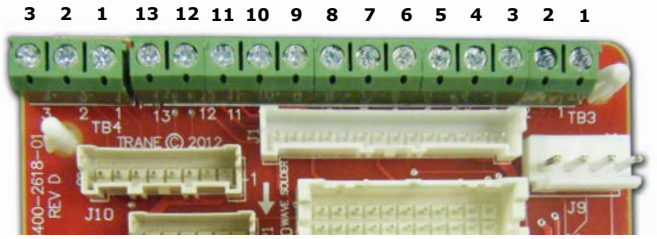
TB3 (right five positions) is normally used to provide 24V hookup to a wall mounted fan speed switch, and to accept the returns from the switch for High, Medium, and Low requests.

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

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

CSTI Adapter Board Field Connections

Figure 47. CSTI adapter board field connections



1. VSP 10V
2. VSP 0–10V
3. VSP DC COM

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

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

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

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

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

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

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

Adjustment and Configuration of the Engine 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 ECM engine board. If it is not practical to stay clear of these areas during adjustment of the ECM engine board, please contact Trane Global Parts for configuration kit that allows easy powering of the engine board outside of the unit with a 9V battery.**
- **Configuration adjustments to the ECM engine 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.**

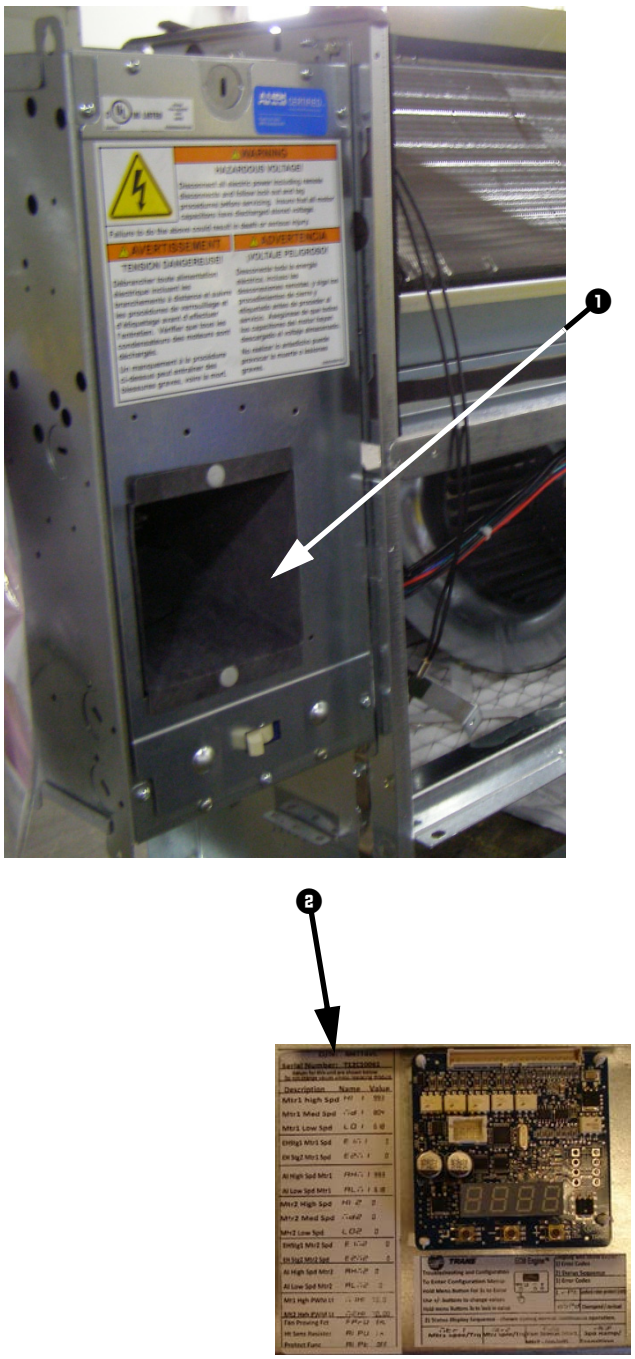
⚠CAUTION

Burn Hazard!

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. 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.

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

Figure 48. ECM engine label



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

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

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

Status Display

Figure 49. Status display

The ECM engine board contains a four-digit, seven-segment display that is used to present information in a format close to real-world language, while having a small-form factor. Most characters are immediately recognizable; however, please consult Table 9 and Table 10 for the graphical representation of each alphanumeric character.

Table 9. Screen representation of alphabetical characters

A	B	C	D	E	F	G	H	I	J	K	L	M
A	b	C	d	E	F	9	H	I	J	H	L	n

N	O	P	Q	R	S	T	U	V	W	X	Y	Z
n	0	P	9	r	5	t	U	u	"	H	y	2

Table 10. 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

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

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

RPM Mode ***RUNNING/ FAN STATUS*** ***CONTINUOUS LOOP*** Displayed when: 1) No error codes are present 2) Motor has completed ramping	mtr 1 0000 → 2000	Indicates the current rpm of Motor 1 in the system. "0" rpm here indicate that no fan speed has been requested.
	mtr2 0000 → 2000	Indicates the current rpm of Motor 2 in the system. "0" rpm here indicate a fan off condition OR a fan "missing" condition[(a)].
	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 "Troubleshooting (ECM)," p. 105 for additional information.
	YES / no	If "on," this indicates that the fan is performing correctly and will be used to report fan status correctly, depending on FPru mode.
	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 "Troubleshooting (ECM)," p. 105 for additional information. 3) If the target speed for Motor 2 is "0," this is used to indicate a missing motor[(a)].
	YES / no	If "on," this indicates that the fan is performing correctly and will be used to report fan status correctly, depending on FPru mode.
	EhEn YES / no	Indicates that the temperature sensing circuit has calculated a logical "on" based on the settings of the following parameters: A i27 / A i26 / A iPU

(a) Motor 1 is the only motor in unit sizes 075 and 100; unit sizes 1250 and 1500 contain two motors.

Configuration parameter and value display and modification changes

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

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

Figure 50. User interface input buttons

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

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

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

Table 11. 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.

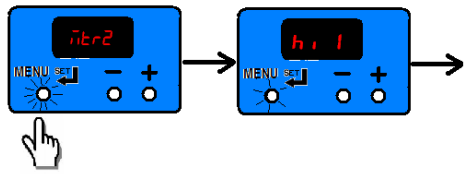
	Decrement	
Button	**Duration**	**Action**
Short Press in Status Display	<1 sec	None
Short Press in Configuration Display	<1 sec	Scrolls through parameter names, or decreases value of parameter.
Long Press/Hold in Status Display	>3 sec	N/A
Long Press/Hold in Configuration Display	>3 sec	Faster scroll through parameter name, or faster decrease of values of parameters.

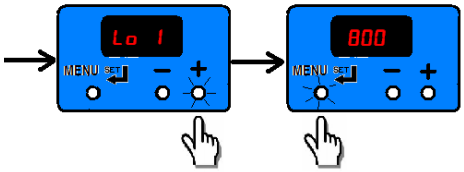
	Increment	
Button	**Duration**	**Action**
Short Press in Status Display	<1 sec	None
Short Press in Configuration Display	<1 sec	Scrolls through parameter names, or increases value of parameter.
Long Press/Hold in Status Display	>3 sec	N/A
Long Press/Hold in Configuration Display		Faster scroll through parameter name, or faster increase of values of parameters.

Configuration Use 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 ECM engine scrolling status display and proceed as follows:

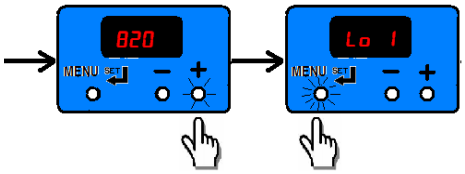




Example 2. We wish to change the change the value of Low Speed to 820 rpm:

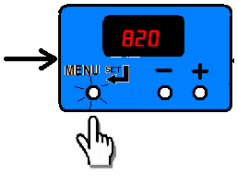
We will continue from the previous example as shown below, using a long press to "save" the new desired value.

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

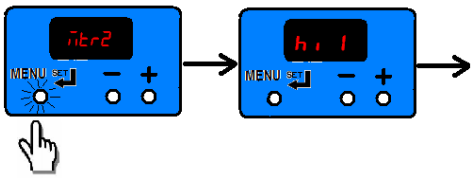


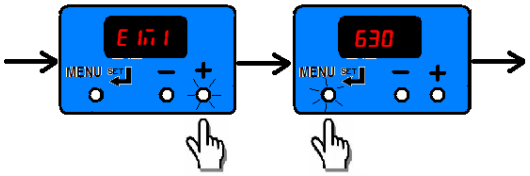
Example 3. We wish to double check to see if the value of "820 rpm" has been saved.

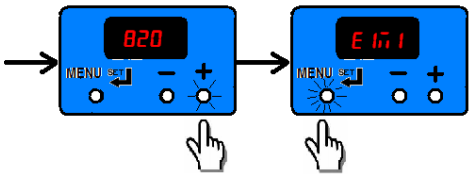
Note: *If the display has timed out and returned to the status loop, repeat Example 1 and Example 2 to arrive back at this example's starting point.*



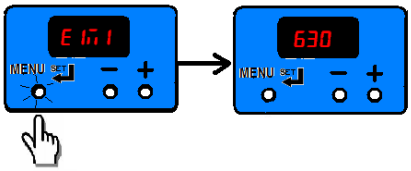
Example 4. We wish to change the value of a protected value on an electric heat unit.







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



Priority / Error Display

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

Notes:

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

Error Codes Displayed during abnormal operation.	MTR 1 LOCH	Indicates a locked rotor condition of Motor 1. The motor will be locked out until the cause has been resolved, and the power cycled; refer to refer to "Troubleshooting (ECM)," p. 105 for resolution details. Motor 2 will continue to operate, but will not be monitored. Fan Status function, if being used, will report an inoperative motor. Electric heat and changeover heat will be shut down.
	MTR2 LOCH	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 "Troubleshooting (ECM)," p. 105 for resolution details. Motor 1 will continue to operate, but will not be monitored. Fan Status function, if being used, will report an inoperative motor. Electric heat and changeover heat will be shut down.
	MTR 1 OSPd	Indicates that Motor 1 has experienced a run-away or over speed condition, and has been shutdown. The unit will offer limited "limp-in" performance, and Motor 2 will continue to operate, but will not be monitored. Fan Status function, if being used, will report an inoperative motor. Refer to "Troubleshooting (ECM)," p. 105: to reset, the cause must be resolved and the power to the unit cycled. Electric heat and changeover heat will be shut down.
	MTR2 OSPd	Indicates that Motor 2 has experienced a run-away or over speed condition, and has been shutdown. The unit will offer limited "limp-in" performance, and Motor 1 will continue to operate, but will not be monitored. Fan Status function, if being used, will report an inoperative motor. Refer to "Troubleshooting (ECM)," p. 105: to reset, the cause must be resolved and the power to the unit cycled. Electric heat and changeover heat will be shut down.
	RAMP 0000 → 2000 2000 → 0000	Indicates the motor is transitioning between speeds, ramping up or down. The message "RAMP" is briefly displayed, followed by the target speed for "Motor 1" only. Once the target speed has been reached, the status display will resume operation.
	u 123	On power on, the version of software is briefly displayed, followed by the results of a POST (power on self test).

Initial Setup and Configuration

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

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

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

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

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

Configuration

Configuring the ECM Engine Controller

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

⚠WARNING

Hazardous Voltage w/Capacitors!

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 an appropriate voltmeter that all capacitors have discharged. Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

⚠WARNING

Safety Alert!

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

- **The adapter boards contain high voltage. Connections to the adapter boards/changes to the CSTI configuration switches should be made only with the power to the unit disconnected.**
- **The adapter boards contain high voltage. Configuration adjustments to the ECM engine 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.**
- **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 ECM engine board. If it is not practical to stay clear of these areas during adjustment of the ECM engine board, please contact Trane Global Parts for configuration kit that allows easy powering of the engine board outside of the unit with a 9V battery.**

⚠CAUTION

Burn Hazard!

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. 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.

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.**

Notes:

- *The 0–10V (variable speed) inputs are available for use, but are not mandatory. The Trane Brushless DC system*

comes standard with three to five field-accessible thermostatic inputs (with adjustable speed), so the use of the 0–10V inputs is optional.

- *All inputs are independently configurable and simultaneously accessible, and the ECM engine will choose the highest user (configured and requested) speed. However, care should be taken with customer controls to avoid contention of signals.*

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

The ECM engine is factory configured to drive the unit to a minimum speed (catalogue "low speed" value), defined as $A_{LT}1$ and $A_{LT}2$ 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 $A_{LT}1$ and $A_{LT}2$. If the analogue input goes to 10V, the ECM engine will drive the motor to maximum speed (normally catalogue "high speed" value), defined as $AhT1$ and $AhT2$, and will change speed in response.

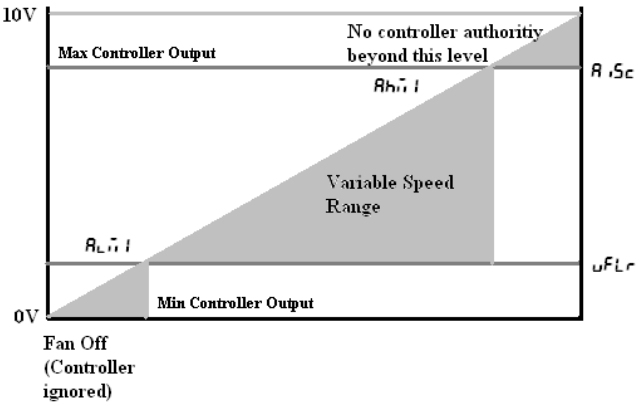
Although the ECM engine board ships with settings that will work with most 0–10 Vdc outputs, calibration should be performed to maximize response range and controller authority. Typically, the only settings needed for the VSP inputs are calibration of the signal to ensure that the system obeys the following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

1. The minimum output from the field supplied controller is met with a positive fan response. That is, we do not want the $uFLr$ setting on the ECM engine board to be higher than the minimum output of the field supplied controller, as the ECM engine will "ignore" a portion of the usable range of the customer fan variable speed output.
2. The minimum output from the field supplied controller is not significantly greater than the floor setting $uFLr$ floor. If the minimum output of the controller is significantly greater than the floor setting, the first point that the motor will turn on will be above the $A_{LT}1$ and $A_{LT}2$ 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 ($A_{LT}1$ and $A_{LT}2$)
3. The maximum output of the controller needs to be 10V, or if lower, needs to be compensated using the analog input scaling value, $A.Sc$ to normalize the operational range. As a default, the scaling value is set to 1.00 (so a voltage of 5V will be graded as 5V); however, to compensate for long runs or lower max voltages (i.e., lower than 10.00), the scaling value can be increased accordingly to maximize operational range.

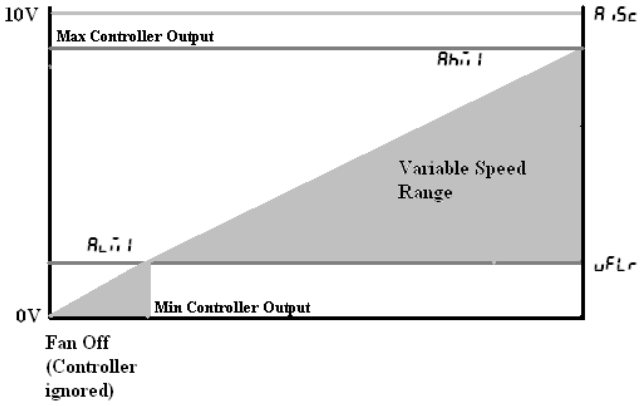
   For example, if the voltage is only reaching a value of 9.0V at the adapter boards, then the $A.Sc$ parameter should be set to (10/9=) 1.111. If left un-calibrated, the unit will never attain maximum speeds, defined as $AhT1$ and $AhT2$.
4. The ECM engine can accept slightly over-biased inputs up to 12 Vdc, and the $A.Sc$ parameter can be set to a value less than 1.0 to compensate.

VSP Setup Examples

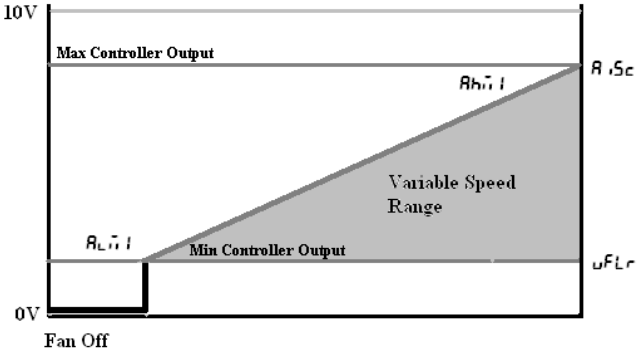
Example 1: $uFLr$ set too high and $A.Sc$ set too high



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



Example 3: $uFLr$ set correctly and $A.Sc$ set correctly



Use of Potentiometer/Rheostat For VSP

⚠WARNING

Hazardous Voltage w/Capacitors!

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 an appropriate voltmeter that all capacitors have discharged. Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

⚠WARNING

Safety Alert!

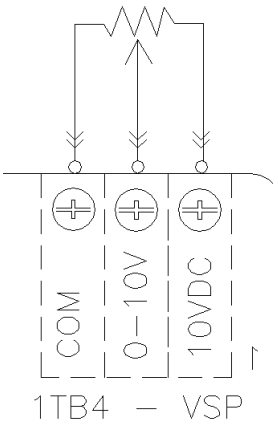
You MUST follow all recommendations below. Failure to do so could result in death or serious injury.

- **The adapter boards contain high voltage. Connections to the adapter boards/changes to the CSTI configuration switches should be made only with the power to the unit disconnected.**
- **Configuration adjustments to the ECM engine 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.**
- **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 ECM engine board. If it is not practical to stay clear of these areas during adjustment of the ECM engine board, please contact Trane Global Parts for configuration kit that allows easy powering of the engine 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 51, the uFLr setting will define a null-zone (off).

The typical connection is depicted in Figure 51; however, please consult the unit schematic for the most updated instruction, as Figure 51 is provided as reference only.

Figure 51. Typical connection



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

⚠WARNING

Hazardous Voltage w/Capacitors!

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 an appropriate voltmeter that all capacitors have discharged. Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

⚠WARNING

Safety Alert!

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

- **The adapter boards contain high voltage. Connections to the adapter boards should be made only with the power to the unit disconnected.**
- **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 ECM engine board. If it is not practical to stay clear of these areas during adjustment of the ECM engine board, please contact Trane Global Parts for configuration kit that allows easy powering of the engine board outside of the unit with a 9V battery.**

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

- On units with electric heat and a changeover coil, the engine board and adapter boards are pre-configured to cause hydronic heat and electric heat to be mutually exclusive:
  - On units with ComfortLink™ controls (Tracer ZN controllers), the Tracer ZN board will serve as the primary logic to select the electric heat only if hot water is not available, but the engine board will service as a backup lockout.
  - On units with Customer Supplied Controllers (CSTI units), the engine board and CSTI board will serve as the primary lockout.
- On CSTI units selected with a changeover coil configuration, the engine board is factory configured to work in conjunction with the CSTI adapter board to provide a useful auto-changeover function. Traditionally, a fixed setpoint bi-metallic disc temperature switch is used to provide changeover with customer controls; however, the engine board has defeatable and configurable bi-metallic disc temperature switch emulation when combined with the CSTI adapter board. The ECM engine is preconfigured for typical values, so changeover settings do not necessarily need to be changed.
  - An NTC thermistor is supplied and affixed to the supply pipes where applicable. The ECM engine has several settings that affect the operation of the changeover function:
    - FPrU parameter should normally be set to EHL or EHFS to use the changeover functions.
    - EHL parameter should be chosen if the unit has a changeover coil without electric heat.
    - EHFS parameter should be chosen if the unit has a changeover coil with electric heat. Generally, this will perform the same as the EHL parameter but in addition, will disable heating function on electric heat and on the changeover coil if there are fan failures. The auxillary heating coil function will continue to operate and respond to the customer heating request.
- A iPU parameter should be set to In for CSTI units and to OUt for ComfortLink controller units.
- A i2Ti parameter defines the temperature at which the engine board will close the triac onboard the ECM engine (if FPrU parameter is set correctly).
- A i2b parameter defines the temperature at which the engine board will open the triac onboard the ECM Engine (if FPrU parameter is set correctly). By leaving a "gap" between the make and break value, we will simulate hysteresis of a real bi-metallic disc temperature switch.
- When combined with the CSTI adapter board, the bi-metallic disc temperature switch emulation and the electric heat lockout function will work when the switches are set correctly.

Adjustment and Configuration of the CSTI Adapter Board

⚠CAUTION

Burn Hazard!

If SW4 is turned off, the factory/customer controller/ thermostat will be able to actuate the electric heat while hot water is available or if the fans have failed. This switch should NOT be turned off if the unit schematic indicates that it should be on, to prevent overheating of the unit (due to simultaneous electric heat and hydronic heat actuation, or failure of the fan) and to use the preferred hydronic heating over electric heat. 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.

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

Figure 52. CSTI adapter board: board-mounted switches

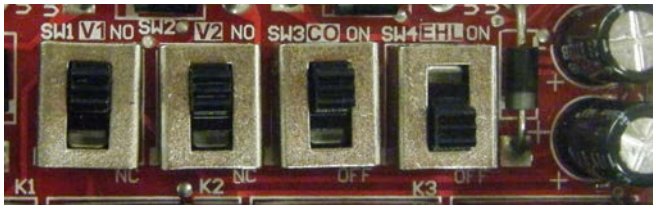


Table 12. CSTI adapter board: switch functions

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

Notes:

- *All switches are factory-set based on customer configuration of the unit model number. The unit will function correctly as shipped; however, the switch functions and positions are depicted for customer convenience and for service and troubleshooting aids.*
- *SW3 and SW4 work in conjunction with settings on the ECM engine controller. Simple activation of*

changeover and electric heat lockout function may not work correctly unless the ECM engine board is configured to perform these functions.

- *Customers are advised to locate the changeover coil temperature sensor on the bypass line if possible, to avoid measuring standing water temperature.*
- *If a 4-pipe unit with changeover function is selected, the heating input will drive the main coil if hot water is detected, but will always drive the auxiliary coil or electric heat (where available).*
- *Where electric heat is available with a changeover coil, the electric heat is factory-configured to be deactivated if there is hot water available and if there is a fan failure.*

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

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

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

Cooling

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

1. A unit is factory configured with a changeover coil (cooling/heating) as the only coil or as the main coil portion.
2. SW3 on the CSTI adapter board is turned on, and the FPrU parameter set to EHL or EhFS to use the changeover functions.
   a. EhL parameter should be chosen if the unit has a changeover coil without electric heat.
   b. EhFS parameter should be chosen if the unit has a changeover coil with electric heat. Generally, this will perform the same as the EhL parameter but will in addition, disable the heating function on electric heat and on the changeover coil heat if there are fan failures. The auxiliary heating coil valve will continue to respond to customer heating requests.
3. The ECM engine has sensed that there is cold water available on the supply/bypass line for the changeover coil. In this case, "cold" water is inferred by the ECM engine if:
   a. A 10K NTC thermistor (similar to Trane part number X13790374010) is wired properly to the engine board, through the crossover cables and CSTI adapter boards.
   b. The input impedance of the thermistor circuit must be set correctly (the A iPU parameter should be set to in for CSTI units).
   c. The temperature sensed is lower than the A i2Ti parameter.
   d. The A i2b parameter is higher than the A i2Ti parameter.
   e. The temperature is not in the dead-band between the A i2b parameter and the A i2Ti parameter (in this case, previous state will be retained).
4. The customer thermostat is properly hooked up the input strip 1TB3, and is requesting cooling input (V1) based on the customer cooling setpoint being lower than the space temperature.

Heating

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

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

b. The input impedance of the thermistor circuit must be set correctly (the A iPU parameter should be set to in for CSTI units).

c. The temperature sensed is higher than the A i26 parameter.

d. The A i26 parameter is higher than the A i2Ti parameter.

e. The temperature is not in the dead-band between the A i26 parameter and the A i2Ti parameter (in this case, previous state will be retained).

4. The customer thermostat is properly hooked up the input strip 1TB3, and is requesting heating input (V2) based on the customer heating set point being higher than the space temperature.

5. The heating input on 1TB3 will drive the main changeover coil IF conditions 1–4 are satisfied, but will always drive the auxiliary coil valve (if present). Electric heat will be locked out (where present) if hot water is available since SW4 will be factory set to "ON" in these units.

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

1. The presence of hot water in the changeover coil section (if the FPrU parameter is set to EHL).
2. Abnormal behavior of the fan/s (if the FPrU parameter is set to FnSt).
3. Or a combination of both the presence of hot water or abnormal behavior of the fan/s (if the FPrU parameter is set to EHFS).
4. The preceding three examples depend on the inference of the engine board that hot water is present. In this case, "hot" water is determined if:

   a. The temperature sensed is higher than the A i26 parameter.

   b. The A i26 parameter is higher than the A i2Ti parameter.

   c. The temperature is not in the dead-band between the A i26 parameter and the A i2Ti parameter (in this case, previous state will be retained).

   d. The input impedance of the thermistor circuit must be set correctly (the A iPU parameter should be set to in for CSTI units).

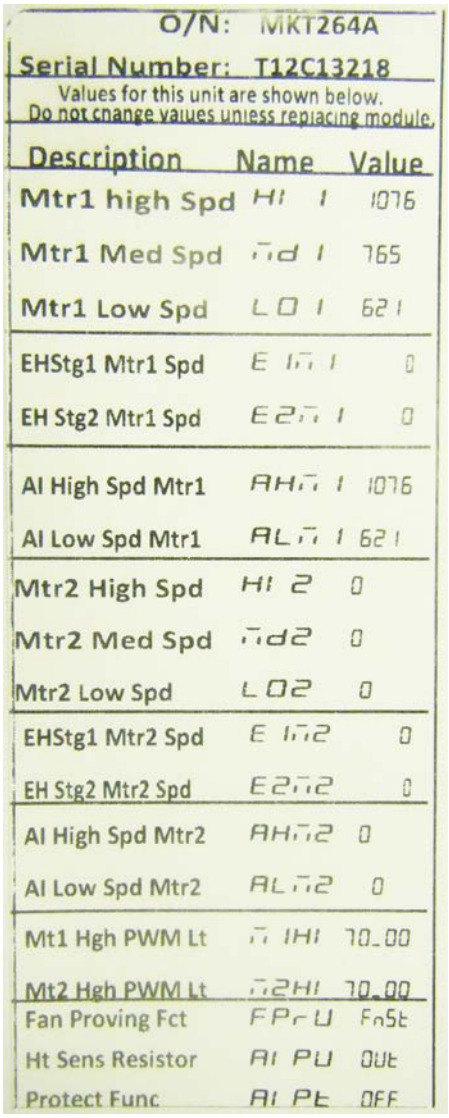
Configuring the ECM Engine Board

Every Trane Fan-Coil or Cabinet Heater unit with BLDC motors will have modules specifically configured at the factory for the operation of that unit. The ECM engine configuration label is affixed to the low-voltage access lid on the outside of the control panel (see Figure 48, p. 50 and Figure 53, p. 60). The ECM engine label may be on the back-side of the low voltage access lid, depending on the unit configuration.

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

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

Figure 53. ECM engine label



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

Configuration Settings of the ECM Engine 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 ECM engine board. If it is not practical to stay clear of these areas during adjustment of the ECM engine board, please contact Trane Global Parts for configuration kit that allows easy powering of the engine board outside of the unit with a 9V battery.

The adapter boards contain high voltage. Configuration adjustments to the ECM engine 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.

⚠CAUTION

Burn Hazard!

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. 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.

NOTICE:

Equipment Damage!

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

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

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

Additional Notes:

1. *This list is applicable only to Fan-coil and Force-Flo products.*
2. *Do not change the electric heat protection settings if your unit has electric heat.*
3. *If the format setting for rpm values are not correct (i.e., not four-digit: XXXX), please check the operation mode of the ECM engine board* mod 1 *and* mod 2 *and motor signal output format* SI 91 *and* SI 92*.*

Table 13. Configuration settings of the ECM engine board

Description on Unit Label	User Interface Name	Typical User Interface Value	Description	Notes: These notes are provided for reference only, and the ECM engine label must be used as the ultimate guide for setting up an engine board on specific units.
Mtr 1 High Spd	H i 1	1080	Sets the high-speed rpm for Motor 1.	Do not exceed 1700 rpm. Do not set under 450 rpm. On units with two motors, the single shafted motor is designated as Motor 1. If the unit has only one motor, all seven speed settings for the second motor (H i 2, Md 2, Lo 2, E 1n2, E2n2, ALn2, AHn2) should be set to zero. Analog inputs below the uFLr setting will be rejected. Note: E 1n1, E 1n2, E2n1, E2n2 settings are locked out on units with electric heat.
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.	
EHStg1 Mtr1 Spd	E 1n1	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).	
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.	
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.	
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	E 1n2	0	Assigns an rpm to be associated with a call for 1st stage electric heat, for Motor 2 (only on electric heat equipped units).	
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	Mod 1	rPn	Sets the operational mode for Motor 1.	Must be set to rPn for fan-coil products.
Op Mode Mtr 2	Mod2	rPn	Sets the operational mode for Motor 2.	Must be set to rPn for fan-coil products.
Mtr 1 Out Format	S ig1	PWn	Sets the interface type for Motor 1.	Must be set to PWn for fan-coil products.
Mtr 2 Out Format	S ig2	PWn	Sets the interface type for Motor 2	Must be set to PWn for fan coil products.
Mtr 1/2 PWM Freq.	FrEq	100	Sets the PWM frequency, for cases when the PWM outputs are used.	On fan-coil units, the PWn must not be changed.
Mtr 1 PWM Volt	M1uL	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	M2uL	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	M1H i	70	Sets the maximum output % that the controller will request from Motor 1.	This envelope protection value should not be altered.
Mt1 Low PWM Lt	M1Lo	19.5	Sets the minimum maximum output % that the controller will request from Motor 1.	This envelope protection value should not be altered.
Mt2 Hgh PWM Lt	M2H i	70	Sets the maximum output % that the controller will request from Motor 2.	This envelope protection value should not be altered.
Mt2 Low PWM Lt	M2Lo	19.5	Sets the minimum maximum output % that the controller will request from Motor 2.	This envelope protection value should not be altered.
Mt1 Ovspd RPM	rPn1	3000	Selects the rpm above which the Motor 1 will be assumed to be in an overspeed condition and will need to be shut down.	This envelope protection value should not be altered.

Table 13. Configuration settings of the ECM engine board (continued)

Description on Unit Label	User Interface Name	Typical User Interface Value	Description	Notes: These notes are provided for reference only, and the ECM engine label must be used as the ultimate guide for setting up an engine board on specific units.
Mt2 Ovspd RPM	rPM2	3000	Selects the rpm above which the Motor 2 will be assumed to be in an overspeed condition and will need to be shut down.	This envelope protection value should not be altered.
Fan Proving Fct	FPru	FnSt	Selects which mode should be assigned to the Binary output circuit, depending on unit type.	This setting has to be correct for proper unit operation of electric heat and changeover units.
AI Boost Amp	AIsc	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	0.3	Rejects noise on the analog input lines and sets up the engine board to turn on if the thermostat or controller is commanding its analog outputs on.	
PulsePerRev	FdbH	12	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	PuL1	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	IuL1	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	IuL2	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	AI2M	85	Sets the make value for the engine board triac output based on the thermistor input.	Operation also depends on FPru, AI2b, and AIPU settings.
Ht Sens Bk Val F	AI2b	90	Sets the break value for the engine board triac output based on the thermistor input.	Operation also depends on FPru, AI2M, and AIPU settings.
Ht Sens Resistor	AIPU	oUt	Sets the input impedance of the thermistor input.	Should be pre-set to “OUT” for Tracer ZN controllers.
Mt 1 Ramp %/sec	M1rP	3	Sets the ramp rate for Motor 1, in % per second.	
Mt 2 Ramp %/sec	M2rP	3	Sets the ramp rate for Motor 2, in % per second	
EH Rmp Accel	EhrP	5	Sets the acceleration factor for the electric heat inputs.	Is used to force faster ramps when electric heat is requested.
Ramp MAX Time	MhrP	5	Sets the maximum ramp time for both Motor 1 and Motor 2 (in seconds).	Overrides the ramp rates M1rP and M2rP if the calculated ramp time exceeds MhrP.
EH Fan off delay	EHdL	0	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 shut down the affected motor, if rotational response is not detected.

Table 13. Configuration settings of the ECM engine board (continued)

Description on Unit Label	User Interface Name	Typical User Interface Value	Description	Notes: These notes are provided for reference only, and the ECM engine label must be used as the ultimate guide for setting up an engine board on specific units.
Protect Funct	EhPt	on	This function protects settings on the board that affect the safety of the electric heat system.	Do NOT change this setting. This setting locks out the following parameters from being changed, for safe operation of the unit.
				A iPU
				FPru
				A iiH
				A ibH
				E 1i1
				E 1i2
				E2i1
				E2i2
				S iS
				iod1
				iod2
				i 1H i
				i 1Lo
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	u2.00	Displays the software version.	

Fan Speed Response Verification

1. After performing controller specific commissioning, observe the display on the ECM engine board with the power on, to the unit. The ECM engine display should display a looping status indicator as follows:

   itr 1 → 0 → itr2 → 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 "1050" rpm are shown in the following example. Each unit is factory-configured differently and will have different settings for different fan speeds.*

2. While the unit remains on, exercise the fan controls on the unit, either directly or indirectly through request for unit heat/cool. Observe the fan spinning, and then observe the fan display on the ECM engine board. It should display a looping status indicator as follows:

   For a size 075 or 100 unit (using typical unit operating fan speeds):

   itr 1 → 1050 → itr2 → 0 → FSt 1 → On → FSt2 → OFF → EhEn → On

   For a size 125 or 150 unit (using typical unit operating fan speeds):

   itr 1 → 1050 → itr2 → 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: rAiP

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

Congratulations! Your new Trane BLDC Engine/Motor system is performing properly.

Time Clock

Setting the Time Clock

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

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

The following procedure covers:

- setting the time format
- setting the current time and day
- setting the program ON / OFF settings (events)
- pre set program selections
- deleting programs
- daylight savings setting
- overriding programs (manually)

Figure 54. Time clock

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

The time clock (see Figure 54) is located behind the access door of a Unit Ventilator.

Reset the Time Clock

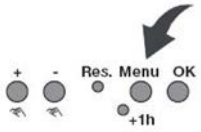
To clear any programs that may exist from the factory, press the reset button (**Res.**).

Note: *The time clock uses Standard Time. If you are programming during Daylight Savings Time, one hour should be subtracted from times needed (see "Daylight Savings Time," p. 66).*

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

Set the Time Format, Time, and Day

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



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

Set the Program

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

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

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

Set the Switching ON Time

Figure 55. Setting the switching ON time

1. Press **OK** until **prog 01** is visible on the LED display (see Figure 55).

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

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

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

Set the Switching OFF Time

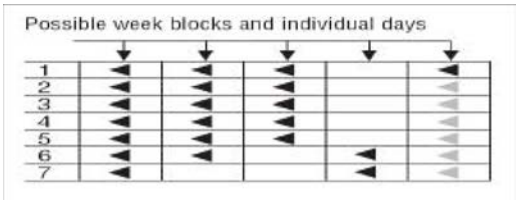
1. The hour display begins to blink—use the **+** and/or **-** buttons to select the desired setting and then press **OK**.
2. The minute display begins to blink—use **+** / **-** to select the desired setting and press **OK**.
3. The day display (on the left side of the display screen) begins to blink—use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

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

Preset Program Selections

When selecting daily programming, preset selections can be used (see Figure 56).

Figure 56. Preset program selection options



Deleting Programs

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

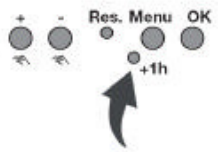
Important: *Switching programs **must** be deleted in ON-OFF pairs. When you delete a single ON instruction, you must also delete the corresponding OFF instruction.*

Daylight Savings Time

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

- Press the **+1h** button (see Figure 57) to add 1 hour to the current time. Press the **+1h** button again to subtract 1 hour from the current time.

Figure 57. Daylight Savings Time



Override Program (Manual)

To override the program, press the **OVR** (**+**) button (see Figure 58).

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

Figure 58. Manual program override

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

Wired Controllers—Communication Wiring

Wiring Installation (ZN520)

Tracer ZN520 controllers are LonTalk® devices that interface with the Trane Tracer Summit building management system. Reference the unit wiring diagram or submittals.

Ground shields at each Tracer ZN520, taping the opposite end of each shield to prevent any connection between the shield and anther ground. Refer to the most recent version of Trane publication CNT-SVX04A-EN (*Tracer ZN520 Unit Controller: Installation, Operation and Programming Guide*) for the communication wiring diagram.

Communication wire must conform to the following specification:

1. Shielded twisted pair 18 AWG
2. Capacitance 23 (21–25) picofarads (pF) per foot
3. Listing/Rating—300 V 150C NEC 725-2 (b) Class 2 Type CL2P
4. Trane Part No. 400-20-28 or equivalent, available through Trane BAS Buying Group Accessories catalog.

Note: *Communication link wiring is a shielded, twisted pair of wire and must comply with applicable electrical codes.*

Follow these general guidelines when installing communication wiring on units with a Tracer ZN520 controller:

- Maintain a maximum 5000 ft. aggregate run.
- Install all communication wiring in accordance with the NEC and all local codes.
- Solder the conductors and insulate (tape) the joint sufficiently when splicing communication wire. Do not use wire nuts to make the splice.
- Do not pass communication wiring between buildings because the unit will assume different ground potentials.
- Do not run power in the same conduit or wire bundle with communication link wiring.

Note: *You do not need to observe polarity for LonTalk communication links.*

Device Addressing

LonTalk devices are given a unique address by the manufacturer. This address is called a Neuron ID. Each Tracer ZN520 controller can be identified by its unique Neuron ID, which is printed on a label on the controller's logic board. The Neuron ID is also displayed when communication is established using Tracer Summit or Rover service tool. The Neuron ID format is 00-01-64-1C-2B-00.

Wire Characteristics

Controller communication-link wiring must be low capacitance, 18-gage, shielded, twisted pair with stranded, tinned-copper conductors. For daisy chain configurations, limit the wire run length to 5,000 ft. Truck and branch configurations are significantly shorter. LonTalk wire length limitations can be extended through the use of a link repeater.

Recommended Communication Wiring Practices

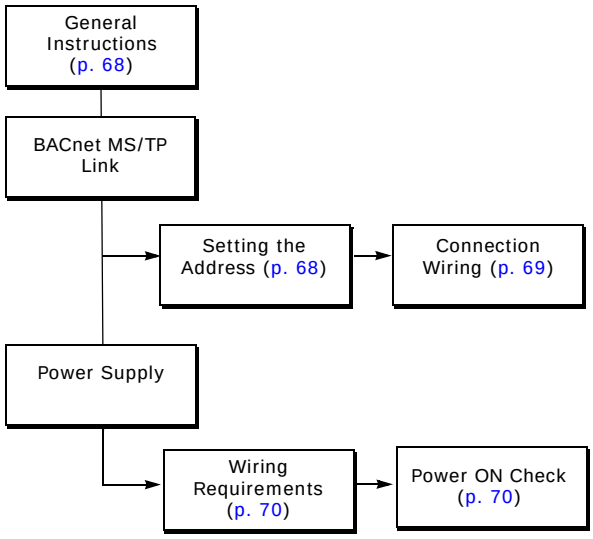
The following guidelines should be followed while installing communication wire.

- LonTalk is not polarity sensitive. Trane recommends that the installer keep polarity consistent throughout the site.
- Only strip away two inches maximum of the outer conductor of shielded cable.
- Make sure that the 24 Vac power supplies are consistent in how they are grounded. Avoid sharing 24 Vac between LonTalk UCMs.
- Avoid over-tightening cable ties and other forms of cable wraps. A tight tie or wrap could damage the wires inside the cable.
- Do not run LonTalk cable alongside or in the same conduit as 24 Vac power.
- In an open plenum, avoid lighting ballasts, especially those using 277 Vac.
- Do not use a trunk and branch configuration, if possible. Trunk and branch configurations shorten the distance cable can be run.

Wiring Installation (Tracer UC400)

This section provides information about wiring the UC400 controller. For more detailed information, refer to BAS-SVX02D-EN *(Installation, Operation, and Maintenance: Tracer UC400 Programmable Controller)*, or the most recent revision.

Wiring Overview Outline

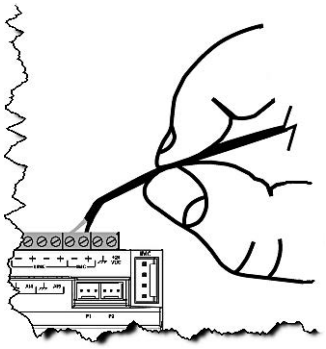


General Instructions

Conformance to Regulatory Standards

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

Connecting Wires to Terminals



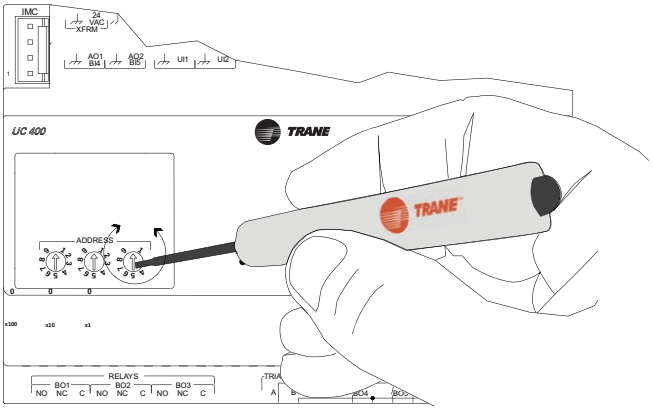
To connect wires to the UC400 controller or the expansion modules:

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

BACnet MS/TP Link

Setting the Address

The rotary address dials on the UC400 controller serve one or two purposes depending upon the network: they are always used for the MAC Address, which is sometimes all or part of the BACnet Device ID (refer to the illustration below).



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

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

Important: *Each device on the link must have a unique MAC Address/Device ID. The controller rotary addresses should be sequentially set, with no gaps in the numbering, starting with 001 on each link (for example 001, 002, 003, 004 and so on). A duplicate address or a 000 address setting will interrupt communications and cause the Tracer SC device installation process to fail.*

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

BACnet networks without a Tracer SC system controller

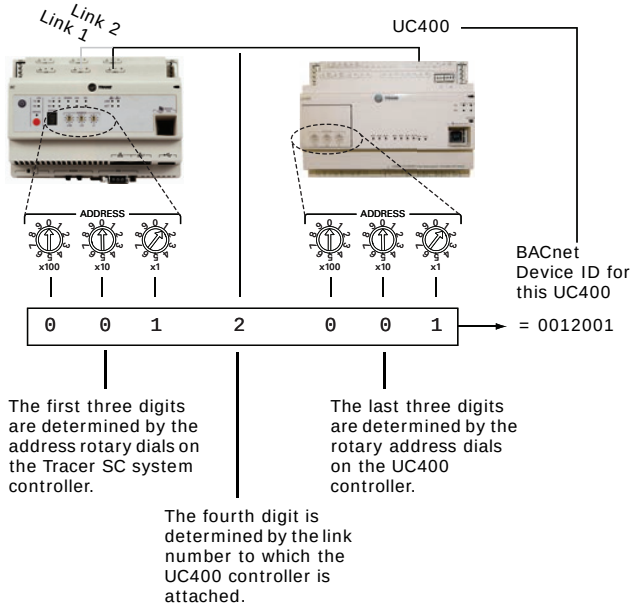
On BACnet networks without a Tracer SC system controller, the Device ID can be assigned one of two ways:

- It can be the same number as the MAC Address, determined by the rotary address dials on the UC400 controller. For example, if the rotary address dials are set to 042, both the MAC Address and the BACnet Device ID are 042.
- It can be soft set using 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 controller is always soft set by the system controller using the following scheme illustrated below.

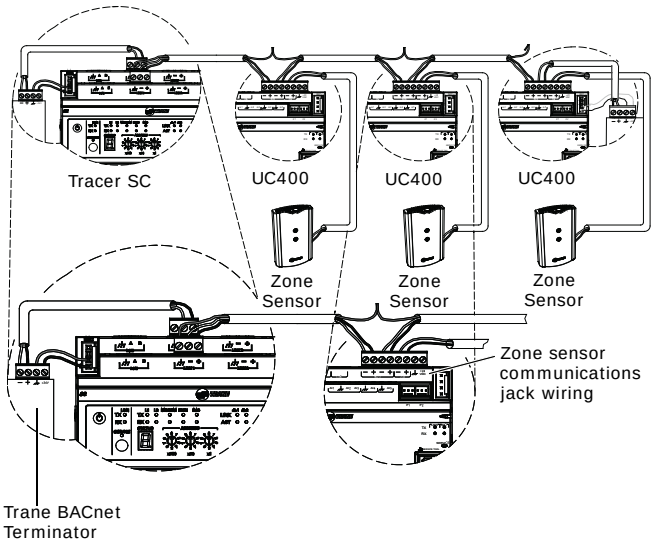
Note: *The BACnet Device ID is displayed as the Software Device ID on the Tracer TU* ***Controller Settings*** *page in the* ***Protocol*** *group.*



Connection Wiring

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. The illustration below shows an example of BACnet link wiring with multiple UC400 controllers.

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).*



Power Supply

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

⚠WARNING

Hazardous Voltage!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

⚠CAUTION

Personal Injury and Equipment Damage!

After installation, make sure to check that the 24 Vac transformer is grounded through the controller. Failure to check could result in personal injury and/or damage to equipment. Measure the voltage between chassis ground and any ground terminal on the UC400 controller. Expected result: Vac £ 4.0 V

NOTICE:

Avoid Equipment Damage!

Sharing 24 Vac power between controllers could cause equipment damage.

A separate transformer is recommended for each UC400 controller. The line input to the transformer must be equipped with a circuit breaker sized to handle the maximum transformer line current.

If a single transformer is shared by multiple UC400 controllers:

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

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

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

Transformer Recommendations

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

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

Wiring Requirements

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

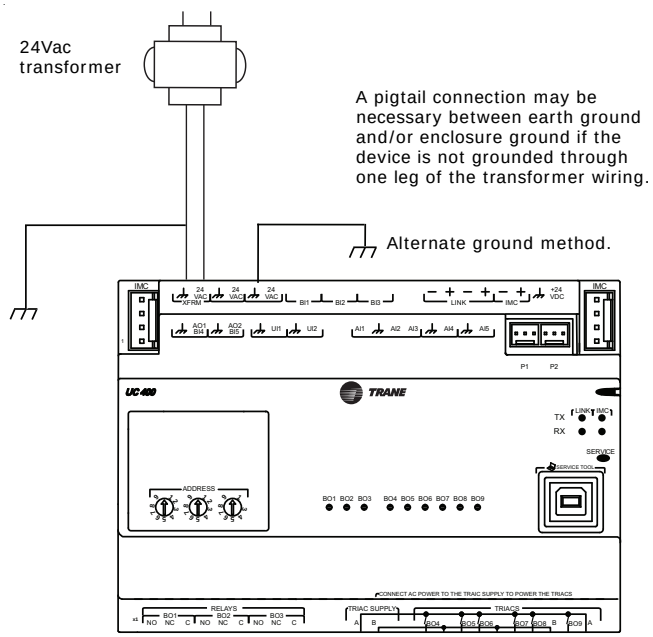
- A dedicated power circuit disconnect switch must be near the controller, easily accessible by the operator, and marked as the *disconnecting device* for the controller.
- 18 AWG (0.823 mm^2) copper wire is recommended for the circuit between the transformer and the controller.

Important: *The controller must receive AC power from a dedicated power circuit; failure to comply may cause the controller to malfunction.* DO NOT *run AC power wires in the same wire bundle with input/output wires; failure to comply may cause the controller to malfunction due to electrical noise.*

Connecting Wires

To connect the wires:

1. Disconnect power to the transformer.
2. Connect the 24Vac secondary wires from the transformer to the 24Vac and ⏚ terminals on the UC400 controller (refer to the illustration below).
3. Do one of the following to ensure the controller is adequately grounded:
   - Connect a grounding pigtail at some point along the secondary wire that runs between the controller ⏚ terminal and the transformer.
   - Ground one of the ⏚ terminals on the controller to the enclosure (if the enclosure is adequately grounded) or to an alternate earth ground.



Power ON Check

To perform a **Power ON** check:

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

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

Pre-Start

Pre-Start-up Checklist

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

- ☐ Is the high voltage power supply correct and in accordance with the nameplate ratings?
- ☐ Is the field wiring and circuit protection the correct size?
- ☐ Is the low voltage control circuit wiring correct per the unit wiring diagram?
- ☐ Is the piping system clean/complete and correct?
- ☐ Is unit serviceable? (See "Dimensions and Weights," p. 11.)
- ☐ Are all the unit access panels secure and in place?
- ☐ Is the water flow established and circulating through all the units?
- ☐ Is the condensate line properly sized, run, trapped and pitched?
- ☐ Does the indoor blower turn freely without rubbing?
- ☐ Has all work been done in accordance with applicable local and national codes?
- ☐ Has heat transfer fluid been added in the proper mix to prevent freezing if required?

Startup

Tracer ZN520 Unit Startup

Refer to the most recent version of Trane publication CNT-SVX04A-EN *(Tracer ZN520 Unit Controller: Installation, Operation and Programming Guide)*. The factory pre-programs the ZN520 with default values to control the temperature and unit airflow. Use Tracer Summit building automation system or Rover™ software to change the default values.

Follow the procedure below to operate the ZN520 in a stand-alone operation:

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

The appropriate control valve will actuate assuming the following conditions:

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

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

Tracer UC400 Unit Startup

Refer to the most recent version of Trane publication BAS-SVX48B-EN *(Installation, Operation, and Programming: Tracer UC400 Programmable Controller)* for Tracer UC400 unit ventilator. The factory pre-programs the Tracer UC400 unit ventilator with default values to control the temperature and unit airflow. Use Tracer SC building automation system or Tracer TU software to change the default values.

Follow the procedure below to operate the Tracer UC400 in a stand-alone operation:

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

The appropriate control valve will actuate assuming the following conditions:

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

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

General Information

Manual Fan Speed Switch

The manual fan mode switch is available with a four-position switch (off-hi-med-lo) allows manual fan mode selection and is available unit- or wall-mounted. See Figure 59.

Figure 59. Fan speed switch

The fan speed switch can be used to provide simultaneous fan speed customer requests in addition to external controller fan speed request. The wall-mounted option is low-voltage and has three 24-volt relays using a factory-wired transformer and relays to control the fan motor.

Fan Mode Switch Operation

Off

Fan is turned off, two-position damper option spring-returns closed.

Hi, Med, Lo

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

Tracer ZN520 Operation

Off

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

Auto

Fan speed control in the auto setting allows the modulating (3-wire floating point) or 2–position control valve option and three-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 at low fan speed, the water valve opens. When the low fan speed capacity switch point is reached, the fan switches to medium speed 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.

UC400 Controller Operation

Off

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

Auto

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

Low/Med/High

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

Tracer ZN520 Sequence of Operation

The Tracer ZN520 operates the fan in the following modes:

1. occupied
2. unoccupied
3. occupied standby
4. occupied bypass
5. Tracer Summit with supply fan control

Occupied (Tracer ZN520)

When the controller is in the occupied mode, the unit attempts to maintain the space temperature at the active occupied heating or cooling setpoint, based on the measured space temperature, the discharge air temperature, the active setpoint, and the proportional/integral control algorithm. The modulating control algorithm used when occupied or in occupied standby is described in the following sections. Additional information related to the handling of the controller setpoints can be found in the previous Setpoint operation section.

Unoccupied Mode (Tracer ZN520)

When the controller is in the unoccupied mode, the controller attempts to maintain the space temperature at the stored unoccupied heating or cooling setpoint, based on the measured space temperature, the active setpoint and the control algorithm, regardless of the presence of a hard-wired or communicated setpoint. Similar to other configuration properties of the controller, the locally stored unoccupied setpoints can be modified using Rover service tool.

In unoccupied mode, a simplified zone control algorithm is run. During the cooling mode, when the space temperature is above the cool setpoint, the primary cooling capacity operates at 100 percent. If more capacity is needed, the supplementary cooling capacity turns on (or opens to 100 percent). During the heating mode, when the space temperature is below the heat setpoint, the primary heating capacity turns on. All capacity is turned off when the space temperature is between the unoccupied cooling and heating setpoints. Note that primary heating or cooling capacity is defined by unit type and whether heating or cooling is enabled or disabled. For example, if the economizer is enabled and possible, it will be the primary cooling capacity. If hydronic heating is possible, it will be the primary heating capacity.

Occupied Standby Mode (Tracer ZN520)

The controller can be placed into the occupied standby mode when a communicated occupancy request is combined with the local (hard-wired) occupancy binary input signal. When the communicated occupancy request is unoccupied, the occupancy binary input (if present)

does not affect the controller's occupancy. When the communicated occupancy request is occupied, the controller uses the local occupancy binary input to switch between the occupied and occupied standby modes.

During occupied standby mode, the controller's economizer damper position goes to the economizer standby minimum position. The economizer standby minimum position can be changed using Rover service tool.

In the occupied standby mode, the controller uses the occupied standby cooling and heating setpoints. Because the occupied standby setpoints typically cover a wider range than the occupied setpoints, the Tracer ZN520 controller reduces the demand for heating and cooling the space. Also, the outdoor air economizer damper uses the economizer standby minimum position to reduce the heating and cooling demands.

When no occupancy request is communicated, the occupancy binary input switches the controller's operating mode between occupied and unoccupied. When no communicated occupancy request exists, the unit cannot switch to occupied standby mode.

Occupied Bypass Mode (Tracer ZN520)

The controller can be placed in occupied bypass mode by either communicating an occupancy request of Bypass to the controller or by using the timed override On button on the Trane zone sensor.

When the controller is in unoccupied mode, you can press the On button on the zone sensor to place the controller into occupied bypass mode for the duration of the bypass time (typically 120 minutes).

Occupancy Sources (Tracer ZN520)

There are four ways to control the controller's occupancy:

- Communicated request (usually provided by the building automation system or peer device)
- By pressing the zone sensor's timed override On button
- Occupancy binary input
- Default operation of the controller (occupied mode)

A communicated request from a building automation system or another peer controller can change the controller's occupancy. However, if communication is lost, the controller reverts to the default operating mode (occupied) after 15 minutes (configurable, specified by the "receive heartbeat time"), if no local hard-wired occupancy signal exists.

A communicated request can be provided to control the occupancy of the controller. Typically, the occupancy of the controller is determined by using time-of-day scheduling of the building automation system. The result of the time-of-day schedule can then be communicated to the unit controller.

Tracer Summit with Supply Fan Control (Tracer ZN520)

If the unit is communicating with Tracer Summit and the supply fan control programming point is configured for Tracer (the factory configures as local), Tracer Summit will control the fan regardless of the fan mode switch position.

When the fan mode switch is set to Off or when power is restored to the unit, all Tracer ZN520 lockouts (latching diagnostics) are manually reset. The last diagnostic to occur is retained until the unit power is disconnected. Refer to Trane publication, CNT-SVX04A-EN (*Tracer ZN520 Unit Controller: Installation, Operation and Programming Guide*) for specific instructions regarding the procedure for running the Tracer ZN520.

Cooling Operation (Tracer ZN520)

The heating and cooling setpoint high and low limits are always applied to the occupied and occupied standby setpoints. During the cooling mode, the Tracer ZN520 controller attempts to maintain the space temperature at the active cooling setpoint. Based on the controller's occupancy mode, the active cooling setpoint is one of the following:

- Occupied cooling setpoint
- Occupied standby cooling setpoint
- Unoccupied cooling setpoint

The controller uses the measured space temperature, the active cooling setpoint, and discharge air temperature along with the control algorithm to determine the requested cooling capacity of the unit (0 percent–100 percent). The outputs are controlled based on the unit configuration and the required cooling capacity. To maintain space temperature control, the Tracer ZN520 cooling outputs (modulating hydronic valve, two-position hydronic valve, or outdoor air economizer damper) are controlled based on the cooling capacity output.

The cooling output is controlled based on the cooling capacity. At 0 percent capacity, all cooling capacities are off and the damper is at minimum position. Between 0 percent and 100 percent capacity, the cooling outputs are controlled according to modulating valve logic (modulating valves) or cycled on (2-position valves). As the load increases, modulating outputs open further and binary outputs are energized longer. At 100 percent capacity, the cooling valve or damper is fully open (modulating valves) or on continuously (and 2-position valves).

Unit diagnostics can affect fan operation, causing occupied and occupied standby fan operation to be defined as abnormal. Refer to "Troubleshooting (Wireless Controls)," p. 96 for more information about abnormal fan operation.

The Tracer ZN520 controller operates the supply fan continuously when the controller is in the occupied and occupied standby modes, for either heating or cooling.

The controller only cycles the fan off with heating and cooling capacity in the unoccupied mode.

The economizer is used for cooling purposes whenever the outdoor temperature is below the economizer enable setpoint and there is a need for cooling. The economizer is used first to meet the space demand, and other forms of cooling are used if the economizer cannot meet the demand alone. See modulating outdoor air damper operation for additional information.

Cascade cooling control initiates a discharge air tempering function if the discharge air temperature falls below the discharge air temperature control low limit, all cooling capacity is at minimum, and the discharge control loop determines a need to raise the discharge air temperature. The controller then provides heating capacity to raise the discharge air temperature to its low limit.

Discharge Air Tempering (Tracer ZN520)

The discharge air tempering function enables when cold outdoor air is brought in through the outdoor air damper, causing the discharge air to fall below the discharge air temperature control low limit. The controller exits the discharge air tempering function when heat capacity has been at 0 percent for five minutes.

Heating Operation (Tracer ZN520)

During heating mode, the Tracer ZN520 controller attempts to maintain the space temperature at the active heating setpoint. Based on the occupancy mode of the controller, the active heating setpoint is one of the following:

- Occupied heating
- Occupied standby heating
- Unoccupied heating

During dehumidification in the heating mode, the controller adjusts the heating setpoint up to the cooling setpoint. This reduces the relative humidity in the space with a minimum of energy usage.

The controller uses the measured space temperature, the active heating setpoint, and discharge air temperature, along with the control algorithm, to determine the requested heating capacity of the unit (0 percent–100 percent). The outputs are controlled based on the unit configuration and the required heating capacity.

Unit diagnostics can affect the Tracer ZN520 controller operation, causing unit operation to be defined as abnormal. Refer to "Diagnostics," p. 90 for more information about abnormal unit operation.

The heating output is controlled based on the heating capacity. At 0 percent capacity, the heating output is off continuously. Between 0 percent and 100 percent capacity, the heating output is controlled according to modulating valve logic (modulating valves) or cycled on (two-position valves). As the load increases, modulating outputs open further and binary outputs are energized longer. At 100 percent capacity, the heating valve is fully open (modulating valves) or on continuously (two-position valves).

The Tracer ZN520 fan output(s) normally run continuously during the occupied and occupied standby modes, but cycle between high and off speeds with heating/cooling during the unoccupied mode. When in the occupied mode or occupied standby mode and the fan speed is set at the high, medium, or low position, the fan runs continuously at the selected speed. Refer to "Diagnostics," p. 90 for more information on abnormal fan operation.

When the unit's supply fan is set to auto, the controller's configuration determines the fan speed when in the occupied mode or occupied standby mode. The fan runs continuously at the configured heating fan speed or cooling fan speed. For all fan speed selections except off, the fan cycles off during unoccupied mode.

The economizer outdoor air damper is never used as a source of heating. Instead, the economizer damper (when present) is only used for ventilation; therefore, the damper is at the occupied minimum position in the occupied mode. The damper control is primarily associated with occupied fan operation.

Fan Mode Operation (Tracer ZN520)

For multiple fan speed applications, the Tracer ZN520 controller offers additional fan configuration flexibility. Separate default fan speeds for heating and cooling modes can be configured. The fan runs continuously for requested speeds (off, high, medium, or low). When the fan mode switch is in the Auto position or a hard-wired fan mode input does not exist, the fan operates at the default configured speed. See Table 14, p. 75 for default fan configuration for heat and cool mode. During unoccupied mode, the fan cycles between high speed and off with heating and cooling fan modes. If the requested speed is off, the fan always remains off.

Table 14. Fan configuration (Tracer ZN520)

	Auto Fan Operation	Fan Speed Default
Heating	Continuous	Off
		Low
		Medium
		High
Cooling	Continuous	Off
		Low
		Medium
		High

During dehumidification, when the fan is on Auto, the fan speed can switch depending on the error. Fan speed increases as the space temperature rises above the active cooling setpoint.

Additional flexibility built into the controller allows you to enable or disable the local fan switch input. The fan mode request can be either hard-wired or communicated to the

controller. When both are present, the communicated request has priority over the hard-wired input. See Table 15, Table 16, and Table 17.

Table 15. Local fan switch enabled (Tracer ZN520)

Communicated Fan Speed Input	Fan Switch (Local)	Fan Operation
Off	Ignored	Off
Low	Ignored	Low
Medium	Ignored	Medium
High	Ignored	High
Auto	Off	
Low		
Medium		
High		
Auto	Off	
Low		
Medium		
High		
Auto (configured default, determined by heat/cool mode)		

Table 16. Fan operation in heating and cooling modes (Tracer ZN520)

	Heating		Cooling	
Fan Mode	Occ.	Unocc.	Occ.	Unocc.
Off	Off	Off	Off	Off
Low	Low	Off/high	Low	Off/high
Medium	Med	Off/high	Med	Off/high
High	High	Off/high	High	Off/high
Auto	Default fan sp.	Off/high	Default fan sp.	Off/high

Table 17. Local fan switch disabled or not present (Tracer ZN520)

Communicated Fan Speed Input	Fan Operation
Off	Off
Low	Low
Medium	Medium
High	High
Auto (or not present)	Auto (fan runs at the default speed)

Continuous Fan Operation (Tracer ZN520)

During occupied and occupied standby modes, the fan normally is on. For multiple speed fan applications, the fan normally operates at the selected or default speed (off, high, medium, or low). When fan mode is auto, the fan operates at the default fan speed.

During unoccupied mode, the controller controls the fan off. While unoccupied, the controller heats and cools to maintain the unoccupied heating and cooling setpoints. In unoccupied mode, the fan is controlled on high speed only with heating or cooling.

The unit fan is always off during occupied, occupied standby, and unoccupied modes when the unit is off due to a diagnostic or when the unit is in the off mode due to the local zone sensor module, a communicated request, or the default fan speed (off).

If both a zone sensor module and communicated request exist, the communicated request has priority.

Fan Cycling Operation (Tracer ZN520)

Tracer ZN520 does not support fan cycling in occupied mode. The fan cycles between high speed and off in the unoccupied mode only. The controller's cascade control algorithm requires continuous fan operation in the occupied mode.

Fan Off Delay (Tracer ZN520)

When a heating output is controlled off, the Tracer ZN520 controller automatically holds the fan on for an additional 30 seconds. This 30-second delay gives the fan time to blow off any residual heat from the heating source, such as a steam coil. When the unit is heating, the fan off delay is normally applied to control the fan; otherwise, the fan off delay does not apply.

Fan Start on High Speed (Tracer ZN520)

On a transition from off to any other fan speed, the Tracer ZN520 controller automatically starts the fan on high speed and runs the fan at high speed for 0.5 seconds. This provides the ample torque required to start all fan motors from the off position.

Entering Water Temperature Sampling Function (Tracer ZN520)

Only units using the main hydronic coil for both heating and cooling (2-pipe changeover and 4-pipe changeover units) use the entering water temperature sampling function. Two-pipe changeover and 4-pipe changeover applications allow the main coil to be used for heating and for cooling; therefore, these applications require an entering water temperature sensor.

When three-way valves are ordered with a Tracer ZN520 control, the controller is factory-configured to disable the entering water temperature sampling function, and the entering water sensor is mounted in the proper location. Disabling entering water temperature sampling eliminates unnecessary water flow through the main coil when three-way valves are used.

The controller invokes entering water temperature sampling only when the measured entering water temperature is too cool to heat or too warm to cool. Entering water is cold enough to cool when it is five degrees below the measured space temperature. Entering water is warm enough to heat when it is five degrees above the measured space temperature.

When the controller invokes the entering water temperature sampling function, the unit opens the main hydronic valve for no more than three minutes before considering the measured entering water temperature. An initial stabilization period is allowed to flush the coil. This period is equal to 30 seconds plus half of the valve stroke

time. Once this temperature stabilization period has expired, the controller compares the entering water temperature against the effective space temperature (either hard-wired or communicated) to determine whether the entering water can be used for the desired heating or cooling. If the water temperature is not usable for the desired mode, the controller continues to compare the entering water temperature against the effective space temperature for a maximum of three minutes.

The controller automatically disables the entering water temperature sampling and closes the main hydronic valve when the measured entering water exceeds the high entering water temperature limit (110°F). When the entering water temperature is warmer than 110°F, the controller assumes the entering water temperature is hot because it is unlikely the coil would drift to a high temperature unless the actual loop temperature was very high.

If the entering water temperature is unusable—too cool to heat or too warm to cool—the controller closes the hydronic valve and waits 60 minutes before initializing another sampling. If the controller determines the entering water temperature is valid for heating or cooling, it resumes normal heating/cooling control and effectively disables entering water temperature sampling until it is required.

Electric Heat Operation (Tracer ZN520)

The Tracer ZN520 controller supports one or two-stage electric heat operation for heating. To control the space temperature, electric heat is cycled to control the discharge air temperature. The rate of cycling is dependent upon the load in the space and the temperature of the incoming fresh air from the economizer (if any). Two-pipe changeover units with electric heat use the electric heat only when hot water is not available.

Manual Fresh Air Damper (Tracer ZN520)

Units with the manual fresh air damper option ship with the damper in the closed position, which is adjustable from zero to 100 percent in 25 percent increments. To adjust the position, first remove the air filter to expose the damper stop screw on the control panel end. Relocate the stop screw to the appropriate position. Then loosen the stop screw wingnut and adjust the linkage.

Economizer Damper Option (Tracer ZN520)

With a valid outdoor air temperature (either hard-wired or communicated), Tracer ZN520 uses the modulating economizer damper as the highest priority source of cooling. Economizer operation is only possible through the use of a modulating damper.

Economizing is possible during the occupied, occupied standby, unoccupied, and occupied bypass modes.

The controller initiates the economizer function if the outdoor air temperature is cold enough to be used as free cooling capacity. If the outdoor air temperature is less than the economizer enable setpoint (absolute dry bulb), the controller modulates the outdoor air damper (between the active minimum damper position and 100 percent) to control the amount of outdoor air cooling capacity. When the outdoor air temperature rises 5°F above the economizer enable point, the controller disables economizing and moves the outdoor air damper back to its predetermined minimum position based on the current occupancy mode or communicated minimum damper position.

Table 18. Relationship between outdoor temperature sensors and damper position (Tracer ZN520)

Outdoor Air Temp.	Modulating Outdoor Air Damper		
	Occupied or Occupied Bypass	Occupied Standby	Unoccupied
None or invalid	Open to occupied minimum position	Open to occupied standby minimum position	Closed
Failed	Open to occupied minimum position	Open to occupied standby minimum position	Closed
Present and economizing feasible	Economizing minimum postion to 100%	Economizing between occupied standby minimum position to 100%	Open & economizing when unit is operating, closed
Present & economizing not feasible	Open to occupied minimum position	Open to occupied standby minimum position	Closed

Dehumidification (Tracer ZN520)

Dehumidification is possible when mechanical cooling is available, the heating capacity is located in the reheat position, and the space relative humidity setpoint is valid.The controller starts dehumidifying 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.The controller uses the cooling and reheat capacities simultaneously to dehumidify the space. While dehumidifying, the discharge air temperature is controlled to maintain the space temperature at the current setpoint.

A typical scenario involves high humidity and high temperature load of the space.The controller sets the cooling capacity to 100 percent and uses the reheat capacity to warm the discharge air to maintain space temperature control. Dehumidification may be disabled via Tracer or configuration.

Note: *If the unit is in the unoccupied mode, the dehumidification routine will not operate.*

Data Sharing (Tracer ZN520)

Because this controller utilizes LonWorks® technology, the controller can send or receive data (setpoint, heat/cool mode, fan request, space temperature, etc.) to and from other controllers on the communication link, with or

without the existence of a building automation system. This applies to applications where multiple unit controllers share a single space temperature sensor (for rooms with multiple units but only one zone sensor) for both standalone (with communication wiring between units) and building automation system applications. For this application you will need to use the Rover service tool. For more information on setup, refer to the Trane publication EMTX-SVX01G-EN *(Rover Service Tool: Installation, Operation, and Programming Guide)*, or the most recent version.

Binary Inputs (Tracer ZN520)

The Tracer ZN520 controller has four available binary inputs (see Table 19). Normally, these inputs are factory-configured for the following functions:

- Binary input 1: Low temperature detection (freezestat)
- Binary input 2: Condensate overflow
- Binary input 3: Occupancy/ Generic
- Binary input 4: Fan status

Note: *The generic binary input can be used with a Tracer Summit™ building automation system only.*

Each binary input default configuration (including normally open/closed) is set at the factory. However, you can configure each of the four binary inputs as normally open or normally closed. The controller will be set properly for each factory-supplied binary input end-device. When no device is connected to the input, configure the controller's input as not used.

Table 19. Binary input configurations (Tracer ZN520)

Binary Input	Description	Configuration	Controller Operation	
			Contact Closed	Contact Open
BI 1	Low temperature detection[a]	Normally closed	Normal	Diagnostic[b]
BI 2	Condensate overflow[a]	Normally closed	Normal	Diagnostic[b]
BI 3	Occupancy	Normally open	Unoccupied	Occupied
BI 3	Generic binary input	Normally open	Normal[c]	Normal[c]
BI 4	Fan status[a]	Normally open	Normal	Diagnostic[d]

Note: The occupancy binary input is for standalone unit controllers as an occupied/unoccupied input. However, when the controller receives a communicated occupied/unoccupied request, the communicated request has priority over the hard-wired input.

(a) During low temperature, condensate overflow, and fan status diagnostics, the Tracer ZN520 control disables all normal unit operation of the fan, valves, and damper.
(b) Table 20 shows the controller's response to low temperature detection, condensate overflow, and fan status diagnostics.
(c) The generic binary input does not affect unit operation. A building automation system reads this input as a generic binary input.
(d) If the fan mode input is in the off position or the controller is in the unoccupied mode with the fan off, the fan status input will be open. A diagnostic will not be generated when the controller commands the fan off. A diagnostic will only be generated if the fan status input does not close after one minute from energizing a fan output or any time the input is open for one minute. The controller waits up to one minute after energizing a fan output to allow the differential pressure to build up across the fan.

Binary Outputs (Tracer ZN520)

Binary outputs are configured to support the following:

- Three fan stages (when one or two fan stages are present, medium fan speed can be configured as exhaust fan)
- One hydronic cooling stage
- One hydronic heating stage (dehumidification requires this to be in the reheat position)
- One DX cooling stage
- One or two-stage electric heat (dehumidification requires this to be in the reheat position)
- Face and bypass damper
- Modulating outdoor air damper
- One baseboard heat stage

For more information, see Table 20.

Table 20. Binary output configuration (Tracer ZN520)

Binary Output	Configuration
J1-1	Fan high
J1-2	Fan medium
J1-3	Fan low
J1-4	(Key)
J1-5	Cool valve—open, or 2-position valve[a]
J1-6	Cool valve—close Note 1
J1-9	Heat valve—open, or 2 position valve, or 1st electric heat stage[a]
J1-10	Heat valve—close or 2nd Electric heat stage[a]
J1-11	Fresh air damper—open
J1-12	Fresh air damper—close
TB4-1	Generic/baseboard heat output
TB4-2	24 Vac

(a) For Tracer ZN520 units configured and applied as 2-pipe hydronic heat/cool changeover, terminals J1-5 and J1-6 are used to control the primary valve for both heating and cooling. For Tracer ZN520 units configured and applied as 2-pipe hydronic heat/cool changeover with electric heat, terminals J1-5 and J1-6 are used to control the primary valve (for both cooling and heating), and terminals J1-9 and J1-10 are used only for the electric heat stage. For those 2-pipe changeover units, electric heat will not be energized while the hydronic supply is hot (5° or more above the space temperature).

Table 21. Analog inputs (Tracer ZN520)

Description	Terminals	Function	Range
Zone	TB3-1	Space temperature input	5°F to 122°F
Ground	TB3-2	Analog ground	NA
Set	TB3-3	Setpoint input	40°F to 115°F
Fan	B3-4	Fan switch input	4821 to 4919 W (off)
			2297 to 2342 W (auto)
			10593 to 10807 W (low)
			13177 to 13443 W (medium)
			15137 to 16463 W (high)
Ground	TB3-6	Analog ground	NA
Analog input 1	J3-1	Entering water temperature	-40°F to 212°F
	J3-2	Analog ground	NA
Analog input 2	J3-3	Discharge air temperature	-40°F to 212°F
	J3-4	Analog ground	NA
Analog input 3	J3-5	Fresh air temp/generic temp	-40°F to 212°F
	J3-6	Analog ground	NA
Analog input 4	J3-7	Universal input	0% to 100%
		Generic 4–20mA	0% to 100%
		Humidity	0 to 2000 ppm
		CO_2	
	J3-8	Analog ground	NA
Ground	J3-9	Analog ground	NA

Notes:
1. The zone sensor, entering water temperature sensor, discharge air sensor, and the outside air temperature sensor are 10KΩ thermistors.
2. Zone sensor: Wall-mounted sensors include a thermistor soldered to the sensor's circuit board. Unit mounted sensors include a return air sensor in the units return air stream.
3. Changeover units include an entering water temperature sensor.

Zone Sensor (Tracer ZN520)

The Tracer ZN520 controller accepts the following zone sensor module inputs:

- Space temperature measurement (10kΩ thermistor)
- Local setpoint (either internal or external on the zone sensor module)
- Fan switch
- Timed override (On) and Cancel timed override
- Communication jack

Space Temperature Measurement (Tracer ZN520)

Trane zone sensors use a 10kΩ thermistor to measure the space temperature. Typically, zone sensors are wall-mounted in the room and include a space temperature thermistor. As an option, the zone sensor can be unit-mounted with a separate space temperature thermistor located in the unit's return air stream. If both a hard-wired and communicated space temperature value exist, the controller ignores the hard-wired space temperature input and uses the communicated value.

External Setpoint Adjustment (Tracer ZN520)

Zone sensors with an external setpoint adjustment (1kΩ) provide the Tracer ZN520 controller with a local setpoint (50°F to 85°F or 10°C to 29.4°C). The external setpoint is exposed on the zone sensor's front cover.

When the hard-wired setpoint adjustment is used to determine the setpoints, all unit setpoints are calculated based on the hard-wired setpoint value, the configured setpoints, and the active mode of the controller. The hard-wired setpoint is used with the controller's occupancy mode (occupied, occupied standby, or unoccupied), the heating or cooling mode, the temperature deadband values, and the heating and cooling setpoints (high and low limits) to determine the controller's active setpoint.

When a building automation system or other controller communicates a setpoint to the controller, the controller ignores the hard-wired setpoint input and uses the communicated value. The exception is the unoccupied mode, when the controller always uses the stored default unoccupied setpoints. After the controller completes all setpoint calculations, based on the requested setpoint, the occupancy mode, the heating and cooling mode, and other factors, the calculated setpoint is validated against the following setpoint limits:

- Heating setpoint high limit
- Heating setpoint low limit
- Cooling setpoint high limit
- Cooling setpoint low limit

These setpoint limits only apply to the occupied and occupied standby heating and cooling setpoints. These setpoint limits do not apply to the unoccupied heating and cooling setpoints stored in the controller's configuration.

When the controller is in unoccupied mode, it always uses the stored unoccupied heating and cooling setpoints.The unit can also be configured to enable or disable the local (hard-wired) setpoint. This parameter provides additional flexibility to allow you to apply communicated, hard-wired, or default setpoints without making physical changes to the unit.

Similar to hard-wired setpoints, the effective setpoint value for a communicated setpoint is determined based on the stored default setpoints (which determines the occupied and occupied standby temperature deadbands) and the controller's occupancy mode.

Fan Switch (Tracer ZN520)

The zone sensor fan switch provides the controller with an occupied (and occupied standby) fan request signal (Off, Low, Medium, High, Auto). If the fan control request is communicated to the controller, the controller ignores the hard-wired fan switch input and uses the communicated value. The zone sensor fan switch input can be enabled or

disabled through configuration using the Rover service tool. If the zone sensor switch is disabled, the controller resorts to its stored configuration default fan speeds for heating and cooling, unless the controller receives a communicated fan input.

When the fan switch is in the off position, the controller does not control any unit capacity. The unit remains powered and all outputs drive to the closed position. Upon a loss of signal on the fan speed input, the controller reports a diagnostic and reverts to using the default fan speed.

On/Cancel Buttons (Tracer ZN520)

Momentarily pressing the on button during unoccupied mode places the controller in occupied bypass mode for 120 minutes. You can adjust the number of minutes in the unit controller configuration using Rover service tool. The controller remains in occupied bypass mode until the override time expires or until you press the Cancel button.

Communication Jack (Tracer ZN520)

Use the RJ-11 communication as the connection point from Rover service tool to the communication link—when the communication jack is wired to the communication link at the controller. By accessing the communication jack via Rover, you can access any controller on the link.

Communications (Tracer ZN520)

Tracer ZN520 controller communicates via Trane's LonTalk protocol. Typically, a communication link is applied between unit controllers and a building automation system. Communication also is possible via Rover, Trane's service tool. Peer-to-peer communication across controllers is possible even when a building automation system is not present. You do not need to observe polarity for LonTalk communication links.

The controller provides six 0.25-inch quick-connect terminals for the LonTalk communication link connections, as follows:

- Two terminals for communication to the board
- Two terminals for communication from the board to the next unit (daisy chain)
- Two terminals for a connection from the zone sensor back to the controller

Table 22. Zone sensor wiring connections (Tracer ZN520)

TB1	Description
1	Space temperature / timed override detection
2	Common
3	Setpoint
4	Fan mode
5	Communications
6	Communications

UC400 Sequence of Operation

The UC400 controller will operate to maintain the space temperature setpoint. This section provides information about sequence of operations.

Power-up Sequence (UC400)

When 24Vac power is initially applied to the UC400 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 (UC400)").
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 UC400 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 (UC400)

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 (UC400)

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 (UC400)," p. 81).
- 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 UC400 controller has the following occupancy modes:

- Occupied
- Unoccupied
- Occupied standby
- Occupied bypass

Occupied Mode (UC400)

In Occupied Mode, the UC400 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 (UC400)

In unoccupied mode, the UC400 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 (UC400)

The UC400 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 (UC400)

The UC400 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 (UC400)

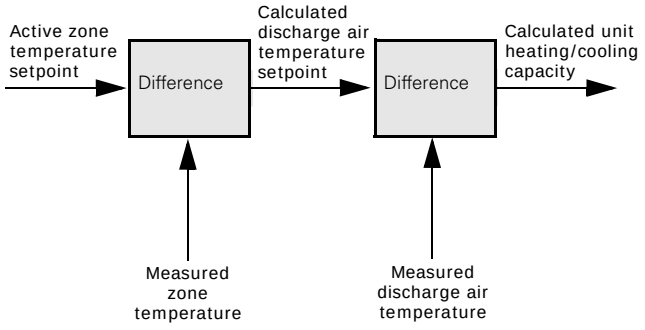
If the UC400 controller has a timed override option (**ON/CANCEL** buttons), pushing the **ON** button initiates a timed override on request. A timed override on request changes the occupancy mode from unoccupied mode to occupied bypass mode. In occupied bypass mode, the controller controls the space temperature based on the occupied heating or cooling setpoints. The occupied bypass time, which resides in the UC400 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 (UC400)

The UC400 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).



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 (UC400)."").

- **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 (UC400)

If the UC400 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 (UC400)

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 UC400 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 following section, "Entering Water Temperature Sampling Function (UC400)".)

Entering Water Temperature Sampling Function (UC400)

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 UC400 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 (UC400)

The UC400 controller supports 1-, 2-, 3-speed fans and variable-speed fans. The fan always operates continuously while either heating or cooling during occupied, occupied standby, and occupied bypass operation. During unoccupied operation, the fan cycles between **OFF** and **HIGH**, regardless of the fan configuration. When running in **AUTO** mode, the fan operates differently based on the mode and the type of fan.

For 1-, 2-, and 3-speed fans, each time the fan is enabled, the fan begins operation and runs on high speed for a period of time (0.5 seconds for fan coils and 3 seconds for

unit ventilators and blower coils) before changing to another speed. Initially running on high speed provides adequate torque to start the fan motor from the **OFF** position.

Note: *In occupied mode, the UC400 controller requires continuous fan operation because of cascade zone control. In unoccupied mode, the fan cycles.*

Manual Fan Speed Control (UC400)

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 (UC400)

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 (UC400)

When the controller is configured for *Energy Efficient Mode,* by means of the *Fan Operating Mode Request MV* point, the controller and daughter board will minimize energy use by running the fan at the lowest possible speed while maintaining space temperature. The controller will fully utilize valves, economizer, or electric heat which increases fan speed to meet space temperature (unless the fan has been manually controlled. Refer to the preceding section, "Manual Fan Speed Control (UC400)").

AUTO Fan Operation; ECM Acoustical Mode (UC400)

When the controller is configured for *Acoustical Mode*, by means of the *Fan Operating Mode Request MV* point, the controller and daughter board will minimize acoustical nuisance by balancing changes in fan speed and total fan noise. The controller will fully **OPEN** cooling and heating valves before increasing fan speed to meet space temperature (unless the fan has been manually controlled. Refer to the preceding section, "Manual Fan Speed Control (UC400)"). If multiple stages of electric heat exist the controller will use a single minimum air flow for each stage.

Exhaust Control (UC400)

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 (UC400)

The UC400 controller supports one or two modulating or two-position valves, depending on the application (refer Table 23, p. 84). 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. 81).

Modulating Valve Operation (UC400)

The UC400 controller supports tri-state modulating valve control. Two binary outputs control each valve: one to drive the valve open and one to drive the valve closed. The stroke time for each valve is configurable using the Tracer TU service tool. The controller supports the following:

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

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

Modulating Valve Calibration (UC400)

Modulating valve calibration is automatic. During normal controller operation, the UC400 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 (UC400)

The UC400 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.

Modulating Outdoor/Return Air Damper (UC400)

The UC400 controller operates the modulating outdoor/return air dampers based on the following:

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

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

A BAS-communicated minimum position setpoint has priority over all locally configured setpoints. When a communicated minimum position setpoint is not present, the controller uses the configured minimum position for low fan speed whenever the fan is running at low speed, regardless of the occupancy state. Refer to Table 23 and Table 24 for more information about how the controller determines the position of the modulating outdoor air damper.

Table 23. Modulating outdoor air damper position setpoint determination (UC400)

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

Table 24. Relationship between outdoor temperature sensors and damper position (UC400)

	Modulating outdoor air damper position		
Outdoor Air Temperature	Occupied or Occupied Bypass	Occupied Standby	Unoccupied
No or invalid outdoor air temperature.	Open to occupied minimum position.	Open to occupied standby minimum position.	Closed.
Failed outdoor air sensor.	Open to occupied minimum position.	Open to occupied standby minimum position.	Closed.
Outdoor air temperature present and economizing possible (Refer to section, "Economizing (Free Cooling) (UC400)," p. 84).	Economizing; damper controlled between occupied minimum position and 100%.	Economizing; damper controlled between occupied standby minimum position and 100%.	Open and economizing during unit operation; otherwise closed.
Outdoor air temperature present and economizing not possible (Refer to section, "Economizing (Free Cooling) (UC400)," p. 84).	Open to occupied minimum position.	Open to occupied standby minimum position.	Closed.

Economizing (Free Cooling) (UC400)

Cooling with outdoor air (during the times when the temperature is low enough to allow) is referred to as economizing (free cooling). The UC400 controller and applications with modulating outside air damper, support

economizing. The modulating outdoor air damper provides the first source of cooling for the controller.

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

Two-position Control Of A Modulating Outdoor Air Damper (UC400)

The UC400 controller supports two-position outdoor air damper actuators. However, a modulating outdoor/return air damper actuator can be used for two-position control. Two-position control can be achieved by not providing an outdoor air temperature (neither hard wired nor communicated) to the controller, and by setting the damper minimum position (using the Tracer TU service tool) to the desired value, typically 100 percent.

Electric Heat Operation (UC400)

The UC400 controller supports both SCR (modulating) and staged electric heat (1- or 2-stages). SCR heat is *only* a field-installed option. In a unit configured with staged electric heat, the electric heating circuit(s) are cycled **ON** and **OFF** appropriately to maintain the desired space temperature at the active heating setpoint. In a unit configured with SCR (modulating) electric heat, the UC400 will send a 0 to 10 Volt DC signal to adjust SCR capacity in order to maintain the desired space temperature.

In both staged and modulating electric heat applications, the simultaneous use of electric and hydronic heat is not supported and the UC400 will operate electric heat *only* when hot water *is not* available (for example, in a changeover unit). In addition, the UC400 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 (UC400)

The UC400 controller supports space dehumidification when:

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

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

Peer-to-peer Communication (UC400)

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 (UC400)

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

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

Smart Reset (UC400)

The UC400 controller will automatically restart a unit that is locked out as a result of a **Low Coil Temp Detection** (BI3) diagnostic. Referred to as *smart reset*, this automatic restart will occur 30 minutes after the diagnostic occurs. If the unit is successfully restarted, the diagnostic is cleared. If the unit undergoes another **Low Coil Temp Detection** diagnostic within a 24-hour period, the unit will be locked out until it is manually reset.

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

Low Coil Temperature Protection (UC400)

For more information refer to BAS-SVX48B-EN *(Installation, Operation, and Programming: Tracer UC400 Programmable Controller)*, or the most recent revision, and the preceding section, "Smart Reset (UC400)".

Condensate Overflow (UC400)

For more information refer to BAS-SVX48B-EN *(Installation, Operation, and Programming: Tracer UC400 Programmable Controller)*, or the most recent revision.

Fan Status (UC400)

In 1-, 2- and 3-speed fans, the status is based on the statuses of the supply fan output multistate and analog points dedicated to fan control. The fan status is reported as **HIGH**, **MEDIUM**, **LOW**, and as a percentage, whenever

the fan is running. The fan status is reported as **OFF** whenever the fan is not running. In addition, a fan status switch can be connected to binary input 5 (BI5) to monitor the status of the fan for belt-driven or direct-driven units (except Trane Macon factory ECM fan motor units). The fan status switch provides feedback to the controller as follows:

- If the fan is not operating when the controller has the fan controlled to **ON**, the controller generates a *Low Airflow-Supply Fan Failure* diagnostic.
- If the UC400 controller energizes the fan output for 1 minute, and the fan status switch indicates no fan operation, the controller performs a unit shutdown and generates a *Low Airflow-Supply Fan Failure* diagnostic.
- If the fan has been operating normally for one minute, but the fan status switch indicates no fan operation, the same diagnostic is generated.

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

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

Fan Off Delay (UC400)

After heating has been controlled **OFF**, the UC400 controller keeps the fan energized for an additional 30 seconds in order to remove residual heat from the heating source.

Filter Maintenance Timer (UC400)

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 UC400 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 (UC400)

Freeze avoidance is used for low ambient temperature protection. It is initiated *only* when the fan is **OFF**. The UC400 controller enters the freeze avoidance mode when the outdoor air temperature is below the freeze avoidance setpoint (configurable using the Tracer TU service tool). The controller disables freeze avoidance when the outdoor air temperature rises 3°F (1.7°C) above the freeze avoidance setpoint.

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

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

Freeze Protection (Discharge Air Temperature Low Limit) (UC400)

The UC400 controller monitors the discharge air temperature with a 10 kΩ thermistor wired to AI4. The freeze protection operation is initiated whenever the discharge air temperature falls below the discharge air temperature low limit. The discharge air temperature low limit is configurable using the Tracer TU service tool. During freeze protection, the controller increases the heating capacity or decreases the cooling capacity in order to raise the discharge air temperature above the low limit. If the discharge air temperature remains below the low limit for 3 minutes, the controller generates a **Discharge Air Temp Limit** diagnostic.

Freeze protection will also perform a smart reset. Refer to *"Smart Reset (UC400)," p. 85*.

Maintenance

⚠WARNING

Hazardous Service Procedures!

The maintenance and troubleshooting procedures recommended in this section of the manual could result in exposure to electrical, mechanical or other potential safety hazards. Always refer to the safety warnings provided throughout this manual concerning these procedures. When possible, disconnect all electrical power including remote disconnects 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. Failure to follow all of the recommended safety warnings provided, could result in death or serious injury.

Service Access

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

1. Remove the end pocket front panel.
2. Remove the return air grille by releasing the mounting screws.
3. If there is no shelving or other obstructions, removing the end panel may allow more access.

Periodic Maintenance

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

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

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

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

Filter Replacement. The air filter on the vertical unit is located near the bottom of the unit. Filter sizing may be found in Table 5, p. 11.

1. To remove the filters, take-off the air section's front panel.
2. Slide the filter out of the filter rack on the bottom of the unit.
3. Replace old filter with new filter and re-attach front panel.

NOTICE:

Equipment Damage!

Do not operate unit without filters or grilles in place. Failure to do so may cause equipment failure.

Cleaning of the Drain Pan. The unit ventilators drain pan is removable for periodic cleaning or easy access for maintenance/drainage issues. Use Figure 60 and Figure 61, p. 88, and the following steps for removing the drain pan.

⚠WARNING

Hazardous Voltage!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

1. Turn off power to the unit and remove the front panel.
2. Disconnect the condensate drain line from the P-trap.
3. Disconnect fan plug.
4. Remove (4) pan clips located at each end of the pan's front.
5. Disconnect the fan board ground wire and slide out fan board (see Figure 60).
6. Remove drain pan for cleaning (see Figure 61, p. 88).
7. When reinstalling, reverse sequence.

Figure 60. Slide out fan board

Figure 61. Removal of drain pan

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

⚠WARNING

Hazardous Voltage!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/ tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

1. Turn off power to the unit and remove the front panel.
2. Disconnect P-trap from drain pan.
3. Disconnect motor plug.
4. Slide fan board by pulling deck forward (see Figure 62).

NOTICE:

Equipment Damage!

Support the fanboard to prevent the deck from sliding too far forward and falling out of the unit. Failure to do so could cause equipment damage.

5. When reinstalling, use the same steps in reverse order.

Motor . The fan motor is a permanent split capacitor type motor with voltage specific power. See electrical performance and Table 25 for motor voltage.

Table 25. Motor voltage

Unit voltage	Motor voltage
115-60-1	115-60-1
208-60-1	208/230-60-1
230-60-1	208/230-60-1
208-60-3	208/230-60-1
460-60-3	277-60-1
277-60-1	277-60-1
230-60-3	208/230-60-1

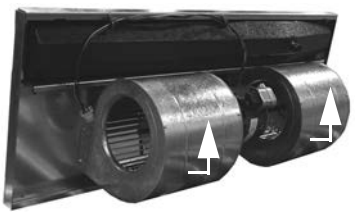
If a replacement motor is required, it should be ordered from The Trane Company. To replace the fan motor, complete the following steps:

6. Complete steps for removal of fan board (see "Cleaning of the Drain Pan," p. 87).
7. Disconnect the fan board ground wire.
8. Using a 7/16-in. Allen wrench, loosen the coupling on the fan shaft.
9. Loosen the screw on the motor clamp until it allow the motor to be lifted off the base (see Figure 63).
10. Lift the motor and pull forward until fan shaft separates from the motor (see Figure 64).
11. Attach new motor to fan shaft and reverse steps to complete installation.

Figure 62. Fan board removal for fan / motor access

Figure 63. Loosen screws

Figure 64. Lift / pull motor forward



Modulating Valves. The valve should be serviced by a trained, experienced technician. For detailed piping installation steps, see "Installation—Piping," p. 24; for modulating valve removal steps, see "Modulating Water Valves (Option)," p. 25.

For general servicing or malfunction, follow one of the appropriate steps:

⚠WARNING

Hazardous Voltage!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

⚠CAUTION

Hot Water!

The modulating valves may contain hot water. If the valve is leaking, drain system OR isolate valve from the system. DO NOT remove valve body from plumbing as hot water could come out which could result in minor to moderate burns.

NOTICE:

Structural Damage!

If the valve is leaking, drain system OR isolate valve from the system. DO NOT remove valve body from plumbing. If the system contains water, structural damage could result.

1. If the valve is leaking, drain system OR isolate valve from the system. DO NOT remove valve body from plumbing.
2. Ensure the cartridge needs to be replaced. If so, follow appropriate steps explained for cartridge assembly removal.
3. If the motor or other internal parts of the actuator is damaged, replace the entire actuator assembly.

Note: *These hydronic valves are designed and tested for silent operation. However, water noise may occur as a result of high water velocity. Piping noises may also occur in high temperature (over 212°F) systems with insufficient water pressure.*

Note: *Do not use petroleum-based or mineral oil type boiler additives. Compounds with a 50 percent water dilution that can be used are diethylene glycol, etheylene glycol and propylene glycol.*

Coil Cleaning. Periodically the hydronic coils should be cleaned from dirt accumulation that could reduce the unit performance. To clean the equipment coil:

1. Remove the unit's front panel.
2. Remove the unit's front nosing.
3. Removed the coil's solid steel front cover.
4. Vacuum the dust/particles from the coil face.
5. Reverse order for re-installation.

Preventive Maintenance

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

- Inspect the filters monthly. Follow the instructions for "Filter Replacement," p. 87.
- Inspect and clean the drain pan every three months.
- Check the coils for "dirt" accumulation every three to six months. *Clean the coils at least once each year.*

Inspect the unit ventilator insulation every three months; thoroughly clean as needed.

Diagnostics

Troubleshooting Checklist

⚠WARNING

Hazardous Service Procedures!

The maintenance and trouble shooting procedures recommended in this section of the manual could result in exposure to electrical, mechanical or other potential safety hazards. Always refer to the safety warnings provided throughout this manual concerning these procedures. When possible, disconnect all electrical power including remote disconnects 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 per these tasks. Failure to follow all of the recommended safety warnings provided, could result in death or serious injury.

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

Problem	Heating	Cooling	Cause	Correction
Room too warm (outside air temperature is below 35°F)	X		Main power off.	Check fuses.
	X		Room sensor is not properly set.	Reset room sensor temperature.
	X		Room sensor is providing a false reading due to walls being cold from the night temperature setting.	Start the warm-up cycle earlier in the morning to provide appropriate time-frame to increase room temperature prior to space occupation.
	X		Sensor is mounted on a block wall that is leaking cold air into the room through the mounting holes.	Relocate sensor.
	X		Face and bypass damper, or coil valve is malfunctioning.	Replace malfunctioning component, or contact the control's contractor, or if Trane controls, see CNT-SVX04A-EN for more information concerning Tracer controls.
Room too warm (outside air temperature is above 35°F)	X		Room sensor is not properly set.	Reset room sensor temperature.
	X		Face and bypass damper or coil control valve is malfunctioning.	Replace malfunctioning component, or contact the control's contractor, or if Trane controls, see CNT-SVX04A-EN for more information concerning Tracer controls.
	X		OA damper is in the closed position.	Ensure OA damper is in the open position.
	X		Clogged filter.	Replace filter.
Room too warm (outside air temperature is above 35°F) Unit utilizes Wall Fin auxiliary radiation:	X		Control valve is malfunctioning.	Check flow of hot water through the control valve.
	X		Boiler.	Check the boiler reset schedule to determine if the loop temperature can be decreased.
	X		Steam.	Check the operation of the control valves.
	X		Outside air temperature is above 60°F to 65°F.	The economics of the unit ventilator selection dictate that, in most cases, the unit will be sized to provide adequate natural (ventilation) cooling without outside temperatures up to 60°F to 65°F. Above this point, a changeover should be made to the mechanical cooling cycle.

Problem	Heating	Cooling	Cause	Correction
Room too cool		X	Room sensor is not properly set.	Reset room sensor temperature.
		X	Clogged filter.	Replace filter.
		X	Face and bypass damper, or coil valve is malfunctioning.	Replace malfunctioning component, or contact the control's contractor, or if Trane controls, see CNT-SVX04A-EN for more information concerning Tracer controls.
		X	OA damper is in the open position.	Ensure OA damper is in the closed or minimum outside air position.
		X	Boiler pressure or temperature design requirements not being met.	On hot water and steam type units, check the boiler pressure or temperature to ensure that the requirements are being met.
Room too cool Unit utilizes Wall Fin auxiliary radiation:		X	Radiation controls malfunctioning.	Check the operation of the wall fin controls.
Room too hot		X	Room sensor is not properly set.	Reset room sensor temperature.
		X	Clogged filter.	Replace filter.
		X	Face and bypass damper, or coil valve is malfunctioning.	Replace malfunctioning component, or contact the control's contractor, or if Trane controls, see CNT-SVX04A-EN for more information concerning Tracer controls.
		X	OA damper is in the open position.	Ensure OA damper is in the minimum outside air position.
		X	Chiller temperature design requirements not being met.	Check the temperature of the water leaving the chiller to ensure that it meets design requirements.
Motor		X	If the motor fails to start, and other motors on the same circuit are functioning.	Check the unit switch to ensure it is in the ON position.
		X	If the motor fails to start, and other motors on the same circuit are functioning.	Check for loose switch or motor connection.
Unit 265 and 460 volt unit	X	X	If the unit fails to start.	Check fuse in right-hand end pocket inside the transformer mounting box. Replace with Trane fuse X1311057435 (ABC type 6A 250V).

Output Testing and Diagnostics (Tracer ZN520)

Table 26. Tracer ZN520 diagnostics

Diagnostic	Fan	Other Outputs[a]
Condensate overflow	Off	Valves Closed, Fresh air damper Closed, Electric heat Off, Baseboard heat Off
Low temperature detection	Off	Valves Open, Fresh air damper Closed, Electric heat Off, Baseboard heat Off
Low air flow - fan failure	Off	Valves Closed, Fresh air damper Closed, Electric heat Off, Baseboard heat Off
Space temperature failure	Off	Valves Closed, Fresh air damper Closed, Electric heat Off, Baseboard heat Off
Entering water temp failure	On	Valves Enabled[b], Fresh air damper Enabled[b], Electric heat Enabled[b], Baseboard heat Off
Discharge air temp low limit	Off	Valves Open, Fresh air damper Closed, Electric heat Off, Baseboard heat Off
Discharge air temp failure	Off	Valves Closed, Fresh air damper Closed, Electric heat Off, Baseboard heat Off
Fresh air temp failure	On	Valves Enabled, Fresh air damper Minimum position[c], Electric heat Enabled, Baseboard heat Enabled
Relative humidity failure	On	Valves Enabled, Fresh air damper Enabled, Electric heat Enabled, Baseboard heat Enabled
Generic 4–20mA failure	On	Valves Enabled, Fresh air damper Enabled, Electric heat Enabled, Baseboard heat Enabled

Table 26. Tracer ZN520 diagnostics

Diagnostic	Fan	Other Outputs[a]
CO_2 Input failure	On	Valves Enabled, Fresh air damper Enabled, Electric heat Enabled, Baseboard heat Enabled
Maintenance required	On	Valves Enabled, Fresh air damper Enabled, Electric heat Enabled, Baseboard heat Enabled
Local fan mode failure	On	Valves Enabled, Fresh air damper Enabled, Electric heat Enabled, Baseboard heat Enabled
Local setpoint failure	On	Valves Enabled, Fresh air damper Enabled, Electric heat Enabled, Baseboard heat Enabled
Invalid unit configuration	Off	Valves Disabled, Fresh air damper Disabled, Electric heat Disabled, Baseboard heat Disabled
Normal—power up	On	Valves Enabled, Fresh air damper Enabled, Electric heat Enabled

(a) The generic binary output (TB4-1, TB4-2) state is unaffected by all unit diagnostics.

(b) When the entering water temperature is required but not present, the Tracer ZN520 controller generates a diagnostic to indicate the sensor loss condition. The controller automatically clears the diagnostic once a valid entering water temperature value is present (non-latching diagnostic). When the entering water temperature sensor fails, the controller prohibits all hydronic cooling operation, but allows the delivery of heat when heating is required. In the Cool mode, all cooling is locked-out, but normal fan and outdoor air damper operation is permitted.

(c) When the outdoor air temperature sensor has failed or is not present, the Tracer ZN520 controller generates a diagnostic to indicate the sensor loss condition. The controller automatically clears the diagnostic once a valid outdoor air temperature value is present (non-latching diagnostic). When the outdoor air temperature sensor fails or is not present, the controller prohibits economizer operation.

Translating Multiple Diagnostics (Tracer ZN520)

The controller senses and records each diagnostic independently of other diagnostics. It is possible to have multiple diagnostics present simultaneously. The diagnostics are reported in the order they occur.

Possible diagnostics include:

- Low temperature detection
- Condensate overflow
- Low air flow—fan status
- Discharge air temp limit
- Space temperature failure[1]
- Entering water temp failure[1]
- Discharge air temp failure[1]
- Outdoor air temp failure[1]
- Local setpoint failure[1]
- Local fan mode failure[1]
- CO_2 sensor failure[1]
- Generic AIP failure[1]
- Humidity input failure[1]
- Defrosting compressor lockout[1]
- Maintenance required
- Invalid unit configuration
- Generic temperature failure
- Discharge air low limit

Resetting Diagnostics (Tracer ZN520)

There are a number of ways in which diagnostics are reset:

1. Automatic reset by the controller
2. By initiating a manual output test at the controller
3. By cycling power to the controller
4. Through Rover, Trane's service tool
5. Tracer ZN520: by using any other communicating device ab le to access the controller's diagnostic reset input.
6. Tracer ZN520: by cycling the fan switch from Off to any speed setting.

Automatic Reset by the Controller (Tracer ZN520)

The controller includes an automatic diagnostic reset function that attempts to automatically restore the unit when a low temperature diagnostic occurs.

Note: *The controller implements the automatic diagnostic reset function only once every 24 hours. For the controller to increment the 24 hour timer, you must maintain power to the controller. Cycling power resets all timers and counters.*

After the controller detects the first special diagnostic, the unit waits 30 minutes before invoking the automatic diagnostic reset function. The automatic diagnostic reset function clears the special diagnostic and attempts to restore the controller to normal operation. The controller resumes normal operation until another diagnostic occurs.

Note: *The automatic diagnostic reset function does not operate during the manual output test sequence.*

If a special diagnostic occurs within 24 hours after an automatic diagnostic reset, the controller must be manually reset. Other possible methods of resetting diagnostics are described in the sections that follow.

Manual Output Test (Tracer ZN520)

To verify proper end device operation, press the controller's Test button. This exercise will verify all outputs in a predefined sequence, the first of which will attempt to reset the controller diagnostics if any are present.

Cycling Power to the Controller (Tracer ZN520)

After removing and reapplying the 24 Vac power from the board, the unit cycles through a power-up sequence. By default, the controller attempts to reset all diagnostics present at power-up. Diagnostics present at power-up and those that occur after power-up are handled according to Table 27.

Table 27. Tracer ZN520 controller diagnostics

Diagnostic	Latching	Fan	Valves	Elec Heat	Damper
Auxiliary temp. failure	No	Enabled	No action	No action	No action
Condensate overflow detection	Yes	Off	Closed	Off	Closed
Entering water temp. failure	No	Enabled	Enabled	Enabled	Enabled
Fan mode failure	No	Enabled	Enabled	Enabled	Enabled
Invalid unit configuration failure	Yes	Disabled	Disabled	Disabled	Disabled
Low temp. detection	Yes	Off	Open	Off	Closed
Maintenance required	Yes	Enabled	No action	No action	No action
Setpoint	No	Enabled	No action	No action	No action
Zone temp. failure	No	Off	Closed	Off	Closed

Notes:
1. Priority Level: Diagnostics are listed in order from highest to lowest priority. The controller senses and records each diagnostic independently of other diagnostics. It is possible to have multiple diagnostics present simultaneously. The diagnostics affect unit operation according to priority level.
2. Latching: A latching diagnostic requires a manual reset of the controller; while a non-latching diagnostic automatically resets when the input is present and valid.
3. Enabled: End device is allowed to run if there is a call for it to run.
4. Disabled: End device is not allowed to run even if there is a call for it to run.
5. No Action: The diagnostic has no affect on the end device.

[1] Non-latching diagnostics automatically reset when the input is present and valid.

Using Trane's Service Tool, Rover (Tracer ZN520)

Rover, Trane's service tool, can reset diagnostics present in the controller and troubleshoot the unit. For more information, refer to the Trane publication EMTX-SVX01G-EN (*Rover Service Tool: Installation, Operation, and Programming Guide*), or the most recent revision.

Diagnostic Reset (Tracer ZN520)

Any device that can communicate the network variable nviRequest (enumeration "clear_alarm") can reset diagnostics in the Tracer ZN520 controller.The controller also attempts to reset diagnostics whenever power is cycled.

Cycling the Fan Switch (Tracer ZN520)

Cycle the fan speed switch from Off to any speed and the controller resets all diagnostics. Diagnostics may recur immediately if the problem still exists.

Table 28. Fan outputs do not energize (Tracer ZN520)

Probable Cause	Explanation
Random start	After power-up, the controller always observes a random start that varies observed between 0 and 25 seconds. The controller remains off until the random start time expires.
Power-up control wait	When power-up control wait is enabled (non-zero time), the controller remains off until one of two conditions occurs: 1. The controller exits power-up control wait once it receives communicated information. 2. The controller exits power-up control wait once the power-up control wait time expires.
Cycling fan operation	When the fan mode switch is in the auto position, the unit fan cycles off when there is no call for heating or cooling. The heating/cooling sources cycle on or off periodically with the unit fan to match the capacity according to pulse-width-modulation (PWM) logic.
Unoccupied operation	The fan cycles with capacity when the unit is in unoccupied mode. This occurs even if the unit is in continuous fan operation. While unoccupied, the fan cycles on or off with heating/cooling to provide varying amounts of heating or cooling to the space to match the to pulse-width-modulation (PWM) logic.
Fan mode off	When using the local fan mode switch to determine the fan operation, the off position controls the unit fan to off.
Requested mode: off	It is possible to communicate the operating mode (such as off, heat, and cool) to the controller. When "off" is communicated to the controller, the unit controls the fan to off. The unit is not capable of heating or cooling when the controller is in this mode.
Diagnostic present	A specific list of diagnostics effects fan operation. For more information, see "Diagnostics," p. 90.
No power to the controller	If the controller does not have power, the unit fan will not operate. For the controller to operate normally, it must have an input voltage of 24 Vac. When the green LED is off continuously, the controller does not have sufficient power or the controller has failed.
Manual output test	The controller includes a manual output test sequence to verify binary output operation and the associated wiring. However, based on the current step in the test sequence, the unit fan may not be powered on. Refer to "Manual Output Test (Tracer ZN520)," p. 92.
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 the typical unit wiring diagrams.

Table 29. Valves stay closed (Tracer ZN520)

Probable Cause	Explanation
Normal operation	The controller opens and closes the valves to meet the unit capacity requirements.
Requested mode: off	It is possible to communicate the operating mode (such as off, heat, and cool) to the controller. When off is communicated to the controller, the unit controls the fan to off. The unit is not capable of heating or cooling when the controller is in this mode.
Valve override	The controller can communicate a valve override request. This request affects the valve operation.
Manual output test	The controller includes a manual output test sequence to verify analog and binary output operation and the associated wiring. However, based on the current step in the test sequence, the valves may not be open. Refer to "Manual Output Test (Tracer ZN520)," p. 92.
Diagnostic present	A specific list of diagnostics affects valve operation. For more information, see "Diagnostics," p. 90.
Sampling logic	The controller includes entering water temperature sampling logic that automatically invokes during 2-pipe or 4-pipe changeover. It determines when the entering water temperature is either too cool or too hot for the desired heating or cooling mode.
Unit configuration	The controller must be properly configured based on the actual installed end devices and application. When the unit configuration does not match the actual end device, the valves may not work correctly.
No power to the controller	If the controller does not have power, the valves do not operate. For the controller to operate normally, it must have an input voltage of 24 Vac. When the green LED is off continuously, the controller does not have sufficient power, or the controller has failed.
Unit wiring	The wiring between the controller outputs and the valve(s) must be present and correct for normal valve operation. Refer to the typical unit wiring diagrams.

Table 30. Valves stay open (Tracer ZN520)

Probable Cause	Explanation
Normal operation	The controller opens and closes the valves to meet the unit capacity requirements.
Valve override	The controller can communicate a valve override request to affect the valve operation.
Manual output test	The controller includes a manual output test sequence that verifies analog and binary output operation and the associated wiring. However, based on the current step in the test sequence, the valves may be open. Refer to "Manual Output Test (Tracer ZN520)," p. 92.
Diagnostic present	A specific list of diagnostics affects valve operation. For more information, see "Diagnostics," p. 90.
Sampling logic	The controller includes entering water temperature sampling logic that automatically invokes during 2-pipe or 4-pipe changeover to determine if the entering water temperature is correct for the unit operating mode.
Unit configuration	The controller must be properly configured based on the actual installed end devices and application. When the unit configuration does not match the actual end device, the valves may not work correctly.
Unit wiring	The wiring between the controller outputs and the valve(s) must be present and correct for normal valve operation. Refer to the typical unit wiring diagrams.

Table 31. Electric heat not operating (Tracer ZN520)

Probable Cause	Explanation
Normal operation	The controller cycles electric heat on and off to meet the unit capacity requirements.
Requested mode: off	It is possible to communicate the operating mode (such as off, heat, cool) to the controller. When off is communicated to the controller, the units shuts off the electric heat.
Communicated disable	Numerous communicated requests may disable electric heat, including an auxiliary heat enable input and the heat/cool mode input. Depending on the state of the communicated request, the unit may disable electric heat.
Manual output test	The controller includes a manual output test sequence that verifies analog and binary output operation and associated output wiring. However, based on the current step in the test sequence, the electric heat may not be on. Refer to "Manual Output Test (Tracer ZN520)," p. 92.
Diagnostic present	A specific list of diagnostics affects electric heat operation. For more information, see "Diagnostics," p. 90.
Unit configuration	The controller must be properly configured based on the actual installed end devices and application. When the unit configuration does not match the actual end device, the electric heat may not work properly.
No power to the controller	If the controller does not have power, electric heat does not operate. For the controller to operate normally, a 24 Vac input voltage must be applied. When the green LED is off continuously, the controller does not have sufficient power or has failed.
Unit wiring	The wiring between the controller outputs and the electric heat contacts must be present and correct for normal electric heat operation. Refer to the typical unit wiring diagrams.
ECM Motor / Control Board Failure	ECM controls include sophisticated fan proving / interlock circuitry that will disable electric heat if one or more motors are not performing normally
Hot water is present on a changeover unit	On units with changeover coil and electric heat, simultaneous operation of hydronic heat and electric heat is not allowed.

Table 32. Fresh air damper stays open (Tracer ZN520)

Probable Cause	Explanation
Normal operation	The controller opens and closes the fresh air damper based on the controller's occupancy mode and fan status. Normally, the fresh air damper is open during occupied mode when the fan is running and closed during unoccupied mode.
Manual output test	The controller includes a manual output test sequence that verifies analog and binary output operation and associated output wiring. However, based on the current step in the test sequence, the fresh air damper may not be open. Refer to "Manual Output Test (Tracer ZN520)," p. 92.
Unit configuration	The controller must be properly configured based on the actual installed end devices and application. When the unit configuration does not match the actual end device, the damper may not work correctly.
Unit wiring	The wiring between the controller outputs and the fresh air damper must be present and correct for normal damper operation. Refer to the typical unit wiring diagrams.

Table 33. Fresh air damper stays closed (Tracer ZN520)

Probable Cause	Explanation
Normal operation	The controller opens and closes the fresh air damper based on the controller's occupancy mode and fan status. Normally, the fresh air damper is open during occupied mode when the fan is running and closed during unoccupied mode.
Warmup and cooldown	The controller includes both a warmup and cooldown sequence to keep the fresh air damper closed during the transition from unoccupied to occupied. This is an attempt to bring the space under control as quickly as possible.
Requested mode: off	It is possible to communicate the operating mode (such as off, heat, cool) to the controller. When off is communicated to the controller, the unit closes the fresh air damper.
Manual output test	The controller includes a manual output test sequence that verifies analog and binary output operation and associated output wiring. However, based on the current step in the test sequence, the fresh air damper may not be open. Refer to "Manual Output Test (Tracer ZN520)," p. 92.
Diagnostic present	A specific list of diagnostics effects fresh air damper operation. For more information, see "Diagnostics," p. 90.
Unit configuration	The controller must be properly configured based on the actual installed end devices and application. When the unit configuration does not match the actual end device, the damper may not work correctly.
No power to the controller	If the controller does not have power, the fresh air damper does not operate. For the controller to operate normally, a 24 Vac input voltage must be applied. When the green LED is off continuously, the controller does not have sufficient power or has failed.
Unit wiring	The wiring between the controller outputs and the fresh air damper must be present and correct for normal damper operation. Refer to the typical unit wiring diagrams.

Output Testing and Diagnostics (UC400)

This section provides information about the following:

- Output testing
- Diagnostics

Note: *For detailed description of LED activities and troubleshooting tips, refer to the section.*

Output Testing (UC400)

Important: Do not *directly overwrite the outputs. Output testing can be accomplished by overriding the following analog and multistate value points in the desired state or position:*

- *Cool valve request*
- *DX cool request*
- *Economizer request*
- *Electric heat request*
- *Heat valve request*
- *Supply fan speed request*

The points can be overridden on the Tracer TU analog or multistate pages by clicking on the **Override** icon in the control column. A higher priority (lower number) must be chosen over the current control setting.

Diagnostics (UC400)

Diagnostics are informational messages that indicate the operational status of the UC400 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 (UC400)

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 (UC400). Manual diagnostics (also referred to as latching) cause the unit to shut down. Manual diagnostics can be cleared from the UC400 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 (UC400).

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

Smart Reset Diagnostics (UC400). 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 (UC400)."

Informational Diagnostics (UC400). 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.

Table of Diagnostics (UC400)

Table 34 lists each diagnostic that can be generated by the UC400 controller, the diagnostic effect on outputs *(consequences)*, and diagnostic type.

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

Table 34. UC4000 diagnostics

Diagnostic	Probable Cause	Consequences	Diagnostic Type
Filter change required	Fan run hours exceed the time set to indicate filter change.	• Fan **Unaffected** • Valves **Unaffected** • Electric heat **Unaffected**	Informational
Condensate overflow	The drain pan is full of water.	• Fan **OFF** • Valves **Closed** • Outdoor air damper **Closed** • DX/electric heat **OFF**	Manual
Low coil temp detection	The leaving fluid temperature may be close to freezing.	• Fan **OFF** • Valves **Open** • Outdoor air damper **Closed** • DX/electric heat **OFF**	Smart reset/ Manual
Low airflow supply fan failure	The fan drive belt, contactor, or motor has failed.	• Fan **OFF** • Valves **Closed** • Outdoor air damper **Closed** • DX/electric heat **OFF**	Manual

Table 34. UC4000 diagnostics (continued)

Diagnostic	Probable Cause	Consequences	Diagnostic Type
Space temperature failure[a]	Invalid or missing value for zone temperature.	• Discharge air temperature control runs • Unit shuts **OFF** if both space temperature and discharge air temperature fail	Automatic
Entering water temp failure	Invalid or missing value for zone temperature.	• Fan **Unaffected** (enabled) • Valves **Unaffected** • Outdoor air damper **Unaffected** • DX/electric heat **Unaffected**	Automatic
Discharge air temp low limit	Discharge air temperature has fallen below the Discharge Air Temperature Low Limit.	• Fan **OFF** • Valves **Open** • Outdoor air damper **Closed** • DX/electric heat **OFF**	Smart reset/ manual
Discharge air temp failure[a]	Invalid or missing value for discharge air temperature.	• Simplified zone control algorithm runs • Unit shuts OFF if zone temperature fails	Automatic
Outdoor air temp failure	Invalid or missing value for outdoor air temperature.	• Fan **Unaffected** • Valved **Unaffected** • Outdoor air damper **Minimum Position** • DX cooling/electric heat **unaffected**	Automatic
Humidity input failure	Invalid or missing value for relative humidity.	• Fan **Unaffected** • Valves **Unaffected** • Outdoor air damper **Unaffected** • DX cooling/electric heat **Unaffected**	Automatic
CO_2 sensor failure	Invalid or missing value for CO_2.	• Fan **Unaffected** • Valves **Unaffected** • Outdoor air damper **Unaffected** • DX cooling/electric heat **Unaffected**	Informational
Generic AIP failure	Invalid or missing value for generic analog input.	• Fan **Unaffected** • Valves **Unaffected** • Outdoor air damper **Unaffected** • DX cooling/electric heat **Unaffected**	Informational
Local fan mode failure	Invalid or missing fan-speed switch *(reverts to default fan speed)*.	• Fan **Unaffected** • Valves **Unaffected** • Outdoor air damper **Unaffected** • DX cooling/electric heat **Unaffected**	Automatic
Local setpoint failure	Invalid or missing value for zone temperature setpoint *(reverts to default setpoint)*.	• Fan **Unaffected** • Valves **Unaffected** • Outdoor air damper **Unaffected** • DX cooling/electric heat **Unaffected**	Automatic

(a) For detailed information about zone temperature control methods, refer to "Zone Temperature Control (UC400)," p. 81.

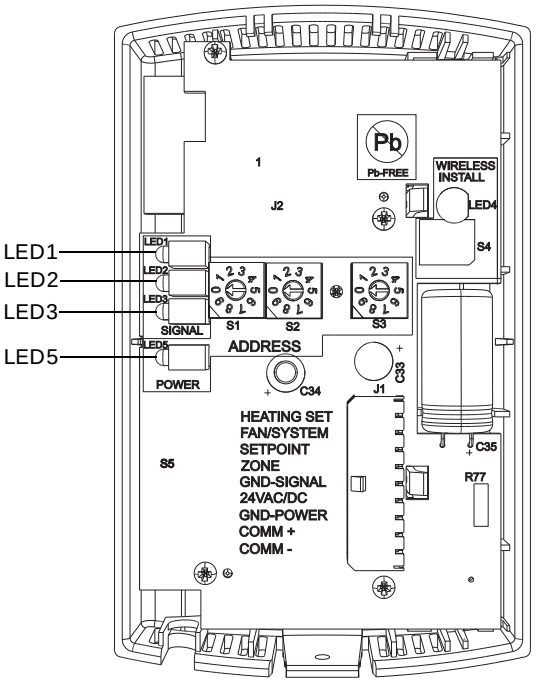
Troubleshooting (Wireless Controls)

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

The receiver for all models has four LEDs: LED1, LED2, LED3, and LED5. Figure 65 shows their locations.

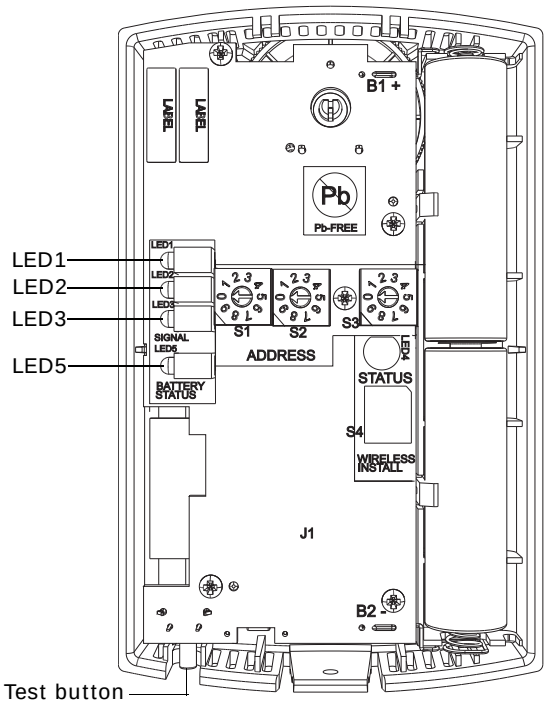
Note: *To view LEDs on a flush mount receiver on a fan-coil unit, the front panel of the unit must be removed.*

Figure 65. LED locations on the receiver

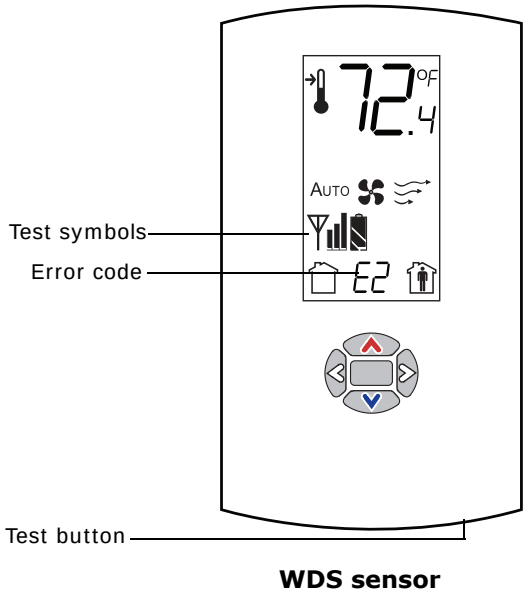


The sensor for model WZS have four LEDs: LED1, LED2, LED3, and LED5. The sensor for model WDS has test symbols and error codes that appear on the display. All three sensor models have a Test button. Figure 66 shows their locations.

Figure 66. LED, Test button, and symbol locations on the sensor



WZS sensor



WDS sensor

Diagnostics (Wireless Controls)

LED1, LED2, and LED3, located on the sensor of model WZS respond to diagnostics by exhibiting specific blinking patterns. View their response by pressing the Test button (see Table 35, p. 97).

Error codes appear on the display of the model WDS sensor when diagnostics occur (see Table 35).

Table 35. Diagnostics on the sensor (wireless controls)

LED state when Test button is pressed (WZS sensor)	Error code (WDS sensor display)	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.

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 Table 36).

Table 36. Diagnostics on the receiver (wireless controls)

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

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

Testing Signal Strength (Wireless Controls)

To initiate a signal strength test, push the Test button on the sensor (see location of Test button in Figure 66, p. 97).

- **Models WZS:** LED1, LED2, and LED3 respond by indicating signal strength. You can view them on the sensor (Table 37) and the receiver (Table 38).
- **Model WDS:** Test symbols on the sensor display indicate signal strength (Table 37). LED1, LED2, and LED3, on the receiver, respond by indicating signal strength (Table 38).

Table 37. Observing signal strength on the sensor (wireless controls)

User action	LED state (WZS sensors)	Symbol (WDS sensor display)	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 38. Observing signal strength on the receiver (wireless controls)

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

Testing Battery Status (Wireless Controls)

Initiate a battery status test as follows:

- On model WZS, push the Test button on the sensor (see location on Figure 66, p. 97). LED5 on the sensor responds by indicating the level of battery strength, as shown in Table 39, p. 98.
- On model WDS, push the Test button on the sensor (see location on Figure 66, p. 97). In response, a battery test symbol appears on the display. The symbol shown indicates battery life expectancy (see Table 40).

Table 39. Battery status: LED5 on model WZS sensors (wireless controls)

User action	LED state (WZS)	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 40. Battery status: Battery symbol on model WDS sensor display (wireless controls)

User action	Battery test symbol	Indicates...
Press Test button		Full battery power.
		50% battery life left.
		25% 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 (Wireless Controls

LED5 on the receiver of all models (Figure 65, p. 96) lights and stays constantly On when 24 V power is normal.

Using the Wireless Sensor System to Check Signal Strength on a Site (Wireless Controls)

Follow these steps 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, and on the display on model WDS (Figure 66, p. 97).

For more information on interpreting the LEDs and the display symbols that indicate signal strength, see "Testing Signal Strength (Wireless Controls)," p. 97.

Replacing Sensor Batteries (Wireless Controls)

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

Battery Type (Wireless Controls)

NOTICE:

Equipment Damage!

The batteries are manufactured in a ready-to-use state. They are not designed for recharging. Recharging can cause battery leakage or, in some cases, can cause the safety release vent to open.

NOTICE:

Equipment Damage!

Do not attempt to hook up the sensor to a power supply. Equipment damage may result.

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 (Wireless Controls)

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 a model WDS may decrease with extended LCD display activity.*

Battery Installation (Wireless Controls)

⚠WARNING

Prevent Injury!

Batteries can explode or leak and cause burns if installed backwards, disassembled, charged, or exposed to water, fire, or high temperature.

⚠WARNING

Prevent Injury!

Keep away from small children. If swallowed, contact your local poison control center immediately.

6. Observe the polarity indicators that are molded into the cover.
7. Install two batteries (of the type specified in "Battery Type (Wireless Controls)," p. 99) 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 (Wireless Controls)

Before attempting manual or automatic association, the receiver must indicate readiness to associate (one blink pattern of LED3 on receiver). Refer to "Observing the Receiver for Readiness to Associate," p. 33.

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 the Sensor to the Receiver," p. 33).

8. Using a small screwdriver, set the three rotary address switches (Figure 39, p. 33, locations S1, S2, S3) on the receiver to an address between 001 and 999.

Notes:

- An address can be changed without powering down the receiver or sensor.
- An address can be changed at any time after initial association has been established.

9. Set the three rotary address switches (Figure 39, p. 33, locations S1, S2, S3) on the sensor to the same address as the receiver.
10. Record the address and location of the receiver and sensor pair.
    - 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 (Wireless Controls)," p. 97) and the battery life "Testing Battery Status (Wireless Controls)," p. 98) are adequate for proper functioning.

Disassociation (Wireless Controls)

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 (Wireless Controls)

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 (Wireless Controls)

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

To replace a failed sensor or receiver:

11. Confirm that the device is disassociated (see Table 35 and Table 36, p. 97).
12. 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.*
13. 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 (Wireless Controls)," p. 99).*

Servicing and Testing (Wireless Controls)

If the wireless sensor system is not working as expected, use the tools and procedure described in this section.

Servicing and Testing Tools (Wireless Controls)

No special tools or software are necessary to service and test the wireless sensor system. Test the system by using:

- The LEDs on the receiver, LEDs on the model WZS sensor, and the display on the model WDS sensor
- The Test button on the sensor
- The address test mode on the receiver
- A common volt-ohm meter

Procedure for Testing the Wireless Sensor System (Wireless Controls)

If the wireless sensor system 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 (Wireless Controls)," p. 98) and signal strength ("Testing Signal Strength (Wireless Controls)," p. 97) are indicated on the display.

Procedure for Testing the Receiver (Wireless Controls)

If the receiver is not working as expected:

1. Verify that the receiver is powered.
2. Set the receiver address to 000 to force the zone temperature output and zone temperature setpoint output to their default mode values (see "Output Values—Failure and Default Modes of Operation (Wireless Controls)," p. 101).
3. Measure the receiver output resistance (see "Measuring Output Resistance (Wireless Controls)," p. 101).
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 (Wireless Controls)," p. 97.

Forcing a Sensor to Transmit (Wireless Controls)

To force a wireless sensor to transmit during servicing, press the Test button on the sensor.

Output Power Level (Wireless Controls)

The maximum output power level of a wireless sensor set is controlled by software and restricted by channel of operation and agency requirements per country or region. The sensor has a default maximum power level of 10 mW,

but the receiver determines the ultimate output power level of the sensor.

Output Values—Failure and Default Modes of Operation (Wireless Controls)

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

Table 41. Output values

Situation	Zone temperature output	Zone setpoint output	Heating setpoint output	Fan/ System output
Receiver address = 000	11.17 kΩ, 72.5°F (22.5°C), indefinitely	451 Ω, 72.5°F (22.5°C), indefinitely	501 Ω, 70.5°F (21.4°C), indefinitely	2320 Ω Fan = Auto System = Off
Receiver address = 001 to 999 and: Receiver is powered up, but not is associated, or Receiver has received a disassociation request from the associated sensor.	11.17 kΩ, 72.5°F (22.5°C) Hold for 15 minutes, then open	451 Ω, 72.5°F (22.5°C), Hold for 15 minutes, then open	501 Ω, 70.5°F (21.4°C), indefinitely	2320 Ω Fan = Auto System = Off
Receiver address = 001 to 999 and receiver has not received a communication within 35 minutes from the associated sensor.	Open	Open	Open	Open
Receiver has no power.	Open	Open	Open	Open
Thermistor in sensor has failed to either open or close.	Open	Normal value	Normal value	N/A
Setpoint potentiometer has failed to either open or close.	Normal value	Open	Open	N/A

Measuring Output Resistance (Wireless Controls)

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 42, p. 101.
   b. WDS only: Measure between the grounded GND-SIGNAL (black) wire and the FAN/SYSTEM (green) wire. Compare resistance measurements to those given in Table 43, p. 101.

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

Table 42. Receiver resistance table for all models (wireless controls)

Zone or setpoint temperature	Nominal zone temperature output resistance	Nominal setpoint and 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

Table 43. Receiver resistance table for model WDS (wireless controls)

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 (Wireless Controls)

NOTICE:

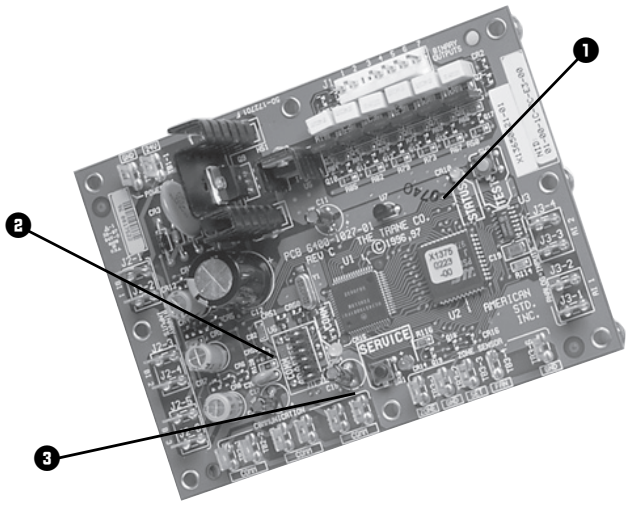
Equipment Damage!

Spraying glass cleaner or any other solution directly on the sensor may 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.

Troubleshooting (Tracer ZN520)



1. **Green STATUS LED**
   Indicates Whether the Controller is Powered On (24 Vac Supplied)
2. **Yellow COMM LED**
   Indicates if Communication is Functioning
3. **Red SERVICE LED**
   Indicates if Service is Needed

Red SERVICE LED (Tracer ZN520)

During normal operation, the LED is off continuously when power is applied to the controller.

If the LED is on continuously, even when power is applied to the controller means that someone is pressing the SERVICE button or that the controller has failed.

If the LED flashes once every second, use Rover, Trane's service tool, to restore the unit to normal operation. Refer to the Rover product literature for more information.

Note: *If the Service button is held down for more than 15 seconds on the Tracer ZN520 controller, it will uninstall itself from the ICS communication network and shut down all unit operation.*

Green STATUS LED (Tracer ZN520)

During normal operation, the LED is on continuously.

If the LED blinks once, the controller is in Manual output test mode.

If the LED blinks twice the controller is in Manual output test mode, with one or more diagnostics present.

If the LED blinks (1/4 second on, 1/4 second off for 10 seconds) the controller is in the "Wink" mode.

Note: *The "wink" feature allows the identification of a particular controller. When sending a request from a device, such as Rover, the controller will "wink" to indicate it received the signal.*

If the LED is off, either the power is off, an abnormal condition is present or the TEST button is pressed.

Yellow COMM LED (Tracer ZN520)

If the LED is off continuously, the controller is not detecting any communication. This is normal for units in standalone applications.

If the LED blinks, the controller detects communication.

If the LED is on continuously, this indicates an abnormal condition.

Manual Output Test (Tracer ZN520)

The purpose of the manual output test sequence is to verify output and end device operation. Use the manual output test to:

- Verify output wiring and operation without using Rover, service tool
- Force the water valve to open and balance the hydronic system

Note: *The manual output test is not an automatic cycle. You must press the TEST button to proceed through each step.*

The controller observes all diagnostics that occur during the test sequence. Although an automatic diagnostic reset sequence exists as part of the controller's normal operation, the automatic diagnostic reset feature is not active during the test sequence.

If left in an individual test step, the controller remains in test mode for 60 minutes and then exits to normal operation.

Many service calls are due to unit diagnostics. The test sequence resets unit diagnostics and attempts to restore normal unit operation prior to testing the outputs. If the diagnostics remain after a reset, the STATUS LED indicates the diagnostic condition is still present (two blinks).

Manual Output Test Procedure (Tracer ZN520)

Follow the procedure below to test Tracer ZN520 controllers.

1. Press and hold the TEST button for at least two seconds (not exceeding 5 seconds), and then release, to start the test mode.
2. The test sequence will turn off all outputs and then attempt to clear all diagnostics.
3. Press the TEST button several more times (no more than once per second) to advance through the test sequence.

The outputs are not subject to minimum times during the test sequence. However, the test sequence only permits one step per second which limits minimum output time.

The green LED is turned off when the TEST button is pressed. To begin the manual output test mode, press and hold the TEST button (turning off the green LED) for at least

two seconds.The green LED will begin to blink, indicating the controller is in test mode.

Table 44. Test sequence for 1-heat/1-cool configurations (Tracer ZN520)

Steps	Fan BOP1-3	Cool Output BOP4[a]	Heat Output BOP5	Damper BOP6
1. Off	Off	Off	Off	Closed
2. Fan High	High	Off	Off	Closed
3. Fan Medium	Medium	Off	Off	Closed
4. Fan Low	Low	Off	Off	Closed
5. Cool	High	On	Off	Closed
6. Heat	High	Off	On	Closed
7. Fresh Air Damper[b]	High	Off	Off	Open
8. Exit	[c]			

Note: For all 1-heat/1-cool applications including 2-pipe changeover, BOP4 energizes in the cooling test stage and BOP5 energizes in the heat test stage.This occurs even though during normal 2-pipe changeover operation BOP4 controls the unit valve for both cooling and heating.

(a) At the beginning of the Fan High step, the controller attempts to clear all diagnostics.
(b) The fresh air damper (BOP6) only energizes during this step if binary output 6 has been configured as a fresh air damper.
(c) After the Fresh Air Damper step, the test sequence performs the Exit step.This initiates a reset and attempts to return the controller to normal operation.

Troubleshooting (UC400)

Table 45 through Table 50, p. 105 provide troubleshooting information if encountering operational problems with the UC400 controller.

Table 45. Fan does not energize (UC400)

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 34, p. 95.
Unit configuration	The controller must be properly configured based on the actual installed end devices and application. If the unit configuration does not match the actual end device, the fans may not work correctly.
Random start observed	After power-up, the controller always observes a random start from 5 to 30 seconds. The controller remains **OFF** until the random start time expires.
Cycling fan operation/ continuous	The controller continuously operates the fan when in the occupied, occupied standby, or occupied bypass mode. When the controller is in the unoccupied mode, the fan is cycled between high speed and **OFF** with capacity.
Unoccupied operation	Even if the controller is configured for continuous fan operation, the fan normally cycles with capacity during unoccupied mode. While unoccupied, the fan cycles **ON** or **OFF** with heating/cooling to provide varying amounts of heating or cooling to the space.
Fan mode off	If a local fan mode switch determines the fan operation, the **OFF** position controls the fan to off.
Requested mode off	The user can communicate a desired operating mode (*such as **OFF**, heat, and cool*) to the controller. If **OFF** is communicated to the controller, the unit controls the fan to off. There is no heating or cooling.

Table 46. Valves remain closed (UC400)

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 34, p. 95.
Normal operation	The controller opens and closes the valves to meet the unit capacity requirements.

Table 46. Valves remain closed (UC400) (continued)

Probable Cause	Explanation
Unit configuration	The controller must be properly configured based on the actual installed end devices and application. If the unit configuration does not match the actual end device, the valves may not work correctly.
Random start observed	After power-up, the controller always observes a random start from 5 to 30 seconds. The controller remains **OFF** until the random start time expires.
Requested mode off	The user can communicate a desired operating mode (such as **OFF**, heat, and cool) to the controller. If **OFF** is communicated to the controller, the unit controls the fan to off. There is no heating or cooling.
Entering water temperature sampling logic	The controller includes entering water temperature sampling logic, which is automatically initiated during 2-pipe and 4-pipe changeover, if the entering water temperature is either too cool or too hot for the desired heating or cooling.
Valve configuration	Ensure the valves are correctly configured, using the Tracer TU service tool, as normally open or normally closed as dictated by the application.

Table 47. Valves remain open (UC400)

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 34, p. 95.
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.
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**.

Table 48. DX or electric heat does not energize (UC400)

Probable Cause	Explanation
Unit wiring	The wiring between the controller outputs and the end devices must be present and correct for normal operation. Refer to applicable wiring diagram.
Failed end device	Check the control contactors or the electric heat element, including any auxiliary safety interlocks, to ensure proper operation.
No power to the controller	If the controller does not have power, heat outputs do not operate. For the controller to operate normally, apply an input voltage of 24 Vac. If the Marquee/Power LED is **OFF** continuously, the controller does not have sufficient power or has failed.
Diagnostic present	Several diagnostics affect DX and electric heat operation. For detailed information about these diagnostics, refer to Table 34, p. 95.
Normal operation	The controller controls compressor or electric heat outputs as needed to meet the unit capacity requirements.
Unit configuration	The controller must be properly configured based on the actual installed end devices and application. If the unit configuration does not match the actual end device, DX or electric heat may not operate correctly.
Requested mode off	The user can communicate a desired operating mode (such as **OFF**, heat, and cool) to the controller. If **OFF** is communicated to the controller, the unit shuts off the compressor or electric heat.
Freeze avoidance	When the fan is **OFF** with no demand for capacity (0%), and the outdoor air temperature is below the freeze avoidance setpoint, the controller disables compressors and electric heat outputs (100%) to prevent coil freezing. This includes unoccupied mode when there is no call for capacity or any other time the fan is **OFF**.

Table 49. Outdoor air damper remains closed (UC400)

Probable Cause	Explanation
Unit wiring	The wiring between the controller outputs and the outdoor air damper must be present and correct for normal outdoor air damper operation. Refer to applicable wiring diagram.
Failed end device	Check damper actuator to ensure proper operation.
No power to the controller	If the controller does not have power, the outdoor air damper does not operate. For the controller to operate normally, apply an input voltage of 24 Vac. If the Marquee/Power LED is **OFF** continuously, the controller does not have sufficient power or has failed.
Diagnostic present	Several diagnostics affect outdoor air damper operation. For detailed information about these diagnostics, refer to Table 34, p. 95.
Normal operation	The controller opens and closes the outdoor air damper based on the controller's occupancy mode and fan status. Normally, the outdoor air damper is open during occupied mode when the fan is running and closed during unoccupied mode.
Unit configuration	The controller must be properly configured based on the actual installed end devices and application. If the unit configuration does not match the actual end device, the outdoor air damper may not work correctly.
Warm-up and cool-down sequence	The controller includes both a morning warm-up and cool-down sequence to keep the outdoor air damper closed during the transition from unoccupied to occupied. This is an attempt to bring the space under control as quickly as possible.
Requested mode off	The user can communicate a desired operating mode (such as **OFF**, heat, or cool) to the controller. If **OFF** is communicated to the controller, the unit closes the outdoor air damper.

Table 50. Outdoor air damper remains open

Probable Cause	Explanation
Unit wiring	The wiring between the controller outputs and the outdoor air damper must be present and correct for normal outdoor air damper operation. Refer to applicable wiring diagram.
Failed end device	Check damper actuator to ensure proper operation.
Normal operation	The controller opens and closes the outdoor air damper based on the controller occupancy mode and fan status. Normally, the outdoor air damper is open during occupied mode when the fan is running and closed during unoccupied mode. (Refer to the section, "Modulating Outdoor/Return Air Damper (UC400)," p. 84.)
Unit configuration	The controller must be properly configured based on the actual installed end devices and application. If the unit configuration does not match the actual end device, the outdoor air damper may not work correctly.

Troubleshooting (ECM)

⚠WARNING

Hazardous Voltage w/Capacitors!

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 an appropriate voltmeter that all capacitors have discharged. Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

⚠WARNING

Safety Alert!

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

- **The BLDC 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. Unplugging the motor is adequate to ensure that there will be no power request.**
- **The adapter boards contain high voltage. Configuration adjustments to the ECM engine 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.**
- **Initial hookups to the CSTI and standard adapter boards, 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.**

Notes:

- *The new Trane BLDC system is a closed loop system that has equipment protections and envelope enforcements. Do not assume that the motor has failed without first consulting the ECM engine status/diagnostics screen. In many cases, the engine shuts down the motor operation and locks it out to prevent equipment damage.*
- *Electric Heat operation and Changeover Coil control on CSTI units are co-coordinated by the ECM engine board. Changeover function on Tracer ZN units can also be affected by incorrect configuration of the ECM engine or improper wiring of terminals to analog*

input 1 on the Tracer ZN controller (polarity sensitivity).

- *The mini-access lid on the front of the main control panel lid has the ECM engine troubleshooting/setup guide affixed to the back of the lid. This guide is unit-specific and should be consulted before determining the disposition of a unit.*

General Information (ECM)

The ECM engine oversees and monitors all motor operations and changes to speed resulting from:

- Direct Fan Speed Requests
  - Customer Fan Speed Switches
  - Thermostat Fan Speed, On or 0–10V requests
  - Automatic Fan Request from Tracer ZN / UC controllers
- Indirect Fan Speed Requests
  - Electric Heat requests will bring the fan to the proper speed.
- Conflicting Fan Speed Requests
  - If two or more commands are received (direct or indirect), the fan will honor the higher speed requested.

Note: *In some cases, indirect requests will result in fan behavior change regardless of whether the end-device fails to actuate (due to device failure, or safety/down-stream lockouts).*

The ECM engine board also coordinates the operation of Electric Heat, Electric/Hydronic Heat lockouts, and CSTI Changeover coil operation.

Troubleshooting Information (ECM)

General system troubleshooting tips (ECM)

- ECM engine configuration must perfectly match the factory-supplied ECM.
  - Refer to "ECM Overview and Setup," p. 45 for troubleshooting configuration of the engine board.
- The ECM engine will display troubleshooting information, and contains dual tachometers to aid in performance verification.
- Under normal circumstances, the ECM engine display will display the operational status of the motors and electric heat circuit/sensors, however, a malfunction will drive a priority display mode that will present the error code instantly to the screen. The error must be cleared by solving by powering down, removing the cause of the problem and restarting the engine board.
- Engine Label setup document (affixed to the back of the low voltage access lid) should be used to verify engine configuration settings.
- For proper operation of the system, all plugs must be firmly seated in all boards and motors. Insecure connections will cause malfunction and the system will shutdown.
- Do not unplug or plug-in motors or connectors while the system is receiving a speed request of any kind. The system must be powered down before plugging or un-plugging 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.

Troubleshooting a motor that does not spin, or spins too slowly (ECM)

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:

These exceptions are:

1. If a motor has been locked out due to engine locked rotor protection:
   - Assuming Motor 1 has an obstruction. In this case, the "Status Display" will be interrupted to display:

     LOCH → mtr 1 → LrPt

     Solution:
     i. Remove obstruction from the fan wheel.
     ii. Ensure that motor plugs and all plugs to adapter boards and the ECM engine board are secure
     iii. 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.
     iv. Verify that m1Lo and m2Lo, the low motor signal output limits, are set correctly.
2. If a motor has been locked out due to overspeed or runaway condition:
   - Assuming Motor 1 has an overspeed condition. In this case, the "Status Display" will be interrupted to display:

     OSPd → mtr 1 → OSPd

     Solution:
     i. Ensure that set-screw is attached firmly to the motor shaft.
     ii. Ensure that motor plugs and all plugs to adapter boards and the ECM engine board are secure.
     iii. Verify that the configuration does not specify a speed lower than 450 rpm for the affected motor. Speeds below 450 rpm are not supported on fan-coil units.

3. VSP Inputs (0–10V inputs) are of the wrong polarity
   – Verify that variable speed (VSP) inputs are properly wired to 1TB4.

   Notes:

   - *Do not short the courtesy 10 Vdc supply to chassis or loads that require greater than 10 mA of DC current.*
   - *Please observe proper polarity of 0–10 Vdc inputs. Failure to observe proper polarity can cause failure of the ECM engine board, the customer-supplied controller or the Tracer ZN controller.*
4. 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.*

   – The ECM Engine board contains an adjustable noise floor parameter, uFLr that can be configured to reject signals below the noise floor.

   – If the noise floor parameter is set too high, it can be lowered as long as there are acceptable noise levels on the inputs lines.

Troubleshooting a motor that spins too fast, or spins without any apparent speed request (ECM)

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.)

Notes:

- *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.*
- *The new fan coil designs incorporate sophisticated fan interlocks that will lockout heat if there is a fan failure.*

If the preceding conditions do not describe the behavior of the unit, the following checks should be performed:

- 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.
- Verify that the fan speed request is not below 450 rpm. Speeds below 450 rpm are not supported on the fan-coil product.
- 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.*

  – For Fan Speed Switch units, that incorporate the Tracer ZN/CSTI adapter board, all inputs to TB3 must be 24 Vac with respect to unit chassis.

  Note: *Do not short 24 Vac (pos 1 or pos 2) to chassis; refer to the unit schematic.*

  – For Tracer ZN units, where there is a desire to use parallel fan inputs on the adapter board TB3 strip, the inputs must be COM (i.e., the inputs will honor only 0 V with respect to unit chassis).

  Note: *Do not short 24 Vac (pos 1 or pos 2) to chassis; refer to the unit schematic.*
- Verify that variable speed (VSP) inputs are properly wired to 1TB4.

  Notes:

  - *Do not short the courtesy 10 Vdc supply to chassis or loads that require greater than 10 mA of DC current.*
  - *Please observe proper polarity of 0–10 Vdc inputs. Failure to observe proper polarity can cause failure of the ECM Engine board, the customer-supplied controller or the Tracer ZN controller.*
- Verify that the signal on the VSP inputs is noise free. The ECM engine board contains an adjustable noise floor parameter, uFLr, that can be configured to reject signals below the noise floor.

  Note: *If the customer supplied controller outputs signals that are below the noise threshold, they will be ignored by the ECM engine.*
- Verify that VSP input settings are correct. The ECM engine board contains an adjustable digital amplifier, A.Sc, 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 faster than the requested ratio, and will hit the limit Ahi1 before the input voltage has reached its upper limit.
- Verify that m1Lo and m2Lo, the low motor signal output limits, are set correctly.

Replacing ECM Components

⚠WARNING

Hazardous Voltage w/Capacitors!

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 an appropriate voltmeter that all capacitors have discharged. Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

⚠WARNING

Safety Alert!

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

- **The BLDC 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. Unplugging the motor is adequate to ensure that there will be no power request.**
- **The adapter boards contain high voltage. Configuration adjustments to the ECM engine 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.**
- **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 ECM engine board. If it is not practical to stay clear of these areas during adjustment of the ECM engine board, 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.**

NOTICE:

Equipment Damage!

The motor harness attached to the single plug to which the motor mates contains the very important 115V motor voltage jumper; the motor harness should always be present for 115V units and should not be modified or substituted. Failure to follow this instruction could result in equipment damage.

Notes:

- *Ensure that drip-loops are maintained on wiring on pipe end of unit to avoid wicking of water into the unit.*
- *Before assuming that any of the boards or components in the new system have failed, please ensure that the ECM engine board has been configured correctly and that the switches on the CSTI board (where applicable) are set correctly.*
- *It is necessary to configure the service replacement ECM engine board before commissioning the unit. The ECM engine board is pre-configured with safe values, but will NOT work correctly unless properly configured.*
- *Only genuine Trane® replacement components with identical Trane part numbers should be used.*
- *Unit fan assemblies contain concealed wires that should be removed before the fan-board is removed, to avoid nicking the wire.*
- *Care should be maintained to retain the order of the motors with respect to the motor plugs. On a unit with two motors, the double-shafted motor will always be to the left side, and will be designated as Motor 2 by the controller.*

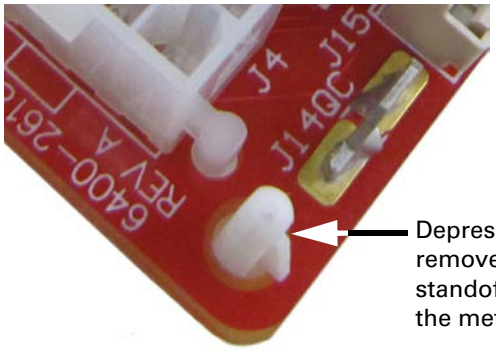
Tips:

- *Ensure that motor nameplate voltage is the same as unit voltage (for 3-phase/ 4-wire units with Neutral, motor voltage will be L-N, not L1-L2).*
- *Ensure that motor harness is correct (harness will have jumper installed for 115V units only).*
- *Ensure that configuration on ECM Engine matches the affixed label.*
- *Maintain correct plug/motor association. The plugs will have the motor number and shaft configuration printed on an affixed label.*
- *Ensure that configuration of switches on CSTI adapter board matches depiction of switches on the unit schematic.*
- *Ensure that all wires are plugged in securely.*
- *Ensure that edge protection on sharp edges, grommets, and wire management devices are maintained when replacing components.*
- *Ensure that blunt-tip screws are used when in the proximity of wire harnesses.*

Circuit Modules Replacement Notes/Work Instructions

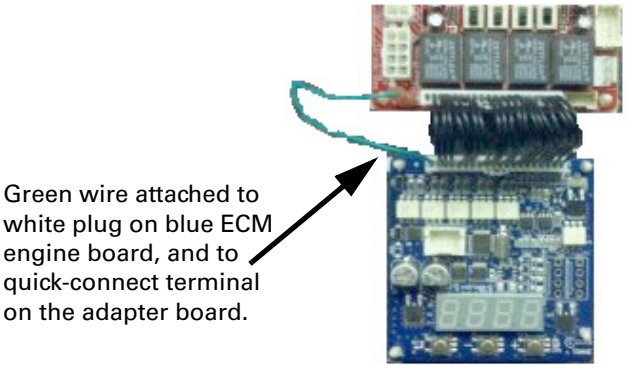
1. Circuit modules are equipped with nylon standoffs which can either be removed by squeezing the barbs at the rear of the control panel, or squeezing the latch above the circuit module. If the latter method is chosen, the standoffs will be retained on the metal panel. The new standoffs (affixed to the replacement modules) can be removed if necessary, so the new module circuit board can be attached to the retained standoffs.

Figure 67.

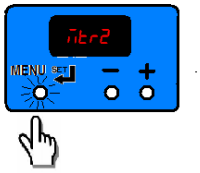


2. If replacing the ECM engine module, special care should be taken to avoid electro-static discharge damage. Please use an ESD protection wrist-strap and frequently touch a grounded surface (with unit power off) to discharge any static buildup.
3. Replace connectors carefully onto the appropriate board. For units with a green wire attached to the CSTI or standard adapter boards, please **ensure that the green wire is attached to the engine board white connector** as shown in Figure 68.

Figure 68.

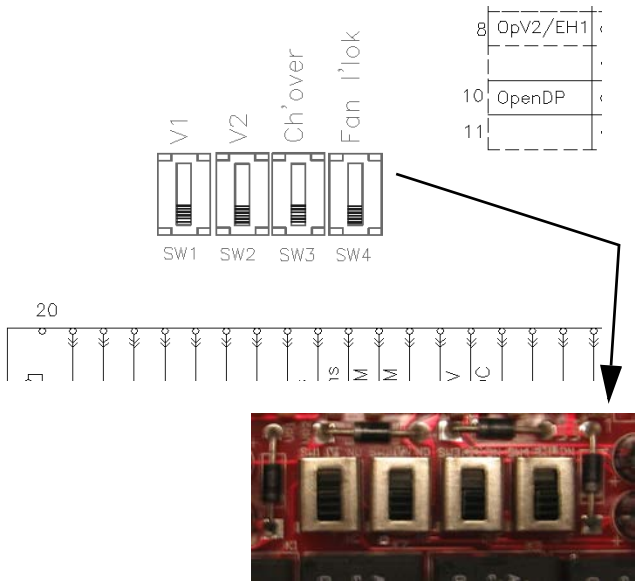


4. Ensure that the new ECM engine controller is configured to match the ECM engine configuration label that is present on the unit. It is necessary to configure the ECM engine board to avoid improper operation of the unit, discomfort to the end user, and loud fan operation.



5. Ensure that the CSTI adapter board switches are set correctly, as indicated on the attached unit schematic (where applicable).

Figure 69.



6. After replacing modules, commission the unit by performing at a minimum, "Fan Speed Response Verification," p. 64.

Softsetting the IMC Address of an ECM Engine Module

When a blower coil, fan-coil, or unit ventilator application requires an ECM engine module, the Tracer UC400 requires that the ECM engine module be configured at IMC address 99. If an engine module is found at an address other than 99 (as it will be in a field application / hardware replacement scenario), Tracer TU populates the Expansion Module box on the Controller Status screen as shown here.

Figure 70.

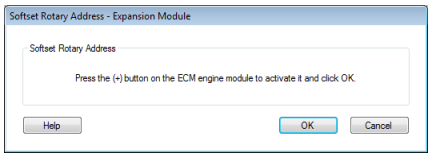
Notice one ECM type is configured at address 99, but no ECM is found at that address. Also, notice that another ECM has been found with an address of 0. When this situation occurs, Tracer TU displays a Softset… button you can use to configure the engine module address.

Complete the following steps to softset the engine module address:

1. Click the **Softset…** button to initiate the softest procedure.

   Tracer TU displays the Softset Rotary Address - Expansion Module dialog box.

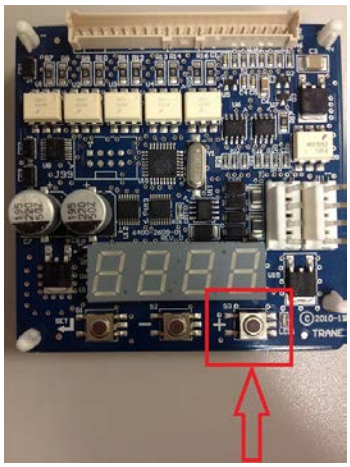
Figure 71.



2. Prior to clicking OK, activate the engine module using the **(+)** button on the ECM engine board in the control box.

   Once the engine module is activated, the LED to the right of the (+) button lights up.

Figure 72.



3. Once the light has been activated, click **OK** on the Softset Rotary Address - Expansion Module dialog box shown in Step 2.

   When you click OK, Tracer TU softsets the engine module IMC address to 99 and the light on the module will turn off.

4. Return to the Expansion Module Status box, click **Discover** and wait five to ten seconds for Tracer TU to refresh the screen.

   Once complete, the value in the Error column updates to None and the Status column updates to Comm Up.

Figure 73.

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