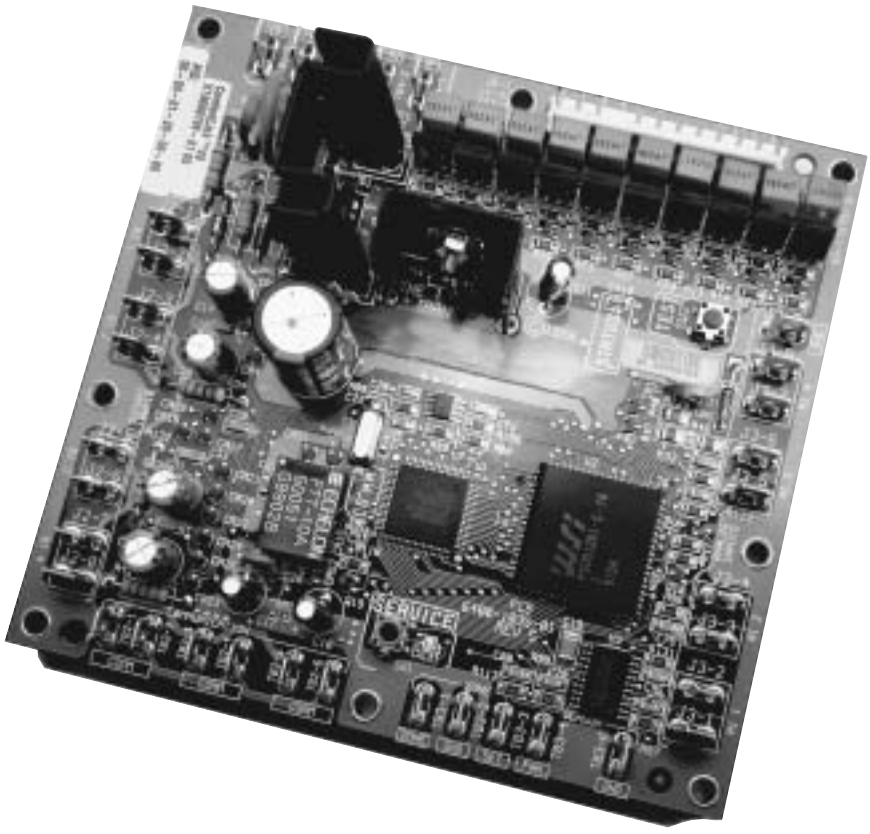
Installation - Operation - Maintenance and user guide

Trane ZN. LonWorks® control for fan coil units and chilled water cassettes (CWS)



CNT-SVX13B-E4

General information

About this manual

These instructions are given as a guide to good practice in the installation, start-up, operation and periodic maintenance by the user of Trane ZN. LonWorks® control. They do not contain the full service procedures necessary for the continued successful operation of this equipment. The services of a qualified service technician should be employed, through the medium of a maintenance contract with a reputable service company. Cautions appear at appropriate places in this instruction manual. Your personal safety and the proper operation of this machine require that you follow them carefully. The constructor assumes no liability for installations or servicing performed by unqualified personnel.

Warranty

Warranty is based on the general terms and conditions of the constructor. The warranty is void if the equipment is modified or repaired without the written approval of the constructor, if the operating limits are exceeded, or if the control system or the electrical wiring is modified. Damage due to misuse, lack of maintenance, or failure to comply with the manufacturer's instructions, is not covered by the warranty obligation. If the user does not conform to the instructions given in this document, it may entail cancellation of warranty and liabilities by the constructor.

Reception

When the unit arrives on site, check it has not been damaged in any way during transport. If damage is observed, or even merely suspected, notify the carrier within 24 hours by registered letter. Notify the local sales office at the same time. The unit should be totally inspected within 3 days of delivery.

Contents

Description

The Tracer® ZN. unit controller is a microprocessor-based direct digital controller that is dedicated to the control and the optimization of chilled water terminal units. The unit controller is designed to provide improved comfort with a minimum energy consumption through the use of custom proportional integral derivative (PID) control algorithms as well as intelligent fan speed and setpoint control strategies. Moreover, the controller maintains the discharge air temperature using a cascade control algorithm. The discharge air temperature is based on the difference between the space temperature and setpoint so the unit capacity modulates to achieve the PID calculated discharge air temperature setpoint, which gives an incomparable level of comfort.

The controller is factory installed and pre-commissioned, resulting in a highly integrated product, reduced installation and commissioning time.

The following configurations are supported by the controller:

- 2-pipe cooling only
- 2-pipe changeover + electric heater
- 2-pipe cooling + electric heater
- 2-pipe changeover
- 2-pipe heating only
- 4-pipe

For those units which require auto changeover with a 2-pipe system, a sensor measures the entering water temperature as to determine whether the installation is in cooling or heating mode. Using the entering water temperature sampling function (see control features), the auto changeover units can also be used with two-way valves. Typically the control loop includes:

- 1 ZN. LON controller (located into the unit's control panel)
- 1 return air sensor or 1 remote, wall mounted, room sensor
- 1 discharge air temperature sensor
- 1 changeover sensor (following the application)
- 1 or 2 valves and actuators

Features

The ZN. unit controller may be applied as part of a Trane Tracer Summit™ system, as a stand-alone device, or as an interoperable controller. The unit controller may be applied in a peer-to-peer communication environment, where data can be exchanged between similar controllers without requiring a master device.
In stand-alone configuration, ZN. receives operation commands from the zone sensor. The zone sensor module is capable of transmitting the following information to the controller:

- Zone setpoint
- Current zone temperature
- Fan mode selection (Off-Auto-High-Medium-Low)
- Timed override on/cancel request

In network configuration, ZN. can either receive its operating parameters from the wall thermostat and/or from a BMS connected on the network.

Occupancy modes

Four occupancy modes are controlled:

- **Occupied (or Comfort):** This is the normal operating mode for occupied spaces or daytime operation. This mode uses the occupied cooling and heating setpoints. The controller is selecting automatically (if auto) the lowest fan speed, the valve or the electric heater (if present) are modulating in order to maintain the requested setpoint.
- **Occupied Standby (or Economy) [only available in network + BMS configuration]:** Mode used to reduce the heating and cooling operation during the occupied hours when the space is vacant or unoccupied. Setpoints are widened thus reducing energy consumption. This mode is selected when the communication request is 'occupied' and the occupancy input indicates 'unoccupied' (see binary inputs). Occupied standby cooling and heating setpoints are activated in this mode.
- **Unoccupied (or Antifreeze):** Normal operating mode for unoccupied spaces or nighttime operation. Unoccupied cooling and heating setpoints are activated. If the zone temperature deviates outside of the unoccupied setpoints, the high speed is automatically selected.
- **Occupied Bypass (or Night override):** Mode used for timed override conditions. In occupied bypass mode, the controller is using the occupied cooling and heating setpoints for 120 minutes (factory setting). This mode is selected when the communication request is 'unoccupied' and an occupant presses the 'On' pushbutton on the remote zone sensor when present. This mode stops when the time elapsed, the occupant presses the 'Cancel' pushbutton on the remote zone sensor or the communication request switches to 'occupied'.

Features

Table 1 describes the combination of communication requests, the hardwire input and the 'ON' (occupied)/'CANCEL' (unoccupied) push buttons on the zone sensor upon the occupancy state of the control.

Table 1

Description occupancy	Communicated request	Binary input	On/Cancel pushbuttons	Effective mode
Stand alone	N/A	Occupied	'On'	Occupied
Stand alone	N/A	Occupied	'Cancel'	Occupied
Stand alone	N/A	Unoccupied	'On'	Occupied bypass
Stand alone	N/A	Unoccupied	'Cancel'	Unoccupied
Communicating	Occupied	Occupied	'On'	Occupied
Communicating	Occupied	Occupied	'Cancel'	Occupied
Communicating	Occupied	Unoccupied	'On'	Occupied standby
Communicating	Occupied	Unoccupied	'Cancel'	Occupied standby
Communicating	Occupied standby	Occupied	'On'	Occupied bypass
Communicating	Occupied standby	Occupied	'Cancel'	Occupied standby
Communicating	Occupied standby	Unoccupied	'On'	Occupied bypass
Communicating	Occupied standby	Unoccupied	'Cancel'	Occupied standby
Communicating	Unoccupied	Occupied	'On'	Occupied bypass
Communicating	Unoccupied	Occupied	'Cancel'	Unoccupied
Communicating	Unoccupied	Unoccupied	'On'	Occupied bypass
Communicating	Unoccupied	Unoccupied	'Cancel'	Unoccupied

N/A = Not available

Setpoint operation

The controller has three sets of possible heating and cooling setpoints:

- Occupied
- Occupied standby [network application only]
- Unoccupied

Occupied setpoints are calculated from the local setpoint given by the local zone sensor (thumbwheel) when present, communicated from the BMS or the controller can use his own default values if two first are not present.
From the local setpoint, they are calculated as following:

Occupied heating setpoint = Default occupied heating setpoint + offset

Occupied cooling setpoint = Default occupied cooling setpoint + offset

with offset = local setpoint - ((default occupied cooling setpoint + default occupied heating setpoint)/2)

Occupied standby setpoints are also calculated from the local setpoint with the following formula:

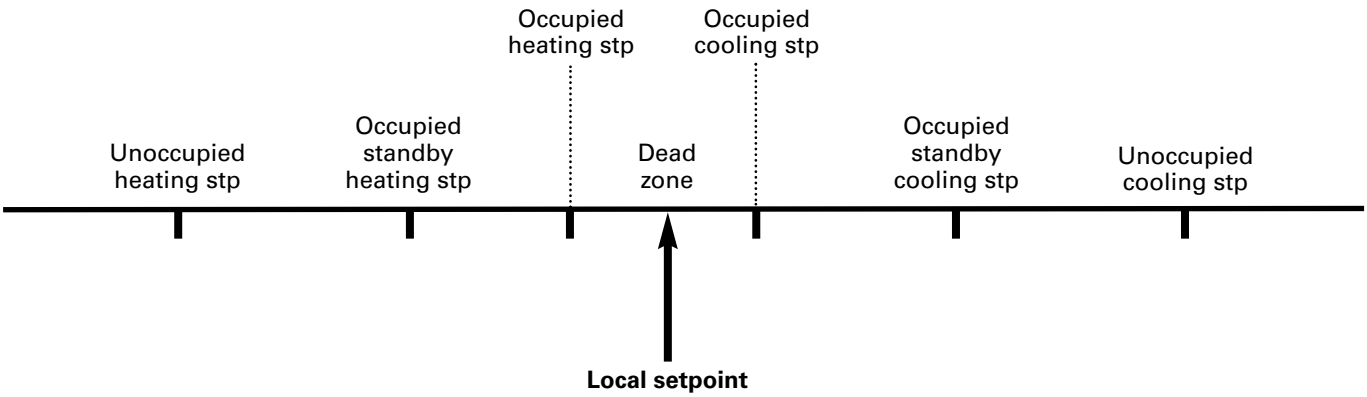
Occupied standby cooling stp = Default occupied standby cooling setpoint + offset

Occupied standby heating stp = Default occupied standby heating setpoint + offset

Unoccupied setpoints are stored values (factory-downloaded) (see default values).

Features

Figure 1



Typically, the range of the local setpoint is from 10°C to 29°C. The effective setpoint can be limited in cooling and heating mode via configuration parameters (see default values).

Automatic Heat/cool mode determination

The controller automatically determines whether heating or cooling is needed based on space and system conditions. Utilizing a cascade proportional/integral (PI) control algorithm to maintain the space temperature at the active heating or cooling setpoint. The controller measures the space temperature and reads the temperature setpoint to determine the required unit's heating or cooling capacity (0-100%) and drive the fan speed (if 'auto') and the valve position accordingly.

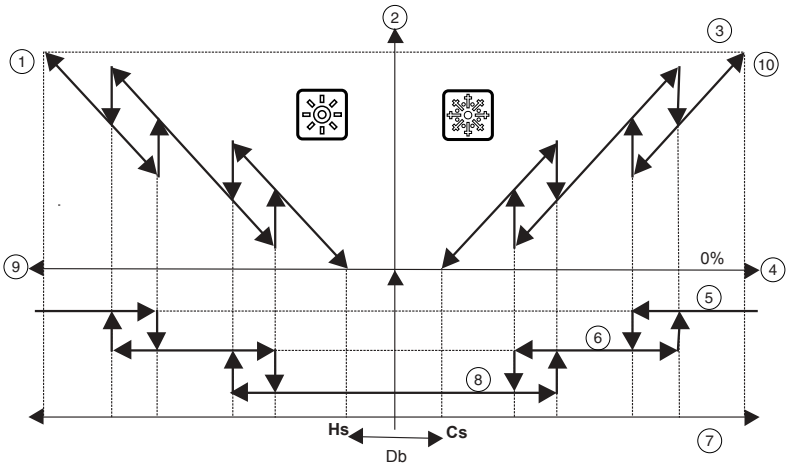
Sequence of operation

Off: Fan is off, valves are closed.
Auto: Fan speed control in the auto setting allows the modulating control valve option and three-speed fan to work cooperatively to meet precise capacity requirements, 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 (water valve fully open), the fan automatically 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 (see figures 2 and 3).

Low, Medium, High: The fan will run continuously at the selected speed and the valve will cycle to meet the setpoint.

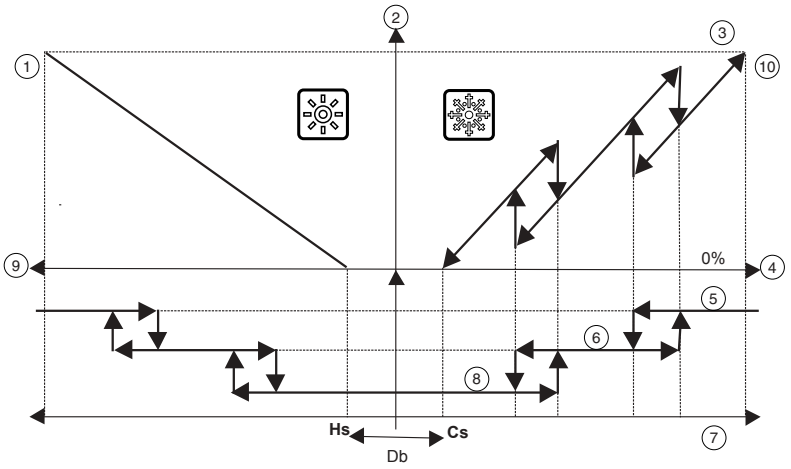
Features

Figure 2 - Example: 2-pipe cooling / 2-pipe heating / 2-pipe changeover / 4-pipe operation



Hs = Heating setpoint (occupied)
Cs = Cooling setpoint (occupied)
Db = Dead band
1. Heating valve
2. Valve position
3. 100% Open
4. Cooling
5. High
6. Medium
7. Fan speed
8. Low
9. Heating
10. Cooling valve

Figure 3 - Example: 2-pipe cooling + electric heater / 2-pipe changeover + electric heater operation



Hs = Heating setpoint (occupied)
Cs = Cooling setpoint (occupied)
Db = Dead band
1. Electric heater
2. Valve position
3. 100% Open
4. Cooling
5. High
6. Medium
7. Fan speed
8. Low
9. Heating
10. Cooling valve

Note: Two-pipe changeover units with electric heater use the electric heat only when hot water is not available. The use of hot water AND electric heater is not supported. If a unit with electric heater is controlled off, then the fan is energized during 30 seconds after the electric heater stops.

Features

Control features

Entering Water Temperature Sampling Function (optional)
A 2-pipe changeover system that uses a two-way control valve might not sense the correct entering water temperature during long periods when the control valve is closed. This function periodically samples the entering water temperature by opening the valve. Then the controller reads the entering water temperature for up to 3 minutes to check if the correct water temperature is available for the selected operating mode. The entering water temperature must be 2.5°K or more above the space temperature to allow heating and 2.5°K or more below the space temperature to allow cooling. If the water temperature is not suitable with the selected operating mode, then a new sampling occurs 60 minutes later.
Note: This changeover sensor is factory-wired and is coiled to the unit side for mounting on customer-supplied piping. This sensor must detect accurate water temperature for proper changeover.

Random Start
In order to reduce electrical spikes at power up in the building, especially when the units are equipped with electric heater option, multiple unit start-ups are randomly and automatically staggered from 5 to 32 seconds.

Filter Maintenance Status
For ease of maintenance, the ZN controller has a built-in timer that, when it reaches zero, can initiate an alarm notification to Trane Tracer Summit™ system. The filter maintenance status is based on cumulative fan run hours. Factory default value is 300 hours.

Water Valve Override
Using Tracer Summit™, the water valve override function drives all water valves in every unit fully open simultaneously. This helps reduce the time required for waterside balancing. After two hours, if no information has been sent, the controller returns to its normal operation.

Freeze avoidance function
This function has been especially designed for units equipped with a fresh air inlet. If the discharge air temperature falls below the 'freeze avoidance setpoint', then the controller reacts in order to prevent the coil to freeze. The fan is stopped, the cooling and heating outputs are energized.

Freeze protection
If the discharge air temperature drops below the 'discharge air low limit' then the unit shuts down and must be restarted manually. See 'Resetting diagnostics'

Manual Output Test Function
This feature is an invaluable tool for troubleshooting a unit. By simply pressing the controller's test button, service personnel can manually exercise outputs in a pre-defined sequence.

Binary inputs

Occupancy / windows contact (B13 - J2-5/J2-6 on the controller)
To allow energy savings to take place, the occupancy binary input can be wired up to a motion sensor, card reader, window contact or time clock, and will turn the unit from occupied to unoccupied mode whenever the space occupancy is not proved. This binary input is factory-configured as Normally Open (NO) and is used for two occupancy-related functions:
- For stand alone controllers (any unit not receiving a communicated occupancy request)
- For controllers that receive a communicated occupancy request (typically from a building automation system such as Tracer Summit™):

Refer to Table 1 to see the effect of the binary input upon the occupancy state of the control.

Features

Condensate overflow (J2-3 & J2-4 on the controller)

For UniTrane fancoils and HFO/HFR ductable units, if a condensate pump is used with the unit (not supplied by Trane), it is possible to connect the condensate overflow switch to the controller through this binary input. When the condensation reaches the trip point, the condensate overflow signal will generate a diagnostic that disables fan operation, closing all unit water valves (when present), turning off the electric heater (when present). Although the condensate overflow automatically resets when the condensation returns to a normal level, the unit needs to be restarted manually. The overflow switch has to be wired directly on the controller input BI 2.
The binary input is factory configured to normally open (NO) so:
If the contact is open ➜ Normal unit operation
If the contact is closed ➜ Unit shutdown (need a manual restart).
For CWS units, the condensate pump is factory-mounted and connected to the controller. In this case, the binary input is factory-configured to normally closed (NC) so:

If the contact is closed=normal unit operation

If the contact is open=unit shutdown (needs a manual restart)

Generic I/O (on the controller)
Tracer™ ZN. unit controller comes equipped with three generic points for use with a Tracer Summit™ system:
- Generic Binary Input (Shared with occupancy) (J2-5/J2-6 on mainboard)
- Generic Binary Output (TB4-1/TB4-2 on mainboard)
- Generic Analog Input (4-20mA, humidity sensor, CO^2 sensor or other) (J3-7/J3-8 on mainboard)

The two generic inputs are only for passing information to the BAS system. They do not have any effect on the unit's operation. The generic binary output is controlled from the BAS system and its state is not affected by unit operation, even under a diagnostic shutdown.

Communication

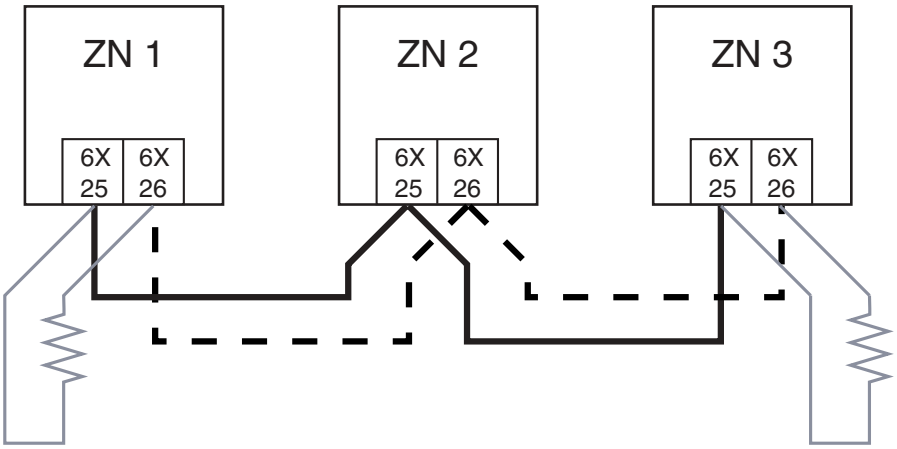
For optimal system performance, fan coil units can operate as part of an Integrated Comfort™ System (ICS) building automation. The ZN controllers are linked directly via a twisted shielded pair cable to the Tracer Summit™ building control unit which acts as a communication server. Direct integration of ZN controllers into Tracer Summit™ allows for a highly flexible system and additional features.
As an example, master/slave interactions can be easily established according to floor layout and can be modified when this layout change with very little specific engineering requirement. ZN controllers are fully compliant with LonMark® specification and are LonMark® certified. This means they can easily be integrated into any Lon network, Lon compatible BMS and complies with SCC profiles as to increase interoperability capability. Their mandatory and optional network variables can then be accessed with any standard LonMark® tool. The configuration of the controller can be done through the use of any software tool matching EIA/CEA 860 standard plug ins.

Peer-to-peer communication
Tracer™ ZN. uses LON communication interface type FTT - 10A.
It allows peer-to-peer (also referred to as master/slave) data communication. Data such as zone temperature, setpoint, and occupancy can be shared from a master control to a peer control with or without the presence of Tracer Summit™. This communication allows all units to operate with the same data to prevent conflicts between units (see figure 4). This way of communication data between devices is called "custom binding".

For futher detail, refer to the official documentation LonWorks® FTT-10A free topology transceiver user's guide and to the official LonWorks® guidelines LonMark® layer 1-6 interoperability guidelines version 3.0. These documents and additional information are available on the Internet site www.lonmark.org.

Features

Figure 4 - Daisy chain topology



Wiring Communication Link
To ensure proper network communication, follow the recommended wiring practices outlined in this section.
Recommended wiring practices
Follow these guidelines when installing communication wire:

- Although LonWorks® FFT-10A does not require polarity sensitivity, Trane recommends keeping polarity consistent throughout the site.
- Do not run communication wire alongside or in the same conduit as 230 Vac power.
- In open plenums, avoid running wire near lighting ballasts.
- Use a daisy chain configuration. See Figure 4. Trane strongly recommends using a daisy chain topology. Other topologies (branch, star…) are much less reliable.
- Use termination resistors as described in "Placing termination resistors".
- Insulate termination-resistors leads.
- Use only one type of communication wire (same characteristics wire).

Placing termination resistors
LonWorks® FTT-10A communication links require termination resistors. To correctly place termination resistors, follow these guidelines:

- Terminate a daisy chain configuration with a 105 ohm resistor at the extreme end of each wire.
- If a repeater is used, each link of the configuration that is created by the repeater requires termination resistors.

Cable characteristics
Level 4 cable may be used with TP/FT-10 channels. The level 4 cable specification used by Echelon and as originally defined by the National Electrical Manufacturers Association (NEMA) differs from the Category 4 specification proposed by the Electronic Industries Association / Telecommunication Industries Association (EIA /TIA). The following specifications can be used by cable suppliers to identify a compliant Level 4 cable.

Features

Specifications apply to shield or unshielded 22AWG (0.65mm²) cable	
D-C resistance (ohms/1000 feet at 20°C) maximum for a single copper conductor regardless of whether it is solid or stranded and is or is not metal coated	18.0
D-C resistance unbalance (percent) maximum	5
Mutual capacitance of a pair (pF/foot) maximum	17
Pair to ground capacitance unbalance (pF/1000 feet) maximum	1000
Characteristic impedance (ohms)	
772 kHz	102+/- 15%
1.0 MHz	100 +/- 15%
4.0 MHz	100 +/- 15%
8.0 MHz	100 +/- 15%
10.0 MHz	100 +/- 15%
16.0 MHz	100 +/- 15%
20.0 MHz	100 +/- 15%
Attenuation (dB/1000 feet at 20°C) maximum	
772 kHz	4.5
1.0 MHz	5.5
4.0 MHz	11
8.0 MHz	15
10.0 MHz	17
16.0 MHz	22
20.0 MHz	24

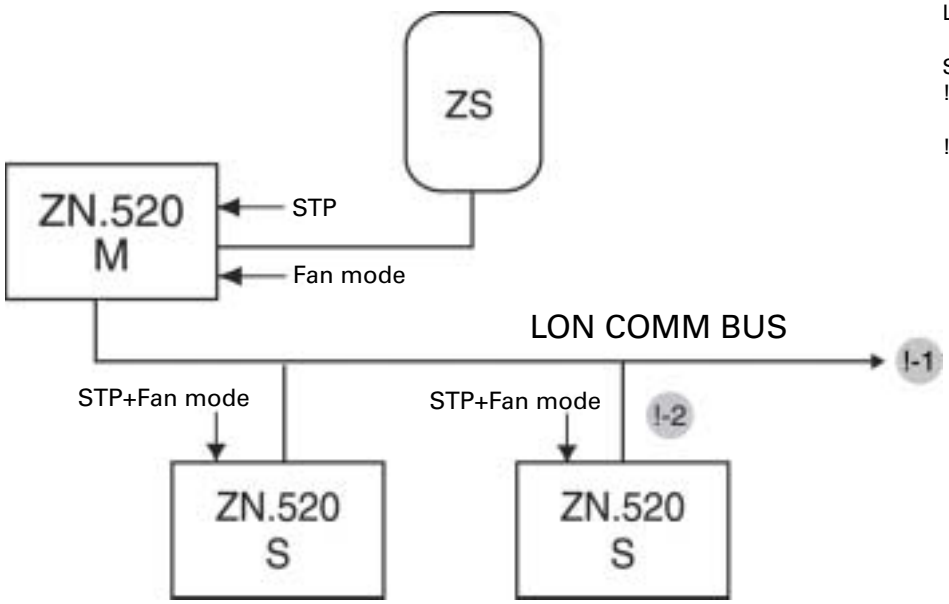
Worst pair to pair near end crosstalk (dB) minimum. Values are shown for information only. The minimum NEXT coupling loss for any pair combination at room temperature is to be greater than the value determined using the formula NEXT (F MHz)>NEXT (0.772)-15log10(F MHz / 0.772) for all frequencies in the range of 0.772 MHz for a length of 330 meters.

772 kHz	58
1.0 MHz	56
4.0 MHz	47
8.0 MHz	42
10.0 MHz	41
16.0 MHz	38
20.0 MHz	36

For the TP/FT-10 channel operating in a bus topology , the maximum bus length of level 4 22AWG (0.65 mm²) cabling is 1400 meters with a maximum stub length of 3 meters. It is recommended to use shielded cable if high amplitude modulation noise exist or transient protection is required.

Features

Figure 5 - Simple data sharing application



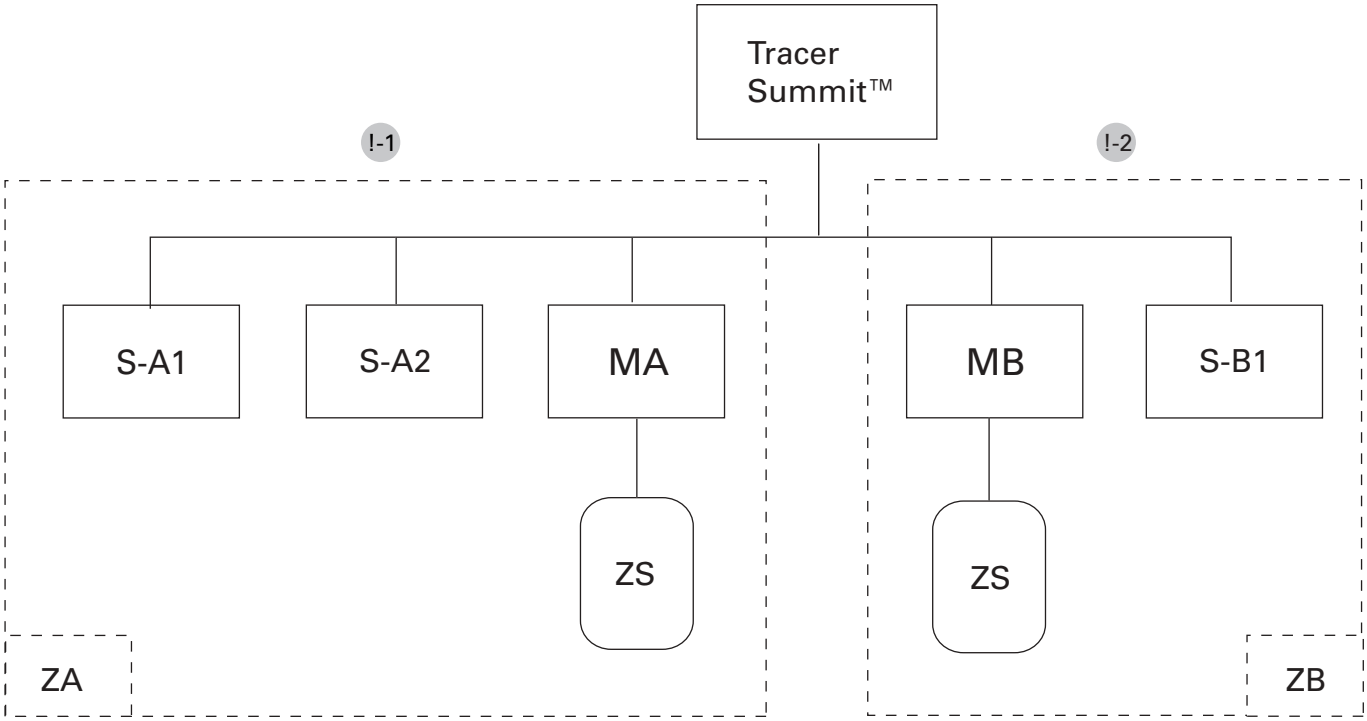
ZS = Zone sensor
M = Master
S = Slave
LON COMM BUS = LON communication bus
STP = Setpoint
!1= Maximum 1400 m with the use of 1 repeater
!2= Maximum 60 devices (120 with 1 repeater)

In Figure 5, multiple masters and slave controllers are connected on the same communication link with Tracer Summit™. The master for Zone A is the only controller with a zone sensor.
Master A communicates data to slave controllers A1 and A2. Connected to the same communication link, the master controller for Zone B is connected to the zone sensor and communicates data to slave B1.

Tracer Summit, in that case, acts as a system optimizer for the two zone systems, and allows for coordination with other systems components such as chillers, lifts, or fire safety systems.

Features

Figure 6 - More complex data sharing application



ZS = Zone sensor
MA = Master zone A
MB = Master zone B
S-Ax = Slave x zone A
S-Bx = Slave x zone B
ZA = Zone A
ZB = Zone B
!1= Maximum 1400 m with the use of 1 repeater
!2= Maximum 60 devices (120 with 1 repeater)

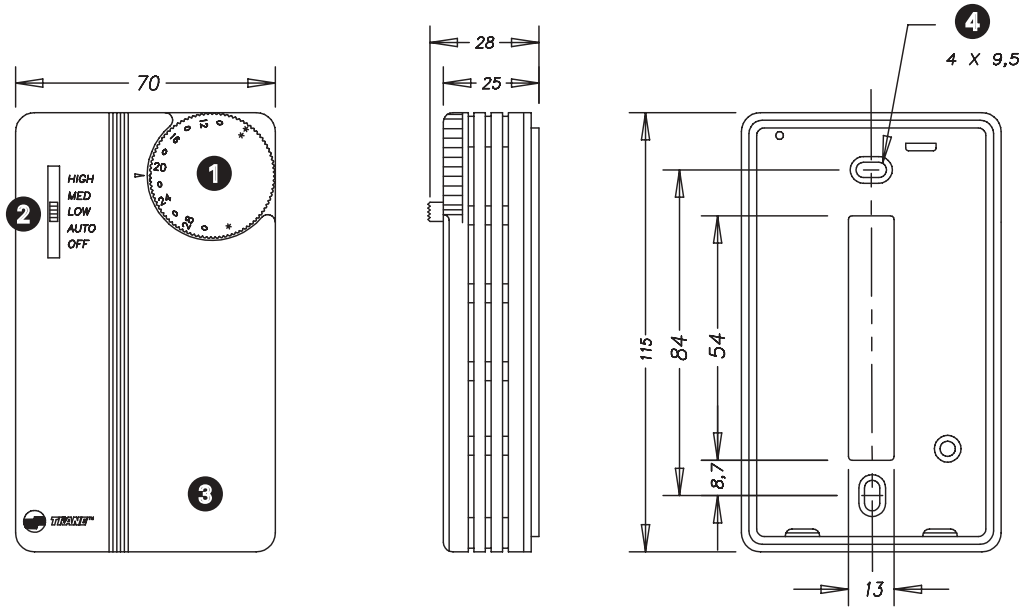
Features

Zone sensor option

Two zone sensors can be connected to the ZN. control :

- A simplified option zone sensor - TH02
- A full option zone sensor - TH01

Figure 7 - Simplified option zone sensor - TH02 Ref 35168531-001



❶ External adjustable thumbwheel (setpoint)

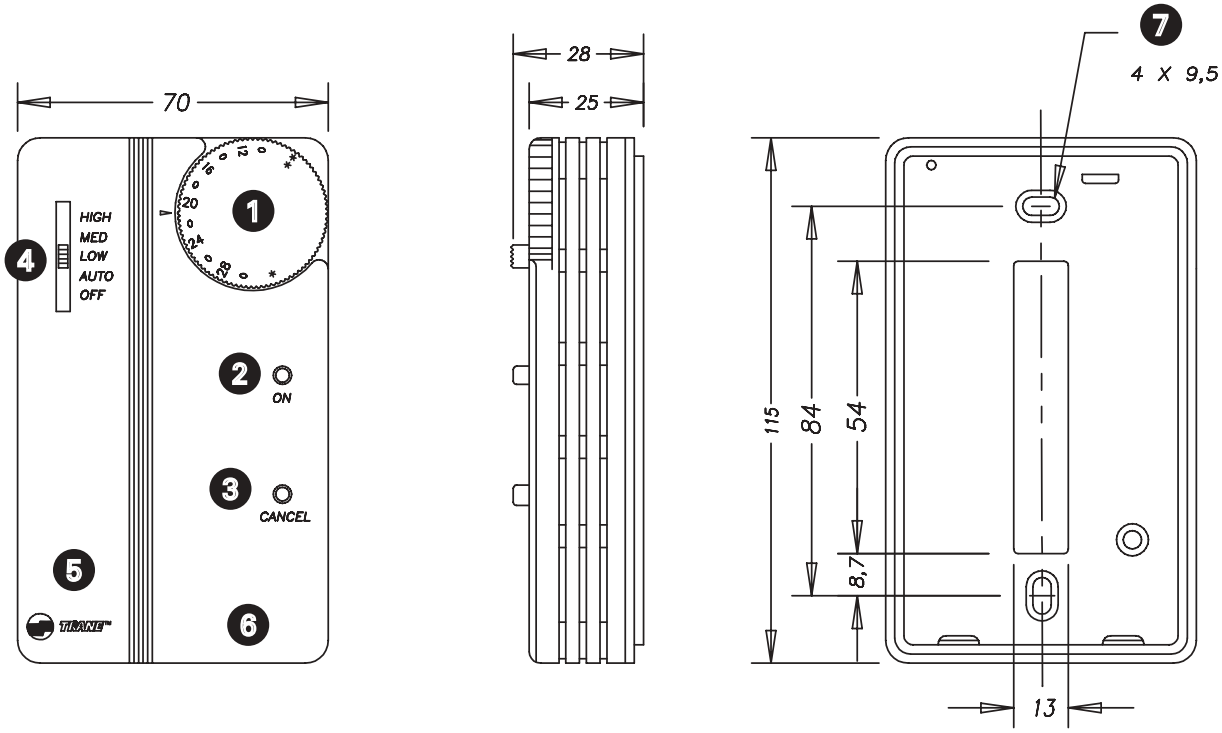
❷ High/Medium/Low/Auto/Off fan speed switch

❸ Built-in air temperature sensor

❹ Drilling hole

Features

Figure 8 - Full option zone sensor - TH01 Ref 35168530-001



❶ External adjustable thumbwheel (setpoint)

❷ Occupied mode /Timed override button

❸ Unoccupied mode / Cancel override button

❹ High/Medium/Low/Auto/Off fan speed switch

❺ Built-in air temperature sensor

❻ Internal communications jack for easy connection to the Rover Service tool (RJ-11 type)

❼ Drilling hole.

Features

Zone sensor technical features

Color of the wall sensor: light grey pantone #2C (equivalent to RAL 9002)
Room temperature sensor: 10 kohms at 25°C +/- 0.2°C
Thumbwheel : 1 kohms +/- 10%
Working temperature: -18°C to 65°C
Figures 9 and 10 show the wiring of the zone sensors.

Figure 9 - Zone sensor only

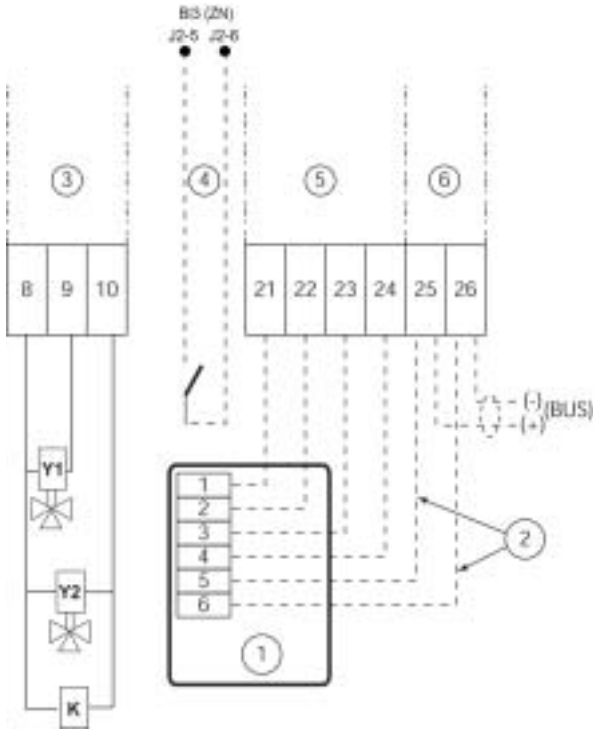
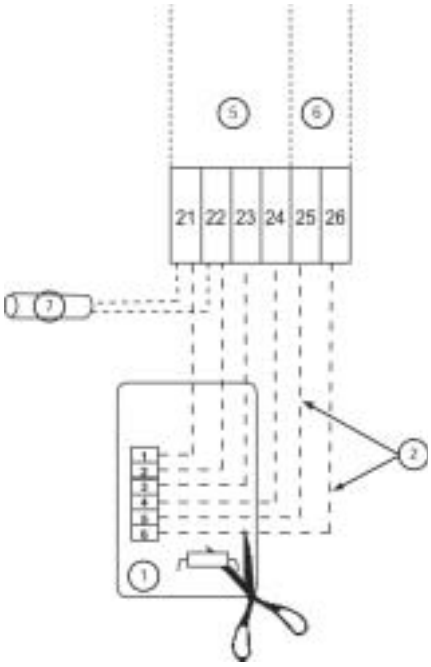


Figure 10 - Zone sensor + return air sensor



1 = Zone sensor

2 = Communication link (TH01 only)

3 = Factory-wired

4 = Occupancy window contact

5 = Zone sensor temperature sensor

6 = Communication BUS

7 = Return air sensor -
Ref 35168528-001

Note: If a return air sensor is present, the internal sensor of the wall sensor must be cut on jobsite.

---------- Wiring to be done on job site
———————— Wiring done in the factory

Features

Table 2 - Recommended cables

Description	Cable	Maximum length	Polarity	Wiring on terminals
Occupancy	1 pair 0.9mm²	30 m	No	J2-5 & J2-6 on printed board (B1 3)
Condensate overflow	1 pair 0.9mm²	30 m	No	J2_3 & J2_4 on printed board (BI 2)
Zone sensor	2 pairs* 0.9mm²	60 m	No	21, 22, 23, 24
Communication link capacitance 72 +/- 6 pF/m max	1 pair* 0.9mm²	500 m between repeaters	Yes	25, 26

* Wire must be plenum rated, shielded twisted pair with strand, tinned copper conductors

Specifications (ZN controller)
Power supply: from 24VAC transformer fuse protected (secondary)
Operating Environment: 0 to 60°C, 5% to 95% non-condensing
Storage Environment: -40 to 85°C, 5% to 95% non-condensing
Agency Listings: UL 916 Energy Management System
Agency Compliance IEC 1000-4-2 (ESD), IEC 1000-4-4(EFT), IEC 1000-4-5 (Surge) FCC Part 15, Class A

Default values (factory-downloaded)

Unoccupied cooling setpoint:	30°C	
Default occupied standby cooling setpoint:	25°C	
Default occupied cooling setpoint:	22°C	
Default occupied heating setpoint:	20°C	
Default occupied standby heating setpoint:	17°C	
Unoccupied heating setpoint:	14°C	
Cooling setpoint high limit:	28°C	
Cooling setpoint low limit:	14°C	
Heating setpoint high limit:	26°C	
Heating setpoint low limit:	12°C	
Timed override period:	120 minutes	
Freeze avoidance setpoint:	6°C	
Discharge air low limit:	3°C	
Control point high limit:	65.5°C	
Control point low limit:	12°C	
Binary input 2: (J2-3/J2-4)	Condensate overflow	UniTrane,HFO/HFR= Normally Open, CWS=normally closed
Binary input 3: (J2-5/J2-6)	Occupancy	Normally Open
Analog input 3: (J3-5/J3-6)	Outdoor air temperature	
Analog input 4: (J3-7/J3-8)	Generic device	
Binary output 10:	Generic	Normally Open
Fan operation, cooling:	Continuous	
Fan operation, heating:	Continuous	
Default fan speed, cooling:	Auto	
Default fan speed, heating:	Auto	
Space temperature sensor offset:	0.0°F	
Hardwired setpoint offset:	0.0°F	
Maintenance required time setpoint:	300h	
Power-up control wait:	0s	

Features

Data lists

Tables 3 and 4 provide the input/output listing and the configuration properties for the unit controller. The content of the lists conforms to both the LonMark® Space Comfort Controller Functional Profile 85.00 and the LonMark® node object.

Table 3 - Input/output listing (1)

Input	SNVT type	Output	SNVT type
nviRequest	SNVT_obj_request	nvoStatus	SNVT_obj_status
nviSpaceTemp	SNVT_temp_p	nvoFileDirectory	SNVT_address
nviSetpoint	SNVT_temp_p	nvoSpaceTemp	SNVT_temp_p
nviSetptOffset	SNVT_temp_p	nvoUnitStatus	SNVT_hvac_status
nviOccSchedule	SNVT_tod_event	nvoEffectSetpt	SNVT_temp_p
nviOccManCmd	SNVT_occupancy	nvoEffectOccup	SNVT_occupancy
nviOccSensor	SNVT_occupancy	nvoHeatCool	SNVT_hvac_mode
nviApplicMode	SNVT_hvac_mode	nvoSetpoint	SNVT_temp_p
nviHeatCool	SNVT_hvac_mode	nvoDischAirTemp	SNVT_temp_p
nviFanSpeedCmd	SNVT_switch	nvoTerminalLoad	SNVT_lev_percent
nviComprEnable	SNVT_switch	nvoSpaceRH	SNVT_lev_percent
nviAuxHeatEnable	SNVT_switch	nvoOutdoorTemp	SNVT_temp_p
nviValveOverride	SNVT_hvac_overid	nvoSpaceCO2	SNVT_ppm
nviEmergOverride	SNVT_hvac_emerg	nvoEnterWaterTemp	SNVT_temp_p
nviSourceTemp	SNVT_temp_p		
nviSpaceRH	SNVT_lev_percent		

(1) LonMark certification pending

Table 4 - Configuration properties (1)

Configuration property	SNVT type	SCPT reference	Description
nciSndHrtBt	SNVT_time_sec	SCPTmaxSendTime (49)	Send heartbeat
nciSetpoints	SNVT_temp_setpt	SCPTsetPnts (60)	Occupancy temperature setpoints
nciUnitType	SNVT_hvac_type	SCPThvacUnitType (169)	Unit type
nciMinOutTm	SNVT_time_sec	SCPTminSendTime (52)	Minimum send time
nciRcvHrtBt	SNVT_time_sec	SCPTmaxRcvTime (48)	Receive heartbeat
nciLocation	SNVT_str_asc	SCPTlocation (17)	Location label
nciBypassTime	SNVT_time_min	SCPTbypassTime (34)	Local bypass time
nciSpaceRHSetpt	SNVT_lev_percent		Space RH Setpoint
nciOAMinPos	SNVT_lev_percent		Minimum outside air position during occupied mode

(1) LonMark certification pending

Features

Modulating valve package

The control valve is modulating depending on the 24V triac signal from the controller, which determines the valve position by a control algorithm. If the valve loses power, the valve returns to the close position. Valve packages are factory-mounted and leak-tested at 13 bar. Depending on the application, a 2-way or a 3-way/4-port valve is available.

Actuators

Electro-thermic actuators for 2-way and 3-way valves

Power supply	24 VAC(±10%) 50Hz/60Hz
Initial current	0.7 A (17W)
Permanent current	0.09 A
Power	3 W
Maximum stroke	8 mm
Opening time	4 min
Closing time	4-6 min. depending on heating time
Differential pressure	1.5 bar
Ambient temperature	0-50°C
Protection standard	IP43 for vertical installations, actuator pointing upwards, IP40 for horizontal installations

Valve bodies

2-way modulating valves

Action	Normally Closed (NC)
Water temperature	2-130°C
DN size	15 mm or 20 mm (see table below)
Connection diameter	½" gas or ¾" gas (see table below)
Port connection type	Flat sealing
Static pressure	PN16
Maximum stroke	6.5 mm
Flow characteristic	Equal percentage
Leakage rate	0.02% of kvs
Close-off pressure	250 kPa
Body	Red bronze
Trim	stainless steel stem, brass plug
Suitable medium	Water, with maximum 50% glycol

Features

3-way/4-port modulating valves (V5833C)

Action	Normally Closed (NC)
Water temperature	2-120°C
Maximum stroke	6.5 mm
Flow characteristic	Equal percentage
Port connection type	Flat sealing
Static pressure	PN16
Leakage rate	0.02% of kvs
Suitable medium	Water, with maximum 50% glycol

	UniTrane™ #01-08 HFO/HFR 04-06-08"	UniTrane™ #11-20	
COOLING	**References**	**References**	**Valve action***
2-way valve body	V9071X1615, 1/2", kvs=1.6 Differential pressure = 2.5 bar		Normally closed
24V actuator for ZN	M8450A1000, stroke=6.5mm		
3-way/4-port valve body	V5833C1033t, 1/2", kvs=1.6 Differential pressure = 1.5 bar	V5833C1041t, 3/4", kvs=2.5 Differential pressure = 1.5 bar	Normally closed
24V actuator for ZN	M8450A1000, stroke=6.5mm	M8450A1000, stroke=6.5mm	
HEATING			
2-way valve body	V9071X0015, 1/2", kvs=1.0 Differential pressure = 2.5 bar	V5833C1033t, 1/2", kvs=1.6 Differential pressure = 1.5 bar	Normally closed
24V actuator for ZN	M8450A1000, stroke=6.5mm	M8450A1000, stroke=6.5mm	
3-way/4-port valve body	V9071X1615, 1/2", kvs=1.0 Differential pressure = 2.5 bar	V9071X1615, 1/2", kvs=1.6 Differential pressure = 2.5 bar	Normally closed
24V actuator for ZN	M8450A1000, stroke=6.5mm	M8450A1000, stroke=6.5mm	

Valve action * : position of the valve if NOT energized

	CWS 600x600			CWS 875x875			Valve action
	025P/065P	045P	025PL	045PL/065PL	095P/135P/155P	095PL/135PL/155PL	
COOLING	**References**	**References**	**References**	**References**	**References**	**References**	
2-way cooling	35168517-001 V9071X1615 kvs=1.6, 1/2" M8450A1000 6.5mm	35168517-001 V9071X1615 kvs=1,6, 1/2" M8450A1000 6.5mm	35168517-001 V9071X1615 kvs=1.6, 1/2" M8450A1000 6.5mm	35168517-001 V9071X1615 kvs=1.6, 1/2" M8450A1000 6.5mm	35168518-001 V9071X2529 kvs=2.5 ¾" M8450A1000 6.5mm	35168518-001 V9071X2529 kvs=2.5, ¾" M8450A1000 6.5mm	Normally closed
3-way/4-port cooling	35168520-001 V5833C1033 kvs=1.6, 1/2" M8450A1000 6.5mm	35168519-001 V5833C1025 kvs=1.6, 1/2" M8450A1000 6.5mm	35168519-001 V5833C1025 kvs=1.6, 1/2" M8450A1000 6.5mm	35168520-001 V5833C1033 kvs=1.6, 1/2" M8450A1000 6.5mm	35168521-001 V5833C1041 kvs=2.5. ¾" M8450A1000 6.5mm	35168521-001 V5833C1041 kvs=2.5, ¾" M8450A1000 6.5mm	Normally closed
HEATING	**References**	**References**	**References**	**References**	**References**	**References**	
2-way heating			35168517-001 V9071X1615 kvs=1.6, 1/2" M8450A1000 6.5mm	35168517-001 V9071X1615 kvs=1.6, 1/2" M8450A1000 6.5mm		35168518-001 V9071X1615 kvs=2.5, ¾" M8450A1000 6.5mm	Normally closed
3-way/4-port heating			35168520-001 V5833C1033 kvs=1.6, 1/2" M8450A1000 6.5mm	35168520-001 V5833C1025 kvs=1.6, 1/2" M8450A1000 6.5mm		35168521-001 V9071X1615 kvs=2.5, ¾" M8450A1000 6.5mm	Normally closed

Installation

Unit identification

Units arrive on site with an identification sticker with pictograms, which clearly indicates important information such as the customer order number, job name, unit model size, coil type, presence of an electric heater, motor type, unit handing, and so on.

Figure 11: Unit identification sticker (UniTrane, HFO/HFR only)

Installation

① = Indicates unit description

② = Indicates the ZN control configuration program

2-pipe cooling only

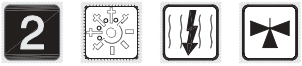
2-pipe heating only

2-pipe cooling + electric heater

2-pipe changeover, 2-way valve

2-pipe changeover, 3-way valve

2-pipe changeover + electric heater, 2-way valve



2-pipe changeover + electric heater, 3-way valve

4-pipe

③ = Indicates customer order number (max 25 alphanumeric characters)

④ = Indicates job name (max 25 alphanumeric characters)

⑤ = Indicates personal customer tag (max 22 alphanumeric characters)

⑥ = Indicates the unit handing

= Right hand

= Left hand

⑦ = Indicates the coil type

= 3-row coil (2 pipes)

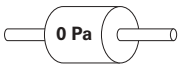
= 4 pipes

⑧ = Indicates the presence of an electric heater

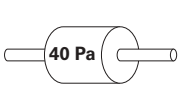

Unit with electric heater

-- Unit without electric heater

⑨ = Indicates the motor type



Standard motor



HESP motor

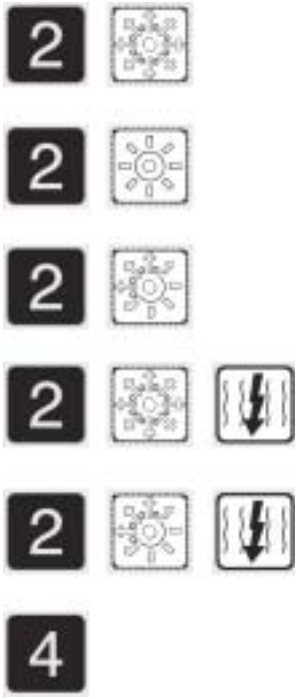
Installation

Installation

Control Panel Kit Identification (CWS)

For all chilled water cassettes, the ZN LonTalk® control is available as a kit.

- 5 valve packages are available depending on the unit size and the operating (cooling or heating) mode.
- 6 control panel kits are available depending on the application:



2-pipe cooling only

2-pipe heating only

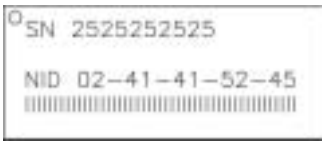
2-pipe changeover

2-pipe cooling + electric heater

2-pipe changeover + electric heater

4-pipe

Figure 12 - Neuron Identification Sticker



Neuron identification

In order to quickly identify the neuron ID of each unit on the job site and, as a consequence, to save time, each controller is supplied with 4 neuron identification stickers with bar codes. One is located on the side of the control box and the 3 others are coiled inside the box. They can be used to either identify the unit once installed (false ceiling applications) or to locate the unit on a mechanical/layout drawing.

Installation

Electrical connection

All electrical connections have to be made on the terminal blocks of main electrical control box.

Warning: Disconnect the power supply before making electrical connections. Failure to do so may cause serious accidents as well as irreversible damage to certain electrical components (motors, relays, etc..).

Warning: Use copper conductors only. Unit terminals are not designed to accept other types of wiring. Aluminium or other materials could lead to galvanic corrosion or overheating at the contact point thus damaging the unit. The customer's electrical connections must comply with current standards. Fan coils manufactured by Trane comply with CEI regulations. The changeover sensor must be installed on the installation's entering water piping (responsibility of the installer).

The factory-mounted electrical heaters are fitted with a safety device that prevents them functioning if the fan breaks down. All faults must be reported to the maintenance department.

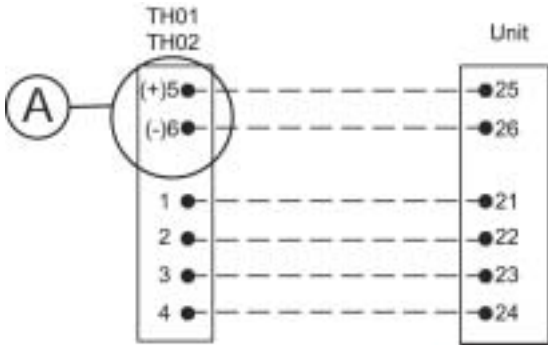
Warning: If an electric heater is connected by an installer, operation of the electric heater must be subordinated to operation of the fan.

Connecting the zone sensors

Installation preparation -location of thermostats

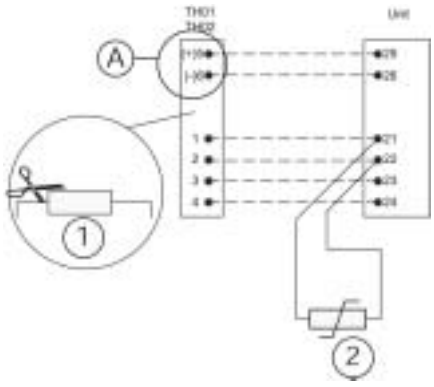
Warning: Do not install thermostats near or above a source of heat (i.e. direct sunlight, hot lamps or radiator). Thermostats should be installed at least 1.5 m above floor level.

Figure 13 - Zone sensor only



A = TH01 only
TH01: Ref. 35168530-001
TH02: Ref. 35168531-001
Recommended cable size: 2 pairs 0.9mm², maximum 60m
If TH01 + 1 pair 0.9mm², capacitance 72±6pf/m max, maximum 60m.
It is possible to connect a return air sensor to TH01 and 02 thermostats.
In this case it is necessary to disable the air sensor included in the thermostat and connect the return air sensor as indicated in Figure 14.

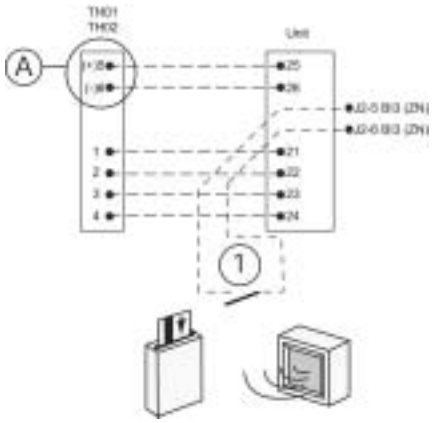
Figure 14 - Zone sensor + return air sensor



A = TH01 only
1 = Zone sensor
2 = Return air sensor: Ref 35168528-001
- - - - - Customer wiring
Recommended cable size: 2 pairs 0.9mm², maximum 60m
If TH01 + 1 pair 0.9mm², capacitance 72±6pf/m max, maximum 60m
It is possible to connect an area occupancy sensor or any device having a free potential contact to the control proceeding as indicated in Figure 15.

Installation

Figure 15

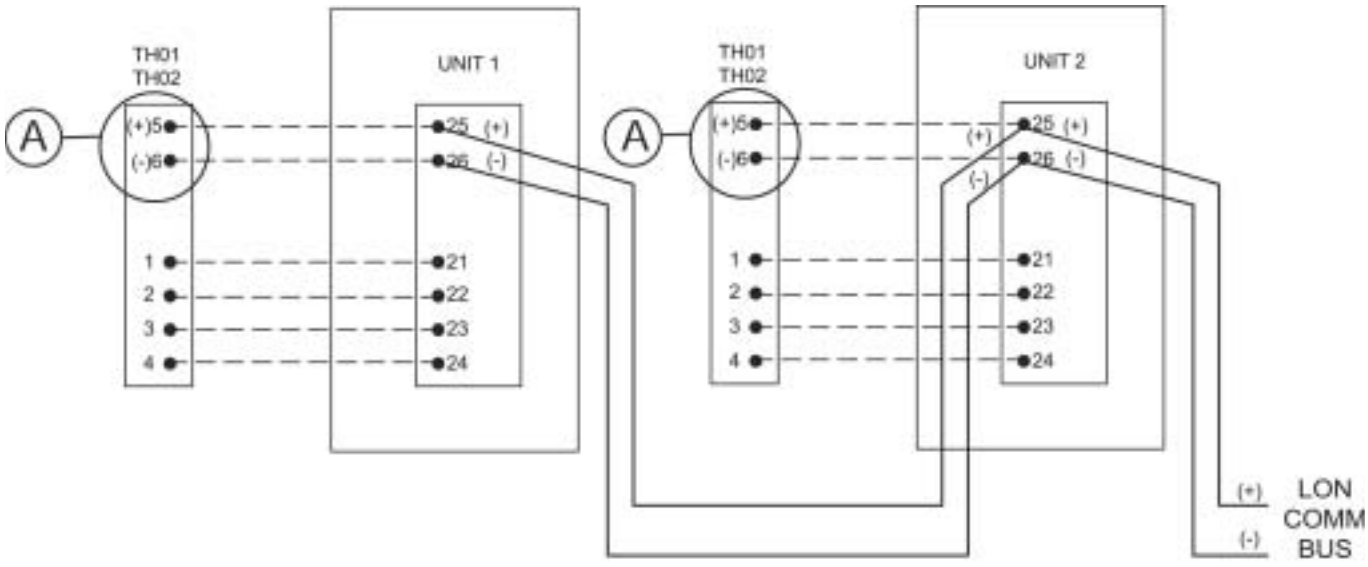


A = TH01 only
1 = Field-supplied contact
- - - - - Customer wiring
Recommended cable size: 2 pairs 0.9mm², maximum 60m
IfTH01 + 1 pair 0.9mm², capacitance 72±6pf/m max, maximum 60m.

Communication between units

It is possible to connect several units together thanks to a communication bus.
For connection refer to Figure 16.

Figure 16 - Bus connection



A = TH01 only
- - - Customer wiring
Recommended cable size: 1 pair 0.9mm², capacitance 72±6pf/m max, maximum 1400 m with the use of a repeater.

Installation

Main power supply

Units with modulating/communicating control are supplied with the fuse disconnect switch.
Refer to the wiring diagrams supplied with the units for more information.
To connect main power supply, refer to Figures 17 to 19.

Figure 17 - UniTrane, HFO/HFR without electric heater

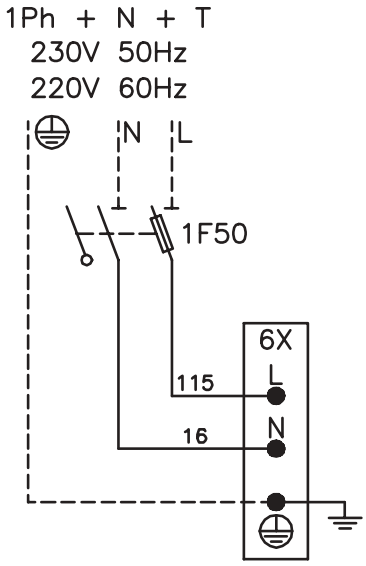


Figure 18 - UniTrane, HFO/HFR with electric heater

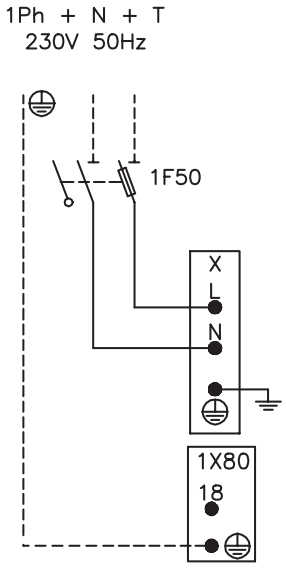
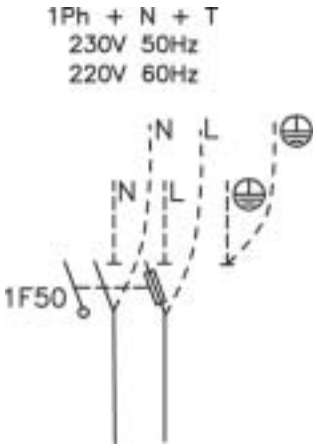


Figure 19 - Power-supply for CWS units



Troubleshooting

LED operation

Red service LED

Table 5 - Red service LED activity

Red LED activity	Description
LED is off continuously after power is applied to the controller	Normal operation
LED is on continously, even when power is first applied to the controller	Someone is pressing the Service push button or the controller has failed
LED flashes about once every second	Uninstall (normal controller mode). Use Rover service tool to restore the unit to normal operation. Refer to the Rover product literature for more information.

Black service push button
The Service push button, located at the bottom center of the controller, can be used to install the Tracer ZN.520 zone controller in a communication network.

Warning! If the Service push button is held down for more than 15 seconds, the Tracer ZN.520 zone controller will uninstall itself from the ICS communication network and shut down all unit operation. This mode is indicated by the red Service LED flashing once every second.

Green status LED
The green LED normally indicates whether or not the controller is powered on (24 VAC). The green LED is also used to indicate that the controller is in a manual test mode or wink mode. Table 6 describes the different patterns.

Table 6 - Green status LED activity

Green LED activity	Description
LED is on continuously	Power on (normal operation)
LED blinks (one blink)	The controller is in manual output test mode. No diagnostics present.
LED blinks (2 blinks)	The controller is in manual output test mode. One or more diagnostics are present. (1)
LED blinks (1/4 second on, ¼ second off for 10 seconds)	Wink mode (2)
LED off	Power is off. Controller failure. Test button is pressed.

Note[1]: During manual output test, certain diagnostics make the status LED light in a two-blink pattern. If a two-blink pattern remains after an attempt to clear diagnostics, the diagnostic condition is still present and may affect the manual output test. The diagnostic must then be cleared using another method. Refer to 'Resetting diagnostic'.

Note[2]: the Wink feature allows you to identify a controller. By sending a request from Rover service tool, you can request the controller to wink (blink on and off as a notification that the controller received the signal). The green LED blinks (1/4 second on, 1/4 second off for 10 seconds) during Wink mode.

Troubleshooting

Yellow comm LED
The yellow comm LED blinks at the rate the controller receives communication.

The yellow LED does not blink when the controller is transmitting communication data. Table 7 describes the different patterns.

Table 7 - Yellow Comm LED activity

Yellow LED activity	Description
LED off continuously	The controller is not detecting any communication. (Normal for stand-alone applications.)
LED blinks or flickers	The controller detects communication. (Normal for communicating applications, including data sharing.)
LED on continuously	Abnormal condition or extremely high traffic on the link.

Manual output test

The test sequence verifies output and end device operation. The manual output test can be conducted to verify output wiring and actuator operation without using a service tool.
Many service calls are initiated due to diagnostics, so the test sequence attempts to clear diagnostics and restore normal unit operation prior to testing the outputs. If the diagnostics remain after an attempt to clear diagnostics, the status LED lights in a two-blink pattern, indicating the diagnostic condition is still present.

Translating multiple diagnostics
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.

Resetting diagnostics
There are many ways to reset diagnostics:
- Automatically by the controller.
- By initiating a manual output test at the controller.
- By cycling power to the controller.
- By using a building automation system.
- By using the Rover service tool.
- By using any other communicating device able to access the controller's diagnostic reset input.
- By cycling the fan switch from off to any speed setting.

Automatically: The Tracer ZN.520 zone controller includes an automatic diagnostic reset function. This function attempts to automatically recover a unit when the Low Coil Temperature Detection diagnostic occurs. After the controller detects the Low Coil Temperature Detection diagnostic, the unit waits 30 minutes before invoking the automatic diagnostic reset function. The automatic diagnostic reset function clears the Low Coil Temperature Detection diagnostic and attempts to restore the controller to normal operation. The controller resumes normal operation until another diagnostic occurs. If a Low Coil Temperature Detection diagnostic recurs within 24 hours after an automatic diagnostic reset, you must manually reset the diagnostic.
Manual output test: You can use the Test button on the controller either during installation to verify proper end device operation or during troubleshooting. When you press the Test button, the controller exercises all outputs in a predefined sequence. The first and last steps of the sequence reset the diagnostics.

Cycling power: When someone turns off the controller's 24 VAC power, then re-applies power, the unit cycles through a power-up sequence. By default, the controller attempts to reset all diagnostics at power-up. Diagnostics present at power-up and those that occur after power-up are handled according to the defined diagnostics sequences.
Building automation system: Some building automation systems can reset diagnostics in the Tracer ZN.520 zone controller.
Rover service tool: The Rover service tool can reset diagnostics in the Tracer ZN.520 zone controller.
Diagnostic reset: Any device that can communicate the network variable nviRequest (enumeration "clear_alarm") can reset diagnostics in the Tracer ZN.520 zone controller. The controller also attempts to reset diagnostics whenever power is cycled.
Cycling the fan switch: If the user cycles the fan speed switch from off to any speed, the controller resets all diagnostics. Diagnostics may recur immediately if the problem still exists.

Troubleshooting

Questionable unit operation

Table 8 - Fan outputs do not energize

Probable cause	Explanation
Unit wiring	The wiring between the controller outputs and the fan relays and contacts must be present and correct for normal fan operation.
No power to the controller	If the controller does not have power, the unit fan does not operate. For the Tracer ZN.520 zone 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 has failed.
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 devices, 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.
Power-up control wait	When power-up control wait is enabled (non-zero time), the controller remains off until one of two conditions occur: The controller exits power-up control wait once it receives communicated information. The controller exits power-up control wait once the power-up control wait time expires.
Diagnostic present	A specific list of diagnostics affects fan operation.
Manual output test	The controller includes a manual output test sequence you can use to verify output operation and associated output wiring. However, based on the current step in the test sequence, the unit fan may not be on.
Fan mode off	When a local fan mode switch (provided on the Trane zone sensor) determines the fan operation, the off position controls the unit off.
Requested mode off	You can communicate a desired operating mode (such as off, heat, and cool) to the controller. When off is communicated to the controller, the unit controls the fan off. There is no heating or cooling.
Unoccupied operation	When the controller is in the unoccupied mode, the fan is cycled.
Cycling fan operation/continuous	The controller operates the fan continuously 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.

Table 9 - Valves stay closed

Probable cause	Explanation
Unit wiring	The wiring between the controller outputs and the valve(s) must be present and correct for normal valve operation.
Random start observed	After power-up, the controller always observes a random start from 5- 30 seconds. The controller remains off until the random start time expires.
Unit configuration	The controller must be properly configured based on the installed end devices and application. When the unit configuration actual does not match the actual end devices, the valves may not work correctly.
Power-up control wait	When power-up control wait is enabled (non-zero time), the controller remains off until one of two conditions occur: The controller exits power-up control wait once it receives communicated information. The controller exits power-up control wait once the power-up control wait time expires.
Diagnostic present	A specific list of diagnostic affects valve operation.
Manual output test	The controller includes a manual output test sequence you can use to verify output operation and associated output wiring. However, based on the current step in the test sequence, the valve(s) may not be open.
Fan mode off	When a local fan mode switch (provided on the Trane zone sensor) determines the fan operation, the Off position controls the unit off and valves to close.
Requested mode off	You can communicate a desired operating mode (such as off, heat, and cool) to the controller. When Off is communicated to the controller, the unit controls the fan off. There is no heating or cooling (valves are closed).
Sampling logic	The controller includes entering water temperature sampling logic which is automatically invoked during 2-pipe and 4-pipe changeover when the entering water temperature is either too cool or too hot for the desired heating or cooling. Refer to "Entering water temperature sampling function" on page 9. **Example:** A 2-pipe heat/cool changeover unit will not cool if the entering water temperature is too warm for cooling or if the entering water sensor is not present. The unit will not heat if the entering water temperature is too cool for heating. If failed the controller will close valve for one hour then re-attempt sampling routine.

Troubleshooting

Table 10 - Valves stay open

Probable cause	Explanation
Unit wiring	The wiring between the controller outputs and the valve(s) must be present and correct for normal valve operation.
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 devices, the valves may not work correctly.
Diagnostic present	A specific list of diagnostic affects valve operation
Manual output test	The controller includes a manual output test sequence you can use to verify output operation and associated output wiring. However, based on the current step in the test sequence, the valve(s) may be open.
Sampling logic	The controller includes entering water temperature sampling logic which automatically invoked during 2-pipe and 4-pipe changeover when the entering water temperature is either too cool or too hot for the desired heating or cooling. Refer to "Entering water temperature sampling function" on page 9.
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. The controller opens and closes the valves to meet the unit capacity requirements.
Normal operation	The controller opens and closes the valves to meet the unit capacity requirements.

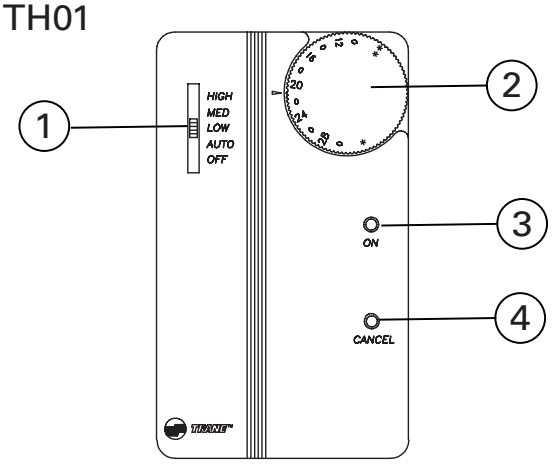
Table 11 - Electric output does not energize

Probable cause	Explanation
Unit wiring	The wiring between the controller outputs and the end devices must be present and correct for normal operation.
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 devices, the unit may not work correctly.
Diagnostic present	A specific list of diagnostics affect electric heat operation.
Manual output test	The controller includes a manual output test sequence you can use to verify output operation and associated output wiring. However, based on the current step in the test sequence, the electric output may be off.
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 electric heat output. This includes unoccupied mode when there is no call for capacity or any other time the fan is off.
Normal operation	The controller energizes the outputs only as needed to meet the unit capacity requirements.

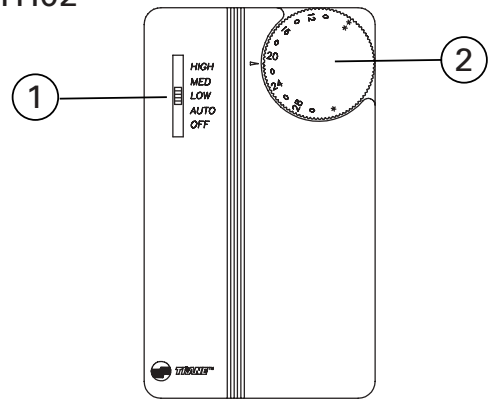
User Guide

Figures 20 and 21 - Remote, wall mounted, zone sensors TH01 and TH02

TH01



TH02



1 = Fan speed selection:
OFF = Stop / Reset
AUTO = Automatic fan speed variation
LOW = Low fan speed
MED = Medium fan speed
HIGH = High fan speed

2 = Temperature setting

3 = Occupied mode / Timed Override

4 = Unoccupied mode / Cancel Override
TH01: Trane reference 35168530-001
TH02: Trane reference 35168531-001

Note: To avoid accidental engaging of a mode, push buttons 'On' and 'Cancel' must be held in for at least 1 second.

Notes

Notes

Quality Management System Approval

Trane
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www.trane.com

For more information contact your local district office or e-mail us at comfort@trane.com

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