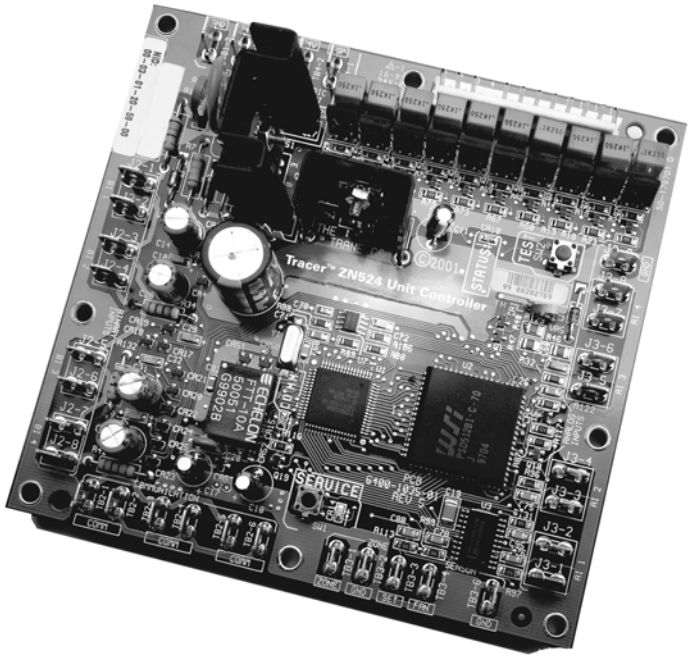
Engineering Bulletin

Tracer® ZN524

Unit Controller for water-source heat pumps



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Introduction

General

The TracerTM ZN524 water-source heat pump unit controller is a microprocessor-based direct digital controller that controls a range of water source heat pump equipment including:

- high-efficiency horizontal and vertical units;
- premuim-horizontal and vertical units; and
- console water source heat pumps.

The Tracer ZN524 is designed to provide accurate and reliable zone temperature control through the use of

pre-engineered control algorithms. Based on the unit type, the controller is a factory installed and commissioned, resulting in a highly integrated product. Factory commissioning helps to ensure the highest level of quality and customer satisfaction.

Applications

The ZN524 unit controller may be applied as part of a Trane Tracer Summit® system, as part of a Trane Tracer Loop controller small building system, a stand-alone device, or as an interoperable controller. In addition, 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 controller.

Inputs/Outputs

The Tracer ZN524 unit controller is factory configured to control the unit fan, reversing valve, one or two compressors, and various other end-devices and components. The controller utilizes space temperature and setpoint inputs; fan mode switch input and entering water temperature to condition the space. Other optional inputs include condensate overflow, and occupancy.

Features and Benefits

Factory Installed and Commissioned Controls

All Trane controls are factory-commissioned and installed. The ZN524 control board, sensors, power transformer, required wiring, and actuators (when applicable) are installed as part of the normal construction of the unit.

Upon completion, each unit receives testing via an automated download/test stand. The computer downloads the proper unit configuration and location ID and proceeds to test the unit both mechanically and electrically. The unit must pass all phases of testing before the automated tester allows the unit to be shipped. This helps to ensure a high quality product is delivered and installation time is reduced.

Occupied/Unoccupied

Note: *Occupied and unoccupied modes are typically coordinated by the Trane Tracer Summit or Tracer Loop Controller*

The ZN524 unit controller is factory programmed with a set of occupied, occupied standby, and unoccupied setpoints. During unoccupied conditions, when larger space temperature swings can be tolerated, the controller significantly reduces unit run-time, saving operating expense.

The controller has a binary input that is configured to be either an input for switching between occupied and

unoccupied modes or as a generic input. This feature allows the controller to function as a stand-alone controller, or allows the unit to be put into an occupied standby mode when used with an occupancy sensor in a building automation system application.

The controller can accept both hardwired and communicating occupancy inputs. This gives the user ultimate application flexibility for localized or system-wide time-of-day scheduling.

Timed Override

The controller includes a timed override function for after- hours operation. This allows the user to request unit operation by the touch of a button on the unit's space temperature sensor. Additionally, the user can push the cancel button at any time during the override command to place the unit back into unoccupied mode.

Random Start

The controller inhibits fan and compressor operation for a random period of time at power-up and on the transition to the occupied mode. This avoids a possible system power surge that may occur when multiple units start at the same time.

High and Low Pressure Protection

The controller has built-in refrigerant high and low pressure protection capabilities. These safeties prevent the unit from operating with high/low refrigeration pressure levels that may occur under abnormal system conditions.

Compressor Minimum Timers

All unit compressors are subjected to minimum on and off timers to prevent short cycling and therefore maximize compressor life.

Condensate Overflow

When the condensation reaches a trip point in the drain pan, the condensate overflow switch disables unit operation. This feature prevents water damage to the building.

Fan Status

Tracer ZN524 unit controllers provide two methods of monitoring fan status. The first method monitors the fan output status through the Tracer ZN524 unit controller. This method is not considered positive proof of airflow, but is typically acceptable on direct drive fan applications.

Tracer ZN524 unit controller also has the ability to accept a binary input from a fan proof switch for belt driven applications or when proof of flow is required by the customer. When fan operation is expected by the controller, but not confirmed by the proof switch, unit operation is disabled if the unit is configured as Fan Status with Diagnostic.

If the unit is configured as Fan Status - No Diagnostic, the status of the fan proof switch will be passed to the BAS system and does not have any affect on the operation of the unit.

Filter MaintenanceControls

Filter maintenance status for the Tracer ZN524 unit controller is based on the cumulative run hours of the unit fan. An adjustable and re-settable timer exists in the controller that, when expired, indicates to the user through Tracer Summit or Rover service tool, that maintenance is recommended for that unit. The unit controller complies to ASHRAE 62-89 Filtration Section.

Active Dehumidification

The Tracer ZN524 unit controller supports active dehumidification through the use of a reheat coil and humidity sensor.

This feature allows the user to keep space RH levels within ASHRAE 62-89 guidelines to provide comfort as well as minimizing the risk of microbial growth and damage to the building or its furnishings.

Interoperability

Trane has lead the industry with BACnet interoperability and is now expanding the realm of interoperable solutions by offering LonMark certified unit controllers. The Tracer ZN524 controller is certified to the LonMark Space Comfort Controller (SCC) profile. This allows the ZN524 to be used as a unit controller on other control systems that support LonTalk and the SCC profile (See Table 1, pg. 7). Building owners have more choices and, design engineers have more flexibility to meet the challenges of building automation.

Waterside economizer

The Tracer ZN524 unit controller supports a two position waterside economizer through the use of an economizer coil. This feature can help comply with ASHRAE 90.1 guidelines and allows the user to reduce energy consumption.

Electric/Boilerless Heat

The Tracer ZN524 unit controller supports two types of electric heat, Main heat and Boilerless. When used as a main heat source the electric heat can operate concurrently with compressor heat or as the only source of heat. When

configured for boilerless, the electric heat only operates when compressor heat has been disabled, typically based on entering water temperature.

Manual Output Test

A manual output test function is included to assist in the installation and trouble shooting processes. This function allows the user to temporarily override normal unit operation and manually exercise each of the controller's outputs. This enables the user to quickly verify fan, reversing valve, compressor, and outdoor air damper operation.

Generic I/O

Tracer ZN524 unit controller comes equipped with three generic points for use with a Tracer Summit system:

- Binary Input (shared with occupancy)
- Binary Output
- Analog Input (4-20mA shared with humidity sensor and often used with an optional carbon dioxide sensor)

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

Specifications

LonMark Space Comfort Controller Profile

The Tracer ZN524 unit controller conforms to the LonMark Space Comfort Controller Profile. It provides LonTalk communications via an FTT-10A transceiver.

Typical Zone Sensor

Description

- Space temperature
- Setpoint
- Fan switch (off and auto) timed override and cancel buttons
- Communication jack for use with laptop communication tool
- Vertical case with Trane logo

Specifications

- Power
  - 18 to 32 VAC (24 VAC, 300mA nominal); 50 or 60 Hz
- Dimensions:
  - Height: 5.25″ (133.35 mm)
  - Width: 5.50″ (140 mm)
  - Depth: 2.25″ (57 mm)
- Operating Environment Storage
  - 32 to 140°F (0 to 60°C)
  - 5 to 95% non-condensing
  - -40 to 185°F (-40 to 85°C)
- Environment

  5 to 95% non-condensing
- Agency Listings System

  UL and CUL 916 Energy Management
- Agency Compliance
  - IEC 1000-4-2 (ESD)
  - IEC 1000-4-4 (EFT)
  - IEC 1000-4-5 (Surge)
  - FCC Part 15
  - Class A

Table 1. Input/Output summary

Type	Description
Binary Inputs	Condensate Overflow
	Occupancy[a]
	Fan status[b],[c]
	Low evaporation temperature
	Generic [a],[b]
	High/Low pressure protect (Circuit 1)
	High/Low pressure protect (Circuit 2)
Binary Outputs	Fan
	Reversing Valve
	Electric heat[a],[c]
	Reheat[a],[c]
	Compressor[a]
	Compressor[b]
	Isolation valve[a]
	Isolation valve[b]
	Waterside economizer (2-position)[c]
	Outside Air Damper (2-position)
	Generic[b]
Analog Inputs	Entering water temperature[a]
	Outside air temperature [a]
	Discharge Air
	Leaving Water Temperature (Circuit 1)[c]
	Space temperature
	Space temperature setpoint
	Fan switch
	Relative humidity[a],[c]
	Universal (Generic)[a],[b],[c]

(a) Indicates that two or more features can be associated with this point (Only one may be used).
(b) Indicates Tracer Summit is required.
(c) Indicates optional feature.

Table 2 provides an input/output listing for the Tracer ZN524 unit controller. Table 3, p. 8 provides 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 2. Input/Output listing

Input	SNVT type
nviRequest	SNVT_obj_request
nviSpaceTemp[a]	SNVT_temp_p
nviSetpoint	SNVT_temp_p
nviSetptOffset	SNVT_temp_p
nviOccSchedule	SNVT_tod_event
nviOccManCmd	SNVT_occupancy
nviOccSensor	SNVT_occupancy
nviApplicMode	SNVT_hvac_mode

Output	SNVT type
nvoStatus	SNVT_obj_status
nvoFileDirectory	SNVT_address
nvoSpaceTemp[a]	SNVT_temp_p
nvoUnitStatus[a]	SNVT_hvac_status
nvoEffectSetpt	SNVT_temp_p
nvoEffectOccup	SNVT_occupancy
nvoHeatCool	SNVT_hvac_mode
nvoSetpoint	SNVT_temp_p

Table 2. Input/Output listing (continued)

Input	SNVT type	Output	SNVT type
nviHeatCool	SNVT_hvac_mode	nvoDischAirTemp	SNVT_temp_p
nviFanSpeedCmd	SNVT_switch	nvoLoadAbsK	SNVT_power_kilo
nviComprEnable	SNVT_switch	nvoTerminalLoad	SNVT_lev_percent
nviAuxHeatEnable	SNVT_switch	nvoSpaceRH	SNVT_lev_percent
nviEconEnable	SVNT_switch	nvoOutdoorTemp	SNVT_temp_p
nviEmergOverride	SNVT_hvac_emerg	nvoSpaceCO2	SNVT_ppm
nviSourceTemp	SNVT_temp_p	nvoEnterWaterTemp	SNVT_temp_p
nviSpaceRH	SNVT_lev_percent	nvoLeaveWaterTemp	SNVT_temp_p
nviOutdoorTemp	SNVT_temp_p	nvoOADamper	SNVT_lev_percent
nviValveOverride	SNVT_havac overid		

(a) Required points under Space Comfort Controller profile. All other points are optional.

Table 3. Configuration properties

Configuration property	SNVT type	SCPT reference	Description
nciSndHrtBt[a]	SNVT_time_sec	SCPTmaxSendTime (49)	Send heartbeat
nciSetpoints[a]	SNVT_temp_setpt	SCPTsetPnts (60)	Occupancy temperature setpoint
nciUnitType[a]	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
nciRHSpaceSetPt	SNVT_lev_percent	SCPThumSetPt (36)	Space RH setpoint
nciManualTime	SNVT_time_min	SCPTmanOvrTime(35)	Manual Override Duration for Water Valve

(a) Required points under Space Comfort Controller profile. All other points are optional.

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