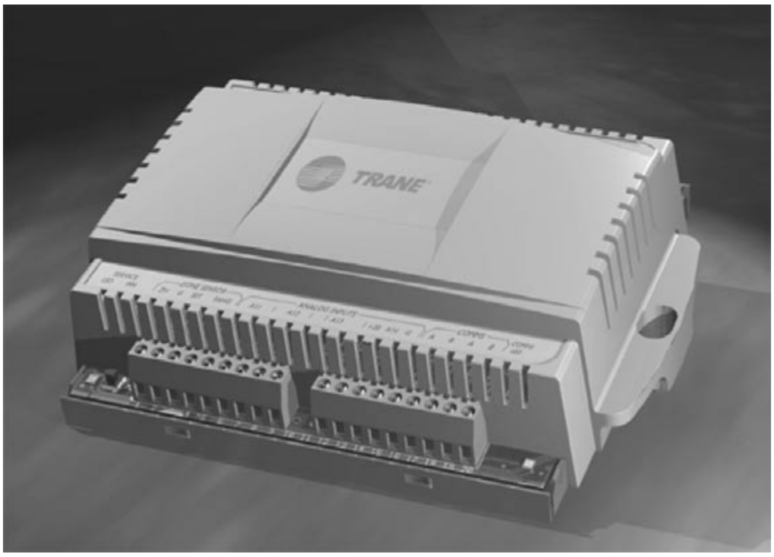
Installation and Operation

Tracer™ ZN.511 Zone Controller



CNT-SVX06A-E4

General Information

Tracer ZN.511 Zone Controller Installation and Operation

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Special Notifications

Warnings, Cautions, "Important" statements, and Notes appear at appropriate locations throughout this manual. 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, may result in minor or moderate injury. A caution may also be used to alert against unsafe practices and where property-damage-only accidents could occur.

IMPORTANT

Alerts installer, servicer, or operator to potential actions that could cause the product or system to operate improperly but will not likely result in potential for damage.

Note: A note may be used to make the reader aware of useful information, to clarify a point, or to describe options or alternatives.

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Overview and specifications

This guide provides installation and configuration information for the Tracer ZN.511 zone controller, as well as a description of the associated operations. The overview includes a product description, specifications, and descriptions of ancillary products that may be necessary.

Product description

The Tracer ZN.511 is an application-specific controller that provides direct-digital zone temperature control. The controller can operate as a stand-alone device or as part of a building automation system (BAS). Communication between the controller and a BAS occurs via a Comm5 communication link, which is based on the LonTalk protocol.

The controller is designed to be field installed and is sent from the factory unconfigured. You can configure the controller, using the PC-based Rover service tool, to support either of the following configurations:

- Water-source heat pumps, one or two compressors
- 1 heat/1 cool fan coils with two-position valves

Note: For information about using the Rover service tool, see the Rover Installation/ Operation/ Programming guide (EMTX-SVX01A-EN).

Storage environment

If a Tracer ZN.511 zone controller is to be stored for a substantial amount of time, store it in an indoor environment that meets the following requirements:

- Temperature: -40° to 185°F [-40° to 85°C]
- Relative humidity: 5-95%, noncondensing

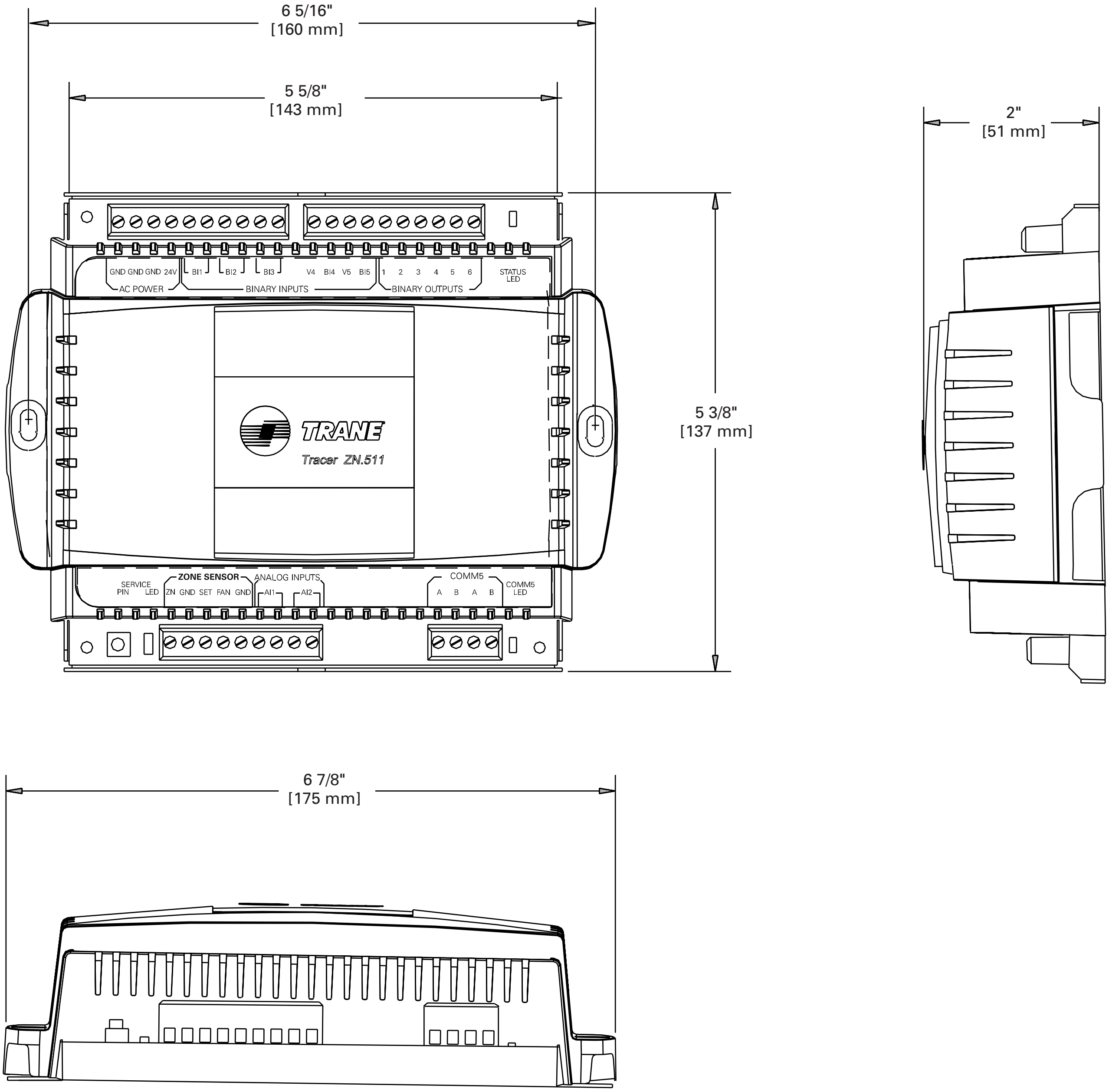
Dimensions

For complete dimensional drawing, see Figure 1.

- Height: 5 3/8" [137 mm]
- Width: 6 7/8" [175 mm]
- Depth: 2" [51 mm]

Overview and specifications

Figure 1 – Tracer ZN.511 Dimensions



Overview and specifications

Clearances

For wiring, ventilation, and maintenance, provide the following minimum clearances for the controller:

Front: 4" [100 mm]

Each side: 1" [25 mm]

Top and bottom: 4" [100 mm]

Agency listing and/or compliance

CE – Immunity: EN 50082-1:1997; EN 50082-2:1995

CE – Emissions: EN 50081-1:1992 (CISPR 22) Class B

UL and C-UL 916 listed: Energy-management system

UL 94-5V (UL flammability rating for plenum use)

FCC Part 15, Class A

Overview and specifications

Additional components

The Tracer ZN.511 zone controller may require the use of additional components for monitoring and proper control of the associated fan coil or heat pump. Using these components depends on the application. They are not included with the Tracer ZN.511 zone controller.

Power transformer
A transformer providing 24 Vac is required to power the Tracer ZN.511 zone controller and associated output relays, and valve and damper actuators.

Zone temperature sensors
Table 1 shows the Trane zone-temperature sensors that are supported by the Tracer ZN.511 zone controller.

Table 1 – Tracer Zone Sensor Options

		Fan					Zone		Timed Override Buttons		
BAS Order Number	Use	High	Medium	Low	Automatic	Off	Set Point Thumbwheel	Temperature Sensor	On	Cancel	Comm Jack
4190 1087	Any							x			
4190 1088	Any							x	x	x	x
4190 1090	Heat pump						x	x	x	x	x
4190 1094	Heat pump						x	x			x
4190 1095	Unit vent	x		x		x	x	x	x	x	x
4190 1115	Fan coil	x	x	x	x	x	x	x	x	x	x
4190 1116	Unit vent	x		x	x	x	x	x	x	x	x
4190 1117	Any				x	x	x	x	x	x	x

Water- and duct-temperature sensors
Temperature sensors must be Trane 10 kΩ (at 25°C) thermistors. Entering water (fan coil), leaving water (heat pump), and discharge air inputs may use a sealed temperature sensor (part number 4190 1100).

Binary-input switching devices
Occupancy, condensate overflow, and low-temperature inputs accept switching devices that may have normally-open or normally-closed dry contacts.

Current-sensing switches must be capable of switching 24 Vac for heat-pump-compressor circuit applications (see “Compressor line-voltage monitoring”). The current-sensing switch must sense line-voltage current as low as 2 A. This amperage is common for a 1/2-ton compressor, which is typically the smallest compressor on a heat pump.

Output relays
Relays for fan (speed) control connected to the Tracer ZN.511 binary outputs cannot exceed 12 VA (0.5 A) current draw at 24 Vac.

Valve and damper actuators
Actuators cannot exceed 12 VA draw at 24 Vac. Use actuators with on/off action and spring return to the normally-open or normally-closed position, based on the desired default position.

General wiring information

This chapter provides specifications and general information about wiring the Tracer ZN.511 zone controller. The controller requires wiring for:

- Input/output terminals
- AC power to the controller
- Communication-link wiring, if the controller is to communicate with a building automation system (BAS)

Input/output terminal wiring

All input/output terminal wiring for the Tracer ZN.511 zone controller is application specific and dependent on the configuration of the controller. Input/output terminal wiring must meet the following requirements:

- All wiring must comply with the National Electrical Code and local codes.
- Use only 18–22 AWG, twisted-pair wire with stranded, tinned-copper conductors. (Shielded wire is not required for input/output wiring. Shield connections are not included on the controller.)
- Binary input and output wiring must not exceed 300 ft (100 m).
- Analog input wiring must not exceed 300 ft (100 m).
- Do not run input/output wires in the same wire bundle with any AC power wires.

For application-specific wiring information and diagrams, see Chapter 4, Applications for the heat-pump configuration, and Chapter 6, Applications for the 1 heat/1 cool configuration.

General wiring information

AC power wiring

⚠ CAUTION

Complete the input/output wiring before applying power to the Tracer ZN.511 zone controller. Failure to do so may cause damage to the controller or power transformer, due to inadvertent connections to power circuits.

⚠ CAUTION

Make sure that the 24 Vac transformer is properly grounded. Failure to do so may result in damage to equipment and/or personal injury.

IMPORTANT

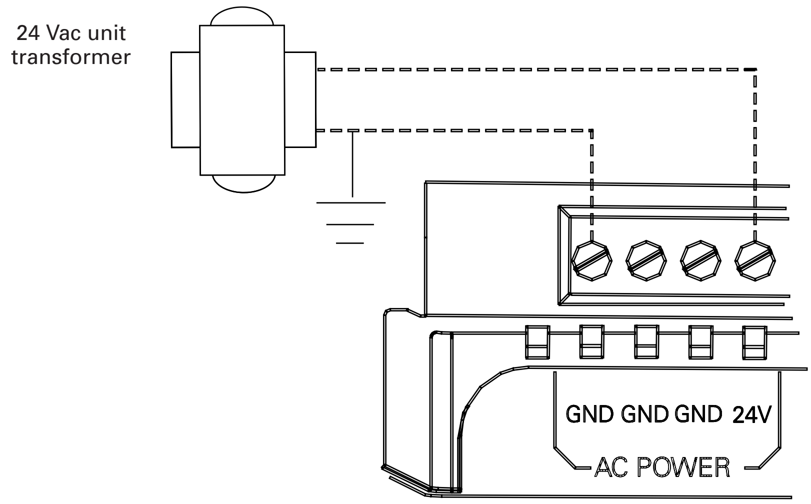
Do not share 24 Vac between controllers.

All wiring must comply with National Electrical Code and local codes.

The AC power connections are in the top left corner of the Tracer ZN.511 zone controller (see Figure 2).

If you are providing a new transformer for power, use a UL-listed Class 2 power transformer supplying a nominal 24 Vac (19-30 Vac). The transformer must be sized to provide adequate power to the Tracer ZN.511 zone controller (9 VA) and output devices, including relays and valve actuators, to a maximum of 12 VA per output utilized. The Tracer ZN.511 may be powered by an existing transformer integral to the controlled heat pump or fan coil, provided that the transformer has adequate power available and adequate grounding is observed.

Figure 2 – Connecting AC power wires to the controller



General wiring information

Communication-link wiring and addressing

The Tracer ZN.511 zone controller communicates with the BAS and with other Comm5 controllers via a Comm5 communication link. For important instructions on network wiring, refer to the *Tracer Summit Hardware and Software Installation guide* (BMTW-SVN01B-EN). Wiring for the communication link must meet the following requirements:

- All wiring must comply with the National Electrical Code and local codes.
- Communication-link wire must be plenum-rated, 18 AWG, shielded, twisted pair with stranded, tinned-copper conductors. Wire capacitance between conductors must be 23 ±2 pF/ft (72 ±6 pF/m). Use only Trane part number 400-2028 wire or the equivalent. Echelon Level IV specification wire is not supported.
- At the controller, the shield should be spliced with the shield from the next section of communication-link wiring and taped to prevent any connection to ground.
- Termination resistors are required for wiring Comm5 devices communicating on a network. For important instructions on using termination resistors for Comm5 applications, refer to the *Tracer Summit Hardware and Software Installation guide* (BMTW-SVN01B-EN).

Each Tracer ZN.511 zone controller has a unique 12-character alphanumeric device address for communicating on a BAS network. This address, referred to as a *Neuron ID*, is assigned in the factory before the product is shipped. Each controller can be identified by viewing its unique Neuron ID, which is on a printed label attached to the circuit board of the controller. Additional adhesive-backed, peel-off Neuron ID labels are tethered to the controller for placing on mechanical prints or unit location worksheets. The Neuron ID will appear when communication is established with the Rover service tool or a BAS. An example Neuron ID is 00-01-64-1C-2B-00.

Mounting the controller

This chapter gives recommendations and requirements for mounting the Tracer ZN.511 zone controller.

Location recommendations

For fan-coil applications, the controller can usually be mounted inside the end pocket of the unit. For heat-pump applications, the controller should be mounted on the side of the unit. Trane recommends locating the Tracer ZN.511 zone controller:

- Near the controlled piece of equipment to reduce wiring costs
- Where it is easily accessible for service personnel
- Where public access is restricted to minimize the possibility of tampering or vandalism

Operating environment requirements

Operate a Tracer ZN.511 zone controller in an indoor environment that meets the following requirements:

- Temperature: 32°F to 140°F [0°C to 60°C]
- Relative humidity: 5-95%, noncondensing

Mounting the controller

Mounting recommendations

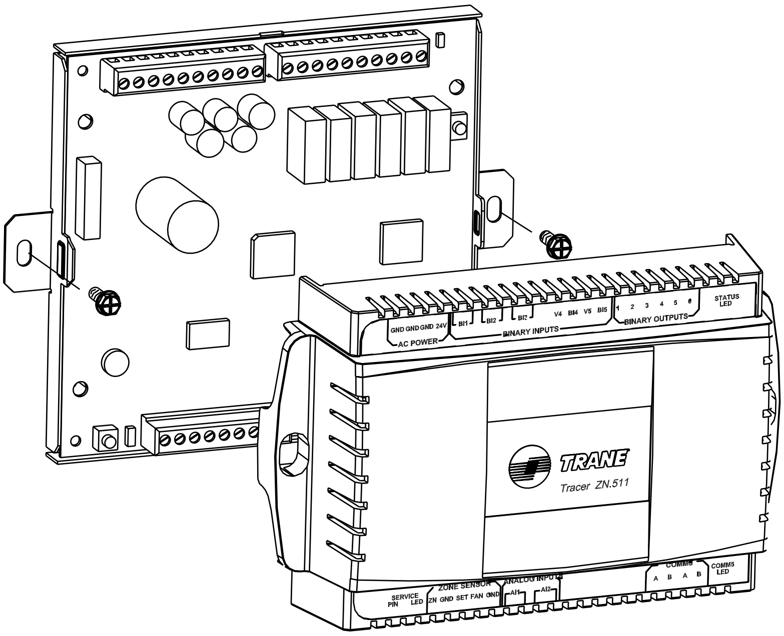
Mounting recommendations are as follows:

IMPORTANT

Mount the Tracer ZN.511 zone controller with the cover on to avoid the possibility of damaging the circuit board during installation.

- Mount the controller in any direction, other than with the front of the cover facing downward.
- Mount using the two 3/16" [0.19 mm] radius mounting holes provided (see Figure 3). Mounting fasteners are not included.
- Attach the controller securely so that it can withstand vibrations of associated HVAC equipment.
- When the controller is mounted in a small enclosed compartment, complete all wiring connections before securing the controller in the compartment.

Figure 3 – Mounting the Tracer ZN.511 zone controller



Applications for the heat pump configuration

This chapter provides information about the function of inputs and outputs and examples of wiring for typical heat-pump applications. The types of heat-pump applications supported by the Tracer ZN.511 zone controller are shown in Table 2.

The decision to wire many of the input/output terminals discussed in this chapter depends on the application. Figure 6 shows the minimum wiring necessary for proper operation of all heat pump applications. Table 7 includes all required and all optional components that can be wired for heat-pump applications.

IMPORTANT

The Tracer ZN.511 zone controller is shipped from the factory in an unconfigured state. Use the PC-based Rover service tool to configure the controller. If the controller is part of a BAS, it is recommended that you configure the controller after BAS communication has been established.

Table 2 – Heat pump applications for the Tracer ZN.511 zone controller

Application	Single compressor	Dual compressor
Water-source heat pump (heating/cooling)	×	×
Water-source heat pump (cooling only)	×	×

Applications for the heat pump configuration

Binary inputs for water-source heat-pump applications

The Tracer ZN.511 zone controller includes five binary inputs. Each binary input associates an input signal of 0 Vac with open contacts and 24 Vac with closed contacts. Table 3 gives the function of each binary input for water-source heat-pump applications. Each function is explained in the succeeding paragraphs. For an explanation of the diagnostics generated by each binary input, see “Diagnostics.” For more information about how the controller operates, see the chapter “Sequence of operations for the heat-pump configuration”.

Table 3 – Binary inputs for water-source heat-pump applications

Binary input terminal label	Function
BI1	Low-temperature detection
BI2	Condensate overflow
BI3	Occupancy or generic binary input
BI4 and V4	High and low pressure cutout (compressor 1)
BI5 and V5	High and low pressure cutout (compressor 2)

BI1: Low-temperature detection (circuit 2)
The function of low-temperature detection is to protect a heat exchanger from freezing. BI1 is used to protect the second heat exchanger in a two-compressor unit. If BI1 is wired to a binary low-temperature detection device (freeze-protection switch), the ZN.511 will detect a low-temperature condition and generate a Low Temp Detection Circuit 2 diagnostic.

Low-temperature detection for the first heat exchanger is always done by AI1 (see “AI1: Leaving-water temperature”).

Note: Some heat pumps have a safety circuit to protect the unit. This circuit contains the compressor contactor, a lockout relay, and unit safeties (Figure 4). These safeties may include a freeze-protection switch. For the Tracer ZN.511 to generate a Low Temp Detection Circuit 2 diagnostic, the freeze-protection switch must be removed from the safety circuit and wired directly to BI1. If the application does not warrant the use of BI1, configure the input as Not Used. Diagnostics for this function will not be generated; however, units with a safety circuit containing a freeze-protection switch will maintain their existing level of freeze protection.

BI2: Condensate overflow
The function of condensate overflow is to prevent the condensate drain pan from overflowing and causing water damage to the building. If BI2 is wired to a condensate-overflow switch and the level of condensate reaches the trip point, the Tracer ZN.511 will detect the condition and generate a Condensate Overflow diagnostic.

Note: On some heat pumps, the condensate-overflow switch may be wired into the safety circuit (see Figure 4). For the Tracer ZN.511 to generate a Condensate Overflow diagnostic, the condensate-overflow switch must be removed from the safety circuit and wired directly to BI2. If the application does not warrant the use of BI2, configure the input as Not Used. Diagnostics for this function will not be generated; however, units with a safety circuit containing a condensate-overflow switch will maintain their existing level of condensate-overflow protection.

Applications for the heat pump configuration

BI3: Occupancy or generic binary input
The function of occupancy is to save energy on unit operation by changing room set points when the zone is unoccupied. BI3 is used for two occupancy-related functions. For stand-alone controllers, this binary input can be wired to a binary switch (occupancy sensor) or time clock to determine the occupancy mode — either occupied or unoccupied. For controllers receiving a BAS-communicated occupancy request, the function of BI3 is to change the mode from occupied to occupied standby. (For more information on occupancy-related functions, see “Occupancy modes.”)

BI3 is the only input that can be configured as a generic binary input. When configured as a generic binary input, it can be monitored only by a BAS and has no direct effect on Tracer ZN.511 operation.

BI4 and BI5: High/low pressure cutout
The function of the high- and low-pressure cutout is to protect the refrigerant circuit from abnormal pressure conditions by locking out (disabling) the compressor operation. Binary input 4 (terminals BI4 and V4) is used to lock out the first compressor and binary input 5 (terminals BI5 and V5) is used to lock out the second compressor. Upon an enable-compressor request, the controller waits 4 seconds before checking the status of BI4 or BI5. After that, the input must close (sense 24 Vac) to operate normally. If the input opens for more than 200 ms, a High/Low Pressure Cutout diagnostic will be generated for that compressor, and it will be locked out.

Note: BI4 and BI5 must have 24 Vac applied to them for the controller to allow heat-pump operation. For this reason, an electrical jumper is factory installed between BI4 and V4, and between BI5 and V5. Terminals V4 and V5 supply 24 Vac for inputs BI4 and BI5, respectively. If either compressor-contactor monitoring or line-voltage monitoring are used, the jumpers must be removed from the terminal strip. If neither is used, the jumpers must remain in the terminal strip for proper operation. If jumpers are used, no High/Low Pressure Cutout diagnostics will be generated. However, units with a safety circuit containing high- and low-pressure switches will continue to protect against abnormal pressure conditions.

These inputs can be used in one of three ways:

- To monitor the compressor contactor
- To monitor compressor line voltage
- To directly monitor the high- and low-pressure switches

Applications for the heat pump configuration

Compressor contactor monitoring
By connecting BI4 to the first compressor contactor (see Figure 4), the controller will monitor (indirectly) the high/low pressure safeties by monitoring the state of the compressor contactor. When the refrigerant circuit experiences an abnormal pressure condition, the high- or low-pressure cutout switch will trip the lockout relay, causing the compressor contactor to de-energize. This will result in the controller generating a High/Low Pressure Cutout diagnostic. BI5 will perform the same function for the safety circuit of the second compressor.

Note: With the compressor contactor-monitoring option, the controller will generate a High/Low Pressure Cutout diagnostic when any safeties, including the freeze-protection switch and the condensate-overflow switch remaining in the safety circuit, trip the lockout relay.

Figure 4 – Compressor contactor monitoring

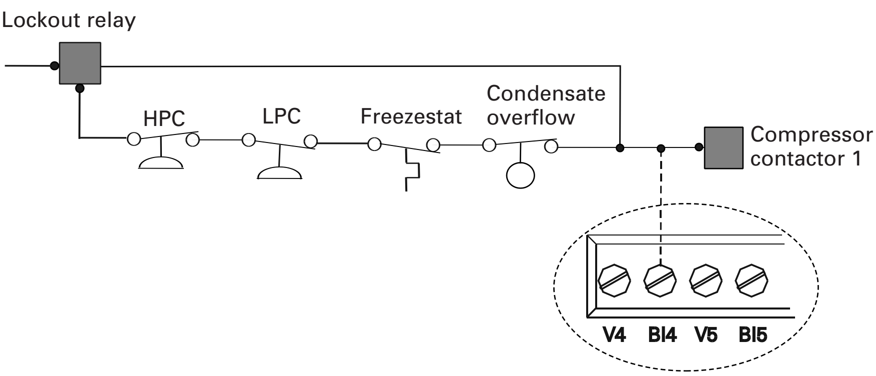


Figure note:
For units with two compressors, wire BI5 to compressor contactor 2 in the same way.

To ensure that compressor contactor monitoring is functioning, perform the following test:

1. Using a voltmeter, place the probes across the 24 V side of the compressor contactor. When the compressor is in operation, the voltmeter should register a value close to 24 V.
2. Cause a fault to occur in the unit (example: manually close the water valve to lock the unit out on high pressure). The voltmeter should now register a value below 10 V.

If the voltmeter registers a value less than 10 V (most lockout relays will register a value less than 1 V), the controller will detect a lockout condition and generate a High/Low Pressure Cutout diagnostic. If the voltmeter registers a value greater than 10 V, the controller will not detect a lockout condition and will not generate a High/Low Pressure Cutout diagnostic. In this case, the compressor line-voltage monitoring option, described in the next section, should be used.

Applications for the heat pump configuration

Compressor line-voltage monitoring
By connecting BI4 and V4 to a field-supplied current-sensing relay, the controller will monitor the operation of the first compressor. Install the current-sensing relay onto the line-voltage wiring going to the compressor (see Figure 5). When the refrigerant circuit experiences an abnormal-pressure condition, the high- or low-pressure cutout switch will trip the safety circuit, causing the compressor contactor to de-energize and the compressor operation to be locked out. This will result in the controller generating a High/Low Pressure Cutout diagnostic. This option may be required on heat pumps that use older lockout relays and in cases where the compressor contactor is inaccessible. BI5 and V5 will perform the same function for the second compressor.

Note: With the compressor line-voltage monitoring option, a controller will generate a High/Low Pressure Cutout diagnostic when any safeties remaining in the safety circuit, including the freeze-protection switch and the condensate overflow switch, trip the lockout relay.

Figure 5 – Compressor line-voltage monitoring

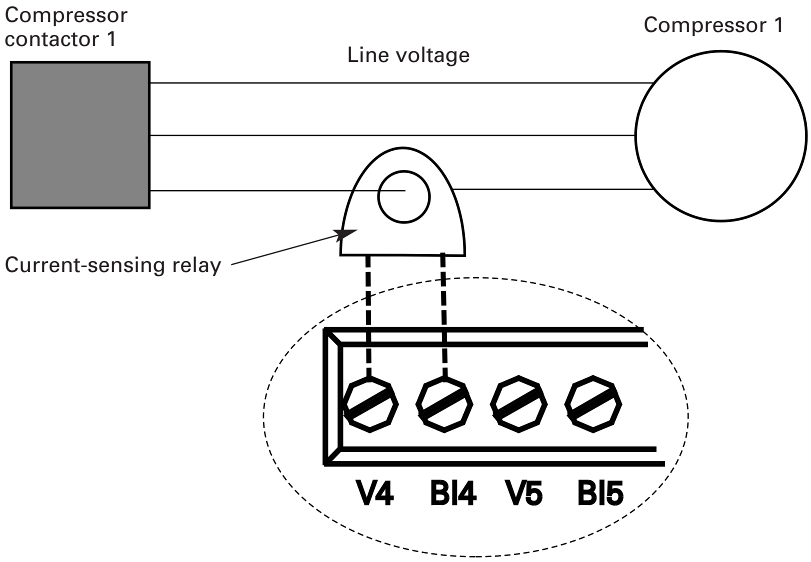


Figure note:
For units with two compressors, wire BI5 and V5 in the same way.

High/low pressure switch monitoring
By removing both the high- and low-pressure switches from the safety circuit and wiring them, in series, directly to BI4 and V4, the controller will monitor the operation of the first compressor. When the refrigerant circuit experiences an abnormal-pressure condition, the high-and low-pressure cutout switches will open. This will result in the controller generating a high- or low-pressure cutout diagnostic and disabling compressor operation. BI5 and V5 will perform the same function for the second compressor.

Applications for the heat pump configuration

Analog inputs for water-source heat-pump applications

The Tracer ZN.511 zone controller includes five analog inputs. Table 4 gives the function of each input for water-source heat-pump applications. Each function is described briefly in the succeeding paragraphs. For an explanation of the diagnostics generated by each analog input, see “Diagnostics.” For more information about how the controller operates, see the chapter “Sequence of operations for the heat-pump configuration”.

Note: Use a GND terminal as the common ground for all zone sensor analog inputs. See Figure 7.

ZN: Zone temperature
The ZN analog input functions as the local (hardwired) zone-temperature input. The controller receives the temperature as a resistance signal from a 10 kΩ thermistor in a standard Trane zone sensor that is wired to analog input ZN. A communicated zone-temperature value can also be used for controllers operating on a BAS. When both hardwired and communicated zone-temperature values are present, the controller uses the communicated value. When neither a hardwired nor a communicated zone-temperature value is present, the controller generates a Zone Temp Failure diagnostic.

The ZN analog input is also used to communicate timed-override requests and cancel requests to the controller, for applications utilizing a Trane zone sensor with the ON and CANCEL button options.

Table 4 – Analog inputs for water-source heat pump application

Analog input terminal label	Function
ZN	Zone temperature
SET	Local set point
FAN	Fan mode input
AI1	Leaving water temperature
AI2	Discharge air temperature

SET: Local set point
The SET analog input functions as the local (hardwired) temperature set point input for applications utilizing a Trane zone sensor with a temperature set point thumbwheel. The ability to enable or disable the local set point input is available in the Rover service tool. A communicated set point value can also be used for controllers operating on a BAS. When both hardwired and communicated set point values are present, the controller uses the communicated value. When neither a hardwired nor a communicated set point value is present, the controller uses the stored default set points (configurable in Rover). If a valid hardwired or communicated set point value is established and then is no longer present, the controller generates a Set point Failure diagnostic.

FAN: Fan mode input
The FAN analog input functions as the local (hardwired) fan-mode switch input for applications utilizing the Trane zone sensor with a fan-mode switch option. Valid fan modes for a heat pump are off and auto. The ability to enable or disable the local fan mode input is available in the Rover service tool. A communicated fan-mode request can also be used for controllers operating on a BAS. When both hardwired and communicated fan mode values are present, the controller uses the communicated value. When neither a hardwired nor a communicated fan-mode value is present, the controller recognizes the fan-mode value as auto and operates according to the default configuration. If a valid hardwired or communicated fan-mode value is established and then is no longer present, the controller generates a Fan Mode Failure diagnostic.

Applications for the heat pump configuration

AI1: Leaving-water temperature

Note: Neither AI1 nor AI2 is polarity sensitive; you can connect either terminal to either sensor lead.

The AI1 analog input functions as the local (hardwired) leaving-water temperature input. The controller will not accept a BAS-communicated leaving-water temperature value. The leaving-water temperature is used to protect the heat exchanger from freezing. The controller compares the leaving-water temperature to the Leaving Water Temperature Cutout Set point, which is configurable in Rover (default of 35°). When the leaving-water temperature falls below the cutout set point, the controller generates a Low Temp Detection Circuit 1 diagnostic. When a valid leaving-water temperature is not present, the controller generates a Leaving Water Temp Failure diagnostic.

BI1 is used to protect the second heat exchanger from freezing in a two-compressor unit (see “BI1: Low-temperature detection (circuit 2)”).

AI2: Discharge-air temperature

Note: Neither AI1 nor AI2 is polarity sensitive; you can connect either terminal to either sensor lead.

The AI2 analog input functions as the local (hardwired) discharge-air temperature input. The discharge-air value is used for information and troubleshooting only and does not affect the operation of the controller. The controller receives the temperature as a resistance signal from a 10 kΩ (thermistor wired to AI2). A communicated discharge-air temperature value can also be used for controllers operating on a BAS. When both hardwired and communicated discharge-air temperature values are present, the controller uses the communicated value. If a valid hardwired or communicated discharge-air temperature value is established and then is no longer present, the controller generates a Discharge Air Temp Failure diagnostic.

Applications for the heat pump configuration

Binary outputs for water-source heat-pump applications

The heat-pump configuration supports applications with the following components:

- A single-speed supply fan
- A reversing valve
- One or two compressors
- A two-position outdoor air ventilation damper (optional)

A Tracer ZN.511 zone controller has six binary outputs. Each binary output is a relay with an output rating of 12 VA. Table 5 describes the function of each output for water-source heat-pump applications.

Generic binary output
Binary output 6 is the only output that can be configured as a generic binary output. When configured as a generic binary output, it can be monitored only by a BAS, and has no direct effect on Tracer ZN.511 operation.

Overriding binary outputs
The Tracer ZN.511 controller includes a manual output test. Use this feature to manually control the outputs in a defined sequence. For more information about the manual output test, see “Manual output test” on page 56.

Table 5 – Binary outputs for water-source heat pump applications

Binary output terminal label	Function
1	Fan
2	Reversing valve
3	Not used
4	Compressor 1
5	Compressor 2
6	Two-position outdoor air damper or generic binary output

Wiring requirements and options

Table 6 and Figure 6 show required controller inputs for minimal proper operation of all heat-pump applications.

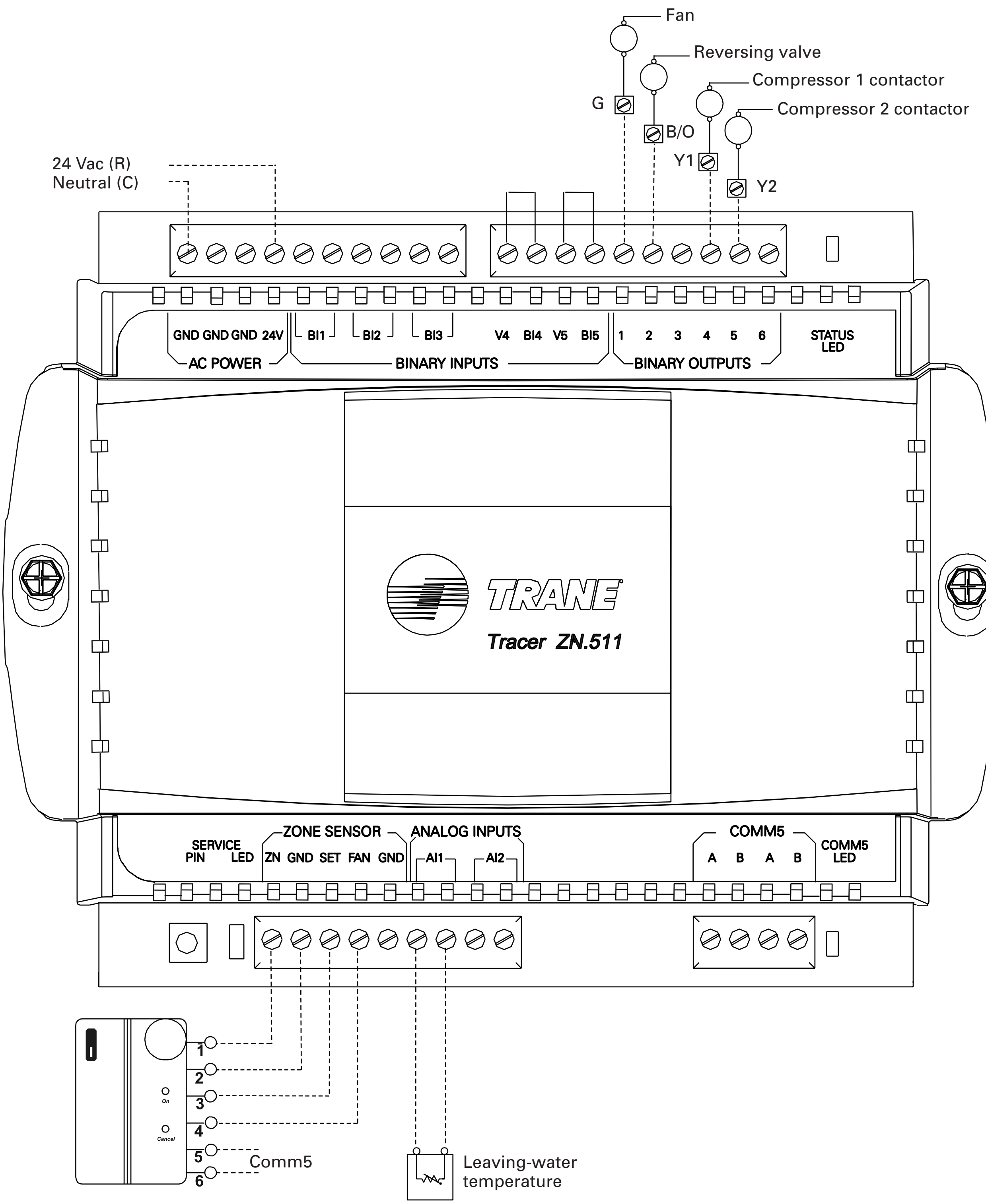
Figure 7 shows all required and optional components connected for heat pump applications.

Table 6 – Required controller inputs for proper operation

Function	Input source	For more information, see:
24 Vac power	Terminals: GND, 24 V	“AC power wiring”
Zone temperature	Terminals: ZN, GND or communicated	“ZN: Zone temperature”
Freeze protection for circuit 1 heat exchanger	Terminals: AI1	“AI1: Leaving water temperature”
High/low pressure cutout	Terminals: BI4 and V4 (BI5 and V5 for two-compressor units only) (If these terminals are not used, the factory-installed jumpers must remain connected.)	“BI4 and BI5: High/low pressure cutout”

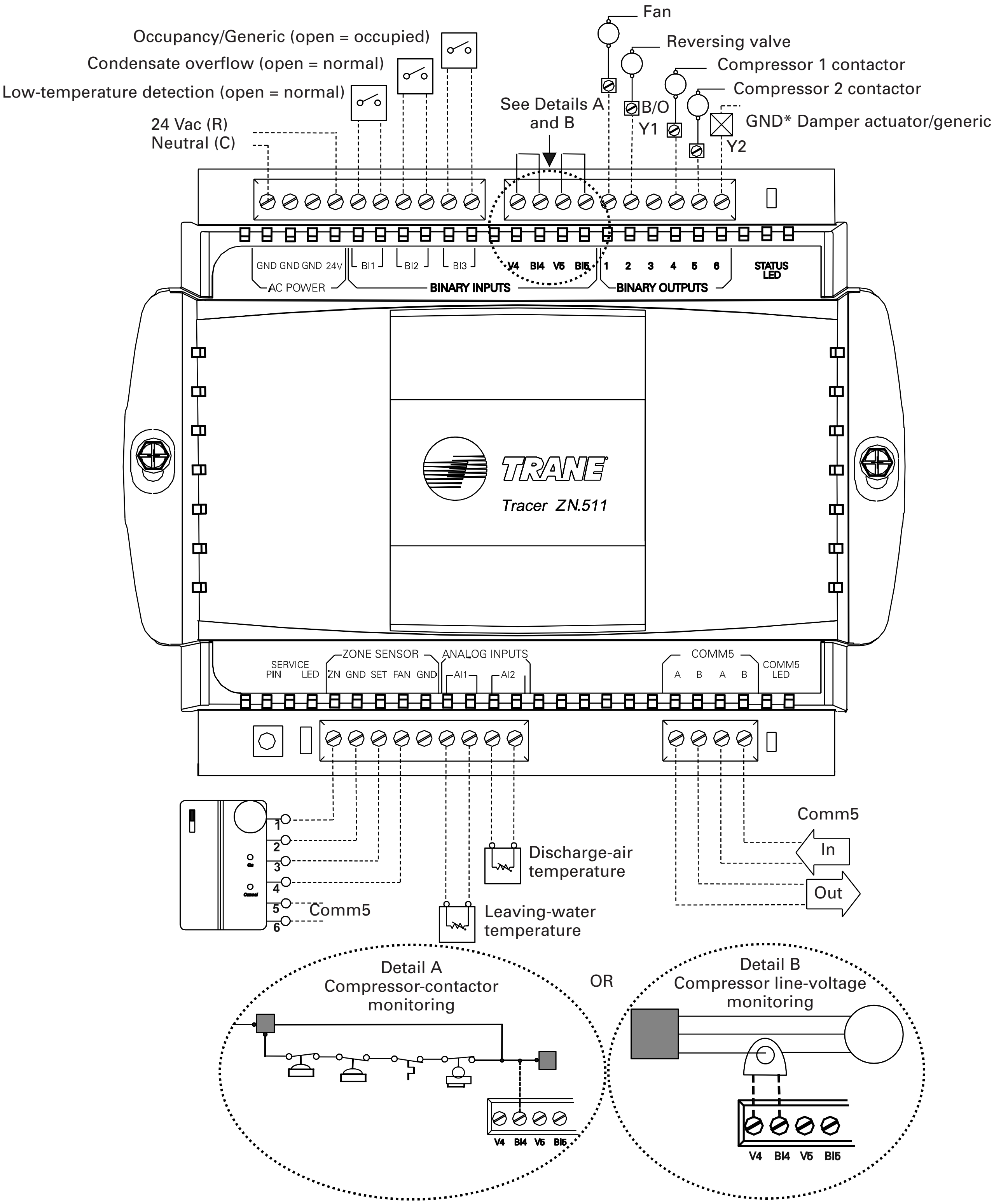
Applications for the heat pump configuration

Figure 6 – Wiring diagram for heat-pump applications, showing required wiring for minimal proper operation



Applications for the heat pump configuration

Figure 7 – Wiring diagram for heat-pump applications, with all required and optional components connected



*The grounding wire of binary output 6 should be connected to one of the AC POWER (GND) terminals.

Sequence of Operations for the heat pump configuration

A Tracer ZN.511 zone controller configured to control a heat pump will operate to maintain the zone-temperature set point. This chapter discusses many of the operational sequences used by the controller to accomplish this goal.

Power-up sequence

When 24 Vac power is initially applied to the Tracer ZN.511 zone controller, the following sequence occurs:

1. All outputs are controlled off.
2. The controller reads all input local values to determine initial values.
3. The random-start timer begins (see “Random start”).
4. If a hardwired zone-temperature value is not detected, the controller begins to wait for a communicated value. This can take several minutes (15-minute default) and occurs concurrently with the remainder of the power-up sequence. If a communicated zone-temperature value arrives, normal operation can begin when the power-up sequence has concluded. If a communicated zone-temperature value does not arrive, a Zone Temp Failure diagnostic is generated (normal operation cannot begin without a valid zone-temperature value).
5. The random-start timer expires.6. The power-up control wait function begins automatically if the configured power-up control wait time is greater than zero. When this function is enabled, the controller waits for the configured amount of time (from 0 to 120 seconds) to allow a communicated occupancy request to arrive. If a communicated occupancy request arrives, normal operation can begin. If a communicated occupancy request does not arrive, the controller assumes stand-alone operation.
7. Normal operation begins assuming no diagnostics have been generated.

Random start

Random start is intended to prevent all units in a building from energizing major loads at the same time. The random-start timer delays the fan and compressor start-up from 5 to 30 seconds. If neither heating nor cooling is initiated, or if fan operation is not required during the delay, the random-start timer is allowed to time-out.

Zone temperature control

The Tracer ZN.511 zone controller calculates a required heating or cooling capacity (0–100%) according to the measured zone temperature and the active temperature set point, and sequences the heat pump heating and cooling stages accordingly. The active temperature set point is determined by the current operating modes, which include occupancy mode and heat/cool mode.

Occupancy modes

Occupancy modes can be controlled by any of the following:

- The state of the local (hardwired) occupancy binary input BI3 (see “BI3: Occupancy or generic binary input”)
- A timed override request from a Trane zone sensor (see “Timed override control”)
- A communicated signal from a peer device (see “Peer-to-peer (master/slave) data sharing”)
- A communicated signal from a BAS

A communicated request, either from a BAS or a peer controller, 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 hardwired occupancy request exists). The Tracer ZN.511 has the following occupancy mode options:

- Occupied
- Unoccupied
- Occupied standby
- Occupied bypass

Sequence of Operations for the heat pump configuration

Occupied mode
In occupied mode, the controller maintains the zone temperature based on the occupied heating or cooling set points. The controller uses the occupied mode as a default mode when other forms of occupancy request are not present. The fan will run as configured (continuous or cycling with compressor operation). The outdoor air damper will close when the fan is off. The temperature set points can be local (hardwired), communicated, or stored default values (configurable in Rover).

Unoccupied mode
In unoccupied mode, the controller operates to maintain the zone temperature based on the unoccupied heating or cooling set point. The fan will cycle with compressor operation. The outdoor air damper will remain closed. The controller always uses the stored default set point values (configurable in Rover), regardless of the presence of a hardwired or communicated set point value.

Occupied standby mode
The controller is placed in occupied standby mode only when a communicated occupied request is combined with an unoccupied request from occupancy binary input BI3. In occupied standby mode, the controller maintains the zone temperature based on the occupied standby heating or cooling set points. Because the occupied standby set points are typically spread 2°F [1.1°C] in either direction and the outdoor air damper is closed, this mode reduces the demand for heating and cooling the space. The fan will run as configured (continuous or cycling with the compressor). The controller always uses the stored default set point values (configurable in Rover), regardless of hardwired or communicated set point values.

Occupied bypass mode
The controller is placed in occupied bypass mode when the controller is operating in the unoccupied mode and 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 zone temperature based on the occupied heating or cooling set points. The fan will run as configured (continuous or cycling with the compressor). The outdoor air damper will close when the fan is off. The controller will remain in occupied bypass mode until either the CANCEL button is pressed on the Trane zone sensor or the occupied bypass time (configurable in Rover) expires. The temperature set points can be local (hardwired), communicated, or stored default values (configurable in Rover).

Timed-override control

If the zone sensor has a timed-override option (ON/CANCEL buttons), pushing the ON button momentarily shorts the zone-temperature signal to the controller. This short is interpreted as 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 zone temperature based on the occupied heating or cooling set points. The occupied bypass time, which resides in the Tracer ZN.511 and defines the duration of the override, is configurable through the Rover service tool from 0 to 240 minutes (default value of 120 minutes). When the occupied bypass time expires, the unit sequences from occupied bypass mode to unoccupied mode. Pushing the CANCEL button momentarily sends a fixed resistance of 1.5 kΩ to the ZN analog input of the controller, which is interpreted as a "timed-override cancel" request. A "timed-override cancel" request will end the timed-override before the occupied bypass time has expired and will sequence the unit from occupied bypass mode to unoccupied mode.

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

Sequence of Operations for the heat pump configuration

Morning warm-up

The morning warm-up feature is initiated when the controller is in transition from unoccupied to occupied and the zone temperature is 3°F [1.7°C] below the occupied heating set point. The fan will be turned on and the outdoor air damper will remain closed. When the zone temperature reaches the occupied heating set point, the controller begins operating in the occupied mode.

Morning cool-down

The morning cool-down feature is initiated when the controller is in transition from unoccupied to occupied and the zone temperature is 3°F [1.7°C] above the occupied heating set point. The fan will be turned on and the outdoor air damper will remain closed. When the zone temperature reaches the occupied heating set point, the controller begins operating in the occupied mode.

Heating or cooling mode

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

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

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

In heating and cooling mode, the controller maintains the zone temperature based on the active heating set point and the active cooling set point, respectively. The active heating and cooling set points are determined by the occupancy mode of the controller.

When no communicated signal is present (stand-alone operation) or the communicated signal is auto, the controller automatically determines the heating or cooling mode.

Fan operation and status

The Tracer ZN.511, configured for heat-pump control, supports single-speed fan applications. The fan can be configured for continuous or cycling operation for both heating- and cooling-mode operation. When configured for continuous operation, the fan normally runs continuously during the occupied, occupied standby, and occupied bypass modes. When configured for cycling operation, the fan will cycle with compressor operation during the occupied, occupied standby, and occupied bypass modes. During the unoccupied mode, the fan cycles with compressor operation regardless of the fan configuration. The fan will de-energize either when an off signal is communicated to the control or when the fan speed switch is set to OFF. The ability to enable or disable the fan speed switch for the associated controller is also configurable.

Compressor operation

The Tracer ZN.511 supports applications with one or two compressors. The compressor(s) will cycle to meet zone temperature requirements. Compressor operation will be overridden by a preset, 3-minute minimum, on/off time delay, in order to maintain oil return when the unit is either initially energized, manually reset, switched between modes, or cycled within a single mode. If a compressor diagnostic occurs, the controller ignores the minimum on/off time and locks out the compressor. If a compressor is locked out, the smart reset function is enabled (see “Smart reset”).

For two-compressor units, if one of the compressors is locked out as a result of a Low Temperature Detection diagnostic, a Leaving Water Temp Failure diagnostic, or a High-Low Pressure Cutout diagnostic, the operation of the other compressor will not be affected.

Sequence of Operations for the heat pump configuration

Outdoor air damper operation

The Tracer ZN.511 supports a two-position outdoor air damper. The damper is used only as a source for ventilation air, not as a cooling source (economizer). In occupied and occupied standby modes, the damper is open when the fan is on and closed when the fan is off. In occupied standby and unoccupied modes, as well as during morning warm-up and morning cool-down, the damper remains closed.

Reversing-valve operation

The reversing valve is configurable to energize in either the cooling mode (typical of Trane units) or the heating mode. Be sure to configure the reversing-valve operation based on the heat pump manufacturer's design. An energized valve will remain energized until a mode change (either from cooling to heating or vice versa) is initiated. The reversing-valve operation is delayed after compressor shutdown to reduce noise due to refrigerant migration. The reversing valve will de-energize when a power failure occurs, or when the controller is set to off either through a communicated off signal or when the fan switch is set to OFF.

Peer-to-peer (master/slave) data sharing

Tracer ZN.511 zone controllers have the ability to share data with other LonTalk-based controllers. Several controllers can be bound as peers, using the Rover service tool, to share:

- Set point
- Zone temperature
- Heating/cooling mode
- Fan status
- Unit capacity control

Shared data is communicated from the controller assigned as master to the other (slave) controllers. Applications having more than one unit serving one zone can benefit by using this feature, which prevents multiple units from simultaneously heating and cooling.

Unit-protection strategies

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

- Smart reset
- High/low pressure cutout
- Low-temperature protection
- Condensate overflow
- Filter-maintenance timer
- Fan off delay

Smart reset
The Tracer ZN.511 will automatically restart a unit that is locked out as a result of a High/Low Pressure Cutout (BI4, BI5) diagnostic or a Low Temp Detection Circuit 1 (AI1) or Low Temp Detection Circuit 2 (BI1) 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 smart reset diagnostic within a 24-hour period, the unit will be locked out until it is manually reset. For more information on manual resetting, see "Manual (latching) diagnostics."

Low-temperature protection
See "AI1: Leaving-water temperature" for circuit 1, and "BI1: Low-temperature detection (circuit 2)" for circuit 2.

Filter-maintenance timer
The filter-maintenance timer tracks the amount of time (in hours) that the fan is enabled. The Maintenance Required Timer Set point, configured with the Rover service tool, is used to set the amount of time until maintenance (typically, a filter change) is needed. If the set point is configured to zero, the filter-maintenance timer is disabled.

The controller compares the fan-run time to the Maintenance Required Timer Set point. When the set point is reached, the controller generates a Maintenance 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.

Fan off delay
After heating has been controlled off, the Tracer ZN.511 automatically keeps the fan energized for an additional 30 seconds. The purpose of this feature is to remove residual heat from the heating source.

Applications for the 1 heat/1 cool configuration

This chapter provides information about the function of inputs and outputs, and examples of wiring, for typical 1 heat/1 cool applications. The types of 1 heat/1 cool applications supported by the Tracer ZN.511 zone controller are fan-coil units and cabinet heaters as shown in Table 7.

The decision to wire many of the input/output terminals discussed in this chapter depends on the application. Figure 9 through Figure 13 show typical applications that include all required, and all optional, components for 1 heat/1 cool applications.

Binary inputs for 1 heat/1 cool applications

The Tracer ZN.511 controller includes five binary inputs, three of which are available for use in 1 heat/1 cool applications. Each binary input associates an input signal of 0 Vac with open contacts and 24 Vac with closed contacts. Table 8 gives the function of each binary input for 1 heat/1 cool applications. Each function is explained in the succeeding paragraphs. For an explanation of the diagnostics generated by each binary input, see "Diagnostics." For more information about how the controller operates, see the chapter "Sequence of operations for the 1 heat/1 cool configuration."

Table 7 – 1 heat/1 cool applications for the Tracer ZN.511 zone controller

Application	Without electric heat	With electric heat
2-pipe hydronic cooling only	×	×
2-pipe hydronic heat/cool changeover	×	×
2-pipe hydronic heating only	×	
Electric heat only (single stage)		×
4-pipe applications	×	
4-pipe main-coil heat/cool changeover	×	

Table 8 – Binary inputs for 1 heat/1 cool applications

Binary input terminal label	Function
BI1	Low-temperature detection
BI2	Condensate overflow
BI3	Occupancy or generic binary input
BI4 and V4	Not used
BI5 and V5	Not used

BI1: Low-temperature detection
The function of low-temperature detection is to protect the coil from freezing. If BI1 is wired to a binary low-temperature detection device (freeze-protection switch), the Tracer ZN.511 will detect a low-temperature condition and generate a Low Temp Detection diagnostic. If the application does not warrant the use of BI1, configure the input as Not Used. This will disable the generation of diagnostics for this function.

BI2: Condensate overflow
The function of condensate overflow is to prevent the condensate drain pan from overflowing and causing water damage to the building. If BI2 is wired to a condensate-overflow switch and the level of condensate reaches the trip point, the ZN.511 will detect the condition and generate a Condensate Overflow diagnostic. If the application does not warrant the use of BI2, configure the input as Not Used. This will disable the generation of diagnostics for this function.

BI3: Occupancy or generic binary input
The function of occupancy is to save energy by spreading zone set points when the zone is unoccupied. BI3 is used for two occupancy-related functions. For stand-alone controllers, this binary input can be hardwired to a binary switch or clock to determine the occupancy mode – either occupied or unoccupied. For controllers receiving a BAS-communicated occupancy request, the function of BI3 is to change the mode from occupied to occupied standby. (For more information on occupancy-related functions, see "Occupancy modes.")

BI3 is the only input that can be configured as a generic binary input. When configured as a generic binary input, it can be monitored only by a BAS, and has no direct effect on Tracer ZN.511 operation.

Applications for the 1 heat/1 cool configuration

Analog inputs for 1 heat/ 1 cool applications

The Tracer ZN.511 controller includes five analog inputs. Table 9 describes the function of each input for 1 heat/1 cool applications. Each function is explained in the succeeding paragraphs. For an explanation of the diagnostics generated by each analog input, see "Diagnostics." For more information about how the controller operates, see the chapter "Sequence of operations for the 1 heat/1 cool configuration."

Note: Use a GND terminal as the common ground for all zone sensor analog inputs. See Figure 8 through Figure 13.

ZN: Zone temperature
The ZN analog input functions as the local (hardwired) zone-temperature input. The controller receives the temperature as a resistance signal from a 10 kΩ thermistor in a standard Trane zone sensor, wired to analog input ZN. A communicated zone-temperature value via the Comm5 communications link can also be used for controllers operating on a BAS. When both hardwired and communicated zone-temperature values are present, the controller uses the communicated value. If neither a hardwired nor a communicated zone-temperature value is present, the controller generates a Zone Temp Failure diagnostic.

The ZN analog input is also used to communicate timed-override requests and cancel requests to the controller, for applications utilizing a Trane zone sensor with the ON and CANCEL button option.

Table 9 – Analog inputs for 1 heat/1 cool applications

Analog input terminal label	Function
ZN	Zone temperature
SET	Local set point
FAN	Fan-mode input
AI1	Entering-water temperature
AI2	Discharge-air temperature

SET: Local set point
The SET analog input functions as the local (hardwired) temperature set point input for applications utilizing a Trane zone sensor with a temperature set point thumbwheel. The ability to enable or disable the local set point input is available in the Rover service tool. A communicated set point value via the Comm5 communications link can also be used for controllers operating on a BAS. If both hardwired and communicated set point values are present, the controller uses the communicated value. If neither a hardwired nor a communicated set point value is present, the controller uses the stored default set points (configurable in Rover). If a valid hardwired or communicated set point value is established and then is no longer present, the controller generates a Set point Failure diagnostic.

FAN: Fan-mode input
The FAN analog input functions as the local (hardwired) fan-mode switch input for applications utilizing the Trane zone sensor with a fan-mode switch option. Valid fan modes for a 1 heat/1 cool unit are off, low, medium, high, and auto. The ability to enable or disable the local fan-mode input is available in the Rover service tool. A communicated fan-mode request via the Comm5 communications link can also be used for controllers operating on a BAS. If both hardwired and communicated fan-mode values are present, the controller uses the communicated value. If neither a hardwired nor a communicated fan-mode value is present, the controller recognizes the fan-mode value as auto and operates according to the default configuration. If a valid hardwired or communicated fan-mode value is established and then is no longer present, the controller generates a Fan Mode Failure diagnostic.

Applications for the 1 heat/1 cool configuration

AI1: Entering-water temperature sampling

Note: Neither AI1 nor AI2 is polarity sensitive; you can connect either terminal to either sensor lead.

The AI1 analog input functions as the local (hardwired) entering-water temperature sampling input for 1 heat/1 cool applications. An entering-water temperature communicated via the Comm5 communications link can also be used for controllers operating on a BAS. If both hardwired and communicated entering-water temperature values are present, the controller uses the communicated value. If a valid hardwired or communicated entering-water temperature value is established and then is no longer present, the controller generates an Entering Water Temp Failure diagnostic.

For units configured as 2-pipe or 4-pipe changeover units, the entering-water temperature is used to make heat/cool operation decisions. If neither a hardwired nor a communicated entering-water temperature value is present on changeover units, the controller will operate in heating mode only, assuming the water is hot.

For units not configured as changeover units, entering-water temperature sampling is used for information and troubleshooting only and does not affect the operation of the controller.

AI2: Discharge-air temperature

Note: Neither AI1 nor AI2 is polarity sensitive; you can connect either terminal to either sensor lead.

The AI2 analog input functions as the local (hardwired) discharge-air temperature input. The discharge-air value is used for information and troubleshooting only and does not affect the operation of the controller. The controller receives the temperature as a resistance signal from a 10 kΩ thermistor wired to analog input AI2. A discharge-air temperature value communicated via the Comm5 communications link can also be used for controllers operating on a BAS. If a valid hardwired or communicated discharge-air temperature value is established and then is no longer present, the controller generates a Discharge Air Temp Failure diagnostic.

Applications for the 1 heat/1 cool configuration

Binary outputs for 1 heat/1 cool applications

This configuration supports fan coil and cabinet heater applications, with the following components:

- Supply fan with up to three speeds
- Main hydronic coil with a 2-position control valve (optional)
- Hydronic heating coil with a 2-position control valve or single-stage electric heat (both optional)
- Two-position outdoor air ventilation damper (optional)

The Tracer ZN.511 controller includes five binary outputs. Each binary output is a relay with a rating of 12 VA. Table 10 describes the function of each output for 1 heat/1 cool applications.

Generic binary output
Binary output 6 is the only output that can be configured as a generic binary output. When configured as a generic binary output, it can be monitored only by a BAS, and has no direct effect on Tracer ZN.511 operation.

Overriding binary outputs
The Tracer ZN.511 controller includes a manual-output test. Use this feature to manually control the outputs in a defined sequence. For more information about the manual-output test, see “Manual-output test.”

Table 10 – Binary outputs for 1 heat/1 cool applications

Binary output terminal label	Function
1	Fan high, or single fan speed
2	Fan medium
3	Fan low
4	Cool/changeover valve
5	Heat (hydronic or electric)
6	Two-position outdoor air damper or generic binary output

Table 11 – Required controller inputs for all 1 heat/1 cool applications

Function	Input source	For more information, see:
24 Vac power	Terminals: GND, 24 V	“AC power wiring”
Zone temperature	Terminals: ZN, GND or communicated	“ZN: Zone temperature”
Entering-water temperature – required only for two-pipe and four-pipe fan coil units with auto-changeover	Terminals: AI1or communicated	“AI1: Entering-water temperature sampling”

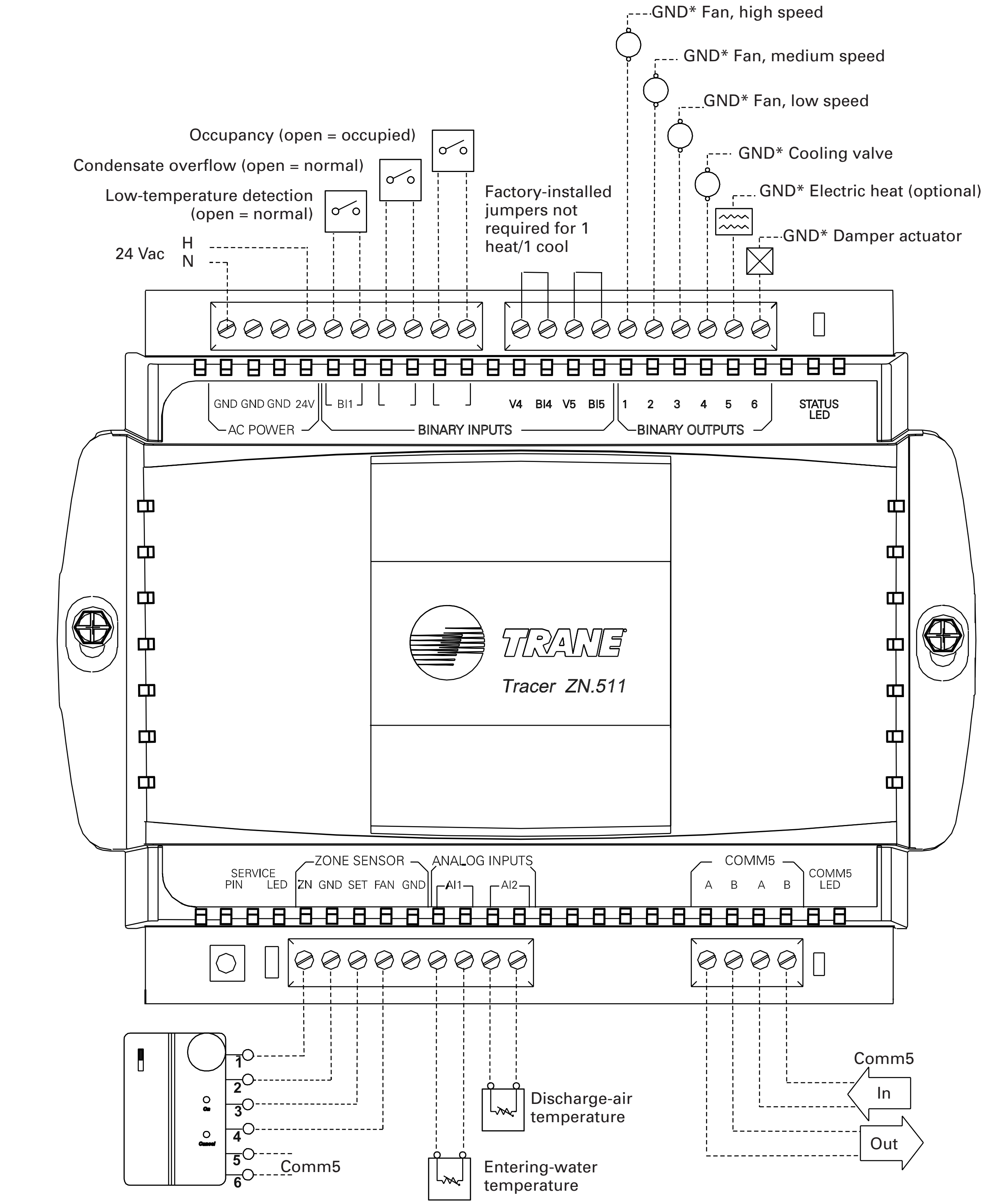
Wiring requirements and options

Table 11 shows required controller inputs for minimal proper operation of all 1 heat/1 cool applications.

Figure 9 through Figure 13 show typical applications that include all required and all optional components for 1 heat/1 cool applications.

Applications for the 1 heat/1 cool configuration

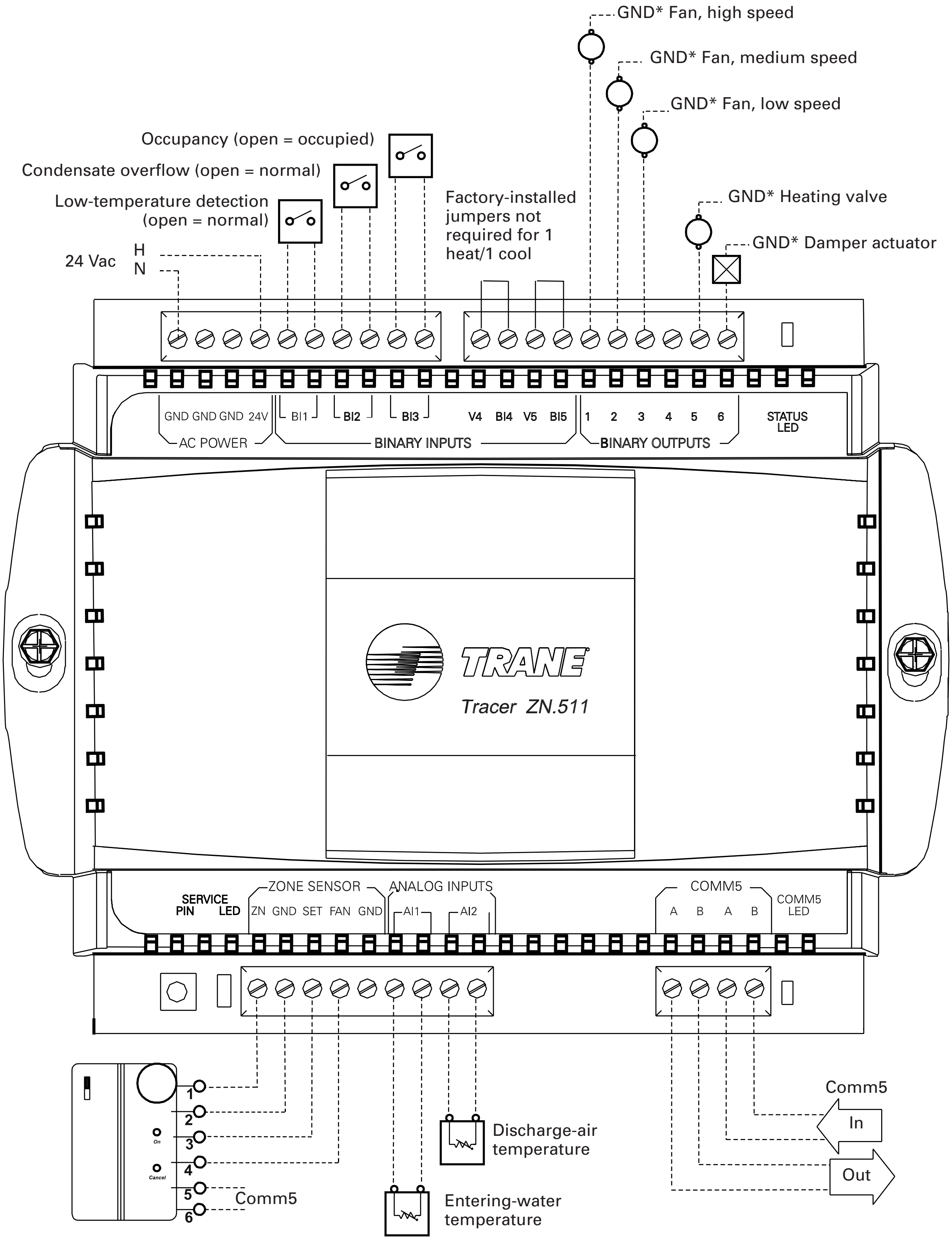
Figure 8 – Two-pipe, hydronic-cooling fan coil



*The grounding wire of a binary output should be connected to one of the AC POWER (GND) terminals.

Applications for the 1 heat/1 cool configuration

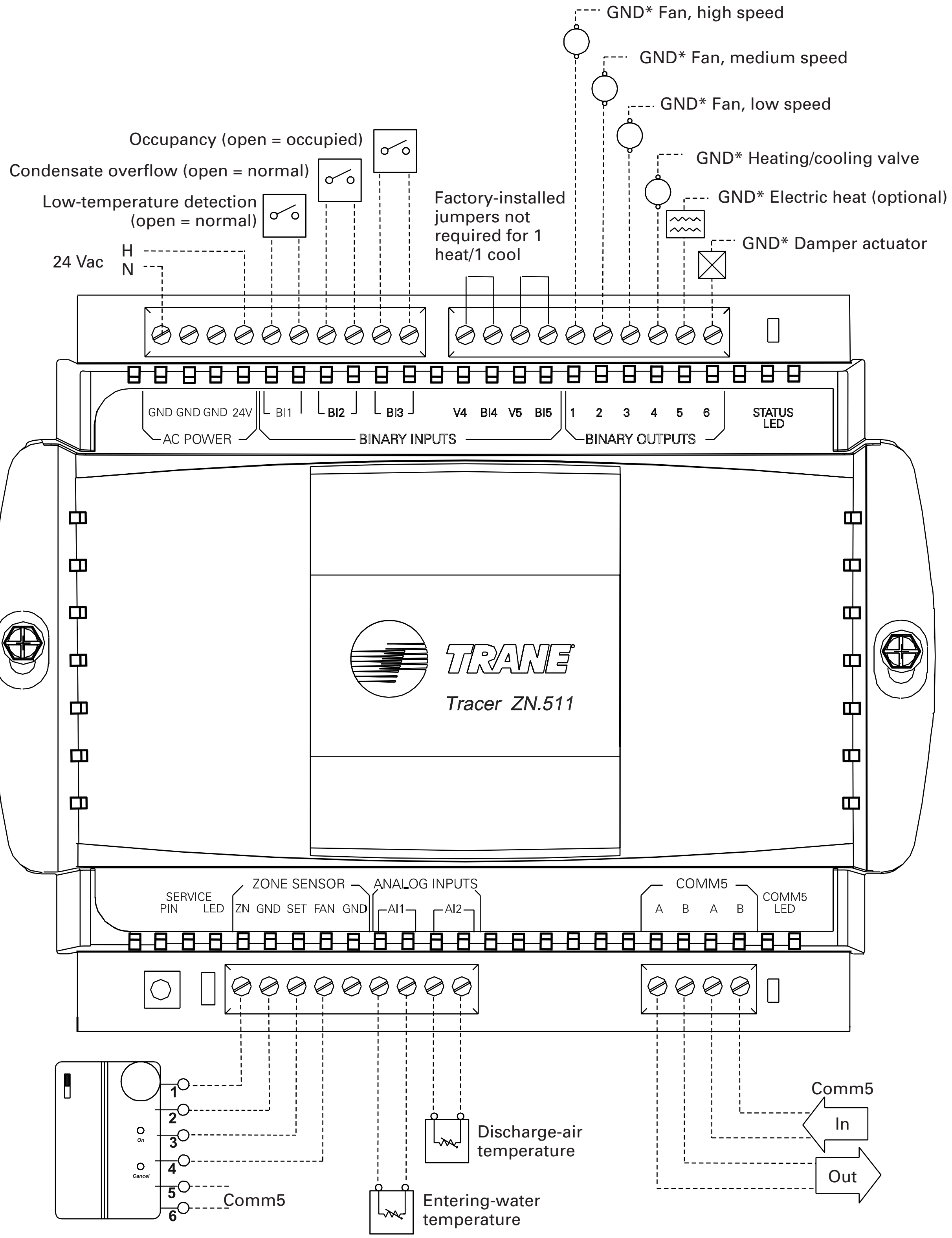
Figure 9 – Two-pipe, heating-only fan coil



*The grounding wire of a binary output should be connected to one of the AC POWER (GND) terminals.

Applications for the 1 heat/1 cool configuration

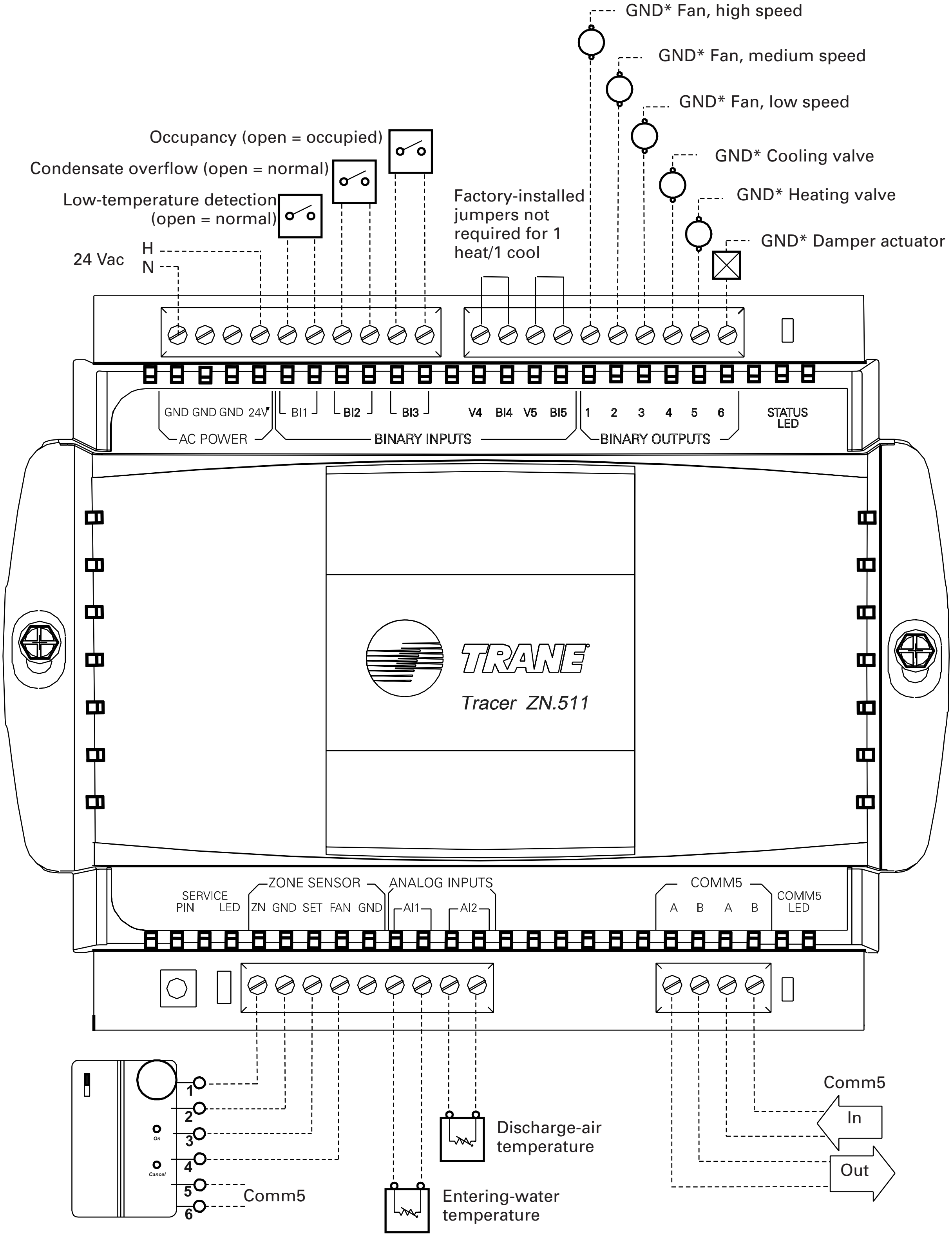
Figure 10 – Two-pipe fan coil with auto-changeover



*The grounding wire of a binary output should be connected to one of the AC POWER (GND) terminals.

Applications for the 1 heat/1 cool configuration

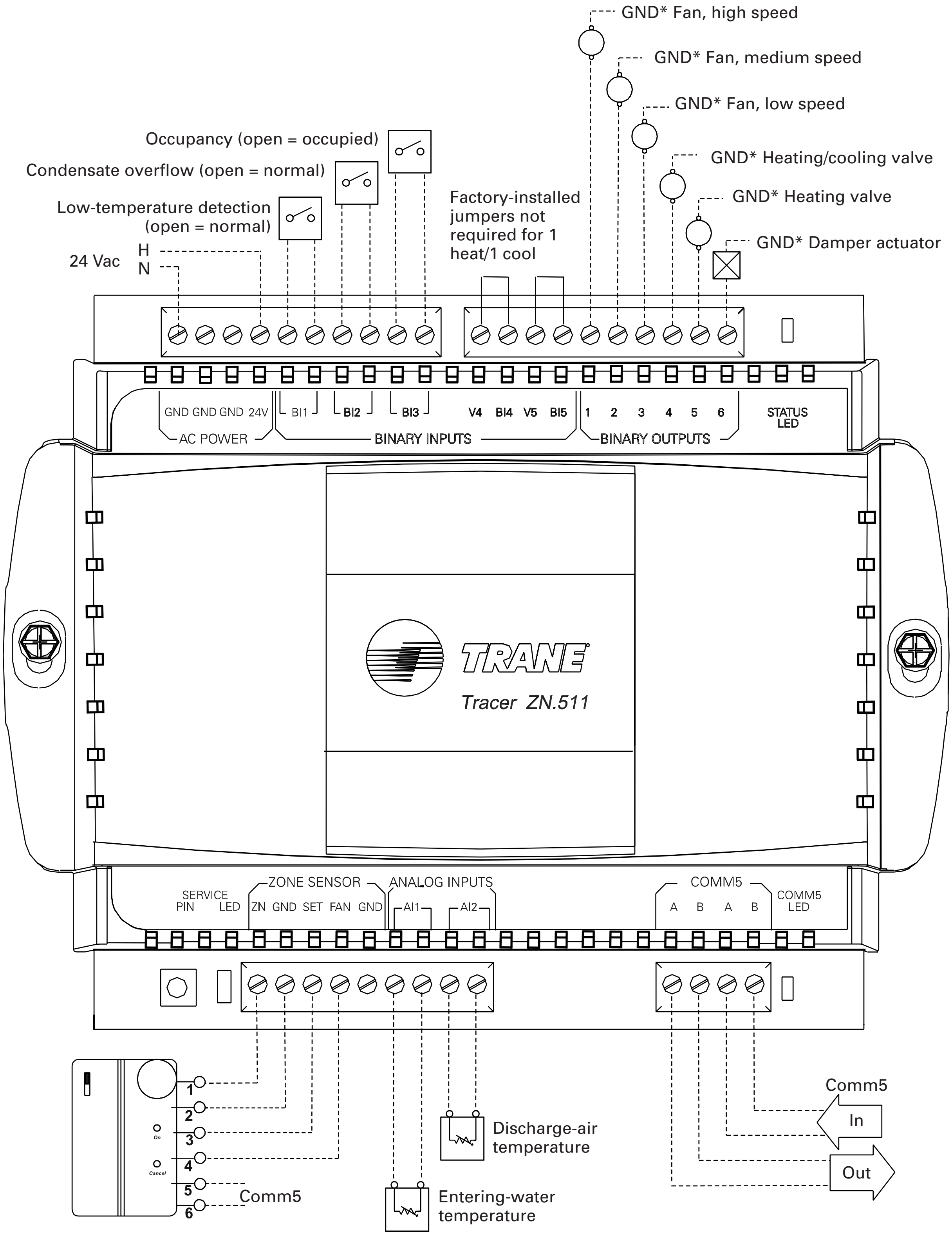
Figure 11 – Four-pipe heating/cooling fan coil



*The grounding wire of a binary output should be connected to one of the AC POWER (GND) terminals.

Applications for the 1 heat/1 cool configuration

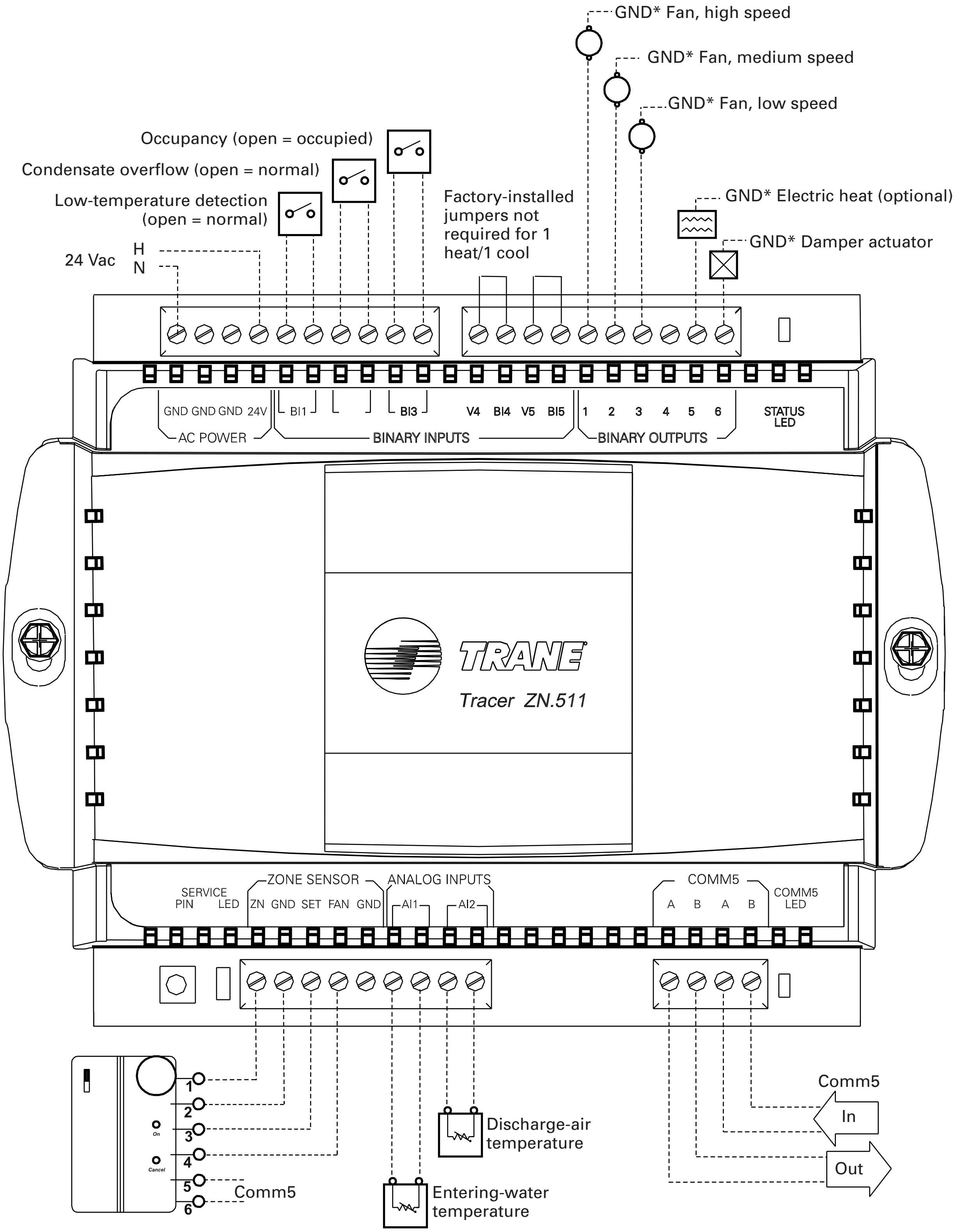
Figure 12 – Four-pipe fan coil with auto-changeover



*The grounding wire of a binary output should be connected to one of the AC POWER (GND) terminals.

Applications for the 1 heat/1 cool configuration

Figure 13 – Fan coil with electric heat



*The grounding wire of a binary output should be connected to one of the AC POWER (GND) terminals.

Sequence of operations for the 1 heat/1 cool configuration

A Tracer ZN.511 zone controller configured to control a 1 heat/1 cool unit will operate to maintain the zone-temperature set point. This chapter discusses many of the operational sequences used by the controller to accomplish this goal.

Power-up sequence

When 24 Vac power is initially applied to the Tracer ZN.511 zone controller, the following sequence occurs:

1. All outputs are sequenced off.
2. The controller reads all input local values to determine initial values.
3. The random-start timer begins (see "Random start").
4. If a hardwired zone-temperature value is not detected, the controller begins to wait for a communicated value. (This can take several minutes [15-minute default] and occurs concurrently with the remainder of the power-up sequence.) If a communicated zone-temperature value arrives, normal operation can begin when the power-up sequence has concluded. If a communicated zone-temperature value does not arrive, a Zone Temp Failure diagnostic is generated (normal operation cannot begin without a valid zone-temperature value).
5. The random-start timer expires.
6. The power-up control wait function begins automatically if the configured power-up control wait time is greater than zero. When this function is enabled, the controller waits for the configured amount of time (from 0 to 120 seconds) to allow a communicated occupancy request to arrive. If a communicated occupancy request arrives, normal operation can begin. If a communicated occupancy request does not arrive, the controller assumes stand-alone operation.
7. Normal operation begins, assuming that no diagnostics have been generated.

Random start

Random start is intended to prevent all units in a building from energizing major loads at the same time. The random-start timer delays the fan start-up from 5 to 30 seconds. If neither heating nor cooling is initiated, or if fan operation is not required during the delay, the random-start timer is allowed to time out.

Zone-temperature control

The Tracer ZN.511 zone controller calculates a required heating or cooling capacity (0–100%) according to the measured zone temperature and the active temperature set point, and sequences the fan coil unit heating and cooling stages accordingly. The active temperature set point is determined by the current operating modes, which include occupancy mode and heat/cool mode.

Sequence of operations for the 1 heat/1 cool configuration

Occupancy modes

Occupancy modes can be controlled by any of the following:

- The state of the local (hardwired) occupancy binary input BI3 (see "BI3: Occupancy or generic binary input")
- A timed override request from a Trane zone sensor (see "Timed override control")
- A communicated signal from a peer device (see "Peer-to-peer (master/slave) data sharing")
- A communicated signal from a BAS

A communicated request, either from a BAS or a peer controller, 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 hardwired occupancy request exists). The Tracer ZN.511 has the following occupancy mode options:

- Occupied
- Unoccupied
- Occupied standby
- Occupied bypass

Occupied mode
In occupied mode, the controller maintains the zone temperature based on the occupied heating or cooling set points. The controller uses the occupied mode as a default mode when other forms of occupancy request are not present. The fan will run as configured (continuous or cycling). The outdoor air damper will close when the fan is off. The temperature set points can be local (hardwired), communicated, or stored default values (configurable in Rover).

Unoccupied mode
In unoccupied mode, the controller attempts to maintain the zone temperature based on the unoccupied heating or cooling set point. The fan will cycle between high speed and off. The outdoor air damper will remain closed. The controller always uses the stored default set point values (configurable in Rover), regardless of the presence of a hardwired or communicated set point value.

Occupied standby mode
The controller is placed in occupied standby mode only when a communicated occupied request is combined with an unoccupied request from occupancy binary input BI3. In occupied standby mode, the controller maintains the zone temperature based on the occupied standby heating or cooling set points. Because the occupied standby set points are typically spread 2°F [1.1°C] in either direction and the outdoor air damper is closed, this mode reduces the demand for heating and cooling the space. The fan will run as configured (continuous or cycling) for occupied mode. The controller always uses the stored default set point values (configurable in Rover), regardless of hardwired or communicated set point values.

Occupied bypass mode
The controller is placed in occupied bypass mode when the controller is operating in the unoccupied mode, and 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 zone temperature based on the occupied heating or cooling set points. The fan will run as configured (continuous or cycling). The outdoor air damper will close when the fan is off. The controller will remain in occupied bypass mode until either the CANCEL button is pressed on the Trane zone sensor or the occupied bypass time (configurable in Rover) expires. The temperature set points can be local (hardwired), communicated, or stored default values (configurable in Rover).

Sequence of operations for the 1 heat/1 cool configuration

Timed-override control

If the zone sensor has a timed-override option (ON/CANCEL buttons), pushing the ON button momentarily shorts the zone-temperature signal to the controller. This short is interpreted as 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 zone temperature based on the occupied heating or cooling set points. The occupied bypass time, which resides in the Tracer ZN.511 and defines the duration of the override, is configurable through the Rover service tool from 0 to 240 minutes (default value of 120 minutes). When the occupied bypass time expires, the unit sequences from occupied bypass mode to unoccupied mode. Pushing the CANCEL button momentarily sends a fixed resistance of 1.5 kΩ to the ZN analog input of the controller, which is interpreted as a timed-override cancel request. A timed-override cancel request will end the timed override before the occupied bypass time has expired, and will sequence the unit from occupied bypass mode to unoccupied mode.

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

Morning warm-up

The morning warm-up feature is initiated when the controller is in transition from unoccupied to occupied and the zone temperature is 3°F [1.7°C] below the occupied heating set point. The fan will be turned on and the outdoor air damper will remain closed. When the zone temperature reaches the occupied heating set point, the controller begins operating in the occupied mode.

Morning cool-down

The morning cool-down feature is initiated when the controller is in transition from unoccupied to occupied and the zone temperature is 3°F [1.7°C] above the occupied heating set point. The fan will be turned on and the outdoor air damper will remain closed. When the zone temperature reaches the occupied heating set point, the controller begins operating in the occupied mode.

Heating or cooling mode

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

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

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

In heating and cooling mode, the controller maintains the zone temperature based on the active heating set point and the active cooling set point, respectively. The active heating and cooling set points are determined by the occupancy mode of the controller.

For two-pipe and four-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 (see “AI1: Entering water temperature sampling”), for which a valid entering-water temperature is required. When neither a hardwired nor a communicated entering-water temperature value is present on changeover units, the controller will operate in heating mode only (assuming the water is hot), and the sampling function is not used.

For 1 heat/1 cool units that are not changeover applications, whether the entering-water temperature is hot or cold is dependent on the configuration of the unit. For these applications, the entering-water sampling function is not used. The entering-water temperature value is used for information and troubleshooting only and does not affect the operation of the controller.

Sequence of operations for the 1 heat/1 cool configuration

Entering-water temperature sampling function

The entering-water temperature-sampling function is used with two-pipe and four-pipe changeover units and requires a valid entering water temperature value. If the entering-water temperature value is less than 5°F [2.8°C] above a valid zone-temperature value for hydronic heating, and greater than 5°F [2.8°C] below a valid zone temperature value for hydronic cooling, the sampling function is enabled. When the sampling function is enabled, the controller opens the main hydronic valve to allow the water temperature to stabilize. After 3 minutes, the controller again compares the entering water temperature value to the zone temperature value to determine if the desired heating or cooling function can be accomplished. If the entering-water temperature value remains out of range to accomplish the desired heat/cool 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 and status

The Tracer ZN.511, configured for 1 heat/1 cool operation, supports three fan speeds. Every time the fan is enabled, the fan will begin operation and run for 3 seconds in high speed before changing to any other speed. This is done to provide adequate torque to start the fan motor from the off position. The controller can be set to Auto, a specific fan speed, or Off. If both a communicated and hardwired values are present, the communicated value has priority.

When the controller receives a communicated Auto signal or the associated fan-speed switch is set to AUTO, the fan will operate in the Auto mode. In the Auto mode, the fan will operate as configured in Rover. The fan can be configured for continuous or cycling operation and for a default fan speed for both heating and cooling mode operation. When configured for continuous operation, the fan operates continuously at the default fan speed during occupied, occupied standby, and occupied bypass operation. When configured for cycling operation, the fan will cycle between off and the default fan speed during occupied, occupied standby, and occupied bypass operation. During unoccupied operation, the fan will cycle between off and high regardless of the fan configuration.

When the controller receives a communicated fan-speed signal (high, medium, low) or the associated fan-speed switch is set to a specific fan-speed, the fan will run continuously at the desired fan speed during occupied, occupied standby, and occupied bypass operation. During unoccupied operation, the fan will cycle between off and high regardless of the fan configuration.

The fan will turn off when the controller receives a communicated “off” signal, when the fan-speed switch is set to OFF, or when the default fan speed is set to off and the fan is operating in the auto mode.

The ability to enable or disable the controller’s associated fan-speed switch is also configurable.

Sequence of operations for the 1 heat/1 cool configuration

Two-position valve operation

The Tracer ZN.511 zone controller will control hydronic, two-position valves for any of the 1 heat/1 cool applications shown in Table 12.

The controller opens and closes the appropriate value to control the zone temperature at the heating set point in heating mode or at the cooling set point in cooling mode.

Two-pipe operation
For two-pipe applications, the Tracer ZN.511 can be configured as heating only, cooling only, or heat/cool changeover (see Table 12). The main coil can be used as the primary heating source and/or the primary cooling source. If present, an electric heating element can only be used as the primary heating source, not as a second stage of heating. A changeover unit requires a valid entering-water temperature value – either communicated or hardwired – to operate properly. The entering-water temperature value, along with the entering-water temperature sampling function, allows a changeover unit to accurately and reliably control zone temperature. When there is not a valid entering-water temperature present for a changeover unit, the controller will operate only in heating mode and the water will be assumed hot.

Table 12 – Configuration options for 1 heat/1 cool applications

Application	Main coil	Auxiliary coil	Electric heat option?
2-pipe cooling only	Cool	N/A	Yes
2-pipe heating only	Heat	N/A	No
2-pipe heat/cool changeover	Heat/Cool	N/A	Yes
4-pipe heating and cooling	Cool	Heat	No
4-pipe main-coil changeover	Heat/Cool	Heat	No

Four-pipe operation
For four-pipe applications, the Tracer ZN.511 can be configured as heat/cool or heat/cool changeover (see Table 12). The main coil can be used as the primary cooling source or the primary heating/cooling source. The auxiliary coil can only be used as the primary heating source, not as a second stage of heating. During normal operation, the controller never uses the main coil and auxiliary coil simultaneously. A changeover unit requires a valid entering-water temperature value – either communicated or hardwired – to operate properly. The entering-water temperature value, along with the entering-water temperature-sampling function, allows the changeover unit to accurately and reliably control zone temperature. When there is not a valid entering-water temperature present for a changeover unit, the controller will only operate in heating mode and the water will be assumed hot.

Electric heat operation
The Tracer ZN.511 supports a single stage of electric heat for 2-pipe applications (see Table 12). Electric heat can only be used as the primary heat source, not as a second stage of heating. Electric heat is cycled on and off to maintain zone temperature at the active heating set point.

Outdoor-air damper operation

The Tracer ZN.511 supports a two-position outdoor-air damper. The damper is used as a source for ventilation air only, not as a cooling source (economizer). In occupied and occupied standby mode, the damper is open when the fan is on and closed when the fan is off. In occupied standby and unoccupied mode, as well as during morning warm-up and morning cool-down, the damper remains closed.

Peer-to-peer (master/slave) data sharing

Tracer ZN.511 zone controllers have the ability to share data with other LonTalk-based controllers. Several controllers can be bound as peers, using the Rover service tool, to share:

- Set point
- Zone temperature
- Heating/cooling mode
- Fan status
- Unit capacity control

Shared data is communicated from the controller assigned as master to the other (slave) controllers. Applications having more than one unit serving one zone can benefit by using this feature, which prevents multiple units from simultaneously heating and cooling.

Sequence of operations for the 1 heat/1 cool configuration

Unit-protection strategies

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

- Smart reset
- High/low pressure cutout
- Low-temperature protection
- Condensate overflow
- Filter-maintenance timer

Smart reset
The Tracer ZN.511 will automatically restart a unit that is locked-out as a result of a Low Temp Detection Circuit 1 (BI1) 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 smart reset diagnostic within a 24-hour period, the unit will be locked out until it is manually reset. For more information on manual resetting, see "Manual (latching) diagnostics").

Low-temperature protection
See "BI1: Low-temperature detection."

Condensate overflow
See "BI2: Condensate overflow."

Filter-maintenance timer
The filter-maintenance timer tracks the amount of time (in hours) that the fan is enabled. The Maintenance Required Timer Set point, configured with the Rover service tool, is used to set the amount of time until maintenance (typically, a filter change) is needed. If the set point is configured to zero, the filter-maintenance timer is disabled.

The controller compares the fan-run time to Maintenance Required Timer Set point. When the set point is reached, the controller generates a Maintenance 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.

Fan-off delay
After heating has been controlled off, the Tracer ZN.511 automatically keeps the fan energized for an additional 30 seconds. The purpose of this feature is to remove residual heat from the heating source.

Status indicators for operation and communication

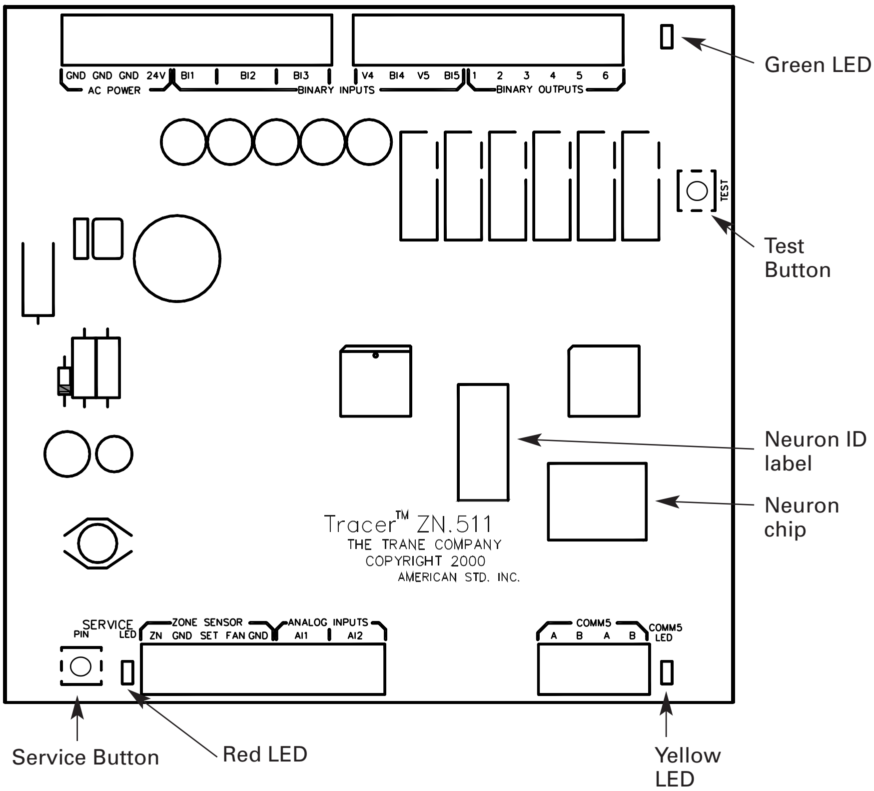
This chapter describes the operation and communication status indicators on the Tracer ZN.511 controller, including:

- A description of the location and function of the Test button and Service button and the light-emitting diodes (LEDs) located on the controller
- A complete list of the diagnostics that can occur, their effect on controller outputs, and an explanation of how diagnostics are cleared and the device restored to normal operation

Test button

The Test button is used to perform the manual output test (see “Manual output test”), which verifies that the controller is operating properly. It is located as shown in Figure 14.

Figure 14 – Tracer ZN.511 zone controller circuit board



Status indicators for operation and communication

Manual-output test

The manual-output test sequentially turns off and on all binary outputs to verify their operation. The test overrides normal operation of the controller, which is suspended while the test is being performed.

Use the manual-output test to:

- Verify output wiring and operation
- Force compressor operation (on heat pumps) so that a technician can use test equipment to verify unit operation.
- Force the water valve open (on 1 heat/1 cool units) to balance the hydronic system
- Clear diagnostics and restore normal operation (although not a primary function of the manual output test)

The manual-output test is performed either by repeatedly pressing the Test button to proceed through the test sequence or by using the Rover service tool. Table 13 lists the outputs for heat pump configurations in the sequence in which they are verified; Table 14 lists the outputs for 1 heat/1 cool configurations in the sequence in which they are verified. The procedure is as follows:

1. Press and hold the Test button for 3 to 4 seconds, then release the pin to start the test mode. The green LED goes off when the Test button is pressed, and then it blinks (as described in Table 16) when the pin is released to indicate the controller is in manual test mode.
2. Press the Test button (no more than once per second) to advance through the test sequence. Table 13 shows the resulting activities of the binary outputs.

Note: The outputs are not subject to minimum on or off times during the test sequence. However, the test sequence permits only one step per second, which enforces a minimum output time.

Service button

The Service button is located as shown in Figure 14. The Service button is used to:

- Identify a device (see “Identifying a device” in the *Rover Installation/ Operation/ Programming* guide (EMTX-SVX01A-EN)
- Add a device to the active group (see “Adding a device” in EMTX-SVX01A-EN)
- Verify PCMCIA communications (see “Verifying PCMCIA communications” in EMTX-SVX01A-EN)
- Make the green LED “wink” to verify that the controller is communicating on the link (see Table 16 and “Setting the Auto-wink option” in EMTX-SVX01A-EN)

Status indicators for operation and communication

Table 13 – Manual output test sequence for water-source heat pump configurations

Step (number of times Test button is pressed in sequence)	Result	Fan (BOP1)	Reversing valve (BOP2)	Compressor 1 (BOP4)	Compressor 1 (BOP5)	Damper/Generic (BOP6
1	Begins test mode	Off	Off	Off	Off	Closed/Off
2	Fan on[1]	On	Off	Off	Off	Closed/Off
3	Reversing valve on	On	On	Off	Off	Closed/Off
4	Compressor 1	On	On	On	Off	Closed/Off
5	Compressor 2[2]	On	On	On	On	Closed/Off
6	Compressor(s) off[3]	On	Off	Off	Off	Closed/Off
7	Heat 1	On	Off	On	Off	Closed/Off
8	Heat 2[2]	On	Off	On	On	Closed/Off
9	Outdoor air damper[4]	On	Off	Off	Off	Open/On
10	Exit[5]					

[1] At the beginning of Step 2, the controller attempts to clear all diagnostics.
[2] BOP5 will be controlled during this step regardless of its configuration.
[3] This stage helps avoid an abrupt transition from cooling to heating by turning off the compressors prior to changing the reversing-valve state.
[4] BOP6 will be controlled during this step regardless of its configuration.
[5] This step will exit the manual-output test and initiate a reset to restore the controller to normal operation.

Table 14 – Manual-output test sequence for 1 heat/1 cool configurations

Step (number of times Test button is pressed in sequence)	Result	Fan high (BOP1)	Fan medium (BOP2)	Fan low (BOP3)	Cool output (BOP4)[1]	Heat output (BOP5)	Damper/Generic (BOP6
1	Begins test mode	Off	Off	Off	Off	Off	Closed/Off
2	Fan high[2]	On	Off	Off	Off	Off	Closed/Off
3	Fan medium	Off	On	Off	Off	Off	Closed/Off
4	Fan low	Off	Off	On	Off	Off	Closed/Off
5	Cool	On	Off	Off	On	Off	Closed/Off
6	Heat	On	Off	Off	Off	On	Closed/Off
7	Outdoor-air damper[3]	On	Off	Off	Off	Off	Open/On
8	Exit[4]						

[1] For all 1 heat/1 cool applications including 2-pipe changeover, BOP4 energizes in the cool-test stage and BOP5 energizes in the heat-test stage, even though during normal unit operation BOP4 may control the unit valve for both cooling and heating (2-pipe changeover).
[2] At the beginning of Step 2, the controller attempts to clear all diagnostics.
[3] BOP6 will be controlled during this step regardless of its configuration.
[4] This step will exit the manual-output test and initiate a reset to restore the controller to normal operation.

Status indicators for operation and communication

Interpreting LEDs

The red LED on the Tracer ZN.511 controller (see Figure 14) indicates whether the controller is capable of operating normally (see Table 15).

Table 15 – Red LED: Service indicator

LED activity	Explanation
LED is off continuously when power is applied to the controller.	The controller is operating normally.
LED is on continuously when power is applied to the controller.	The controller is not working properly, or someone is pressing the Service button.
LED flashes once every second.	The controller is not executing the application software because the network connections and addressing have been removed.[1]

[1] Restore the controller to normal operation using the Rover service tool. Refer to EMTX-SVX01A-EN for more information.

The green LED on the Tracer ZN.511 controller (see Figure 14) indicates whether the controller has power applied to it and if the controller is in manual test mode (see Table 16).

Table 16 – Green LED: Status indicator

LED activity	Explanation
LED is on continuously.	Power is on (normal operation).
LED blinks (one recurring blink).	Manual-output test mode is being performed and no diagnostics are present.
LED blinks (blinks twice as a recurring sequence).	Manual-output test mode is being performed and one or more diagnostics are present.
LED blinks (1/4 second on, 1/4 second off for 10 seconds).	The Auto-wink option is activated, and the controller is communicating.[1]
LED is off continuously.	The power is off, the controller has malfunctioned, or the Test button is being pressed.

[1] By sending a request from the Rover service tool, you can request the controller’s green LED to blink (“wink”), a notification that the controller received the signal and is communicating.

The yellow LED on the Tracer ZN.511 controller (see Figure 14) indicates the controller’s communications status (see Table 17).

Table 17 – Yellow LED: Communications indicator

LED activity	Explanation
LED is off continuously	The controller is not detecting any communication (normal for stand-alone applications).
LED blinks.	The controller is detecting communication (normal for communicating applications, including data sharing).
LED is on continuously.	Abnormal condition.

Status indicators for operation and communication

Diagnostics

In response to a diagnostic, the controller attempts to protect the equipment by activating or de-activating, or opening or closing, certain outputs. Table 18 and Table 19 list diagnostics that can occur with the Tracer ZN.511 controller. The tables present each diagnostic that can be generated, its effect on outputs (consequences), and its type (categorized according to clearing method).

Note: The generic binary output is unaffected by diagnostics.

Table 18 – Diagnostics for heat pump configurations

Diagnostic	Probable cause	Consequences	Diagnostic type[1]
Maintenance Required	Fan run hours exceed the time set to indicate filter change	Fan unaffected Valves unaffected Electric heat unaffected Damper unaffected	Informational
Condensate Overflow	The drain pan is full of water	Fan off Valves closed Electric heat off Compressors off Damper closed	Manual
Low Temp Detection Circuit 1	The leaving-fluid temperature is close to freezing	Fan unaffected[2] Compressor 1 off Compressor 2[2] Damper[2]	Smart reset/ Manual
Low Temp Detection Circuit 2	The leaving fluid temperature is close to freezing	Fan unaffected[2] Compressor 1[2] Compressor 2 off Damper[2]	Smart reset/ Manual
Low Temp Detection Circuits 1 and 2	The leaving fluid temperature is close to freezing	Fan off Compressor 1 off Compressor 2 off Damper closed	Smart reset/ Manual
High/Low Pressure Cutout Circuit 1	Abnormal refrigerant pressures	Fan unaffected[2] Compressor 1 off Compressor 2[2] Damper[2]	Smart reset/ Manual
High/low Pressure Cutout Circuit 2	Abnormal refrigerant pressures	Fan unaffected Compressor 1[2] Compressor 2 off Damper[2]	Smart reset/ Manual
High/Low Pressure Cutout Circuits 1 and 2	Abnormal refrigerant pressures	Fan off Compressor 1 off Compressor 2 off Damper closed	Smart reset/ Manual

1 For more information on types of diagnostics and how they are cleared from the controller, see "Clearing diagnostics."
2 High/low pressure cutout and low temperature detection diagnostics for water-source heat-pump configurations isolate each circuit and independently disable compressor operation. For single compressor units, these diagnostics cause the compressor to shut down, the unit fan to be controlled off, and the outdoor air damper to be closed (when present).

Status indicators for operation and communication

Table 18 (Continued)– Diagnostics for heat pump configurations

Diagnostic	Probable cause	Consequences	Diagnostic type[1]
Zone Temp Failure	Invalid or missing value for zone temperature	Fan off[2] Valves closed Electric heat off Compressors off Damper closed	Automatic
Leaving Water Temp Failure	Invalid or missing value for zone temperature	Fan unaffected[2] Compressor 1 off Compressor 2[2] Damper[2]	Manua
Discharge Air Temp Failure	Invalid or missing value for zone temperature	Fan unaffected Valves unaffected Electric heat unaffected Compressors unaffected Damper unaffected	Automatic
Set point Failure	Invalid or missing value for zone set point	Fan unaffected Valves unaffected Electric heat unaffected Compressors unaffected Dampers unaffected	Automatic
Fan Mode Failure	Invalid or missing value for fan mode switch resistance	Fan unaffected Valves unaffected Electric heat unaffected Compressors unaffected Damper unaffected	Automatic
Invalid Unit Configuration	Software configuration is done improperly	Fan off Valves closed Electric heat off Compressors off Damper closed	Manual
Normal—Power Up	On start-up	Fan unaffected Valves unaffected Electric heat unaffected Compressors unaffected Damper unaffected	Automatic

1 For more information on types of diagnostics and how they are cleared from the controller, see “Clearing diagnostics.”

2 High/low pressure cutout and low temperature detection diagnostics for water-source heat-pump configurations isolate each circuit and independently disable compressor operation. For single compressor units, these diagnostics cause the compressor to shut down, the unit fan to be controlled off, and the outdoor air damper to be closed (when present).

Status indicators for operation and communication

Table 19 – Diagnostics for 1 heat/1 cool configurations

Diagnostic	Probable cause	Consequences	Diagnostic type[1]
Maintenance Required	Fan run hours exceed the time set to indicate filter change	Fan unaffected Valves unaffected Electric heat unaffected Damper unaffected	Informational
Condensate Overflow	The drain pan is full of water	Fan off Valves closed Electric heat off Compressors off Damper closed	Manual
Low Temp Detection	The leaving fluid temperature is close to freezing	Fan off Valves open Electric heat off Damper closed	Smart reset/ Manual
Zone Temp Failure	Invalid or missing value for zone temperature	Fan off Valves closed Electric heat off Compressors off Damper closed	Automatic
Entering Water Temp Failure	Invalid or missing value for zone temperature	Fan unaffected Valves unaffected[2] Electric heat unaffected[2] Damper unaffected[2]	Automatic
Discharge Air Temp Failure	Invalid or missing value for zone temperature	Fan unaffected Valves unaffected Electric heat unaffected Damper unaffected	Automatic
Set point Failure	Invalid or missing value for zone set point	Fan unaffected Valves unaffected Electric heat unaffected Damper unaffected	Automatic
Fan Mode Failure	Zone set point	Fan unaffected Valves unaffected Electric heat unaffected Compressors unaffected Damper unaffected	Automatic
Invalid Unit Configuration	Software configuration is done improperly	Fan off Valves closed Electric heat off Compressors off Damper closed	Manual
Normal — Power Up	On start-up	Fan unaffected Valves unaffected Electric heat unaffected Compressors unaffected Damper unaffected	Automatic

[1]For more information on types of diagnostics and how they are cleared from the controller, see “Clearing diagnostics.”

[2]When the entering-water temperature is required but not present, the 1 heat/1 cool unit generates a diagnostic to indicate the sensor loss condition. The controller automatically clears the diagnostics after a valid entering-water temperature value is present (nonlatching diagnostic). When the entering-water temperature fails, the controller prohibits all cooling operation, but allows the delivery of heat when heating is required. In cool mode, all cooling is locked out, but normal fan and damper operation is permitted.

Status indicators for operation and communication

Clearing diagnostics
Diagnostics are categorized according to the type of clearing function each has. The four categories are:

- Manual (latching)
- Automatic (nonlatching)
- Smart reset
- Informational

Note: Clearing diagnostics refers to deleting diagnostics from the software; it does not affect the problem that generated the message. For help with diagnosing a problem, see "Troubleshooting."

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

- By using the Rover service tool (see "Resetting a diagnostic" in EMTX-SVX01A-EN, *Rover Installation, Operation, and Programming guide*)
- Through a building automation system (see product literature)
- By initiating a manual output test at the controller (see "Manual-output test")
- By cycling power to the controller. When the 24 Vac power to the controller is cycled off and then on again, a power-up sequence occurs.
- By turning the zone sensor fan switch to OFF and then back on to any other setting. (This feature will be available beginning with controller software version 2.10.)

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

Smart-reset diagnostics
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, you must manually clear the diagnostic.

Informational diagnostics
Informational diagnostics provide information about the status of the controller. They do not affect machine operation. They can be cleared from the controller in the same ways that manual diagnostics are cleared (see "Manual (latching) diagnostics").

Troubleshooting

Use Table 20 through Table 25 to assist you in diagnosing any of the following operational problems that you might encounter with the Tracer ZN.511 zone controller:

- Fan does not energize (Table 20)
- Valves remain closed (Table 21)
- Valves remain open (Table 22)
- Compressors are not running (Table 23)
- Electric heat does not energize (Table 23)
- An outdoor air damper stays closed (Table 24)
- An outdoor air damper stays open (Table 25)

Table 20 – Fan does not energize

Probable cause	Explanation
Unit wiring	The wiring between the controller outputs and the fan relays and contacts must be present and correct for normal fan operation. Refer to applicable wiring diagram.
Failed end device	The fan motor and relay must be checked to ensure proper operation
Random start observed	After power-up, the controller always observes a random start from 0 to 25 seconds. The controller remains off until the random start time expires.
Power-up control-wait	If 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 after it receives communicated information. 2) The controller exits power-up control-wait after the power-up control-wait time expires.
Cycling fan operation	If configured to cycle with capacity, normally the fan cycles off with heating or cooling. The heating/cooling sources cycle on or off periodically with the fan to provide varying amounts of capacity to the zone.
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 off.
Requested mode off	You 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 off. There is no heating or cooling.
Diagnostic present	A specific list of diagnostics affects fan operation, depending on whether the unit is configured as 1 heat/1 cool or a water-source heat pump. For more information, see Table 18 and Table 19.
No power to the controller	If the controller does not have power, the unit fan does not operate. For the Tracer ZN.511 controller to operate normally, it must have an input voltage of 24 Vac. If 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 (1 heat/1 cool or water-source heat pump). If the unit configuration does not match the actual end device, the valves may not work correctly.
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. Refer to the "Manual output test."

Troubleshooting

Table 21 – Valves remain closed

Probable cause	Explanation
Unit wiring	The wiring between the controller outputs and the valve(s) must be present and correct for normal valve operation. Refer to applicable wiring diagram.
Failed end device	The valves must be checked to ensure proper operation.
Normal operation	The controller opens and closes the valves to meet the unit capacity requirements.
Requested mode off	You can communicate a desired operating mode (such as off, heat, and cool) to the controller. If off is communicated to the controller, the unit turns the fan off. There is no heating or cooling.
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 valves may not be open. Refer to the “Manual-output test.”
Diagnostic present	A specific list of diagnostics affects valve operation, dependent on whether the unit is configured as 1 heat/1 cool or a water-source heat pump. For more information, see Table 18 and Table 19.
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. (See “AI1: Entering-water temperature sampling.”)
Unit configuration	The controller must be properly configured based on the actual installed end devices and application (1 heat/1 cool or water-source heat pump). If the unit configuration does not match the actual end device, the valves may not work correctly.
Valve configuration	Ensure that the valves are correctly configured, using the Rover service tool, as normally open or normally closed as dictated by the application.
No power to the controller	If the controller does not have power, the unit valve(s) will not operate. For the ZN.511 controller to operate normally, you must apply an input voltage of 24 Vac. If the green LED is off continuously, the controller does not have sufficient power or has failed.

Troubleshooting

Table 22 – Valves remain open

Probable cause	Explanation
Unit wiring	The wiring between the controller outputs and the valve(s) must be present and correct for normal valve operation. Refer to applicable wiring diagram.
Failed end device	The valves must be checked to ensure proper operations.
Normal operation	The controller opens and closes the valves to meet the unit capacity requirements.
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 values may not be open. refer to the “Manual-output test.”
Diagnostic present	A specific list of diagnostics affects valve operation, depending on whether the unit is configured as 1 heat/1 cool or a water-source heat pump. For more information, see Table 18 and Table 19.
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. (See “AI1: Entering water temperature sampling.”)
Unit configuration	The controller must be properly configured based on the actual installed end devices and application (1 heat/1 cool or water-source heat pump). If the unit configuration does not match the actual end device, the valves may not work correctly.
Valve configuration	Ensure that the valves are correctly configured, using the Rover service tool, as normally open or normally closed as dictated by the application.

Troubleshooting

Table 23 – Electric heat does not energize

Probable cause	Explanation
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 applicable wiring diagram.
Failed end device	Check the electric heat element, including any auxiliary safety interlocks, to ensure proper operation.
Normal operation	The controller turns electric heat on and off to meet the unit capacity requirements.
Requested mode off	You 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 all 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 you can use to verify 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 the “Manual-output test.”
Diagnostic present	A specific list of diagnostics affects electric heat operation, depending whether the unit is configured as 1 heat/1 cool or a water-source heat pump. For more information, see Table 18 and Table 19.
Unit configuration	The controller must be properly configured based on the actual installed end devices and application (1 heat/1 cool only). If the unit configuration does not match the actual end device, the electric heat may not work correctly.
No power to the controller	If the controller does not have power, electric heat does not operate. For the ZN.511 controller to operate normally, you must apply an input voltage of 24 Vac. If the green LED is off continuously, the controller does not have sufficient power or has failed.

Troubleshooting

Table 24 – Outdoor air damper remains closed

Probable cause	Explanation
Unit wiring	The wiring between the controller outputs and the outdoor air damper must be present and correct for normal outdoor air damper operation. Refer to applicable wiring diagram.
Failed end device	Check damper actuator to ensure proper operation.
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.
Warm-up and cool-down	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	You 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.
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 outdoor air damper may not be open. Refer to the “Manual-output test.”
Diagnostic present	A specific list of diagnostics affect outdoor air damper operation, depending whether the unit is configured as 1 heat/1 cool or a water-source heat pump. For more information, see Table 18 and Table 19.
Unit configuration	The controller must be properly configured based on the actual installed end devices and application (1 heat/1 cool or water-source heat pump). If the unit configuration does not match the actual end device, the outdoor air damper may not work correctly.
No power to the controller	If the controller does not have power, the outdoor air damper does not operate. For the ZN.511 controller to operate normally, you must apply an input voltage of 24 Vac. If the green LED is off continuously, the controller does not have sufficient power or has failed.

Troubleshooting

Table 25 – 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'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. (See "Outdoor air damper 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 outdoor air damper may be open. Refer to the "Manual-output test.".
Unit configuration	The controller must be properly configured based on the actual installed end devices and application (1 heat/1 cool or water-source heat pump). If the unit configuration does not match the actual end device, the outdoor air damper may not work correctly.

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