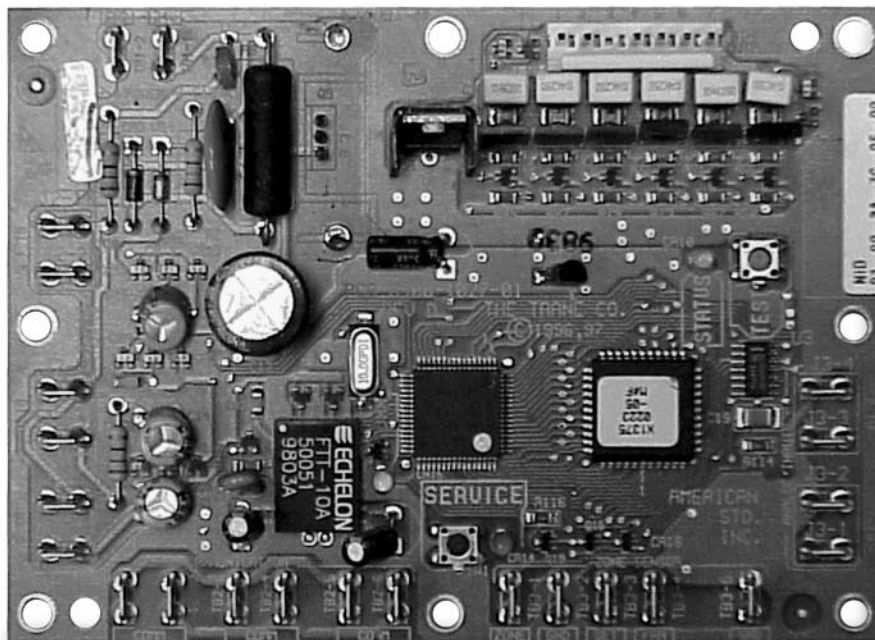# Installation, Operation, and Programming

Tracer™ ZN510 Controller

Literature
History

The Trane Company has a policy of continuous product improvement and it reserves the right to change specifications and design without notice.

Installation, Operation, and Programming	**WSHP-IOP-2**
Library	**Service Literature**
Product Section	**Unitary**
Product	**Water-Source Heat Pumps**
Model	**000**
Literature Type	**Installation, Operation, and Programming**
Sequence	**1**
Date	**April 1998**
File No.	**SL-UN-000-WSHP-IOP-2-0498**
Supersedes	**New**

Related Literature

- CNT-IOP-1 ZN510 1 Controller: Installation, Operation, and Programing

- WSHP-PD-1 Water-Source Heat Pump Controller Product Data Sheet

- WMCA-PD-1 ZN510 Loop Controller Product Data sheet

- WSHP-IOP-3 ZN510 Water-Source Heat Pump Controller Installation, Operation, and Programming Guide

- WMCA-IOP-1 ZN510 Controller Installation, Operation, and Programming Guide

Table of Contents

Start-up Procedure

Installation of New Units

1. Follow all instruction for installation of water source heat pumps as detailed in the IOM (Installation Operation Maintenance manual).

2. Disconnect power or disable the circuit breaker to unit.

3. Run communication link wire to field terminal strips 14 and 16. (See wiring diagram in the unit).

4. Install zone sensor to low voltage control terminals 1 through 6. (See wiring diagram in the unit and zone sensor submittals).

5. Verify that water connections have been made to unit, then ensure that water is circulating through the unit.

6. Reapply power.

7. Check for STATUS GREEN LED operation to ensure power and communication has been made to the ZN510™.

Peel IDENTIFICATION TAG from unit and place in the ZN510 IOP, on a copy of Sheet 6 of this document, or on building plans for future location use. The actual room location on the tag may be hand written.

Zone Sensor Placement

Zone sensor location is an important element of effective room control and comfort.

The best sensor location is typically on a wall, remote from the HVAC unit. Readings at this location assure that the desired setpoint is achieved across the space, not just near the unit itself. It may be necessary to subdivide the zone with multiple units to ensure adequate control and comfort.

The following are typical areas where the zone sensor should not be mounted:

- Near drafts or "dead spots" (e.g., behind doors or corners)

- Near hot or cold air ducts

- Near radiant heat (e.g., heat emitted from appliances or the sun)

- Near concealed pipes or chimneys

- On outside walls or other non-conditioned surfaces

- In air flows from adjacent zones or other units

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Power Up Sequence

Power Up Sequence
When 24 VAC power initially is applied to the ZN510 controller, the following sequence occurs:

1. All outputs are controlled off.

2. The controller reads all inputs to determine their initial values.

Note: Because the space temperature can be hardwired to the controller or communicated, the controller waits for several minutes to check for the presence of a communicated value.

3. A random start time is hard coded on every board and cannot be disabled. The board generates a random time delay between 0 and 25 seconds. Once this time expires, the power up control wait time (if configured) will wait for 120 seconds. The power up control wait allows ample time for a communicated request to arrive. If the power up control wait time expires, and the controller does not receive a communicated occupancy command, the unit assumes stand alone operation.

4. Normal operation begins.

Unit Identification Tag

Unit Identification Tag

The unit identification tag is factory mounted and provided for easy identification of an installed unit. It contains model number, tagging, and location information. See *Figure 1*.

The top portion of the unit identification tag remains permanently affixed to the unit for identity purposes. The bottom portion of the tag provides pertinent information that is removable to be placed on building plans or in the ZN510 IOP on page 33. This provides identification history about the unit's location for quick reference.

These tags provide information about unit location, unit serial number, and NID (neuron identification number). The NID is similar to the serial number of the unit but is specific to the identification of the ZN510 Board. The location identification is a customer defined, clear English description, of the unit's physical location. This is a 27 character description of the location. For example, if the location identification for a unit is "Conference Room 101", the ZN510 and Rover (the Trane Comm 5 service tool) will recognize this clear English description so maintenance can be performed on the appropriate unit. If location identification is not defined, it will default to the unit serial number. This provides some information so the user has multiple references to the unit. The blank location is provided for field modification in case the unit is moved from the initial location.

Unit Identification Tag

Model #: GEHB07211JD0A10DLC010N001100010000000

Order #: L9A123A-A
Serial #: W97H23456
Tagging: WSHP 1-1
NID: 01-001C-7B-DB-00

Location ID: Conference Room 101

TRANE®

Trane - Waco, TX 76714

NID: 01-00-1C-7B-DB-00	Location:
Serial #: W97H23456	Location: Conference Room 101

Figure 1: Unit Identification Tag

Note: Fold and tear carefully along dashed removable line.

Unit Operation

General Information

The ZN510 controller is a microprocessor-based direct digital controller that controls a variety of water source heat pump equipment including:

- Standard efficiency horizontal and vertical units up to 10 tons.
- High efficiency horizontal and vertical units.

- Console water source heat pumps.

ZN510 is designed to provide accurate and reliable zone temperature control by using custom proportional integral (PI) algorithms. The controller is factory installed and configured to support:

- Single fan speed.

- Up to two compressors.
- Reversing valve.
- 2-position outdoor air damper or generic binary output.

Peer-to-peer communication across controllers is possible even when a building automation system is not present. ZN510 is also adaptable as a standalone system.
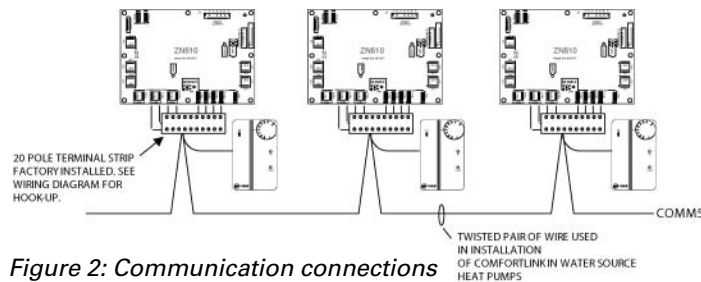

Figure 2: Communication connections

Communication

The ZN510 controller communicates via Trane's Comm5 protocol. Typically, a communication link is applied between unit controllers and a building automation system. Communication is also possible with Trane's service tool *Rover*™. ZN510 provides a total of six 1/4-inch quick-connect terminals for connection to the Comm5 communication link. These connections include:

- Two terminals (TB2-1, TB2-2)

are provided for direct connection of Rover to the ZN510 Board or provided as spare terminals.

- Two terminals (TB2-3, TB2-4) are connected to the field terminal strip (1TB1-14, 1TB1-16) for connection to the communication link (daisy chain).

- Two terminals (TB2-5, TB2-6) are connected to the field terminal strip (1TB1-5, 1TB1-6) which should be connected to the zone sensor communication jack. This provides direct connect of Rover to the communication link without having to connect directly to the ZN510 board or provided as spare terminals.

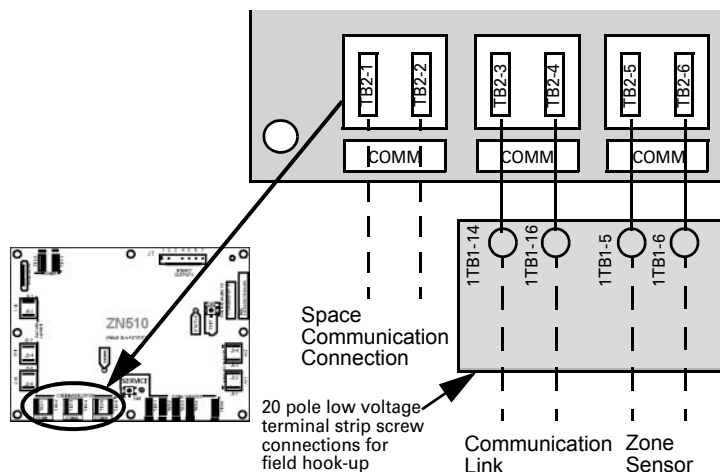- The field terminal strip 1TB1 provides screw terminations for all field connections.

Figure 3: Communication Wiring

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Unit Operation

Power

The ZN510 controller is powered by 24 VAC. A total of two 1/4-inch quick-connect terminals are provided for 24 VAC connection to the board. See *Figure 4* for ZN510 power requirement.

Note: Power for field installed ancillary devices is not available from the board. It must be tapped at transformer. See Table 21 for excess power available.
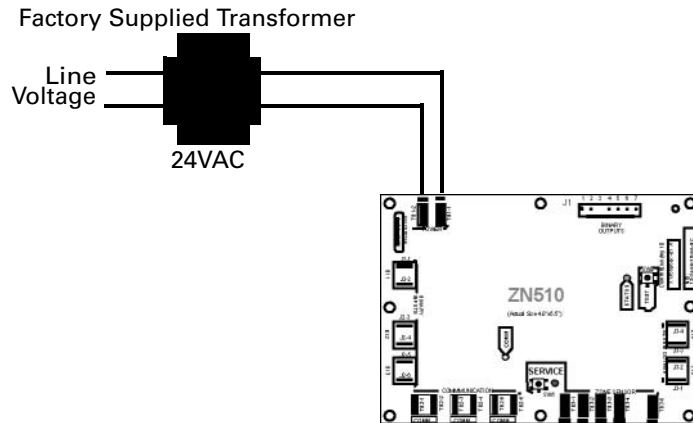

Figure 4: Power Connections

Binary Outputs

The ZN510 uses five of its binary outputs to control heat pump units. Outputs are load side switching triacs. The triac acts as a switch by either making or breaking the circuit between the load (reversing valve, damper, contactor, relay) and ground.

See *Figure 5* for the configuration of the five binary outputs.

2-Position Damper Actuator or Generic Binary Output

Binary output 6 (BOP 6) is factory configured to control a normally closed 2-position outdoor air damper. It may be field modified to control a generic output for control by a building automation system. If set up as a generic output, the controller does not use BOP 6 as part of the normal control. A building automation system must issue commands to control the generic binary output.
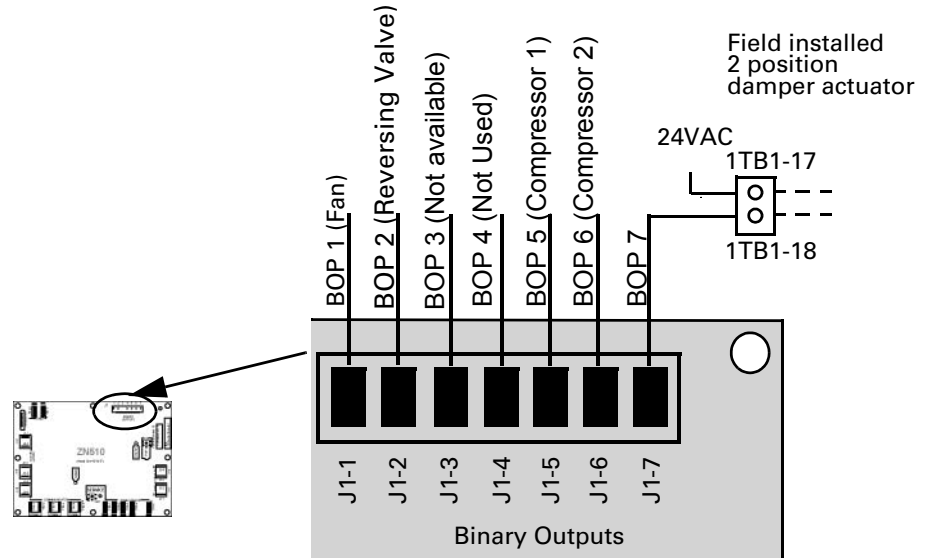
Note:

- During occupied mode, the outdoor air damper is closed when the fan is controlled off.

- During unoccupied mode, the outdoor air damper normally remains closed.

- 2-position damper must not exceed 10 VA power output from board.

Figure 5: Binary outputs

Table 1: BOP 6 control of a 2-position outdoor air damper

Model	Fan Operation	Outdoor Air Damper
Occupied	On or cycling Off	Open Closed
Occupied warm up or cool down	On or cycling	Closed
Occupied standby	On or cycling	Closed
Unoccupied	Cycling	Closed
Diagnostic present	Diagnostic dependent	Closed

Unit Operation

Output Overrides

The ZN510 controller includes a manual output test function. Use this feature to manually exercise the outputs in a defined sequence. The purpose of the test sequence, is to verify output and end device operation. Use the manual output test to:

- Verify output wiring and operation without using Trane's service tool, Rover.

- Force compressor operation, allowing the technician to use refrigerant gauges or other test equipment to verify unit operation.

The test sequence resets unit diagnostics and attempts to restore normal unit operation prior to testing the outputs. If the diagnostics remains after a reset, the status LED indicates the diagnostic condition is still present and has affected the manual output test. See Troubleshooting section for Green LED and Testing Heat Pump Configurations on page 21 & 22.

Analog Outputs

ZN510 does not use analog outputs.

Binary Inputs

The ZN510 controller has three available binary inputs (BI). These inputs are factory-configured for the following functions:

- BI 1= Low temperature detection (freezestat) (Circuit 2).

- BI 2 = Condensate overflow.

- BI 3 = Occupancy or generic binary input.

Each binary input may be configured as not used depending on options selected. BI 3 is configured as a normally open occupancy input, but may be field modified for generic binary input which is only supported by a building automation system.

Note:
The diagnostic functions related to binary inputs such as low temperature detection and condensate overflow are fixed sequences.

Each binary input associates an input signal of 0 VAC with open contacts and 24 VAC with closed contacts. See *Figure 6* for typical binary input configurations for the heat pump.
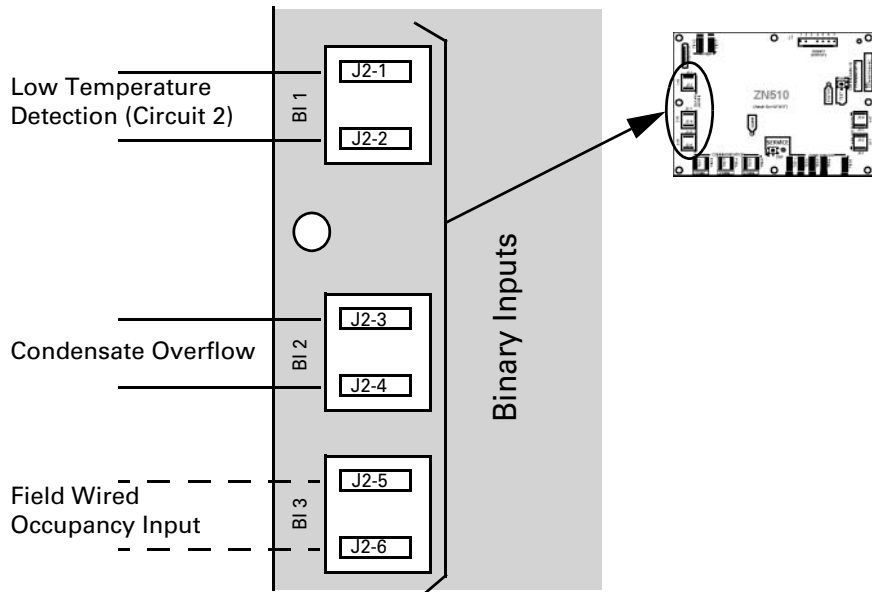
Figure 6: Binary inputs.

Table 2: Binary input configurations

Binary Input	Description	Configuration	Contact Closure	Contact Open
BI 1	Low Temperature Detection (Cir 2)	Normally closed	Normal	Diagnostic
BI 2	Condensate Overflow	Normally closed	Normal	Diagnostic
BI 3	Occupancy	Normally open	Unoccupied	Occupied
	Generic	Normally open	Normal	Normal

Note:
See Page 10 for specific information concerning BI 1, BI 2 and BI 3.

Unit Operation

Low Temperature Detection
The low temperature detection diagnostic protects the heat exchanger by using an analog leaving water temperature sensor to protect refrigerant circuit 1 and a binary low temperature detection device to protect refrigerant circuit 2. Each individual refrigerant circuit is disabled when the low temperature condition exists for that circuit.

For two compressor units, the controller responds to low temperature detection by allowing the fan to operate, while disabling the compressor for the faulty circuit. The compressor for the normal circuit continues to operate. The outdoor air damper also operates normally.

All unit operation is disabled when the heat pump shuts down both circuits, due to low temperature conditions. See Table 3 for more information.

Table 3: ZN510 response to low temperature detection diagnostic

Description	Fan Operation	Compressor Operation	Damper Operation
Low Temperature Detection (Circuit 1)	Enabled	Circuit 1-Disabled Circuit 2-Normal Operation	Normal operation
Low Temperature Detection (Circuit 2)	Enabled	Circuit 1-Normal Operation Circuit 2-Disabled	Normal operation
Low Temperature Detection (Circuits 1 and 2)	Disabled	Circuit 1-Disabled Circuit 2-Disabled	Closed

Note:
- *The low temperature detection device automatically resets when the heat exchanger temperature returns to normal. However, you must manually reset the low temperature detection diagnostic to clear the diagnostic and restart the unit. Refer to page 28 on how to reset a unit.*

- *If BOP 6 is configured as a generic binary output, the state of the output is not affected by the low temperature detection diagnostic or by other diagnostics.*

Condensate Overflow
A condensate overflow switch detects the condensate condition. The condensate overflow switch is a normally closed device. This switch is physically connected to the binary input 2 (BI 2). When the condensation reaches the trip point, the binary input detects the diagnostic condition. A condensate overflow signal generates a diagnostic which disables the fan, disables all compressors, and closes the 2-position outdoor air damper (when present). The condensate overflow diagnostic does not affect the generic binary output (when present).

Note:
The condensate overflow switch, located in the condensate pan, automatically resets when the condensation returns to normal levels. However, you must manually reset the controller's condensate overflow diagnostic to clear the diagnostic and restart the unit. Refer to page 28 on how to reset a unit.

Occupancy
ZN510 uses the occupancy binary input for two occupancy-related functions. For standalone controllers (any unit not receiving a communicated occupancy request, typically from a building automation system), the occupancy binary input determines the unit's occupancy based on the hardwired signal. Typically, the signal is a dry set of binary contacts which is either connected to a switch or timeclock contacts.

When a hardwired occupancy signal is open, the unit switches to occupied mode (if the occupancy input is configured as normally open). When a hardwired occupancy signal is closed, the controller switches to Unoccupied mode.

Unit Operation

In Occupied mode, the controller operates according to the occupied setpoints. In Occupied Standby Mode, the unit controller operates according to the Occupied Standby setpoints. When the controller receives a communicated unoccupied request, the controller operates according to the unoccupied setpoints regardless of the state of the hardwired occupancy input.

If neither the binary input nor the communicated input is used to select the occupancy mode, the controller defaults to occupied mode because the occupancy binary input (if present) typically is configured as normally open without an occupancy device connected.

Table 4: Normally open hardwired input configuration (BI 3)

Description	Communicated Request	Hardwired State	Result
Standalone	NA	Open = Occupied	Occupied
Standalone	NA	Closed = Unoccupied	Unoccupied
Communicating	Occupied	Open = Occupied	Occupied
Communicating	Unoccupied	Open = Occupied	Unoccupied
Communicating	Occupied Standby	Open = Occupied	Occupied Standby
Communicating	Occupied	Closed = Occupied Standby	Occupied Standby
Communicating	Unoccupied	Closed = Occupied Standby	Unoccupied
Communicating	Occupied Standby	Closed = Occupied Standby	Occupied Standby

Note:
If configured for normally closed, all states are opposite of Table 4.

Generic Binary Input
Building automation systems can monitor the status of the generic binary input. This input does not affect controller operation.

High and Low Pressure Switches
The high and low pressure cutout switches are wired in series with the compressor contactor in the unit. The ZN510 controller detects the state of each switch circuit by monitoring the controller's compressor triac outputs. If either the high pressure switch (HPC) or the low pressure switch (LPC) switch opens, a fault condition occurs. This open circuit prevents the compressor contactor from energizing keeping the compressor from running. The controller automatically detects the fault condition by measuring the compressor triac output signal.

By default, when the HPC or LPC switches detect a high or low pressure condition in the refrigerant circuit, the special input detects the diagnostic and disables all compressor operation for that circuit. The unit fan continues to operate, if only one circuit is disabled in a two compressor unit. When the HPC/LPC diagnostic is present on both circuits, the ZN510 shuts off the unit fan and disables unit operation. See *Figure 7* for high and low pressure switch.

When the refrigerant circuit returns to normal, the HPC and the LPC switches automatically reset. The high or low pressure cutout diagnostic may need to be manually reset to clear the diagnostic and enable compressor operation for the fault circuit.
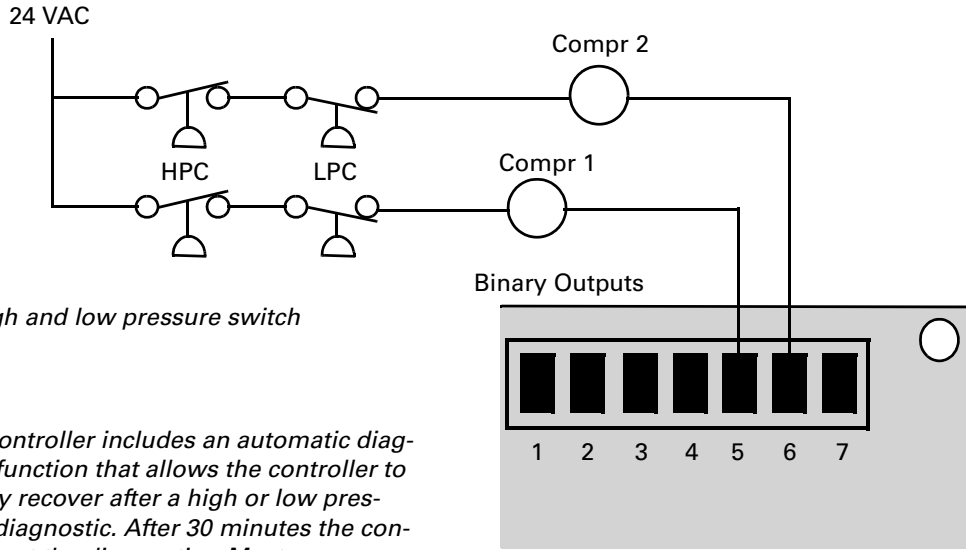
Unit Operation

24 VAC

Compr 2

Compr 1

HPC   LPC

Binary Outputs

Figure 7: High and low pressure switch

Note:
The ZN510 controller includes an automatic diagnostic reset function that allows the controller to automatically recover after a high or low pressure cutout diagnostic. After 30 minutes the controller will reset the diagnostics. Most diagnostics occur due to intermittent water temperature or flow problem. The "smart reset" may eliminate many service calls.

1   2   3   4   5   6   7

Analog Inputs
The ZN510 controller has five available analog inputs (AI). These inputs are factory-configured for the following functions:

- Zone = Space temperature.

- Set = Local setpoint.

- Fan = Fan mode input.

- AI 1 = Leaving water temperature (Circuit 1).

- AI 2 = Discharge air temperature.

See *Figure 8* for analog inputs.

ZN510
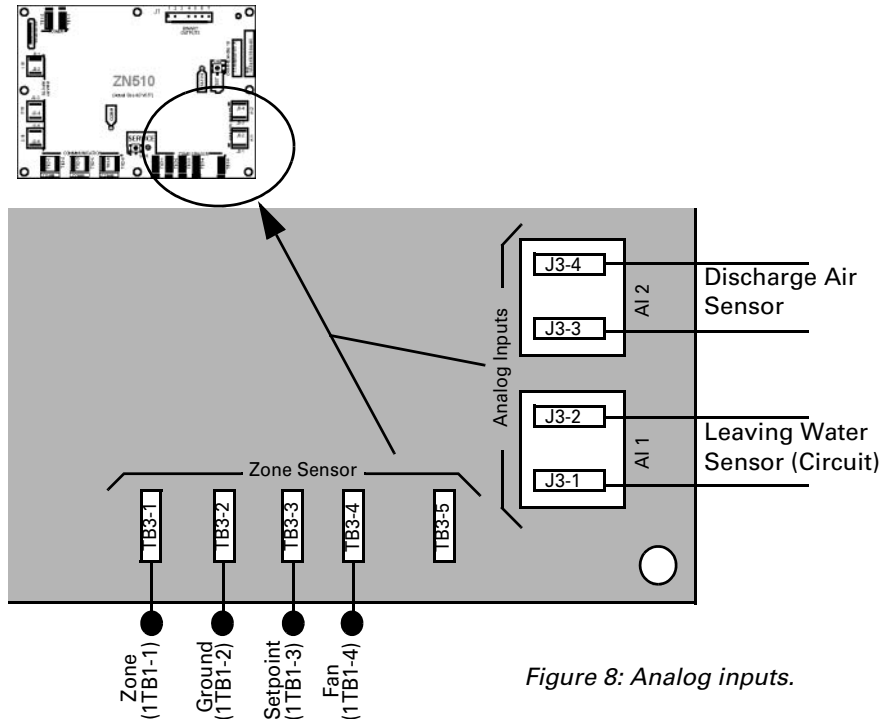
Analog Inputs

J3-4
J3-3
AI 2

Discharge Air Sensor

J3-2
J3-1
AI 1

Leaving Water Sensor (Circuit)

Zone Sensor

TB3-1   TB3-2   TB3-3   TB3-4   TB3-5

Zone (1TB1-1)
Ground (1TB1-2)
Setpoint (1TB1-3)
Fan (1TB1-4)

Figure 8: Analog inputs.

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Unit Operation

Space Temperature
ZN510 controls the space temperature according to the active space temperature, the active heating/cooling setpoint, and the space temperature control algorithm. The ZN510 controller receives the space temperature from either a wired zone sensor or as a communicated value. When neither a zone sensor nor communicated space temperature is present, the ZN510 controller generates a space temperature failure diagnostic.

Note:
The ZN510 controller cannot operate without a valid space temperature value (either hardwired or communicated).

The space temperature input can communicate timed override ON or CANCEL requests to the ZN510 controller. If the ON button is temporarily pressed, the zone sensor sends a signal to the controller. This signal is then interpreted as a timer override request which places the unit into occupied.

The controller uses the timed override request (while the zone is unoccupied) as a request to switch to the Occupied Bypass mode (occupied bypass). This Occupied Bypass mode lasts for the duration of the occupied bypass time, typically 120 minutes.
or
The controller's Occupancy mode is determined from either a system level controller or another peer controller.

The CANCEL button cancels the timed override request and returned the unit to unoccupied mode. If the CANCEL button is temporarily pressed, the zone sensor sends a signal to the controller. This signal is then interpreted as a timed override cancel which places the unit into unoccupied.

Local Setpoint
The local setpoint analog input is designed as the local (hardwired) setpoint input. This input cannot be used for any other function. The local input is a resistance input intended for use with Trane zone sensors.

If neither a hardwired nor communicated setpoint is present, the controller uses the stored default setpoints:

- **Occupied setpoints:**
  In the occupied mode, the unit attempts to maintain the space temperature at the active occupied heating or cooling setpoint based on the measured space temperature, the active setpoint, and the proportional/integral control algorithm.

- **Occupied standby setpoints**:
  In occupied standby mode, the controller uses the occupied standby cooling and heating setpoints. Because the occupied standby setpoints typically cover a wider range than the occupied setpoints, the ZN510 controller reduces the demand for heating and cooling the space. Also, the outdoor air damper is normally closed during occupied standby mode to further reduce the heating and cooling demands.

- **Unoccupied setpoints**:
  In unoccupied mode, the unit attempts to maintain the space temperature at the stored unoccupied heating or cooling setpoint based on the measured space temperature, the active setpoint, and the proportional/integral control algorithm, regardless of the presence of a hardwired or communicated setpoint.

Once a valid setpoint is established (through the hardwired input or through communication) and when neither a local setpoint or communicated setpoint is present, the controller generates a setpoint failure diagnostic.

When a setpoint failure diagnostic occurs, the controller operates using the default heating and cooling setpoints. These setpoints are factory-configured, but may be changed using the Trane service tool, Rover.

The ZN510 controller uses the following validation sequence for the setpoints:

1. Check for a communicated setpoint. If present, validate this setpoint.

2. Check for a hardwired setpoint and validate the setpoint.

3. Use the default setpoint and validate this setpoint.

Fan Mode Input
The fan mode analog input (Fan) is designed to operate as the fan mode switch input. This input cannot be used for any other function. The fan switch on a Trane zone sensor generates the fan mode signal.

The ZN510 controller detects the unique resistance corresponding to each position of the fan switch. By measuring the resistance, the controller determines the requested fan mode.

Unit Operation

Possible Fan Modes	Heat Pump (1-speed)
OFF	Fan Off
AUTO	Continuous: (Field Modified) ● In occupied mode, the fan runs continuously. In unoccupied mode, the fan cycles OFF when no heating or cooling is required.
AUTO	Cycling: (Factory Default) ● The fan cycles ON and OFF with compressor operation.

The ZN510 controller receives the fan mode from either a wired zone sensor or as a communicated valve. When neither a zone sensor nor communicated fan mode are present, the ZN510 controller will default unit operation to AUTO.

Note:
- A building automation system can also generate a fan mode request and communicate this request to the controller.

- If the ZN510 controller does not receive a hardwired or commu-nicated request for the fan mode, the unit recognizes the fan input as AUTO and the fan operates according to the default configuration.

Fan Off Delay
When the heating output is controlled off, the ZN510 automatically runs the fan **ON** for an additional 30 seconds to give the fan time to blow off any residual heat.

Leaving Water Temperature
ZN510 uses analog input 1 (AI 1) as the leaving water temperature input for use with a thermistor. This input (AI 1) is automatically assigned as a leaving water temperature input. As explained in the binary input section, the leaving water temperature input protects the heat exchanger (circuit 1) from low temperatures. The second heat exchanger, present in units with two compressors is protected with a binary low temperature detection device. Based on the application of the unit, circuit operation is terminated when the leaving water temperature falls below 35 F or 20 F. This is set when the unit is ordered.

The ZN510 controller compares the measured leaving water temperature to the leaving water temperature low limit value to determine a fault condition. When the measured leaving water temperature is less than the leaving water temperature low limit, the controller generates a Low Temp Detect diagnostic. If the Leaving Water Temp Sensor fails to open or close the controller generates a Leaving Water Temp Failure diagnostic. This disables unit operation.

Note:
A low temperature detection failure diagnostic for compressor 1 may require you to manually reset the unit to restore compressor opera-tion.

Similarly, the ZN510 controller uses a binary low temperature detection device (fixed low limit trip point) to lock-out circuit 2 when a fault condi-tion is detected.

See the Diagnostics section on page 28 for information about the automatic diagnostic reset function.

Filter Maintenance Timer
The controller's filter maintenance timer is based on the unit fan's cumulative run hours. The controller compares the fan run time against an adjustable fan run hours limit (maintenance required setpoint time, stored in the controller) and recommends unit maintenance (i.e. changing the filter).

Use Rover or BAS system to edit the maintenance required setpoint time. Once the setpoint limit is exceeded the controller generates a filter maintenance timer diagnostic. When the maintenance required setpoint time is zero, the controller disables the diagnostic feature.

Discharge Air Temperature
Analog input 2 (AI 2) is used as the discharge air temperature input for use with a 10,000 ohm thermistor. Typical factory placement of the thermistor is at the discharge area of the unit. The discharge air temperature sensor does not affect unit operation. The measured temperature is for information only to be read by the building automation system or for troubleshooting unit operation with Rover.

Once a valid discharge air temperature signal has been established by the thermistor or communicated and the value is no longer present, the controller generates a discharge air temperature failure diagnostic. This will not disable unit operation. If the sensor returns with a valid temperature, the diagnostic automatically clears

Zone Sensor

Zone Sensor

The ZN510 controller accepts the following zone sensor inputs:

- Space temperature measurement.
- Local setpoint (internal or external on the zone sensor).
- Fan switch. (Optional)
- Timed override (ON and CANCEL).
- Communication Jack.

If both hardwired and communicated space temperature values exist, the controller ignores the hardwired space temperature input and uses the communicated value.

Internal and External Setpoint Adjustment

Zone sensors with an internal or external setpoint adjustment provide the ZN510 controller with a local setpoint (50 to 85 F or 10 to 29.4 C). The internal setpoint adjustment is concealed under the zone sensor's cover. To reveal the adjustable setpoint wheel, remove the zone sensor cover. The external setpoint (when present) is exposed on the zone sensor's front cover.

When the hardwired setpoint adjustment is used to determine the setpoints, all unit setpoints are calculated based on the hardwired setpoint values, the configured setpoints, and the active mode of the controller.

Setpoint Operation

The controller has three methods of heating and cooling setpoints operation. See Table 5 for the methods of setpoint operation.

Table 5: Methods of setpoint operation.

Method	Situation used
Zone Sensor (with an adjustable hardwired setpoint)	A hardwired, adjustable setpoint is connected to the controller. Local setpoints are enabled in the unit configuration. No communicated setpoint is present.
Communicated source	A setpoint is communicated to the unit controller (typically from a building automation system or a peer controller). If both a hardwired setpoint and a communicated setpoint exist, the controller uses the communicated value. The configuration feature for enabling or disabling the local setpoint does not affect the setpoint handling when communicated setpoints are used. The communicated setpoint always takes priority over the hardwired setpoint, even when the local setpoint is enabled.
Stored default setpoints	The controller uses the locally stored default heating and cooling setpoints when neither a local hardwired setpoint or communicated setpoint is present. When a building automation system is present, the controller uses the default setpoints when no setpoint is communicated to the controller and no hardwired setpoint exists. The controller uses stored default setpoints when only a local setpoint exists, but the local setpoint is disabled in the configuration of the controller. The controller always uses the stored default (unoccupied) setpoints in unoccupied mode.

Zone Sensor

Zone Sensor Features
Fan Switch (Optional)

The zone sensor fan switch provides the controller with an occupied (and occupied standby) fan request signal of OFF or AUTO. If the fan control request is communicated to the controller, the controller ignores the hardwired fan switch input and uses the communicated value. The zone sensor fan switch signal can be enabled or disabled through configuration in the ZN510 controller.

ON or CANCEL Buttons

Momentarily pressing the ON button during unoccupied mode places the controller in occupied bypass mode for 120 minutes. You can adjust the number of minutes in the unit controller configuration using Trane's service tool, Rover. The controller remains in occupied standby mode until the override timer expires or until the CANCEL button is pressed.

Communication Jack

Use the RJ-11 communication jack as the connection point from Rover to the communication link (when the communication jack is wir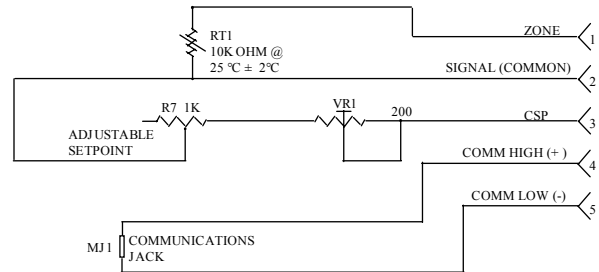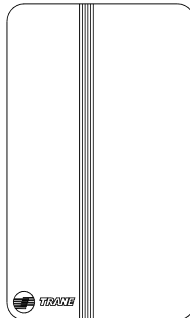ed to the communication link at the controller). By accessing the communication jack via Rover, entrance to all controllers on the link may be gained.

Table 6: Zone Sensor Options

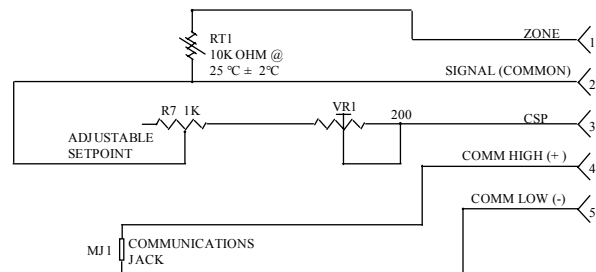Part Number:
X13510628010
Description:
- Space temperature (0.2 C resolution).
- Internal setpoint.
- Communication jack.
- Vertical case with Trane logo

Part Number:
X13510606010
Description:
- Space temperature (0.2 C resolution).
- External setpoint.
- Communication jack.
- Vertical case with Trane logo
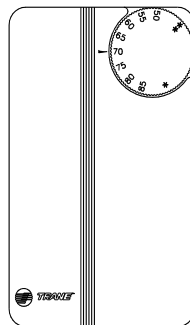
Zone Sensor Specifications
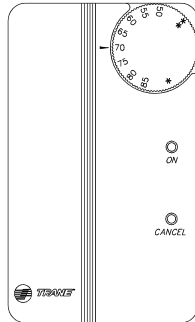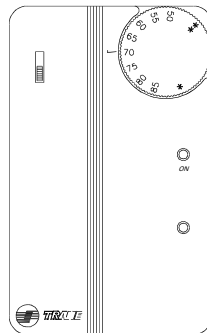
Part Number:
X13510606020
Description:

- Space temperature (0.2 C resolution).
- External setpoint.
- ON and CANCEL buttons.
- Communication jack.
- Vertical case with Trane logo.

Part Number:
X13510635010
Description:

- Space temperature (0.2 C resolution).
- External setpoint.
- Fan Switch (OFF and AUTO).
- ON and CANCEL buttons.
- Communication jack.
- Vertical case with Trane logo.

Heating or Cooling Control Mode Operation

Heating or Cooling Operation

For both single and dual compressor operation, the ZN510 controller cycles the compressor(s) on and off to meet heating or cooling zone demands. The controller uses the unit capacity and pulse width modulation (PWM) logic along with minimum on/off timers to determine the operation for compressor 1.

With a dual compressor unit, if the desired conditions are not met by controlling only the first compressor, the controller runs compressor 1 continuously and controls compressor 2 according to PWM logic along with the minimum on/off timers. See *Table 6* for heat pump heating or cooling operation.

Table 7: Heat pump heating or cooling operation*

Unit	Capacity			
	0%	**Between 0 and 50%**	**Between 50 and 100%**	**100%**
Single compressor	Compressor OFF continuously.	Compressor output is controlled according to pulse width modulation (PWM) logic between 0 and 100%. The controller calculates the compressor on/off times based on PWM logic and heating/cooling capacities. The compressor is controlled on for longer periods as the capacity increases and shorter periods as the capacity decreases.		Compressor ON continuously.
Dual (Two) compressors	Both compressors OFF continuously.	#1: ON PWM. #2: OFF continuously.	#1: ON continuously. #2: ON PWM.	Both compressors ON continuously.

__Note__: No diagnostics present.

Certain heat pump configurations may use one or two compressors for cooling control. Heat pumps use reversing valve control to switch between heating and cooling. The controller supports cooling only configurations and heat pump configurations.

For heat pump configurations, the unit's reversing valve is energized in cooling and de-energized in heating. For cooling, the reversing valve output is energized simultaneously with the compressor (compressor 1 in two compressor applications). The reversing valve remains energized until the controller turns on the compressor for heating, simultaneously de-energizing the reversing valve. The reversing valve only changes state when the controller turns on compressor 1.

When a power failure occurs, the reversing valve output defaults to the heating (de-energized) state. To reduce noise due to refrigeration migration after compressor shutdown, the controller does not immediately operate the reversing valve. The reversing valve changes state only when the compressor controls on, except when the controller is in off mode.

For cooling only configurations, no reversing valve is present and the controller uses the compressor stages for cooling.

Compressor Minimum ON/OFF Timers

- When fan mode = OFF, Compressor minimum ON timers are ignored.

- When fan mode = AUTO, Compressor minimum OFF timers are observed.

- The diagnostic reset ignores the compressor timers ON and OFF.

- A communicated compressor disabled or unoccupied signal ignores minimum ON times.

Single and Dual Compressor Operation

Other Modes
Occupancy Operation
Unoccupied operation normally is associated with evening hours when the space is vacant. In unoccupied mode, the controller always uses the default unoccupied heating and cooling setpoints stored in the controller. As the unit goes unoccupied, the compressors ON timers are ignored and the compressors are disabled.

When ZN510 controls the space to unoccupied mode, the occupant may have the ability to request timed override through the Trane zone sensor's ON button. Based on the controller or system setup, the controller interprets the request and initiates the occupied setpoint operation. During a timed override, the controller applies the occupied heating and cooling setpoint, but reports the effective occupancy mode as occupied bypass mode. In the occupied bypass mode, a building automation system can detect whether the occupancy mode was overrode.

Morning Warm Up
The damper (field installed or for the console product) remains closed during morning warm up until the space temperature is within two degrees of the effective heating setpoint. The 2-position outdoor air damper normally is open during the occupied mode when the controller turns on the unit fan. The damper is normally closed during:

- occupied mode when the fan is OFF.
- warm up/cool down mode.
- occupied standby mode.
- unoccupied mode.
- certain diagnostic conditions.

ZN510 keeps the 2-position outside air damper closed on a transition from unoccupied mode to occupied mode as part of the morning warm up sequence.

Data Sharing

Master Controller

ZN510 can send or receive data (such as setpoint, heat/cool mode, fan request and space temperature) to and from other controllers on the communication link, with or without a building automation system. This includes applications where multiple unit controllers share a common space temperature sensor, both for standalone and building automation applications.

The master controller (the unit controller with the hardwired zone sensor) in peer-to-peer communication can send its zone temperature to one or more slave controllers which allows the slave controllers to track each other's zone temperature. For these applications, Rover is used in set up of the controller.

See *Figure 9* for Master/Slave setpoint operation for peer-to-peer set up.

Setpoint Operation

Controllers sharing information peer-to-peer can share a variety of data, including the heating/cooling setpoint (communicated from a master to a slave).

The standalone master controller derives its setpoint from either the local hardwired setpoint input or from its default setpoints. Peer-to-peer applications often require the use of one hardwired setpoint to be shared across two or more controllers. This can be achieved by wiring the adjustable setpoint (typically included as a part of the Trane zone sensor module) to the controller defined as the master. Trane's service tool, Rover may be used to set up the master and one or more slaves to share that setpoint. For this application, each communicating controller uses the same setpoint.
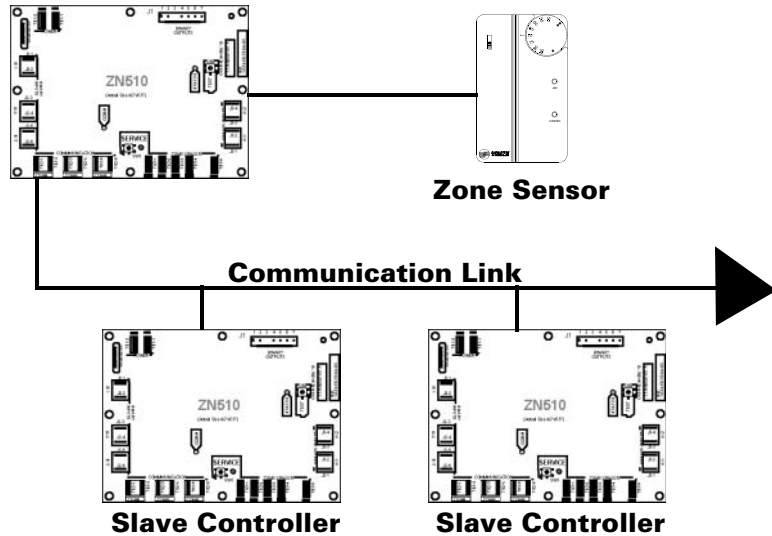
Figure 9: Master/slave setpoint operation for peer-to-peer setup

Note:
Each controller derives it's effective setpoint and default setpoints (including deadbands between setpoints) from the setpoint input (hardwired or communicated). To make sure the peer-to-peer setpoint application results in identical setpoints for each communicating controller, each controller must have exactly the same default setpoints.

Simplified Peer-to-Peer (Master/Slave) Setup

To simplify setting up master/slave applications, the controller provides information that groups all necessary shared data into one communication variable. This master/slave variable includes the following information:

- Space temperature.

- Setpoint.

- Heating/cooling mode.

- Occupancy.

- Fan status.

- Unit control algorithm capacity.

This information is communicated from the master to the slave to ensure similar unit operation.

Use Rover, Trane's service tool, to set up peer-to-peer applications.

Refer to the Rover *product literature for more information on setting up applications.*

Configuration

Configurable Parameters

Rover, Trane's service tool, uses the unit type "heat pump" to determine and download unit configuration information, such as the default analog inputs, the default binary inputs, and the default binary output configurations. See Table 7 for default configurations for heat pumps.

Table 8: Heat pump heating or cooling operation.

Unit Type	Heat pump
Cooling Source	Compressor
Heating Source	Compressor (none for cooling only units)
Compressors	1 (2 for 2-compressor units)
Binary Outputs	BOP 1: Fan on (normally open) BOP 2: Reversing valve (normally open)* BOP 3: Not used BOP 4: Compressor 1 (normally open) BOP 5: Compressor 2 (normally open)** BOP 6: Outdoor Air Damper (normally open)***
Binary Inputs	BI 1: Low temperature detection, circuit 2 (normally closed)*** BI 2: *Condensate overflow* (normally closed)† BI 3: Occupancy (normally open)
Analog Inputs	Zone: Space temperature (0.0 F calibration) Set: Setpoint (0.0 F calibration) Fan: Fan mode AI 1: Leaving water temperature AI 2: Discharge air temperature
Fan	Fan operation (heating): Cycling Fan operation (cooling): Cycling Fan speed default (heating): On/high Fan speed default (cooling): On/high Fan switch (hardwired): Enabled
Setpoints	Unoccupied cooling setpoint: 85 F Occupied standby cooling: 78 F Occupied cooling setpoint: 74 F Occupied heating setpoint: 71 F Occupied standby heating: 67 F Unoccupied heating setpoint: 60 F Cooling setpoint high limit: 115 F Cooling setpoint low limit: 40 F Heating setpoint high limit: 115 F Heating setpoint low limit: 40 F Thumbwheel set point: Enabled
Occupied Bypass Timer	120 minutes
Leaving Water Temperature Low Limit	Unit specific (20 F ground source or 35 F standard)
Location Identifier	Unit specific (maximum of 30 characters)

* BOP 2, BI1: Not used on cooling only units.

** BOP 5: Not used on signal compressor unit.

*** Configured but not required.

† Optional model number dependent

The heating and cooling setpoint high and low limits only apply to the occupied and occupied standby setpoints. These limits never apply to the unoccupied setpoints.

The occupied bypass time is used for timed override applications. The timed override timer is maintained in the unit controller. When the timed override is applicable, the controller reports "Occupied Bypass" as its effective occupancy mode.

The leaving water temperature low limit is used for freeze protection of circuit 1 on heat pumps. Circuit 2 is protected by a binary low temperature detection device (freezestat) with a fixed trip point.

Troubleshooting

Red Service LED

Table 9: Red LED activity

Red LED Activity	Description
LED off continuously when power is applied to the controller.	Normal operation.
LED on continuously, even when power is applied to the controller.	Someone is pressing the service button or the controller has failed.
LED flashes once every second.	Use Rover, Trane's service tool, to restore the unit to normal operation or unconfigured.

!Warning! Service Button

The black Service button on the ZN510 board allows the user to send a service pin message, which allows efficient identification of the unit's location. However, if the Service button is held for more than 10 seconds, the ZN510 will shut down the software application and disable the unit's operation. The only method to restore the unit is through the use of Rover service tool. We strongly suggest that this function only be exercised under the strict direction of factory service personnel.

Green Status LED

The green LED normally indicates whether the controller is powered on (24 VAC).

Table 10: Green LED activity

Green LED Activity	Description
LED on continuously.	Power on (normal operation).
LED blinks (one blink).	Manual output test mode (2-second hold), No diagnostics present.
LED blinks (two blinks).	Manual output test mode (2-second hold), One or more diagnostics are present.
LED blinks (1/4 second on, 1/4 second off for 10 seconds.	"Wink" mode. This feature allows the identification of a controller. By sending a request from a device, such as Rover, Trane's service tool or ZN510 Loop Controller, a request to the controller can be made to "wink" a notification that the controller received the signal. When the zone sensor ON button is held for 10 seconds "Wink" mode is sent from Comfort Link Controller.
LED off.	● Power off. ● Abnormal condition. ● Test button is pressed.

Yellow Service LED

Table 11: Yellow LED activity

Yellow LED Activity	Description
LED off continuously.	The controller is not detecting any communication. (Normal for standalone applications).
LED blinks.	The controller detects communication. (normal for communicating applications, including data sharing).
LED on continuously.	Abnormal condition.

Troubleshooting

Manual Output Testing the Heat Pump Configurations

The procedure for testing heat pump configurations is:

1. Press and hold the Test button for at least three seconds to start the test mode.

2. The test sequence resets diagnostics and turns off all outputs.

3. Press the Test button several more times (no more than once per second) to advance through the test sequence.

Table 12: Test sequence

Step	Fan BOP 1	Reversing Valve BOP 2	Compr 1 BOP 4	Compr 2 BOP 5	Damper BOP 6
1. Off	Off	Off	Off	Off	Closed
2. Fan on (At the beginning of step 2, the controller attempts to clear all diagnostics).	On	Off	Off	Off	Closed
3. Reversing Valve	On	On	Off	Off	Closed
4. Cool 1	On	On	On	Off	Closed
5. Cool 2	On	On	On	On	Closed
6. Compressor(s) off This stage helps avoid compressor cooling and heating in sequential steps by turning the compressors off prior to changing the reversing valve state.	On	Off	Off	Off	Closed
7. Heat 1	On	Off	On	Off	Closed
8. Heat 2	On	Off	On	On	Closed
9. Outdoor air damper	On	Off	Off	Off	Open
10. Exit After the outdoor air damper step, the test sequence performs the exit step. This initiates a reset and attempts to return the controller to normal operation.					

Testing the Heat Pump Configurations

The outputs are not subject to minimum times during the test sequence. However, the test sequence only permits one step per second which limits output time.

All outputs are exercised regardless what timer they are or are not configured for. For example, single compressor heat pumps function the same as two compressor units. For single compressor units, the cool 2 and heat 2 steps control the appropriate binary outputs, but do not affect unit operation.

Reversing valve and damper outputs cycle independent of configuration.

Pump Operation for Systems with ZN510 Loop Controller

During Unoccupied, the pumps will be OFF but should be energized to test compressor operation. The user must override the pumps either at the ZN510 Loop Controller or by pushing the ON button of the zone sensor. This will send the units to an occupied bypass, which will turn the pumps on prior to operating manual output test.

Troubleshooting

Questionable Unit Operation

Table 13: Fan output does not energize

Probable Cause	Explanation
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.	When power up control wait is enabled (non-zero time), the controller remains off until one of two conditions occurs: • The controller exits power up control wait once it receives communicated information. • The controller exits power up control wait once the power up control wait time expires.
Cycling fan operation.	When configured to cycle with capacity, normally the unit fan cycles off with heating or cooling. The heating/cooling sources cycle on or off periodically with the unit fan to provide varying amounts of capacity to the space.
Unoccupied operation.	Even when 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.	When a local fan mode switch determines the fan operation, the off position controls the unit fan off.
Requested mode off.	The desired operating mode (such as off, heat and cool) can be communicated to the controller. When 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. See Diagnostics section on page 27.
No power to the controller.	If the controller does not have power, the unit fan does not operate. For the ZN510 controller to operate normally, it must have an input voltage of 24 VAC. When the green LED is off continuously, the controller does not have sufficient power or has failed.
Unit configuration.	The controller must be properly configured based on the actual installed end devices and application.
Manual output test.	The controller includes a manual output test sequence that may be used 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 overrides on page 9.
Unit wiring.	The wiring between the controller outputs and the fan relays and contacts must be present and correct for normal fan operation.

Troubleshooting

Questionable Unit Operation

Table 14: Compressor(s) not running

Probable Cause	Explanation
Normal operation.	The controller compressor(s) turn on and off to meet the unit capacity requirements.
Requested mode off.	The desired operating mode (such as off, heat and cool) can be communicated to the controller. When off is communicated to the controller, the unit shuts off all unit compressor(s).
Communicated disable.	Numerous communicated requests may disable the compressor, including a compressor enable input. Depending on the state of the communicated request, the unit may disable the compressor.
Manual output test.	The controller includes a manual output test sequence that may be used to verify output operation and associated output wiring. However, based on the current step in the test sequence, the compressor(s) may not be on. Refer to the manual output overrides on page 9.
Diagnostic present.	A specific list o f diagnostics affects compressor operation, depending whether the unit is configured as heat pump. For more information, see the Diagnostics section on page 27.
Unit configuration.	The controller must be properly configured based on the actual installed end devices and application. When the unit configuration does not match the actual end device, the compressor may not work correctly.
No power to the controller.	If the controller does not have power, the compressor does not operate. For the ZN510 controller to operate normally, a voltage input of 24 VAC must be applied. When the green LED is off continuously, the controller does not have sufficient power or has failed.
Unit wiring.	The wiring between the controller outputs and the compressor contacts must be present and correct for normal compressor operation.

Table 15: Outdoor air damper stays open

Probable Cause	Explanation
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. Refer to the outdoor air damper section on page 8.
Manual output test.	The controller includes a manual output test sequence that may be used to verify output operation and associated output wiring. However, based on the current step in the test sequence, the outdoor air damper may not open. Refer to the manual output overrides on page 9.
Unit configuration.	The controller must be properly configured based on the actual installed end devices and application. When the unit configuration does not match the actual end device, the outdoor air damper may not work correctly.
Unit wiring.	The wiring between the controller outputs and the compressor contacts must be present and correct for normal damper operation.

Troubleshooting

**Questionable Unit
Operation**

Table 16: Outdoor air damper stays closed

Probable Cause	Explanation
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. Refer to the outdoor air damper section on page 8.
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.	The desired operating mode (such as off, heat and cool) can be communicated to the controller. When off is communicated to the controller, the unit closes the outside air damper.
Manual output test.	The controller includes a manual output test sequence that may be used 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 overrides on page 9.
Diagnostic present.	A specific list o f diagnostics affects outdoor air damper operation, depending whether the unit is configured as heat pump. For more information, see the Diagnostics section on page 27.
Unit configuration.	The controller must be properly configured based on the actual installed end devices and application. When the unit configuration does not match the actual end device, the outdoor air damper may not work correctly.
No power to the controller.	If the controller does not have power, the compressor does not operate. For the ZN510 controller to operate normally, a voltage input of 24 VAC must be applied. When the green LED is off continuously, the controller does not have sufficient power or has failed.
Unit wiring.	The wiring between the controller outputs and the outdoor air damper must be present and correct for normal outdoor air damper operation.

Diagnostics

Table 17: ZN510 controller diagnostics

Diagnostic	Fan	Other Outputs
Condensate overflow	Off	Compressors: Off Damper: Closed
Low temp detect - Crt 1	Enabled	Compressor 1: Off Compressor 2: See note below. Damper: See note below.
Low temp detect - Crt 1	Enabled	Compressor 1: See note below. Compressor 2: Off Damper: See note below.
Low temp detect - Crt 1 and 2	Off	Compressor 1: Off Compressor 2: Off Damper: Closed
High/low press cutout - Crt 1	Enabled	Compressor 1: Off Compressor 2: See note below. Damper: See note below.
High/low press cutout - Crt 2	Enabled	Compressor 1: See note below. Compressor 2: Off Damper: See note below.
High/low press cutout - Crt 1 and 2	Off	Compressor 1: Off Compressor 2: Off Damper: Closed
Space temperature failure*	Off	Compressor(s): Off Damper: Closed
Leaving water temp failure	Enabled	Compressor 1: Off Compressor 2: See note below. Damper: See note below.
Discharge air temp failure*	Enabled	Compressor(s): No action Damper: No Action
Maintenance required (example: Filter Status)	Enabled	Compressor(s): No action Damper: No Action
Local setpoint failure*	Enabled	Compressor(s): Enabled Damper: Enabled
Local fan mode failure*	Enabled	Compressor(s): Enabled Damper: Enabled
Invalid unit configuration	Disabled	Compressor(s): Disabled Damper: Disabled

High/low pressure cutout and **low temperature detection** diagnostics for 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).

When BOP 6 is configured as a generic binary output, BOP 6's state is unaffected by all unit diagnostics.

Note: Non-latching diagnostics automatically reset when the input is present and valid.

Diagnostics

Translating Multiple Diagnostics

The controller senses and records each diagnostic independently of the diagnostics. It is possible to have multiple diagnostics present simultaneously. The diagnostics are reported in the order they occur.

Resetting Diagnostics

1. Automatically by the controller.

2. By initiating a manual output test at the controller.

3. By cycling power to the controller.

4. Through a building automation system such as ZN510 Loop Controller.

5. Through Rover, Trane's service tool.

6. Through any communicating device with the ability to access the controller's alarm reset input.

Automatic Diagnostic Reset

The ZN510 controller includes an automatic diagnostic reset function. This function attempts to automatically recover a unit when the following diagnostics occur:

- Low temperature detection, Circuit 1

- Low temperature detection, Circuit 2

- Low temperature detection, Circuit 1 and 2

- High/low pressure cutout, Circuit 1

- High/low pressure cutout, Circuit 2

- High/low pressure cutout, Circuit 1 and 2

When one or more of these special diagnostics occurs, the controller responds to the diagnostic as defined in the table 17 on page 27. After the controller detects the first special diagnostic (listed on page 27), the unit waits 30 minutes before invoking the automatic diagnostic reset function. The automatic diagnostic reset function clears all special diagnostics and attempts to restore the controller to normal operation. The controller resumes normal operation until another diagnostic occurs.

If a special diagnostic occurs within 24 hours after an automatic diagnostic reset, the diagnostic must be manually reset.

Cycling Power

When the 24 VAC power to the controller has been turned off, the unit cycles through a power up sequence. By default, the controller attempts to reset all diagnostics at power up. Diagnostics present at power up and those that occur after power up are handled according to the table on page 27.

Building Automation System (CLC)

Some building automation systems can reset diagnostics in the ZN510 controller. The ZN510 Loop Controller can reset diagnostics in the ZN510 Controller. For complete information, refer to the building automation system product literature.

Rover Service Tool

Trane's service tool, Rover, can reset diagnostics in the ZN510 controller. For complete information about Rover, refer to the Rover product literature.

Alarm Reset

Any device that can communicate alarm reset information can reset diagnostics in the ZN510 controller.
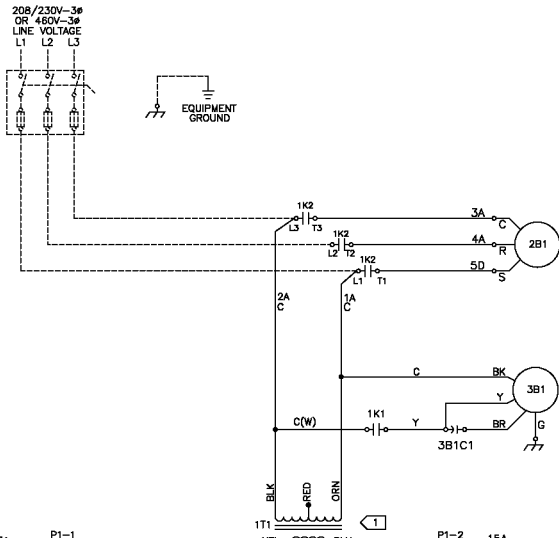
ZN510 Controller Replacement

1. Disconnect power or disable the circuit breaker to unit.

2. Remove bad or questionable ZN510 Controller.

3. Install controller in the unit with the heatsink placement at the top of the control box. (See page 32).

4. Connect the power to the ZN510 ONLY. (TB1-1 & TB1-2 on ZN510)

5. Connect Rover and properly configure the controller, unless a previously configured board is purchased.

6. Power down.

7. Connect the remaining input and output wiring to the controller.

8. Reapply power.

9. Complete sequence 7 and 8 above in the installation section of this manual.

10. Refer to BAS manual for instructions on how to install the new ZN510 into BAS system.

Wiring Diagram

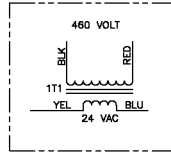| MOTOR SPEED TAP		
HIGH	MED	LOW
BLK	BLU	RED

FOR MED & LOW SPEED TIE BLACK & PURPLE ON 460V UNIT ONLY

208/230V-3∅ OR 460V-3∅ LINE VOLTAGE
L1 L2 L3

EQUIPMENT GROUND

460 VOLT

BLK   RED
1T1
YEL   BLU
24 VAC

INSET B

LEGEND	
DEVICE DESIGNATION	DESCRIPTION
1K1	BLOWER RELAY
1K2	COMPRESSOR CONTACTOR
1T1	CONTROL POWER TRANSFORMER
2B1	COMPRESSOR MOTOR 1
2B1S1	HIGH PRESSURE CONTROL 1
2B1S5	LOW PRESSURE CONTROL 1
1U1	COMFORTLINK 10
3B1	FAN MOTOR
3B1C1	FAN RUN CAPACITOR
4L1	REVERSING VALVE
4RT1	LEAVING WTR TEMP SENSOR
4RT2	DISCHARGE AIR TEMP SENSOR
4S5	CONDENSATE FLOAT SWITCH
1TB1	TERMINAL BOARD

1K2 — 2B1 — C / R / S

3B1 — BK / Y / BR / G

3B1C1

C(W) — 1K1

1T1 — BLK / RED / ORN — YEL / BLU — 24 VAC

OPTIONAL: FIELD SUPPLIED 2 POSITION OUTSIDE AIR DAMPER
24 VAC 1TB1-17
30A 1TB1-18

CONDENSATE OVERFLOW
4S5

OPTIONAL OCCUPANCY CONNECTIONS

1U1

BINARY INPUT

BINARY OUTPUTS

POWER — GND 24V

COMM LINK

ZONE SENSOR
ZONE GND SET FAN GND

ANALOG INPUT
41A P1-13 4RT2 DISCHARGE AIR SENSOR
42A P1-14
43A P1-3 4RT1 LEAVING WATER SENSOR CIRCUIT 1
44A P1-6

ZONE SENSOR CONNECTIONS
FAN MODE   24A 1TB1-4
SET POINT 23A 1TB1-3
COMMON   22A 1TB1-2
ZONE TEMP 21A 1TB1-1

COMMUNICATIONS ZONE SENSOR
COMM 26A 1TB1-6
COMM 25A 1TB1-5

COMMUNICATIONS LINK
COMM 18A 1TB1-16
COMM 19A 1TB1-14

1TB1-17 17A P1-1
1TB1-15 17G P1-7 2B1S1 37A 2B1S5 37A OR 34A 1K2 P1-8 38A
1TB1-15 17J P1-10 4L1 P1-11 36A
1TB1-13 17H P1-4 1K1 P1-5 40A
1TB1-13 17C

P1-12 17D P1-15 33A

Wiring Diagram

208/230-3∅/ 460V-3∅ LINE VOLTAGE
L1 L2 L3

EQUIPMENT GROUND

460 VOLT

INSET B

LEGEND	
DEVICE DESIGNATION	DESCRIPTION
1PB1	POWER BLOCK
1K1	BLOWER CONTACTOR
1K2	COMPRESSOR CONTACTOR 1
1K3	COMPRESSOR CONTACTOR 2
1K8	RELAY REVERSING VALVE
1T1,2	CONTROL POWER TRANSFORMER
2B1	COMPRESSOR MOTOR 1
2B2	COMPRESSOR MOTOR 2
2B1S1	HIGH PRESSURE CONTROL 1
2B1S5	LOW PRESSURE CONTROL 1
2B2S1	HIGH PRESSURE CONTROL 2
2B2S5	LOW PRESSURE CONTROL 2
3B1	FAN MOTOR
1U1	COMFORTLINK 10
4L1,2	REVERSING VALVE
4RT1	LEAVING WTR TEMP SENSOR, CKT 1
4RT2	DISCHARGE AIR TEMP SENSOR
4S5	CONDENSATE OVERFLOW SWITCH
4S6	FREEZESTAT CIRCUIT 2
1TB1	TERMINAL BOARD
1TB5	TERMINAL BOARD

FREEZESTAT CIRCUIT 2

CONDENSATE OVERFLOW

OPTIONAL OCCUPANCY CONNECTIONS

BINARY INPUT

COMM LINK

ZONE SENSOR

BINARY OUTPUTS

POWER

ANALOG INPUT

DISCHARGE AIR SENSOR

LEAVING WATER SENSOR CIRCUIT 1

24 VAC 1TB1-17
30A 1TB1-18
OPTIONAL: FIELD SUPPLIED 2 POSITION OUTSIDE AIR DAMPER

FAN MODE 24A 1TB1-4
SET POINT 23A 1TB1-3
COMMON 22A 1TB1-2
ZONE TEMP 21A 1TB1-1
ZONE SENSOR CONNECTIONS

COMM 26A 1TB1-6
COMM 25A 1TB1-5
COMMUNICATIONS ZONE SENSOR

COMM 18A 1TB1-16
COMM 19A 1TB1-14
COMMUNICATIONS LINK

NOTES:

1. TRANSFORMER (1T1) SHOWN IS WIRED FOR 230V, RED LEAD IS FOR 208V. SEE INSET "B" FOR 460V TRANSFORMER.

2. CONDENSATE OVERFLOW SWITCH (4S5) IS OPTIONAL.

4. REVERSING VALVE (4L1,4L2), TRANSFORMER (1T2), REVERSING VALVE RELAY (1K8), AND TERMINAL STRIP (1TB5) ARE STANDARD WITH HEAT PUMP ONLY.

5. UNLESS OTHERWISE NOTED, ALL SWITCHES ARE SHOWN AT 25° C (77° F). AT ATMOSPHERIC PRESSURE, AT 50% RELATIVE HUMIDITY, WITH ALL UTILITIES TURNED OFF, AND AFTER A NORMAL SHUTDOWN HAS OCCURRED.

6. DASHED LINES INDICATE RECOMMENDED FIELD WIRING BY OTHERS. DASHED LINE ENCLOSURES AND/OR DASHED DEVICE OUTLINES INDICATE COMPONENTS PROVIDED BY THE FIELD. PHANTOM LINE ENCLOSURES INDICATE ALTERNATE CIRCUITRY OR AVAILABLE SALES OPTIONS. SOLID LINES INDICATE WIRING BY TRANE CO.

Hardware Specifications

Specifications

Board Dimensions

Height:	4" (102 mm)
Width:	5-1/2" (140 mm)
Depth:	2-1/4" (57mm)

Operating Environment
32 to 140 F (0 to 60 C)
5 to 95% non-condensing

Storage Environment
-40 to 185 F (-40 to 85 C)
 5 to 95% non-condensing
Power Requirements
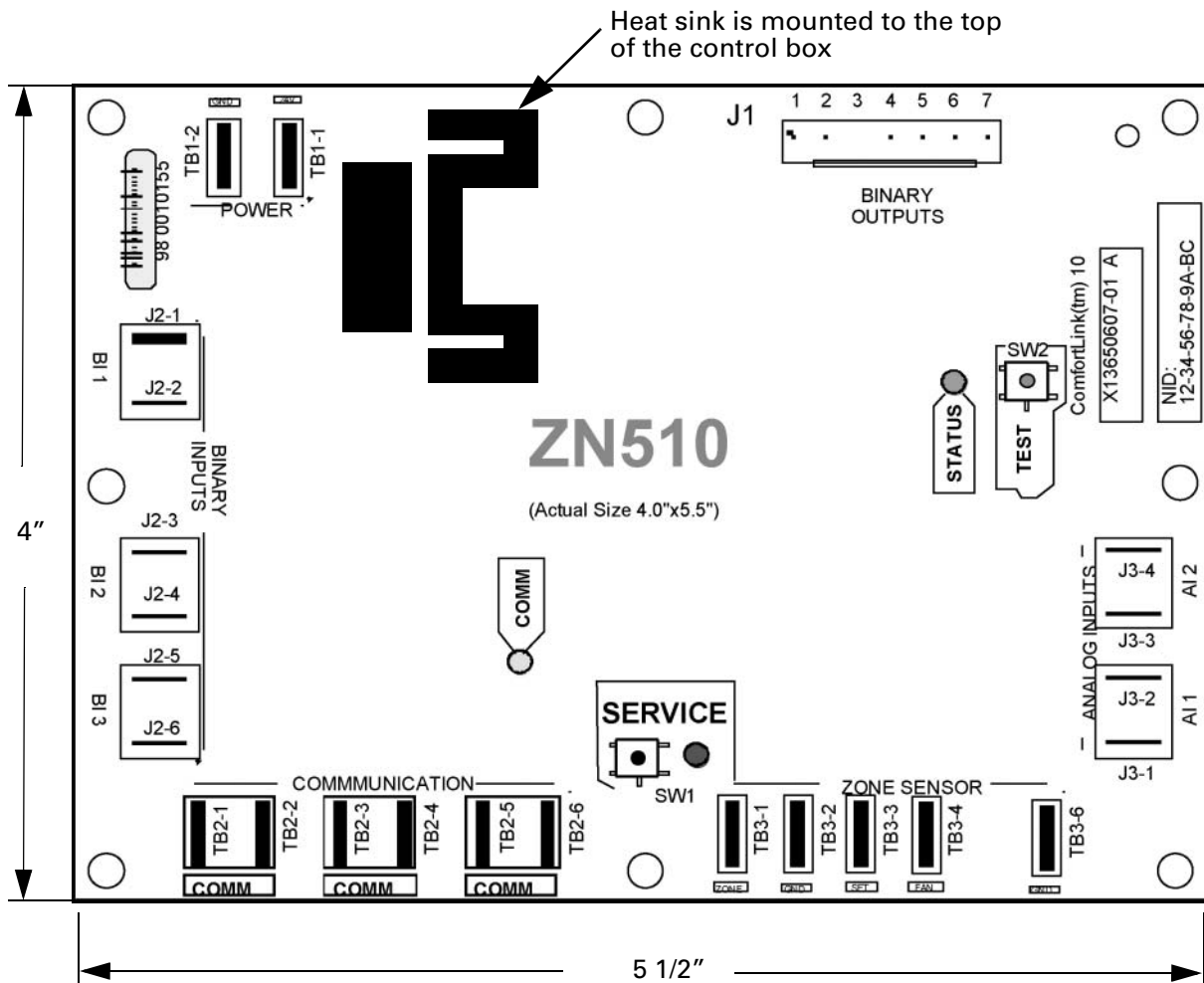18 to 32 VAC (24 VAC nominal)
50 or 60 Hz
300 mA

Agency Listings
UL and CUL 916 Energy
Management System
Agency Compliance
IEC 1000-4-2 (ESD), IEC 1000-4-4

(EFT), IEC 1000-4-5 (Surge), FCC Part
15, Class A.

Input/Output Summary
- Three binary inputs.
- Six binary outputs only five are used.
- Five analog inputs.
- Timed override ON and CANCEL.
- Comm5 communication.

Figure 10: ZN510 Circuit Board

Hardware Specifications

Table 18: Binary Inputs

Description	Terminals	Function
Binary Input 1	J2-1	24 VAC
	J2-2	Input
Binary Input 2	J2-3	24 VAC
	J2-4	Input
Binary Input 3	J2-5	24 VAC
	J2-6	Input

Table 19: Binary Outputs

Description	Terminals	Output Rating	Load Energized	Load De-energized
Binary Output 1	J1-1	12 VA	1 VAC RMS (typical)	24 VAC RMS (typical)
Binary Output 2	J1-2	12 VA	1 VAC RMS (typical)	24 VAC RMS (typical)
Binary Output 3	J1-4	NOT USED		
Binary Output 4	J1-5	12 VA	1 VAC RMS (typical)	24 VAC RMS (typical)
Binary Output 5	J1-6	12 VA	1 VAC RMS (typical)	24 VAC RMS (typical)
Binary Output 6	J1-7	12 VA	1 VAC RMS (typical)	24 VAC RMS (typical)

Table 20: Analog Inputs

Description	Terminals	Function	Range
Zone	TB3-1	Zone temperature input	5 to 122 F (-15 to 50 C)
Ground	TB3-2	Analog ground	NA
Set	TB3-3	Setpoint input	40 to 115 F (4.4 to 46.1 C)
Fan	TB3-4	Fan switch input	OFF = 4821 to 4919 Ohms AUTO = 2297 to 2342 Ohms
Ground	TB3-6	Analog ground	NA
Analog Input 1	J3-1	Leaving water temperature	-40 to 212 F (-40 to 100 C)
	J3-2	Analog ground	NA
Analog Input 2	J3-3	Discharge air temperature	-40 to 212 F (-40 to 100 C)
	J3-4	Analog ground	NA