ZTS-500US

Z-Wave Smart Thermostat
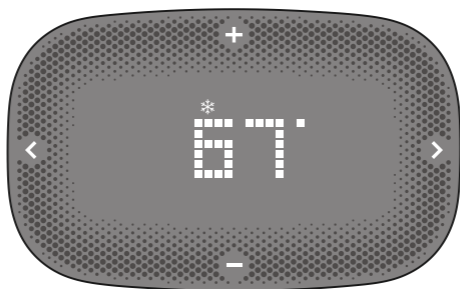
Table of Contents

ZTS-500, Z-Wave Smart Thermostat

Introduction

The ZTS-500 (Figure 1) is a security Z-Wave enabled thermostat designed to control residential HVAC systems. A security enabled Z-Wave Plus Controller must be used in order to fully utilize the product. Users can use local or remote control and monitor the temperature via an App on smartphones or computers while at home or away through a Z-Wave gateway. It can maximize energy conservation and comfort while minimizing the effort required to maintaining a desired temperature in your home.
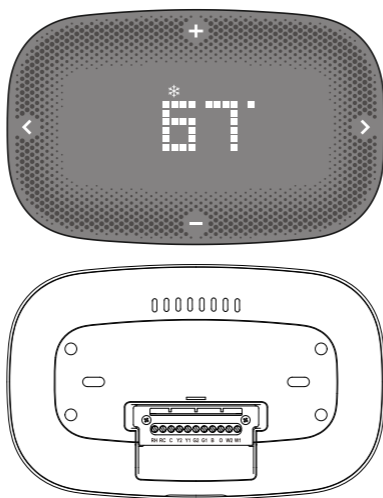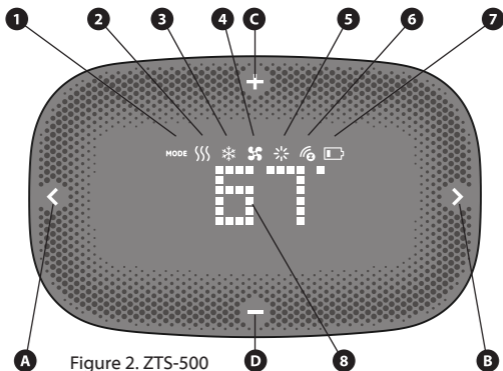

Figure 1. ZTS-500

Product Overview

Figure 2. ZTS-500

Key description

HARD BUTTONS:
A. Short press to navigate to left, or return to previous menu during set up or operating; **Long Press 2 seconds** to **Enter** or **Exit** system level setup menu
B. Short press to navigate to right, or confirm a desired setting; **Long Press 2 seconds** to **Enter** system level setting or **Confirming** a HVAC-system-type-setting and reset-to-factory-default **Action**
C. Short press to set temperature Up; enter Z-Wave inclusion/exclusion mode when in Z-Wave menu; or scroll the value in a specific feature setting.
D. Short press to set temperature Down; or scroll the value in a specific feature setting

ICONS:
1. MODE, flashes in white color when setting mode
2. Heat, flashes in white color when setting temperature under heating mode; appears in Red color when heating device is working
3. Cool, flashes in white color when setting temperature under cooling mode; appears in Blue color when cooling devices is working
4. Fan, flashes in white color when setting fan mode; appears in white color when the fan is working

3

5. LED display brightness, flashes in white color when adjust LED display brightness
6. Z-Wave network icon, appears when it is NOT in Z-Wave network, disappear when it is in Z-Wave network
7. Battery low, flashes in Red color when battery is low
8. Current room temperature display

Supported HVAC Systems & Features

HVAC Systems Compatible

- 24Vac single & two stage conventional heating systems (gas/oil/electric)
- Heat pump systems with up to two stages of heating (electric/gas)
- Zoned forced air and zoned hot water (2 or 3 wire)
- Millivolt systems (12-24Vac or DC source)
- One or two stage cooling systems
- Hybrid systems

HVAC Systems Not Compatible

- Radiant floor and wall heating systems
- Geothermal systems
- Multi-zoned systems
- 110V or higher line voltage systems (e.g. electric baseboard heaters)

  NOTE : Thick black, red, or white wires connected with wire nuts running to existing thermostat typically mean high voltage system.

Features List

- Support 2 stage heat, 2 stage cool, 2 stage fan HVAC systems
- Support "Frequently Listening Routing Slaves"(FLiRS) mode and "Always Listening"mode
- Support Network Wide Inclusion (NWI) and Explore Frames
- Support Security and Non- Security command
- Support battery low and level report
- Support Association Groups
- Advanced features through Z-Wave configuration parameters
- Temperature sensor calibration
- Filter replacement reminder

4

- Z-Wave Plus compliant
- OTA (over-the-air) firmware upgradeability
- Energy saving mode
- Short cycle start up protection
- Support AA x 4 alkaline batteries (No C-wire required) or standard HVAC 24Vac input

Cautions !

- We strongly recommend that installation is performed by a trained HVAC technician.
- Read the enclosed instructions carefully before installing your new ZTS-500. Pay close attention to all warnings and notes and carefully follow the installation steps in the order they are presented to save time and minimize the risk of damaging the thermostat or the system it controls.
- Before disconnecting wires from the existing thermostat, label the wires with the terminal markings from the old thermostat and record them. Take a picture of the old wiring as it will be very helpful with troubleshooting in case you need to reinstall the old unit.
- Turn off electronic devices (e.g. heater, cooler) which will be connected and the electric source before installation and maintenance.
- Do not use metal conduits or cables provided with a metal sheath.
- Adding fuses or protective device in the line circuit is recommended.

Battery safety !

- Use new batteries of the recommended type and size only.
- Never mix used and new batteries together.
- To avoid chemical leaks, remove batteries from the ZTS-500 if you do not intend to use the unit for an extended period of time.
- Dispose of used batteries properly; do not burn or bury them.

Installation Location

This thermostat is restricted to indoor use only. It should be mounted on an inner wall about 5ft (1.5m) above the floor at a position where it is readily affected by changes of the general room temperature with freely circulating air. Avoid mounting above or near hot surfaces or equipment (e.g. TV, heater, refrigerator). Avoid mounting where it will be exposed to direct sunshine, drafts, or in a laundry room or other enclosed space. Do not expose this unit to dripping or splashing liquids.

Get Started

Step-1: Physical Installation and Wiring

Open the box:
- ZTS-500 thermostat
- Screw + Wall Anchor x 2pcs
- User Manual

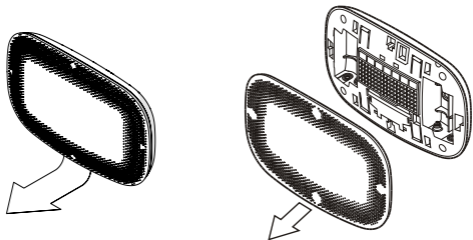1. Remove the front cover by pulling from the lower side of the cover (at the finger recess point)

Figure 4. Open ZTS-500 Front Housing

2. Pull out the terminal board from the back, levering the board from each side to loosen it maybe neccessary.

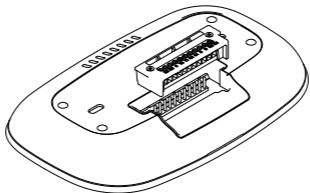Figure 3. Detaching the Terminal Block

3. Wire the proper cables to the terminal block according to the circuit diagram as described in "Thermostat Wiring Reference"on page 11 according to your HVAC system.

Do not loosen or remove the screws on the terminal board!
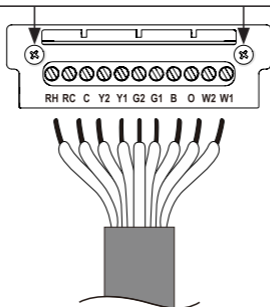
Figure 5. Terminal Block and Pin Assignment

4. Measure and mark the anchor points and drill if neccessory.
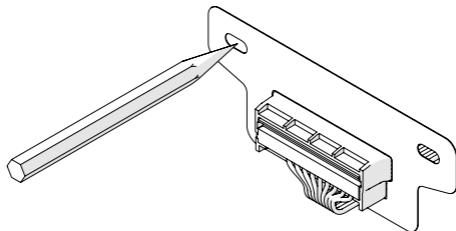
Figure 6. mark the anchor points

5. Carefully realign the terminal block to the pins on the rear of the back housing and push firmly to reattach.

Figure 7. Reattaching the Terminal Block

6. Insert the anchors into the wall at the marked points (step 4), align with the mounting holes at the back of ZTS-500, and fasten it to the wall with the screws.
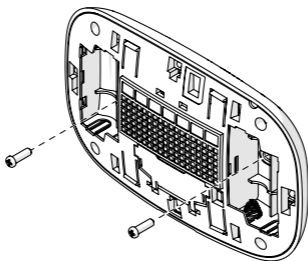
Figure 8. Mount into the Wall

7. The ZTS-500 can be powered by either 4 x AA Alkaline batteries or 24Vac (C-wire). Match the polarity of the batteries with the + / – marks inside the battery compartment. The ZTS-500 works on a battery mode or normal mode based on its power source. The working power mode can only be changed when it is NOT in a Z-Wave network.
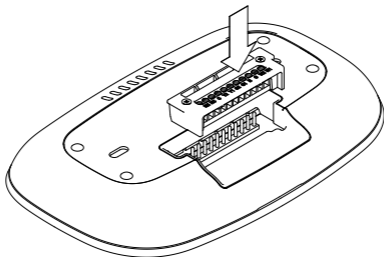
8. Align the front housing of the thermostat with the back housing and push until the housing sections are locked together (Figure 9).refer to the mark of "THIS SIDE UP" on the back of the cover plate to ensure correct position.

THIS SIDE UP
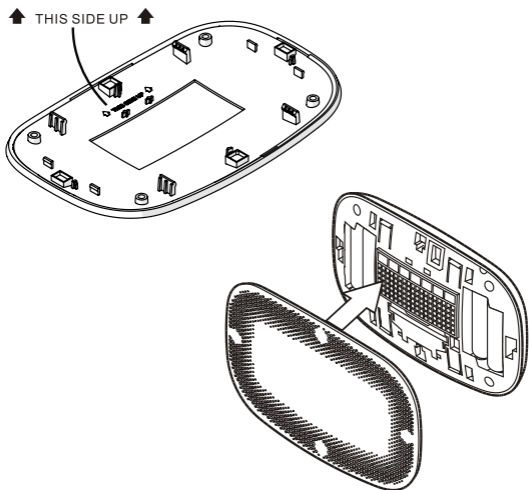
Figure 9. Install the Front Housing

Note:
To prevent abnormal operation, it is important that the ZTS-500 is set to the correct HVAC system type BEFORE operating it or adding it to Z-Wave network. Refer to Initial HVAC system setup after the wiring section.

Thermostat Wiring Reference

Terminals	Symbol
1st stage Heater	W1 or W
2nd stage Heater	W2
Cool changeover (Heat Pump)	O
Heat changeover (Heat Pump)	B
1st stage Fan	G1 or G
2nd stage Fan	G2
1st stage Compressor	Y1 or Y
2nd stage Compressor	Y2
24Vac Common	C
24Vac Power for Cooling	RC
24Vac Power for Heating	RH

RH/RC Jumper

- Most HVAC systems have a built-in common heating and cooling transformer. The ZTS-500 has a built-in RH/RC jumper wire to connect RC and RH inputs for this configuration.
- If the HVAC system contains separated heating and cooling transformers, please cut out the RH/RC jumper and then connect the RC and RH inputs individually.

RH / RC Jumper

Important:

• If there is no C-wire in the HVAC system, the ZTS-500 must be powered by batteries and it will be operated in FLiRS (battery) mode after included into a Z-Wave network.

RC and RH are internal connected

AWG#18 typical wire color

RH RC C Y2 Y1 G2 G1 B O W2 W1

White —— W1 - 1st stage Heater
Vary —— W2 - 2nd stage Heater
Green —— G1 - 1st stage Fan
Vary —— G2 - 2nd stage Fan
Yellow —— Y1 - 1st stage Compressor (Cool)
Vary —— Y2 - 2nd stage Compressor (Cool)
Black (with C-Wire) —— C - 24Vac Common
Red —— R - 24Vac Power

Multi-Stage – 2 Stage Heating & Cooling

RC and RH are internal connected

AWG#18 typical wire color

RH RC C Y2 Y1 G2 G1 B O W2 W1

White —— W - Heater
Green —— G - Fan
Yellow —— Y - Compressor (Cool)
Black (with C-Wire) —— C - 24Vac Common
Red —— R - 24Vac Power

Single-Stage – 1 Stage Heating & Cooling

RC and RH are internal connected

AWG#18 typical wire color

Powered by batteries

RH RC C Y2 Y1 G2 G1 B O W2 W1
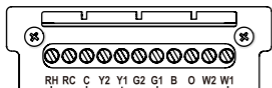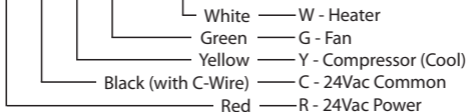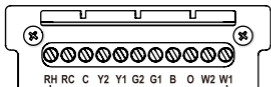
No C-Wire

White —— W - Heater
Red —— R - 24Vac Power

2-Wire System – 1 Stage Heating

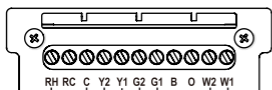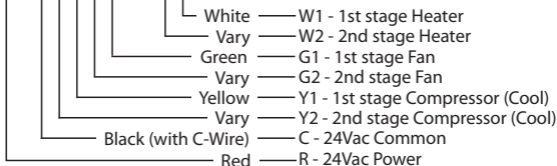*Heat Pump HVAC System Wiring*

Important:

- If there is no C-wire in the HVAC system, the ZTS-500 must be powered by batteries and it will be operated in FLiRS (battery) mode after included into a Z-Wave network.
- DO NOT cut RC/RH jumper for heat pump systems.
- For heat pump output, there is a 3 minutes off time for heat pump protection!

RC and RH are internal connected

AWG#18 typical wire color

RH RC C Y2 Y1 G2 G1 B O W2 W1
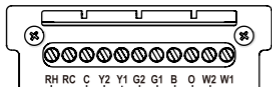
Vary —— W2 - 2nd stage Heater
Orange —— O - Cool changeover (heat pump)
Blue —— B - Heat changeover (heat pump)
Green —— G1 - 1st stage Fan
Vary —— G2 - 2nd stage Fan
Yellow —— Y1 - 1st stage Compressor (Cool)
Vary —— Y2 - 2nd stage Compressor (Cool)
Black (with C-Wire) —— C - 24Vac Common
Red —— R - 24Vac Power

Multi-Stage – 2 Stage Heating & Cooling

RC and RH are internal connected

AWG#18 typical wire color

RH RC C Y2 Y1 G2 G1 B O W2 W1

Orange —— O - Cool changeover (heat pump)
Blue —— B - Heat changeover (heat pump)
Green —— G - Fan
Yellow —— Y - Compressor (Heat/Cool)
Black (with C-Wire) —— C - 24Vac Common
Red —— R - 24Vac Power

Single-Stage – 1 Stage Heating & Cooling

RC and RH are internal connected

AWG#18 typical wire color

Powered by batteries

RH RC C Y2 Y1 G2 G1 B O W2 W1

Yellow —— Y - Compressor (Heat)

No C-Wire

Red —— R - 24Vac Power
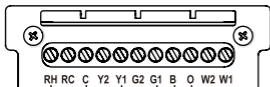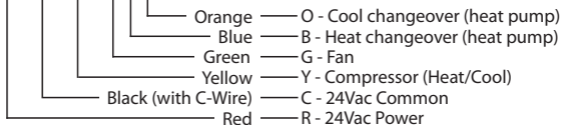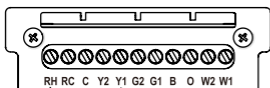
2-Wire System – 1 Stage Heating

Step-2: Initial HVAC System Type Setting

- Pump systems: Non-Heat Pump or Heat Pump
- Heat Fan systems: Gas-Powered or Electric-Powered
- Fan stage systems: One or two stages fan

To prevent abnormal operation, please set ZTS-500 to the correct HVAC system type BEFORE operating it or adding it to Z-Wave network.
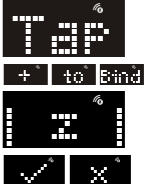
Step	Procedure / Description	LED Display
1	From the Standby screen, long press ">" or "<" for 2 seconds to enter system setting interface, fan, brightness and z-wave network icons will lit up, Z-Wave is the first item to show up, skip that if the HVAC system type is not setup.	Z-W
2	**Set Pump Type:** Press "<" or ">" to navigate to "Pum" screen Press "+" or "−" to select non-heat "NHP" (**default**) or heat pump "HP". Long press ">" for 2 seconds to confirm Non-heat pump: When there is a heating request, thermostat will turn on W1. When there is a cooling request, thermostat will turn on Y1. Heat pump: When there is a heating request, thermostat will turn on Y1 and B. When there is a cooling request, thermostat will turn on Y1 and O.	PUM NHP HP

Step	Procedure / Description	LED Display
3	**Set Fan Type:** Press "<"or ">" to navigate to "Fan"screen. Press "+" or "–" to select gas-powered "Gas"(**default**) or electric-powered "Ele"type. Long press ">" for 2 seconds to confirm Gas-powered : Fan will maintain off state. Electric-powered: Fan will turn on when heating works	Fan Gas Ele
4	**Set Fan Stages:** Press "<"or ">" to navigate to "F-St"screen. Press "+" or "–" to select one stage "One"(**default**) or two stages "Two". Long press ">" for 2 seconds to confirm One stage : Fan speed: Auto/On Two stages: Fan speed: Auto/High/Low Remark: Fan stages cannot be changed when it is in Z-Wave network. You must exclude it first if fan stage setting need to be changed.	F-St One Two

Note:
- *To exit system setting interface, long press "<"key for 2 seconds*
- *The HVAC system type settings keep no change after it is excluded from Z-Wave network or reset to factory default.*

Step-3: Include ZTS-500 to a Z-Wave Network (or gateway/ hub/ controller)

Step	Procedure / Description	LED Display
1	1. From the Standby screen, press ">" or "<" to navigate to Z-Wave icon where "Tap + to Bind" animates; 2. Initiate inclusion command from the Z-Wave gateway, 3. Press "+" on ZTS-500 • "Z" will animate during the inclusion process • "√" indicates successful, "χ" indicates failed • After successfully included to a Z-Wave network, the network icon will disappear as well as the "Tap to Bind" in the operation menu. Alternatively, go to System Setting Interface by long press 2 seconds "<" or ">" key. The first item is for Z-Wave setup, press "+" or "-" to see "Tap + to Bind" and do the above 2 to 3 steps for **Inclusion** or **Exclusion**.	TaP + to Bind Z √ χ

Note:
- *The Z-Wave network icon will only show up if the ZTS-500 is NOT in a Z-Wave network, as well as the menu in the operation interface.*
- *Reset-to-default will exclude it from any Z-Wave network and clear all the configurations and system settings except HVAC system type settings.*
- *All Z-Wave configurations and system settings will keep NO change after excluding the unit from the network, except for the Z-Wave association group information.*

User Interface Overview

General Information:
- Tap any perimeter key "+""–""<""">"to wake up the thermostat display and key illuminations.
- Press "<"and ">"key to navigate to different function (refer to menu map), press "+"and "–"keys to adjust the values.
- In the Operation Interface, selected values will be set **without** a confirmation key press. It will go back to standby menu after 3 seconds without action.
- Z-Wave menu will be skipped if the ZTS-500 is already included into the network

Operation Interface - Menu Map:

STANDBY ←→ MODE ←→ FAN ←→ LED BRIGHTNESS ←→ Z-WAVE

STANDBY :

| Standby | Heat set point | Cool set point |

- Tap the "+"or "–"key to increase or decrease the set point. The temperature will slowly flash as it is adjusted; the "heat"or "cool"icon will flash in white color to indicate the current Mode the thermostat is on.
- Temperature set point cannot be adjusted if the ZTS-500 is on Off mode.
- If the heater or compressor is working, the icons for "Heat"and "Fan"or "Cool"and "Fan"will display with the "Heat"icon in red and "Cool"icon in blue respectively.
- If it's in battery-powered mode, the temperature display will be off after a set amount of time (default 5 seconds) to save battery life. The time can be set in the System Settings Interface.

MODE:

• To set the HVAC system's operating mode: Off, Heat, Cool, Auto.

FAN:

• To set the HVAC system's fan mode.
• For 1 stage fan system: The fan can be set to Auto or On. When set to On, the fan will stay forced on.
• For 2 stage fan system: The fan can be set to Auto, High, or Low. When set to High or Low, the fan will stay forced on.

LED BRIGHTNESS:

• To adjust the brightness of the LED display.
• The brightness level can be set to High, Med, or Low.
  Note: Low is recommended for saving battery life

Z-WAVE:

• To Include the ZTS-500 to a Z-Wave network.
• Tap the "+"key when an inclusion request is sent by a local Z-Wave gateway, HUB, or controller. "✓"indicates successful, "✗"indicates failed.
• If it is included in a Z-Wave network, the "Z-Wave network"icon will disappear. To Exclude the ZTS-500 from a Z-Wave network or to change Z-Wave networks, go to System Settings Interface=>Z-Wave.

System Setting Interface Overview

General Information:
- To enter the System Settings Interface from STANDBY mode, **press and hold either the "<"or ">"key for 2 seconds.** The FAN, LED BRIGHTNESS, and Z-WAVE network icon will appear simultaneously when the ZTS-500 is in the System Settings Interface.
- To exit the System Settings Interface, **press and hold the "<"key for 2 seconds.** Or after 30 seconds without action.
- Press "<"and ">"key to navigate to different function (refer to menu map), press "+"and "−"keys to adjust the values.
- Press "<"key to return to previous menu, **short press ">"key to confirm** a setting except for HVAC pump type settings (fan type, fan stage type and reset to factory default) which requires **long press 2 seconds** to confirm the setting.

System Settings Interface - Menu Map:

Z-WAVE ←→ TEMP. DISPLAY UNIT ←→ LED SLEEP TIMER ←→
FILTER ←→ FIRMWARE VERSION ←→ POWER MODE ←→
HVAC PUMP TYPE ←→ HVAC FAN TYPE ←→
HVAC FAN STAGE ←→ RESET

Z-WAVE:

- To Include or Exclude ZTS-500 to or from a Z-Wave network
- Tap the "+"key when an inclusion or exclusion request is sent by Z-Wave gateway, HUB, or controller. "✓"indicates successful, "✗"indicates failed
Note: All Z-Wave configurations and HVAC system type settings will retain after exclusion except for the association groups information.

TEMPERATURE DISPLAY UNIT:

- To set the temperature display unit, Fahrenheit (°F) or Celsius (°C).
- Default (°F)

LED SLEEP TIMER:

- To set the amount of time the LED display stays on before going to sleep.
- Range: 3 to 60 seconds, and "• • •"always on, step size: 1s, Default: 5s

  Note: shorter timer is recommended for saving battery life

FILTER COUNTER CLEAR :

- "Filt" will flash once the filter counter reaches the pre-set time (default 6 months)
- To clear the counter, press "+" or "−" key to "Clr"screen, press " >"to confirm.
- Press "<"key to exit if you accidently enter this menu. Once the ">"key is pressed, the counter is cleared and will count from 0.

FIRMWARE VERSION:

- To Check the Z-Wave and MCU firmware versions
  - **Z.xxx: Z**=Wave; **xxx** = version x.xx
  - **U.xxx: U**=MCU; **xxx** =version x.xx

POWER MODE:

- To Check the ZTS-500's current power mode.
    - **Batt** = On battery power
    - **24V** = On 24VAC power

HVAC PUMP TYPE:

- To set the HVAC system's pump type, non-heat pump "NHP" (default) or heat pump "HP"
- Long press 2 seconds ">" key to confirm

HVAC FAN TYPE:

- To set the HVAC system's fan type, gas-powered (default) fan or electric-powered fan.
- Long press 2 seconds ">" key to confirm

HVAC FAN STAGE:

- To set the HVAC system's fan stage, One Stage (default) or Two Stage fan.
- Long press 2 seconds ">" key to confirm

RESET TO FACTORY DEFAULT:

- To reset the ZTS-500 to factory default settings
- Press "+" or "−" key to the "Yes" screen.
- Long press 2 seconds ">" key to confirm
  Note: All settings including Z-Wave configurations will be reset to factory default except the HVAC system type retains the last selection.

Alerting Messages

Battery Low Indication

Description	LED Display
"Battery low" icon will be displayed if the battery is running out.(User is required to change new batteries.)	

Filter Replacement

Description	LED Display
Once filter counter reaches the default time (6 months). "Filt" + Fan icon flashes according to your LED display setting: • It flashes 3 seconds in every 10 minutes if the LED display is set to always on; • It flashes 3 times when someone touches the thermostat and lit up the display if the LED display is set to power saving mode (5 to 60 seconds). • User can clear the counter at System Settings when the "Filt" alert flashes (refer to System Settings). user can also use gateway (hub) to set the counter to different value (from 3 months to 12 months) through configuration parameter settings. (refer to Z-Wave Parameters table)	

Defrost Function

Description	LED Display
"Defr" message and "Heat" icon will be displayed if room temperature is below 41℉ / 5℃. All heaters will be forced On, except in cool mode.	Defr

Out of Temperature Range Control Function

Description	LED Display
"Cold" message and "Heat" icon will be displayed if room temperature is below 32℉ / 0℃. All heaters will be forced On, except in cool mode.	Cold
"Hot" message and "Cool" icon will be displayed if room temperature is above 99℉ / 37℃. All heaters will be forced Off. Cooler will turn on if running in cool mode.	Hot

Energy Saving Mode

User can enable/disable energy saving mode by using Z-Wave BASIC set command only. You may refer to the user manual of Z-Wave primary controller. ZTS-500 will ignore other basic set commands except 0x00 (Off) and 0xFF (Resume).

- Enable energy saving mode, Basic set value = 0x00 (Off)
  (Energy saving mode will be mapped to off mode)
- Disable energy saving mode, Basic set value = 0xFF (Resume)
  (Comfort mode will mapped to resume mode)

Short Cycle Start Up Protection

To protect the compressor / heat pump, those outputs are forced off until a 3 minutes countdown finishes. Those outputs can be activated according to the room temperature after 3 minutes.

Z-Wave Setup and Configuration

General Information:

ZTS-500 can be included and operated in any Z-Wave network with other Z-Wave certified devices from other manufacturers and/or other applications. All non-battery operated nodes within the network will act as repeaters regardless of vendor to increase reliability of the network.

ZTS-500 automatically detects the power source (battery or 24Vac) when power up and switch to corresponding Power Mode. Please refer to Z-Wave Glossary for the definition of FLiRS mode (Batt) and Always Listening Mode (24V).

Check the current power source at System Settings menu (refer to page 19)

Important:

Once it is included into a Z-Wave network, operation mode "FLIRS or Always Listening" can NOT be changed even the power source is changed. for example, the ZTS-500 is initially powered up by 24Vac and battery, and included to Z-Wave network, if 24Vac power is not working or removed, battery will drain fast (only survive 3 to 5 days). Make sure to exclude the ZTS-500 from the Z-Wave network before you change power source and re-include it to the network.

Z-Wave Inclusion and Exclusion

Please refer to page 16 "Step 3: Include ZTS-500 to a Z-Wave network"

Support for Association Groups

ZTS-500 supports 1+2 association groups with maximum 5 devices in total:

Association Group # 1

Association Group #1 (max. 1 node) is default to associate with the primary controller (gateway/hub/controller) for thermostat status change report, refer to below for report details:

a) Operation mode (Off, Heat, Cool, Auto)

b) Operation state (Heat on or off, Cool on or off)

c) Fan mode (Auto, On, High, Low)

d) Fan state (Fan on, Fan off)

e) Heat set point (report in precision of 0.5°C or 1°F)

f) Cool set point (report in precision of 0.5°C or 1°F)

g) Current room temperature (report in precision of 0.5°C or 1°F)

(It will trigger room temperature report if there is 2°F / 1°C [default] differ from last report. You can change this setting by set the configuration parameter.)

Association Group # 2 and #3:

These 2 groups are used for ZTS-500 to control extra Z-Wave ON/OFF switches (it could be connected to extra heater or compressor, depending on user's need) by the preset triggering conditions below:

Max. 2 devices (nodes) can be assigned to group 2 and 3 (Total is 2+2 nodes for group 2 and 3).

Triggering condition	Association group_2	Association group_3
Heating mode On	ON (basic set command 0xFF)	OFF (basic set command 0x00)
Cooling mode On	OFF (basic set command 0x00)	ON (basic set command 0xFF)
OFF	OFF (basic set command 0x00)	OFF (basic set command 0x00)

Important:

Please do not associate heater and compressor devices in same association group because heater and compressor device can't turn on simultaneously!

Example:
Association Groups setting

Association group_1 for Auto report to gateway

Z-Wave Gateway (Node ID-A)

Association group_2 for Heater

Association group_3 for Compressor

F-BW8170 (ZTS-500)

F-BW8041 (ZFM-80) (Node ID-B)

F-BW8041 (ZFM-80) (Node ID-C)

F-BW8041 (ZFM-80) (Node ID-D)

F-BW8041 (ZFM-80) (Node ID-E)
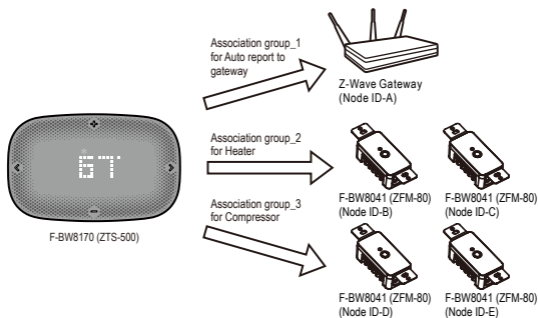
Z-Wave Configuration Parameters

If your gateway/hub/controller supports configuration function, you may refer to below table to change the settings of below functions; otherwise, all value will keep in default.

Functions	Parameter No.	Parameter value range
Scale of temperature	1 (0x01)	0(0x00)= °C 1(0x01)= °F(**default**)
Swing	2 (0x02)	1(0x01)= 1 °F / 0.5 °C 2(0x02)= 2 °F / 1.0 °C (**Default**) 3(0x03)= 3 °F / 1.5 °C 4(0x04)= 4 °F / 2.0 °C
Differential	3 (0x03)	1(0x01)= 1 °F / 0.5 °C 2(0x02)= 2 °F / 1.0 °C (**Default**) 3(0x03)= 3 °F / 1.5 °C 4(0x04)= 4 °F / 2.0 °C
Dead band (On thermostats that automatically control both heating and cooling systems, a dead band is a temperature range in which neither system turns on. The dead band prevents the thermostat from activating heat and cooling in rapid succession. This conserves energy by providing a range of temperatures requiring no energy consumption)	4(0x04)	Dead band value: 3(0x03)= 3 °F / 1.5 °C 4(0x04)= 4 °F / 2.0 °C (**default**) 5(0x05)= 5 °F / 2.5 °C 6(0x06)= 6 °F / 3.0 °C
Upper limit of Heat set point (In order to save energy special in motel service, advance user or administrator can limit the upper heat set point)	5 (0x05)	If in Heat and Auto mode: Unit in F: Range from 41 °F to (99 °F - dead band) Default = 95 °F Example 82 °F; input = 820(0x0334) Unit in C: Range from 5 °C to (37 °C - dead band) Default = 35 °C Example 28 °C; input = 280(0x0118)

Functions	Parameter No.	Parameter value range
Lower limit of Cool set point (In order to save energy special in motel service, advance user or administrator can limit the lower cool set point)	6 (0x06)	If in Cool mode and Auto Mode: Unit in F: Range from (41 °F + dead band) to 99 °F Default = 45 °F Example 68 °F; Input = 680(0x02A8) Unit in C: Range from (5 °C + dead band) to 37°C Default = 7 °C Example 20 °C; Input = 200(0x00C8)
Clear filter counter	7 (0x07)	0(0x00) (**default**)
Set filter counter	8 (0x08)	3 (0 x 03) to 12 (0 x 0c) months 6 (0 x06) months (**default**) Resolution = 1 (0x 01) month
Report filter counter (**Read only**)	9 (0x09)	1 (0x01) to 12 (0x 0c) months

Functions	Parameter No.	Parameter value range
Sensor temperature calibration (This parameter is used to change the display temperature to match with your previous thermostat, or to match another thermostat already in your home.	10 (0x0A)	Temperature offset value. Formula: Display temperature = sensor reading value + offset value (Unit = degree F) 0(0x00)= 0 °F(Default) 1(0x01)= 1 °F(0.5 °C) 2(0x02)= 2 °F(1.0 °C) 3(0x03)= 3 °F(1.5 °C) 4(0x04)= 4 °F(2.0 °C) 5(0x05)= 5 °F(2.5 °C) 6(0x06)= 6 °F(3.0 °C) 7(0x07)= 7 °F(3.5 °C) 8(0x08)= 8 °F(4.0 °C) 9(0x09)= 9 °F 4.5 °C) 10(0x0A)= 10 °F(5.0 °C) -1(0xFF) = -1 °F(-0.5 °C) -2(0xFE)= -2 °F(-1.0 °C) -3(0xFD)= -3 °F(-1.5 °C) -4(0xFC)= -4 °F(-2.0 °C) -5(0xFB)= -5 °F(-2.5 °C) -6(0xFA)= -6 °F(-3.0 °C) -7(0xF9)= -7 °F(-3.5 °C) -8(0xF8)= -8 °F(-4.0 °C) -9(0xF7)= -9 °F(-4.5 °C) -10(0xF6)= -10 °F(-5.0 °C)
LED brightness level	11 (0x0B)	0(0x00)= Level-0 (reserved) 1(0x01)= Level-1 (dark) 2(0x02)= Level-2(middle) **Default** 3(0x03)= Level-3 (bright)
Sleep timer	12 (0x0C)	3(0x03) to 60(0x3C) seconds, 255(0xFF) = Always On Step size = 1s, 5s = **default**

Functions	Parameter No.	Parameter value range
Repeat basic set counter (Association Group A and B only)	13 (0x0D)	Value(X) 0(0x00), 3 (0x03) To 255(0xFF) 0(0X00)= Disable, **default** 3(0x03) to 255(0xFF) minutes (Thermostat sends "Basic Set"command to its association node repeatedly in every X minutes)
Trigger AUTO report if room temperature is different from last report. (It will report room temperature only) • User can use this function to enhance batteries service life.	14 (0x0E)	0 (0x00) = disable Delta change is ≥1(0x01) = 1°F (0.5 °C), **default value after included into a network; Power mode is 24Vac** 2(0x02) = 2 °F (1.0 °C), **default value after included into a network; Power mode is Batt** 3(0x03)= 3 °F(1.5 °C) 4(0x04)= 4 °F(2.0 °C) 5(0x05)= 5 °F(2.5 °C) 6(0x06)= 6 °F(3.0 °C) 7(0x07)= 7 °F(3.5 °C) 8(0x08)= 8 °F(4.0 °C)

Functions	Parameter No.	Parameter value range
AUTO report by time interval. (It will report room temperature only) • User can use this function to enhance batteries service life.	15 (0x0F)	0(0x00)= disable, **default** AUTO report timer: 1(0x01)= 0.5 hr 2(0x02)= 1.0 hr 3(0x03)= 1.5 hrs 4(0x04)= 2.0 hrs 5(0x05)= 2.5 hrs 6(0x06)= 3.0 hrs 7(0x07)= 3.5 hrs 8(0x08)= 4.0 hrs 9(0x09)= 4.5 hrs 10(0x0A)= 5.0 hrs 11(0x0B)= 5.5 hrs 12(0x0C)= 6.0 hrs 13(0x0D)= 6.5 hrs 14(0x0E)= 7.0 hrs 15(0x0F)= 7.5 hrs 16(0x10)= 8.0 hrs

Example for sensor temperature calibration:
If sensor reading value = 77°F, offset value = -2°F
Display temperature = sensor reading value + offset value = 77 - 2 °F
= 75 °F

If using decimal input:
Parameter no. = 10; Parameter value = -2

If using hexadecimal input:
Parameter no. = 0x0A; Parameter value = FE (Size ≥ 1 byte)

Z-Wave Glossary

Device or Node	Devices and nodes are all terms to describe an individual Z-Wave device. These are all interchangeable when setting up your Z-Wave network.
Inclusion	Add a Z-Wave device to the network.
Exclusion	Remove a Z-Wave device from the network.
Remove	To take a device out of a group, scene or association group while that device still exists in the same Z-Wave network.
Network Wide Inclusion (NWI)	Network Wide Inclusion (NWI) enables both end-user friendly, Plug and Play like Z-Wave network installation as well as professional installation scenario where the inclusion process, in terms of time will be reduced significantly. NWI is a feature supported by a new frame type named Explorer which enables the Z-Wave protocol to implement Adaptive Source Routing.
Z-Wave Network	A collection of Z-Wave devices is controlled by primary and secondary controllers operating on the same system. A Z-Wave network has its own unique ID code so that controllers not in the network cannot control the system.
Primary Controller	The first controller is used to set up your devices and network. Only the Primary Controller can be used to include or remove devices from a network. It is recommended that you mark the primary controller for each network for ease in modifying your network.
FLiRS Mode	FLiRS is abbreviation for "Frequently Listening Routing Slave". FLiRS mode is targeted for battery operated applications and will enter sleep mode frequently in order to conserve battery consumption. The response to Z-Wave command is not as quick as Always Listening Device. Normally there is 1-2 seconds latency.
Always Listening Mode	Always Listening Mode is targeted for AC power operated applications and it can act as a repeater, which will re-transmit the RF signal to ensure that the signal is received by its intended destination by routing the signal around obstacle and radio dead spots. The response to Z-Wave command is immediate.
Association	Association is used to organize nodes in different groups allowing the device to identify the nodes by a group identifier. The groups can also be copied to other devices.

Frequently Asked Questions

Q: Why won't my ZTS-500 work with the Z-Wave devices purchased in another country?

A: Due to differing regulations in different countries, Z-Wave products from different regions are set to different frequencies. Before purchasing new devices, be sure to check if the devices are compatible in your region.

Q: Do I need an electrician to install ZTS-500 in my house?

A: It is strongly recommended that a qualified technician install this product.

Q: How do I know which product is compatible with my ZTS-500?

A: The ZTS-500 is compatible with any Z-Wave controller or gateway that has the control capability for "Thermostat" devices. All Z-Wave products are also labeled with the Z-Wave logos shown below.

A: Can I use 2 or more ZTS-500 in my house? What is the max. units?

A: Yes, you can use multiple ZTS-500s in a single home. The maximum number of units depends on the capabilities of the gateways and controllers. For example, different gateways can support up to 8, 16, or 32 ZTS-500 on a given network.

Q: What is the recommended battery type for ZTS-500 and what is estimated batteries service life?

A: Alkaline batteries are recommended for the ZTS-500. Batteries service life is very dependent on the amount of usage per day. With normal use, approximate battery service life is 1 year while operated in FLiRS mode. If you are using battery power as the main power source or as a back-up while AC power is down and the ZTS-500 is in Z-Wave Always Listening mode, the battery will drain very fast (battery will only survive 3-5 days).

Q: What is the meaning of "swing", "differential", and "dead band"?
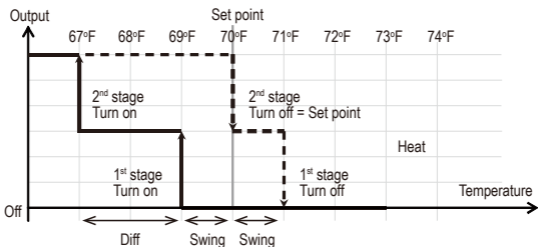
A: Here are the explanations:

HEAT mode:

Thermostat controls the temperature according to the following diagram:

Example : If Heat Set point = 70°F, Swing = 1°F, Differential = 2°F, then

1st stage heater turns on when room temp is 69°F and off at 71°F.

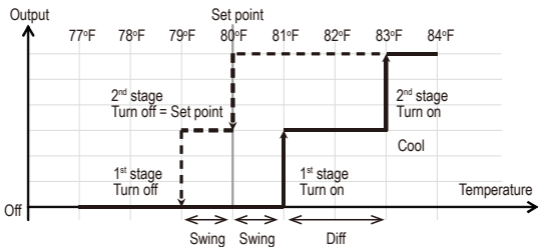2nd stage heater turns on when room temp is 67°F and off at 70°F.

COOL mode:

Thermostat controls the temperature according to the following diagram:

Example : If Cool Set point = 80°F, Swing = 1°F, Differential = 2°F, then

1st stage cooler turns on when room temp is 81°F and off at 79°F.

2nd stage cooler turns on when room temp is 83°F and off at 80°F.

AUTO mode:

Thermostat controls the temperature according to the following diagram.

Press "+" / "−" buttons to adjust the appropriate set point. It will adjust the set point that is closer to the current room temperature.

- If the current temperature is close to heat set point, then it will change the heat set point value.
- If the current temperature is close to cool set point, then it will change the cool set point value.
- If the difference between the two is equal, then it will change the heat set point value by default.
- There is a dead band 4°F / 2°C (by default) between heat set point and cool set point. If user select heat set point is 73°F, then the minimum of cool set point will be limited to 77°F.

Example:

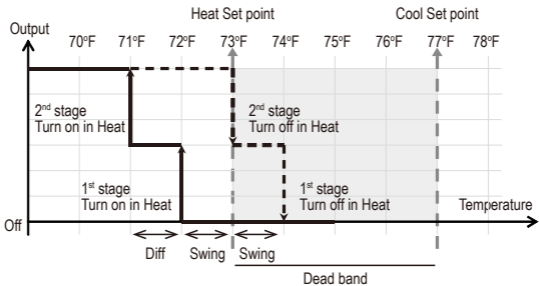: If Room temperature = 75°F, Dead band = 4°F, Swing = 1°F, Differential = 1°F

Heat Set point = 73°F, Cool Set point = 77°F

Then it will change the heat set point by "+"/"−"buttons.

If keep 73°F in heat set point, then the minimum of cool set point will be limited to 77°F,

1st stage heater turns on when room temp is 72°F and off at 74°F.

2nd stage heater turns on when room temp is 71°F and off at 73°F.

Technical Specifications

Model no.	BW8170US (ZTS-500US)
RF Frequency	908.4MHz (US) (ZTS-500US)
RF Operating Distance	up to 132ft (40m) outdoor line of sight, in unobstructed environment
Z-Wave Association Group	Supports 3 association groups, max. 5 nodes ID can be assigned to these association groups.
LED and Button	Curved white LEDs display (Wide viewing angle and high contrast ratio with 3 levels brightness control) Resolution: 18 x 6 dots VA: 64mm x 28mm Status icons: 7 "<", ">", "+" and "–" control buttons and LEDs
Powered By	Dry battery AA x 4pcs or 24 VAC +/- 20% 50/60Hz
Relay Contact	Voltage: 24 VAC 50/60 Hz Current: 1A Max. (Inductive)
Temp Unit	°F or °C
Temp Display Resolution	1°F / 0.5 °C
Temp Measurable Range	32 – 99 °F / 0 – 37 °C
Temp Setting Range	41 – 99 °F / 5 – 37 °C
Temp Swing and Differential	1°F, 2°F, 3°F or 4°F / 0.5°C, 1.0°C, 1.5°C or 2°C
Temp Dead Band	3°F, 4°F, 5°F or 6°F / 1.5°C, 2.0°C, 2.5°C or 3°C
Operating and Storage Temps	Operating: 32 – 122 °F / 0 – 50 °C Storage: 23 – 140 °F / -5 – 60 °C
Dimension (L x H x T)	160mm x 100mm x 28mm
Weight	190g (Batteries excluded)

Wireless Information

This device has an open-air line-of-sight transmission distance of 132 feet (40m) which complies with the Z-Wave standards. Performance can vary depending on the amount of objects in between Z-Wave devices such as walls and furniture. Every Z-Wave device set up in your network will act as a signal repeater allowing devices to talk to each other and find alternate routes in the case of a reception dead spot.

Radio frequency limitations:
1. Each wall or object (i.e.: refrigerator, bookshelf, large TV, etc) can reduce the maximum range of 65 feet (20m) by up to 20 to 30%.
2. Plasterboard and wooden walls block less of the radio signal then concrete, brick or tile walls which will have more of an effect on signal strength.
3. Wall mounted Z-Wave devices will also suffer a loss of range if they are housed in metal junction boxes which could also reduce the range by up to 20 to 30%.

Maintenance

Do not expose your unit to dust, strong sunlight, humidity, high temperatures or mechanical shocks.
1. Do not use old and new batteries together as old batteries tend to leak.
2. Do not use corrosive or abrasive cleansers on your unit.
3. Use a water wet cloth to clean the soft plastic surface, do not use any detergent or cleaning agent.
4. Keep the unit dust free by wiping it with a soft, dry cloth.
5. Do not disassemble the unit, it contains no user-serviceable parts.

FCC Notice

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:
1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

NOTE:
This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
• Reorient or relocate the receiving antenna.
• Increase the separation between the equipment and receiver.
• Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
• Consult the dealer or an experienced radio/TV technician for help.

Notice:
Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user authority to operate the equipment.

IC Notice

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:
1. This device may not cause interference, and
2. This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditionssuivantes:
1. l'appareil ne doit pas produire de brouillage, et
2. l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Warnings

• Do not modify the unit in any way.
• Risk of fire.
• Risk of electrical shock.
• Risk of burns.
• Do not dispose of electrical appliances and unsorted municipal waste, use separate collection facilities. Contact your local government for information regarding the collection systems available.
• There is no user serviceable parts in this unit.

Caution

• Risk of explosion if battery is replaced by an incorrect type.
• Dispose of used batteries according to the instructions.

For more information, updates and other language quick setup guide, please visit our website.
https://www.remotec.com.hk/bw8170-product-page/