ZTS-500US
Z-Wave Smart Thermostat

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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.
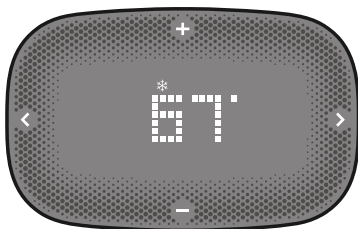

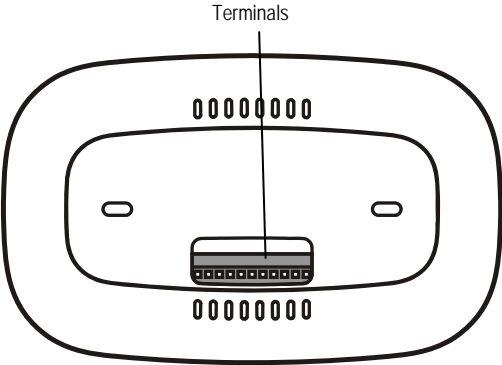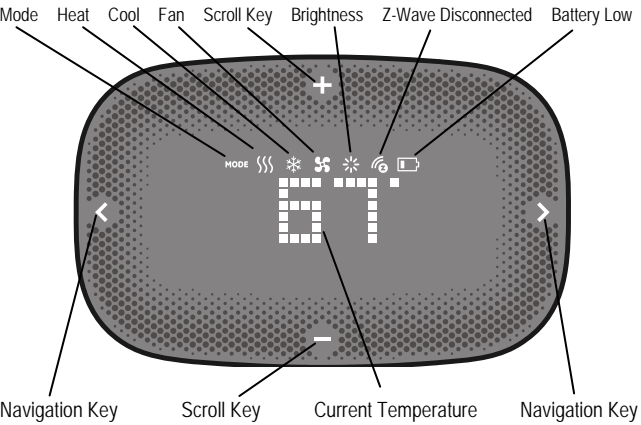
Figure 1. ZTS-500

Product Overview

Mode Heat Cool Fan Scroll Key Brightness Z-Wave Disconnected Battery Low

Navigation Key   Scroll Key   Current Temperature   Navigation Key

Terminals

Figure 2. ZTS-500

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 <u>Not Compatible</u>
- 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 "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
- 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

In the box:
- ZTS-500 Thermostat
- Screw + Wall Anchor x 2pcs
- User Manual

Physical Installation

1. Open the ZTS-500 by pulling the two sections apart (Figure 3). Use the fingertips of one hand to grip the tab on the bottom of the front housing.
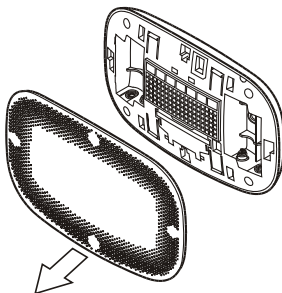
Figure 3. Open ZTS-500 front housing

2. Insert the two included wall anchors into the wall, aligned with two of the mounting holes in the back housing of the thermostat.
3. Open the terminal block of the ZTS-500 then insert all necessary wires through the back housing (Figure 4).
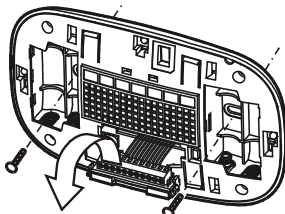
Figure 4. Open the terminal and mount into the wall

4. Fasten the back housing to the wall using the two included mounting screws. Insert the screws through the mounting holes in the housing and into the wall anchors (Figure 4).

5. Wire the proper cables to the terminal block according to the circuit diagram as described in "Thermostat Terminal Wiring" (Figure 5). Afterward, push all cables back into the wall then close the terminal block of the ZTS-500.

Figure 5. Terminal block and pin assignment

6. 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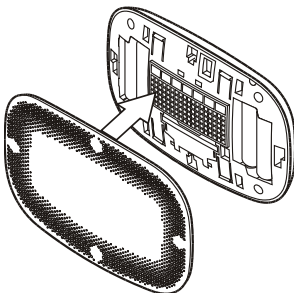 + / – marks inside the battery compartment. The ZTS-500 works on a battery mode or normal mode based on its power source. The working power mode can only be changed when it is NOT in a Z-Wave network.

7. Align the front housing of the thermostat with the back housing and push until the housing sections are locked together (Figure 6).

Figure 6. 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

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

RC/RH 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.

RC/RH jumper
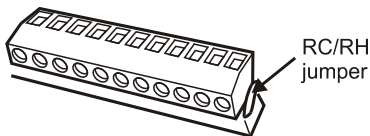
Non-Heat Pump (standard) HVAC System Wiring

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.

White
Vary
Green
Vary
Yellow
Vary
Black (with C-Wire)
Red

W1 - **1st stage Heater**
W2 - **2nd stage Heater**
G1 - **1st stage Fan**
G2 - **2nd stage Fan**
Y1 - **1st stage Compressor (Cool)**
Y2 - **2nd stage Compressor (Cool)**
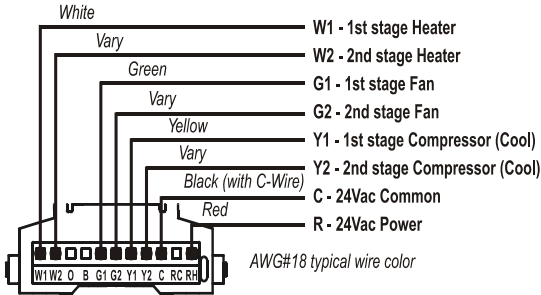C - **24Vac Common**
R - **24Vac Power**

AWG#18 typical wire color

W1 W2 O B G1 G2 Y1 Y2 C RC RH

RC and RH are internal connected

Multi-Stage – 2 Stage Heating & Cooling

White
Green
Yellow
Black (with C-Wire)
Red

W - **Heater**
G - **Fan**
Y - **Compressor (Cool)**
C - **24Vac Common**
R - **24Vac Power**

AWG#18 typical wire color

W1 W2 O B G1 G2 Y1 Y2 C RC RH

RC and RH are internal connected

Single-Stage – 1 Stage Heating & Cooling

White
No C-Wire
Red

W - **Heater**
R - **24Vac Power**

AWG#18 typical wire color
Powered by batteries

W1 W2 O B G1 G2 Y1 Y2 C RC RH

RC and RH are internal connected

2-Wire System – 1 Stage Heating
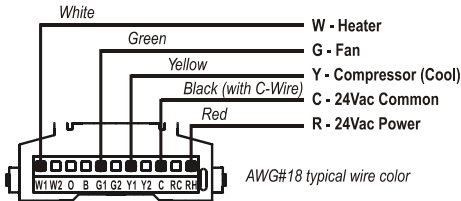
Heat Pump HVAC System Wiring

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.
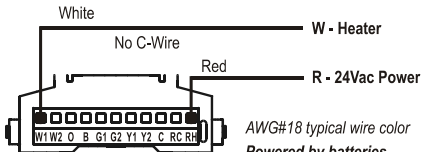- DO NOT cut RC/RH jumper for heat pump systems.
- For heat pump output, there is a 3 minutes off time for heat pump protection!
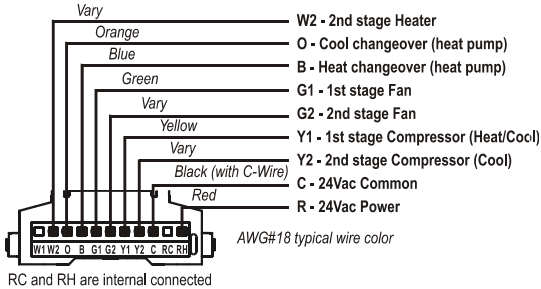
Multi-Stage – 2 Stage Heating & Cooling
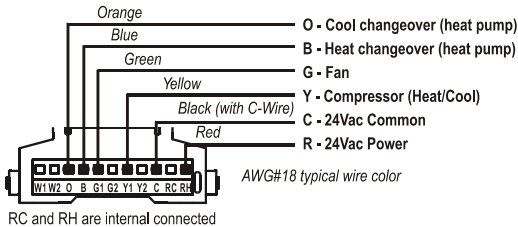
Single-Stage – 1 Stage Heating & Cooling

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.

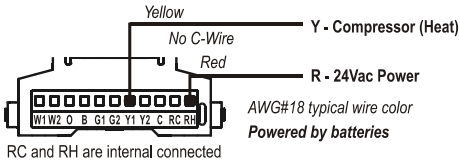| Step	Procedure / Description	LED indication
1	From the Standby screen, press and keep holding "**>**" or "**<**" for 3 seconds to navigate to the System Main (SYS) screen.	Z-W
2	**For Pump Systems:** Press "**>**" to navigate to the pump system (Pum) screen. Press "**+**" or "**–**" to enter the setting. Press "**+**" or "**–**" to select your pump system type, either a non-heat pump system (NHP) or a heat pump system (HP). Press and keep holding "**>**" for 2 seconds to confirm your selection. Press "**<**" to cancel the setting and back to the previous screen. Non-heat pump: **(pre-selected system)** • 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 indication
3	**For Fan Systems:** Press "**>**" to navigate to the fan system (Fan) screen. Press "**+**" or "**–**" to enter the setting. Press "**+**" or "**–**" to select your fan system type, either gas-powered (Gas) or electric-powered (Ele). Press and keep holding "**>**" for 2 seconds to confirm your selection. Press "**<**" to cancel the setting and back to the previous screen. Gas-powered **: (pre-selected system)** • Fan will maintain off state. Electric-powered: • Fan will be turned on when there is heating.	**Fan** **Gas** **Ele**
4	**For Fan Stages:** Press "**>**" to navigate to the fan stage (F-St) screen. Press "**+**" or "**–**" to enter the setting. Press "**+**" or "**–**" to select your fan stage, either one stage (One) or two stages (Two) fan. Press and keep holding "**>**" for 2 seconds to confirm your selection. Press "**<**" to cancel the setting and back to the previous screen. One stage **: (pre-selected system)** • Fan speed: Auto/On Two stages**:** • Fan speed: Auto/High/Low Remark: • To exit the System Main menu, press and keep holding "**<**" key for 3 seconds. • After inclusion procedure, fan stages cannot be changed. You must perform exclusion procedure first if fan stages need to be changed.	**F-St** **One** **Two**

Note:
If the user performs a Reset to Factory Default Settings or Z-Wave Exclusion operation, the ZTS-500 will retain the last selected HVAC system type.

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

When ZTS-500 is not in any Z-Wave network, the "Z-Wave Disconnected" icon will show up on the standby menu when the display is lit up, navigate to the menu by pressing the right "**>**" button from the standby screen where the current temperature is showing. Initiate an inclusion command from your Z-Wave gateway/hub/ controller, Tap the "**+**" scroll key on ZTS-500. If the procedure is successful, a "✓" screen will display. If the procedure fails, a "✗" screen will display.

Note: If the "Z-Wave Disconnected" icon is not showing up at the operation menu, it means the ZTS-500 is already included in a Z-Wave network, and if your gateway cannot find it, it might be included into another Z-Wave network previously. You can go to system settings menu to perform an exclusion procedure and then attempt an inclusion procedure again.

Operation Menu Overview

General Information:
- Tap any perimeter key "**+**" "**–**" "**<**" "**>**" to wake up the thermostat display and key illuminations.
- In STANDBY mode, use the "**<**" and "**>**" navigation keys to access the **MODE**, **FAN**, **LED BRIGHTNESS**, and **Z-WAVE** menus. Use the "**+**" and "**–**" scroll keys to adjust the values in each menu.
- In the Operation Interface, selected values will be set **without** a confirmation key press. It will go back to standby menu after 3 seconds.
- If user navigates the menu from **LED BRIGHTNESS** to the right side, the Z-Wave menu will be skipped if the ZTS-500 is already included into the network and it will loop back to the Standby screen by pressing the "**>**" key.

Operation Interface - Menu Map:

STANDBY ↔ MODE ↔ FAN ↔ LED BRIGHTNESS ↔ Z-WAVE

Press "**+**" / "**–**" in **STANDBY** Menu:

| Standby | Heat set point | Cool set point |

Press "**+**" / "**–**" in **MODE** Menu:

Press "**+**" / "**–**" in **FAN** Menu:

Press "**+**" / "**–**" in **LED BRIGHTNESS** Menu:

Tap the "**+**" scroll key for **Z-Wave** inclusion:

STANDBY mode:

- To adjust the temperature set point, tap the "**+**" or "**–**" scroll key to increase or decrease the set point, respectively. The temperature will slowly flash as it is adjusted.
- The "Heat" or "Cool" icon will display in white when adjusting the heat or cool set point. Temperature set point cannot be adjusted if the ZTS-500 is on **Off** mode.
- If the heater or compressor is turn on, the icons for "Heat" and "Fan" or "Cool" and "Fan" will display with the "Heat" icon in red and "Cool" icon in blue.
- If the ZTS-500 is operating in battery-powered mode, the temperature display will automatically turn off after a set amount of time to preserve battery life. This time can be set in the System Settings Interface.

MODE:

- Use this menu to set the HVAC system's operating mode.
- Available modes include **Off**, **Heat**, **Cool**, and **Auto**.

FAN:
- Use this menu to set the HVAC system's fan mode.
- For a 1 stage fan system: The fan can be set to **Auto** or **On**. When set to **On**, the fan will stay forced on.
- For a 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:
- Use this menu to adjust the brightness of the thermostat's LED display.
- The brightness level can be set to **High**, **Med**, or **Low**.
  Note: Decreasing the brightness of the LED display can extend battery service life.

Z-WAVE:
- Use this menu to perform an inclusion procedure into a local Z-Wave network.
- Tap the "**+**" scroll key when an inclusion request is sent by a local Z-Wave gateway, HUB, or controller. If the inclusion procedure is successful, a "✓" screen will display. If the inclusion procedure fails, a "✗" screen will display.
- If the ZTS-500 is included in a Z-Wave network, the "Z-Wave Disconnected" icon will no longer display in the standby menu. To disconnect the ZTS-500 from a Z-Wave network or to change Z-Wave networks, use the Z-WAVE menu in the System Settings Interface to perform an exclusion procedure.

System Settings Menu Overview:

General Information:
- To enter the System Settings Interface from STANDBY mode, **press and hold either the "<" or ">" navigator key for 3 seconds**. The FAN, LED BRIGHTNESS, and Z-WAVE disconnected icons will display simultaneously when the ZTS-500 is in the System Settings Interface.
- To exit the System Settings Interface, **press and hold the "<" navigation key for 3 seconds**. The ZTS-500 will also automatically exit the System Settings Interface after **30 seconds** without action.
- Use the "**<**" and "**>**" navigation keys to access the **Z-WAVE**, **TEMPERATURE DISPLAY UNIT**, **LED SLEEP TIMER**, **FIRMWARE VERSION**, **POWER MODE**, **HVAC PUMP TYPE**, **HVAC FAN TYPE**, **HVAC FAN STAGE**, and **RESET** menus. Use the "**+**" and "**–**" scroll keys to adjust the values in each menu.
- In the System Settings Interface, **some menus will require** a confirmation key press to set a selected value.

System Settings Interface - Menu Map:

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

Press and keep holding "**>**" or "**<**" key for 3 seconds to enter SYS Main (**SYS**) screen.

Tap the "**+**" scroll key for **Z-WAVE** inclusion or exclusion:

Press "**+**" / "**−**" in **TEMP. DISPLAY UNIT** Menu:
Display current temp. unit, Default: Fahrenheit (°F)

Press "**+**" / "**−**" in **LED SLEEP TIMER** Menu:
Display current time out value,
Range: 3 to 60s, ALWAYS ON, step size: 1s, Default: 5s

Press "**+**" / "**−**" in **FIRMWARE VERSION** Menu:
Display current F/W version

Press "**+**" / "**−**" in **POWER MODE** Menu:
Display current POWER mode

Press "**+**" / "**–**" in **HVAC PUMP TYPE** Menu:
Display current pump setting, Default: "Non-heat pump" system

Press "**+**" / "**–**" in **HVAC FAN TYPE** Menu:
Display current fan setting, Default: Gas

Press "**+**" / "**–**" in **HVAC FAN STAGE** Menu:
Display current fan stage, Default: 1 stage fan

Press "**+**" / "**–**" in **RESET** Menu:
Default: No

Z-WAVE:
- Use this menu to perform an <u>inclusion or exclusion</u> procedure from a local Z-Wave network.
- Tap the "**+**" scroll key when an inclusion or exclusion request is send by a local Z-Wave gateway, HUB, or controller. If the procedure is successful, a "✓" screen will display. If the procedure fails, a "✗" screen will display.
- If ZTS-500 is NOT in any Z-Wave network, you can also include it at Operation menu.
  Note: All Z-Wave configuration parameter values will keep no changes after excluding the unit from the network, except for the association groups information. The ZTS-500 will retain the last selected HVAC system type.

TEMPERATURE DISPLAY UNIT:
- Use this menu to set the units in which the temperature will be displayed, either Fahrenheit (°F) or Celsius (°C).
- Press the "**>**" navigation key to confirm your selection.

LED SLEEP TIMER:
- Use this menu to set the amount of time the LED display stays on before going to sleep.
- Default value is 5 seconds.
- Select "**• • •**" to set the display to Always On.
- Press the "**>**" navigation key to confirm your selection.
  - Note: A low sleep timer is recommended as the LED display significantly impacts battery service life.

FIRMWARE VERSION:
- Use this menu to check the Z-Wave and MCU firmware versions.
  - o **Z.222** = Z-Wave firmware version 2.22
  - o **U.222** = MCU firmware version 2.22
- Because this is a check and not a settings change, simply press the "**<**" or "**>**" navigation keys to navigate to another menu or do nothing and the ZTS-500 will automatically return to **STANDBY** mode.

POWER MODE:
- Use this menu to check the ZTS-500's current power source mode.
  - o **Batt** = On battery power
    The ZTS-500 will be operated in FLiRS mode after included into a Z-Wave network.
  - o **24V** = On 24VAC power
    The ZTS-500 will be operated in Always Listening mode after included into a Z-Wave network.
- Because this is a check and not a settings change, simply press the "**<**" or "**>**" navigation keys to navigate to another menu or do nothing and the ZTS-500 will automatically return to **STANDBY** mode.

HVAC PUMP TYPE:
- Use this menu to set the HVAC system's pump type, either a non-heat pump "NHP" system or a heat pump "HP" system.
- Press and hold the "**>**" navigation key for 2 seconds to confirm. Press the "**<**" navigation key to cancel and return to the previous screen.

HVAC FAN TYPE:
- Use this menu to set the HVAC system's fan type, either a gas-powered fan or an electric-powered fan.
- Press and hold the "**>**" navigation key for 2 seconds to confirm. Press the "**<**" navigation key to cancel and return to the previous screen.

HVAC FAN STAGE:
- Use this menu to set the HVAC system's fan stage, either a 1 or 2 stage fan.
- Press and hold the "**>**" navigation key for 2 seconds to confirm. Press the "**<**" navigation key to cancel and return to the previous screen.

RESET:
- Use this menu to reset the ZTS-500 to factory default settings.
- To reset the ZTS-500 to factory default settings, use the "**+**" or "**–**" scroll key to navigate to the "**Yes**" screen. Press and hold the "**>**" navigation key for 2 seconds to confirm. Press the **<** navigation key to cancel and return to the previous screen.
  - Note: If a reset to factory default settings is performed, all settings including Z-Wave configuration parameter values and association groups information will also be reset to factory default. The ZTS-500 will retain the last selected HVAC system type.

Thermostat Alerts Message

Battery Low Indication

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

Filter Replacement

Description	LED indication
Once the usage hours has reached the pre-set value (500 hours by default), "Filt" message + "Fan" icon will flash for 3 seconds by every 30mins. (User is required to clean or replace the filter and reset the filter counter.)	

Defrost Function

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

Out of Temperature Range Control Function

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

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 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.

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 will detect the power source (4 x AA batteries or 24Vac) during power up and it will switch to corresponding Power Mode automatically. Please refer to Z-Wave Glossary for the definition of FLiRS mode (Batt) and Always Listening Mode (24V). You can check the current power source at system settings menu:

- If it is powered by batteries, ZTS-500 will self-configure to FLiRS mode after included into a network.

- If it is powered by 24Vac or 24Vac with batteries, ZTS-500 will self-configure to Always Listening Mode after included into a network.

Important:
- Regardless of FLiRS mode or Always Listening mode, the setup and operations are the same. Local control can also be used while it is included into a Z-Wave network.
- After inclusion procedure, changing between FLiRS and Always Listening mode is not allowed. To switch modes, you must perform an exclusion procedure first.
- 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).
- The ZTS-500 will retain the last selected HVAC system type after excluded from network.

Z-Wave Inclusion and Exclusion

When ZTS-500 is not in any Z-Wave network, "Z-Wave Disconnected" icon will show up on the standby menu, you can navigate to the Z-Wave from operation menu to do the inclusion. Or you can go to system settings menu, the first menu is for Z-Wave setup, you can do both inclusion and exclusion.

Tap the "**+**" scroll key when an inclusion or exclusion request is sent by a local Z-Wave gateway, HUB, or controller. If the procedure is successful, a "✓" screen will display. If the procedure fails, a "✗" screen will display.

If the ZTS-500 is included in a Z-Wave network, the "Z-Wave Disconnected" icon will no longer display in the standby menu.

Note: All Z-Wave configuration parameter values will keep no changes after excluding the unit from the network, except for the association groups information. The ZTS-500 will retain the last selected HVAC system type.

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
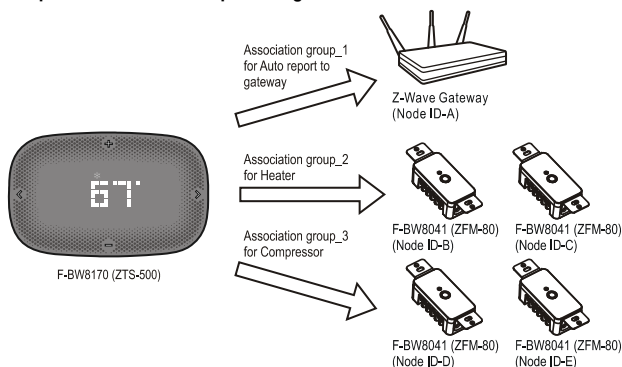
Z-Wave Configuration Parameters

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.

The size of Parameter number is 1 byte; Parameter value can be 1, 2, or 4 bytes.

Functions	Parameter No.	Parameter value range
Scale of temperature	1 (0x01)	0(0x00)= °C 1(0x01)= °F**(default)**

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Functions	Parameter No.	Parameter value range
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)
Reset filter counter	7 (0x07)	0(0x00) **(default)**
Set filter counter	8 (0x08)	500(0x01F4) to 4000(0x0FA0) hours 500(0x01F4) hours **(default)** Resolution = 1(0x0001) hours
Report filter counter **(read only)**	9 (0x09)	0(0x0000) to 9999(0x270F) hours

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 $\geq$ 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 $\geq$ 1 byte)

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.

Q 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).

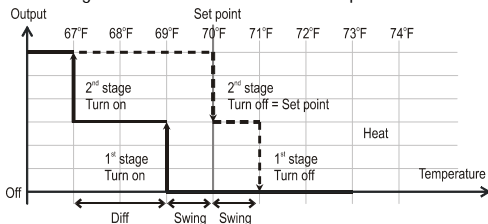**Q What is the meaning of "swing", "differential", and "dead band"?**

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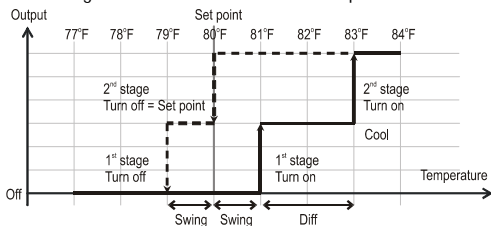
⇒ 2nd stage heater turns on when room temp is 67°F and off at 70°F.

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

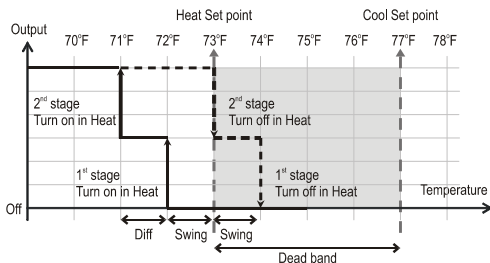Heat Set point = 73°F, Cool Set point = 77°F

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.

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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.