ZTS-500US
Z-Wave Smart Thermostat

ZTS-500, Z-Wave Smart Thermostat

Introduction

The ZTS-500 (Figure 1) is a security Z-Wave enabled thermostat designed to control the majority of 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 smart phone or PC 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

Features List

HVAC System Compatible:
- Standard (Gas/Electric) or Heat Pump HVAC systems

Multi-stage System Compatible:
- Standard HVAC Systems: 2 stages heating, 2 stages cooling, 2 stages fan
- Heat Pump Systems: 2 stages heating, 2 stages cooling, 2 stages fan

Heat Pump change over valve:
- Selectable change over with heat or cool (B or O output)

Fan system:
- Selectable for gas or electric heat systems

Temperature Display, Indication and Control:
- Temperature unit in °F or °C
- Temperature Measurable Range: 32 - 99 °F / 0 - 37 °C
- Temperature Setting Range: 41 - 99 °F / 5 - 37 °C
- Adjustable Temperature Control Swing, Differential and Dead band
  a) Swing: 1°F, 2°F, 3°F or 4°F (0.5°C, 1.0°C, 1.5°C or 2°C)
  b) Differential: 1°F, 2°F, 3°F or 4°F (0.5°C, 1.0°C, 1.5°C or 2°C)
  c) Dead band: 3°F, 4°F, 5°F or 6°F (1.5°C, 2.0°C, 2.5°C or 3°C)
- Temperature sensor calibration
- Filter replacement reminder after 500 hours usage (adjustable 500-4000hrs)
- Defrost function and Out of temperature range control function
- Energy saving mode
- Short cycle start up protection

White LEDs display:
- Resolution: 18 x 6 dots
- View area: 64mm x 28mm
- Status icons: 7
- Wide viewing angle and high contrast ratio with 3 levels brightness control

Z-Wave:
- 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
  a) Association Group-1 is a default status (AUTO) report channel in Z-Wave+ lifeline.
  b) Association Group-2 is used for Heat Pump control
  c) Association Group-3 is used for Compressor control
- Advanced features through Z-Wave configuration parameters
- Z-Wave Plus compliant
- OTA (over-the-air) and USB firmware Upgradeability

Wiring Requirements:
- Uses standard thermostat connections (C, RC,RH, W1, W2, Y1,Y2, G1, G2, O, B) – AWG #18 wires

Power Requirements:
- Support AA x 2 or AA x 4 alkaline batteries (No C-wire required) or standard HVAC 24Vac

Physical Installation and Wiring

Cautions!

- We highly recommend that this installation procedure 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.

Read following scenarios carefully before you start as it matters to the battery life under Z-Wave operation:

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.

Physically Installing the Thermostat

1. Open the ZTS-500 by pulling the two sections apart (Figure 2). Use the fingertips of one hand to grip the tab on the 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 3).
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 3).
5. Wire the proper cables to the terminal block according to the circuit diagram as described in figure 4 and "Thermostat Terminal Wiring". Afterward, push all cables back into the wall then close the terminal block of the ZTS-500.
6. The ZTS-500 can be powered by either two AA Alkaline batteries or four AA Alkaline batteries. Match the polarity of the batteries with the +/- marks inside the battery compartment.
7. Align the front housing of the thermostat with the back housing and push until the housing sections are locked together (Figure 5).

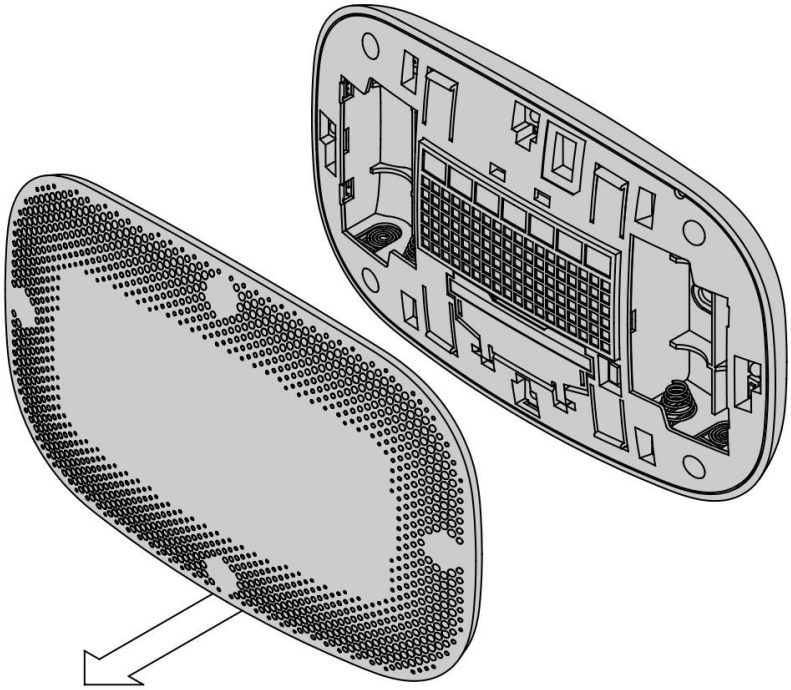


Figure 2. Open ZTS-500 front housing

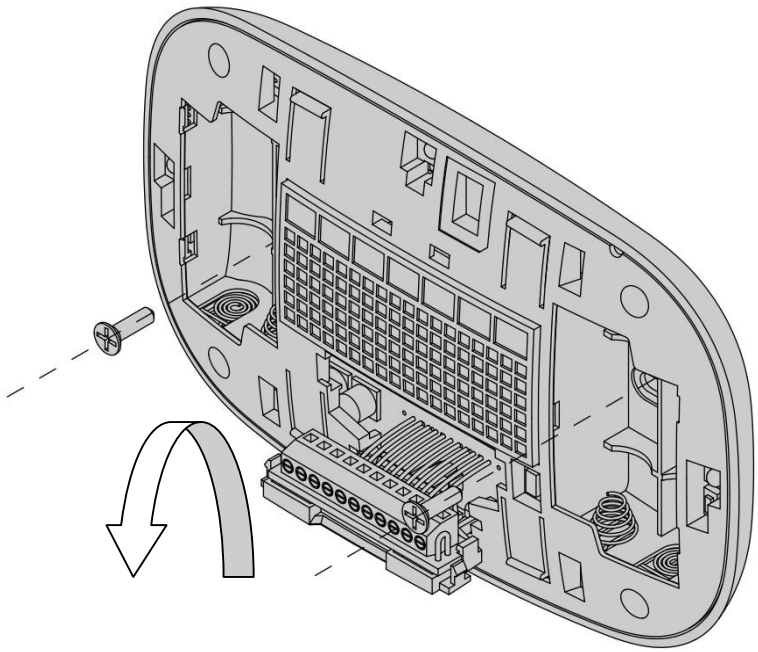


Figure 3. Open the terminal and mount into the wall

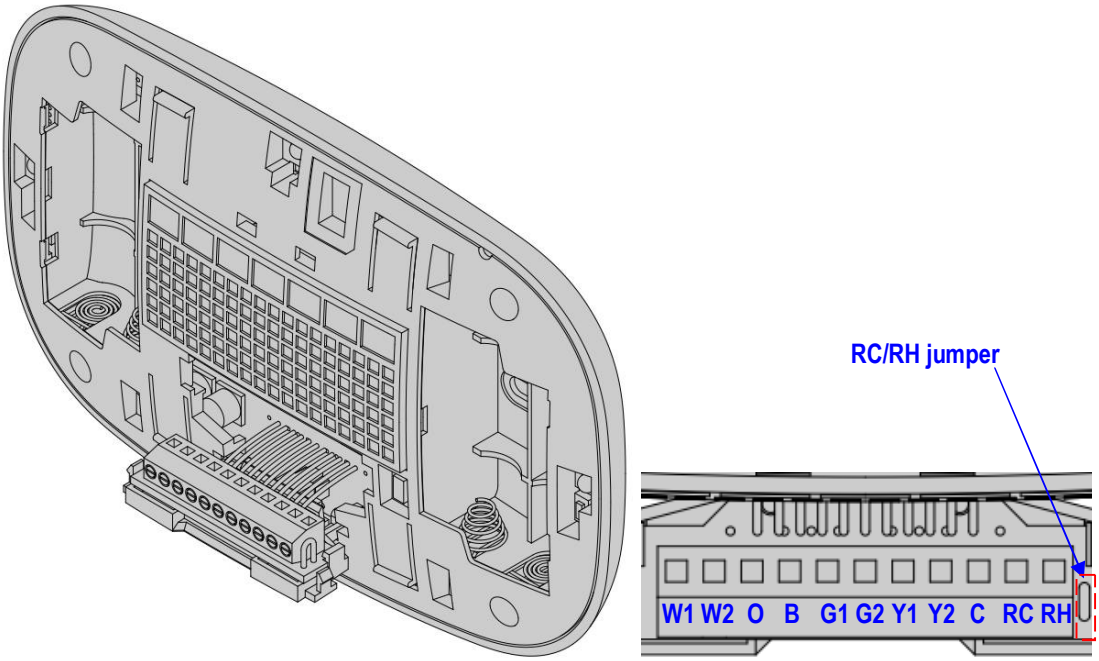


Figure 4. Terminal wiring

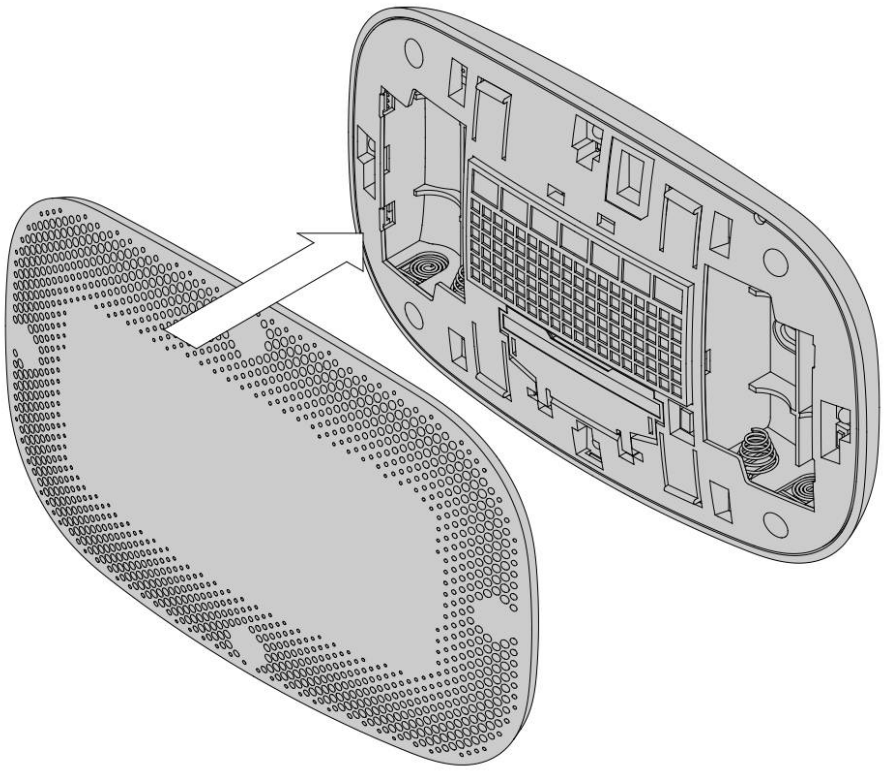


Figure 5. Install the front housing

Thermostat Terminal Wiring

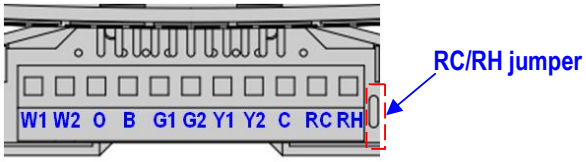
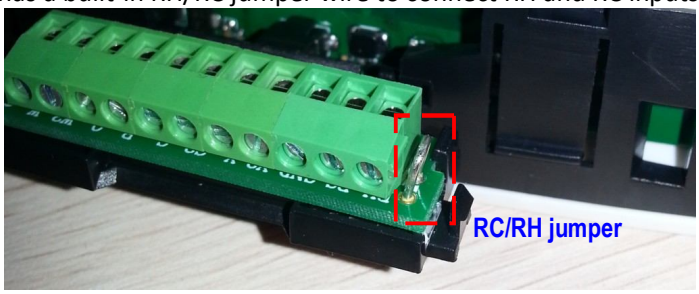


Figure 6. Terminal block and pin assignment

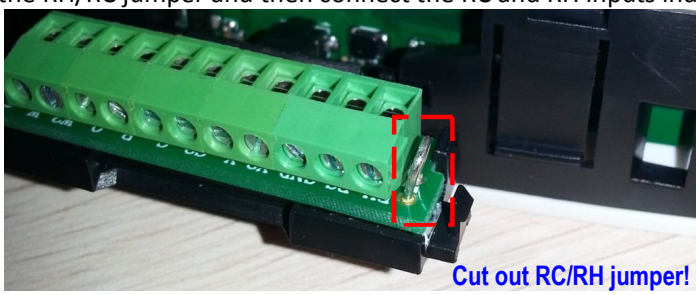
Terminals	Symbol
1st stage Heater	W1 or W
2nd stage Heater	W2
Cool changeover (heat pump)	O
Heat changeover (heat pump)	B
1st stage Fan	G1 or G
2nd stage Fan	G2
1st stage Compressor	Y1 or Y
2nd stage Compressor	Y2
24Vac Common	C
24Vac Power for Cooling	RC
24Vac Power for Heating	RH

RC/RH jumper:

- Most HVAC systems build-in a common heating and cooling transformer. The ZTS-500 has a built-in RH/RC jumper wire to connect RH and RC 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.



Thermostat wiring:

- For Non-Heat Pump HVAC systems, please refer to figure 7, 8, and 9.
- For Heat Pump HVAC systems, please refer to figure 10, 11, and 12.

Non-Heat Pump (standard) HVAC System

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 mode after inclusion into a Z-Wave network.

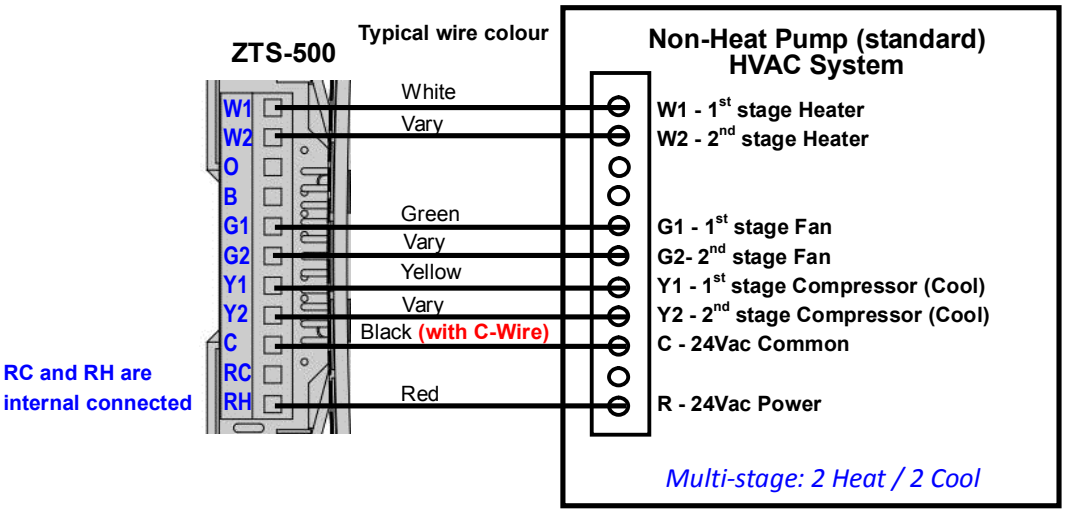


Figure 7. Non-heat pump (Standard Gas or Electric) HVAC system wiring

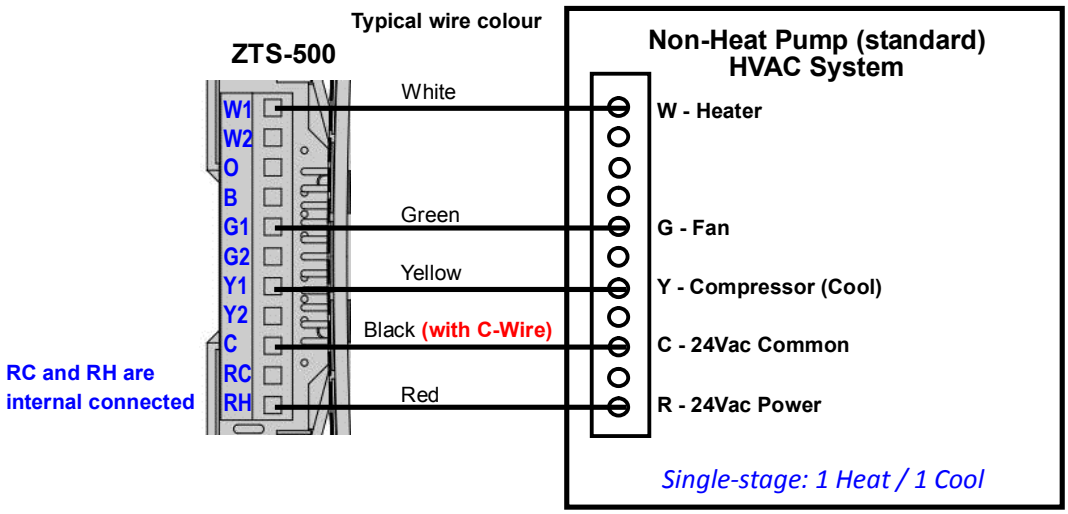


Figure 8. Non-heat pump (Standard Gas or Electric) HVAC system wiring

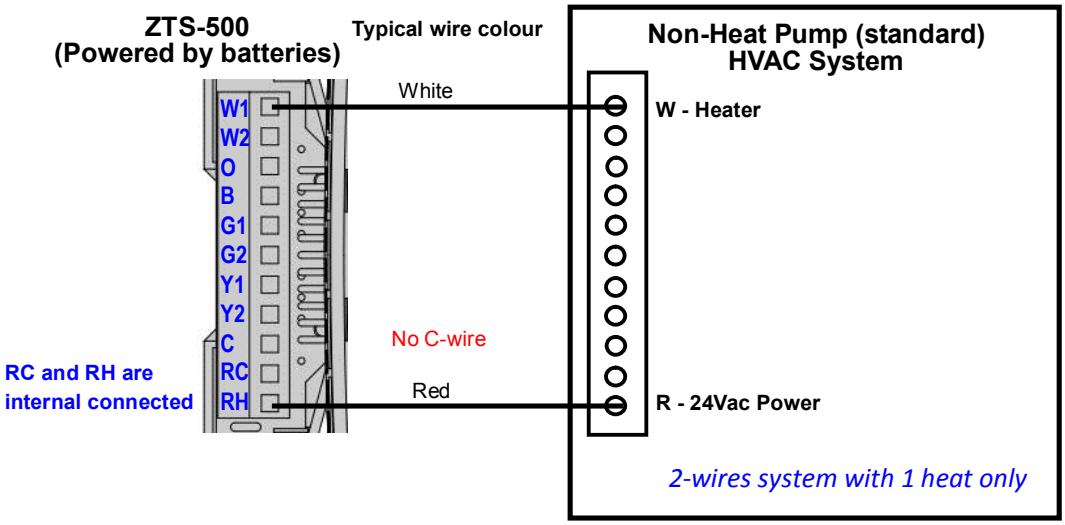


Figure 9. Non-heat pump (Standard Gas or Electric) 2-wires HVAC system wiring

Heat Pump HVAC System

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 mode after inclusion into a Z-Wave network.

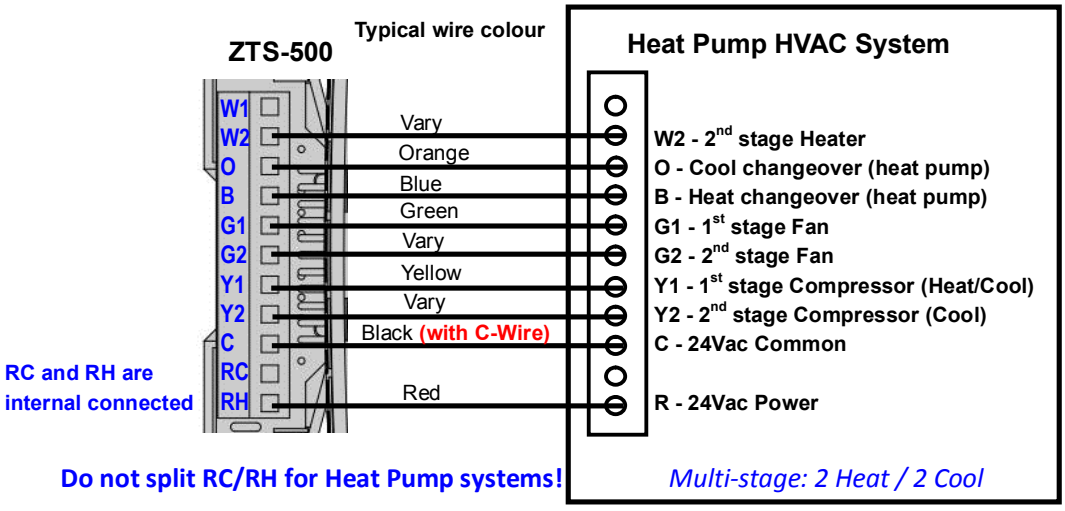


Figure 10. Heat pump HVAC system wiring

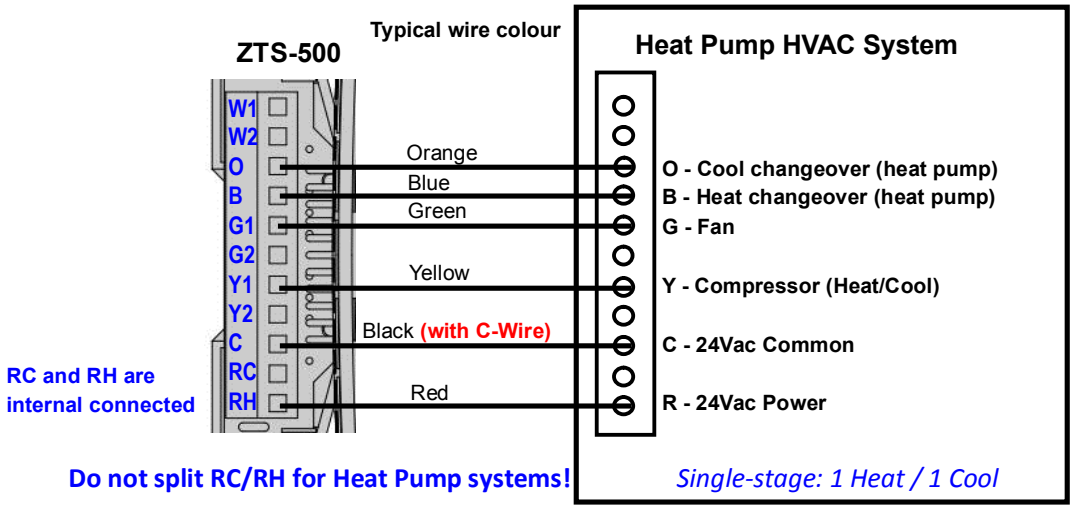


Figure 11. Heat pump HVAC system wiring

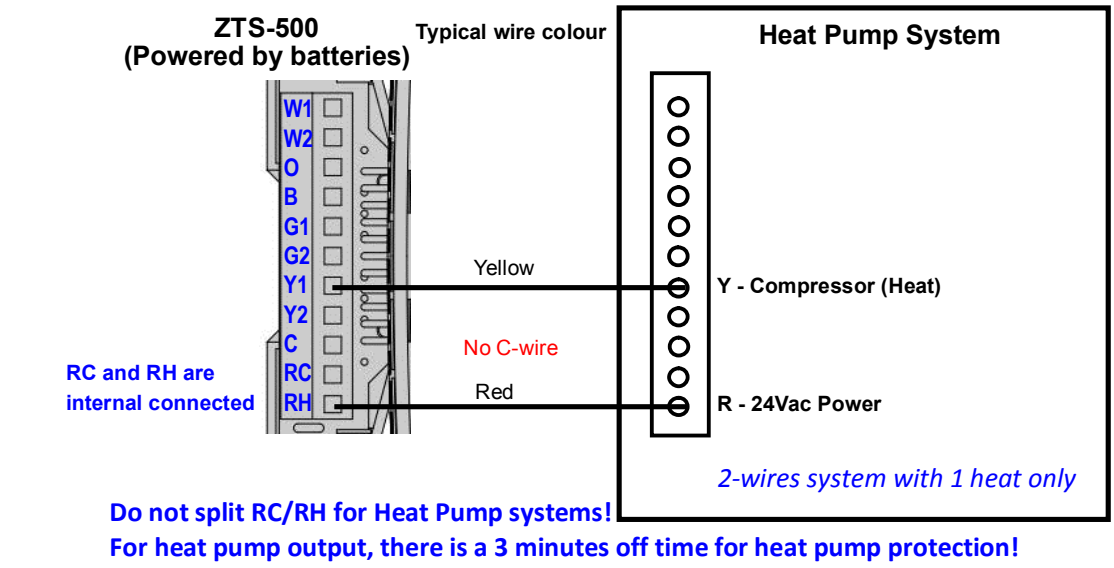


Figure 12. Heat pump 2-wires HVAC system wiring

Setup and Operations

Product Overview

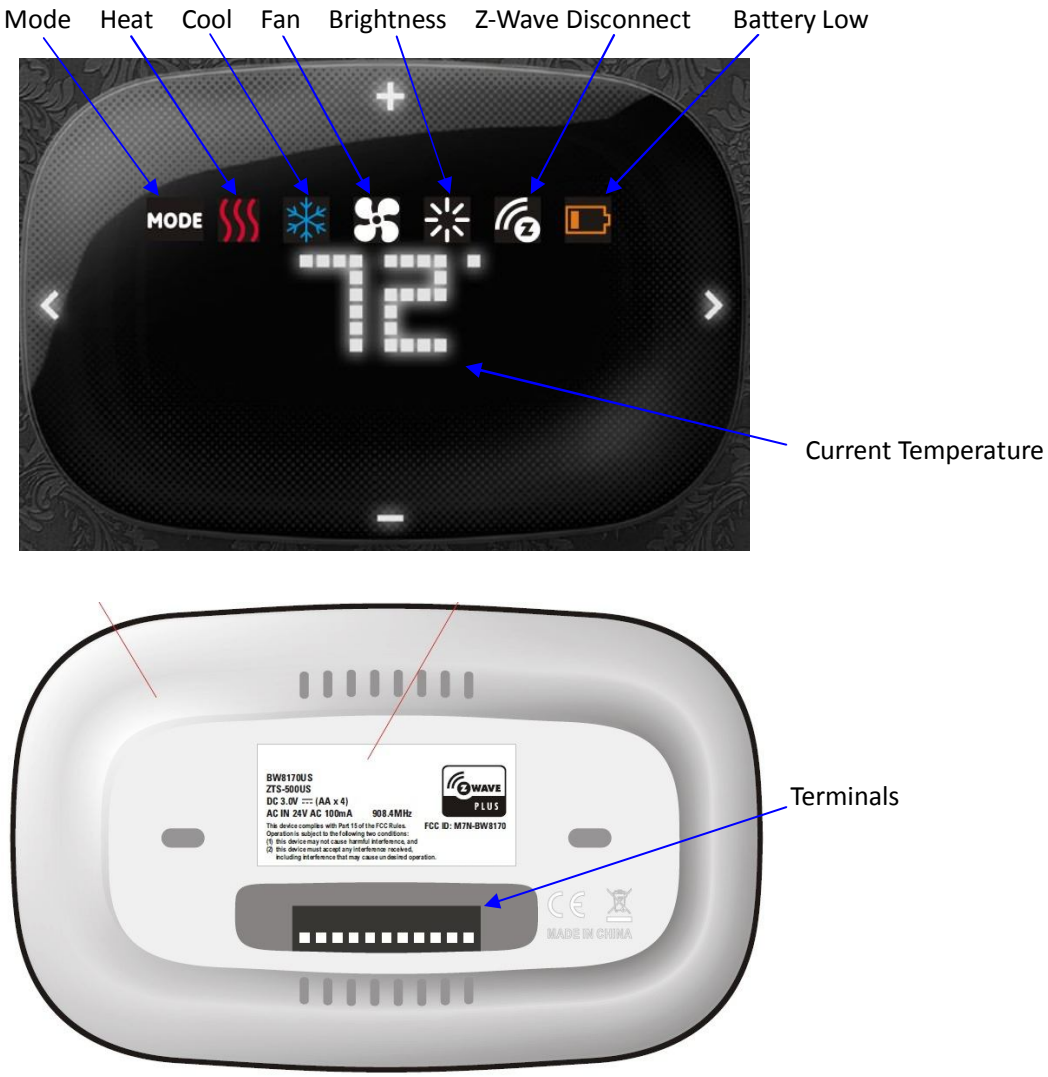


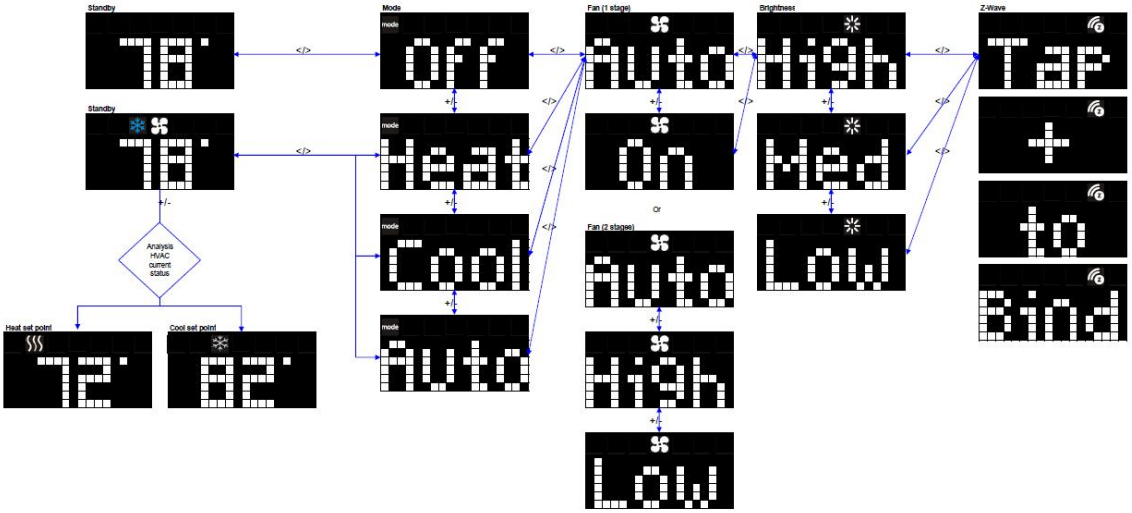
Figure 13. ZTS-500

Description of Function Keys

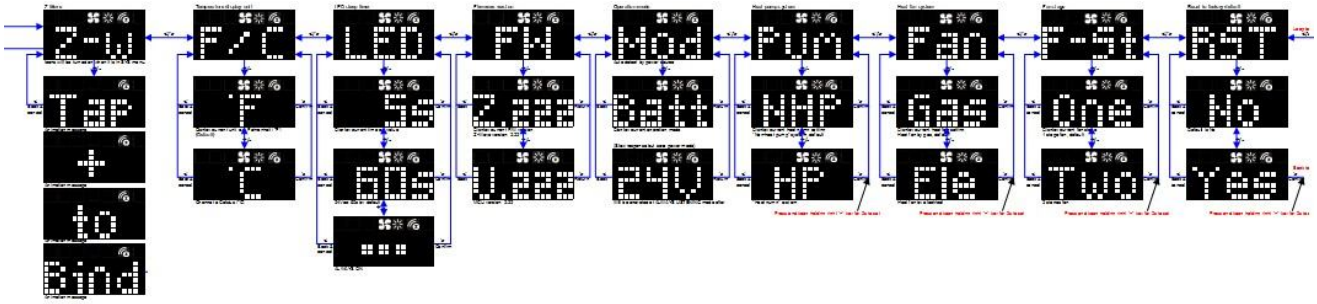
Symbol	Key Description
	Navigation keys or confirmation keys
	Scroll keys

User Interface Layout

Operation menu:



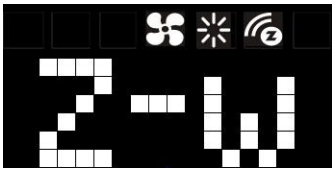
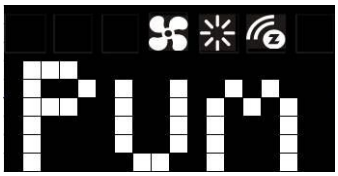
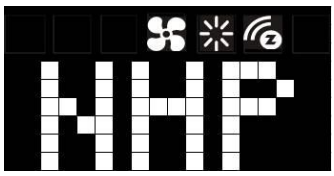
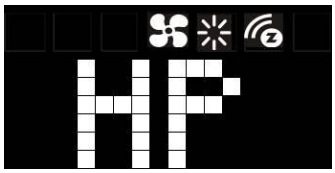
System setup menu:

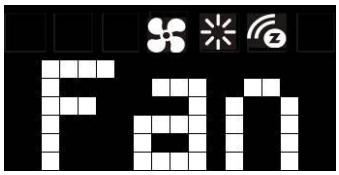
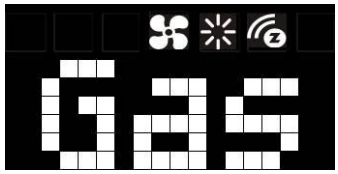
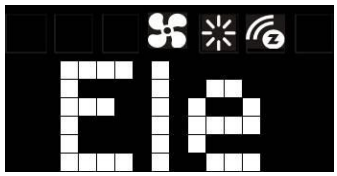
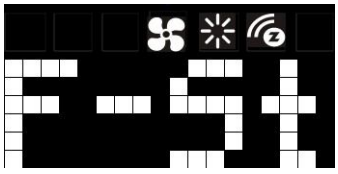
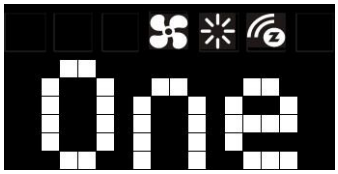
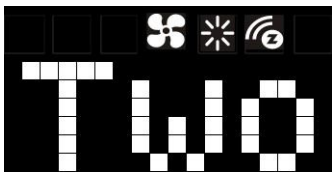


Initial HVAC System Setting

The ZTS-500 supports various different HVAC system types:
- 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, it is important that the ZTS-500 is set to the correct HVAC system type prior to use and Z-Wave inclusion. To set the HVAC system type:

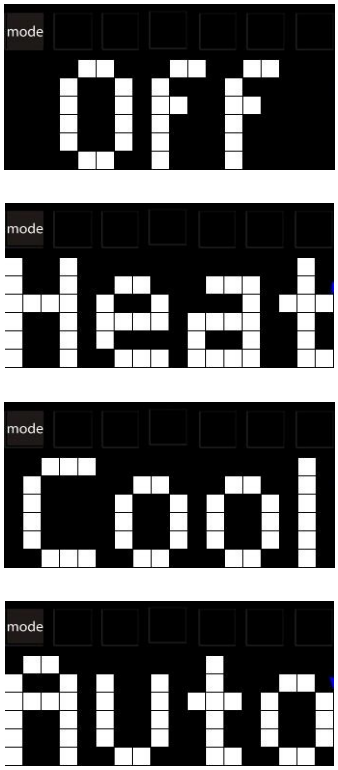
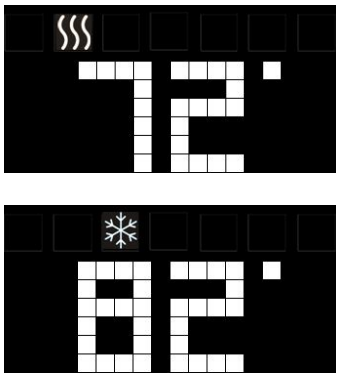
Step	Procedure / Description	LED indication
1	From the Standby screen, press and keep holding > or < for 3 seconds to navigate to the System Main (SYS) screen.	
2	**For Pump Systems:** Press > to navigate to the pump system (Pum) screen. Press + or – to entry the setting. Press + or - to select your 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.	  

3	**For Fan Systems:** Press > to navigate to the fan system (Fan) screen. Press + or – to entry 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.	  
4	**For Fan Stages:** Press > to navigate to the fan stage (F-St) screen. Press + or – to entry 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.	  

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.

Thermostat Mode and Set point

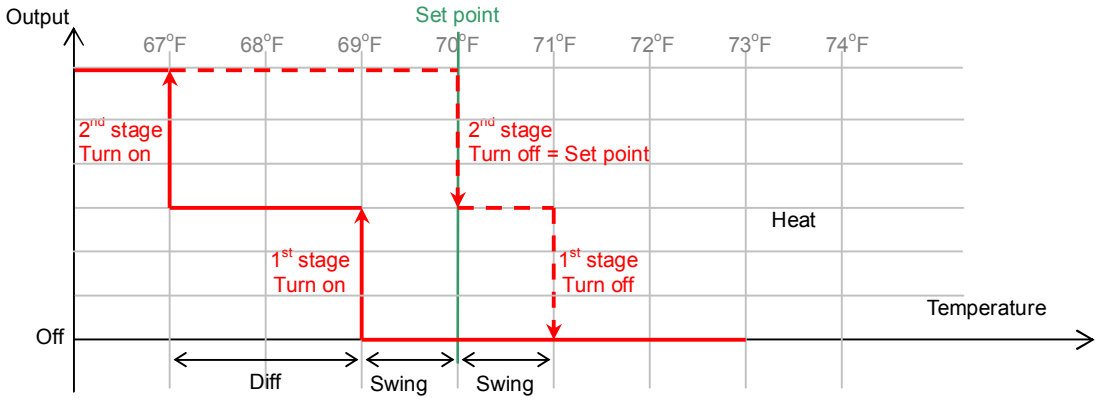
For normal setup and operations, ZTS-500 will take the action after key released and it will go back to standby menu after 3 seconds.

Step	Procedure / Description	LED indication
1	From the Standby screen, press > to navigate to the Mode screen and the Mode LED will keep flashing. Press + or - to scroll to your HVAC mode (Off/Heat/Cool/Auto).	
2	From the Standby screen, press + or - to set your desired temperature set point. Remark: - Heat or Cool icons with white colour will be turned on when adjusting the heat or cool set point. - Heat icon with red colour will be turned on once heater is active. - Cool icon with blue colour will be turned on once compressor is active.	

Explanations of Set point, Swing, Differential and Dead band

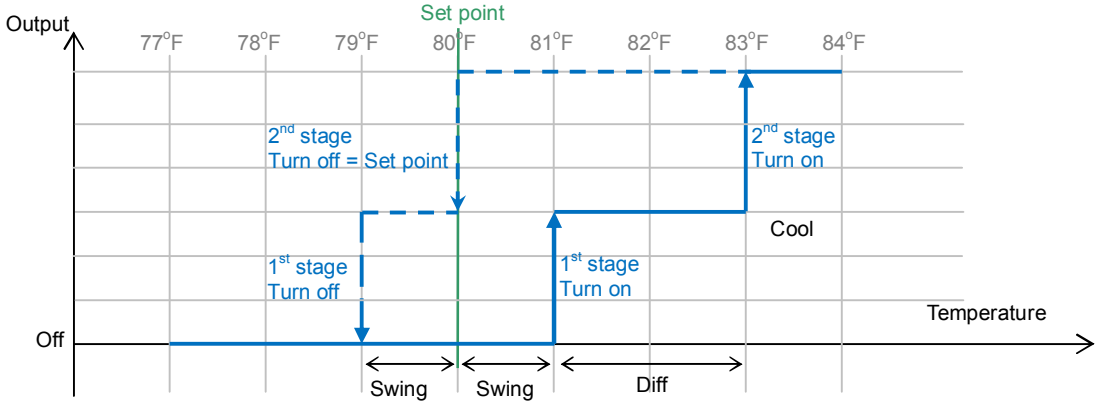
HEAT mode: Thermostat controls the temperature according to the following diagram

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.

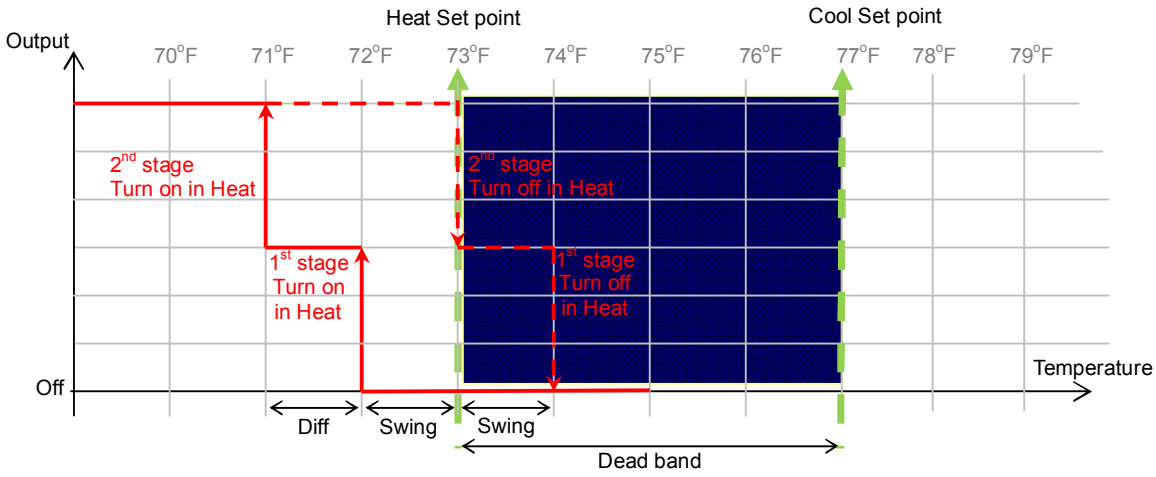


AUTO mode: Thermostat controls the temperature according to the following diagram.

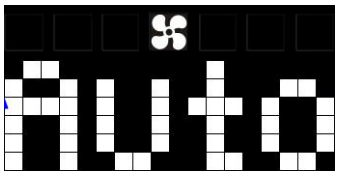
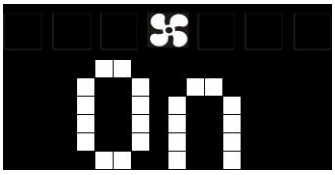
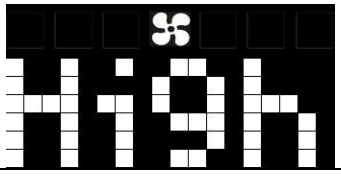
Press + / - buttons to adjust the appropriate set point. It will adjust the set point that is closer to the current room temperature.

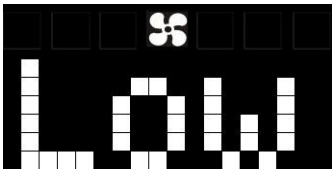
- If the current temperature is close to heat set point, then it will change the heat set point value.
- If the current temperature is close to cool set point, then it will change the cool set point value.
- If the difference between the two is equal, then it will change the heat set point value by default.
- 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.

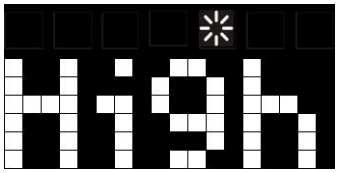
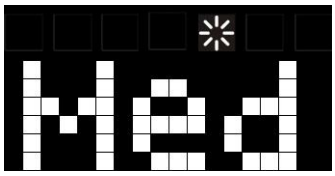
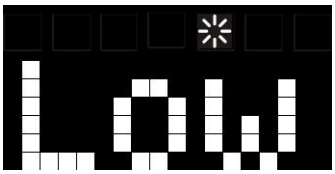


Fan Mode

Step	Procedure / Description	LED indication
1	To adjust the fan mode: From the Standby screen, press > or < to navigate to the Fan Mode screen and the Fan LED will keep flashing. When set to Auto: - Electric-powered: Fan will run during heating and cooling operation. - Gas-powered: Fan will ONLY run during cooling operation.	
2	For one stage fan: Press + or - to change the fan speed (Auto/On). When set to On, the fan will stay ON.	
3	For two stages fan: Press + or - to change the fan speed (Auto/High/Low). When set to High/Low, the fan will stay ON.	

LEDs Brightness

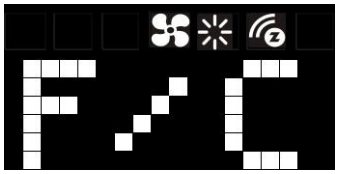
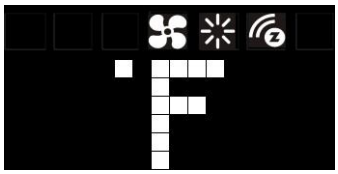
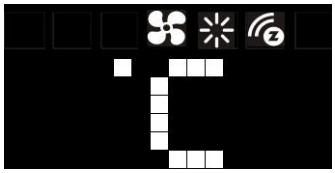
Step	Procedure / Description	LED indication
1	To adjust the brightness: From the Standby screen, press > or < to navigate to the Brightness screen and the Brightness LED will keep flashing. Press + or - to adjust the brightness level (High/Med/Low).	  

Note:
It can extend the battery service life by decreasing the brightness of the LEDs display.

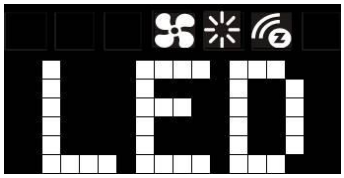
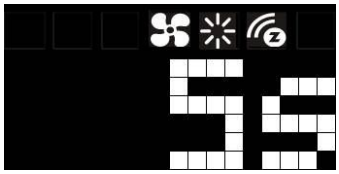
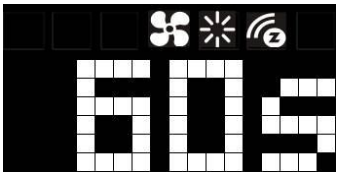
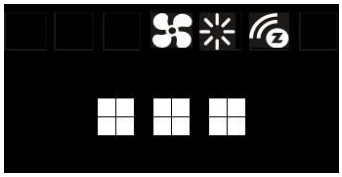
System Settings:

- To enter the System Main menu, press and keep holding > or < for 3 seconds to navigate to the System Main (SYS) screen.
- To exit the System Main menu, press and keep holding < key for 3 seconds to exit.
- To cancel the setting, press < to cancel and back to the previous screen.
- ZTS-500 will exit the System menu automatically if there is no action (time out) within 30 seconds.

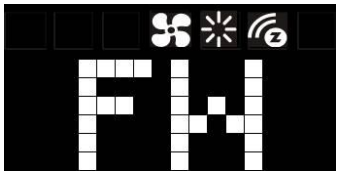
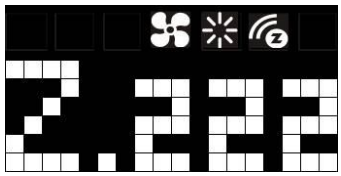
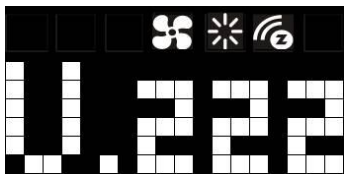
Temperature Display Unit (^{o}F/^{o}C)

Step	Procedure / Description	LED indication
1	In the System Main (SYS) screen: Press > to navigate to the display unit (F/C) screen. Press + or – to entry the setting.	
2	Press + or - to select temperature display unit (°F / °C). Press > to confirm your selection. Default is Fahrenheit (°F)	 

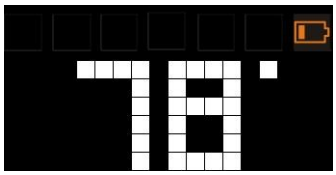
Sleep Timer

Step	Procedure / Description	LED indication
1	In the System Main (SYS) screen: Press > to navigate to the LED sleep timer (LED) screen. Press + or – to entry the setting.	
2	Press + or - to adjust LED sleep timer. Range: 3 to 60s or Always On If powered by battery: 5s by default If powered by 24Vac: 60s by default Press > to confirm your selection. Remark: Reducing sleep timer value can enhance ZTS-500 battery service life significantly.	  

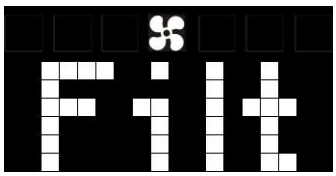
Check Firmware Version

Step	Procedure / Description	LED indication
1	In the System Main (SYS) screen: Press > to navigate to the Firmware (FM) screen. Press + or – to entry the setting.	
2	Press + or - to check the firmware version. Press > or < to back to the previous screen. Z.222 = Z-Wave firmware version 2.22 U.222 = Main MCU firmware version 2.22	 

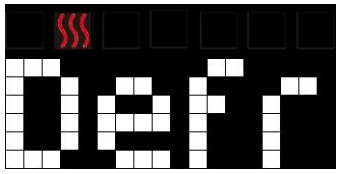
Battery Low Indication

Step	Procedure / Description	LED indication
1	“Battery low” icon will be displayed if the battery is running out. (User is required to change new batteries.)	

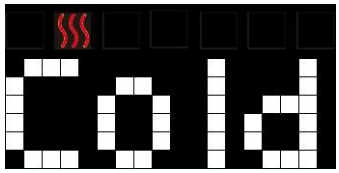
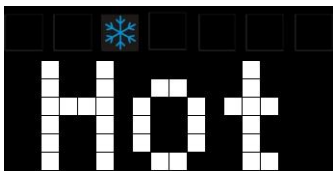
Filter Replacement

Step	Procedure / Description	LED indication
1	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

Step	Procedure / Description	LED indication
1	"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

Step	Procedure / Description	LED indication
1	"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.	
2	"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-100 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.

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.

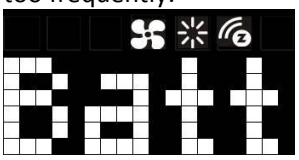
Z-Wave Setup and Operations

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.
You may check Glossary for the definition of FLiRS mode and Always Listening Mode before select the Z-Wave operation mode.

Select FLiRS or Always Listening Mode

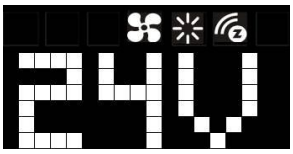
ZTS-500 can be powered by 4 x AA batteries, and/or 24Vac C wire. Before inclusion procedure, user need to check the operation mode or the power source of ZTS-500.

- FLiRS mode (Batt) is targeted for battery operated applications and will enter sleep mode frequently in order to save battery life. ZTS-500 can't act as a repeater in this mode. The response to Z-Wave commands is not as quick as devices on Always Listening mode. Normally there is 1-2 seconds latency on response, you should avoid sending commands to the ZTS-500 too frequently.

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

- Always Listening mode (24V) 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.

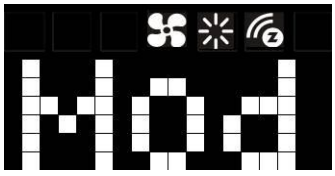
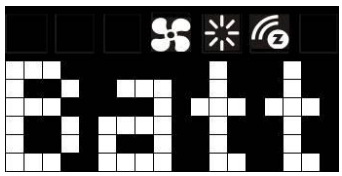
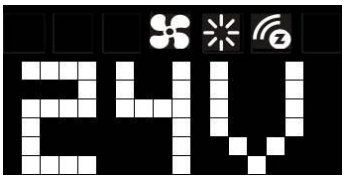
  

  If it is powered by 24Vac or 24Vac plus batteries, ZTS-500 will self-configure to Always Listening Mode.

Important:

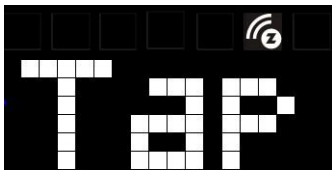
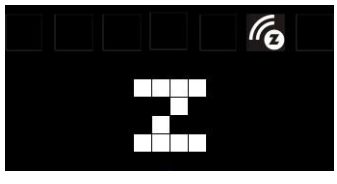
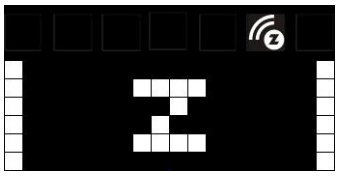
a) Regardless of FLiRS mode or Always Listening mode, the setup and operations are the same. Local control can also be used while it is included into a Z-Wave network.
b) After inclusion procedure, changing between FLiRS and Always Listening mode is not allowed. To switch modes, you must perform an exclusion procedure first.
c) 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).
d) 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.

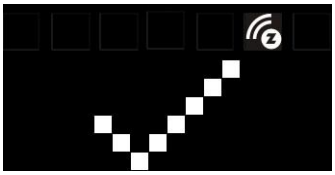
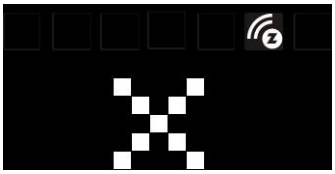
Check FLiRS / Always Listening Mode

Step	Procedure / Description	LED indication
1	In the System Main (SYS) screen: Press > to navigate to the Operation Mode (Mod) screen. Press + or – to entry the setting.	
2	If the screen displayed “Batt”, then the ZTS- 500 will operate in FLiRS mode after inclusion into a Z-Wave network. If the screen displayed “24V”, then the ZTS- 500 will operate in Always Listening mode after inclusion into a Z-Wave network. Press > or < to back to the previous screen.	 

Z-Wave Add (Include) / Remove (Exclude) into/from Z-Wave network

Add (Include) ZTS-500 to Gateway / Controller

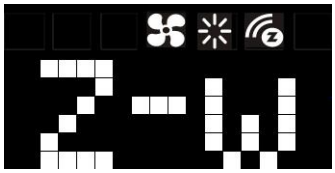
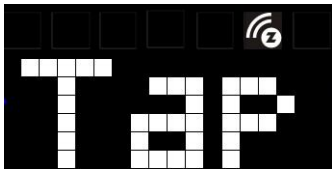
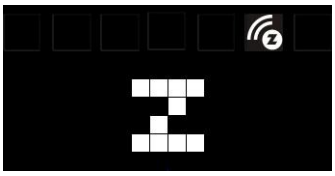
Step	Procedure / Description	LED indication
1	From the Standby screen, press > or < to navigate to the Z-Wave screen and the Z-Wave LED will continuously flash. Tap + to include the ZTS-500 into the network.	
2	There is a “z” animation during Z-Wave searching.	 . . 

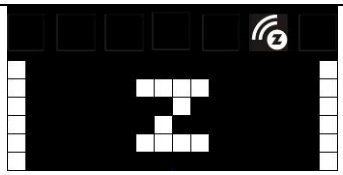
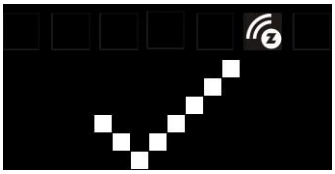
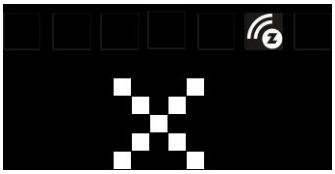
3	- The "✔" symbol will be displayed on screen once the ZTS-500 is added into the network. The Z-Wave disconnect icon will also be removed from the standby screen. - The "x" symbol will be displayed on screen if there is no action (time out) or unable to include the ZTS-500 into the network.	 

Notes:

1. It is recommended to perform the Remove/Exclude procedure before performing an Add/Include procedure. This will ensure the ZTS-500 is not in any other Z-Wave network which will disrupt the inclusion process.
2. If the inclusion process fails, try exclusion and/or resetting the ZTS-500 to factory default and try inclusion again.
3. If the user navigates the menu from 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.

Remove (Exclude) ZTS-500 from Gateway / Controller

Step	Procedure / Description	LED indication
1	Press and keep holding > or < for 3 seconds to navigate to the System Main (SYS) screen. On the Z-Wave (Z-w) screen, press + or – to entry the setting.	
2	Tap + to exclude or include ZTS-500 from or into the network. Press < to cancel and back to the previous screen.	
3	There is a "z" animation during Z-Wave searching.	 . .

		
4	- The "✔" symbol will be displayed on screen once the ZTS-500 is excluded from the network. The Z-Wave disconnect icon will also be displayed in the standby screen. - The "x" symbol will be displayed on screen if there is no action (time out) or unable to exclude the ZTS-500 from the network.	 

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 3 association groups:

Association group / Mode	**Association group_1 (Auto Report)**	**Association group_2 (Heater)**	**Association group_3 (Compressor)**
Heating mode	-	ON (basic set command 0xFF)	OFF (basic set command 0x00)
Cooling mode	-	OFF (basic set command 0x00)	ON (basic set command 0xFF)
OFF	-	OFF (basic set command 0x00)	OFF (basic set command 0x00)

Association group_1 (Auto report):

Association Group-1 is a default status report channel in Z-Wave+ lifeline requirement.

ZTS-500 will trigger AUTO report function if one of below status is changed.

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)

Notes:

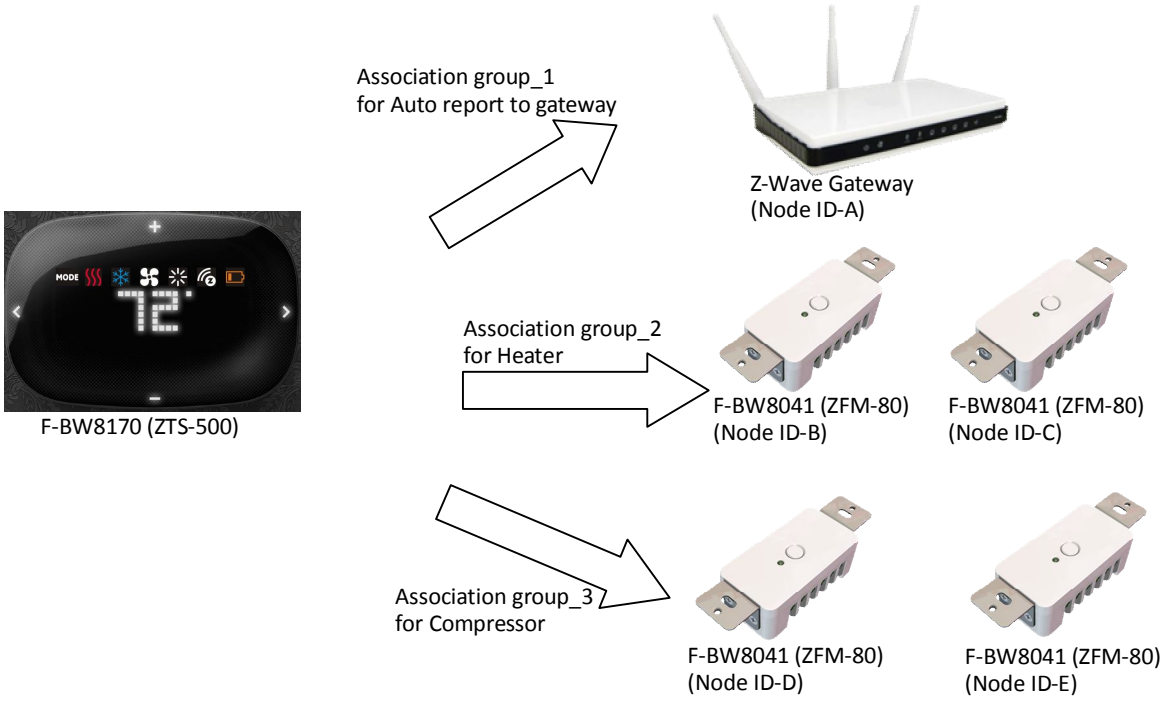
Total 5 devices (nodes) can be assigned in total 3 association groups. Below table lists out the devices (nodes) allocations in the 3 association groups.

No. of Node ID in Association Group_1	No. of Node ID in Association Group_2	No. of Node ID in Association Group_3
1 (AUTO report)	0,1 or 2 nodes	0,1 or 2 nodes

Important:

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

Example: Association groups setting



Z-Wave Configuration Parameters

Different users have different preferred settings of their thermostat, you may use the below configuration parameters to change settings of corresponding functionality.

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

Functions	Parameter Number	Parameter value range
Scale of temperature	1 (0x01)	0 (0x00) = ^{o}C 1 (0x01) = ^{o}F **(default)**
Swing	2 (0x02)	1 (0x01) = 1 ^{o}F / 0.5 ^{o}C 2 (0x02) = 2 ^{o}F / 1.0 ^{o}C **(default)** 3 (0x03) = 3 ^{o}F / 1.5 ^{o}C 4 (0x04) = 4 ^{o}F / 2.0 ^{o}C
Differential	3 (0x03)	1 (0x01) = 1 ^{o}F / 0.5 ^{o}C 2 (0x02) = 2 ^{o}F / 1.0 ^{o}C **(default)** 3 (0x03) = 3 ^{o}F / 1.5 ^{o}C 4 (0x04) = 4 ^{o}F / 2.0 ^{o}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^{o}F/ 1.5^{o}C 4(0x04)= 4^{o}F/ 2.0^{o}C **(default)** 5(0x05)= 5^{o}F/ 2.5^{o}C 6(0x06)= 6^{o}F/ 3.0^{o}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^{o}F to (99^{o}F - dead band) **Default** = 95^{o}F Example 82^{o}F; input = 820 (0x0334) Unit in C: Range from 5^{o}C to (37^{o}C – dead band) **Default** = 35^{o}C Example 28^{o}C; input = 280 (0x0118)
Lower limit of Cool set point (In order to save energy special	6 (0x06)	**If in Cool mode and Auto Mode:** ========== Unit in F: Range from (41^{o}F + dead band) to 99^{o}F **Default** = 45^{o}F

in motel service, advance user or administrator can limit the lower cool set point)		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
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)	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, Batt = 5s, **default** 24Vac = 60s, **default**
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 AUTO report if room temperature is different from last report. AUTO report if room temperature is different from last report. Delta change is >= 1 (0x01) = 1°F (0.5°C), **default value if powered by 24Vac** 2 (0x02) = 2°F (1.0°C), default **value if powered by battery** 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)
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 AUTO report function (by time interval), **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

Sensor temperature calibration example:

If sensor reading value = 77°F, offset value = -2°F

Display temperature = sensor reading value + offset value

= 77-2°F = 75°F

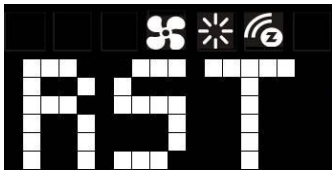
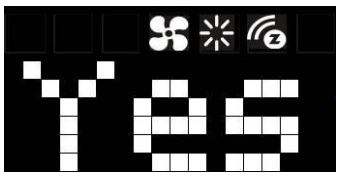
If using decimal input: Parameter no. = 10; Parameter value = -2

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

Reset ZTS-500 to Factory Default Settings

Warning:

Please use this procedure only when the network primary controller is missing or otherwise inoperable.

Step	Procedure / Description	LED indication
1	Press and keep holding > or < for 3 seconds to navigate to the System Main (SYS) screen. Press > to navigate to the Reset (RST) screen. Press + or – to entry the setting.	
2	Press + or - to select Yes. Press and keep holding > for 2 seconds to confirm your selection. Press < to cancel and back to the previous screen.	

Note:

If the user performs a Reset to Factory Default Settings, all settings, Z-Wave configuration parameter values and association groups information will reset to default. The ZTS-500 will retain the last selected HVAC system type.

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 a ZTS-500 in my home?

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 labelled with the Z-Wave logos shown below.

Q Can I use 2 or more ZTS-500 in my house? If so, 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 the 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).

Technical Specifications

Model no.	BW8170US (ZTS-500US)
RF frequency	908.4MHz (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 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)
Temperature display resolution	1°F / 0.5 °C
Temperature measurable range	32 – 99 °F / 0 – 37 °C
Temperature Setting range	41-99 °F / 5-37 °C
Temperature	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)

Checking Accessories

After opening the cover of the packing box, check that the following accessories are included.

- ZTS-500
- Screw + Wall Anchor x 2pcs
- AA batteries x 4pcs (optional)
- User Manual
- Warranty sheet

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. Keep the unit dust free by wiping it with a soft, dry cloth.
4. 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. 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.

This device complies with RSS-310 of Industry Canada. Operation is subject to the condition that this device does not cause harmful interference

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 as 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.