
Deadband Wireless Pneumatic Thermostat- WPT-800-DB Series

1 Overview

The Cypress EnviroSystems Deadband Wireless Pneumatic Thermostat (WPT-DB) retrofits an existing pneumatic thermostat to provide Direct Digital Control (DDC) like zone control functionality with a deadband at a fraction of the time and cost without disturbing occupants.

The WPT-DB enables remote monitoring of zone temperature, branch pressure, remote control of deadbands, and programmable setback or setup of the pneumatic HVAC systems. It also enables integration with utility Demand Response programs.

The WPT-DB can function either as a standalone system or can be integrated with an existing Building Management System via BACnet/IP. As a result, the WPT-DB helps a building owner and tenants save energy by implementing indoor temperature policies, and reduces the maintenance cost of the legacy pneumatic HVAC systems.

1.1 Components

The WPT-DB- 800 Series kit includes the following components:

- WPT-DB
- Universal Wall Bracket
- Mounting screws, #6 x 1" self-tapping (x2)
- Wall Anchors
- CR123 batteries (x2)

1.2 Prerequisites for Installation

The WPT-DB relies on a wireless network for communication unless operating in a standalone mode. When using the WPT-DB in a standalone mode, these prerequisites may be skipped. Before installing the WPT-DB, the wireless network must be set up. The following tasks must be completed before proceeding to WPT-DB installation:

- Installation of WPT Green Box and USB Hub (HUSB)
- Installation of WPT Repeaters (RWAL)
- Assignment of a network ID to the Green Box
- Assignment of a unique node ID to each WPT and/or WPT-DB in the network

Manuals for the WPT Green Box, HUSB, and repeaters can be found at <http://www.cypressenvirosystems.com/wpt-downloads.php>.

1.3 Tools Required for Installation

- # 1 Philips-head screwdriver
- 1/16" hex Allen wrench
- 3/16" Drill (for setting Wall Anchor, if required)

2 WPT-DB Installation

The overall WPT-DB installation procedure includes:

- Mounting the WPT-DB on the wall

- Configuring the WPT-DB
- Calibrating the WPT-DB

2.1 Mounting the WPT-DB

2.1.1 Remove the Existing Thermostat

1. Remove the external cover of the existing thermostat, if any.
2. Locate and remove the mounting screws and carefully remove the unit from the wall along with the attached pneumatic tubes.
3. Detach the old thermostat unit from the air tubes carefully. The air tubes may not have a lot of slack – be careful that the tubes do not retract into the wall. In a 2-pipe system, note the positions of branch and main tubes.

ESD Handling Precautions

Warning!



- The WPT-DB contains ESD sensitive circuit cards and components.
- Great care must be exercised while handling the WPT-DB with the cover open.
- Do not touch any of the circuit boards with fingers or any part of the body.
- Touching the circuit boards may cause the unit to fail due to electrostatic discharge.
- Hold and handle the unit as shown in Figure 1, using the external bottom plastic cover as the support.

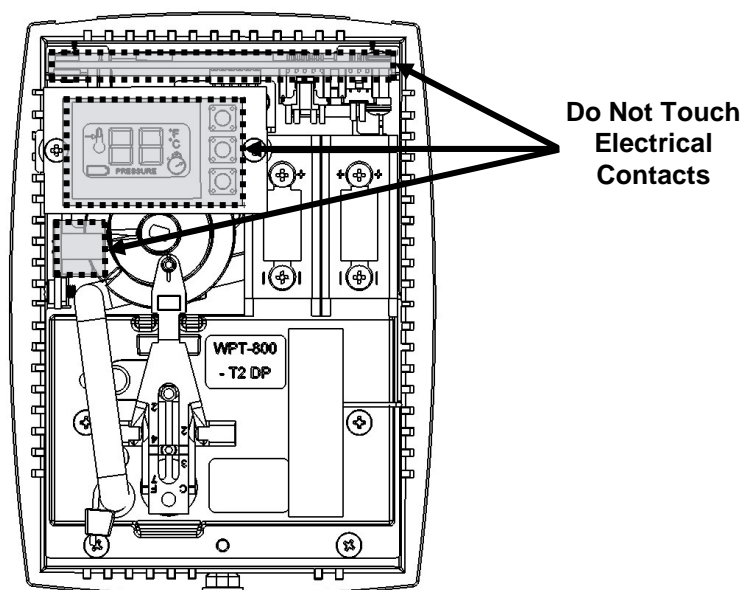


Figure 1. Handling the WPT-DB

Thermostat Lever Handling Precautions

Warning!

- Great care must be exercised while calibrating the WPT-DB.
- Handle the thermostat lever as little as possible.
- Use extreme caution not to allow the lever to rotate sideways while adjusting the setscrew.
- Damage to the bi-metallic spring can result if the end of the lever is allowed to move left or right by more than 1/16".

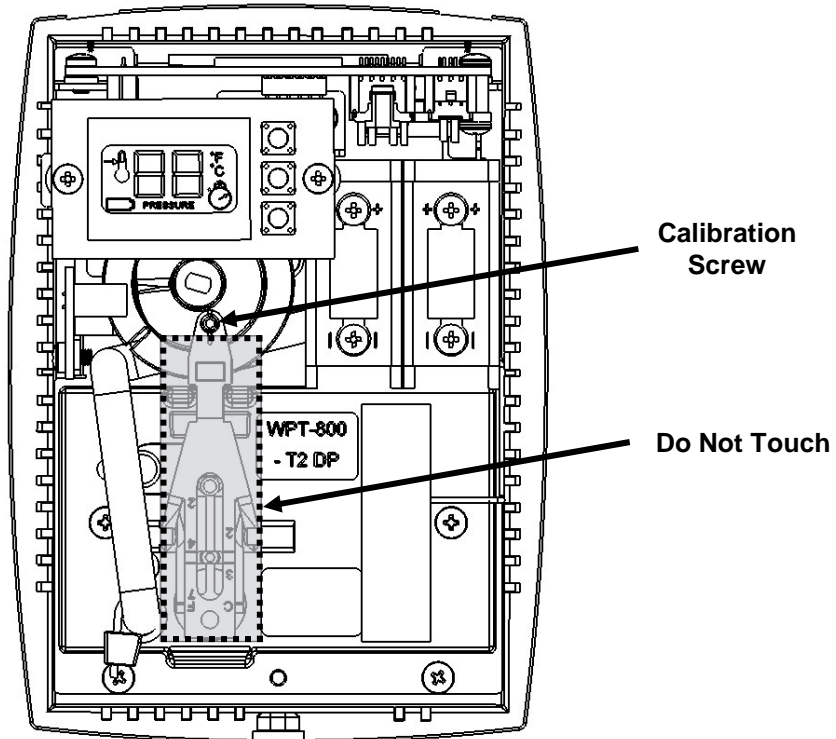


Figure 2. WPT-DB Lever

2.1.2 Installing the WPT-DB

The WPT-DB is installed in the existing thermostat location using the Universal Wall Bracket provided with the WPT-DB kit. To install the WPT-DB:

1. Remove the plastic cover of the WPT-DB using a 1/16" Allen wrench on the bottom screw.
2. If the Universal Wall-mounting Bracket is attached to WPT-DB, remove it by unscrewing the two captive screws on the bottom of the WPT-DB, as shown in Figure 3.

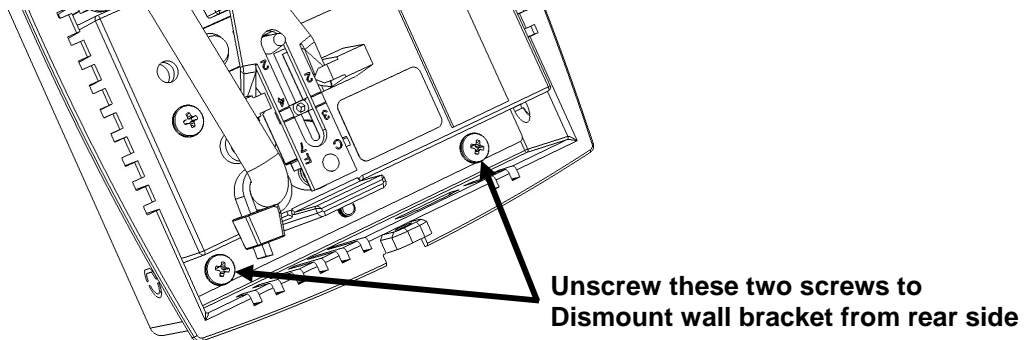


Figure 3. Removing the Universal Wall Bracket

3. Adjust the Universal Wall Bracket against the old thermostat position, such that any two slots on the wall bracket match the existing two screw holes on the wall, and the large center opening is aligned with the air tube(s). The Universal Wall Bracket is shown in Figure 4.

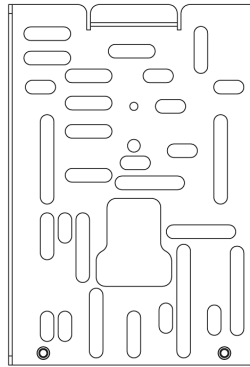


Figure 4. Universal Wall Bracket

4. Pull the air tubes through the central opening of the Universal Wall Bracket.
5. Affix the Universal Wall Bracket to the wall with two screws, as shown in Figure 5.

Note: The provided Wall Anchors can be used if existing receptacles are not in the correct location, or if they are damaged.

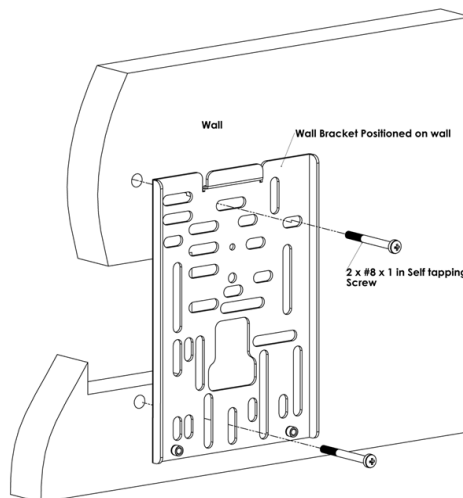


Figure 5. Mounting the Universal Wall Bracket

6. Connect the branch and main tubes to the air tubes marked B and M on the rear of the WPT-DB, as shown in Figure 6. Connect the pneumatic tube to the M port in case of single pipe WPT-DB.

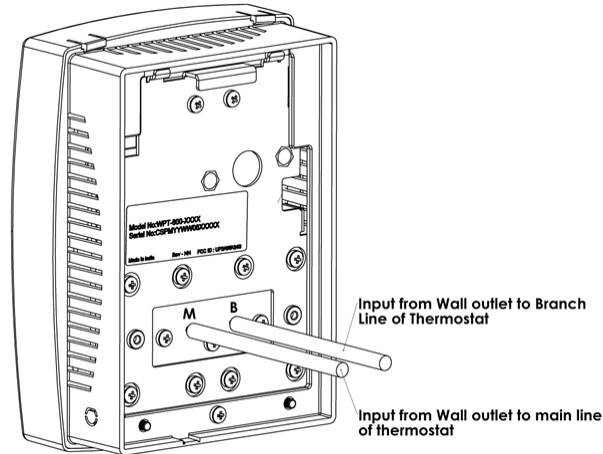


Figure 6. Connecting Main and Branch Tubes to M and B Ports

7. Attach the WPT-DB to the Universal Wall Bracket using the captive screws.
8. Install the batteries and close the top cover. The battery polarities are as shown in Figure 7.

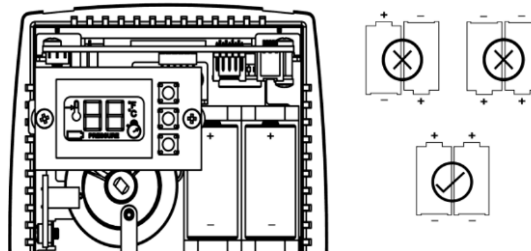





Figure 7. WPT-DB Batteries

2.1.3 Installing/Replacing Batteries



Replace battery with Type CR123A, that meet UL-1642, as evidenced by UL component recognition mark, only (from Panasonic, Energizer or Duracell). Use of any other battery may present a risk of fire or explosion. See Figure 7 for correct polarity.

- Underwriters Laboratories Recognition Mark: 
- Caution: The battery used in this device may present a fire or chemical burn hazard if mis-treated. Do not recharge, disassemble, heat above 100 °C (212 °F), or dispose of in fire.

- Dispose of used battery promptly in accordance with local regulations (place in plastic bag and recycle if possible).
- Do not insert batteries with the  and  polarities reversed.
- Do not short-circuit.
- Be sure to wrap each battery when disposing or storing to avoid short circuit.

**Caution!**

- If leaked liquid gets in the eyes, wash them with clean water and consult a physician immediately.
- Do not use new and used batteries together. Do not use different types of batteries together.
- Do not apply strong pressure to the batteries nor handle roughly.
- Do not use or leave the batteries in direct sunlight or in high-temperature areas.

2.2 Configuring the WPT-DB

NOTE: When installing the WPT-DB in a standalone mode, please skip to Section 2.2.4.

The WPT-DB can be configured using the LCD display and the 3 front buttons. The menu structure is displayed below. Please refer to this diagram while calibrating and configuring the WPT-DB.

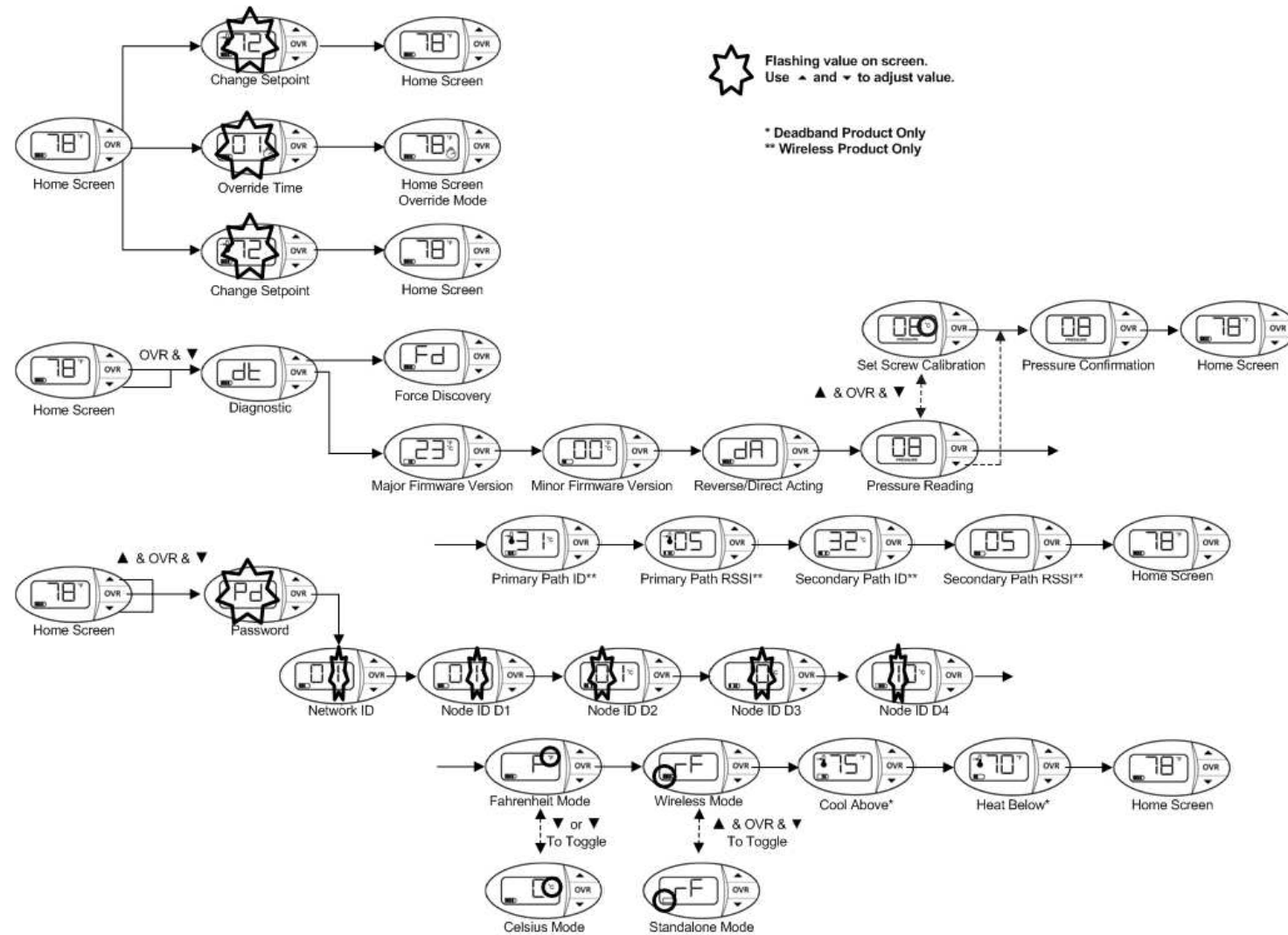


Figure 8. WPT-DB Menu Structure

2.2.1 Programming Mode Password

A password is required to enter the Programming Mode. After pressing all three buttons simultaneously, the following screen will appear:



The password is a series of button presses: **Contact Cypress
EnviroSystems for
password**

2.2.2 Configuring the Network ID and Node ID

The WPT-DB must be configured with a valid network ID and node ID for the unit to be operational. The network ID is a single digit number. The node ID is a four-digit number. The four digit node ID is displayed in groups of two (D2, D1 together and D4, D3 together).



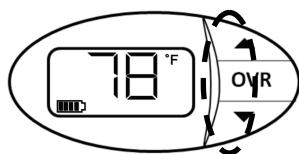
Figure 9. WPT-DB Node ID Digits

Before programming the WPT-DB, insert the batteries in the holder and press any button. The system will turn on and initialize. During initialization and whenever the WPT-DB starts a discovery process, “dy” is displayed on the LCD. During this period, the WPT-DB is attempting to discover its nearest RWALs and HUSB. This process should not be disturbed. Wait for the “dy” to disappear from the LCD before performing any additional operations. After initialization, the LCD displays either E0 or the current temperature. See troubleshooting section for a description of display codes. The WPT-DB is now ready for the configuration of the network ID and the node ID.

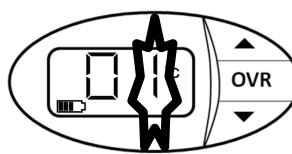
To configure the network ID and the node IDs, perform the following:

1. Press all three buttons simultaneously, then release. The WPT-DB enters “Programming Mode” and requires a password to continue (see section 2.2.1). After the password is successfully entered, the screen will show the current or default network ID.

NOTE: °F icon is displayed, indicating that the network ID is being programmed.



**Press and release all three
buttons simultaneously to
enter Programming Mode**



**After entering a correct
password, the Network ID
will flash signifying
Programming Mode**

Figure 10. Configuring Network ID

2. Press the ▲ or ▼ button to change the network ID to the required value.

NOTE: The network ID cannot have a “0” value.

3. Press OVR to confirm the network ID. This completes the programming of the network ID and the LCD displays the first digit, D1, of the node ID.

NOTE: °C icon is displayed, indicating that the node ID is being programmed.

4. Press the ▲ or ▼ button to change D1 to the required value.

NOTE: D1 cannot have an “F” value.

5. Press OVR to confirm D1.

6. Repeat steps 4 and 5 to configure D2, D3, and D4 of the node ID.

NOTE: While the node ID is being configured, the corresponding bar of the battery indicator flashes.

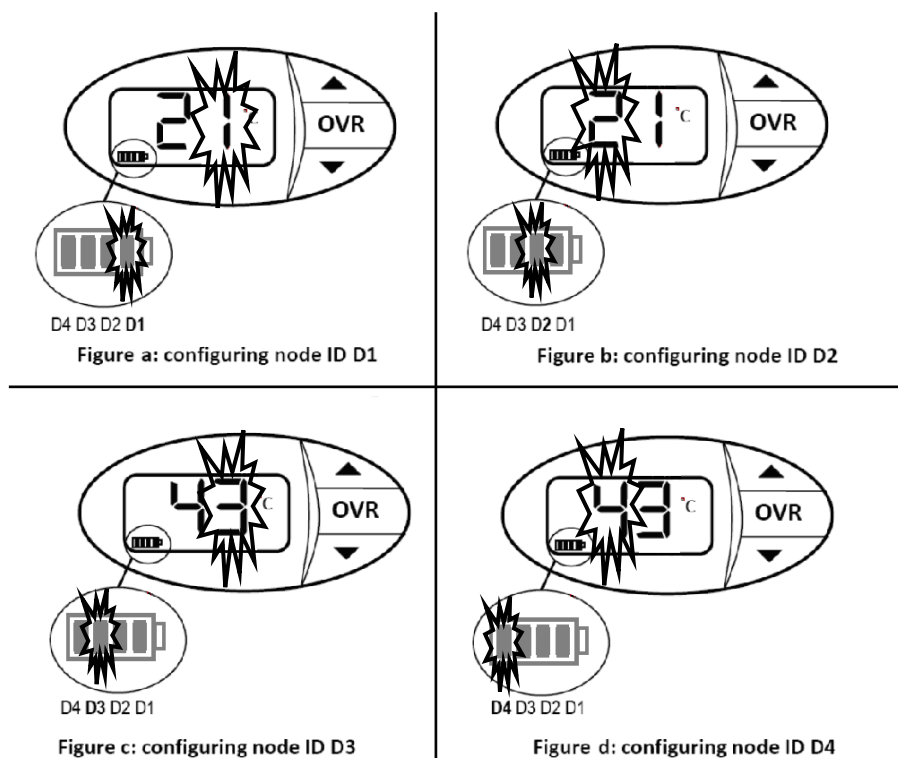


Figure 11. Configuring Node ID 4321

7. After D4 is configured and confirmed, continue to press OVR to exit the Programming Mode.

NOTE: The WPT-DB will automatically exit the Programming Mode if no button is pressed for one minute.

The network and node IDs can be changed any time by completing steps 1 through 7.

2.2.3 Selecting between Celsius and Fahrenheit display

The WPT-DB can display temperatures in Celsius or Fahrenheit. The default setting is for Fahrenheit. To toggle the setting:

1. From the home screen, press all three buttons simultaneously to enter "Programming Mode" and enter the password (see section 2.2.1).
2. Press the OVR button 5 times to navigate past the Network and Node ID programming screen and into the Celsius/Fahrenheit screen.
3. Press ▲ or ▼ to toggle between Celsius and Fahrenheit.
4. Press OVR to accept the C/F change.
5. Continue to press OVR to exit Programming Mode.
6. Verify that the ambient temperature is displayed in the selected units (C or F).

2.2.4 Standalone (RF Mode) On/Off

The WPT-DB can also be used as a standalone pneumatic thermostat. In this setup, the wireless radio is turned off to preserve battery life. If the radio remains on without a wireless network, the WPT-DB will continually search for a network, which reduces the overall battery life. To turn off the radio, perform the following:

1. From the home screen, press all three buttons simultaneously to enter "Programming Mode" and enter the password (see section 2.2.1).
2. Press the OVR button 6 times to navigate past the Network, Node ID, and the C/F screen into the Standalone On/Off screen.
3. Press all three buttons simultaneously to toggle between Standalone (RF Mode) On and Off. In this menu, when the battery icon is empty, RF is off and the device is in standalone mode. When the battery icon is full, RF is on and the device requires a Wireless Network.
4. Press OVR to accept the Standalone changes.

NOTE: The Occupancy state of a WPT-DB in Standalone is always "Occupied". Occupancy Override will not be available, see section 3.2.

2.2.5 Selecting the Deadband Range – Cool Above and Heat Below

The deadband is a temperature range where the WPT-DB will maintain the control pressure. The upper end of the range is referred to as the "Cool Above" temperature, and the lower end of the range is referred to as the "Heat Below" temperature. To set the Deadband range, perform the following:

1. From the home screen, press all three buttons simultaneously to enter the "Programming Mode" and enter the password.
2. Press the OVR button 7 times to navigate past the Network, Node ID, C/F screen and Standalone On/Off screen. The first temperature to set is the "Cool Above" temperature, or the upper end of the deadband temperature range. Use the ▲ or ▼ buttons to change this value.
3. Press the OVR button to accept the "Cool Above" temperature, and now set the "Heat Below" temperature using the ▲ or ▼ buttons.
4. Press the OVR to accept the "Heat Below" temperature and exit the programming mode.

NOTE: Cool Above must always be greater than Heat Below.

2.3 Setting the Deadband Control Pressure

The WPT-DB thermostat extends the functions of the conventional WPT thermostat by allowing a temperature range to be programmed where no heating or cooling takes place. This range is known as the Deadband. All pneumatic systems will have a neutral control pressure (control point), typically ~8psi, where the zone is neither heated nor cooled. If the branch pressure is held at this control pressure, the zone will use a minimal amount of energy. The Deadband Control Pressure is set during calibration. See sec 2.4 for calibration details.

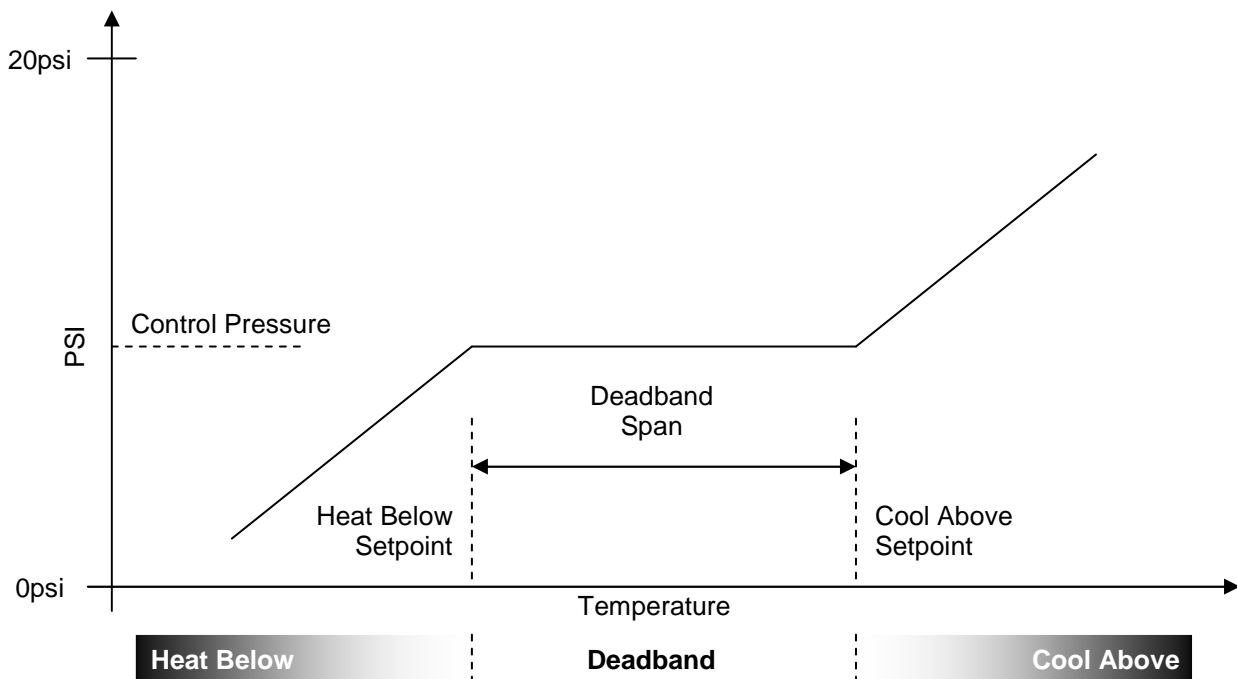


Figure 12: WPT-DB transfer function

2.4 Calibrating the WPT-DB

1. Remove the front cover of the WPT-DB and make sure that the WPT-DB is acclimatized to the ambient temperature.

NOTE: This can take 5 to 10 minutes after attachment to the wall. The bi-metallic spring is very sensitive to body heat. Keep hands and breathe away from WPT-DB to minimize calibration error.

NOTE: The black throttling range adjuster has been factory set to the location marked on the lever as shown in Figure 14. The factory setting provides a Throttling Range (TR) of 4°F. This TR adjuster **MUST NOT BE MOVED** in order to ensure proper operation and accuracy of the WPT-DB.

2. To enter Calibration Mode, perform the following:
 - Press the ▼ button and OVR button together for two seconds. The display will show 'dt'.

- Press OVR four times. The LCD displays the branch pressure in PSI along with PRESSURE indicator. The display shows "--" if the motor is in motion when trying to access branch pressure.
 - Press all buttons simultaneously to enter Calibration Mode. The "C" icon will flash rapidly while in this mode.
3. Use a 1/16" hex Allen wrench and very carefully turn the calibration set screw on the thermostat lever, shown in Figure 14, until the branch pressure is equal to the desired control point. Use extreme caution not to allow the lever to rotate sideways while adjusting the setscrew. Damage to the bi-metallic spring can result if the end of the lever is allowed to move left or right by more than 1/16".

NOTE: Ensure that there is at least one thread of calibration screw adjustment above the top surface of the Friction Clip, or not less than one thread below the bottom surface of the Control Lever as depicted in Figure 15.

NOTE: Each battery segment on the LCD represents 0.25 PSI resolution, as shown in Figure 13. Pay special attention to this extra resolution while turning the set screw. It is critical this value precisely matches the control point for seamless operation.



Figure 13. Pressure Display Resolution

NOTE: Single pipe WPT-DBs might take a longer time to respond during calibration. Please allow sufficient time to calibrate the WPT-DB accurately.

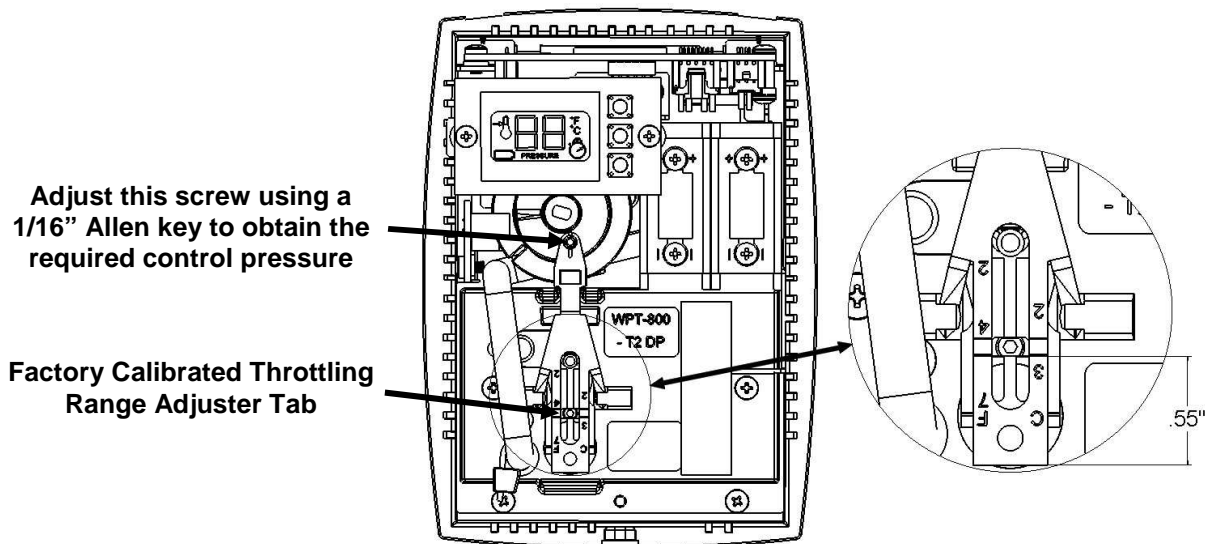


Figure 14. WPT-DB Calibration

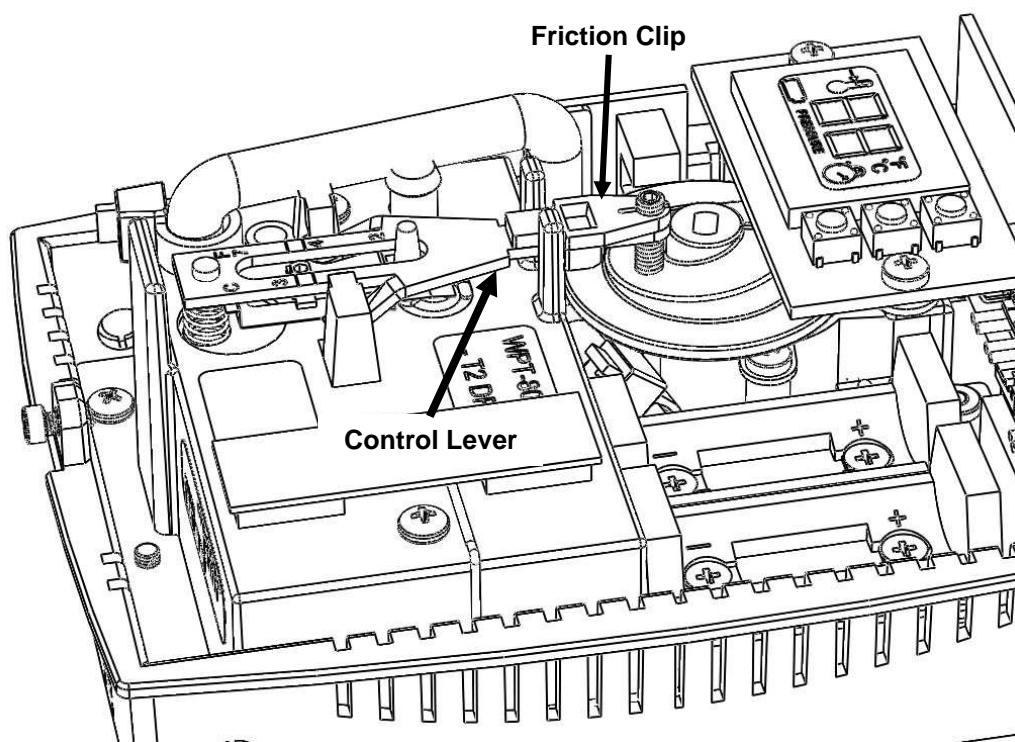


Figure 15. Friction Clip and Control Lever

4. When the desired control pressure is achieved, press the OVR button to exit and save the value.
 - A confirmation screen will appear and flash the stored control pressure for 3 seconds. Repeat the calibration procedure if this value does not match the desired control pressure.
- NOTE:** The WPT-DB will automatically exit Calibration Mode if OVR is not pressed after 3 minutes. The control pressure will NOT be saved and the WPT-DB will return to the home screen.
5. Replace the WPT-DB front cover.

3 Operation

The various indicators and characters that are displayed on the LCD display are shown in the Figure 16.

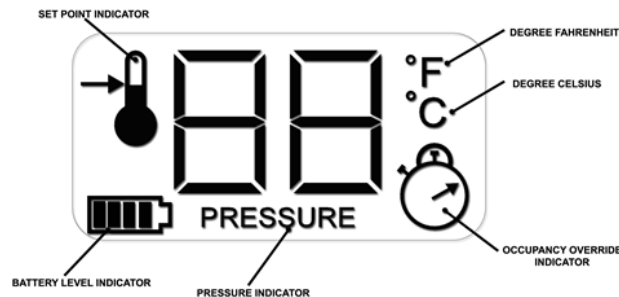


Figure 16. LCD Display

The front panel of the LCD display is used to perform the following functions:

- Adjusting the deadband range
- Turning on/off the occupancy override
- Measuring the branch line pressure

3.1 Adjusting the deadband

NOTE: The deadband span can only be changed from the configuration menu on the WPT-DB or from the WPT Web Console. The deadband span is the difference between the “Cool Above” and “Heat Below” temperature.

The deadband may be shifted up or down using the ▲ or ▼ buttons. To change the deadband range:

- Press the ▲ or ▼ button once to view the current cool above and heat below temperature (they will each flash once).
- Press the ▲ or ▼ button to move the range up or down. Note that the span cannot be changed from here.
- Once the desired value is reached, press the OVR button to accept the change. Leaving the display on the desired value for 5 seconds will also result in a deadband change.

The LCD display will revert to the current temperature.

3.2 Turning ON/OFF the Occupancy Override

NOTE: This feature only works if the WPT-DB is in “Unoccupied” mode as commanded by the scheduler.

To change the occupancy state from “Unoccupied” to “Override”:

- Press the OVR button to activate the occupancy override. The LCD display flashes the override duration in hours.
- Press the ▲ or ▼ button to change the override duration to desired value.

- Once the desired value is reached, press the OVR button to accept the change. Leaving the display on the desired value for 5 seconds will also result in a duration change.

During Occupancy Override, the setpoint will revert to the last "Occupied" value as commanded by the server. During the override duration, the LCD displays the OVR indicator.

3.3 Measuring the Branch Line Pressure

To measure the branch line pressure:

- Press the ▼ button and OVR button together for two seconds.
NOTE: The display shows 'dt'.
- Press OVR four times. The LCD displays the branch pressure in PSI along with PRESSURE indicator. **NOTE:** The display shows "--" if the motor is in motion when trying to access branch pressure. Press OVR to exit and try again.
- Press OVR to exit.

3.4 Checking the Control Pressure

Follow these steps to verify the control pressure:

- Press the ▼ button and OVR button together for two seconds.
NOTE: The display shows 'dt'.
- Press OVR four times. The LCD displays the branch pressure in PSI along with PRESSURE indicator. **NOTE:** The display shows "--" if the motor is in motion when trying to access branch pressure. Press OVR to exit and try again.
- Press the ▼ button. The LCD will flash the stored control pressure for 3 seconds and return to the home screen. The battery segments on the LCD represent 0.25 PSI resolution.

3.5 Locking and Unlocking WPT-DB Controls

The WPT-DB can be locked to prevent occupants from overriding setpoints. To lock or unlock the WPT-DB, press the ▲ and ▼ buttons simultaneously. The display will show "LC" if the unit is locked, "UL" if the unit is unlocked. Press the ▲ and ▼ buttons simultaneously to reach the desired condition.

3.6 Checking Signal Strength

Each WPT-DB attempts to find a primary and secondary wireless path back to the HUB. The paths and associated signal strengths (1-5) from the WPT-DB are displayed in the "dt" menu.

NOTE: This menu is not available in Standalone mode.

- Press the ▼ button and OVR button together for two seconds.
The display will show 'dt'
- Press the OVR button 5 times to see the primary path. ℃ icon is displayed, indicating that the ID is being displayed (either a repeater ID or the HUB ID).
- Press the OVR button again to see the wireless signal strength from the WPT-DB to the primary path.
- Press the OVR button again to see the secondary path. ℃ icon is displayed, indicating that the ID is being displayed (either a repeater ID or the HUB ID).

- Press the OVR button again to see the wireless signal strength from the WPT-DB to the secondary path.

NOTE: The Set Point Icon will identify the path currently in use by WPT-DB as shown in Figure 17.

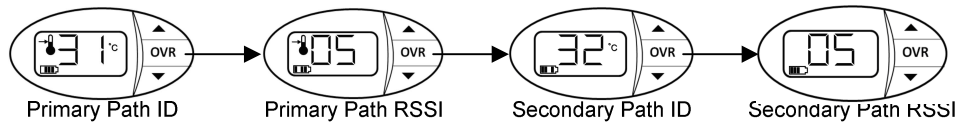


Figure 17. Primary and Secondary Path Signal Strengths

Troubleshooting

The WPT-DB is designed with diagnostic functions to detect and diagnose faults.

Code	Cause	Possible Solution
dy	Indicates that the WPT-DB is performing a discovery operation and it should not be disturbed.	This indication disappears automatically after a few seconds.
dt	Indicates that the WPT-DB is performing a diagnostic operation.	This indication disappears automatically after a few seconds.
Fd	Indicates that the WPT-DB is performing a forced discovery operation.	This indication disappears automatically after a few seconds.
UL	Indicates that the buttons are unlocked by the user.	This indication disappears automatically after a few seconds.
LC	Indicates that the buttons are locked.	This indication disappears automatically after a few seconds.
E0	Discovery error – Not able to connect to nearest repeater or HUSB	Retry discovery by pressing any button. Check if repeater or HUSB is working. Try resetting the repeater. Try with a different position of the repeater/ HUSB if feasible.
E1	Time synchronization error – Not able to synchronize the WPT-DB time with the wireless network	If this error occurs after successful commissioning of the system, the WPT-DB will recover from this error within a couple of refresh cycles.
E2	Radio error – Not able to send/receive data	Restart the unit with removing and inserting the battery. If the error continues, the device requires replacement. Contact the distributor.
E4	Optical Sensor Error – Not able to properly position motor/cam	This error is an indication of a defective device. The unit should be replaced.

Additional Troubleshooting

Symptoms	Possible Solution
The WPT does not seem to build branch pressure.	<p>For 2 pipe WPTs:</p> <ol style="list-style-type: none"> 1. First check that the rubber cap is firmly bottomed into port stub as shown in Figure 18 below. 2. Remove the WPT from the Universal Wall Bracket. 3. Verify both main and branch lines are connected correctly. If they are not attached correctly, reattach the line and check the pressure again. 4. Remove the main line and verify that air is coming out. If possible, measure the main pressure – this requires an additional pressure gauge (not provided by Cypress) connected to the main line. 5. Reconnect the main and remove the branch line connection. 6. Cover the branch port on the WPT completely with a finger. 7. Adjust the setpoint so it is at least 5 degrees above the ambient temperature (for a direct acting stat) or 5 degrees below the ambient temperature (for a reverse acting stat). 8. Check the branch pressure as described in section 3.3. 9. If the pressure in the WPT is the same as the main pressure, then there is a potential leak somewhere in the branch line and there is nothing wrong with the WPT. 10. If the pressure in the WPT is not the same as the main pressure, try swapping the WPT with another unit. <p>For 1 pipe WPTs:</p> <ol style="list-style-type: none"> 1. Remove the WPT from the Universal Wall Bracket. 2. Verify that the branch line is connected correctly. If it is not connected correctly, reattach the branch line and check the pressure again. 3. Remove the branch line and verify that air is coming out. If possible, measure the pressure – this requires an additional pressure gauge (not provided by Cypress) connected to the line. The pressure should build up to the main pressure. Keep in mind that this may take a few minutes depending on the length of tubing. 4. If the pressure does not build up, then there is a leak in the branch line. 5. If the pressure does build up correctly, then try swapping the WPT with another unit.
The WPT does not seem to be controlling correctly and/or is making a loud hissing sound	<ol style="list-style-type: none"> 1. If this is a 2 pipe thermostat check that the rubber cap is firmly bottomed into port stub as shown in Figure 18 below. 2. Check to see that the main and branch lines are connected properly to the WPT. Refer to Figure 6 for proper connection. 3. If the lines are not properly connected, reattach the lines and check the system again. 4. If the lines are properly connected, try swapping the WPT with another unit. 5. If the branch and main lines are swapped, the WPT was installed incorrectly and may be damaged.

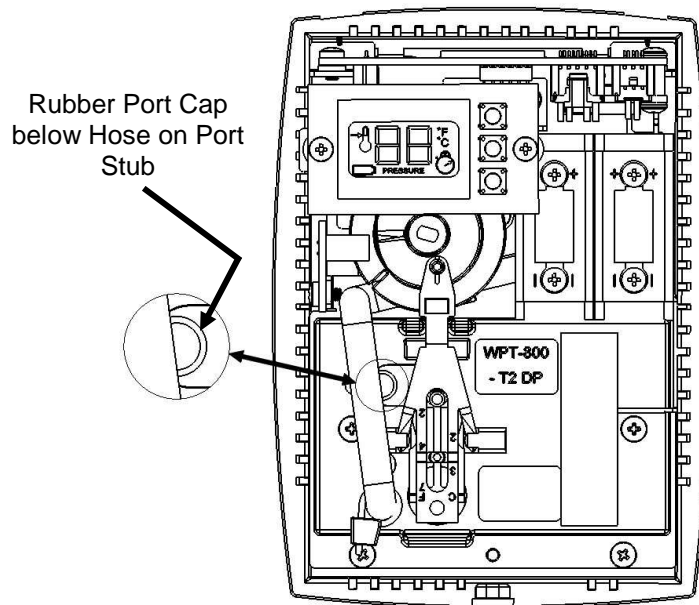


Figure 18. 2 Pipe Thermostat Port Cap

4 Repair

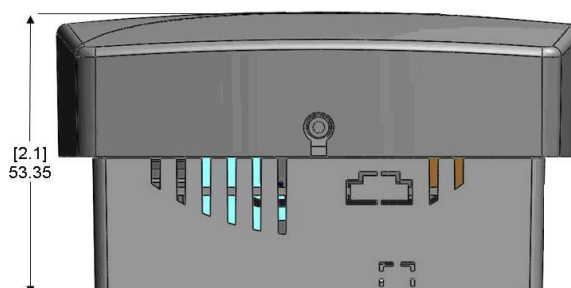
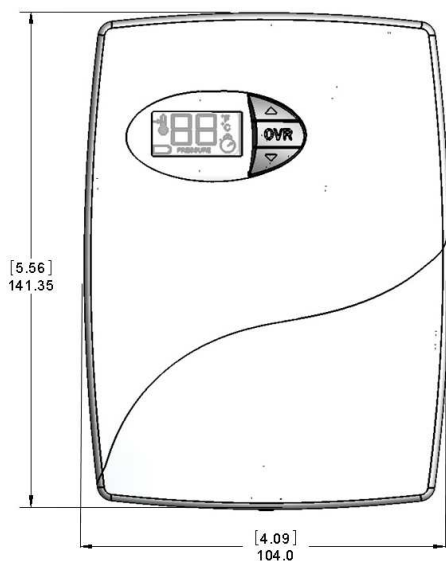
Except for the batteries, the WPT-DB does not have any field replaceable or repairable parts. Contact the original distributor of the unit for repair or warranty service.

NOTE: Care should be taken to keep the unit dust-free during installation.

The WPT-DB is designed to work reliably with a clean, dry-compressed air supply at the required pressure.

5 Technical Specification

Action	Direct / Reverse Acting
Number of pipes	Single / Dual pipe
Setpoint Temperature Range	55°F to 85°F (13°C to 29 °C)
Air connections	Barb fittings, 3/32 in (2.5 mm) ID tube
Maximum Operating Pipe Pressure	25 psi (170 kPa)
Airflow Usage	0.011 scfm (5.2 mL/s)
Sensitivity	Factory Adjusted to 2.0 – 2.5 PSI/F
Operating Frequency Band	2.4 GHz ISM Band
Battery Life	More than 2 years (with four setpoint changes per day)
Operating Conditions	32 to 122°F (0 to 50°C) 95%RH Max, Noncondensing
Storage Conditions	-40 to 122°F (-40 to 50°C) 95%RH Max, Noncondensing
Dimensions	Length: 5.6 in (141 mm) Width: 4.1 in (104 mm) Depth: 2.1 in (53 mm)



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