WT-4000 Series Pneumatic-to-Direct Digital Control (DDC) Room Thermostats

Installation Instructions

Part No. 24-10732-5, Rev. —
Issued November 1, 2013

WT-4000-MCR, WT-4000-0CR, WT-4000-MCM, WT-4000-0CM,
WT-4000-MFR, WT-4000-0FR, WT-4000-MFM, WT-4000-0FM

Refer to the QuickLIT website for the most up-to-date version of this document.

Application

The WT-4000 Series Pneumatic-to-Direct Digital Control (DDC) Room Thermostats provide reliable zone comfort and enhanced energy economy via remote monitoring and temperature setpoint management. This arrangement provides greater energy policy compliance, and facilitates trending of floor space usage in commercial, industrial, and municipal HVAC environments.

The WT-4000 Series Room Thermostats are ideally suited for energy-saving, pneumatic-to-DDC building upgrades. Designed for non-invasive replacement of existing manual pneumatic thermostats, the WT-4000 Series Room Thermostats provide a number of DDC features, including remote wireless setpoint control and occupancy scheduling, and continuous room temperature, branch line pressure, and battery status monitoring. All of these features were previously unavailable in existing pneumatic HVAC control systems.

The innovative design of the WT-4000 Series Room Thermostats completely reshapes the pneumatic HVAC control industry. The room thermostat itself does not utilize any mechanical parts. A solid state temperature sensor replaces the bi-metallic strip elements for precise room temperature monitoring. In addition, an advanced piezoelectric air valve replaces the mechanical relay for improved branch line pressure control. All of these technologies provide longer, more dependable, and maintenance-free operation.

Models are available for stand-alone applications or wireless mesh communications. In a wireless mesh network application, the WT-4000 Series Room Thermostat communicates with the controller by means of a Johnson Controls® WT-ROUTER Router and Johnson Controls WT-BAC-IP Gateway.

Some WT-4000 Series Room Thermostats include a binary dry contact input for an occupancy sensor (field furnished), to detect motion and determine if a space is occupied. This feature maximizes up to 30% energy savings in high-energy usage environments such as schools, dormitories, offices, and hospitals by adjusting the temperature of the space based on the occupancy status.

All WT-4000 Series Room Thermostats include an LCD, with either a Fahrenheit or Celsius temperature display. Depending on the model chosen, the room thermostat can transmit sensed temperature, setpoint temperature, occupancy status, and low battery conditions to an associated router and gateway. The WT-4000 Series Room Thermostat is designed for indoor, intra-building applications only.

The WT-4000 Series uses direct-sequence, spread-spectrum RF technology, and operates on the 2.4 GHz Industrial, Scientific, and Medical (ISM) band. The room thermostat meets the IEEE 802.15.4 standard for low power, low duty cycle RF transmitting systems.

IMPORTANT: Use the WT-4000 Series Pneumatic-to-DDC Room Thermostat only to provide an input to equipment under normal operating conditions. Where failure or malfunction of the room thermostat could lead to personal injury or property damage to the controlled equipment or other property, additional precautions must be designed into the control system. Incorporate and maintain other devices, such as supervisory or alarm systems or safety or limit controls, intended to warn of or protect against failure or malfunction of the room thermostat.

IMPORTANT: The WT-4000 Series Pneumatic-to-DDC Room Thermostat is not designed or intended for use in mission-critical or life/safety applications.

North American Emissions Compliance

United States

Compliance Statement (Part 15.19)

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.

Warning (Part 15.21)

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Canada

Industry Canada Statement

The term **IC** before the certification/registration number only signifies that the Industry Canada technical specifications were met.

Le terme « IC » précédant le numéro d'accréditation/ inscription signifie simplement que le produit est conforme aux spécifications techniques d'Industry Canada.

1.0 WT-4000 Series Thermostat Overview

1.1 HVAC Operation

The WT-4000 Series Thermostat's operation is regulated by a number of operational modes which can be triggered by inputs such as changes in indoor and outdoor environments; data received from other sensing devices, and scheduled times. Each mode is designed to optimize energy use under certain conditions and has a set of rules that will manage HVAC equipment operation and restrict local thermostat requests.

There are two types of Operational Modes – Scheduled and Manual. Scheduled Modes are triggered by occupancy schedules and provide energy savings by aligning HVAC operation to actual building occupancy. Manual Modes can only be initiated by the user at the WT-4000 Series Thermostat level. They are used to adjust HVAC operation manually outside of the schedule, but within set configuration parameters.

1.2 Operating Principle of WT-4000 Series Thermostat

WT-4000 Series Thermostat has been designed to support any 0 to 22 PSI pneumatic HVAC control systems. Variation in branch line pressure is proportional to deviation of room temperature from Set Point; the proportional factor is determined by the Gain, which is defined as the change in branch line pressure in PSI in response to a 1°F change in room temperature.

Figure 1 below shows the linear relationship between branch line pressure and room temperature at a given Set Point for Direct Acting Thermostat configuration (for Reverse Acting the graph would be flipped horizontally).

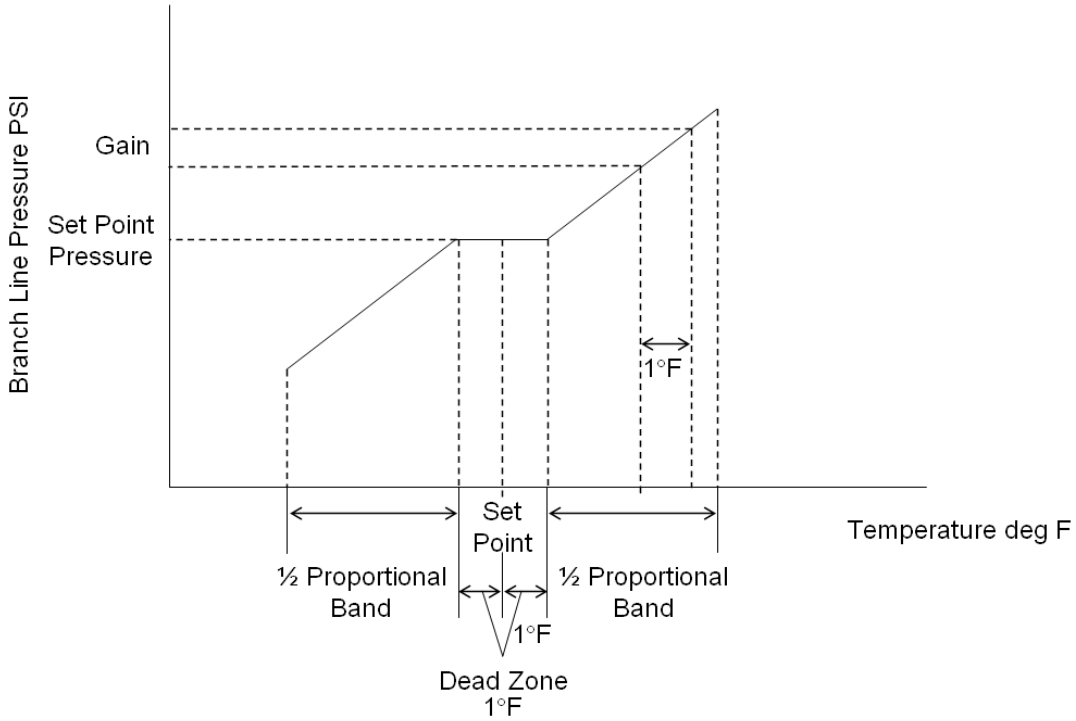


Figure 1. Temperature - Pressure Profile

A direct acting system is shown in Figure 1 where WT-4000 Series Thermostat will increase branch line pressure in response to an increase in room temperature. When room temperature is

within the Dead Zone (default ±1°F) around the Set Point, branch line pressure is regulated at Set Point Pressure, and the pneumatic actuator will be at the minimum heat, cool or neutral position. When room temperature rises above Set Point plus Dead Zone, branch line pressure will increase in proportion to temperature increase, with proportional factor defined by the Gain value. On the other hand, if room temperature decreases below Set Point minus Dead Zone, branch line pressure will decrease in proportion to temperature decrease. The proportional band defines the temperature range where branch line pressure changes in proportion to temperature change. Note that Set Point Pressure, Dead Zone, Gain, and Proportional Band can be adjusted using the menu buttons on WT-4000 Series Thermostat.

1.3 Wireless Operation

WT-4000-MFR, WT-4000-MCR, WT-4000-MFM, and WT-4000-MCM models are equipped with 2.4GHz IEEE 802.15.4 radio and communicate via MeshScape® mesh network protocol. The wireless mesh network forms itself and data communications enable remote monitoring, adjustment and trending to ensure long term performance. In the wireless mesh network a WT-4000 Series Thermostat operates as a battery-powered end node. Being an end node, WT-4000 Series Thermostat does not operate as a router to relay data for other devices in the mesh network. It communicates with the wireless mesh network as an individual device that transmits and receives its own data only, to and from the WT-BAC-IP network controller or through other WT-Router devices. When installed in buildings with common sheetrock walls, its nominal radio communication range is approximately 200 feet. However, if the WT-4000 Series Thermostat is located more than 200 feet from the WT-BAC-IP network controller, WT-Routers must be deployed to relay data generated by the WT-4000 Series Thermostats back to the network controller.

The first step of the installation process is planning the layout of devices on the building's floor plan, including the identification of desired locations for all WT-4000 Series Thermostat devices as well as the WT-BAC-IP network controller. Measure the radial distances between the WT-4000 Series Thermostat devices and the WT-BAC-IP network controller to determine if the WT-4000 Series Thermostat devices are within 200 feet of the WT-BAC-IP. If not, WT-Routers must be installed to relay signals between the WT-4000 Series Thermostat and the WT-BAC-IP. The ideal installation provides each end node device, WT-4000 Series Thermostats, with at least two hops of transmission to the WT-BAC-IP to ensure signal transmission success. Nominal transmission range of WT-Routers in common buildings is 300 feet. To ensure complete coverage of a wireless mesh network, there should be at least two WT-Routers or one WT-Router and the WT-BAC-IP located within a 300 foot radius of every WT-4000 Series Thermostat.

IMPORTANT:

In order for the devices to connect to the same mesh network, they all must have the same Group ID.

The Group ID is set at the factory and cannot be changed in the field.

Figure 2 illustrates the white sticker on the inside of the thermostat that shows the location of the Group ID.

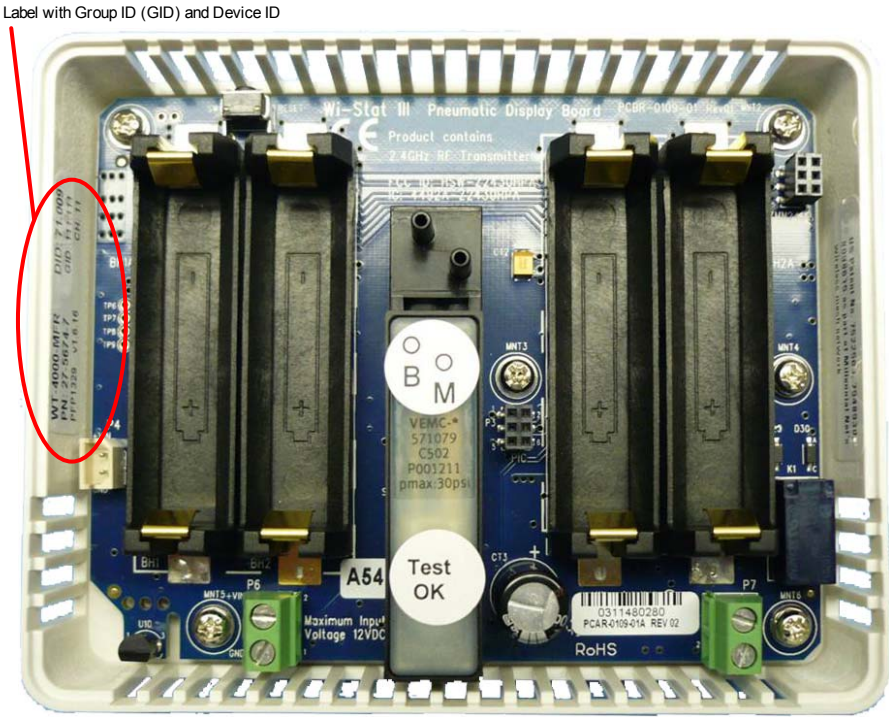


Figure 2: White Label on Inside of Thermostat with Group ID (GID) and Device ID Information

1.4 Standalone Operation

1.4.1 Standalone WT-4000 Series Thermostat Occupancy Programming

The WT-4000-0FR, WT-4000-0CR, WT-4000-0FM, and WT-4000-0CM models operate as standalone pneumatic –to-DDC thermostats with an independent time clock and can be programmed with a Weekday/Weekend occupancy schedule. A complete 7-day schedule consists of two autonomous components:

- Weekday Schedule – Monday through Friday
- Weekend Schedule – Saturday and Sunday

Each component is split into two parts to be scheduled as occupied or unoccupied mode:

- Weekday 1
- Weekday 2
- Weekend 1
- Weekend 2

To accommodate for daytime or nighttime shift schedules, each part can be configured to occupied or unoccupied mode independently.

For each Occupied Mode the following features can be configured:

- Occupied Mode start time
- Temperature Set Point value – adjustable by ±14°F by room occupants

For each Unoccupied Mode the following features can be configured:

- Unoccupied Mode start time
- Upper Temperature limit
- Lower Temperature limit (Thermostat will be off while temperature is within these limits.)

The start time of each schedule part is automatically an end time of the previous one. (Specifically, for a 6 am to 6 pm occupied schedule, occupied mode to start at 6 am and unoccupied at 6 pm). Figures 3 and 4 below illustrate Occupied and Unoccupied schedule setup screens.

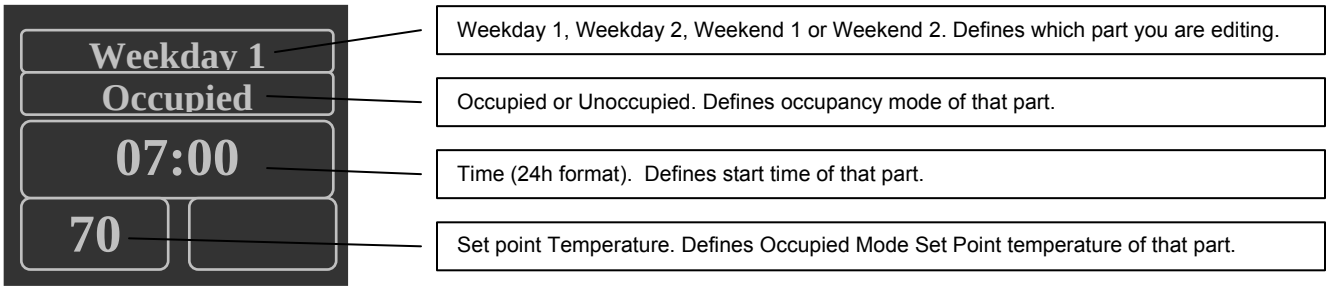


Figure 3. WT-4000 Series Schedule Setup Screen for Occupied Mode

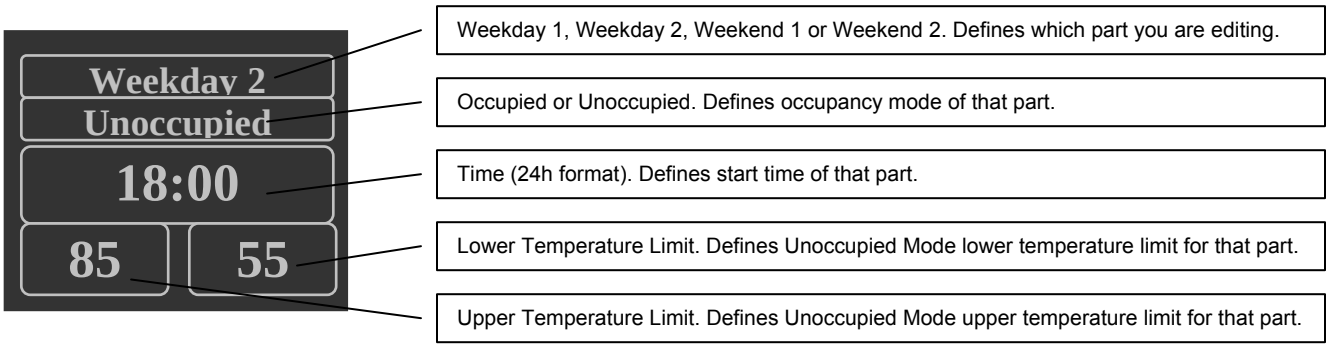


Figure 4. WT-4000 Series Schedule Setup Screen for Unoccupied mode

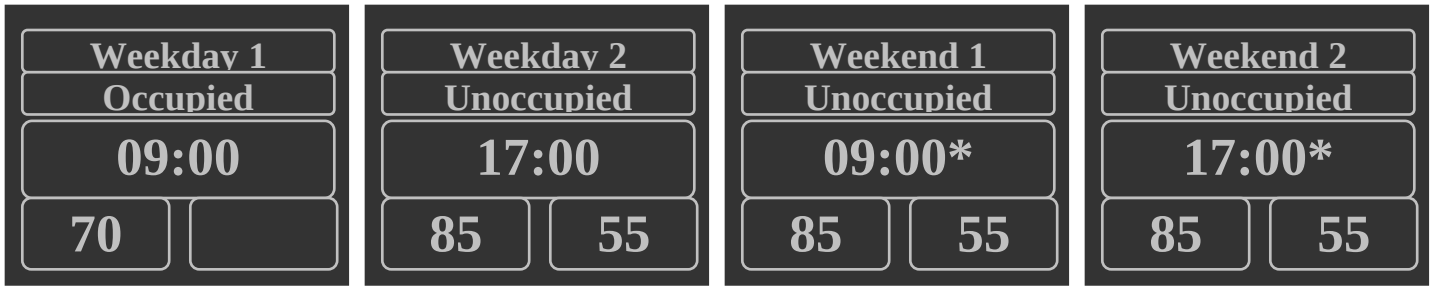
For schedule step-by-step programming instructions please refer to *2.5 WT-4000 Series Thermostat Configuration Steps*.

1.4.2 Standalone WT-4000 Series Occupancy Programming Examples

Standard Office Hours

Set point: 70F
Occupied from 9 am to 5 pm Monday to Friday
Saturday and Sunday: unoccupied, upper limit is 85°F, lower limit is 55°F

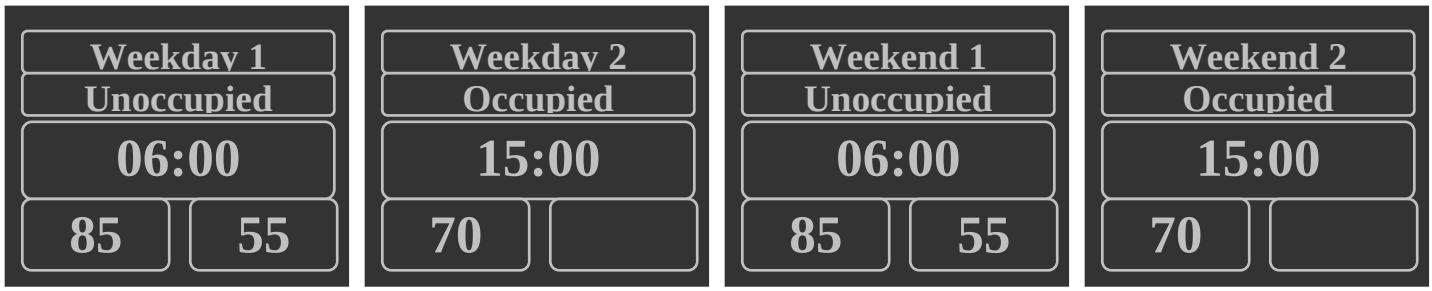
Program WT-4000 Series Schedule Setup Screens:
* Start and end time are irrelevant; both weekend parts are set to the same unoccupied mode.



Night Shift Hours

Set point: 70°F
Occupied from 3 pm to 6 am 7 days a week

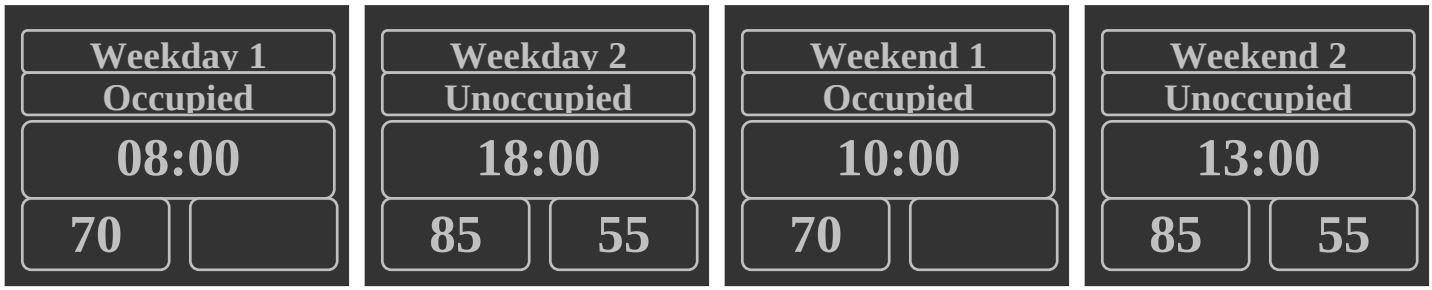
Program WT-4000 Series Schedule Setup Screens:



Extended Office Hours w/ Weekend Schedule

Set point - 70°F
Occupied from 8 am to 6 pm Monday to Friday
Occupied from 10 am to 1 pm Saturday and Sunday

Program WT-4000 Series Schedule Setup Screens:



For schedule step-by-step programming instructions please refer to *2.5 WT-4000 Series Thermostat Configuration Steps*

1.5 WT-4000 Series Thermostat Operational Modes

1.5.1 Scheduled Modes:

The following operational modes are regulated by the HVAC Schedule as defined by the user. Schedules can be set in advance through building automation systems for wireless communicating models and locally at each thermostat for standalone models. The WT-4000 Series Thermostat will execute the schedules automatically.

1.5.2 Occupied Mode

- Occupancy mode is used when the zone, or room, is scheduled to be occupied. The room temperature during this mode is defined by two values set by the thermostat configuration parameters:
  - Set Point (the targeted room temperature for the season)
  - Comfort Zone (the optimal temperature range around the Set Point).

  The WT-4000 Series Thermostat maintains the room temperature within the Comfort Zone.

  If the temperature in the room falls outside of the Comfort Zone range, the thermostat reacts accordingly and automatically requests to heat or cool. The thermostat allows users to adjust the room temperature using the local thermostat, as long as the desired temperature is within the range of the Comfort Zone.

  If the user requests heat or cool outside of the set Comfort Zone, the request at the local thermostat will be overwritten by the thermostat configuration parameters.

  For example, the Set Point value is 70°F and the Comfort Zone Delta is 3°F. The user will only be able to affect the temperature manually between 67° and 73°F, regardless of the temperature requested on the WT-4000 Series Thermostat's LCD screen. Standalone models do not have a configurable comfort zone. A factory programmed range of +/- 14F around installer configured set point is available to user in occupied mode for standalone models.

- **Unoccupied Mode –** Energy saving mode for the times when rooms are unoccupied. When the room temperature is between the upper and lower Unoccupied Mode temperature limits, the WT-4000 Series Thermostat will not call for heating or cooling. If the temperature falls outside the Unoccupied Mode upper and lower temperature range, the WT-4000 Series Thermostat controls the HVAC system to bring the temperature back into the Unoccupied Mode upper and lower temperature range.

Manual Modes:
The following modes cannot be scheduled or triggered remotely. They can only be initiated locally by the user interfacing with the WT-4000 Series Thermostat.

- **Override Mode** – manual mode – can only be initiated by the user by pressing the Override  button on the WT-4000 Series Thermostat. Override has a limited duration time, set by the thermostat configuration parameters; after it expires, the WT-4000 Series Thermostat returns to its regularly scheduled mode. The Override Mode overrides the scheduled Occupied or Unoccupied Mode by allowing the user to control the HVAC system through the local thermostat and permits a wider Comfort Zone range. If the room temperature is outside the Override Comfort Zone range, the WT-4000 Series Thermostat disables local thermostat controls. The Override Mode Comfort Zone range and Override duration time are set by the thermostat configuration parameters.
- **Shoulder Mode –** Energy Saving transition from occupied to unoccupied modes. It can be triggered locally at the WT-4000 Series Thermostat level by pressing Shoulder button -  . While in Shoulder mode, WT-4000 Series Thermostat does not call for heating or cooling when the room temperature is between Upper and Lower Shoulder mode temperature limits.

  Shoulder Mode is used to set back the room temperature set point manually if occupants leave the facility earlier than the scheduled time, essentially overriding the current schedule until the next scheduled mode change occurs.

  For example, if a zone is running a 5-day, 8 am to 6 pm occupancy schedule, but one day occupants are leaving at 2 pm, they can manually set the zone into shoulder mode at 2 pm. The WT-4000 Series Thermostat will remain in Shoulder mode until 6 pm and then will follow its regular schedule. Shoulder mode can also be utilized as a Demand Response mode and can be triggered remotely from the monitoring and control application.

All parameter-defining rules of each mode are configurable. Please see the "WT-4000 Series Thermostat Configuration Parameters" table below, in section 1.7.

1.6 Fail-Safe Features

WT-4000 Series Thermostats have a number of programmed fail-safe features to ensure continuous HVAC operation. In the event of communication failure with WT-BAC-IP gateways, wireless network, or HVAC equipment: a fail-safe mechanism will ensure devices continue to operate in a logical fashion. When the failure condition no longer exists, the device will recover from safe mode and resume normal operation.

- ***WT-4000 Series Thermostat loses radio communication with Site Controller***
  Should the WT-4000 Series Thermostats experience radio communication failure with the WT-BAC-IP, WT-4000 Series Thermostats will follow default single day schedules, preset on the WT-4000 Series Thermostat. WT-4000 Series Thermostat has a built in real time clock that is synchronized with the wireless mesh network, therefore, it can operate with a default, hard-coded day schedule even when it is offline. When the WT-BAC-IP comes back online, the WT-4000 Series Thermostats will automatically receive updated mode status, Set Point values and other configuration commands based on the latest user schedule.
- ***Protection Zone***
  To protect building infrastructure, equipment, and occupants, WT-4000 Series Thermostat has extreme temperature limits (configurable by Administrator) that will allow temperatures to float independently from any mode settings. If these limits are reached, WT-4000 Series Thermostat will automatically react and adjust Heat or Cool, no matter what scheduled mode is running. Default value for Upper bound is 95°F, and the Lower bound default value is 40°F.

1.7 WT-4000 Series Thermostat Configuration Parameters

The following variables define WT-4000 Series Thermostat Configuration Parameters and regulate WT-4000 Series Thermostat operation.

WT-4000 Series Thermostat Configuration Parameters

Parameters	Description	Configuration Method
Occupied Mode		
Set Point value	Zone Set Point temperature	Software
Comfort Zone upper delta (3°F default)	Upper temperature bound on deviation from configuration parameters Set Point during occupied mode.	Software
Comfort Zone lower delta (3°F default)	Lower temperature bound on deviation from parameter Set Point during occupied mode.	Software
Unoccupied Mode		
Constrained float upper limit (85°F default)	Defines upper temperature limit in unoccupied mode. HVAC equipment will remain off while the zone temperature is between upper and lower limits.	Software
Constrained float lower limit (55°F default)	Defines lower temperature limit in unoccupied mode. HVAC equipment will remain off while the zone temperature is between upper and lower limits.	Software
Override mode		
Override duration (default 120 minutes)	WT-4000 Series Thermostat override duration. After time limit expires, WT-4000 Series Thermostat will go into regularly scheduled mode. Maximum 240 minutes	Software
Override mode Comfort Zone upper delta (5°F default)	Comfort Zone upper delta during override mode.	Software
Override mode Comfort Zone lower delta (5°F default)	Comfort Zone lower delta during override mode.	Software
Other Parameters		
HVAC mode (Auto default)	Auto: WT-4000 Series Thermostat will call for heat or cool. Heat: WT-4000 Series Thermostat will only call for heat (for heat only systems) Cool: WT-4000 Series Thermostat will only call for cool (for cool only systems)	Software, Thermostat
HVAC transition delta (5°F default)	Temperature delta before WT-4000 Series Thermostat will automatically transition from heat to cool or from cool to heat based on zone temperature	Software
Operational Modes	1: Occupied; 2: Unoccupied	Factory Configured

Parameters	Description	Configuration Method
Other Parameters		
Dead zone delta (1°F default)	Temperature range around Set Point to prevent HVAC from chattering	Software
WT-4000 Series Thermostat protection zone upper temperature (95°F default)	Maximum temperature allowed in zone. Fail-safe feature, applicable to all zones.	Factory Configured
WT-4000 Series Thermostat protection zone lower temperature (40°F default)	Minimum temperature allowed in zone. Fail-safe feature, applicable to all zones.	Factory Configured
Heat cycle timer	Minimal heat-on to heat-on interval; value range 0 to 30 minutes, increment in minutes; default 0 minute	Factory Configured
Compressor restart delay	Minimal cool-off to cool-on interval; value range 0 to 30 minutes, increment in minute; default 0 minute	Software
Default occupied mode start time in case of wireless communication failure (06:00 am default)	Time of day in hour (0 to 24); used in the event the WT-4000 Series Thermostat goes offline for extended durations	Factory Configured
Default occupied Set Point value in case of wireless communication failure (70°F default)	Used in the event the WT-4000 Series Thermostat goes offline for extended durations	Factory Configured
Default unoccupied Set Point start time in case of wireless communication failure	Time of day in hour (0 to 24); used in event the WT-4000 Series Thermostat goes offline for extended durations; disabled in default configuration, and therefore unit does not go into unoccupied mode when offline.	Factory Configured
Temp sensor calibration factor (°F)	To calibrate WT-4000 Series Thermostat temperature sensor for offset compensation	Factory Configured
Wall time interval for synchronized data reporting (default not reporting on synchronized wall time)	Data reporting interval when device reports on synchronized wall time, in minutes of the hour; allowable values: 1 (5 minutes), 2 (6 minutes), 3 (10 minutes), 4 (12 minutes) , 5 (15 minutes), 6 (20 minutes) , 7 (30 minutes), and 8 (1 minute)	Factory Configured
Shoulder mode Comfort Zone upper delta	Defines upper temperature limit in shoulder mode	Factory Configured

Parameters	Description	Configuration Method
Other Parameters		
Shoulder mode Comfort Zone lower delta	Defines lower temperature limit in shoulder mode	Factory Configured
Direction	Direct Acting - branch line pressure increase turns on Cooling, decrease turns on Heating Reverse Acting - branch line pressure increase turns on Heating, decrease turns on Cooling.	Software, Thermostat
Set Point PSI	Branch line pressure when the room temperature and Set Point are equal; no Heating or Cooling outputs.	Software, Thermostat
Gain /Sensitivity	Number of degrees impacted by 1 PSI change	Software, Thermostat
Prop band - Proportional range/throttling range	Temperature range that represents the controlled device's movement from fully closed to fully open. Typically it is 4°F or 6°F	Software, Thermostat
Unoccupied Mode PSI	Branch line pressure during unoccupied mode when zone temperature is within unoccupied constrained upper and lower limits.	Software, Thermostat

2.0 WT-4000 Series Thermostat Installation

WT-4000-MFR, WT-4000-MCR, WT-4000-MFM, WT-4000-MCM wireless communicating models are models require the WT-BAC-IP gateway and WT-Router to operate as a complete wireless solution. Please refer to the *WT-BAC-IP Gateway Installation Instructions (Part No. 24-10732-21)* for more details on installing the WT-BAC-IP wireless gateway.

2.1 List of Tools and Hardware Needed for Installation

- Couplings or reducers to connect WT-4000 Series Thermostat to existing air tubes (not supplied)
- Needle-nose pliers
- Small level
- Fasteners and anchors to secure wireless Thermostats (Site Specific)
- Plastic tie wraps (for securing WT-Routers, Site Specific)
- Electric Drill (optional)
- Building floor plans for where the system will be installed. These floor plans will serve multiple purposes:
  - To plan the wireless network before installation by identifying thermostat locations
  - To document the locations where wireless devices will be installed

2.2 Electrostatic Sensitive Devices (ESD) Safety Measures

WT-4000 Series Thermostat contains ESD sensitive circuit boards. Please use caution when handling WT-4000 Series Thermostat with back plate (wall plate) removed. Always carry WT-4000 Series Thermostat in static bags they were shipped. Do not touch any part of the circuit board while mounting tubes to the valves with your hands if you are not wearing ESD protective gear. Even minimal electrostatic shock can severely damage WT-4000 Series Thermostat.

2.3 Clean Air Requirement

Before starting installing WT-4000 Series Thermostat thermostats, please ensure air in the pneumatic lines is properly cleaned. Clean, dry and oil free air in the main supply line is required for normal WT-4000 Series Thermostat operation. The pneumatic system must contain a properly operating air dryer and coalescing filter to remove water, oil, and other impurities from the main supply air before it reaches the WT-4000 Series Thermostat. If the existing system is contaminated with oil and/or water, Johnson Controls recommends installation of a pre-filter before each WT-4000 Series Thermostat device to protect it from contaminant and failure.

WT-4000 Series Thermostat failures due to main supply air contamination with impurities including oil, water, dust or other solid particles will not be replaced under warranty.

Johnson Controls Inc. recommends using following in-line filters with WT-4000 Series Thermostat:

- Johnson Controls Air Filter, Code Number A-4000-1037

Before installation, ensure the following:

- Air dryer is functioning properly
- Coalescing air filter is replaced and maintained property
- Install inline filters where possible

2.4 Order of Installation for WT-4000-MFR, WT-4000-MCR, WT-4000-MFM, WT-4000-MCM Model Thermostats

WT-4000-MFR, WT-4000-MCR, WT-4000-MFM, WT-4000-MCM Model Thermostats start looking for a wireless network as soon as it is powered up. It is recommended that WT-BAC-IP and WT-ROUTERs are installed to establish network before putting in WT-4000 Series Thermostats.

If you are installing WT-4000 Series Thermostats before establishing wireless network, please be aware of the following:

- Once powered, WT-4000 Series Thermostats will initialize and look for network for 3 minutes. During initialization, LCD will display code 512 (See Figure 8 for details)

IMPORTANT: Do not press any buttons during initialization process! Configuration changes made during initialization will not be saved!

- WT-4000 Series Thermostats will operate in Occupied Mode with default settings:
  - Set Point Temperature – 70F
  - Comfort zone - ±3F
- These default values can only be changed from the software once site controller is installed
- After installing the Site Controller and WT-ROUTERs, confirm each WT-4000 Series Thermostat is connected to the network by checking LCD screen (see Figure 6).
- Please be aware, default sampling interval is 5 minutes, so it might take some time for all thermostats to connect.

WT-4000 Series Thermostat Installation Steps:

1. Install WT-BAC-IP Gateway
2. Install WT-ROUTERs
3. Configure WT-4000 Series Thermostat (see section 2.5)
4. Install WT-4000 Series Thermostat (see section Part 2.6)

2.5 WT-4000 Series Thermostat Configuration Steps

2.5.1 WT-4000 Series Thermostat Pre-Installation Configuration

WT-4000 Series Thermostats are compatible with wide array of pneumatic HVAC systems. To ensure proper operation, its pneumatic and particular operational settings must be configured to work with your HVAC system. Because WT-4000 Series Thermostat are battery-powered devices with internal memory, configuration can be done prior to or right after installation. To prevent any possible operation conflicts, configuration of all WT-4000 Series Thermostat thermostats before the installation is recommended.

2.5.2 WT-4000 Series Thermostat Configurable Settings

Below is the list of configuration variables that define how WT-4000 Series Thermostat pneumatic pressure commands will correlate with the temperature values. Refer to HVAC equipment documentation or service personnel for the actual values that should be configured on WT-4000 Series Thermostats.

Settings	Details	Range	Increments	System Defaults
Operational				
HVAC Mode	Heat Only – for Heat only systems Cool Only – for Cool only systems Auto – for both Heat and Cool systems	N/A	N/A	Auto
Fan Mode	Only applicable if Fan Relay is used. See Figure 5. Auto – to run Fan only with Heating or Cooling On – to run Fan continuously during occupied mode Speed X – not supported in this version	N/A	N/A	Auto
Pneumatic				
Direction	Direct Acting - branch line pressure increase turns on Cooling, decrease turns on Heating Reverse Acting - branch line pressure increase turns on Heating, decrease turns on Cooling.	N/A	N/A	Direct Acting
Set Point PSI	Branch line pressure when the room temperature and Set Point are equal. Heating and Cooling outputs are OFF.	1 - 22 PSI	0.5 PSI	9 PSI
Gain /Sensitivity	Branch line pressure change needed to change room temperature by 1°F.	1 - 5 PSI	0.5 PSI	2 PSI
Prop band - Proportional range/throttling range	Temperature range that represents the controlled device's movement from fully closed to fully open. Typically it is 6°F or 4 PSI	0 - 10°F	1°F	6°F
Unoccupied Mode PSI	Branch line pressure during unoccupied mode. Heating and Cooling outputs are OFF.	0 – 22 PSI	0.5 PSI	0 PSI

2.5.3 WT-4000 Series Thermostat Configuration

WT-4000 Series Thermostat configuration can be done at the device before installation or through building automation system software when installation is complete. The following steps describe pre-installation device level configuration.

WT-4000 Series Thermostat Configuration Mode

1. Separate the wall plate from the WT-4000 Series Thermostat.
2. Install four Lithium 3.6 V batteries (supplied) into battery compartment. Be sure to match positive (+) battery ends with positive (+) battery terminals in the battery compartment.
3. Once powered, WT-4000 Series Thermostat will initialize in:
    a. 30 seconds if it can connect to the network
    b. 3 minutes if network is not present

IMPORTANT: Do not press any buttons during initialization process! Configuration changes made during initialization will not be saved!

See Figure 6 for LCD screen during initialization.

4. Press and hold Shoulder and Override buttons at the same time for 10 seconds to set WT-4000 Series Thermostat into Configure Mode. LCD screen will change to Firmware Info Menu (See Figure 4) first and in 10 seconds Configuration Menu will appear (See Step 1 in ***HVAC Mode Screen***.)
5. Use Up (+) and Down (-) buttons to navigate through the Menu – see directions below
6. If the Configuration Screen is left idle for 10 seconds, it will return to the normal operation screen
7. All further configurations must be made while in Configuration Mode.

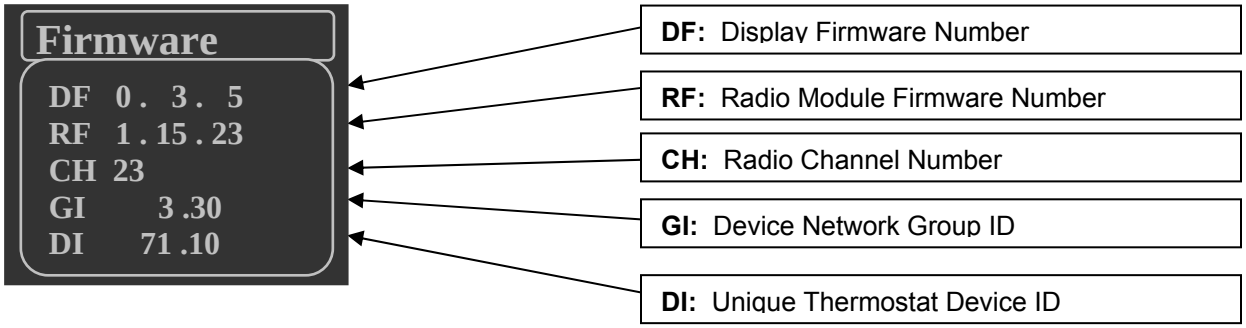
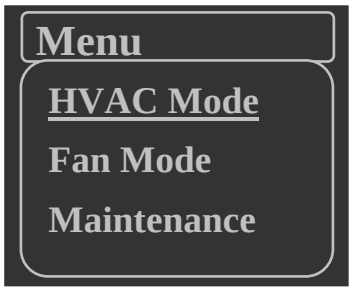


Figure 5. WT-4000 Series Thermostat Firmware Version Screen

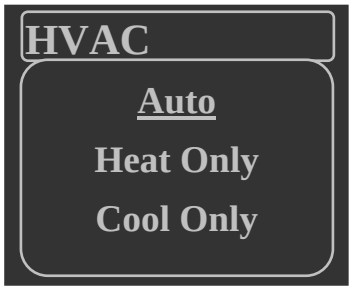
HVAC Mode Screen

1. When in Configuration Mode, press Up/Down buttons to Underline **HVAC Mode** item



2. Press Confirm button

3. Use Up/Down buttons to choose between **Auto, Cool** and **Heat**.



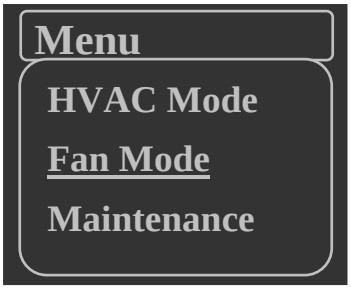
4. Press  Confirm button
5. The LCD Screen will return to the normal operation screen, and changes will be effective immediately

Fan Mode Screen

The Fan Mode screen controls Fan Relay output on the WT-4000 Series Thermostat. It is only applicable if your HVAC System is using an external relay to control fan operation. Most Pneumatic HVAC systems control fan operation at the equipment level. If your system does not have wires connected to the Fan Relay, you will not need to use the Fan Mode option. Refer to your HVAC System documentation for fan operation details.

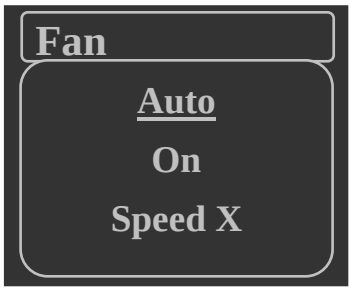
If your FAN Relay is not connected, you may skip this programming step.

1. When in Configuration Mode, press Up/Down buttons to Underline **FAN Mode** item



2. Press  Confirm button

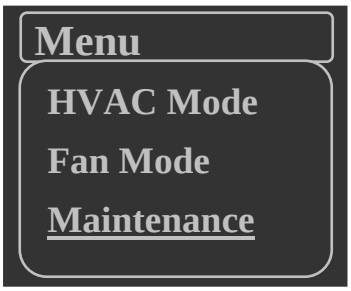
3. Use Up/Down buttons to choose between:
    a. **Auto – to run Fan only with heat or cool output.**
    b. **On – to run Fan continuously during Occupied and Unoccupied modes**
    c. Speed X – Adjustable fan speed - not supported in the version



4. Press  Confirm button
5. The LCD Screen will return to the normal operation screen, and changes will be effective immediately

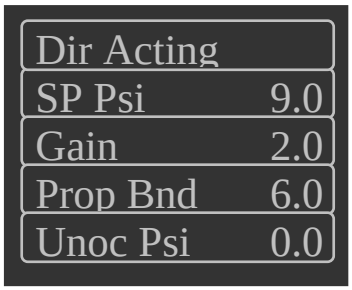
Maintenance – Pneumatic Settings

1. When in Configuration Mode, press Up/Down buttons to Underline **Maintenance** item



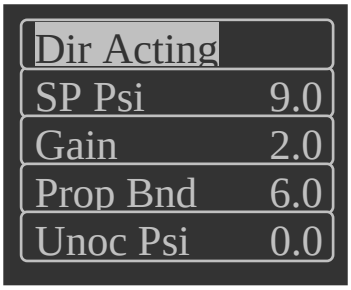
2. Press Confirm button

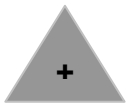
3. Use Up/Down buttons to choose between **Dir Acting, SP Psi, Gain, Prop Bnd** and **Unoc Psi**



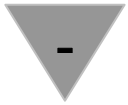
4. Press Confirm button to edit selected item – it will highlight on the menu as follows:

5. Change **Acting Direction**:





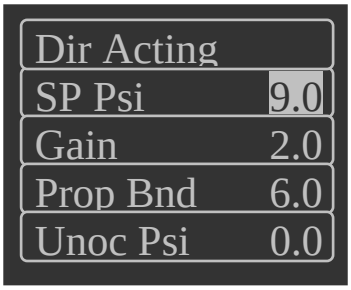
Press Up button to enable Direct Acting (Dir Acting)

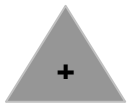


Press Down button to enable Reverse Acting (Rev Acting)

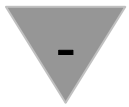
6. Press Confirm button when done.

7. Change **Set Point Pressure**:





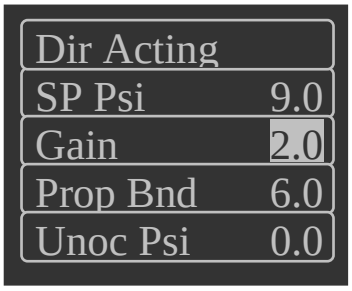
Press Up button to increase branch line pressure at Set Point; valid range 1.0 ~ 22.0 PSI with 0.5 PSI increment; default 9.0 PSI

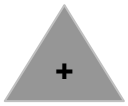


Press Down button to decrease branch line pressure at Set Point

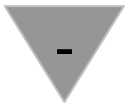
8. Press Confirm button when done.

9. Change **Gain**:





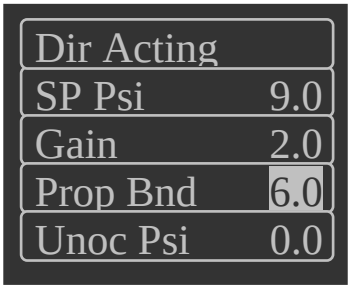
Press Up button to increase Pressure Gain, valid range 1.0 ~ 5.0 PSI with 0.5Psi increment; default 2.0 PSI.

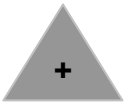


Press this button to decrease Pressure Gain.

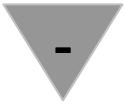
10. Press  Confirm Button when done.

11. Change **Temperature Proportional Range**:





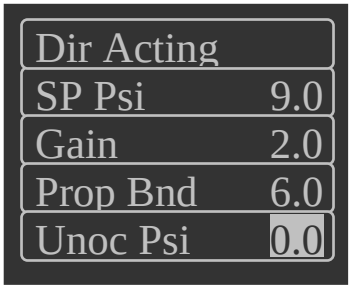
Press Up button to increase temperature proportional band; valid range 0.0 ~ 10.0F w/ 1F increment; default = 6.0F.

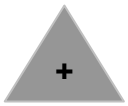


Press this button to decrease Temperature Proportional Band

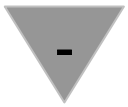
12. Press  Confirm Button when done.

13. Change **Unoccupied Mode Pressure**:





Press Up button to increase branch line pressure during unoccupied mode periods; valid range 0 ~ 22 PSI with 0.5 PSI increment; default = 0 PSI



Press this button to decrease branch line pressure during unoccupied mode periods.

14. Press  Confirm Button when done.

15. Press  Go Back to Previous Screen Button when done.

16. Left idle for 10 seconds Configuration Screen will go back to the normal operation screen.

2.6 WT-4000 Series Thermostat Installation Steps

Follow the steps below to install the WT-4000 Series Thermostat. Only install if you are familiar with HVAC maintenance and commercial thermostats.

1. Remove the old thermostat from the wall and disconnect air tubes. Be sure to mark the Branch and Main Lines.
2. Separate the wall plate from the WT-4000 Series Thermostat.

3. Mount the WT-4000 Series Thermostat wall plate to the mounting surface:
   a. Thread the existing air tubes from the wall through the large opening in the WT-4000 Series Thermostat wall plate. Position the wall plate against the mounting surface to be sure it seats flush.
   b. Use a small level or visually check that the WT-4000 Series Thermostat wall plate is level.
   c. Mounting holes on the wall plate are designed to fit a standard electrical box. If you need additional holes, mark the locations of the mounting holes on the mounting surface.
   d. Remove the wall plate from the mounting surface and drill additional mounting holes at the marked locations as needed.
   e. Using mounting hardware appropriate for the mounting surface (not supplied) and secure the WT-4000 Series Thermostat wall plate to the mounting surface.
4. Thread the air tubes from the wall through the WT-4000 Series Thermostat wall plate and connect them to the WT-4000 Series Thermostat.

Please refer to part 2.3 Clean Air Requirement to ensure quality air in the tubes.

IMPORTANT: Applying too much pressure to the pneumatic barbed connections on the WT-4000 Series Thermostat may cause irreparable damage to the unit.

5. Install four (4) Lithium 3.6 V batteries (supplied) into battery compartment in parallel. Please note, WT-4000 Series Thermostat will run on only 2 batteries installed, but for significantly shorter time. To maximize battery life, be sure to install all 4 batteries. Be sure to match the polarity of the batteries to the polarity of the battery holder on the WT-4000 Series Thermostat.

6. Once powered, WT-4000 Series Thermostat will initialize in:
   a. 30 seconds if it can connect to the network
   b. 3 minutes if network is not present

IMPORTANT: Do not press any buttons during initialization process! Configuration changes made during initialization will not be saved!

See Figure 6 below for LCD screen during initialization.

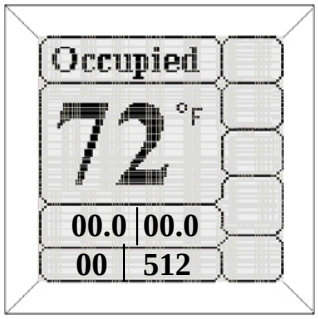


Figure 6. LCD Screen During Initialization

7. Check the wireless connectivity at the intended thermostat installation location – it might take about 30 seconds for WT-4000 Series Thermostat to initialize:
   a. **Look at the Wireless Connection Status indicator on the LCD screen (Figure 8):**
      i.  – Connection is established – correct operation
      ii. Blank – No connection
   b. **Look at the Number of Routes to the WT-BAC-IP on the LCD screen (Figure 8**):
      i. Blank – WT-4000 Series Thermostat is not connecting to the WT-BAC-IP
      ii. 1 – one connection
      iii. 2 – two or more paths established – correct operation
8. If your HVAC system is using a separate Fan control relay, connect it to FAN Relay on WT-4000 Series Thermostat.
9. Attach WT-4000 Series Thermostat onto the installed wall plate by aligning the slot in the enclosure with the top of the wall plate and sliding the bottom of the enclosure over the bottom of the wall plate. Use the supplied screw in the bottom of the enclosure to hold the wall plate secure to the enclosure.
10. Document the Device ID (DID) and location of each WT-4000 Series Thermostat on the floor plan. The Device ID label is located inside the cover on the left side of the WT-4000 Series Thermostat (Figure 2).

3.0 WT-4000 Series Thermostat Operation

WT-4000 Series Thermostat provides full electronic controls to pneumatic HVAC thermostat. Below are Control buttons and Display LCD Screen descriptions.

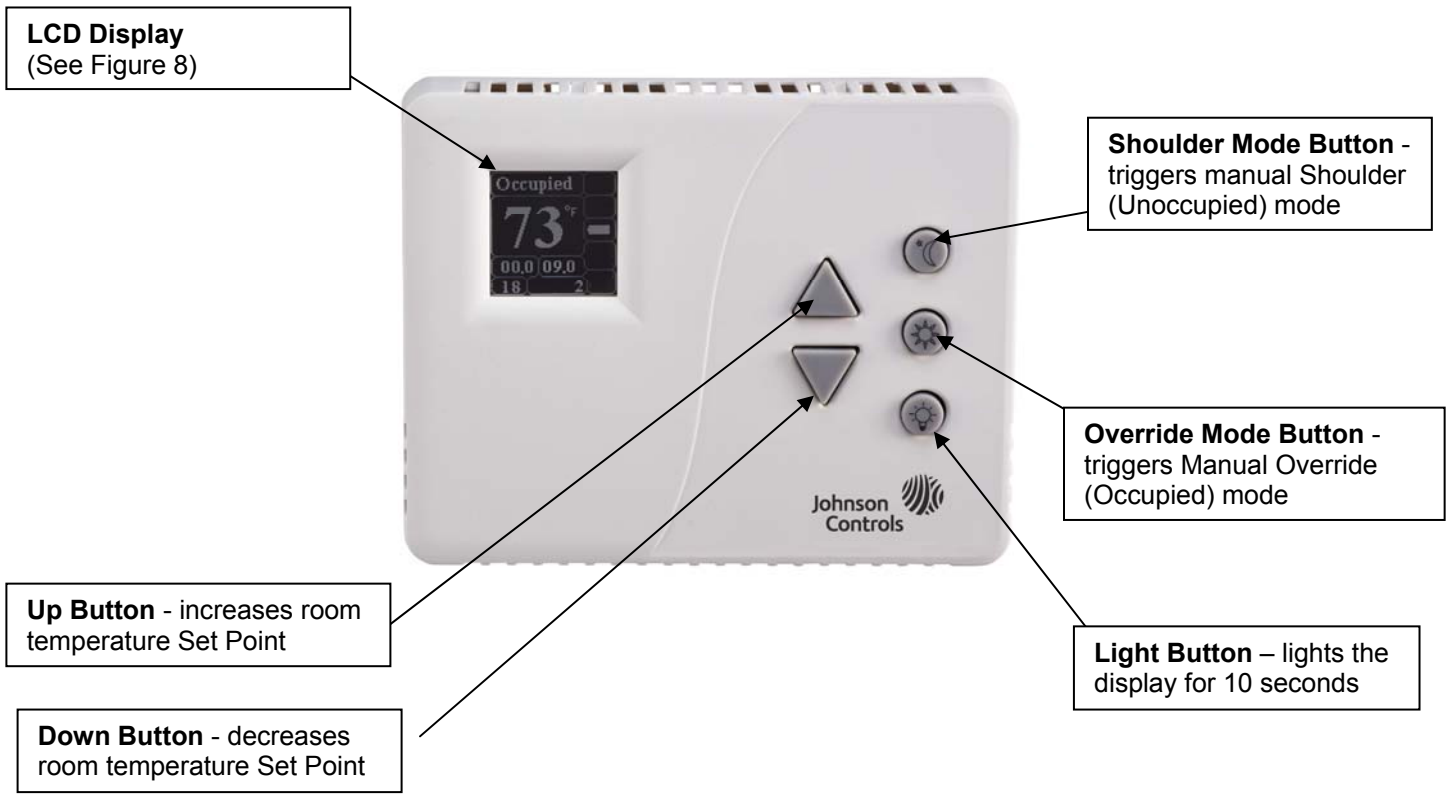


Figure 7. WT-4000 Series Thermostat Button Descriptions

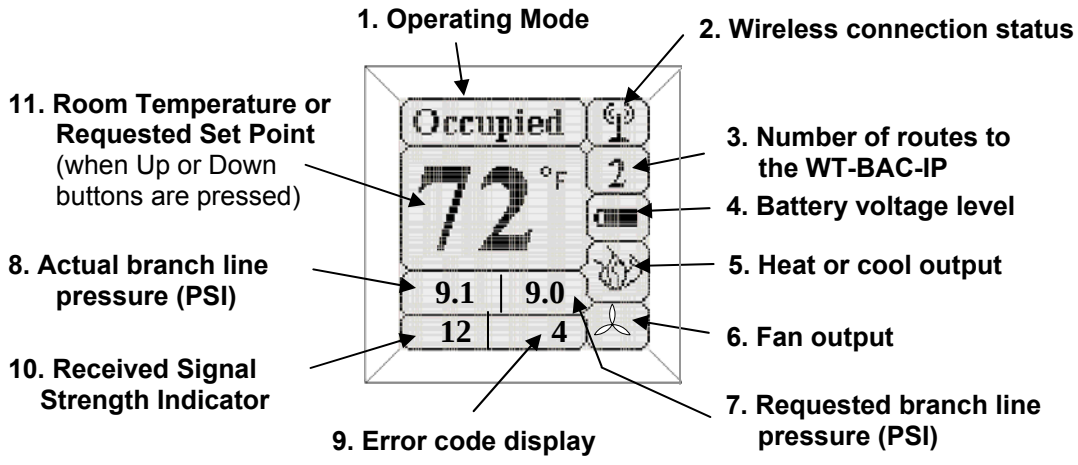


Figure 8. WT-4000 Series Thermostat LCD Display

3.1 LCD Display

1. **Operating Mode:**
   a. Occupied - scheduled occupied mode – temperature can be adjusted within the Comfort Zone
   b. Unoccupied – scheduled unoccupied mode – HVAC controls are off, temperature cannot be adjusted. To turn HVAC on, put WT-4000 Series Thermostat into Override mode by pressing Override Mode button  and then adjust temperature setting using Up/Down buttons.
   c. Override – manual override mode - temperature can be adjusted within the Comfort Zone
   d. Shoulder – manual unoccupied mode – temperature cannot be adjusted. Put WT-4000 Series Thermostat back to its scheduled mode by pressing Shoulder Mode button  again. “Occupied” will reappear on the main screen.
2. **Wireless Connection Status** – indicates if WT-4000 Series Thermostat can connect to the WT-BAC-IP Gateway:
   a.  – Connection is established
   b. Blank – No connection
3. **Number of Routes to the WT-BAC-IP Gateway** – indicates how many communications paths to the WT-BAC-IP that the WT-4000 Series Thermostat can see:
   a. Blank – WT-4000 Series Thermostat is not connecting to the WT-BAC-IP
   b. 1 – one connection
   c. 2 – two or more paths established – correct operation
4. **Battery Voltage Level:**
   a.  - Full battery
   b.  - Low battery, time to replace

5. **Heat or Cool output:**
   a.  – Cooling is on
   b.  – Heating is on
6. **Fan Output** (only applicable with a WT-4000 Series Thermostat where electric Fan Relay is supported; see Installation Instructions)**:**
   a.  – Fan is On
   b. Blank – Fan is Off
7. **Requested Branch Line Pressure (PSI) –** required branch line pressure based on the control calculation.
8. **Actual branch line pressure (PSI) -** measured values of the branch line pressure – should be within 0.6 of the Requested Branch Line Pressure.

9. **Error Code Display:**

Error Code	Description
2	0 PSI available in main line
4	Insufficient branch line pressure
8	Pressure down leak in the system (pressure decreasing while it should remain constant)
12	Insufficient branch line pressure and down leak in the system
16	Pressure up leak in the system (pressure increasing while it should remain constant)
22	Insufficient branch line pressure and up leak in the system
24	Both down leak and up leak in the system
Any other number	Product Error - please contact Tech Support for further instructions

10. **Received Signal Strength Indicator –** Relative Wireless Signal Strength Indicator between WT-4000 Series Thermostat and the device with which it communicates:
    a. **-39 and higher** – strong and solid wireless link. No further analysis needed.
    b. **-44 to -40** – wireless signal is getting through, but this device should be monitored. If signal strength deteriorates further there is a risk of data loss. Consider adding a WT-ROUTER between devices to strengthen the signal.
    c. **-45 and below or "---"** – device has very weak link or failing connect to other devices on the network and might be loosing a significant number of data packets. It may be too far from other devices or there may be wireless interference in the area. To strengthen the wireless link, add a WT-ROUTER between problematic device and other devices on the network to create an additional connection point.
11. **Room Temperature or Requested Set Point –** shows current room temperature. When Up/Down buttons are pressed once, it shows the current user the locally-defined Set Point.

3.2 Adjusting Room Temperature

WT-4000 Series Thermostat works in conjunction with the preset building configuration parameters; therefore you will only be able to change a room temperature within the predefined Room Comfort Zone.

1. Confirm that the WT-4000 Series Thermostat is in scheduled Occupied Mode – top of the LCD Screen must read "Occupied"
2. The temperature reading on LCD screen will display current room temperature

3. To increase/decrease room temperature – press Up/Down buttons to select the desired room temperature
   a. When you press Up/Down buttons once, LCD display will show the user-defined room Set Point value and the LCD will read “Set Point”. (When room temperature and Set Point are the same, HVAC equipment is off.)
   b. If neither Up or Down button is pressed again, within 5 seconds the display will return to the Main Screen
   c. When the Set Point in displayed, keep pressing Up/Down buttons to reach desired room Set Point temperature
   d. If you are pressing Up/Down buttons, but:
      i. Set Point stops increasing/decreasing - you have reached Comfort Zone limits
      ii. Set Point is not changing - your local controls are disabled
      iii. Contact your building Administrator if the room temperature min/max is not comfortable for you
   e. WT-4000 Series Thermostat will decide to heat or to cool based on the current room temperature and Set Point you specify
4. When the desired Set Point is specified, within 5 seconds the display will go back to the Main Screen.

5. If the LCD screen reads **Unoccupied**, the WT-4000 Series Thermostat is scheduled to be in unoccupied mode. If you need to Heat or Cool the area while the WT-4000 Series Thermostat is in unoccupied mode, put the WT-4000 Series Thermostat into Override Mode by pressing Override button . See section 3.3 below for more details.

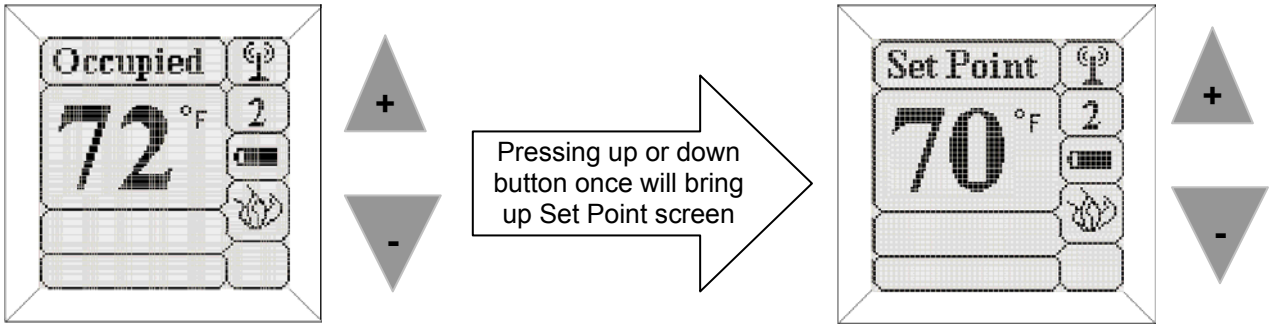


Figure 9. Changing Temperature Request

3.3 Using Override Mode Button

If LCD screen reads **Unoccupied** the WT-4000 Series Thermostat is scheduled to be in unoccupied mode and local thermostat controls are disabled. If you need to Heat or Cool the area:

1. Put the WT-4000 Series Thermostat into Override Mode by pressing Override button .
2. WT-4000 Series Thermostat will stay in Override Mode as defined by the configuration parameters (default - 2 hours). You will be able to adjust room temperature (within the Comfort Zone) for the duration of the Override.
3. Follow Step 3 in Section 3.2 *Adjusting Room Temperature* to change room temperature.
4. Once the override mode duration time expires, WT-4000 Series Thermostat will return to its originally scheduled mode.

5. If you need to extend the heating or cooling duration, press Override Button  again and follow Step 3 instructions above.

3.4 Using Shoulder Mode Button

Shoulder Mode Button allows you to put the WT-4000 Series Thermostat into a “shallow” set back mode. When the WT-4000 Series Thermostat is activated, it will not use HVAC equipment as long as the temperature is within the Shoulder mode Set Point limits configured (default ± 5F). For example, with a Setpoint of 70°F and the Shoulder Mode activated, the WT-4000 Series Thermostat will not turn HVAC equipment on as long as the room temperature is between 65°F and 75°F. Shoulder Mode can be utilized to reduce energy waste when you are leaving a room or zone earlier than when the scheduled Unoccupied Mode time starts.

1. Press the Shoulder Mode button  to activate Shoulder Mode.
2. Shoulder Mode has a limited duration time - WT-4000 Series Thermostat will go back into its regularly scheduled mode at the next scheduled Unoccupied Mode change.
3. To return to Occupied Mode, simply press the Shoulder Mode Button  again.

3.5 WT-4000 Thermostat Point Map

Object Name	Description	BACnet Type	Info
WT_4000_xxx_ai_57	Zone Temperature	AI	Temperature value in degree F multiplied by 10 (BACnet object shows actual value)
WT_4000_xxx_ai_62	Zone Temperature Setpoint - User	AI	This register represents set point specified by pressing up/down buttons on the unit, in degree F multiplied by 10 (BACnet object shows actual value); default 70 deg F
WT_4000_xxx_av_61	Zone Temperature Setpoint - System	AV	This register represents set point specified by energy management application, in degree F multiplied by 10 (BACnet object shows actual value); default 70 deg F
WT_4000_xxx_av_5	Mode = 1-Occ: 2-Unocc: 7-Setback	AV	Mode being requested by schedule 1 = Occupied 2 = Constrained float (unoccupied) 3 ~ 6: reserved 7 = Shoulder mode (shallow setback, also used in demand response events)
WT_4000_xxx_ai_60	Mode = 1-Occ: 2-Unocc: 7-Setback	AI	This register represents the mode that the unit is currently in. 1 = Occupied 2 = Constrained float (unoccupied) 3 ~ 6: reserved 7 = Shoulder mode
WT_4000_xxx_av_7	Comfort Upper Delta	AV	The value represents delta value in degree F multiplied by 10 (BACnet object shows actual value); default 3 deg F; maximum comfort zone is 14 deg F; **if set to 0x00FF this indicates that temperature will not be displayed on screen**
WT_4000_xxx_av_8	Comfort Lower Delta	AV	The value represents delta value in degree F multiplied by 10 (BACnet object shows actual value); default 3 deg F; maximum comfort zone is 14 deg F.
WT_4000_xxx_av_10	Constrained Upper Delta	AV	Default unoccupied mode; defines the upper temperature limit in constrained unoccupied mode; value represents limit in degree F multiplied by 10 (BACnet object shows actual value); default 85 deg F
WT_4000_xxx_av_11	Constrained Lower Delta	AV	Default unoccupied mode; defines the lower temperature limit in constrained unoccupied mode; value represents limit in degree F multiplied by 10 (BACnet object shows actual value); default 55 deg F
WT_4000_xxx_av_15	Override Upper Delta	AV	Comfort zone upper delta during override mode, in degree F multiplied by 10 (BACnet object shows actual value); default 5 degree F

Object Name (Cont'd.)	Description (Cont'd.)	BACnet Type (Cont'd.)	Info (Cont'd.)
WT_4000_xxx_av_16	Override Lower Delta	AV	Comfort zone lower delta during override mode, in degree F multiplied by 10 (BACnet object shows actual value); default 5 degree F
WT_4000_xxx_av_14	Override Timer Max	AV	Maximum 240 minutes; increment in minute
WT_4000_xxx_av_12	Max Protection Temperature	AV	Maximum temperature allowed in zone multiplied by 10 (BACnet object shows actual value); default 90 deg F
WT_4000_xxx_av_13	Min Protection Temperature	AV	Minimum temperature allowed in zone multiplied by 10 (BACnet object shows actual value); default 50 deg F
WT_4000_xxx_av_31_Byte_H	Setback Upper Delta	AV	Shoulder mode is used for shallow setback (as opposed to constrained float for deep setback); it is also the mode used in a demand response event; high byte indicates upper delta, in degree F multiplied by 10, relative to set point (BACnet object shows actual value); device does not call for cool if space temperature is below set point plus upper delta in shoulder mode; default 5 degree F
WT_4000_xxx_av_31_Byte_L	Setback Lower Delta	AV	Low byte indicates lower delta, in degree F multiplied by 10, relative to set point (BACnet object shows actual value); device does not call for heat if space temperature is above set point minus lower delta; default 5 degree F
WT_4000_xxx_av_9	Heat/Cool Delta	AV	Temperature delta in degree F multiplied by 10 before transitioning from heat to cool or cool to heat (BACnet object shows actual value); default value 0
WT_4000_xxx_av_18	Heat/Cool Dead Zone Delta	AV	Temperature control dead zone in degree F multiplied by 10 (BACnet object shows actual value); default 1 deg F
WT_4000_xxx_bi_59_Bit_2	Fan Status	BI	Bit 2 = Fan on (if applicable)
WT_4000_xxx_bi_59_Bit_1	Cooling Status	BI	Bit 1 = Cool on (branch line pressure in cooling zone)
WT_4000_xxx_bi_59_Bit_0	Heating Status	BI	Bit 0 = Heat on (branch line pressure in heating zone)
WT_4000_xxx_bi_59_Bit_7	Setback Button Pressed	BI	Bit 7 = Shoulder mode button pressed
WT_4000_xxx_bi_59_Bit_6	Override Button Pressed	BI	Bit 6 = Override mode button pressed
WT_4000_xxx_bi_59_Bit_10	Occupancy Sensor Shoulder Mode	BI	1 = in shoulder setback mode (no motion detected for 30 min) 0 = in occupied mode
WT_4000_xxx_av_224	Radio Channel	AV	Radio channel number used by the device
WT_4000_xxx_ai_204_Byte_H	Radio Received Signal Strength	AI	High byte indicates radio received signal strength (RSSI) (signed 8 bit for Modbus register; BACnet object shows actual value)
WT_4000_xxx_ai_201	Hop Count	AI	This register shows the number of hops that the device's data is routed through to reach the MeshGate. If this value is shown as 65535, the device is either offline or the batteries are dead.

Object Name (Cont'd.)	Description (Cont'd.)	BACnet Type (Cont'd.)	Info (Cont'd.)
WT_4000_xxx_ai_58_Byte_H	Branch Line Pressure Requested	AI	High byte indicates pressure requested by the unit based on temperature measurement, in PSI multiplied by 10 (BACnet object shows actual value)
WT_4000_xxx_ai_58_Byte_L	Branch Line Pressure Measured	AI	Low byte represents actual branch line pressure measured by the pressure sensor, in PSI multiplied by 10 (BACnet object shows actual value)
WT_4000_xxx_ai_54	High 16 bits of standard 32 bits UTC time	AI	High 16 bits of 32 bit UTC time (UNIX epoch time)
WT_4000_xxx_ai_55	Low 16 bits of standard 32 bits UTC time	AI	Low 16 bits of 32 bit UTC time
WT_4000_xxx_ai_73	Insufficient Pressure Value	AI	In the case where "Error Reporting Register" indicates "insufficient pressure error", this register holds the maximum branch pressure of the system at that time, in PSI multiplied by 10 (BACnet object shows actual value); default 5
WT_4000_xxx_ai_204_Byte_L	Battery Voltage	AI	Low byte: battery voltage level in VDC multiplied by 10 (BACnet object shows actual value)
WT_4000_xxx_av_69	Set point Pressure	AV	The pressure when temperature is at set point value, in PSI multiplied by 10 (BACnet object shows actual value); valid range 1.0 ~ 22.0 PSI; default 9.0 PSI
WT_4000_xxx_av_70_Byte_H	Acting Direction	AV	High byte shows acting direction: 0 = direct acting; 1 = reverse acting; default direct
WT_4000_xxx_av_70_Byte_L	Pressure Sensitivity (Gain)	AV	Low byte shows gain, which indicates change in branch line pressure in PSI multiplied by 10 (BACnet object shows actual value) in response to per degree F change in temperature; valid range 1.0 ~ 5.0, default 2.0 PSI per deg F
WT_4000_xxx_av_71	Temperature Proportional Band	AV	Temperature range in degree F multiplied by 10 (BACnet object shows actual value) where pressure changes in proportion to temperature change; valid range 0.0 ~ 10.0 degree F; default 6.0 deg F
WT_4000_xxx_av_79_Byte_L	Occupancy Non-Activity Grace Period	AV	Grace period for allowed time when motion is not detected before going into shoulder mode Allowed range: 10 - 100 minutes; default 30 minutes

3.6 Technical Specifications

WT-4000 Series Pneumatic-to-DDC Room Thermostats

Thermostat Type	Two-pipe
Control Action	DA/RA dual control action
Temperature Element Type	Advanced piezoelectric air valve
Air Connections	Dual barbed fittings for 5/32 or 1/4 in. (4 or 6 mm) O.D. polytubing
Sensitivity	Adjustable from 1 to 5 psi/F° (13 to 65 kPa/C°); factory set at approximately 2 psi/F° (26 kPa/C°)
Flow Capacity	699 scim (191 mL/s) at 14 psi (96 kPa)
Air Consumption	None
Supply Pressure	**Range:** 0 to 30 psig (0 to 207 kPa) maximum; air supply must be clean, dry, and oil-free **Note:** A minimum supply pressure is required to operate the controlled devices in the system.
	Accuracy: 1.5% of full scale
Setpoint Range	Adjustable up to ±14F° (±8.4C°); factory set at ±3F° (±1.8C°)
Temperature Measurement	**Range:** 32 to 99°F (0 to 37°C)
	Accuracy: ±1.0F° (±0.6C°)
Power Requirements	**Internal:** Four 3.6 VDC, Size AA lithium batteries; typical battery life up to 5 years
	External: Minimum 3.1 to maximum 12 VDC via screw terminal
Room Thermostat Display	LCD indicates room temperature, branch line pressure, temperature setpoint, occupied/setback mode, heat/cool fan status, battery voltage and wireless connection status; supports temperature setpoint adjustment, HVAC mode selection (auto/heat only/cool only), fan mode selection (auto/on), and maintenance mode selection
Wireless Band	Direct-sequence, spread-spectrum, 2.4 GHz ISM band
Operating Frequency Range	2,405 to 2,475 MHz
Channels	**Quantity:** 15
	Spacing: 5 MHz
Transmissions	**Power:** 18 dBm maximum
	Rate: 250 Kbits per second
Ambient Conditions	**Operating:** 41 to 99°F (5 to 37°C), 5 to 95% RH, noncondensing
	Storage: -40 to 185°F (-40 to 85°C), 5 to 95% RH, noncondensing
Materials	White ABS plastic housing
Compliance	**United States:** Transmission Complies with FCC Part 15.247 Regulations for Low Power Unlicensed Transmitters Transmitter FCC Identification: HSW-Z2430HPA RoHS compliant (EU Directive 2002/95/EC)
	Canada: Industry Canada IC: 4492A-Z2430HPA
Shipping Weight	0.75 lb (0.34 kg) excluding batteries and packaging