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

Installation Instructions

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 a proprietary 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:** The WT-4000 Series Pneumatic-to-DDC Room Thermostat is intended 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 :** Le WT-4000 Series Pneumatic-to-DDC Room Thermostat est destiné à transmettre des données entrantes à un équipement dans des conditions normales de fonctionnement. Lorsqu'une défaillance ou un dysfonctionnement du room thermostat risque de provoquer des blessures ou d'endommager l'équipement contrôlé ou un autre équipement, la conception du système de contrôle doit intégrer des dispositifs de protection supplémentaires. Veiller dans ce cas à intégrer de façon permanente d'autres dispositifs, tels que des systèmes de supervision ou d'alarme, ou des dispositifs de sécurité ou de limitation, ayant une fonction d'avertissement ou de protection en cas de défaillance ou de dysfonctionnement du 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.

Installation

The first step of the installation process is to plan the layout of the devices on the building floor plan. This process includes identifying the desired locations for all WT-4000 Series Pneumatic-to-DDC Room Thermostats, as well as the Johnson Controls WT-BAC-IP Gateway.

Next, measure the radial distances between each WT-4000 Series Room Thermostat and the WT-BAC-IP Gateway, to determine if the distances are within 200 ft (61 m). If the distance exceeds 200 ft (61 m), Johnson Controls WT-ROUTER Routers must be installed to relay signals between each room thermostat and the associated gateway.

The ideal installation provides each room thermostat with at least two routes of transmission to the gateway, to ensure signal transmission success. The nominal transmission range of each router in a standard building is 200 ft (61 m). To ensure proper signal transmission in a wireless mesh network, there should be at least two routers, or one router and one gateway, located within a 200 ft (61 m) radius of every room thermostat.

In order for the devices to connect to the same mesh network, they all must have the same group ID. Figure 1 illustrates the white sticker on the inside of the room thermostat housing, that shows the location of the group ID. This white sticker also includes additional device information, including the device ID. Both the group ID and the device ID can be changed in the field; see *Net Config Screen* on page 10 for more details.

Figure 1: White Sticker on Inside of Room Thermostat Housing Showing Location of Group ID (GID) and Device ID (DID)

Dimensions
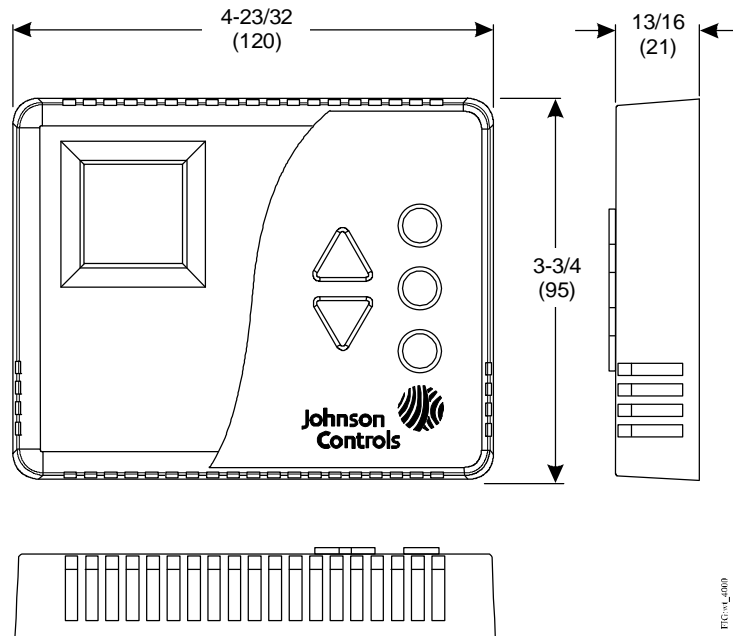
**Figure 2: WT-4000 Series Pneumatic-to-DDC Room Thermostat,
Dimensions, in. (mm)**

Mounting

The WT-4000-MCR, WT-4000-MCM, WT-4000-MFR, WT-4000-MFM wireless room thermostat models require the WT-BAC-IP Gateway and WT-ROUTER Router to operate as a complete wireless solution. Refer to the *WT-BAC-IP Gateway Installation Instructions (Part No. 24-10732-21)* for details on installing the gateway, and the *WT-ROUTER Router Installation Instructions (Part No. 24-10732-13)* for details on installing the router.

Tools and Hardware Required

- Couplings or reducers to connect room thermostats to existing air lines

- Needle nose pliers

- Small level

- Fasteners and anchors to secure room thermostats (site specific)

- Plastic tie wraps to secure routers (site specific)

- Electric drill (optional)

- Building floor plans identifying where the system is to be installed, serving multiple purposes:

  - To plan the wireless network before installation, by identifying room thermostat locations

  - To document the location of where each wireless device is installed

Mounting Procedure

Mount the WT-4000 Series Room Thermostat according to the steps that follow. Only those individuals that are experienced with HVAC maintenance and commercial room thermostats should perform this installation.

1. Remove the old room thermostat from the mounting surface and disconnect the air lines connected to it. Be sure to label the branch line and the main line.

2. Bend the four locking tabs on the wallplate outward to separate the wallplate from the new WT-4000 Series Room Thermostat.

3. Mount the wallplate to the mounting surface:

   a. Thread the existing air lines from the wall through the large opening in the wallplate.

   b. Position the wallplate against the mounting surface to be sure it seats flush with the surface.

   c. Use a small level or visually check that the wallplate is level.

d. Mounting holes on the wallplate are designed to fit a standard electrical box. If additional mounting holes are required, mark the locations on the mounting surface.

e. Remove the wallplate from the mounting surface and drill any additional mounting holes as needed at each of the marked locations.

f. Use the appropriate mounting hardware (field furnished) for the specific mounting surface and secure the wallplate to the surface.

4. Connect the air lines to the room thermostat. See *Clean Air Requirements* on page 5 to ensure that the air supply is clean, dry, and oil-free.

> **IMPORTANT:** Avoid applying excessive pressure while making the air line connections to the barbed fittings on the room thermostat. Failure to do so may damage the room thermostat and void the warranty.

5. Install the four 3.6 V lithium batteries included with the room thermostat into the battery compartment. Be sure to match the positive (+) battery ends with the positive (+) battery terminals in the battery compartment.

Note: The room thermostat can operate with just two batteries installed; however, it operates for a significantly shorter period of time. To maximize battery life, we recommend that all four batteries be installed.

6. Once powered up, the room thermostat initializes in:

a. 30 seconds if the room thermostat can connect to a network.

b. 3 minutes if a network is not present.

> **IMPORTANT:** Do not press any buttons during the initialization process. Configuration changes made during initialization are not saved.

Figure 3 illustrates the LCD during room thermostat initialization.

Figure 3: LCD during Initialization

7. Check the wireless connectivity at the intended room thermostat installation location. It may take approximately 30 seconds for the room thermostat to initialize.

a. Look at the **wireless connection status indicator** on the room thermostat LCD (Figure 5). If ⬚ shows on the upper-right corner of the LCD, the wireless connection is established and the room thermostat is operating properly. If the LCD is blank in the upper-right corner, there is no wireless connection.

b. Look at the **number of routes to the WT-BAC-IP Gateway** on the room thermostat LCD (Figure 5). If the number of routes is blank, the room thermostat is not connected to the gateway. If the number 1 shows, there is one connection. If the number 2 shows, there are two or more connections and the room thermostat is operating properly.

8. Attach the room thermostat to the previously installed wallplate by aligning the slot in the room thermostat housing with the top of the wallplate and sliding the bottom of the room thermostat housing over the bottom of the wallplate.

9. Document the device ID and the location of each room thermostat on the floor plan. A white sticker on the inside of the room thermostat housing includes the device ID (Figure 1).

Safety Measures for Electrostatic Sensitive Devices (ESDs)

The WT-4000 Series Room Thermostat includes an ESD-sensitive circuit board. Use caution when handling the room thermostat when the backplate (wallplate) is removed. Always carry the room thermostat in the static bag it was shipped in. Do not physically touch any part of the circuit board while connecting air lines, without wearing ESD protective gear. Even minimal electrostatic discharge can severely damage the room thermostat.

Clean Air Requirements

Before installing WT-4000 Series Room Thermostats, check that the air in the pneumatic lines is properly cleaned. Clean, dry, and oil-free air in the main supply line is required for normal room thermostat operation.

The pneumatic system must include a properly operating air dryer and coalescing air filter that removes water, oil, and other impurities from the main supply air before it reaches the room thermostat. If the existing pneumatic system is contaminated with water or oil, Johnson Controls recommends installation of a pre-filter before each room thermostat to protect the device from contaminants and failure.

Note: Room thermostat failures due to main supply air contamination with impurities including water, oil, dust, or other solid particles are not replaceable under the product warranty.

Johnson Controls recommends using the following in-line air filter with WT-4000 Series Room Thermostats:

- Johnson Controls A-4000-1037 In-Line Air Filter

Before installing room thermostats, check for the following:

- An air dryer that is operating properly
- A coalescing air filter that is replaced and maintained properly
- In-line air filters before each room thermostat where necessary

Order of Installation for Wireless Room Thermostat Models

The WT-4000-MCR, WT-4000-MCM, WT-4000-MFR, WT-4000-MFM wireless room thermostat models look for a wireless network as soon as they are powered up. We recommend that the WT-BAC-IP Gateway and WT-ROUTER Router are installed first to establish a network connection before the room thermostats are installed and powered.

If the room thermostats are installed before establishing a wireless network, be aware of the following:

- Once powered up, the room thermostat initializes and looks for a network for 3 minutes. During initialization, the LCD shows code 512 (Figure 3).

> **IMPORTANT:** Do not press any buttons during the initialization process. Configuration changes made during initialization are not saved.

- The room thermostat operates in the Occupied Mode with the following default settings:
    - Setpoint temperature: 70°F (21°C)
    - Comfort Zone: ±3F° (±1.8C°)
- The default settings can only be changed from the controller tool, once the WT-BAC-IP Gateway is installed.
- Once the WT-BAC-IP Gateway and the WT-ROUTER Routers are installed, check the LCD on each room thermostat to confirm that they are connected to the network (Figure 5).
- The default sampling interval is 5 minutes, so it may take some time for all of the room thermostats to establish a network connection.

In summary, install the components of the mesh network in the following order:
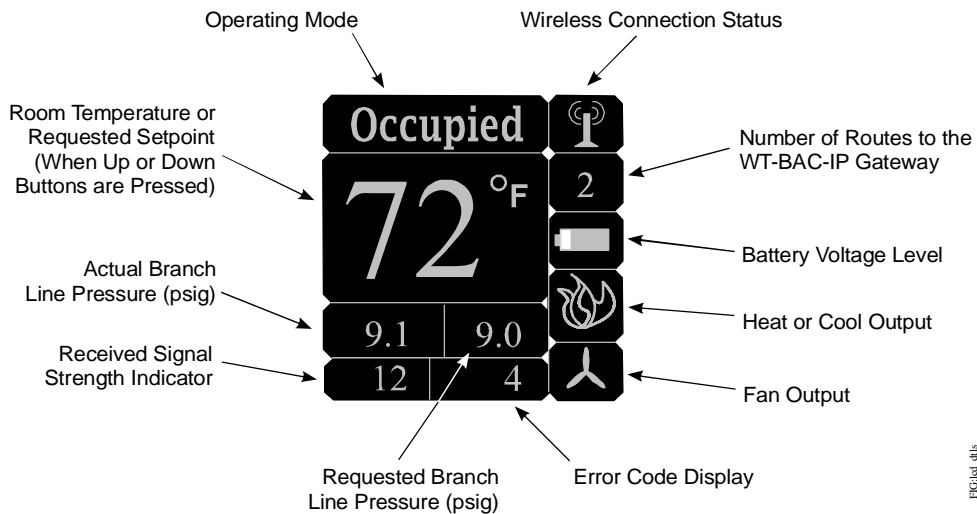
1. Install the WT-BAC-IP Gateway.
2. Install the WT-ROUTER Routers.
3. Configure the WT-4000 Series Room Thermostats; see *Setup and Adjustments* on page 6.
4. Install the WT-4000 Series Room Thermostats; see *Mounting Procedure* on page 3.

Setup and Adjustments

Since the room thermostats are battery-powered devices with internal memory, they can be configured prior to, or right after, installation. Johnson Controls recommends that all of the room thermostats be configured before installation, to prevent any possible issues with operation.

LCD – See Figure 5 for LCD Details

Shoulder Mode Button – Triggers Manual Shoulder (Unoccupied) Mode

Up Button – Increases the Room Temperature Setpoint

Override Mode Button – Triggers Manual Override (Occupied) Mode

Down Button – Decreases the Room Temperature Setpoint

Light Button – Lights the Display for 10 Seconds

Figure 4: WT-4000 Series Pneumatic-to-DDC Room Thermostat Button Descriptions

Operating Mode

Wireless Connection Status

Room Temperature or Requested Setpoint (When Up or Down Buttons are Pressed)

Number of Routes to the WT-BAC-IP Gateway

Battery Voltage Level

Actual Branch Line Pressure (psig)

Heat or Cool Output

Received Signal Strength Indicator

Fan Output

Requested Branch Line Pressure (psig)

Error Code Display

Figure 5: Expanded View of LCD Showing Details

Operating Mode

a. **Occupied – Scheduled Occupied Mode:** The temperature can be adjusted within the Comfort Zone.

b. **Unoccupied – Scheduled Unoccupied Mode:** The HVAC controls are off and the temperature cannot be adjusted. To turn the HVAC controls on, press the Override button

    to put the room thermostat in the Override mode, and then adjust the temperature setting using the Up/Down buttons.

c. **Override – Manual Override Mode:** The temperature can be adjusted within the Comfort Zone.

d. **Shoulder – Manual Unoccupied Mode:** The temperature cannot be adjusted. To put the room thermostat back to its scheduled mode,

   press the Shoulder button again; **Occupied** reappears on the main screen.

Wireless Connection Status

Indicates if the room thermostat is connected to the WT-BAC-IP Gateway.

a. : A connection is established.

b. Blank: There is no connection.

Number of Routes to the WT-BAC-IP Gateway

Indicates how many communication paths exist between the room thermostat and the WT-BAC-IP Gateway.

a. Blank: The room thermostat is not connected to the WT-BAC-IP Gateway.

b. **1**: One connection exists.

c. **2**: Two or more connections exist and the room thermostat is operating properly.

Battery Voltage Level

a. : The battery is fully charged.

b. : The battery charge is low and the batteries should be replaced.

Heat or Cool Output

a. : Cooling is on.

b. : Heating is on.

Requested Branch Line Pressure – psig (kPa)

Indicates the required branch line pressure based on the control calculation.

Actual Branch Line Pressure – psig (kPa)

Indicates the measured values of the branch line pressure. The actual branch line pressure should be within 0.6 psig (4 kPa) of the requested branch line pressure.

Display Codes

Table 1: Display Codes

Display Code	Description
2	0 psig (0 kPa) available in main line
4	Insufficient branch line pressure
8	Pressure down leak in the system (pressure decreases when it should remain constant)
12	Insufficient branch line pressure and pressure down leak in the system
16	Pressure up leak in the system (pressure increases when it should remain constant)
22	Insufficient branch line pressure and pressure up leak in the system
24	Both pressure down leak and pressure up leak in the system
512	Configuring wireless network
1024	Time and Date need to be configured (Stand-Alone Mode)
Any Other Number	Product error; contact the local Johnson Controls representative

Received Signal Strength Indicator

Indicates the relative strength of the wireless signal between the room thermostat and the device it is communicating with.

    a. **-39 and higher**: A strong and solid wireless connection exists; no further analysis is required.

    b. **-44 to -40**: The wireless signal is getting through; however, the room thermostat should be monitored. If the signal strength deteriorates further, there is a risk of data loss. Consider adding a WT-ROUTER Router between the devices to strengthen the signal.

    c. **-45 and lower, or ---** : The room thermostat has a very weak wireless connection or it is failing to connect to other devices on the network, resulting in the loss of a significant number of data packets. The room thermostat may be located too far from the other devices or there may be wireless interference in the area. To strengthen the wireless signal, add a WT-ROUTER Router between the problematic devices on the network to create an additional connection point.

Room Temperature or Requested Setpoint

Indicates the current room temperature. Pressing the Up/Down buttons once shows the locally-defined setpoint temperature.

Adjusting the Room Setpoint Temperature

The WT-4000 Series Room Thermostat operates in conjunction with the preset building configuration parameters; therefore, the room setpoint temperature can only be changed within predefined Comfort Zone limits.

1. Confirm that the room thermostat is in the scheduled Occupied Mode; the top of the LCD must read **Occupied**.

2. The temperature reading on the LCD displays the current room temperature. To increase or decrease the room setpoint temperature, press the Up/Down buttons to select the desired setpoint.

    a. When the Up/Down buttons are pressed once, the LCD shows the user-defined room setpoint value and the LCD reads **Setpoint**.

Note: When the room temperature and the setpoint value are the same, the HVAC equipment is off.

    b. If neither the Up or Down button is pressed again, the LCD returns to the main screen within 5 seconds.

    c. When the setpoint is displayed, keep pressing the Up/Down buttons to reach the desired room setpoint temperature.

    d. If the Up/Down buttons are pressed and the setpoint stops increasing or decreasing, predefined Comfort Zone limits have been reached. If the setpoint does not change, the local controls are disabled.

Note: Contact the building administrator if the room temperature minimum or maximum allowable settings are not comfortable.

    e. The room thermostat decides to heat or cool based on the current room temperature and the specified setpoint.

3. When the desired setpoint is specified, the LCD returns to the main screen within 5 seconds.

4. If the LCD reads **Unoccupied**, the room thermostat is scheduled to be in the Unoccupied Mode. If the area requires heating or cooling while the room thermostat is in the Unoccupied Mode, press the Override button to change the room thermostat to the Override Mode. See *Using the Override Mode Button* that follows.

Using the Override Mode Button

If the LCD reads **Unoccupied**, the room thermostat is scheduled to be in the Unoccupied Mode and the local room thermostat controls are disabled. If the area requires heating or cooling:

1. Press the Override button to change the room thermostat to the Override Mode.

2. The room thermostat stays in the Override Mode, as defined by the configuration parameters (default 2 hours). The room setpoint temperature can be adjusted within predefined Comfort Zone limits for the duration of the Override Mode period.

3. See Step 2 in the *Adjusting the Room Setpoint Temperature* section to change the room setpoint temperature.

4. Once the Override Mode period expires, the room thermostat returns to its originally scheduled mode. If the heating or cooling period needs to be extended, press the Override button again and follow Step 2 in the *Adjusting the Room Setpoint Temperature* section.

Using the Shoulder Mode Button

The Shoulder Mode button allows the WT-4000 Series Room Thermostat to be placed into a shallow setback mode. When the room thermostat is activated, it does not use HVAC equipment as long as the temperature is within the Shoulder Mode configured setpoint limits (default ±5F° [±3C°]).

For example, with a setpoint of 70°F (21°C) and the Shoulder Mode activated, the room thermostat does not turn the HVAC equipment on as long as the room temperature is between 65 and 75°F (18 and 24°C). Use the Shoulder Mode to save energy when a room or zone is vacated earlier than when the Unoccupied Mode is scheduled to begin.

1. Press the Shoulder button (☾) to activate the Shoulder Mode.

2. The Shoulder Mode period has a limited duration; the room thermostat goes back to its regularly scheduled mode at the next scheduled Unoccupied Mode change.

3. Press the Shoulder button (☾) again to return to the Occupied Mode.

Configuration

The following steps describe pre-installation, device-level configuration.

Room Thermostat Configuration Mode

1. Bend the four locking tabs on the wallplate outward to separate the wallplate from the room thermostat.

2. Install the four 3.6 V lithium batteries included with the room thermostat into the battery compartment. Be sure to match the positive (+) battery ends with the positive (+) battery terminals in the battery compartment.

3. Once powered up, the room thermostat initializes in:

   a. 30 seconds if the room thermostat can connect to a network.

   b. 3 minutes if a network is not present.

> **IMPORTANT:** Do not press any buttons during the initialization process. Configuration changes made during initialization are not saved.

Figure 3 illustrates the LCD during room thermostat initialization.

4. Press and hold the Shoulder button (☾) and the Override button (✧) simultaneously for 6 seconds to set the room thermostat in the Configuration Mode. Initially, the LCD changes to the firmware version screen (Figure 6), and then after 10 seconds the configuration menu appears (Figure 7).

5. Use the Up/Down buttons to navigate through the room thermostat menu. All further configuration settings must be made while in the Configuration Mode.

Note: If the configuration screen is left idle for 10 seconds, it returns to the normal operation screen.
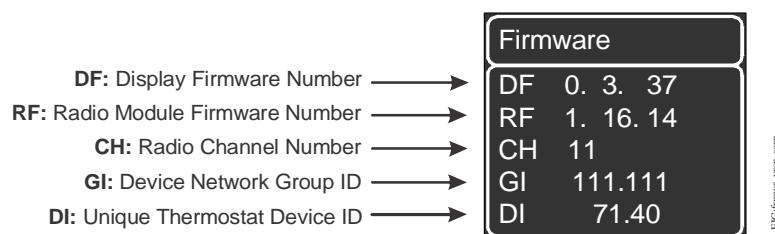
DF: Display Firmware Number ⟶
RF: Radio Module Firmware Number ⟶
CH: Radio Channel Number ⟶
GI: Device Network Group ID ⟶
DI: Unique Thermostat Device ID ⟶

```
Firmware
DF   0.  3.  37
RF   1.  16. 14
CH   11
GI      111.111
DI       71.40
```

Figure 6: WT-4000 Series Room Thermostat Firmware Version Screen

Net Config Screen

1. While in the Configuration Mode, press the Up/Down buttons to select the **Net Config** option (Figure 7).

```
Mesh
Net Config
Fan Mode
Standalone
Maintenance
```
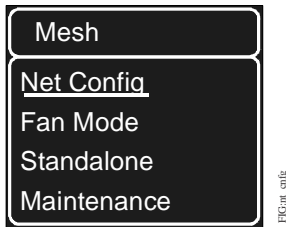FIG:nt_config

Figure 7: Selecting Net Config

2. Press ⬡ to confirm the selection.

3. Press the Up/Down buttons to select **CH** to change the radio channel number, **GI** to change the device network group ID, and **DI** to change the unique thermostat device ID (Figure 8).
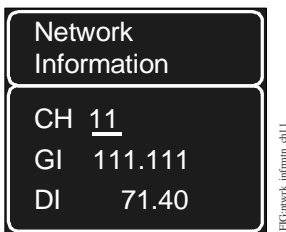
```
Network
Information

CH  11
GI   111.111
DI    71.40
```
FIG:network_infrmtn_ch11

Figure 8: Selecting CH, GI, or DI

4. Press ⬡ to confirm the selection. The LCD returns to the normal operation screen, and the settings are effective immediately.

Maintenance – Pneumatic Settings

1. While in the Configuration Mode, press the Up/Down buttons to select the **Maintenance** option (Figure 9).

```
Mesh
Net Config
Fan Mode
Standalone
Maintenance
```
FIG:mntnce
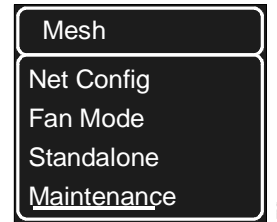
Figure 9: Selecting Maintenance

2. Press ⬡ to confirm the selection.

3. Press the Up/Down buttons to select the **Dir Acting**, **SP Psi**, **Gain**, **Prop Bnd**, or **Unoc Psi** option (Figure 10).

```
Dir Acting
SP Psi      9.0
Gain         2.0
Prop Bnd   6.0
Unoc Psi    0.0
```
FIG:pnmtc_sttngs
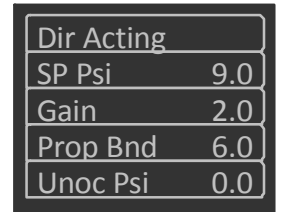
Figure 10: Selecting the Pneumatic Settings

4. Press ⬡ to edit the selected option, which is highlighted on the menu.

5. Change the **direction** as desired (Figure 11).
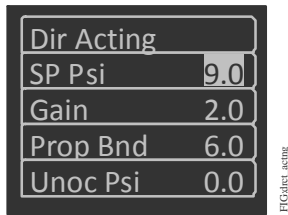
```
Dir Acting
SP Psi      9.0
Gain         2.0
Prop Bnd   6.0
Unoc Psi    0.0
```
FIG:dct_actng
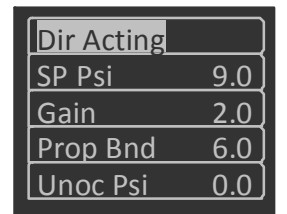
Figure 11: Changing the Direction

a. Press the Up button ▲ to enable direct acting (Dir Acting).

b. Press the Down button ▼ to enable reverse acting (Rev Acting).

---

6. Press ⬡ to confirm the selection.

7. Change the **setpoint pressure** as desired (Figure 12).

```
Dir Acting
SP Psi        9.0
Gain          2.0
Prop Bnd      6.0
Unoc Psi      0.0
```

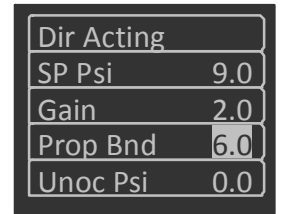**Figure 12: Changing the Setpoint Pressure**

a. Press the Up button ▲ to increase the branch line pressure at setpoint. The valid range is 1 to 22 psig (7 to 152 kPa), adjustable in increments of 0.5 psig (3 kPa). The default setting is 9 psig (62 kPa).

b. Press the Down button ▼ to decrease the branch line pressure at setpoint.

8. Press ⬡ to confirm the selection.

9. Change the **gain/sensitivity** as desired (Figure 13).

```
Dir Acting
SP Psi        9.0
Gain          2.0
Prop Bnd      6.0
Unoc Psi      0.0
```
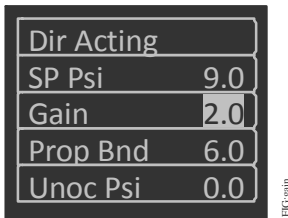
Figure 13: Changing the Gain/Sensitivity

a. Press the Up button ▲ to increase the gain/sensitivity. The valid range is 1 to 5 psi/F° (13 to 65 kPa/C°), adjustable in increments of 0.5 psig (3 kPa). The default setting is 2 psi/F° (26 kPa/C°).

b. Press the Down button ▼ to decrease the gain/sensitivity.

10. Press ⬡ to confirm the selection.

11. Change the **proportional band – proportional range/throttling range** as desired (Figure 14).

```
Dir Acting
SP Psi        9.0
Gain          2.0
Prop Bnd      6.0
Unoc Psi      0.0
```

Figure 14: Changing the Proportional Band – Proportional Range/Throttling Range

a. Press the Up button ▲ to increase the proportional band – proportional range/throttling range. The valid range is 0 to 10F° (0 to 6C°), adjustable in increments of 1F° (0.6C°). The default setting is 6F° (3.6C°).

b. Press the Down button ▼ to decrease the proportional band – proportional range/throttling range.

12. Press ⬡ to confirm the selection.

13. Change the **unoccupied mode pressure** as desired (Figure 15).

```
Dir Acting
SP Psi        9.0
Gain          2.0
Prop Bnd      6.0
Unoc Psi      0.0
```
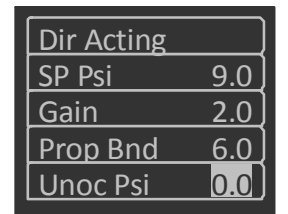
Figure 15: Changing the Unoccupied Mode Pressure

a. Press the Up button ▲ to increase the branch line pressure during Unoccupied Mode periods. The valid range is 0 to 22 psig (0 to 152 kPa), adjustable in increments of 0.5 psig (3 kPa). The default setting is 0 psig (0 kPa).

b. Press the Down button ▼ to decrease the branch line pressure during Unoccupied Mode periods.

14. Press ⊕ to confirm the selection.

15. Press ☾ to go back to the previous screen button when done.

Note: If the configuration screen is left idle for 10 seconds, it returns to the normal operation screen.

Commissioning

Table 2 includes a list of configurable settings that define how WT-4000 Series Room Thermostat pneumatic pressure commands correlate with the temperature values. Refer to the HVAC equipment documentation or service personnel for the actual values that should be configured on the room thermostat.

Table 2: WT-4000 Series Room Thermostat Configurable Settings

| Settings	Details	Range	Increments	System Defaults
Operational				
Net Config	CH – to change the radio channel number	11 through 26	1	11
	GI – to change the device network group ID	Two fields separated by a period; both fields are 1 through 255	1	111.111
	DI – to change the unique thermostat device ID	Two fields separated by a period; first field is 1 through 159, and second field is 1 through 246	1	71.40
Pneumatic				
Direction	Direct acting – branch line pressure increase turns on cooling; decrease turns on heating	N/A	N/A	Direct acting
	Reverse acting – branch line pressure increase turns on heating; decrease turns on cooling			
Setpoint, psig (kPa)	Branch line pressure when the room temperature and setpoint are equal (heating and cooling outputs are off)	1 to 22 psig (7 to 152 kPa)	0.5 psig (3 kPa)	9 psig (62 kPa)
Gain/ Sensitivity	Branch line pressure change needed to change the room temperature by 1F° (0.6C°)	1 to 5 psi/F° (13 to 65 kPa/C°)	0.5 psig (3 kPa)	2 psi/F° (26 kPa/C°)
Proportional Band – Proportional Range/ Throttling Range	Temperature range that represents movement of the controlled device from fully closed to fully open; typically 6F° (3.6C°) or 4 psi (28 kPa)	0 to 10F° (0 to 6C°)	1F° (0.6C°)	6F° (3.6C°)
Unoccupied Mode, psig (kPa)	Branch line pressure during the Unoccupied Mode (heating and cooling outputs are off)	0 to 22 psig (0 to 152 kPa)	0.5 psig (3 kPa)	0 psig (0 kPa)

Operation

The WT-4000 Series Pneumatic-to-DDC Room Thermostats are regulated by a number of operational modes that can be triggered by inputs such as changes in inside and outside 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 manages operation of HVAC equipment and restricts local room thermostat requests.

The two types of operational modes are scheduled and manual. Scheduled modes are triggered by occupancy schedules, and provide energy savings by aligning the operation of HVAC equipment to the actual building occupancy. Manual modes are initiated by the user at the room thermostat level, and adjust the operation of HVAC equipment manually outside of the schedule, but within set energy policy parameters.

The WT-4000 Series Room Thermostats are designed to support any 0 to 22 psig (0 to 152 kPa) pneumatic HVAC control system. Variation in branch line pressure is proportional to the deviation of room temperature from the setpoint. The proportional factor is determined by the gain/sensitivity, which is defined as the change in branch line pressure in psi (kPa) in response to a 1F° (0.6C°) change in room temperature.

Figure 16 illustrates the linear relationship between branch line pressure and room temperature, at a given setpoint for a Direct Acting (DA) room thermostat configuration. For a Reverse Acting (RA) room thermostat configuration, the graph is inverted horizontally.
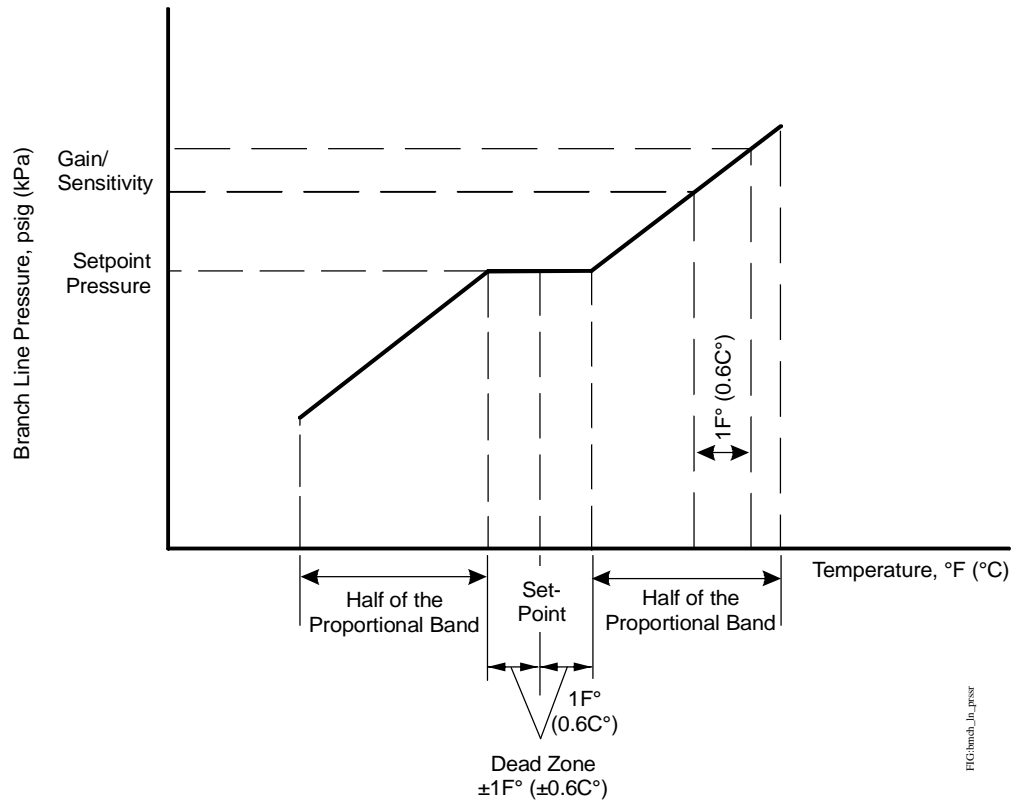
Figure 16: Branch Line Pressure vs. Room Temperature

In a DA room thermostat configuration, the branch line pressure increases in response to an increase in room temperature. When the room temperature is within the ±1F° (±0.6C°) dead zone around the setpoint, the branch line pressure is regulated at the setpoint pressure, and the pneumatic actuator is at the minimum heat (cool or neutral) position.

When the room temperature rises above the setpoint plus the dead zone, the branch line pressure increases proportionally to the increase in temperature. The proportional factor is defined by the gain/sensitivity value.

When the room temperature decreases below the setpoint minus the dead zone, the branch line pressure decreases proportionally to the decrease in temperature. The proportional band defines the temperature range, where the branch line pressure changes proportionally to the change in temperature.

Note: The setpoint pressure, dead zone, gain/sensitivity, and proportional band are adjusted using the menu buttons on the WT-4000 Series Room Thermostat.

Wireless Operation

The WT-4000 Series Pneumatic-to-DDC Room Thermostats include wireless and stand-alone models, designed to monitor and control pneumatic HVAC systems. The room thermostats are equipped with a 2.4 GHz IEEE 802.15.4 radio that communicates via a wireless mesh network. The wireless mesh network forms itself, and data communications enable remote monitoring, adjustment, and trending to provide longer and more dependable and maintenance-free operation.

Note: For each room thermostat in the wireless mesh network, only one object can be written at a time, and the next object cannot be written for at least 5 minutes.

In a wireless mesh network, the room thermostat operates as a battery-powered end node. Being an end node, the room thermostat does not operate as a router to relay data for other devices in the mesh network. Instead, the room thermostat 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 Gateway or through other WT-ROUTER Routers.

During wireless operation, an antenna icon appears in the upper-right corner of the LCD when the room thermostat communicates with the wireless mesh network (Figure 17). The number below the antenna icon represents the number of devices that the room thermostat can communicate with. It is desirable that the room thermostat have two devices it can communicate with. With two devices, if one communication link fails, then the other communication link can be used without delaying any transmissions.

Figure 17: LCD during Wireless Communication

When the room thermostat is installed in buildings with common sheetrock walls, the nominal radio communication range of the room thermostat is approximately 200 ft (61 m). If the room thermostat is located more than 200 ft (61 m) from the WT-BAC-IP Gateway, then WT-ROUTER Routers must be installed to relay data generated by the room thermostat back to the WT-BAC-IP Gateway.

Stand-Alone Operation

Stand-Alone Room Thermostat Occupancy Programming

The WT-4000-0CR, WT-4000-0CM, WT-4000-0FR, and WT-4000-0FM models operate as stand-alone pneumatic-to-DDC room thermostats with an independent time clock, and can be programmed with a Weekday/Weekend occupancy schedule.

During stand-alone operation, a person icon appears in the upper-right corner of the LCD (Figure 18). When the room thermostat is powered up for the first time, the number **1024** appears on the bottom of the LCD indicating that the time and date need to be set before the device can operate according to the occupancy schedule.

Figure 18: LCD during Stand-Alone Operation

A complete 7-day schedule consists of two independent components:

• Weekday Schedule – Monday through Friday

• Weekend Schedule – Saturday through Sunday

Each component is split into two parts to be scheduled as Occupied or Unoccupied Mode:

• Weekday 1

• Weekday 2

• Weekend 1

• Weekend 2

Each part can be configured to Occupied or Unoccupied Mode independently, to accommodate for daytime or nighttime shift schedules.

For each Occupied Mode, the following features can be configured:

• Occupied Mode start time

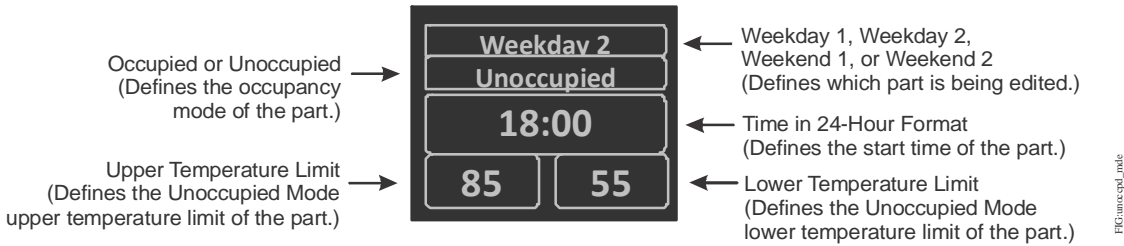• Temperature setpoint range – adjustable ±14F° (±8.4C°) by the room occupants

For each Unoccupied Mode, the following features can be configured:

• Unoccupied Mode start time

• Upper temperature limit

• Lower temperature limit – the room thermostat is off while the room temperature is within these limits

The start time of each schedule part is automatically the end time of the previous schedule part. For example, when the occupied schedule is 6 A.M. to 6 P.M., the Occupied Mode starts at 6 A.M. and the Unoccupied Mode starts at 6 P.M. Figure 19 and Figure 20 illustrate the Occupied and Unoccupied Mode schedule setup.

Occupied or Unoccupied (Defines the occupancy mode of the part.) → **Weekday 1** **Occupied**

07:00

Setpoint Temperature (Defines the Occupied Mode setpoint temperature of the part.) → **70**

← Weekday 1, Weekday 2, Weekend 1, or Weekend 2 (Defines which part is being edited.)

← Time in 24-Hour Format (Defines the start time of the part.)

Figure 19: WT-4000 Series Pneumatic-to-DDC Room Thermostat Schedule Setup Screen for Occupied Mode

Occupied or Unoccupied (Defines the occupancy mode of the part.) → **Weekday 2** **Unoccupied**

18:00

Upper Temperature Limit (Defines the Unoccupied Mode upper temperature limit of the part.) → **85** **55**

← Weekday 1, Weekday 2, Weekend 1, or Weekend 2 (Defines which part is being edited.)

← Time in 24-Hour Format (Defines the start time of the part.)

← Lower Temperature Limit (Defines the Unoccupied Mode lower temperature limit of the part.)

Figure 20: WT-4000 Series Pneumatic-to-DDC Room Thermostat Schedule Setup Screen for Unoccupied Mode

Stand-Alone Room Thermostat Configuration

To set the time and program the stand-alone room thermostat occupancy schedule and temperature setpoints:

1. Press and hold the Shoulder button (☾) and the

   Override button (☼) simultaneously for

   10 seconds to set the room thermostat in the Configuration Mode. Initially, the LCD changes to the firmware version screen, and then after 10 seconds the configuration menu appears. Confirm that the first line in the configuration menu shows **Standalone**; if it indicates **Mesh**, switch to **Standalone** (Figure 21).

   a. Press the Up button ▲ .

   b. Press (☼) to select.

   c. Press the Up button ▲ or the Down button

      ▼ to change the value.

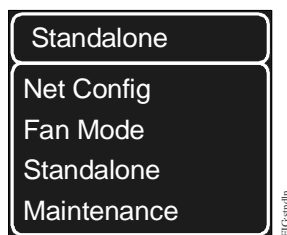   d. Press (☼) to confirm the selection.

Figure 21: Stand-Alone Menu

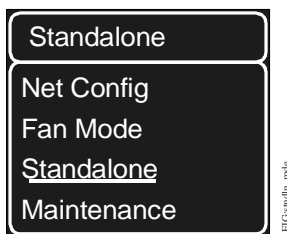2. Use the Up/Down buttons to select **Standalone** on the menu (Figure 22).

Figure 22: Selecting the Stand-Alone Mode

3. Press (☼) to confirm the selection.

4. Select **Date & Time** on the menu (Figure 23) and

   press (☼) to enter the setup screen.

Figure 23: Selecting Date and Time

5. In the **Date & Time** menu (Figure 24), press (☼)

   to highlight the menu options that require editing.

Figure 24: Setting the Date and Time

6. Press the Up button ▲ or the Down button

   ▼ to change the value.

7. Press (☼) to confirm the selection.

8. Repeat Step 5 through Step 7 until all of the menu options are configured correctly. Press the Up

   button ▲ or the Down button ▼ to scroll

   through the date and time menu options.

9. While in the configuration menu, use the Up/Down buttons to navigate to **Weekday** to program the weekday schedule.

10. Press (☼) to open the weekday schedule.

11. Set the **Weekday 1** schedule (Figure 25), which is usually the start of the Occupied Mode.
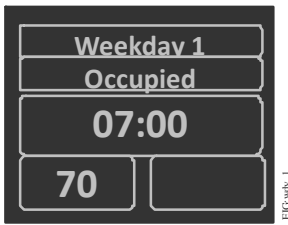
Figure 25: Setting the Weekday 1 Schedule

   a. Leave the top line as **Weekday 1**.

   b. Press the Up button ▲ or the Down button ▼ to scroll through the occupancy mode, start time, and lower temperature limit menu items.

   c. Press ⊕ to open a specific menu item.

   d. Press the Up button ▲ or the Down button ▼ to change the value, then press ⊕ to save the setting.

12. Set the **Weekday 2** schedule (Figure 26).
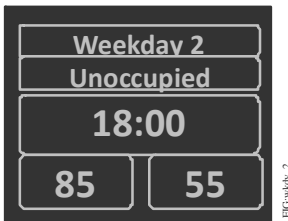
Figure 26: Setting the Weekday 2 Schedule

   a. Press the Up button ▲ or the Down button ▼ to navigate to **Weekday 1**.

   b. Press ⊕ to highlight the selection.

   c. Press the Up button ▲ or the Down button ▼ to change the selection to **Weekday 2**.

   d. Press ⊕ to save the setting.

   e. Press the Up button ▲ or the Down button ▼ to scroll through the occupancy mode, start time, upper temperature limit, and lower temperature limit menu items.

   f. Press ⊕ to open a specific menu item.

   g. Press the Up button ▲ or the Down button ▼ to change the value, then press ⊕ to save the setting.

13. While in the configuration menu, use the Up/Down buttons to navigate to **Weekend** (Figure 27).

Figure 27: Selecting Weekend

14. Program the weekend schedule in a similar manner as the weekday schedule.

15. Once all programming is complete, press 🌙 to exit the Configuration Mode.

Occupancy Programming Example – Standard Office Hours

- Setpoint: 70°F

- Occupied from 9 A.M. to 5 P.M., Monday through Friday

- Saturday and Sunday: Unoccupied, Upper Limit is 85°F, Lower Limit is 55°F

Program the WT-4000 Series Room Thermostat schedule setup screens as illustrated in Figure 28.

Weekday 1	Weekday 2	Weekend 1	Weekend 2
Occupied	**Unoccupied**	**Unoccupied**	**Unoccupied**
09:00	**17:00**	**09:00***	**17:00***
70	**85** **55**	**85** **55**	**85** **55**

* The start and end times are irrelevant, since both weekend parts are set to the same unoccupied mode.

**Figure 28: Occupancy Programming Schedule;
Standard Office Hours**

Occupancy Programming Example – Night Shift Hours

- Setpoint: 70°F

- Occupied from 3 P.M. to 6 A.M., Monday through Sunday

Program the WT-4000 Series Room Thermostat schedule setup screen as illustrated in Figure 29.

Weekday 1	Weekday 2	Weekend 1	Weekend 2
Unoccupied	**Occupied**	**Unoccupied**	**Occupied**
06:00	**15:00**	**06:00**	**15:00**
85 **55**	**70**	**85** **55**	**70**
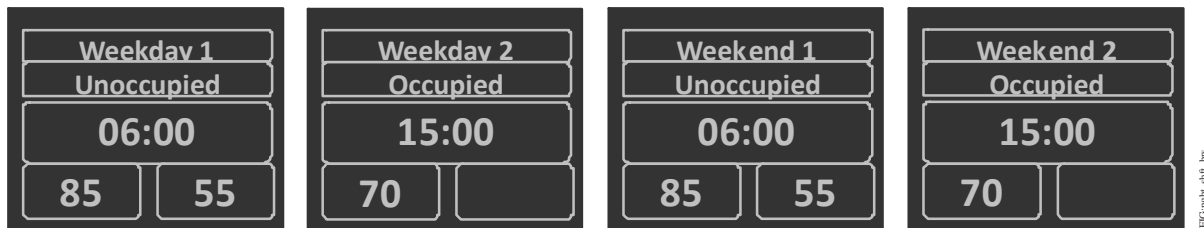
**Figure 29: Occupancy Programming Schedule;
Night Shift Hours**

Occupancy Programming Example – Extended Office Hours with Weekend Schedule

- Setpoint: 70°F

- Occupied from 8 A.M. to 6 P.M., Monday through Friday

- Occupied from 10 A.M. to 1 P.M., Saturday and Sunday

Program the WT-4000 Series Room Thermostat schedule setup screen as illustrated in Figure 30.

Figure 30: Occupancy Programming Schedule; Extended Office Hours with Weekend Schedule

Room Thermostat Operational Modes

Scheduled Modes

Scheduled WT-4000 Series Pneumatic-to-DDC Room Thermostat operational modes are regulated by the HVAC schedules, as defined by the user. The HVAC schedules can be set in advance through the building automation system for wireless communicating models, and locally at each room thermostat for stand-alone models. The room thermostat executes the HVAC schedules automatically.

Occupied Mode

Use the Occupied Mode when the room is scheduled to be occupied. During the Occupied Mode, the room temperature is defined by two values set by the room thermostat configuration parameters:

- Setpoint – the targeted room temperature for the season

- Comfort Zone – the optimal temperature range around the setpoint

The room thermostat maintains the room temperature within the Comfort Zone. If the room temperature falls outside of the range of the Comfort Zone, the room thermostat reacts accordingly and automatically requests heating or cooling.

The room thermostat allows users to adjust the room temperature using the local room thermostat, as long as the desired room temperature is within the range of the Comfort Zone. If the user requests heating or cooling outside of the range of the Comfort Zone, the request at the local room thermostat is overwritten by the room thermostat configuration parameters.

Example: The setpoint temperature is 70°F (21°C) and the range of the Comfort Zone is ±3F° (±1.8C°) around the setpoint temperature. The user is manually able to affect the room temperature only between 67 and 73°F (19 and 23°C), regardless of the temperature requested on the LCD of the local room thermostat. Stand-alone room thermostats do not feature a configurable Comfort Zone. Instead, stand-alone models have a factory set range of ±14F° (±8.4C°) around the installer-configured setpoint temperature in the Occupied Mode.

Unoccupied Mode

Use the Unoccupied Mode to save energy during those times when a room is unoccupied. The room thermostat does not call for heating or cooling when the room temperature is within the upper and lower Unoccupied Mode temperature limits. If the room temperature falls outside of the upper and lower Unoccupied Mode temperature limits, the room thermostat calls for heating or cooling to bring the room temperature back within the Unoccupied Mode upper and lower temperature limits.

Manual Modes

The following manual modes cannot be scheduled or triggered remotely. Instead, these manual modes can only be initiated locally via user interface with the room thermostat. All parameter-defining rules of each mode are configurable; see Table 3.

Override Mode

Press the Override button on the room thermostat to initiate the Override Mode. The Override Mode has a limited duration time, set by the room thermostat configuration parameters. After the Override Mode expires, the room thermostat returns to its regularly scheduled mode.

The Override Mode overrides the scheduled Occupied Mode or Unoccupied Mode by allowing the user to control the HVAC system through the local thermostat, and it permits a wider Comfort Zone range. If the room temperature is outside the Override Comfort Zone range, the room thermostat disables the local thermostat controls.

The Override Mode Comfort Zone range and the Override Mode duration time are set by the room thermostat configuration parameters; see Table 3.

Shoulder Mode

Press the Shoulder button on the WT-4000 Series Room Thermostat to initiate the energy saving transition from the Occupied Mode to the Unoccupied Mode. While in the Shoulder Mode, the room thermostat does not call for heating or cooling when the room temperature is between the upper and lower Shoulder Mode Comfort Zone temperature limits.

Use the Shoulder Mode to manually set back the room temperature setpoint if occupants leave the facility earlier than the scheduled time. Doing so essentially overrides the current schedule, until the next scheduled mode change occurs. For example, when the zone is running a 5-day, 8 A.M. to 6 P.M. occupancy schedule but one day the occupants are leaving at 2 P.M., the zone can be manually set into Shoulder Mode at 2 P.M. The room thermostat remains in Shoulder Mode until 6 P.M., at which time it follows its regular schedule again.

The upper and lower Shoulder Mode Comfort Zone temperature limits are set by the room thermostat configuration parameters; see Table 3.

Note: The Shoulder Mode can also be used as a Demand Response Mode, which can be triggered remotely from the monitoring and control application.

Fail-Safe Features

The WT-4000 Series Pneumatic-to-DDC Room Thermostats have a number of programmed fail-safe features that ensure continuous HVAC operation. In the event of a communication failure with the WT-BAC-IP Gateway, the wireless network, or the HVAC equipment, a fail-safe mechanism ensures that the devices continue to operate in logical fashion. Once the failure condition no longer exists, the devices recover from fail-safe mode and resume normal operation.

Loss of Radio Communication with Site Controller

If the room thermostat experiences radio communication failure with the WT-BAC-IP Gateway, the room thermostat automatically goes into the Occupied Mode. When the room thermostat regains communication with the WT-BAC-IP Gateway, the room thermostat automatically receives updated mode status, setpoint values, and other configuration commands based on the latest user schedule.

Protection Zone

To protect building infrastructure, equipment, and occupants, the room thermostat has extreme temperature limits (configurable by the user) that allow temperatures to float independently from any mode settings. If these temperature limits are reached, the room thermostat automatically reacts and adjusts heating or cooling despite what scheduled mode is running. The protection zone default value for the upper temperature limit is 95°F (35°C) and the lower temperature limit is 40°F (4°C).

WT-4000 Series Pneumatic-to-DDC Room Thermostat Configuration Parameters

The variables included in Table 3 define the
WT-4000 Series Pneumatic-to-DDC Room Thermostat
configuration parameters and regulate room thermostat
operation.

Table 3:   WT-4000 Series Room Thermostat Configuration Parameters (Part 1 of 2)

Parameter	Description	Configuration Method
Occupied Mode		
Setpoint value	Zone setpoint temperature	Configuration tool
Comfort Zone upper delta; default = 14F° (8.4C°)	Upper temperature bound on deviation from configuration parameters setpoint during Occupied Mode	Configuration tool
Comfort Zone lower delta; default = 14F° (8.4C°)	Lower temperature bound on deviation from parameter setpoint during Occupied Mode	Configuration tool
Unoccupied Mode		
Constrained float upper limit; default = 85°F (29°C)	Defines upper temperature limit in Unoccupied Mode; HVAC equipment remains off while the zone temperature is between the upper and lower limits	Configuration tool
Constrained float lower limit; default = 55°F (13°C)	Defines lower temperature limit in Unoccupied Mode; HVAC equipment remains off while zone temperature is between the upper and lower limits	Configuration tool
Override Mode		
Override duration; default = 120 minutes	Room thermostat override duration (240 minute maximum duration); after time limit expires, room thermostat goes into regularly scheduled mode	Configuration tool
Override Mode Comfort Zone upper delta; default = 14F° (8.4C°)	Comfort Zone upper delta during Override Mode	Configuration tool
Override Mode Comfort Zone lower delta; default = 14F° (8.4C°)	Comfort Zone lower delta during override Mode	Configuration tool
Other Parameters		
Network configuration (Net Config)	CH: To change the radio channel number; default = 11 GI: To change the device network group ID; default = 111.111 DI: To change the unique thermostat device ID; default = 71.40	Configuration tool, room thermostat
Operational modes	1: Occupied 2: Unoccupied	Factory configured
Dead zone delta; default = 1F° (0.6C°)	Temperature range around setpoint, to prevent HVAC from chattering	Configuration tool
Room thermostat protection zone – upper limit; default = 95°F (35°C)	Maximum temperature allowed in zone; fail-safe feature applicable to all zones	Factory configured
Room thermostat protection zone – lower limit; default = 40°F (4°C)	Minimum temperature allowed in zone; fail-safe feature applicable to all zones	Factory configured
Default Occupied Mode start time in the event of wireless communication failure; default = 06:00 A.M.	Time of day (0 to 24 hours) in the event the room thermostat goes offline for an extended duration	Factory configured

Table 3: WT-4000 Series Room Thermostat Configuration Parameters (Part 2 of 2)

Parameter	Description	Configuration Method
Default Occupied Mode setpoint value in the event of wireless communication failure; default = 70°F (21°C)	Temperature used in the event the room thermostat goes offline for an extended duration	Factory configured
Default Unoccupied Mode setpoint start time in the event of wireless communication failure	Time of day (0 to 24 hours) in the event the room thermostat goes offline for an extended duration; disabled in default configuration; therefore, device does not go into Unoccupied Mode when offline	Factory configured
Temperature sensor calibration factor; °F (°C)	Calibrates the room thermostat temperature sensor for offset compensation	Factory configured
Shoulder Mode Comfort Zone upper delta	Defines upper temperature limit in Shoulder Mode	Configuration tool
Shoulder Mode Comfort Zone lower delta	Defines lower temperature limit in Shoulder Mode	Configuration tool
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	Configuration tool, room thermostat
Setpoint psig	Branch line pressure when room temperature and setpoint are equal (no heating or cooling outputs)	Configuration tool, room thermostat
Gain/sensitivity	Branch line pressure change needed to change the room temperature by 1F° (0.6C°)	Configuration tool, room thermostat
Proportional band – proportional range/throttling range	Temperature range that represents the controlled device's movement from fully closed to fully open; typically 4F° (2.4C°) or 6F° (3.6C°)	Configuration tool, room thermostat
Unoccupied Mode psig	Branch line pressure during Unoccupied Mode when zone temperature is within unoccupied constrained upper and lower limits	Configuration tool, room thermostat

Table 4: WT-4000 Series Room Thermostat Point Mapping (Part 1 of 3)

Object Name[1]	Description	BACnet® Type	Read/Write or Read-Only	More Information
WT_4000_xxx_av_5	Mode = 1-Occ: 2-Unocc: 7-Shoulder	AV	Read/write	Mode being requested by schedule 1 = Occupied 2 = Constrained float (Unoccupied) 3 to 6: Reserved 7 = Shoulder Mode (shallow setback, also used in demand response events)
WT_4000_xxx_av_7	Comfort upper delta	AV	Read/write	The value represents delta value in °F (°C) multiplied by 10 (BACnet object shows actual value); default 3°F (1.8°C); maximum comfort zone is 14°F (8.4°C)
WT_4000_xxx_av_8	Comfort lower delta	AV	Read/write	The value represents delta value in °F (°C) multiplied by 10 (BACnet object shows actual value); default 3°F (1.8°C); maximum comfort zone is 14°F (8.4°C)
WT_4000_xxx_av_9	Heat/Cool delta	AV	Read/write	Temperature delta in °F (°C) multiplied by 10 before transitioning from heating to cooling or cooling to heating (BACnet object shows actual value); default 0°F (0°C)
WT_4000_xxx_av_10	Constrained upper delta	AV	Read/write	Default Unoccupied Mode; defines the upper temperature limit in constrained Unoccupied Mode; value represents limit in °F (°C) multiplied by 10 (BACnet object shows actual value); default 85°F (29°C)
WT_4000_xxx_av_11	Constrained lower delta	AV	Read/write	Default Unoccupied Mode; defines the lower temperature limit in constrained Unoccupied Mode; value represents limit in °F (°C) multiplied by 10 (BACnet object shows actual value); default 55°F (13°C)
WT_4000_xxx_av_12	Maximum protection temperature	AV	Read/write	Maximum temperature allowed in zone multiplied by 10 (BACnet object shows actual value); default 95°F (35°C)
WT_4000_xxx_av_13	Minimum protection temperature	AV	Read/write	Minimum temperature allowed in zone multiplied by 10 (BACnet object shows actual value); default 40°F (4°C)
WT_4000_xxx_av_14	Override timer maximum	AV	Read/write	Maximum 240 minutes; in increments of 1 minute
WT_4000_xxx_av_15	Override upper delta	AV	Read/write	Comfort Zone upper delta during Override Mode, in °F multiplied by 10 (BACnet object shows actual value); default 5°F (3°C)
WT_4000_xxx_av_16	Override lower delta	AV	Read/write	Comfort Zone lower delta during Override Mode, in °F (°C) multiplied by 10 (BACnet object shows actual value); default 5°F (3°C)
WT_4000_xxx_av_18	Heat/Cool dead zone delta	AV	Read/write	Temperature control dead zone in °F (°C) multiplied by 10 (BACnet object shows actual value); default 1°F (0.6°C)
WT_4000_xxx_av_31_Byte_H	Setback upper delta	AV	Read/write	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 °F (°C) multiplied by 10, relative to setpoint (BACnet object shows actual value); device does not call for cooling if room temperature is below setpoint plus upper delta in Shoulder Mode
WT_4000_xxx_av_31_Byte_L	Setback lower delta	AV	Read/write	Low byte indicates lower delta, in °F (°C) multiplied by 10, relative to setpoint (BACnet object shows actual value); device does not call for heating if room temperature is above setpoint minus lower delta

Table 4: WT-4000 Series Room Thermostat Point Mapping (Part 2 of 3)

Object Name[1]	Description	BACnet® Type	Read/Write or Read-Only	More Information
WT_4000_xxx_av_33	Display mode	AV	Read/write	0 = Normal LCD and button functionality 1 = No temperature display; buttons are disabled 2 = Normal LCD functionality; buttons are disabled **Note:** Display mode set to any other value results in normal LCD and button functionality; this feature is not supported for stand-alone models.
WT_4000_xxx_ai_54	High 16 bits of standard 32 bits UTC time	AI	Read-only	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	Read-only	Low 16 bits of 32 bit UTC time
WT_4000_xxx_ai_57	Zone temperature	AI	Read-only	Temperature value in degree F multiplied by 10 (BACnet object shows actual value)
WT_4000_xxx_ai_58_Byte_H	Branch line pressure requested	AI	Read-only	High byte indicates pressure requested by the unit based on temperature measurement, in psig (kPa) multiplied by 10 (BACnet object shows actual value)
WT_4000_xxx_ai_58_Byte_L	Branch line pressure measured	AI	Read-only	Low byte represents actual branch line pressure measured by the pressure sensor, in psig (kPa) multiplied by 10 (BACnet object shows actual value)
WT_4000_xxx_bi_59_Bit_0	Heating status	BI	Read-only	Active = heating on (branch line pressure in heating zone)
WT_4000_xxx_bi_59_Bit_1	Cooling status	BI	Read-only	Active = cooling on (branch line pressure in cooling zone)
WT_4000_xxx_bi_59_Bit_6	Override button pressed	BI	Read-only	Active = Override Mode button pressed
WT_4000_xxx_bi_59_Bit_7	Setback button pressed	BI	Read-only	Active = Shoulder Mode button pressed
WT_4000_xxx_bi_59_Bit_10	Occupancy sensor Shoulder Mode	BI	Read-only	Active = in Shoulder Setback Mode (no motion detected for 30 minutes) Inactive = in Occupied Mode **Note:** Supply air must be provided to the room thermostat for this feature to be functional.
WT_4000_xxx_ai_60	Mode = 1-Occ: 2-Unocc: 7-Shoulder	AI	Read-only	This register represents the mode that the unit is currently in. 1 = Occupied 2 = Constrained float (Unoccupied) 3 to 6: Reserved 7 = Shoulder Mode
WT_4000_xxx_av_61	Zone temperature setpoint - system	AV	Read/write	This register represents setpoint specified by energy management application, in °F (°C) multiplied by 10 (BACnet object shows actual value); default 70°F (21°C)
WT_4000_xxx_ai_62	Zone temperature setpoint - user	AI	Read-only	This register represents setpoint specified by pressing Up/Down buttons on the unit, in °F (°C) multiplied by 10 (BACnet object shows actual value); default 70°F (21°C)
WT_4000_xxx_av_69	Setpoint pressure	AV	Read/write	The pressure when temperature is at setpoint value, in psig (kPa) multiplied by 10 (BACnet object shows actual value); valid range 1 to 22 psig (7 to 152 kPa); default 9 psig (62 kPa)
WT_4000_xxx_av_70_Byte_H	Action direction	AV	Read/write	High byte shows action direction: 0 = direct acting (default) 1 = reverse acting

Table 4: WT-4000 Series Room Thermostat Point Mapping (Part 3 of 3)

Object Name[1]	Description	BACnet® Type	Read/Write or Read-Only	More Information
WT_4000_xxx_av_70_Byte_L	Pressure gain/sensitivity	AV	Read/write	Low byte shows gain/sensitivity, which indicates change in branch line pressure in psig (kPa) multiplied by 10 (BACnet object shows actual value) in response to per 1F° (0.6C°) change in temperature; valid range 1 to 5 psi/F° (13 to 65 kPa/C°), default 2 psi/F° (26 kPa/C°)
WT_4000_xxx_av_71	Temperature proportional band	AV	Read/write	Temperature range in °F (°C) multiplied by 10 (BACnet object shows actual value) where pressure changes in proportion to temperature change; valid range 0 to 10F° (0 to 6C°); default 6F° (3.6C°)
WT_4000_xxx_av_72	Unoccupied Mode pressure	AV	Read/write	Pressure when the room thermostat is in the Unoccupied Mode and within the temperature constrained float limits, in psig (kPa) multiplied by 10 (BACnet object shows actual value)
WT_4000_xxx_ai_73	Insufficient pressure value	AI	Read-only	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 psig (kPa) multiplied by 10 (BACnet object shows actual value).
WT_4000_xxx_ai_201	Hop count	AI	Read-only	This register shows the number of hops that the device's data is routed through to reach the WT-BAC-IP Gateway. If this value is shown as **65535**, the device is **either offline or the batteries are dead**.
WT_4000_xxx_ai_204_Byte_H	Radio received signal strength	AI	Read-only	High byte indicates radio received signal strength (RSSI)
WT_4000_xxx_ai_204_Byte_L	Battery voltage	AI	Read-only	Low byte: battery voltage level in VDC multiplied by 10 (BACnet object shows actual value)
WT_4000_xxx_ai_510	Device type identifier	AI	Read-only	This register holds an integer value that identifies the device type in the wireless mesh network; not for customer applications.

1. For each WT-4000 Series Room Thermostat in the wireless mesh network, only **one object can be written at a time**, and **the next object cannot be written for at least 5 minutes**.

Repair Information

If the WT-4000 Series Pneumatic-to-DDC Room Thermostat fails to operate within its specifications, replace the unit. For a replacement room thermostat, contact the nearest Johnson Controls representative.

Technical Specifications

WT-4000 Series Pneumatic-to-DDC Room Thermostats (Part 1 of 2)

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
Gain/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 psig (96 kPa)
Air Consumption	None
Supply Pressure	**Range:** 12 to 18 psig (83 to 124 kPa) nominal; 30 psig (207 kPa) maximum **Note:** The air supply must be clean, dry, and oil-free.
	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 4 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, battery voltage and wireless connection status; supports temperature setpoint adjustment, network configuration (Net Config) selection (CH, GI, or DI), 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

The performance specifications are nominal and conform to acceptable industry standard. For application at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.