CYPRESS
ENVIROSYSTEMS

Wireless Pneumatic Thermostat (WPT)
Wireless Network Planning Guide

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Contents

1. Introduction

1.1. Purpose

The purpose of this document is to provide guidelines for installers on maximizing wireless communication range and performance by proper placement of repeaters (RWALs), and USB Hubs (HUSBs).

1.2. Scope

The Wireless Pneumatic Thermostat (WPT) Wireless System described in this document includes the following:

- Wireless Pneumatic Thermostats (WPT-800-TXXXX)
- Wall Powered Repeaters (WPT-800-RWAL)
- USB Hubs (WPT-800-HUSB)

This document does not describe the specification, installation, commissioning, operation, and troubleshooting of the WPT system devices.

1.3. Related Documents

Topic	Reference Document	Document No.
Features and benefits of the WPT	Wireless Pneumatic Thermostat Product Brief	PBWPT
Installing and configuring RWAL	RWAL Installation Manual	910-00002-01
Installing and configuring the HUSB	HUSB Installation Manual	910-00003-01
Installing and configuring the WPT	WPT Installation Manual	910-00005-01
Installing and configuring the WPT Green Box	WPT Green Box Installation Manual	910-00007-01
BACnet objects and properties supported by the WPT Green Box	WPT BACnet PICS	910-00008-01
Using the wireless range tester kit	WPT Wireless Range Tester Kit User Manual	910-00009-01

2. WPT Wireless System Overview

2.1. About the WPT

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

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

The WPT can function either as a standalone system or can be integrated with an existing Building Management System via BACnet/IP. As a result, the WPT helps a building owner and tenants save energy, improve comfort, and reduce the maintenance cost of the legacy pneumatic HVAC systems.

2.2. About the Cypress Envirosystems Wireless Technology

The WPT uses highly integrated, low power, high performance 2.4GHz Direct Sequence Spread Spectrum (DSSS) radios from Cypress Semiconductor. The radios operate in the 2.4 GHz unlicensed Industrial, Scientific, and Medical RF band with a maximum transmission power of +20dBm (100mW). Extensive testing has shown that our wireless solution has a negligible effect on the data throughput of other wireless technologies, such as Bluetooth, Wi-Fi, and cell phones.

2.3. WPT System Architecture

The WPT wireless network uses a Hybrid Mesh-Star topology that increases the ranges with longer battery life and robust wireless communication. The WPT system architecture with multiple options is shown in Figure 1.

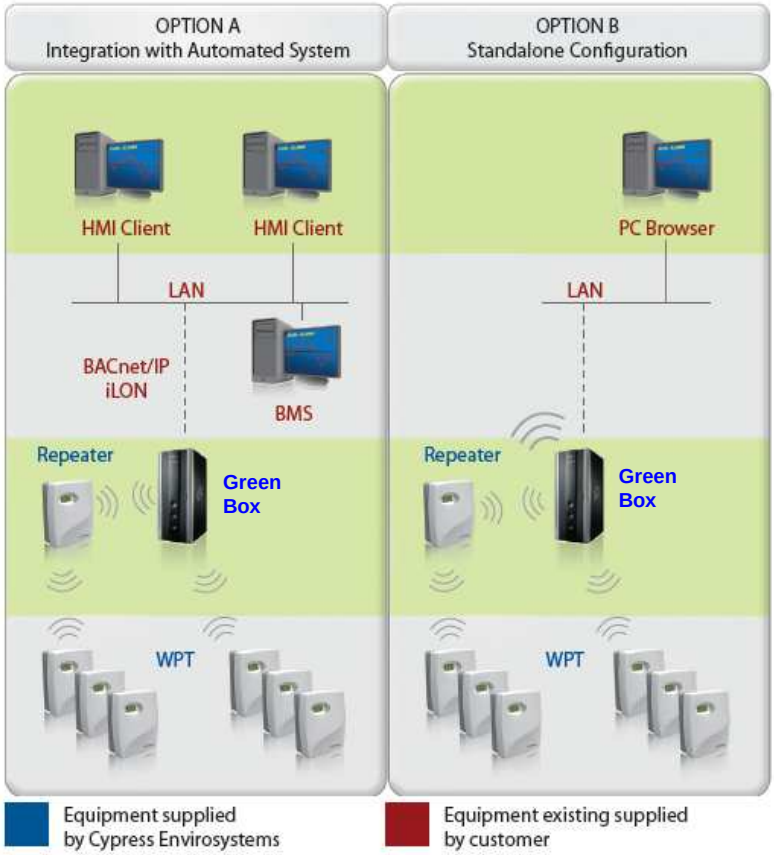

Figure 1- WPT System Architecture

2.4. Buildings Locations and Applications to Avoid

Buildings locations and applications that prohibit cellular telephones or Wi-Fi systems are unsuitable for the WPT Wireless System, including the following:

- Radiation therapy rooms
- Operating rooms
- FDA-validated environments

Do not use the WPT System in applications where loss of remote setpoint temperature control may result in critical impact to the facility or where any loss of historical data is unacceptable for reporting purposes.

3. WPT System Components

3.1. Wireless Pneumatic Thermostats

The WPT replaces the existing conventional pneumatic thermostat. WPTs are available in single-pipe and two-pipe with direct/reverse acting models. Ensure that the right type of WPT is used for retrofitting the existing pneumatic thermostat.

3.2. Wall Powered Repeaters

Wall powered repeaters extend the wireless range of a WPT system network by allowing more number of WPTs to be connected per WPT wireless network.

3.3. USB Hub

The HUSB is required to attach the WPT wireless network to the WPT Green Box. One HUSB is required per WPT wireless network. The HUSB is connected to the WPT Green Box using the USB port.

4. WPT Wireless Network Planning

4.1. Wireless Performance in Buildings

WPTs communicate with repeaters and the HUSB using radio signals. The radio signals can penetrate walls and objects, although the range is best when there is clear line-of-sight. In particular, metal objects or structures in the radio communication path, which reduce the range, should be avoided. Things to keep in mind include:

- Sheet metal walls or surfaces
- Hollow lightweight walls filled with insulating metal foil or wool
- Concrete walls, pillars, metal-reinforces columns
- Glass walls with metal coating
- Plumbing and electrical risers
- Office equipments and furniture such as book shelves, file cabinets, metal partitions, computer racks
- Elevator shafts and stairwells

4.2. WPT Wireless Range Inside Building

The wireless coverage inside the building depends on the materials used. The following are some guidelines for WPT wireless coverage.

Line of Sight	Typical: 300ft in open halls; 150 ft in open office floor and 100ft in corridors
Sheetrock walls / Dry wood	Typical: 100 ft, through 5 walls
Brick walls	Typical: 60 ft, through 3 walls
Ceilings	Typical: 25ft, through 1 ceiling

4.3. Repeater and HUSB Location Guidelines

In order to identify the optimal location for the WPT repeaters, you need the following:

- Copy of the floor plan with the locations of the existing pneumatic thermostats marked along with the locations of the columns, walls, elevator shafts, stairwells, partitions, file cabinets, and other large metal items
- Approximate distance between pneumatic thermostats
- Information about the materials used for the walls

Use the following guidelines to maximize radio communication range and performance:

- Avoid fire-safety walls, elevator shafts, stairwells along the radio path between the WPTs, repeater, and/or HUSBs.
- Avoid installing a repeater along the same side of the wall as that of the WPT. Position the repeater on the opposite side or on the connecting wall.

- Mount the repeater in a central location in the room and at least 4 inches away from the concrete ceiling or wall
- Mount the HUSB and the repeater about 3 ft away from the WPT Green Box and other high frequency sources of interface such as computers, audio and video equipment
- Mount the repeaters and HUSBs at eye-level or higher to minimize obstruction from furniture and people
- Place the wall powered repeaters above or below each other when extending the WPT wireless network across different floors
- Place repeaters at intervals of 60ft to provide wireless path redundancy

4.4. Performing Wireless Site Survey

The purpose of the Wireless Site Survey is to determine the appropriate locations for the HUSB and repeaters to build the WPT wireless network. The survey is completed by checking the wireless signal at each thermostat location. If the wireless signal strength is below an acceptable level, repeaters will be required in order to increase the signal strength.

The various indicators and characters that are displayed on the LCD display are as shown in the Figure 2.

Figure 2. LCD Display

Use the following procedure to perform the Wireless Site Survey.

1. Insert the batteries in the receiver and transmitter and power on by pressing any of the three keys adjacent to the LCD.
2. Using the floor plan, determine the potential target location for the HUSB.
3. Place the receiver at the target location for the HUSB.
4. Take the transmitter to the thermostat location and check the signal strength by pressing the ▲ key on the transmitter. As soon as the ▲ key is pressed, the letters “rt” will be displayed along with the override indicator. This indicates that the transmitter is trying to establish a connection with the receiver.
5. Once the connection is established, the transmitter will display the signal strength on a scale of 0 – 99.
   - Signal strength above 50 indicates acceptable wireless coverage

- If the wireless coverage is bad, the transmitter will display E0 to indicate discovery failure
- To ensure consistent wireless coverage, check the signal strength multiple times by following the above steps.

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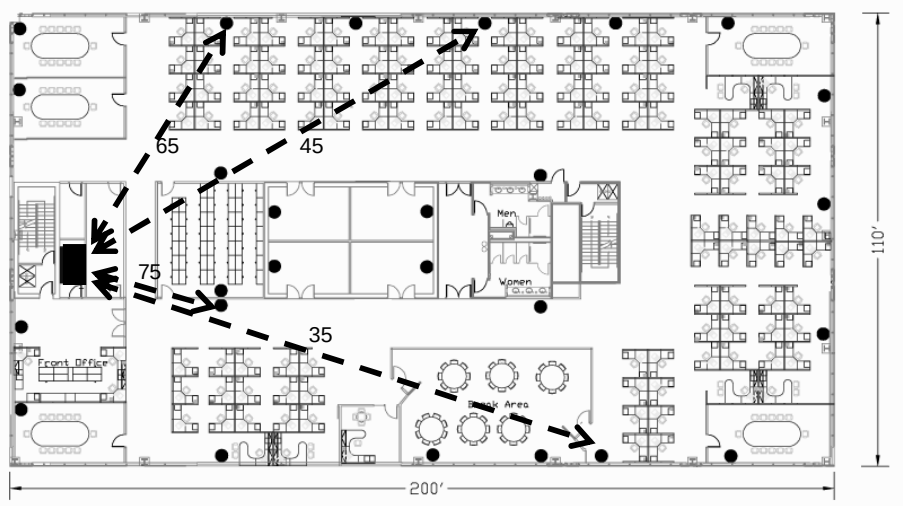
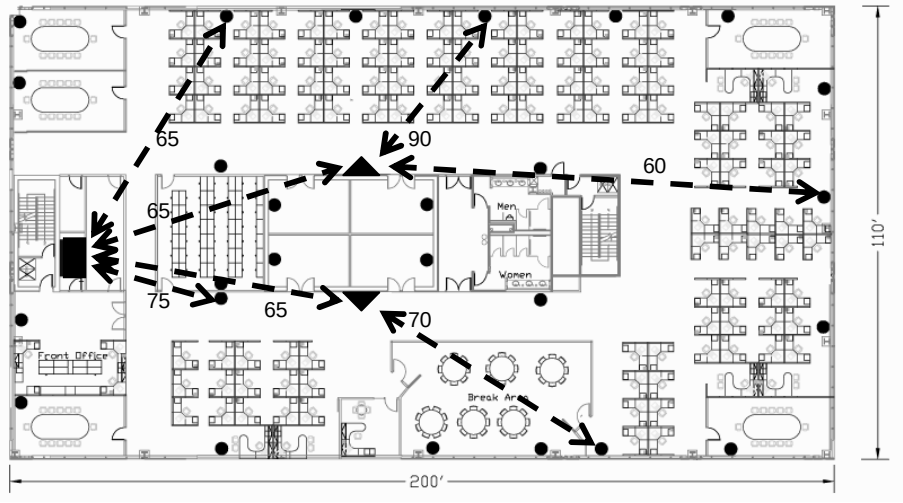


■ HUSB Location ● WPT Location

6. If the signal strength at the WPT is below 50, consider placing a repeater between the HUSB and the thermostat, especially if there are additional thermostats located further from the HUSB.

   In the sample layout above, note that there are several WPTs outside of the coverage area of the HUSB. Repeaters are needed to bring in the signal from those WPTs.



■ HUSB Location ▲ Repeater Location ● WPT Location

7. If a target repeater location is identified, place the receiver at that location and repeat steps 4 and 5.

8. To exit the test press 'OVR' key.

Repeat the above steps to build the WPT wireless network.

Make sure that there is a power outlet available within reach of each of the desired repeater locations to power the repeater.

Note: The typical battery life of the receiver/transmitter is approximately four hours, if in continuous use. If the battery level of the receiver/transmitter is low, the wireless signal measured at the transmitter could also be low. Please keep spare batteries readily available during the site survey.

4.5. Repeater Estimating Guidelines

There are several factors that determine the number of repeaters required in a WPT Wireless Network. The repeaters are used not only to extend the WPT Wireless Network but also to provide redundant wireless path for the WPTs within the coverage area. As a thumb rule, consider one wall powered repeater for every 15 WPTs in a floor.

Use the following guidelines while determining the number of repeaters required:

- Allocate one RWAL for every 15 WPTs in a floor
- Use RWAL for extending the WPT wireless network across the floors

5. Example of WPT Wireless Network Layout

5.1. Repeater and HUSB Location in a Typical Office Floor Plan

Figure 3 shows an example of repeater and HUSB locations in a typical office floor plan.

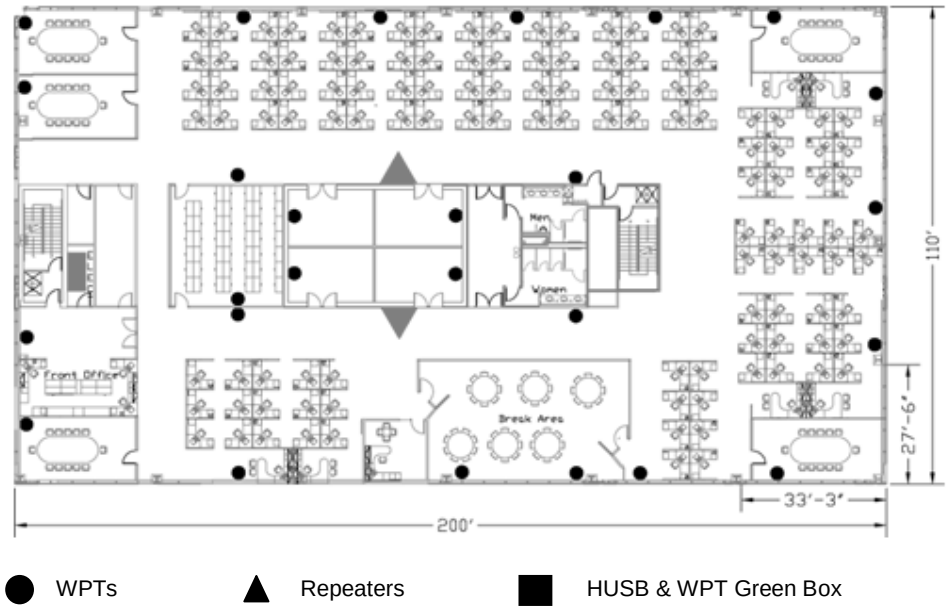


Figure 3. WPT Wireless Network in a typical office floor plan

5.2. WPT Wireless Network Layout in a Multi-floor Office Building

Figure 4 shows an example of repeater and HUSB locations in a typical multi floor office building. The repeaters used for extending the WPT Wireless network across the floor are placed directly above and below the HUSB.

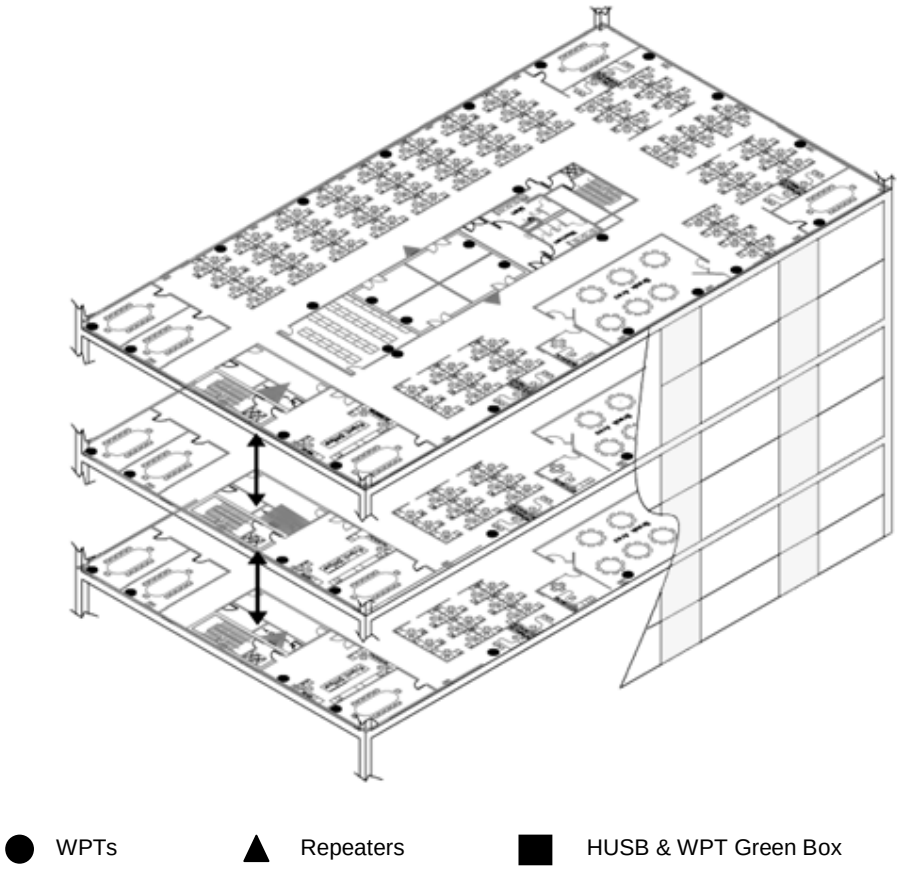


Figure 4. WPT Wireless Network in a Multi-floor Office Building

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