VT8000 Room Controllers

VZ8250 Application Guide
Variable Air Volume (VAV) Unit

Version 6

VICONICS
Beyond Comfort

TABLE OF CONTENTS

1. OVERVIEW

This new cost-effective solution provides contractors with an easy to implement solution for Variable Air Volume (VAV) applications. It is designed for zone temperature control in Variable Air Volume systems:

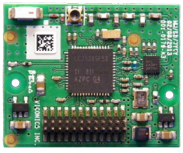
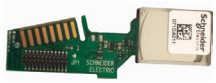
- An Air Handling unit and a VAV rooftop unit serve many zones within a building by supplying a varying amount of supply air at a constant supply air temperature.
- The supply air is discharged into the main duct and branches from this main duct are run to individual zones.
- Each zone has its own Room Controller, which in turn controls a VAV box (damper).
- This damper opens and closes to maintain the zone setpoint by varying the airflow to the zone.
- Some VAV boxes contain heat sources such as electric resistance strip heaters or hot water coils.
- This allows some zones to receive heat while other zones receive cooling from the central rooftop unit.
- Some VAV boxes contain a fan (fan-powered mixing box).
- During the heating cycle, the primary air damper closes to a minimum position and the fan and heating coil are energized to provide heat to the zone. This minimizes the amount of reheat that is required.
- All controllers are equipped with a humidity sensor.
- Supports Pressure Independent (PI) operation using a differential air pressure sensor to manage air flow setpoints.
- Supports Pressure Dependent (PD) operation with approximate airflow based on balanced damper positions.

Commercial and Hospitality Interface (Local Override and Degrees C/F Selection)

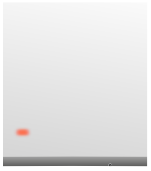
Part Number	Description	PIR Sensor	ZigBee on-board	Communication
VZ8250U5000B	VAV Pressure Dependant/Independant terminal equipment controller, silver	No	No. See note below*	BACnet MS/TP, Modbus RTU or BACnet/IP ready
VZ8250U5500B	VAV Pressure Dependant/Independant terminal equipment controller, silver	Yes	No. See note below*	BACnet MS/TP, Modbus RTU or BACnet/IP ready
VZ8250U5500BP	VAV Pressure Dependant/Independant terminal equipment controller, silver	Yes	Yes	BACnet MS/TP, Modbus RTU or BACnet/IP ready

*__Note__: ZigBee Pro plug-in module is available

Communication Modules for VZ8250 Series

	Part Number	Description
	VCM8000V5045P* Release 24	ZigBee Pro extended profile retrofit communication module.
	VCM8001V5045*	CO2 detection sensor retrofit module.

* __Note__: Only one of the two modules can be plugged in at one time.

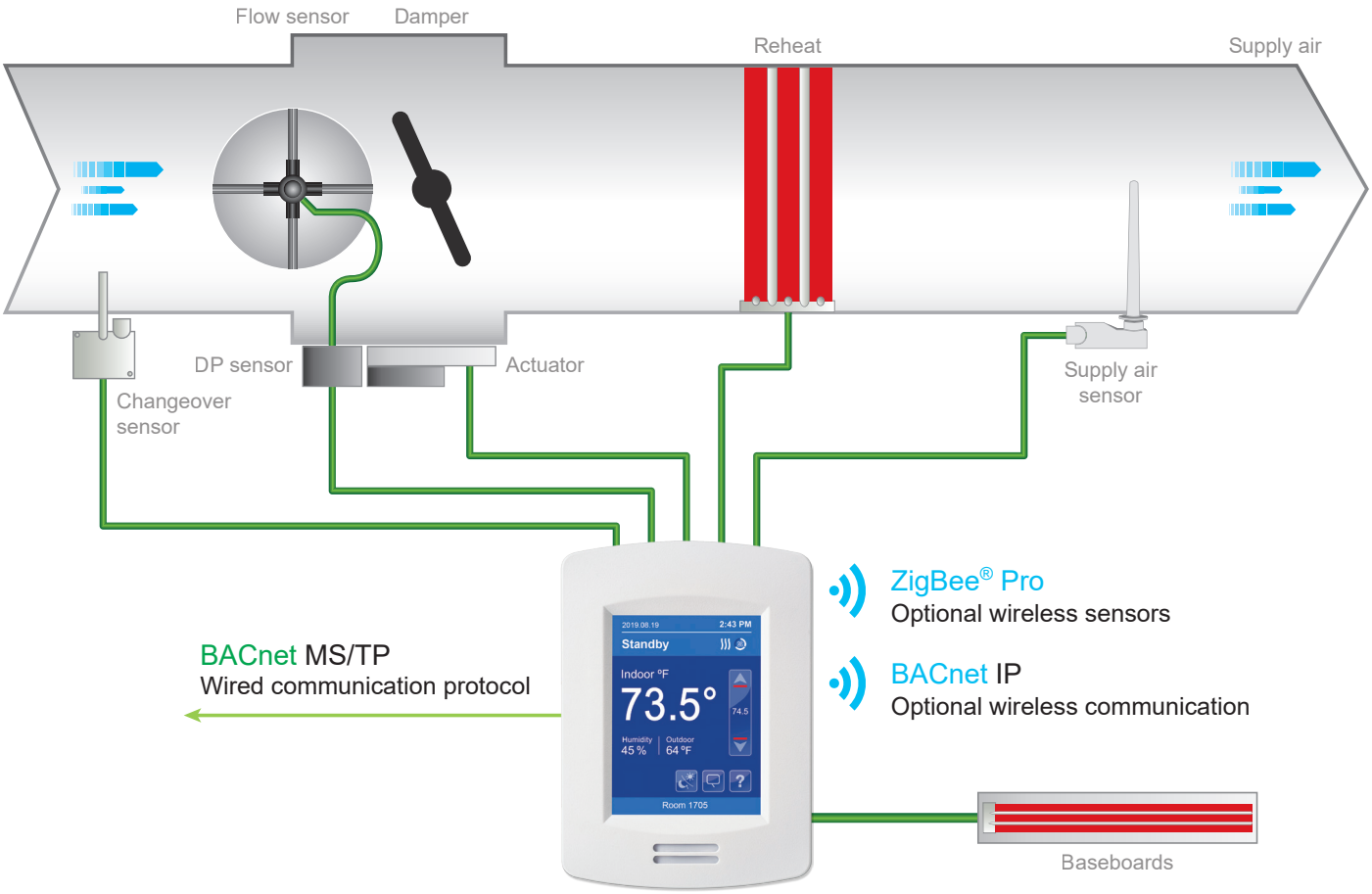
Wireless Accessories for VZ8250 Series*		
	Part Number	Description
	SED-CO2-G-5045	Wireless CO2 sensor with room temperature and humidity
	SED-TRH-G-5045	Wireless sensor with room temperature and humidity
	SED-MTH-G-5045	Wireless motion/temperature/humidity sensor
	SED-WDC-G-5045	Wireless window/door sensor
	SED-WLS-G-5045	Wireless water leakage sensor

* **Note**: Requires embedded ZigBee or a VCM8000V5045P.

2. TYPICAL APPLICATION: PRESSURE INDEPENDENT (NO FAN)

Typical example of an application:

- Damper: 0-10V
- Reheat: 0-10V
- Baseboard: PWM



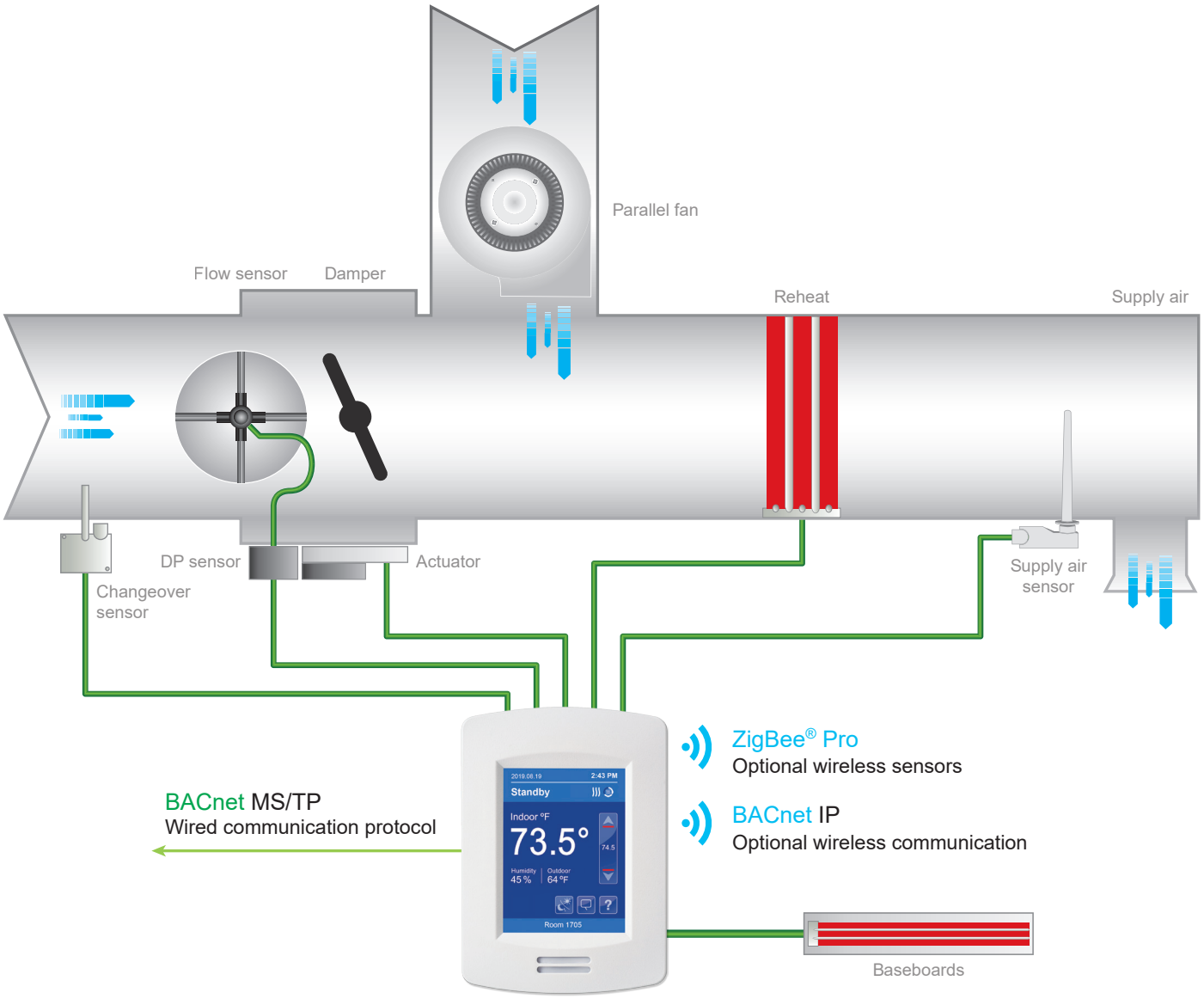
Configuration Parameter Name	Configuration Settings
VAV box type	PI
Actuator type	0-10V DA
Fan type	None
Reheat config.	Duct+base
Duct heater	0-10V DA
Baseboard	PWM Vac

Refer to “5. Sequence of Operations and Wiring” on page 8 for more information.

3. TYPICAL APPLICATION: PRESSURE INDEPENDENT (PARALLEL FAN)

Typical example of an application:

- Damper: 0-10V
- Reheat: 0-10V
- Baseboard: PWM
- Fan: Parallel binary



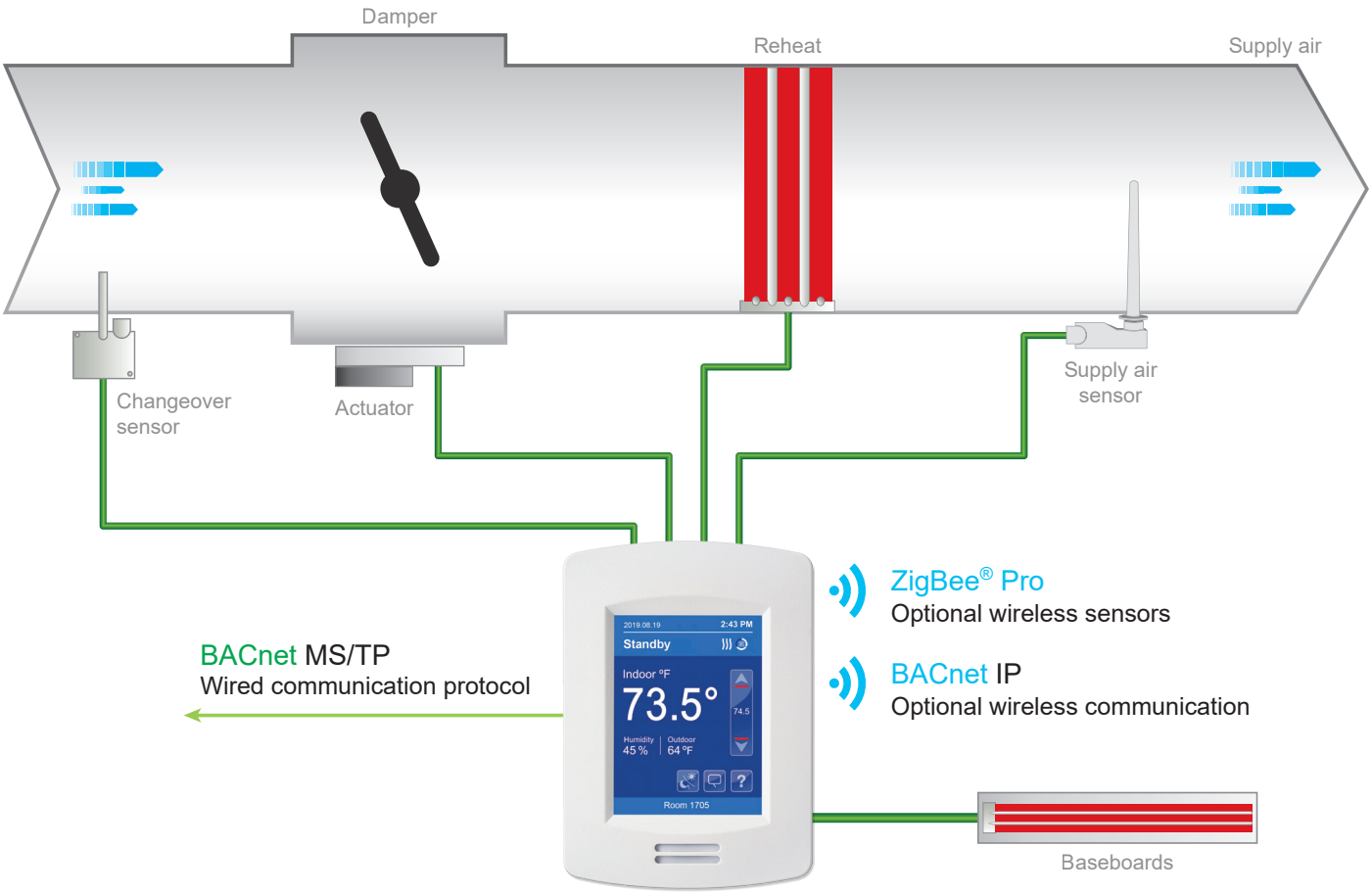
Configuration Parameter Name	Configuration Settings
VAV box type	PI
Actuator type	0-10V DA
Damper control	Analog
Fan type	Par. on/off (parallel binary)
Reheat config.	Duct+base
Duct heater	0-10V DA
Baseboard	PWM Vac

Refer to “5. Sequence of Operations and Wiring” on page 8 for more information.

4. TYPICAL APPLICATION: PRESSURE DEPENDENT (NO FAN)

Typical example of an application:

- Damper: Floating
- Reheat: Floating
- Baseboard: Valve



Configuration Parameter Name	Configuration Settings
VAV box type	PD
Actuator type	Floating
Damper control	Floating
Fan type	None
Reheat config.	Duct+base
Duct heater	Floating
Baseboard	Valve NC (Normally Closed)

Refer to “5. Sequence of Operations and Wiring” on page 8 for more information.

5. SEQUENCE OF OPERATIONS AND WIRING

5.1 PRESSURE INDEPENDENT (PI)

Pressure Independant (PI):

- With or Without Duct Heater
- With or Without Baseboard reheat

OCCUPANCY LEVELS

Occupied:	VZ8250 maintain “Occupied Heating” and “Occupied Cooling’ setpoints.
Override:	Same as Occupied for a defined period then reverts to Unoccupied.
Standby:	VZ8250 maintain “Standby Heating” and “Standby Cooling” setpoints.
Unoccupied:	VZ8250 maintain “Unoccupied Heating” and “Unoccupied Cooling” setpoints.

NOTE: For more information on occupancy levels, refer to the **VZ8250 User Interface Guide**.

OCCUPIED, OVERRIDE AND STANDBY OCCUPANCY MODES:

When there is no demand for Heating, Cooling or CO2 the VZ8250 will open the zone damper to the minimum airflow setpoint, example 30 cfm (14 l/s) (installer adjustable).

The VZ8250 needs to know if the “central HVAC system” is in Cooling or Heating mode. This information is received from BACnet communication, from a local changeover temperature sensor, or statically via configuration parameter at the time of installation.

“Central HVAC system” is in Cooling mode:

On a demand for **Cooling**, the VZ8250 will modulate the zone damper between its minimum and maximum airflow setpoints to satisfy the cooling demand. If there is a demand for CO2, the damper will modulate open to satisfy the highest demand (thermostat will limit the damper opening if the room temperature drops too low). If there is no demand for Cooling or CO2, the damper goes at its minimum airflow setpoint.

On a demand for **Heating**, if the zone has a duct heater, the damper will open to its Reheat airflow setpoint. The duct heater is used as first stage of reheat. If the zone has a baseboard heater, it will be used as second stage of reheat to satisfy the demand for heating.

“Central HVAC system” is in Heating mode:

On a demand for **Heating**, the VZ8250 will modulate the zone damper between its minimum and maximum airflow setpoints to satisfy the heating demand. If there is a demand for CO2 the damper will modulate open to satisfy the highest demand (thermostat will limit the damper opening if the room temperature goes too high). If the zone has a duct heater, the damper will remain to its maximum heating airflow setpoint. The duct heater is used as second stage of heat. If the zone has a baseboard heater it will be used as third stage of heat to satisfy the demand for heating. If there is no demand for Heating or CO2, the damper goes at its minimum airflow setpoint.

On a demand for **Cooling**, the damper will stay at its minimum airflow setpoint (“central HVAC system” is in Heating mode).

UNOCCUPIED MODE, USING UNOCCUPIED COOLING AND HEATING SETPOINTS:

When there is no demand for Heating, Cooling the VZ8250 will close the zone damper. CO2 is not controlled in unoccupied mode.

The VZ8250 needs to know if the “central HVAC system” is in Cooling or Heating mode. This information is received from BACnet communication or from a local changeover temperature sensor.

“Central HVAC system” is in Cooling mode:

On a demand for **Cooling**, if the “Central HVAC system” Fan is ON, the VZ8250 will modulate the zone damper between closed and maximum airflow setpoint to satisfy the cooling demand. If there is no demand for Cooling, the damper closes.

On a demand for **Heating**, if the “Central HVAC system” Fan is ON and if the zone has a duct heater, the damper will open to Reheat airflow setpoint. The duct heater is used as first stage of reheat. If the zone has a baseboard heater it will be used as second stage of reheat to satisfy the demand for heating. If the “Central HVAC system” Fan is OFF the damper will remain closed and if the zone has a baseboard heater it will be used as first stage of heat.

“Central HVAC system” is in Heating mode:

On a demand for **Heating**, if the “Central HVAC system” Fan is ON, the VZ8250 will modulate the zone damper between closed and maximum airflow setpoint to satisfy the heating demand. If the zone has a duct heater, the damper will remain to its max. heat airflow setpoint. The duct heater is used as second stage of heat. If the zone has a baseboard heater it will be used as third stage of heat to satisfy the demand for heating.

On a demand for **Cooling**, the damper will stay closed. (“central HVAC system” is in Heating mode).

5.2 PRESSURE DEPENDENT (PD)

Pressure Dependant (PD):

- With or Without Duct Heater
- With or Without Baseboard reheat

OCCUPANCY LEVELS

Occupied:	VZ8250 maintain “Occupied Heating” and “Occupied Cooling’ setpoints.
Override:	Same as Occupied for a defined period then reverts to Unoccupied.
Standby:	VZ8250 maintain “Standby Heating” and “Standby Cooling” setpoints.
Unoccupied:	VZ8250 maintain “Unoccupied Heating” and “Unoccupied Cooling” setpoints.

NOTE: For more information on occupancy levels, refer to the **VZ8250 User Interface Guide**.

OCCUPIED, OVERRIDE AND STANDBY OCCUPANCY MODES

When there is no demand for Heating, Cooling or CO2 the VZ8250 will open the zone damper to the minimum position, example 30% (installer adjustable).

The VZ8250 needs to know if the “central HVAC system” is in Cooling or Heating mode. This information is received from BACnet communication, from a local changeover temperature sensor, or statically via configuration parameter at the time of installation.

“Central HVAC system” is in Cooling mode:

On a demand for **Cooling**, the VZ8250 will modulate the zone damper between its minimum and maximum position to satisfy the cooling demand. If there is a demand for CO2, the damper will modulate open to satisfy the highest demand (thermostat will limit the damper opening if the room temperature drops too low). If there is no demand for Cooling nor CO2, the damper goes at its minimum position.

On a demand for **Heating**, if the zone has a duct heater, the damper will open to Reheat Position. The duct heater is used as first stage of reheat. If the zone has a baseboard heater, it will be used as second stage of reheat to satisfy the demand for heating.

“Central HVAC system” is in Heating mode:

On a demand for **Heating**, the VZ8250 will modulate the zone damper between its minimum and maximum position to satisfy the heating demand. If there is a demand for CO2, the damper will modulate open to satisfy the highest demand (thermostat will limit the damper opening if the room temperature goes too high). If the zone has a duct heater, the damper will remain at its maximum position. The duct heater is used as second stage of heat. If the zone has a baseboard heater, it will be used as third stage of heat to satisfy the demand for heating. If there is no demand for Heating nor CO2, the damper goes at its minimum position.

On a demand for **Cooling**, the damper will stay at its minimum position (“central HVAC system” is in Heating mode).

UNOCCUPIED MODE, USING UNOCCUPIED COOLING AND HEATING SETPOINTS:

When there is no demand for Heating, Cooling the VZ8250 will close the zone damper. CO2 is not controlled in unoccupied mode.

The VZ8250 needs to know if the “central HVAC system” is in Cooling or Heating mode. This information is received from BACnet communication or from a local changeover temperature sensor.

“Central HVAC system” is in Cooling mode:

On a demand for **Cooling**, if the “Central HVAC system” Fan is ON, the VZ8250 will modulate the zone damper between closed and maximum position to satisfy the cooling demand. If there is no demand for Cooling the damper closes.

On a demand for **Heating**, if the “Central HVAC system” Fan is ON and if the zone has a duct heater, the damper will open to Reheat Position. The duct heater is used as first stage of reheat. If the zone has a baseboard heater, it will be used as second stage of reheat to satisfy the demand for heating. If the “Central HVAC system” Fan is OFF, the damper will remain closed and if the zone has a baseboard heater, it will be used as first stage of heat.

“Central HVAC system” is in Heating mode:

On a demand for **Heating**, if the “Central HVAC system” Fan is ON, the VZ8250 will modulate the zone damper between closed and maximum position to satisfy the heating demand. If the zone has a duct heater, the damper will remain to its maximum position. The duct heater is used as second stage of heat. If the zone has a baseboard heater, it will be used as third stage of heat to satisfy the demand for heating.

On a demand for **Cooling**, the damper will stay closed. (“central HVAC system” is in Heating mode).

6. CONTROL EQUIPMENT

6.1 PRESSURE INDEPENDENT CONTROL

For configuring a Pressure Independent zone, the following Room Controller configuration points are provided:

- Minimum Airflow: Minimum airflow allowed for the zone when the system is on.
- Maximum Cooling Airflow: Maximum airflow allowed for the zone when the system is cooling.
- Maximum Heating Airflow: Maximum airflow allowed for the zone when the system is heating.
- Reheat Airflow: Airflow allowed for the zone when the system is reheating.

All airflow setpoints support:

- Range = 0 – 20000cfm
- Increment = 10cfm

Calibrating the Room Controller airflow sensor using a Balometer is essential. To aid Balancing technicians, the Balancing menu provides access to:

- Measured airflow.
- Airflow setpoints.
- Damper overrides, to force the damper to airflow setpoints, min, max, cool, close, reheat or open.
- Two Airflow Offsets that can be used to calibrate measurements from the Room Controller to those of the Balometer at minimum and maximum airflows.

6.2 PRESSURE DEPENDENT CONTROL

For configuring a Pressure Dependent zone, the following Room Controller configuration points are provided:

- Minimum Damper Position: Minimum Damper Position when the system is on.
- Maximum Cooling Damper Position: Maximum Damper Position when the system is cooling.
- Maximum Heating Damper Position: Maximum Damper Position when the system is heating.
- Reheat Damper Position: Damper Position when the system is reheating.

All damper positions support:

- Range = 0 – 100%
- Increment = 1%

Calibrating the Room Controller airflow sensor using a Balometer is essential. To aid Balancing technicians, the Balancing menu provides access to the Damper positions. These values should be adjusted to achieve Balometer readings matching the desired airflows for the zone.

6.3 CO2 CONTROL

The Room Controller can control the CO2 level in the zone if it is equipped with a CO2 sensor. The available options are:

- VCM8001V5045 CO2 Sensor Module
- SED-CO2-G-5045 Wireless CO2 Sensor (Requires a ZigBee Pro VCM module or a VZ8250 model with embedded ZigBee)

Demand for fresh air will be calculated based on the measured CO2 level relative to the configurable minimum and maximum CO2 parameters, influencing damper positioning.

7. TERMINAL IDENTIFICATION

7.1 FAN TYPE

Supported fan types:

- Parallel On/Off
- Serial On/Off
- Parallel ECM
- Serial ECM

Supported output types:

- On/Off: Binary Output
- ECM: Analog Output

Binary (24V~)		
Terminal	**Name**	**Connection**
4	BO4	24V~ Enable
6, 18 or 21	C / 24 V~ Common	24 V~ Common
ECM (0-10V DC)*		
Terminal	**Name**	**Connection**
6, 18 or 21	C / 24 V~ Common	24 V~ Common
10	UO10	0-10V Output

* **Warning!** Floating duct reheat is not possible when Fan Type is ECM.

7.2 AIR FLOW SENSOR (PI ONLY)

Supported air flow sensor parameters:

- Output voltage = 0-10V (DC)
- Pressure range = 0.5 or 5 inch water column
- Flow a 1 inch water column:
  - Minimum = 10
  - Maximum = 10000

  NOTE: Refer to the VAV box manufacturer flow chart for the recommended settings.

Recommended air flow sensor: Schneider Electric (Veris) PX3PXX01 or equivalent.

PI-Only Air Flow Sensor		
Terminal	Name	Connection
5	RC / 24 V~ Hot	24 V~ Hot
6, 18 or 21	C / 24 V~ Common	24 V~ Common
24	UI24	0-10V Input

7.3 DAMPER

Supported output types:

- 0-10V Direct Acting
- 0-10V Reverse Acting
- 2-10V Direct Acting
- 2-10V Reverse Acting
- Floating

Recommended damper: Schneider Electric MS41-6043 or equivalent.

0-10V Analog Actuator		
Terminal	Name	Connection
5	RC / 24 V~ Hot	24 V~ Hot
6, 18 or 21	C / 24 V~ Common	24 V~ Common
11	UO11	0-10V Output
Floating Actuator*		
Terminal	Name	Connection
6, 18 or 21	C / 24 V~ Common	24 V~ Common
9	UO9	Close Actuator
11	UO11	Open Actuator

* Floating actuation time limits:

  - Minimum = 0.5 minutes
  - Maximum = 9.0 minutes
  - Increment = 0.5 minutes

7.4 CHANGEOVER & SUPPLY SENSORS

The Room Controller is compatible with remote mount temperature sensors using 10k type 2 NTC thermistors.

Changeover & Supply Sensors		
Terminal	Name	Connection
19	UI19	Changeover Sensor
6, 18 or 21	C / 24 V~ Common	24 V~ Common
22	UI22	Supply Sensor

7.5 REHEAT - DUCT

Supported output types:

- 0-10V Direct Acting
- 0-10V Reverse Acting
- 2-10V Direct Acting
- 2-10V Reverse Acting
- Floating
- On/Off
- PWM
- Valve NC
- Valve NO

0-10V Analog Duct Heater			
Terminal	Name	Connection	Required Settings
5	RC / 24 V~ Hot	24 V~ Hot	Duct Heater Configuration: • 0-10V Direct Acting, or • 0-10V Reserve Acting
6, 18 or 21	C / 24 V~ Common	24 V~ Common	
12	UO12	0-10V Output	
Floating Duct Heater			
Terminal	Name	Connection	Required Settings
6, 18 or 21	C / 24 V~ Common	24 V~ Common	Duct Heater Configuration: Floating
10	UO10	24 V~ Close Valve Actuator	
12	UO12	24 V~ Open Valve Actuator	
On/Off or PWM Duct Heater			
Terminal	Name	Connection	Required Settings
6, 18 or 21	C / 24 V~ Common	24 V~ Common	Duct Heater Configuration: • On/Off, or • PWM, or • Valve NC, or • Valve NO
12	UO12	24 V~ Output	

7.6 REHEAT - BASEBOARD

The VZ8250 controls baseboard heaters via:

- Relay = 4 CPH (Cycles Per Hour)
- PWM = 10-second duty cycle
- Valve (Normally Open or Normally Closed) = 8 CPH (Cycles Per Hour)

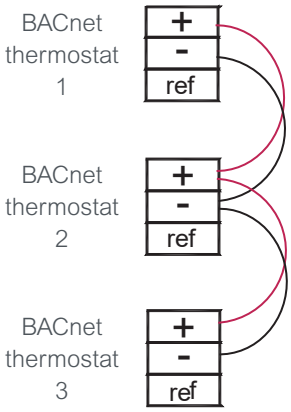
Supported output types:

- Relay On/Off
- PWM
- Valve NC
- Valve NO

Relay with Transformer (Dry Contact)			
Terminal	**Name**	**Connection**	**Required Settings**
7	RH	Room Controller Terminal 5 (24 V~)	Baseboard Reheat: Relay
8	BO8	24 V~ to Baseboard	
24V~			
Terminal	**Name**	**Connection**	**Required Settings**
5	RC / 24 V~ Hot	Room Controller Terminal 7 (RH)	Baseboard Reheat: • Relay, or • PWM, or • Valve NC, or • Valve NO
6, 18 or 21	C / 24 V~ Common	24 V~ Common	
7	RH	Room Controller Terminal 5 (24 V~)	
8	BO8	24 V~ to Baseboard	

APPENDIX A. OPTIONAL NETWORK SET-UP

BACnet communication wiring:



Notes:

- Wiring should be daisy chained
- Respect polarity
- If using 2 conductors shielded wires, connect the shield of each feed together on the back of the controller. ONLY ground the shield at one location. DO NOT connect the shield to the ref terminal.

APPENDIX B. WIRELESS SENSORS

B.1 WIRELESS ZIGBEE® PRO MOTION SENSORS

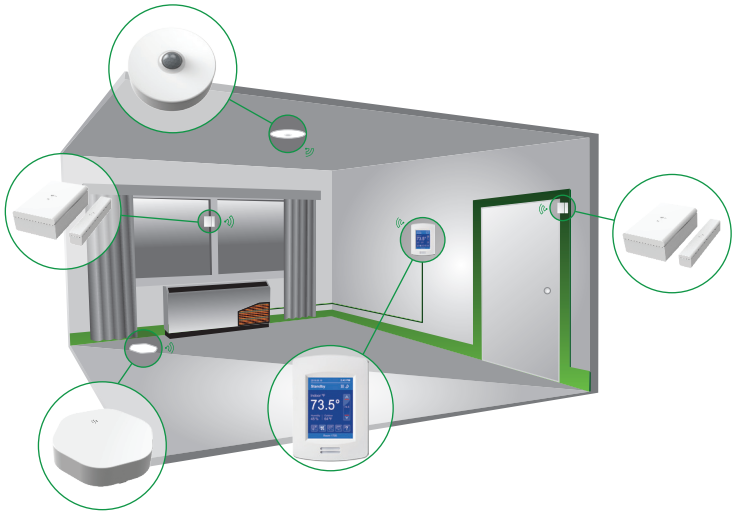
Room Controllers with SED ZigBee® Pro wireless switches can be used in stand-alone mode, or with integration to a central management system, to allow for advanced functions such as central reservation and occupancy functions. Up to twenty different ZigBee motion sensors and switches (SED-WDC, SED-MTH, or SED-WLS) can be used with a Room Controller.

Note that if a ZigBee wireless window switch is used, the Room Controller cannot also use a remote PIR motion sensor, whether wired or wireless. Using one or more wireless remote PIR motion sensors means that a wired PIR motion sensor cannot be used, and vice versa.

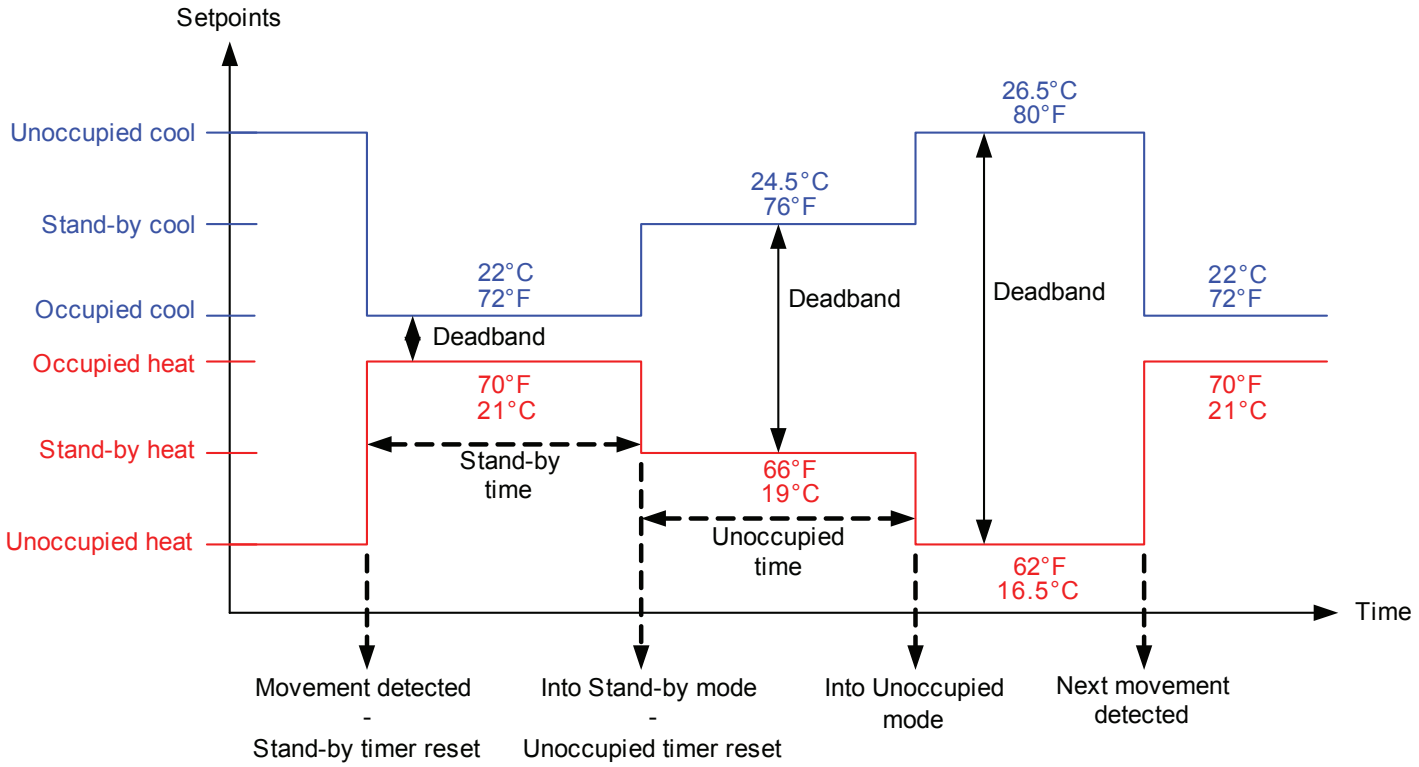
The SED Series sensors are factory delivered with batteries and are ready to be installed, configured, and used right out of the box. Due to the extremely small current consumption of the sensors, the expected battery life is approximately 10 years, which is equivalent to the battery shelf life.

B.2 MODEL SELECTION

Window Switch	Door Switch
Wireless window/door sensor	SED-WDC-G-5045
Wireless motion/temperature/humidity sensor	SED-MTH-G-5045
Wireless water leakage sensor	SED-WLS-G-5045



APPENDIX C. SCHEMATIC OF CONTROLLERS OCCUPANCY SEQUENCE OF OPERATION WITHOUT DOOR SENSOR



APPENDIX D. DEPLOYMENT

Placement of the Room Controller must be given consideration. It is recommended to install the Room Controller as close to a door as possible (but not so as to be blocked by the door), or in an area with high occupant movement.

Ideally the Room Controller should be installed 5 feet (1.5 meters) above the floor surface to ensure maximum detection range is achieved. As well, Room Controller placement should ensure the occupant crosses the lens beam in a perpendicular path within the prescribed detection zone.

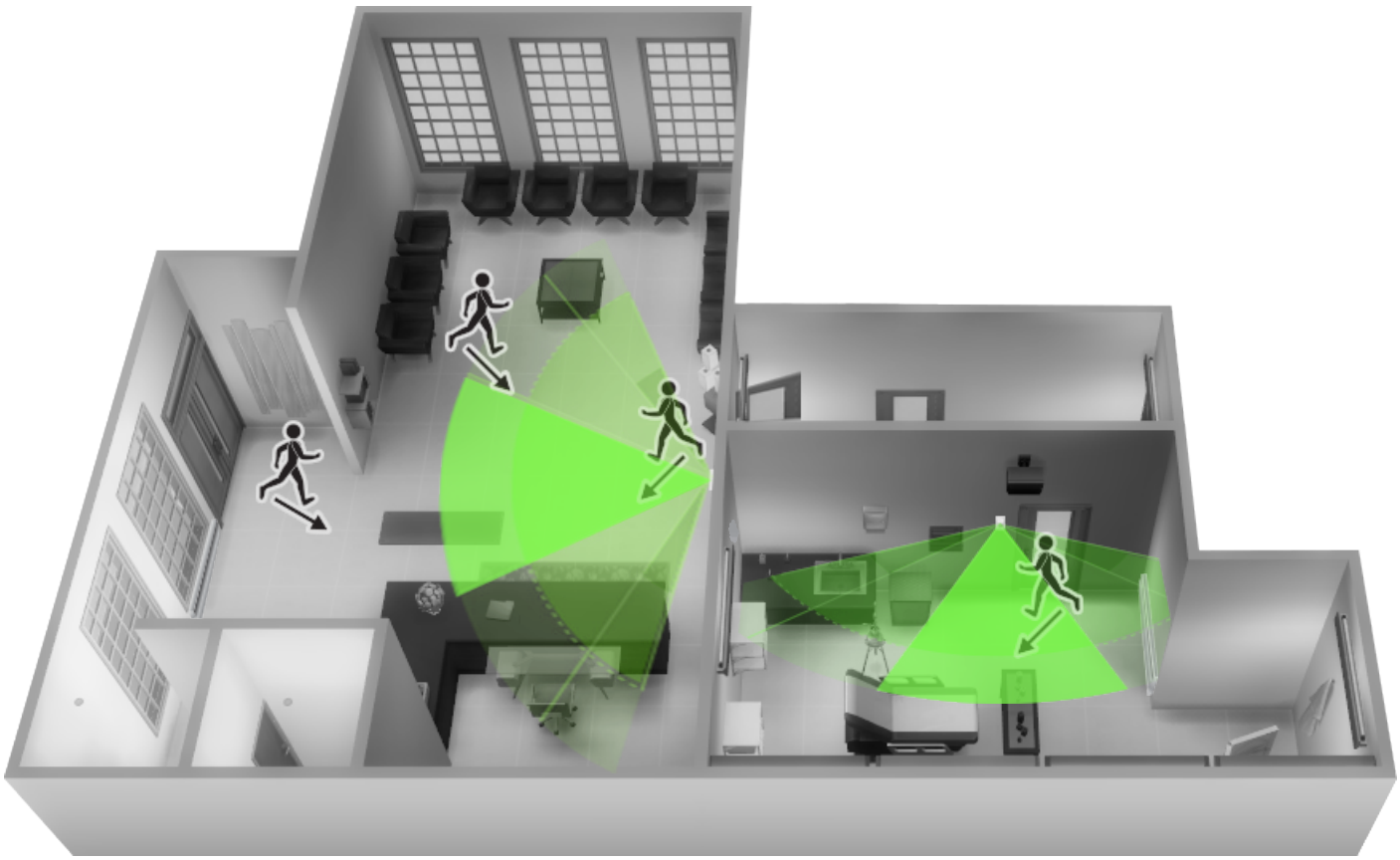
The Room Controller's PIR sensor is very sensitive and can be triggered by vibration from nearby equipment, such as fans or compressor motors. To avoid false motion detection, make sure to place the Room Controller away from vibration sources and install vibration isolators on HVAC equipment.

D.1 EXAMPLE OF RECOMMENDED DEPLOYMENT

The below shows Room Controllers installed in ideal locations for two rooms.

The examination room shows one Room Controller installed adjacent to the door. In this area of the room, occupant traffic is high and ensures the occupant will almost always cross the PIR detection path laterally and within the detection range.

The waiting room shows one Room Controller installed beside a door in the middle of the room. As shown in the diagram below, occupant traffic is high in several areas of the room including the entrance, waiting room, access to the door and activity around the reception desk. Moreover, for each case aforementioned, occupant movement almost always moves lateral to the PIR, which ensures detection by the PIR, as well as respecting the PIR detection range of 20 feet (6 meters) at 140°, and 16 feet (5 meters) between 15° to 30° laterally.



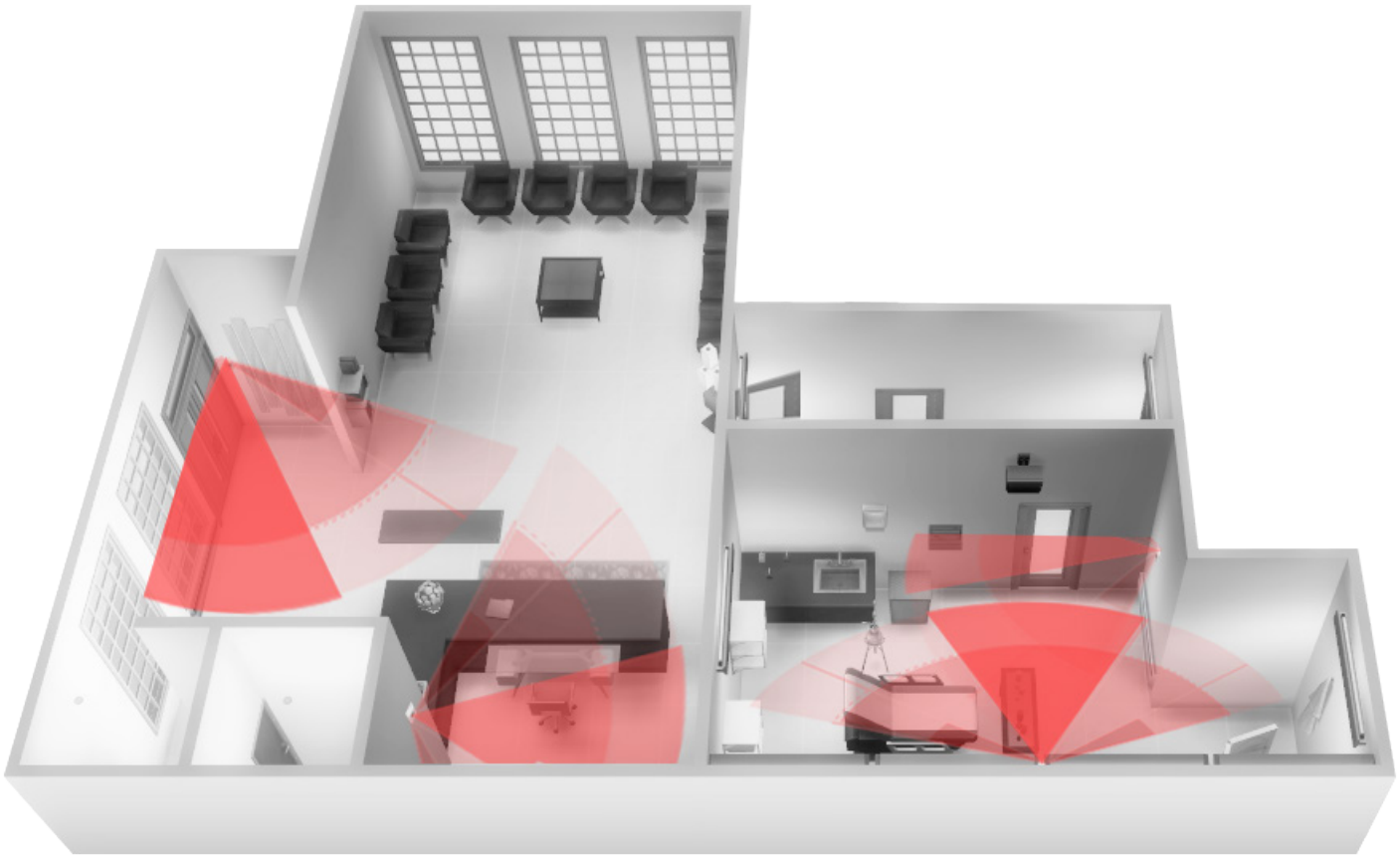
Recommended Installation

D.2 EXAMPLE OF NON-RECOMMENDED DEPLOYMENT

The below shows four Room Controllers (two for each room) installed in non-ideal locations for the two rooms.

The examination room shows one Room Controller installed in a low traffic area near the door, and a second Room Controller installed on the wall directly opposite the door. For the Room Controller installed in the corner wall, the PIR could be blocked by the opened door, while occupant traffic cold also be minimal in this area of the room. For the second Room Controller installed opposite the door, the PIR detection could fall outside the specified detection zone, while at the same time most occupant movement would be not be lateral to the PIR, thereby not respecting optimal crossing patterns for PIR detection.

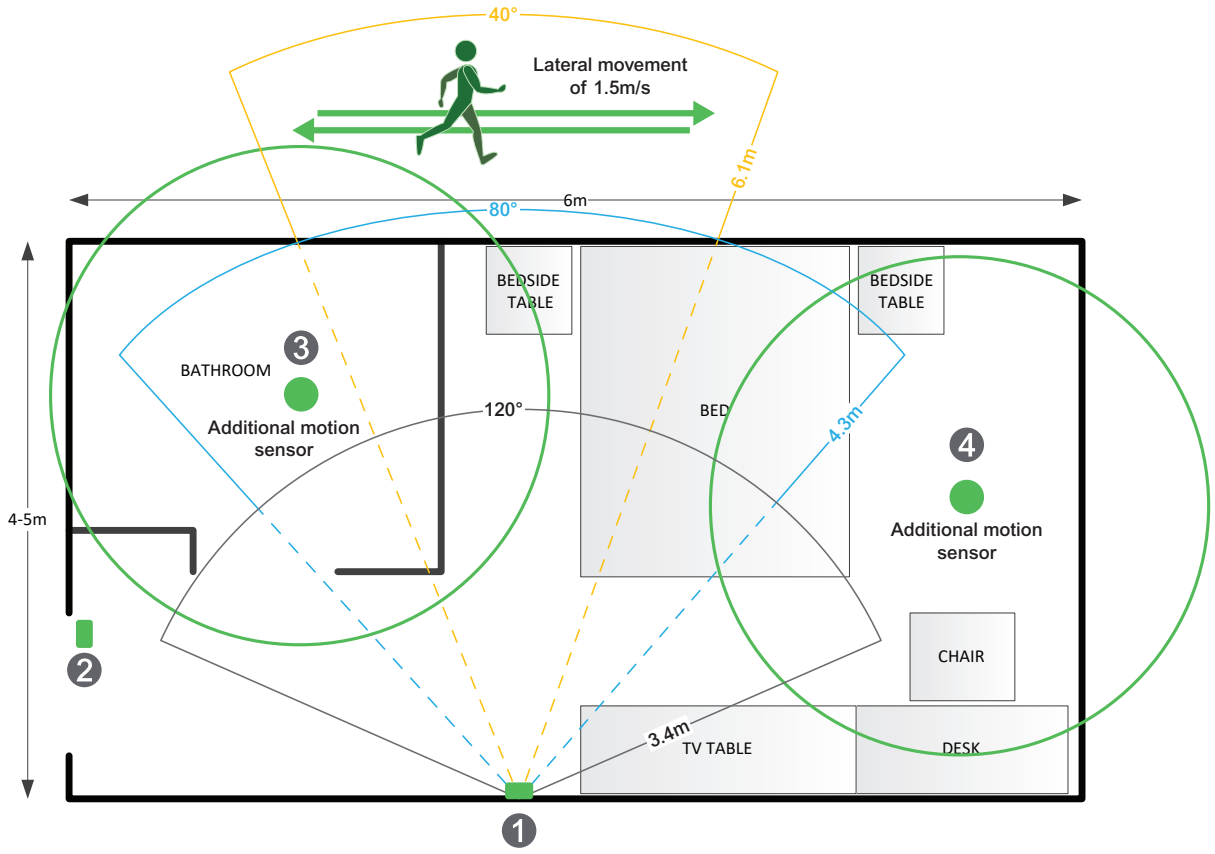
The waiting room shows one Room Controller installed in the corner of the room, and a second Room Controller installed beside the reception area. For the Room Controller installed in the corner, the opening/closing of the door creates high probability that the PIR would get blocked, and therefore, occupancy going undetected. For the Room Controller installed beside the reception area, occupant traffic could fall outside the detection zone, and the receptionist would often be below the 5 foot recommended installation height for the Room Controller.



Non-Recommended Installation

D.3 ROOM CONTROLLER PIR SENSOR DETAILS

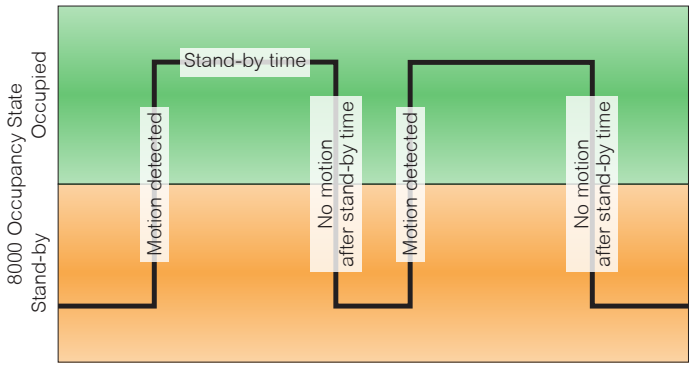
The internal Room Controller PIR sensor only detect lateral movement. It cannot detect movement when a person is moving toward it. It will not detect someone seating on a chair and/or lying on the bed.



D.4 RECOMMENDATIONS FOR INSTALLATIONS

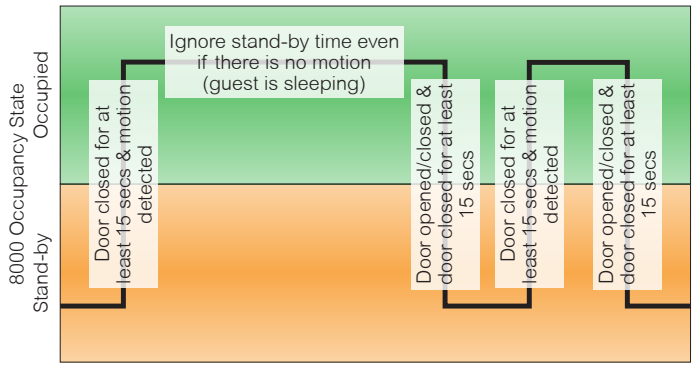
1. Install the Room Controller to cover more lateral movement.
2. Install a door sensor, the internal Room Controller occupancy logic works better with a door sensor. Once a motion is detected after a door is opened, the room stays in occupied state until the door is opened again which put the Room Controller in stand-by mode and if there is a motion then it goes back in occupied mode. It is also recommended to disable the unoccupied mode, set the unoccupied time to 0, so there is only 2 modes in the Room Controller: stand-by and occupied for a stand-alone solution. Please refer to the two(2) diagrams below for the Room Controller internal occupancy states transition.

8000 with internal and/or external motion sensors



More aggressive energy savings logic but may cause bad guest experience (when guest is sleeping or not moving)

8000 with door sensor, internal and/or external motion sensors



Good energy savings logic and better guest experience even when the guest is sleeping or not moving

3. Install additional motion sensor in the bathroom.
4. Install additional motion sensor for better motion detection in the entire room.

D.5 ENERGY SAVINGS

PIR can maximize your energy saving from 10-30% by adjusting temperature set points in unoccupied zones during scheduled periods.

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