



PIR Application Guide for the for VT76xxX5x00(X) Series thermostats

(Issue Date: November, 2015)

Product Overview

The VI-PIR Accessory covers with embedded Passive Infra-Red motion detector have been specifically designed to work with all compatible VT76xx series thermostats. Thermostats compatible with VI-PIR covers use the following part number assignments: VT7xxxxX5xxx(X). The 5 identifies the thermostat base thermostat has the necessary onboard polarized PIR connector and the enhanced occupancy functionality added.

When equipped with a VI-PIR accessory cover, a VT76xx series thermostat provides advanced active occupancy logic, which will automatically switches occupancy levels from Occupied to Unoccupied as required by local activity being present or not.

This advanced occupancy functionality provides advantageous energy savings during occupied hours without sacrificing occupant comfort.

Typical applications that can be meet by the new PIR accessory covers range from:

- Any networked water source heatpump fully integrated to BAS system
- Networked or stand-alone conference rooms
- Networked or stand-alone classrooms units
- Any commercial offices that have random occupancy schedules during occupied hours as dictated by the function of the tenant
- Or any controlled piece of HVAC equipment that may yield energy savings with the introduction of an automatic unoccupied level of occupancy.



The additional following documentation is available on www.viconics.com

- PIR cover installation information is available on document: *PIR Cover Installation-Exx*
- Detailed information on the thermostat (VT76xxX5x00x), is available on document: *LIT-VT7600-PIR-E00.doc*
- Detailed information on the thermostat (VT76x7X5x00x), is available on document: *LIT-VT76x7-PIR-E00.doc*
- Information on the BACnet models (VT76xxX5x00B), is available on document *ITG-VT76xx-PIR-BAC-Exx*
- Information on the Wireless models (VT76xx0X5x00W), is available on documents: *ITG-VWG-40-BAC-Exx* and *LIT-VWG-40-SETUP-Exx*

VI- PIR Cover Models Available

Viconics PIR Cover Part Number	Description	Compatible with the Following Thermostats
COV-PIR-RTU-5000	PIR cover for roof-top and heatpump thermostats	VT76xxX50xx(X)

Configuration Parameters Associated with the Viconics PIR Accessory Covers

The following configuration parameter is specifically provided as standard on all VT76xx series thermostats. It is associated with the advanced occupancy functionality introduced with the addition of a PIR cover. This parameter will allow the installer to set the thermostat occupancy functions exactly as required by the application.

Its functionality only becomes active if a PIR accessory cover is connected.

Configuration Parameter	Description of Configuration parameter
<p>Unoccupied Time:</p> <p>Default 0.5 hours</p>	<p>This parameter sets the time delay between the moment where the PIR cover detected the last movement in the area and the time which the thermostat Unoccupied mode and setpoints become active.</p> <p>Adjustable from 0.5 to 24 hours in 0.5hr increments</p> <p>If no movement are detected in the area and the current mode is occupied. This parameter will then set the time delay between the moment where the thermostat toggles to unoccupied due to movement detection and the time which the thermostat unoccupied mode and setpoints become active after the timer expires.</p> <p>The factory value or 0.5 hours:</p> <p>Adjustable from 0.5 to 24 hours in .5hr increments</p>

Important Notes and Things to Know

When reviewing the following document and planning an application using a Viconics VT76xx thermostat with PIR functionality, please remember the important following notes:

- **VT76xx PIR implementations** use a 2 level occupancy scheme: Occupied And Unoccupied. The application layer does NOT support stand-By mode.
- **Configuration of PIR Function:** PIR application related configuration parameter (Unoccupied Time) is displayed in the configuration menu or available as an object in the network object list. The advanced occupancy functionality of a PIR attached to a VT76xx thermostat is only enabled if A Viconics VI-PIR cover is installed on the thermostat.
- **PIR Cover Warm-Up Period:** When VI-PIR accessory cover is used and a thermostat is powered up; there will be a 1 minute warm up period before any local movements can being detected and acknowledged by the PIR sensing device. The local status LEDs for the VI-PIR cover will also not be active during that one minute period.

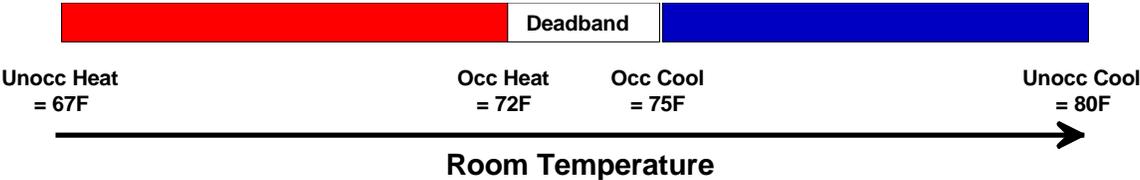
Only when that 1 minute period has elapsed after initial power up of the thermostat will the PIR functionality and local movement status LEDs be activated.

- Setpoints:** The implemented occupied and unoccupied heating and cooling setpoints are under the same limitations and restrictions. This means that:
 - They use exactly the same range:
 - Heating setpoints range are: 40 to 90 °F (4.5 to 32.0 °C)
 - Cooling setpoints range are: 54 to 100 °F (12.0 to 37.5 °C)
 - They are always limited by the applied minimum deadband configuration
 - They will be limited by the Heat Maximum and Cool Minimum configuration parameters

All individual cooling setpoints and all individual heating setpoints can be set independently.

The installer must make sure that the difference between the unoccupied and occupied value can be recovered in a timely fashion when movement is detected in the zone and large enough to warrant maximum energy savings.

Ex.:

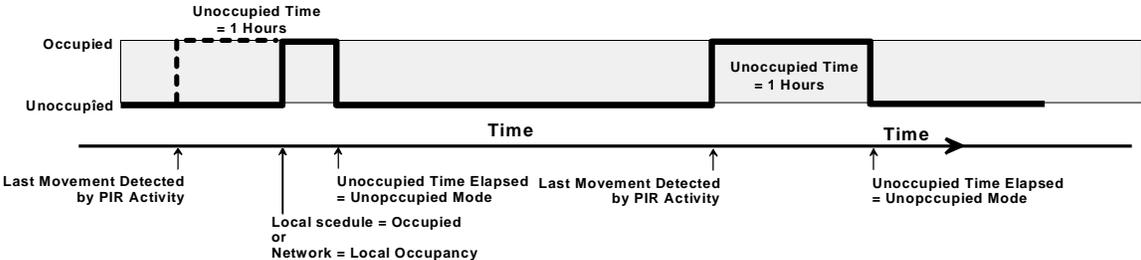


- Unoccupied Events PIR Triggers:** During unoccupied periods (scheduling models with unoccupied local schedule or Unoccupied network command), any movement detected by the PIR cover WILL trigger the internal Unoccupied timer. If an occupied event is scheduled during the time the timer is active (scheduling models with occupied local schedule or Occupied network command) the local thermostat will operate in Occupied mode for the remaining period as dictated by the timer.

Example if:

- The unoccupied timer is set to 1 hour
- A movement is detected at 6:15 AM
- An occupied event is scheduled at 7:00 AM

Then the local thermostat will be occupied from 7:00 AM to 7:15 AM



- **Network Priority and Local Occupancy Routine:**

The internal PIR occupancy logic implementation in conjunction with network commands has been conceived to give the most flexibility while allowing for simple implementation and use.

Network Occupancy Commands: All VT76xx series thermostats have 3 occupancy command levels. This is valid for all network variations available for the thermostats: LON, BACnet-MS-TP or Wireless.

The 3 levels occupancy state level commands are:

State Occupancy Command Levels	Function
Local occupancy	<ul style="list-style-type: none"> - Releases the thermostat to its own occupancy schemes - This may be a PIR sensing device, a local schedule or an occupancy routine done by one of the digital input - This state command level is used to effectively release the thermostat to use the PIR functions
Occupied	<ul style="list-style-type: none"> - Leaves the thermostat in occupied mode and cancels any local occupancy functions, including the PIR occupancy routine - This state command level is used to force the zone to be always occupied
Unoccupied	<ul style="list-style-type: none"> - Leaves the thermostat in unoccupied mode and cancels any local occupancy functions, including the PIR occupancy routine - This state command level is used to force the zone to be always unoccupied. - The only local possible command is a local override if the thermostat is equipped with such an option or if the local keypad lockout allows so

Notes for scheduling all models: VT7652A5x 0B, VT7652B5x 00B, VT7656B5x 00B, VT7657B5x00B and VT7652H5x0B.

- A network occupied or unoccupied command ALWAYS has precedence over the local schedule.
- When the release / local occupancy command is issued, the PIR is only active during Occupied periods as dictated by the local schedule. During the local schedule unoccupied periods, the PIR is not functional and the local thermostat will remain in unoccupied mode.

Network Effective Occupancy Feedback Status: All VT76xx series thermostats have 3 occupancy feedback levels. This is valid for all network variations available for the thermostats: LON, BACnet-MS-TP or Wireless.

Effective Command State Levels	Function
Override / By-Pass	<p>Indicates that the zone is currently local occupied override mode from the unoccupied state</p> <p>This function will operate like a normal local override and its time value is as dictated by the ToccTime configuration parameter setting</p>
Occupied	<p>Indicates that the zone is currently occupied</p> <p>This effective feedback state may be driven by a local occupancy routine like a PIR sensor or by an occupied network command</p>
Unoccupied	<p>Indicates that the zone is currently unoccupied</p> <p>This effective feedback state may be driven by a local occupancy routine like a PIR sensor or by an unoccupied network command</p>

1) BACnet Object Used for Occupancy Commands and Feedback

Object Name	Object ID	BACnet Index	Text
Occupancy Command	MV 12	1	Local Occupancy (PIR or Internal Schedule)
		2	Occupied
		3	Unoccupied
Effective Occupancy	MV 34	1	Occupied
		2	Unoccupied
		3	Temporary Occupied

2) LON Snivets Used for Occupancy Commands and Feedback

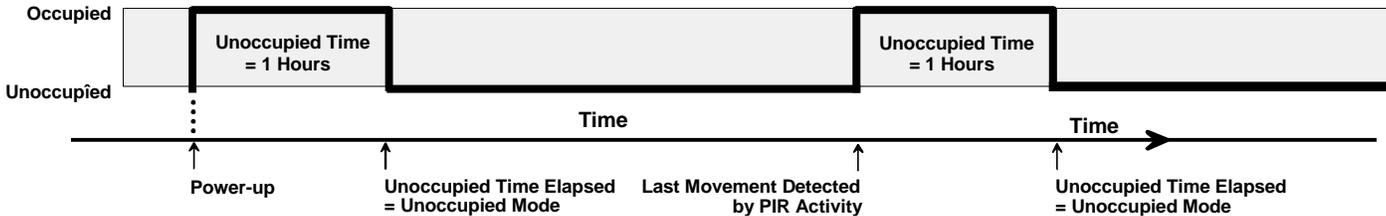
Snivet Name	Notes and Indexes
network input SNVT_occupancy nviOccCmd	<ul style="list-style-type: none"> ➤ Default Null Value: OC_NUL = 0xFF Releases the thermostat to its internal Occupancy function: Internal scheduling, PIR, etc.... ➤ Valid Range: <ul style="list-style-type: none"> 0 = OC_OCCUPIED 1 = OC_UNOCCUPIED 2 = OC_BYPASS – Not Used 3 = OC_STANDY – Not Used 0xFF = OC_NUL (Release to PIR or internal schedule)
network output SNVT_occupancy nvoEffectOccup	<ul style="list-style-type: none"> ➤ This output network variable is used to indicate the actual occupancy mode of the unit. This information is typically reported to a supervisory controller or provided to another Space Comfort Controller to coordinate the operation of multiple units ➤ Valid Range: <ul style="list-style-type: none"> 0 = OC_OCCUPIED 1 = OC_UNOCCUPIED 2 = OC_BYPASS¹ 3 = OC_STANDBY – Not Used <p>Note 1: OC_BYPASS can be initiated by local override. NvoEffectOccup will only be in OC_BYPASS for the duration of the ToccTime (nciGenOpts), until reinitiated by either a transition of the local input or an update to nviOccManCmd.</p>

- Initial State, PIR Occupancy Routine:** The initial effective occupancy state on power-up with either a PIR cover is present:
 - o In stand-alone applications at power-up: Local occupancy mode = Occupied
 - o From a previous network unoccupied command: Local occupancy mode = Unoccupied**
 - o From a previous network occupied command: Local occupancy mode = Unoccupied**

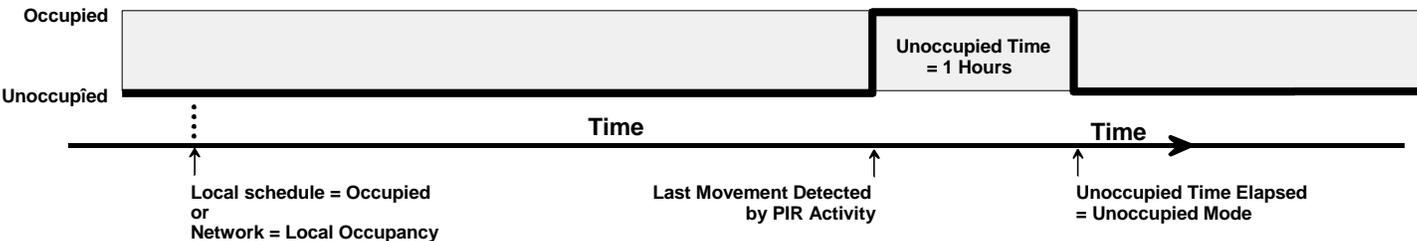
** Valid only if no movements are detected by the PIR for a time duration equal to the Unoccupied Time period "prior" to the occupancy event toggle. See last item under **Important Notes and Things to Know**

When the network effectively releases a thermostat to its local PIR routine from a previous occupied or unoccupied network state, the resulting occupancy state is Unoccupied.

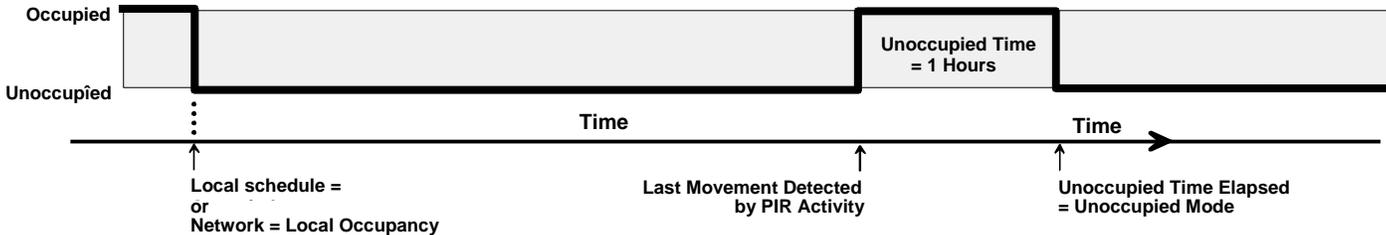
Initial Power-Up, Stand-Alone or Networked



After Receiving the Local Occupancy / PIR Network Command From a Previous Network Unoccupied State



After Receiving the Local Occupancy / PIR Network Command From a Previous Network Occupied State

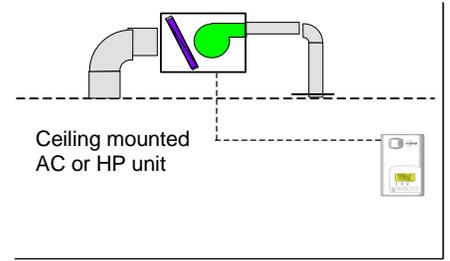


Typical Applications

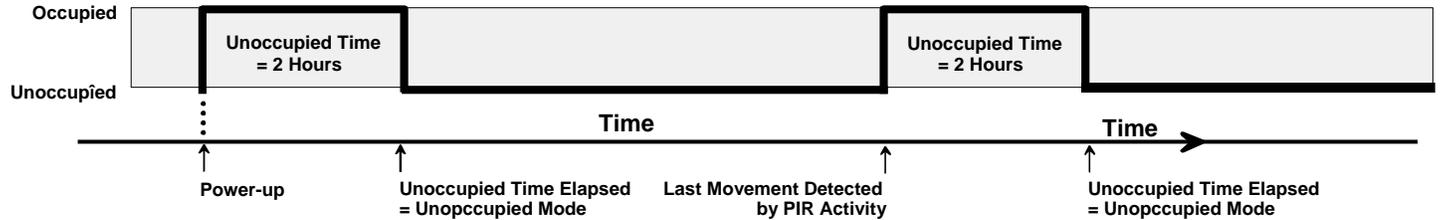
- VT760x Stand-alone application using 2 levels of occupancy with a VI-PIR accessory cover

Non-Scheduling models

Set-up and Configuration	
Thermostat used	Non-Scheduling VT760xX5000
PIR used	COV-PIR-RTU-C-5000 accessory cover
Unoccupied timer value	2.0 hours
Network interface used	None, stand-alone



Sequence of operation:



At initial power-up, when the thermostat 24 Vac power supply is applied; the initial occupancy of the zone will be occupied mode for 2 hours.

If no movement is detected after the 2 hours timer expires, the thermostat occupancy will switch to unoccupied mode.

As soon as the PIR device detects a movement or motion, the occupancy status switches to occupied mode and the occupied setpoints are used.

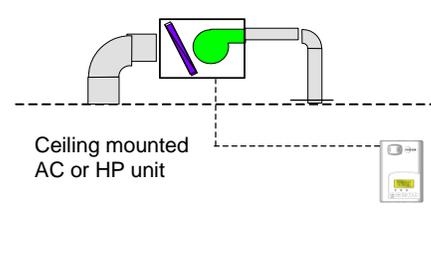
Anytime the PIR device detects local motion, the elapsed unoccupied timer value will be reset. If no motion is detected in the zone for the entire unoccupied timer duration, then the room switches to unoccupied mode and the unoccupied setpoints are used.

At anytime, if the PIR device detects a local movement or motion, the occupancy status switches to occupied mode and the occupied setpoints are used.

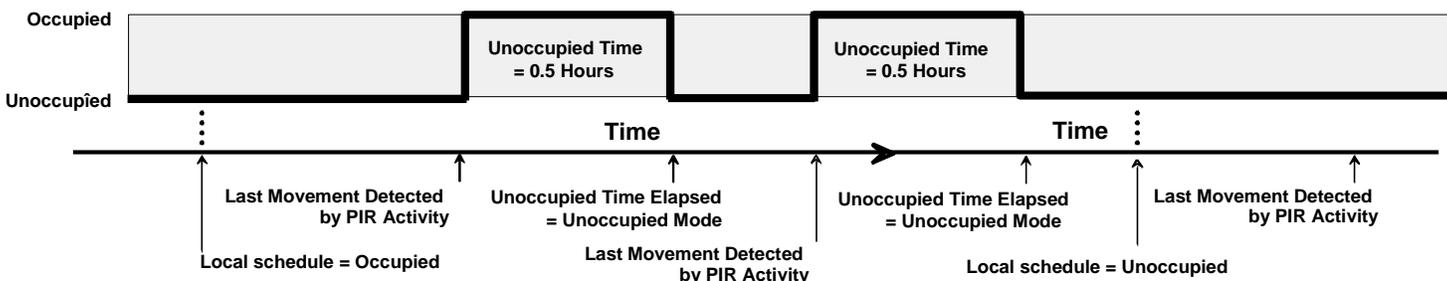
- VT765x Stand-alone application using 2 levels of occupancy with a VI-PIR accessory cover

Scheduling models

Set-up and Configuration	
Thermostat used	Scheduling VT765xX5000
PIR used	COV-PIR-RTU-C-5000 accessory cover
Unoccupied timer value	0.5 hours
Network interface used	None, stand-alone



Sequence of operation:



At initial power-up, when the thermostat 24 Vac power supply is applied; the initial occupancy of the zone will be as dictated by the local thermostat schedule.

If the thermostat schedule is Unoccupied, then the local occupancy mode will be unoccupied and the unoccupied setpoints will be used.

During unoccupied periods by the schedule, the PIR function is not used and the device will remain unoccupied independently of movements or motion detected.

During an unoccupied periods by the schedule, a local override can be made by a user by using the "Override Schedule Y/N?" question prompt in the menu. The override duration will be equivalent to the value set in the "TocTime" configuration parameter. The PIR function is not used during the local override period.

The PIR function is only used when the local thermostat is in occupied mode as dictated by the local schedule.

During the occupied period as dictated by the local schedule; as soon as the PIR device detects a movement or motion, the occupancy status switches to occupied mode and the occupied setpoints are used.

if no movement is detected after the 0.5 hour timer expires, the thermostat occupancy will switch to unoccupied mode.

Anytime the PIR device detects local motion during the occupied period as dictated by the local schedule, the elapsed unoccupied timer value will be reset. If no motion is detected in the zone for the entire unoccupied timer duration, then the room switches to unoccupied mode and the unoccupied setpoints are used.

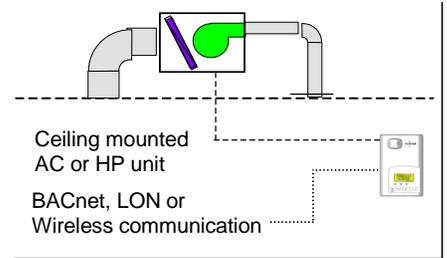
At anytime, if the PIR device detects a local movement or motion during the occupied period as dictated by the local schedule, the occupancy status switches to occupied mode and the occupied setpoints are used.

When the thermostat switches to an unoccupied periods as dictated by the local schedule, the PIR function is not used and the device will remain unoccupied independently of movements or motion detected.

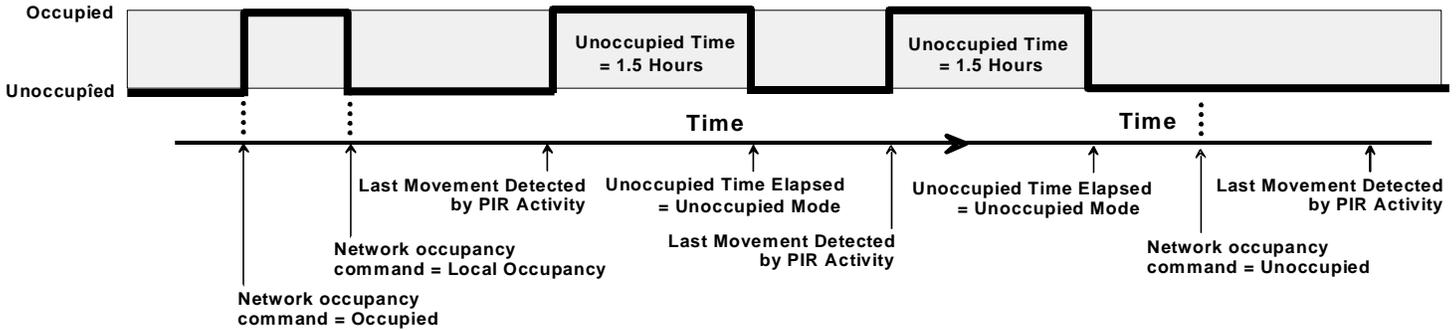
• VT760x Networked application using 2 levels of occupancy with a VI-PIR accessory cover

Non-Scheduling models

Set-up and Configuration	
Thermostat used	Non-Scheduling VT760xX5000X
PIR used	COV-PIR-RTU-C-5000 accessory cover
Unoccupied timer value	1.5 hours
Network interface used	None, stand-alone



Sequence of operation:



At initial power-up, when the thermostat 24 Vac power supply is applied; the initial occupancy of the zone will be occupied mode for 1.5 hours unless a Network Occupied or Unoccupied command is received.

If a Network Occupied Command is received, the PIR function is not used and the device will remain occupied independently of movements or motion detected.

If a Network Unoccupied Command is received, the PIR function is not used and the device will remain unoccupied independently of movements or motion detected.

During a Network Unoccupied Command period, a local override can be made by a user by using the "Override Schedule Y/N?" question prompt in the menu. The override duration will be equivalent to the value set in the "ToccTime" configuration parameter. The PIR function is not used during the local override period.

The PIR function is only used if the local thermostat receives a Network Local Occupancy Command as dictated by the remote BAS front end schedule.

During the Network Local Occupancy Command period as dictated by the local schedule; as soon as the PIR device detects a movement or motion, the occupancy status switches to occupied mode and the occupied setpoints are used.

if no movement is detected after the 1.5 hour timer expires, the thermostat occupancy will switch to unoccupied mode.

Anytime the PIR device detects local motion during the Network Local Occupancy Command period as dictated by the remote BAS front end schedule, the elapsed unoccupied timer value will be reset. If no motion is detected in the zone for the entire unoccupied timer duration, then the room switches to unoccupied mode and the unoccupied setpoints are used.

At anytime, if the PIR device detects a local movement or motion during the Network Local Occupancy Command period as dictated by the remote BAS front end schedule, the occupancy status switches to occupied mode and the occupied setpoints are used.

If a Network Occupied Command is received, the PIR function is not used and the device will remain occupied independently of movements or motion detected.

If a Network Unoccupied Command is received, the PIR function is not used and the device will remain unoccupied independently of movements or motion detected.

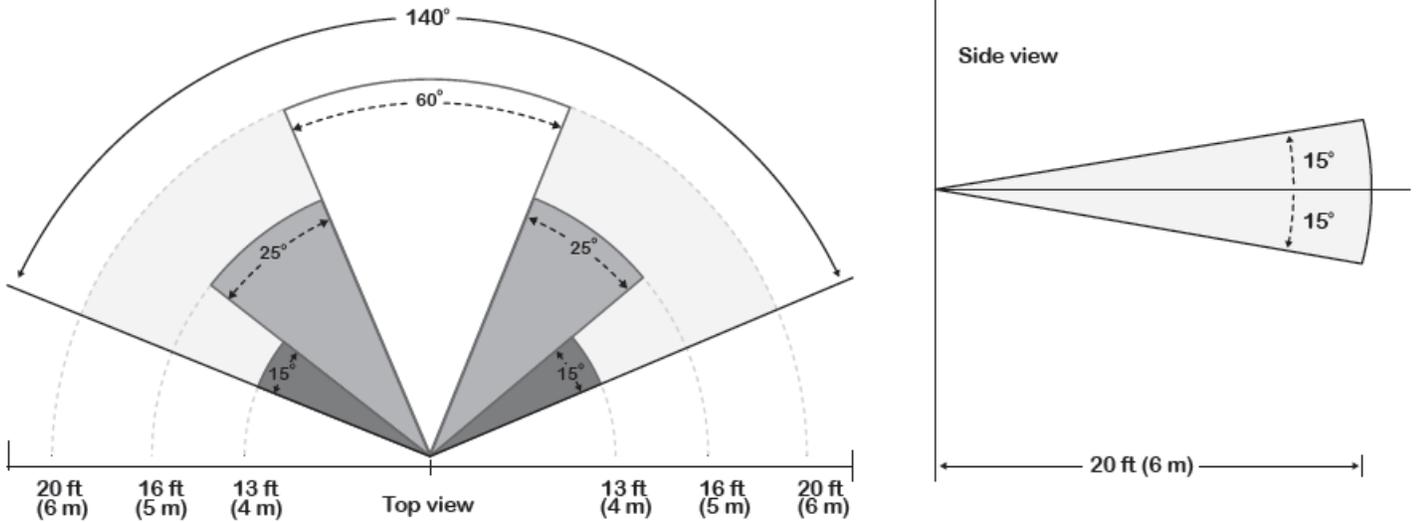
Typical Detection Pattern for VI-PIR Lens

Sequence of Operation

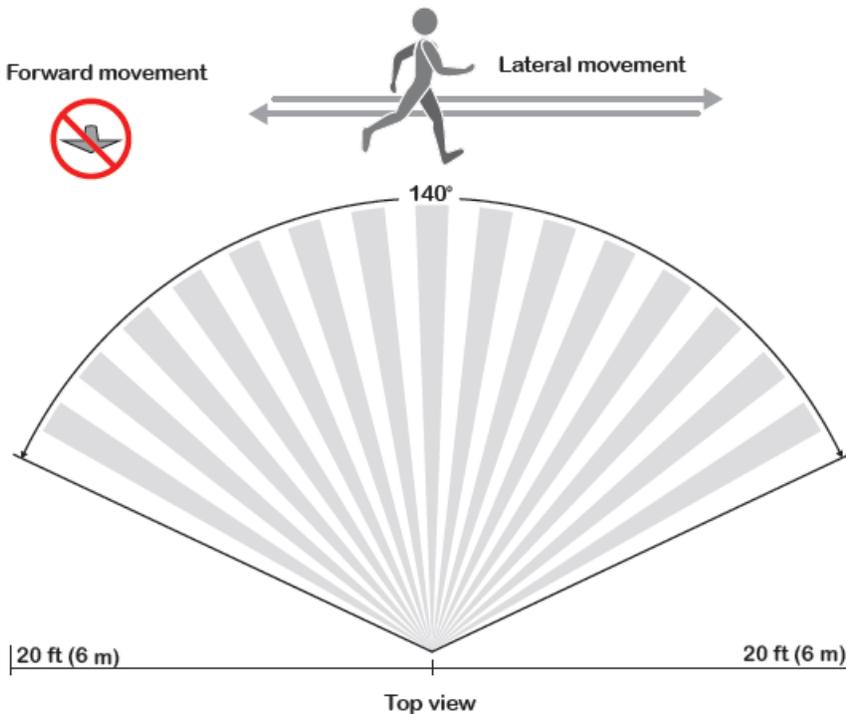
Initially, the Room Controller is in Stand-by mode and Stand-by setpoints are used. When the Passive Infra-Red (PIR) sensor detects motion, the Occupancy status switches to Occupied and the Stand-By Time timer is reset. The Occupied setpoints are used for this operation. If no motion is detected in the room for the entire Stand-By Time duration (adjustable parameter), the room switches to Stand-by mode and Stand-by setpoints are used. While in Stand-by mode, if no motion is detected for the entire Unoccupied Time period (adjustable parameter), the room switches to Unoccupied mode and uses its Unoccupied setpoints. While in Stand-By or Unoccupied mode, any motion switches the room back to Occupied mode.

PIR ranges measure 20 feet (6 meters) at 140° and 13 feet (4.5 meters) minimum between 15° to 30° laterally. A typical installation height of approximately 5 feet (1.5 meters) is considered in these measurements.

The below illustrates the resolution.



Fresnel lens beam and detection field



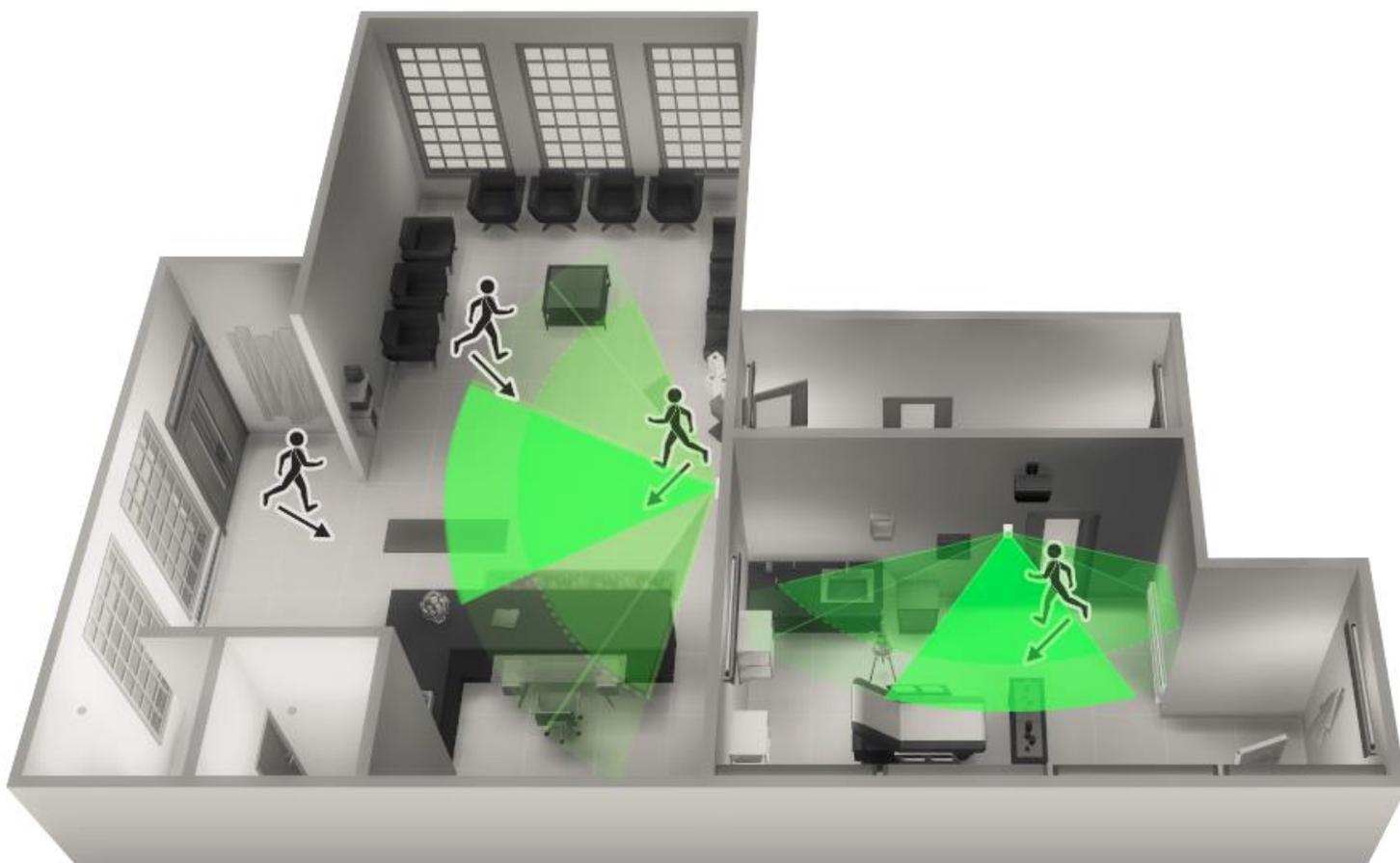
Deployment

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.

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 120°, and 15 feet (4.5 meters) between 15° to 30° laterally.



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 could 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.

