Density

Pre-Install Assessment Guide

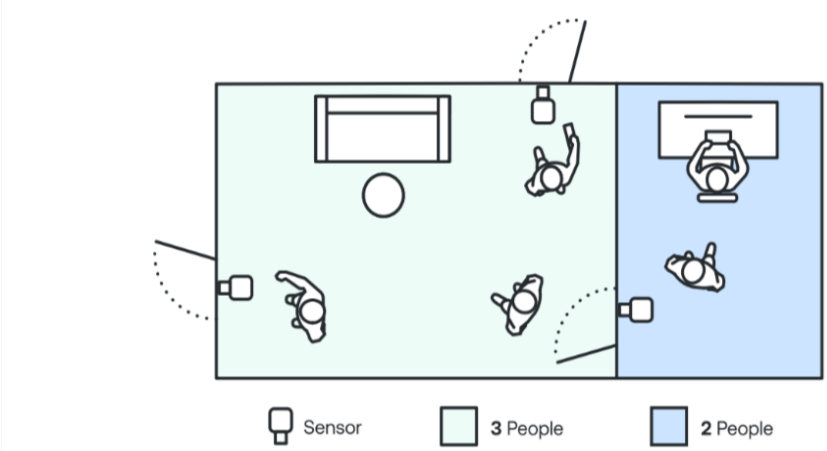
Sensor Version s5b (lid with ceiling mount threads)

Entryway Guidelines 01

Number of Sensors

To maintain an accurate count of a space, you need to install a sensor above every entryway to that space.

The sensor is designed for indoor use only.

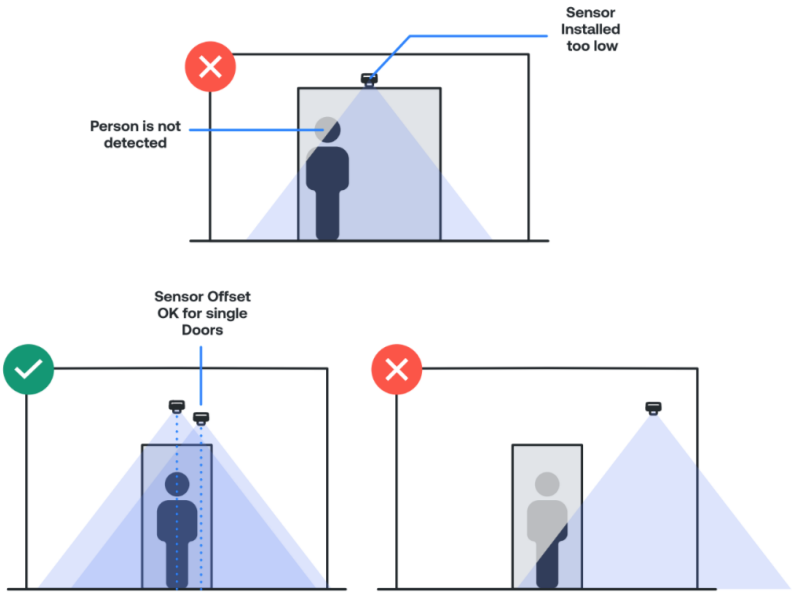


Field of View / Placement

The total detection area beneath the sensor is called the FOV (Field of View). To count people, the entryway needs adequate FOV coverage. Refer to the Install Height Chart to determine the minimum sensor height for your entryway.

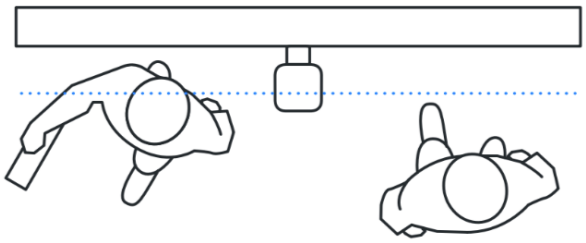
The sensor should be centered horizontally above the entryway or hallway to ensure people are detected within the field of view. The exception to this rule is if the sensor height is at 100in (254cm) or below and the sensor is being mounted over a single swinging door. In this case, a sensor offset of 10in (25.4cm) will be needed. See Single Door Specifics Section.

The sensor cannot be mounted inside of the ceiling, on a side wall facing the entryway, or in the corner of a room.



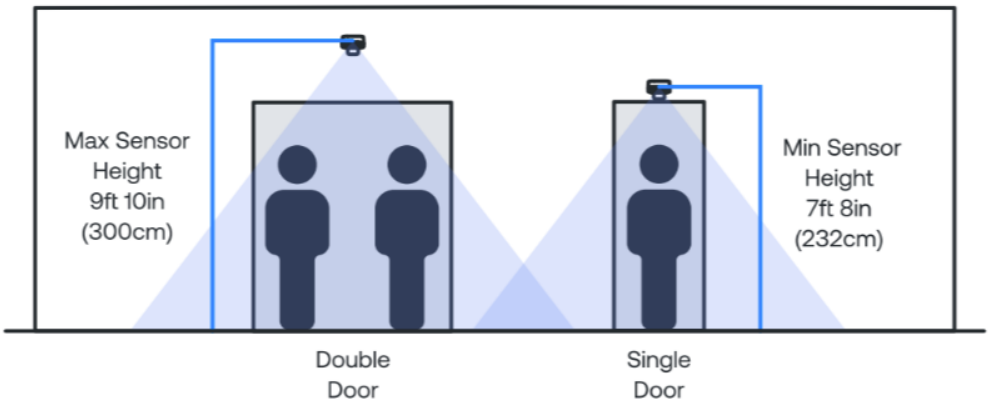
Trigger Line

People are counted as they cross an invisible barrier known as the Trigger Line. The sensor needs to be installed as close to the entryway as possible to ensure people cross this line.



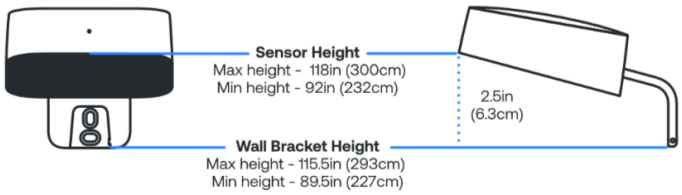
Install Height

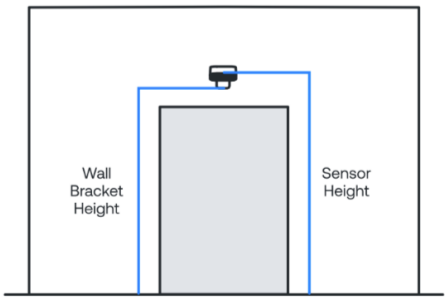
The higher the sensor height, the greater the entryway FOV (Field of View) coverage. Install the sensor at its maximum height of 9ft 10in (118in or 300cm) for optimal entryway coverage. The minimum install height for the sensor is 7ft 8in (232cm). Refer to the Install Height Chart.



Sensor Height

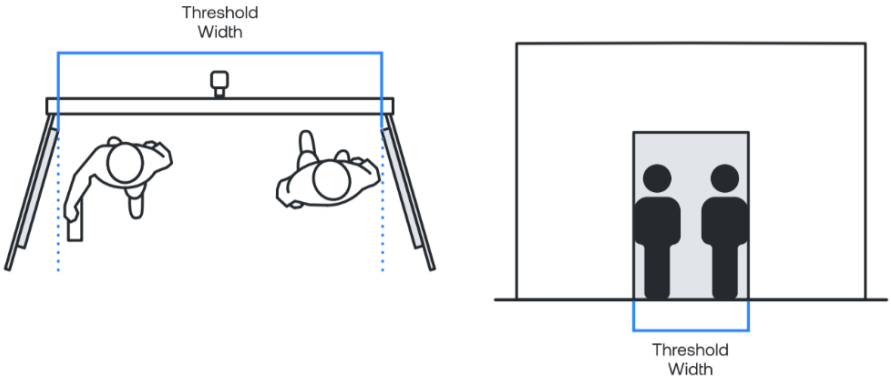
Adequate sensor height is very important to ensure proper FOV coverage of the entryway. The Sensor Height is determined by measuring the distance between the front edge of the sensor or black window and the ground. The Wall Bracket Height is the distance between the bottom of the Wall Bracket and the ground. For wall mounted installations, Sensor Height can be determined by measuring the Wall Bracket Height and adding 2.5in (6.3cm) to that measurement.





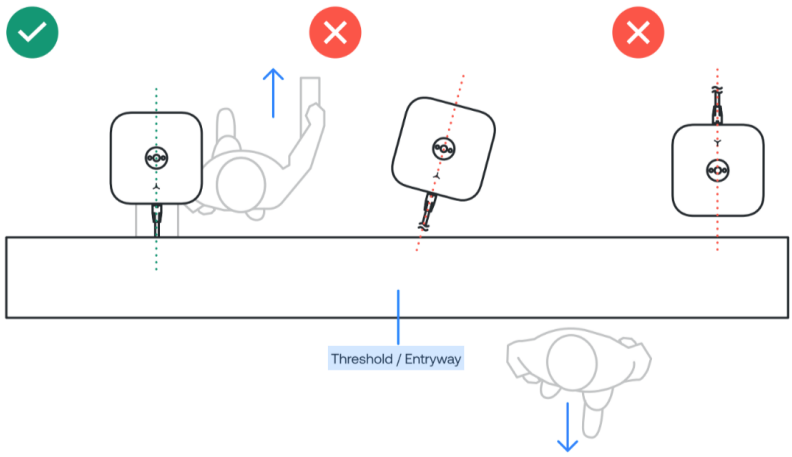
Threshold Width

To determine the Threshold Width of the entryway, measure the open space that a person can physically walk through. Doors with handles can restrict the walkable pathway and reduce the FOV coverage requirements. For entryways with doors, open the door fully and measure the width of the unobstructed path through the doorway. For hallways or entryways with no doors, measure the distance from wall to wall.



Sensor Orientation

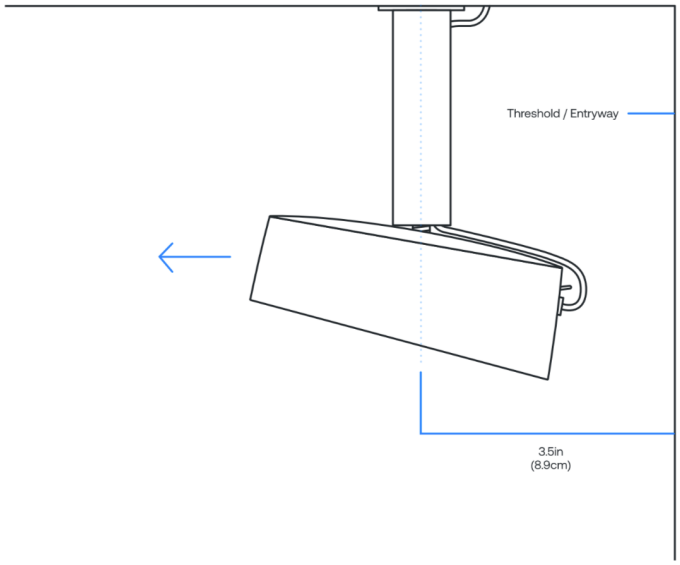
The sensor must be positioned parallel to the flow of traffic. If mounted near an entryway, the sensor should be pointing away from the wall.



Sensor Positioning

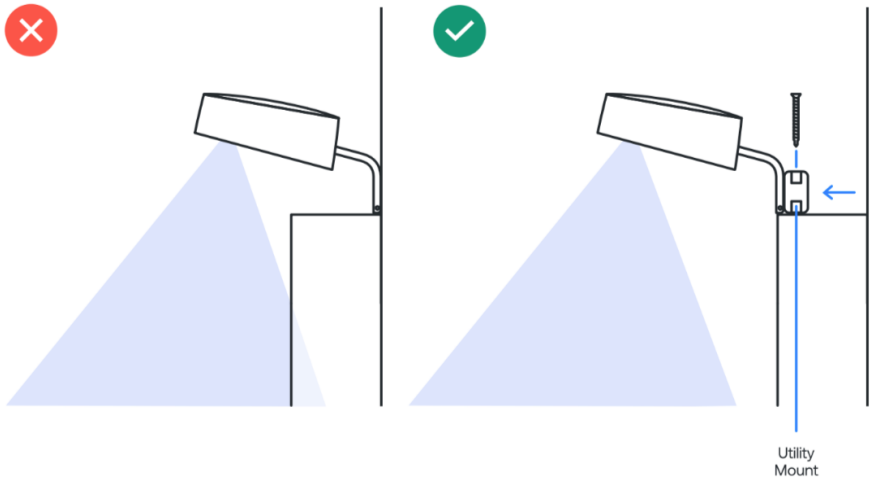
When mounting the sensor to the ceiling, make sure that the sensor is not mounted too close or too far away from the entryway/threshold. The optimal position for the threaded rod is 3.5in (8.9cm) away from the threshold/entryway.

In some cases obstructions or other environmental issues may call for the sensor to be installed outside of these guidelines. Any deviation from the guidelines should be under direct consultation of an account representative.



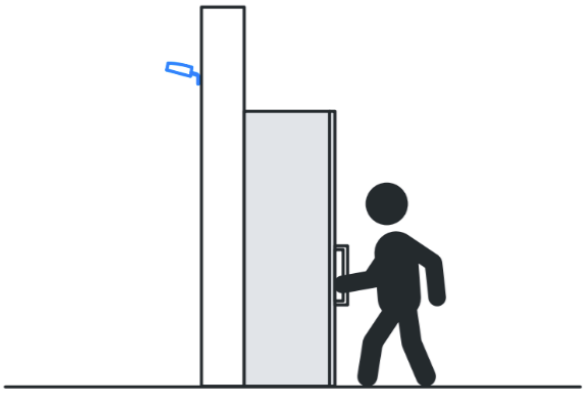
Door Frames

Installing the sensor near a door frame can cause potential FOV interference. If your installation requires a door frame mount, make sure to position the sensor towards the front edge of the door frame.



Door Swing

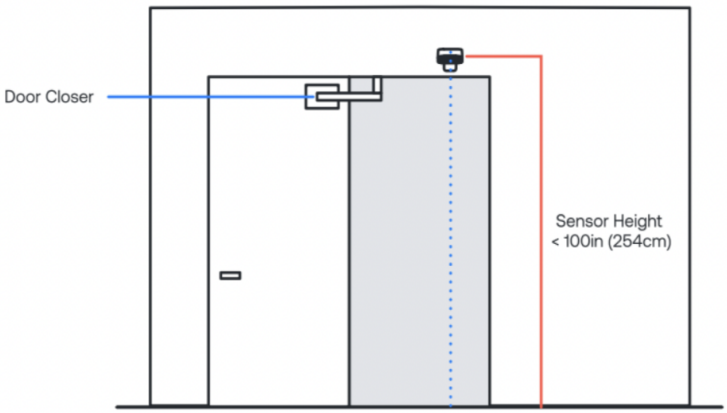
The sensor performs best when mounted on the non-door swing side of the entryway.

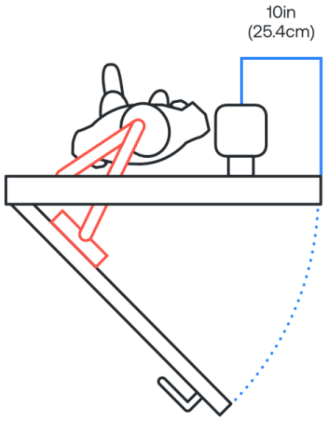


Single Door Specifics

For some single doors, the optimal sensor placement is closer to the handle side of the door. Mount the sensor approximately 10in (25.4cm) away from the handle side of the door if your single door meets any of the below criteria:

- The sensor height is 100in (254cm) or less
- A door closer swings under the sensor

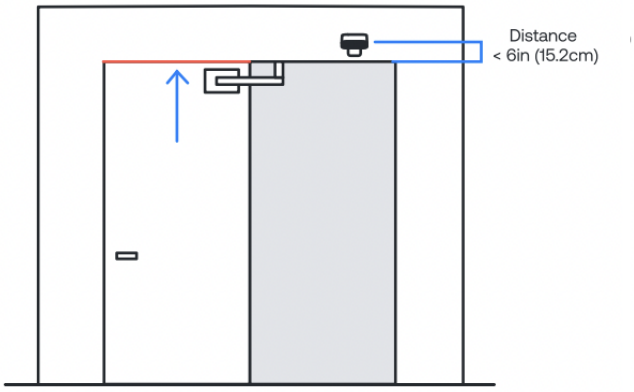




Black Tape

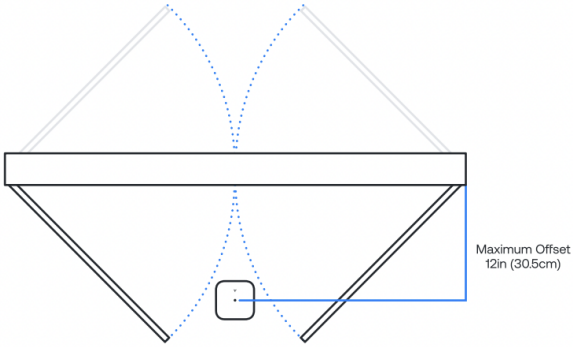
If the sensor is mounted too close to a swinging door, the IR light emitting from the sensor will bounce off of the top surface of the door and cause interference with the sensor. If the door swings underneath the sensor, and the distance between the sensor and the top of the door is 6in (15.2cm) or less, apply a strip of black painters or gaffers tape to the entire top surface of the door. Make sure to trim off any excess tape. The tape will help absorb the emitted sensor light, and mitigate any interference.

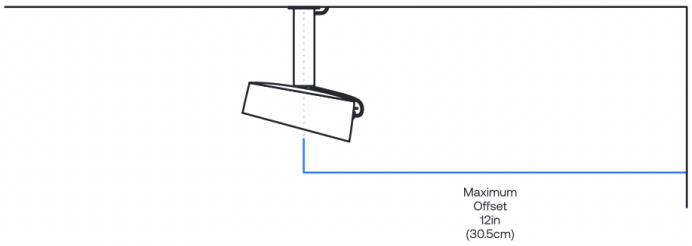
** Metal doors cause extreme light reflection at any sensor height. If your door is made of metal, apply a strip of black tape to the entire top surface of the door regardless of sensor height.*



Door Swing Offset

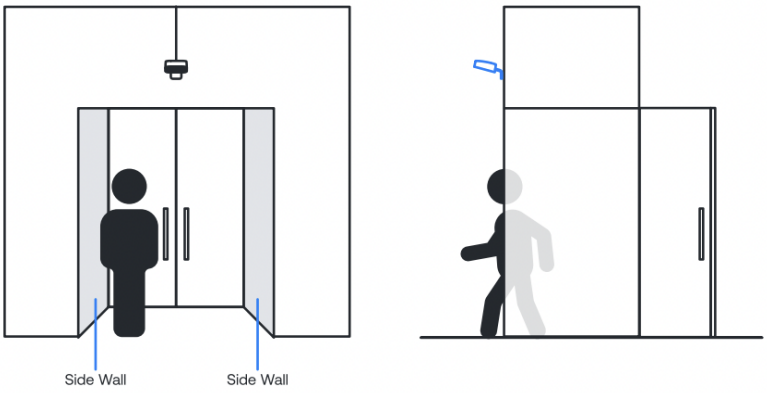
Doors that swing both directions, and that are flush with the ceiling require the sensor to be ceiling mounted and offset away from the swinging door to avoid any collision. The maximum offset distance for the sensor is 12in (30.5cm), measured from the wall to the center of the sensor.





Overhang

Some doorways have a structural overhang which would prevent the sensor from being installed above the door at the optimal mounting height. The sensor can be offset from the door and mounted above the opening of the overhang. The opening will act as an extension of the door entryway. In order for the overhang mount to work, there needs to be structural side walls to confine human movement to the area beneath the sensor.



Install Height Chart - Single Sensor

To determine the necessary sensor height for a given threshold, first measure the threshold width (the physical opening that a person can walk through), then refer to the Install height Chart for the minimum sensor height. Use the minimum sensor height as the starting measurement for the Mounting Zone. The upper measurement of the mounting zone will be the overall maximum sensor install height of 118in (300cm). Mount the sensor near the center of the Mounting Zone.

** If the sensor height is at 100in (254cm) or below and the sensor is being mounted over a single swinging door, a sensor offset of 10in (25.4cm) will be needed. The sensor is offset to be positioned over the handle side of the door so coverage is emphasized on the side that people walk through the door. See Single Door Specifics.*

Install Height Chart			
Standard (in)		Metric (cm)	
Threshold Width	Min Sensor Height	Threshold Width	Min Sensor Height
≤ 40in	*92in (7ft 8in)	≤ 101cm	*232cm
≤ 45in	*93in	≤ 114cm	*236cm
≤ 50in	*96in	≤ 127cm	*244cm
≤ 55in	99in	≤ 140cm	251cm
≤ 60in	102in	≤ 153cm	259cm
≤ 65in	105in	≤ 166cm	266cm
≤ 70in	108in	≤ 178cm	274cm
≤ 75in	111in	≤ 191cm	282cm
≤ 80in	114in	≤ 203cm	290cm
≤ 85in	117in	≤ 216cm	297cm
≤ 90in (7ft 6in)	118in (9ft 10in)	≤ 229cm	300cm
Minimum Sensor Height - 92in (7ft 8in) Maximum Sensor Height - 118in (9ft 10in)		Minimum Sensor Height - 232cm Maximum Sensor Height - 300cm	

If your entryway falls outside of these guidelines, additional sensors may be needed. Please reach out to your account representative or support@density.io

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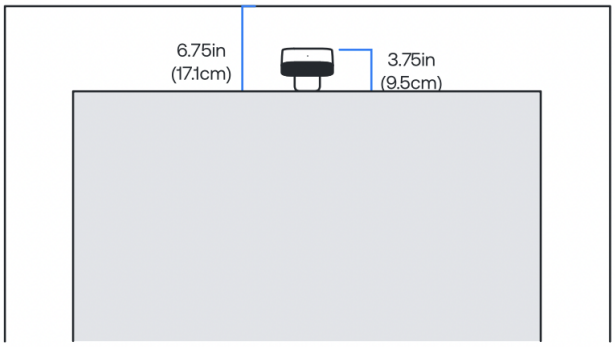
Clearance

For standard wall mount installations (section 5), a minimum of 6.75in (17.1cm) of unobstructed vertical wall space is required above the entryway. This allows enough clearance to mount the sensor, and for the sensor to receive adequate air flow to operate as expected.

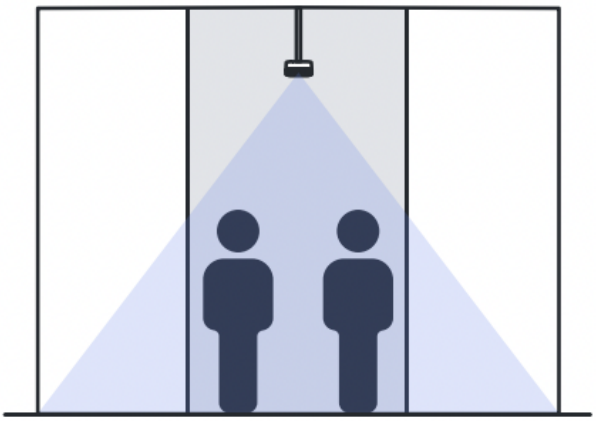
For ceiling mount installations, the sensor cannot hang below the entryway if the door swings toward the sensor as the door will make contact. If the door swings toward the sensor, the sensor must be offset away from the door (see Door Swing Offset section).



Hallways

In certain scenarios the sensor can be suspended over hallways using a threaded rod and a Ceiling Mount Kit.

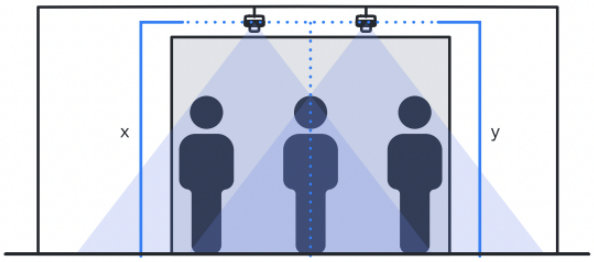
Make sure to follow the Install Height Chart for hallway installs.

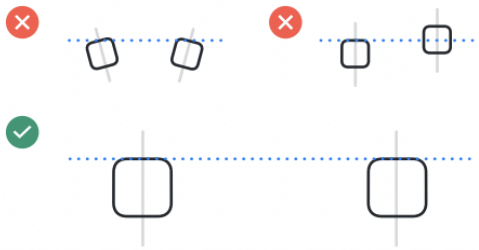


Multiple Sensors

If entryway width is too wide, and the sensor cannot be mounted high enough for ample FOV coverage, an additional sensor or two can be added. We recommend using less sensors when possible, however, one entryway can support up to 3 sensors total.

When installing multiple sensors, they should be mounted in line and parallel to each other as shown.

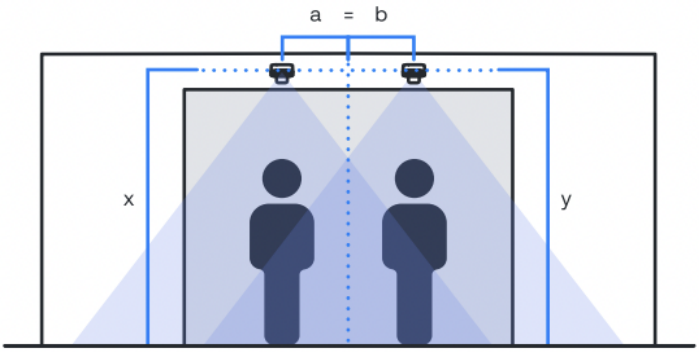




Multi Unit Spacing - 2 Sensors

For 2 sensor installs, the distance between the centerpoint of the entryway and the center point of the left and right sensors should be equal (a = b). The distance from the ground to the sensors should also be equal (x = y).

Make sure to record distance between sensor centerpoints, sensor height, as well as both sensor serial numbers.



Install Height / Spacing Chart - 2 Sensors

The Install Height / Spacing Chart lists the minimum sensor height requirements for various threshold widths as well as the required distance between sensors.

To use the chart, measure the threshold width (the physical opening that a person can walk through), then look at the chart for the minimum required install height. Space the sensors over the threshold according to the Distance Between Sensors section of the chart. The minimum allowable distance between sensors is 22in (56cm), and the maximum allowable distance between sensors is 67in.

If needed, please reach out to your account representative or support@density.io for a walk through of the Install Height / Spacing Chart.

2 Sensors - Standard (in)

Threshold Width	Min Sensor Height	Sensor Heights	92in	94in	96in	98in	100in	102in	104in	106in	108in	110in	112in	114in	116in	118in
		Distance Between Sensors														
≤ 68in	*92in		25in	28in	30in	34in	37in	40in	43in	46in	49in	52in	55in	58in	61in	64in
≤ 74in	94in		N/A	28in	30in	34in	37in	40in	43in	46in	49in	52in	55in	58in	61in	64in
≤ 80in	96in		N/A	N/A	30in	34in	37in	40in	43in	46in	49in	52in	55in	58in	61in	64in
≤ 86in	98in		N/A	N/A	N/A	34in	37in	40in	43in	46in	49in	52in	55in	58in	61in	64in
≤ 92in	100in		N/A	N/A	N/A	N/A	37in	40in	43in	46in	49in	52in	55in	58in	61in	64in
≤ 98in	102in		N/A	N/A	N/A	N/A	N/A	40in	43in	46in	49in	52in	55in	58in	61in	64in
≤ 104in	104in		N/A	N/A	N/A	N/A	N/A	N/A	43in	46in	49in	52in	55in	58in	61in	64in
≤ 110in	106in		N/A	N/A	N/A	N/A	N/A	N/A	N/A	46in	49in	52in	55in	58in	61in	64in
≤ 116in	108in		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	49in	52in	55in	58in	61in	64in
≤ 122in	110in		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	52in	55in	58in	61in	64in
≤ 128in	112in		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	55in	58in	61in	64in
≤ 134in	114in		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	58in	61in	64in
≤ 140in	116in		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	61in	64in
≤ 146in	*118in		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	64in

*Minimum Sensor Height - 92in (7ft 8in) *Maximum Sensor Height - 118in (9ft 10in)

2 Sensors - Metric (cm)

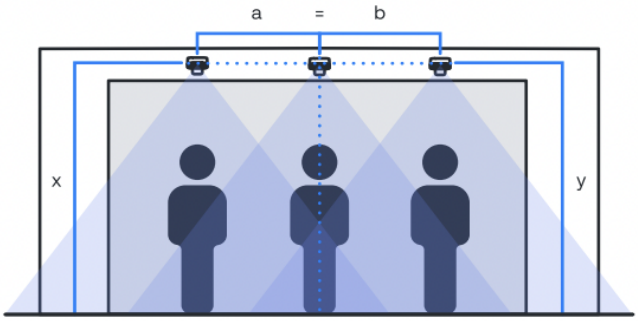
Threshold Width	Min Sensor Height	Sensor Heights	232cm	239cm	245cm	249cm	254cm	259cm	264cm	269cm	274cm	279cm	284cm	289cm	295cm	300cm
		Distance Between Sensors														
≤ 157cm	*232cm		63cm	71cm	76cm	86cm	94cm	101cm	109cm	117cm	124cm	132cm	140cm	147cm	155cm	162cm
≤ 173cm	234cm		63cm	71cm	76cm	86cm	94cm	101cm	109cm	117cm	124cm	132cm	140cm	147cm	155cm	162cm
≤ 188cm	239cm		N/A	71cm	76cm	86cm	94cm	101cm	109cm	117cm	124cm	132cm	140cm	147cm	155cm	162cm
≤ 203cm	245cm		N/A	N/A	76cm	86cm	94cm	101cm	109cm	117cm	124cm	132cm	140cm	147cm	155cm	162cm
≤ 218cm	249cm		N/A	N/A	N/A	86cm	94cm	101cm	109cm	117cm	124cm	132cm	140cm	147cm	155cm	162cm
≤ 234cm	254cm		N/A	N/A	N/A	N/A	94cm	101cm	109cm	117cm	124cm	132cm	140cm	147cm	155cm	162cm
≤ 249cm	259cm		N/A	N/A	N/A	N/A	N/A	101cm	109cm	117cm	124cm	132cm	140cm	147cm	155cm	162cm
≤ 264cm	264cm		N/A	N/A	N/A	N/A	N/A	N/A	109cm	117cm	124cm	132cm	140cm	147cm	155cm	162cm
≤ 279cm	269cm		N/A	N/A	N/A	N/A	N/A	N/A	N/A	117cm	124cm	132cm	140cm	147cm	155cm	162cm
≤ 295cm	274cm		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	124cm	132cm	140cm	147cm1	155cm	162cm
≤ 310cm	279cm		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	132cm	140cm	47cm	155cm	162cm
≤ 325cm	284cm		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	140cm	147cm	155cm	162cm
≤ 340cm	289cm		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	147cm	155cm	162cm
≤ 356cm	295cm		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	155cm	162cm
≤ 371cm	*300cm		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	162cm

*Minimum Sensor Height - 232cm (2.32m) *Maximum Sensor Height - 300cm (3m)

Multi Sensor Spacing - 3 Sensors

For 3 sensor installs, the distance between the centerpoint of centrally mounted sensor and the center point of the left and right sensors should be equal (a = b). The distance from the ground to the sensors should also be equal (x = y).

Make sure to record distance between sensor centerpoints, sensor height, as well as both sensor serial numbers.



Install Height / Spacing Chart - 3 Sensors

The Install Height / Spacing Chart lists the minimum sensor height requirements for various threshold widths as well as the required distance between sensors.

To use the chart, measure the threshold width (the physical opening that a person can walk through), then look at the chart for the minimum required install height. Space the sensors over the threshold according to the Distance Between Sensors section of the chart. The minimum allowable distance between sensors is 22in (56cm), and the maximum allowable distance between sensors is 67in.

3 Sensors - Standard (in)

Threshold Width	Min Sensor Height	Sensor Heights														
			92in	94in	96in	98in	100in	102in	104in	106in	108in	110in	112in	114in	116in	118in
		Distance Between Sensors														
≤ 93in	*92in		25in	28in	30in	34in	37in	40in	43in	46in	49in	52in	55in	58in	61in	64in
≤ 102in	94in		N/A	28in	30in	34in	37in	40in	43in	46in	49in	52in	55in	58in	61in	64in
≤ 111in	96in		N/A	N/A	30in	34in	37in	40in	43in	46in	49in	52in	55in	58in	61in	64in
≤ 120in	98in		N/A	N/A	N/A	34in	37in	40in	43in	46in	49in	52in	55in	58in	61in	64in
≤ 129in	100in		N/A	N/A	N/A	N/A	37in	40in	43in	46in	49in	52in	55in	58in	61in	64in
≤ 138in	102in		N/A	N/A	N/A	N/A	N/A	40in	43in	46in	49in	52in	55in	58in	61in	64in
≤ 147in	104in		N/A	N/A	N/A	N/A	N/A	N/A	43in	46in	49in	52in	55in	58in	61in	64in
≤ 156in	106in		N/A	N/A	N/A	N/A	N/A	N/A	N/A	46in	49in	52in	55in	58in	61in	64in
≤ 165in	108in		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	49in	52in	55in	58in	61in	64in
≤ 174in	110in		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	52in	55in	58in	61in	64in
≤ 183in	112in		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	55in	58in	61in	64in
≤ 192in	114in		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	58in	61in	64in
≤ 201in	116in		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	61in	64in
≤ 210in	*118in		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	64in

*Minimum Sensor Height - 92in (7ft 8in) *Maximum Sensor Height - 118in (9ft 10in)

3 Sensors - Metric (cm)																	
Threshold Width	Min Sensor Height	Sensor Heights															
			232cm	239cm	245cm	249cm	254cm	259cm	264cm	269cm	274cm	279cm	284cm	289cm	295cm	300cm	
		Distance Between Sensors															
≤ 213cm	*232cm		63cm	71cm	76cm	86cm	94cm	101cm	109cm	117cm	124cm	132cm	140cm	147cm	155cm	162cm	
≤ 236cm	234cm		63cm	71cm	76cm	86cm	94cm	101cm	109cm	117cm	124cm	132cm	140cm	147cm	155cm	162cm	
≤ 259cm	239cm		N/A	71cm	76cm	86cm	94cm	101cm	109cm	117cm	124cm	132cm	140cm	147cm	155cm	162cm	
≤ 282cm	245cm		N/A	N/A	76cm	86cm	94cm	101cm	109cm	117cm	124cm	132cm	140cm	147cm	155cm	162cm	
≤ 304cm	249cm		N/A	N/A	N/A	86cm	94cm	101cm	109cm	117cm	124cm	132cm	140cm	147 cm	155cm	162cm	
≤ 328cm	254cm		N/A	N/A	N/A	N/A	94cm	101cm	109cm	117cm	124cm	132cm	140cm	147cm	155cm	162cm	
≤ 350cm	259cm		N/A	N/A	N/A	N/A	N/A	101cm	109cm	117cm	124cm	132cm	140cm	147cm	155cm	162cm	
≤ 373cm	264cm		N/A	N/A	N/A	N/A	N/A	N/A	109cm	117cm	124cm	132cm	140cm	147cm	155cm	162cm	
≤ 396cm	269cm		N/A	N/A	N/A	N/A	N/A	N/A	N/A	117cm	124cm	132cm	140cm	147cm	155cm	162cm	
≤ 419cm	274cm		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	124cm	132cm	140cm	147cm1	155cm	162cm	
≤ 442cm	279cm		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	132cm	140cm	47cm	155cm	162cm	
≤ 465cm	284cm		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	140cm	147cm	155cm	162cm	
≤ 488cm	289cm		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	147cm	155cm	162cm	
≤ 510cm	295cm		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	155cm	162cm	
≤ 533cm	*300cm		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	162cm	
*Minimum Sensor Height - 232cm (2.32m) *Maximum Sensor Height - 300cm (3m)																	

Creating an Installation Plan 02

General Installation Checklist

Collecting adequate data and measurements for each entryway will help Density provide entryway-specific installation recommendations to maximize people-counting accuracy.

Reference the checklist below:

- Floor plan with each entryway clearly labeled (alphabetical or numerical reference system recommended)
- Device can be positioned horizontally over the entryway
- No obstructions to the FOV (e.g. exit signs, sensors, etc.)
- Recommended sensor install height of 2in-10in above the top of the door frame. (Please consult Density for more information)
- Available power through PoE+ connection (switch or injectort)
- Available internet connectivity through wired ethernet, or WiFi

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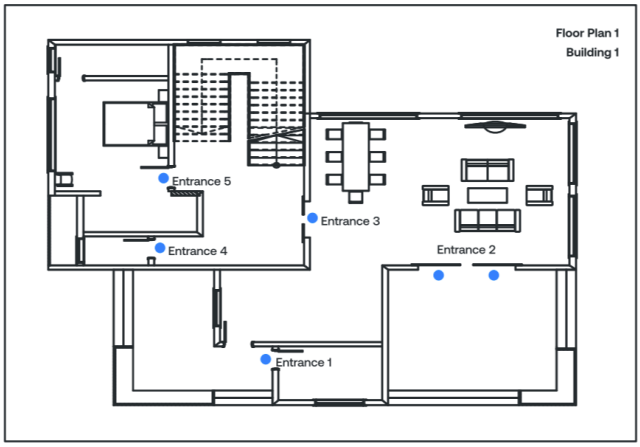
Floor Plans

In order to get an accurate count for any given enclosed space, all entries/exits for that space must be covered by a Density threshold sensor. Floor plans allow Density to determine the number and location of all Density sensors that need to be installed.

Action: Please provide up-to-date, high-fidelity floor-plans that include spaces to be measured and associated entranceways/exits.



Entryway Measurements and Details

Entryway measurements allow Density to position a device at a given doorway to maximize accuracy.

Action: Please take the measurements and details listed here for each door that will be monitored by a Density sensor.

Item	Description	Why
Door Information		
Door Side	E.g. Office side, Outside conference room, etc.)	Will need info for front and back to determine optimal placement
Floor plan location / Door name	E.g. Floor-plan ID 1, Atrium entrance	Easy to navigate to door for installation
	Measurements	
Entryway Width	Width of entryway opening through which individuals can pass	FOV Width
Entryway Height	Height of entryway opening through which individuals can pass	FOV Height
Clearance above Entryway	Distance from top of the entryway to ceiling	Ensure enough space for standard mount
Ceiling Height	Distance from floor to ceiling	In case we need to use a ceiling mount
	Note Additional Detail	
Wall material above Entryway and Ceiling Material	E.g. concrete, glass, etc.	To determine best mounting method
Potential Obstructions	Pictures and measurements of objects potentially in front of or below sensor, e.g, exit signs, motion sensors.	Anticipate FOV issues

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Entryway Photographs

Photographs are necessary to understand the possible mounting options, and to give a better understanding of the environment the sensor will be performing in.

Entryway Photographs 03

Entryway Photographs

Please provide Density with digital photos of each of the doorways.

For each doorway, provide the following photos:

- Facing the entryway head-on (Full-height of doorway, including clearance space above)
- Facing the entryway at a 45 degree angle (full-height of doorway, including clearance space above)
    - Special photos of any potential obstructions or unique features of a particular entryway (optional)

Front of Door Photo

Back of Door Photo

Example 45-degree Angle Photo

The full-length view and multiple angles of both sides of the door will allow us to anticipate obstructions or other unique characteristics that may impact the installation of the sensor.

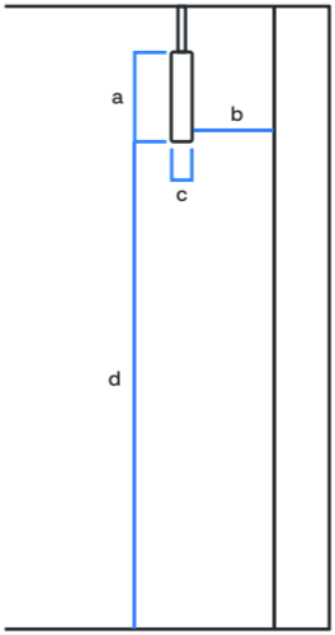
45 degree Photo of front

45 degree Photo of back

Doorway-specific characteristics

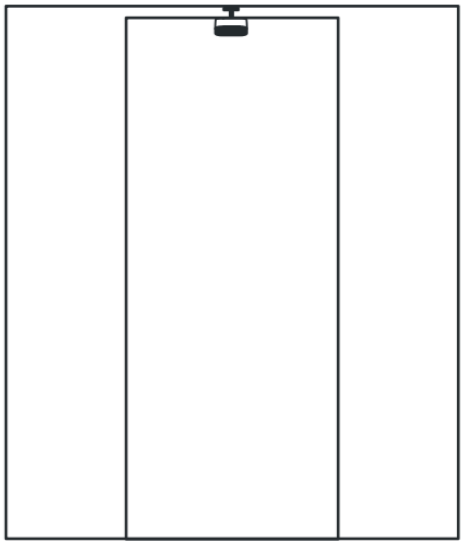
Exit Signs and Sensors :

Record measurements (a,b,c,d) of any exit signs or other peripheral sensors that may interfere with the physical installation or the FOV of the sensor.



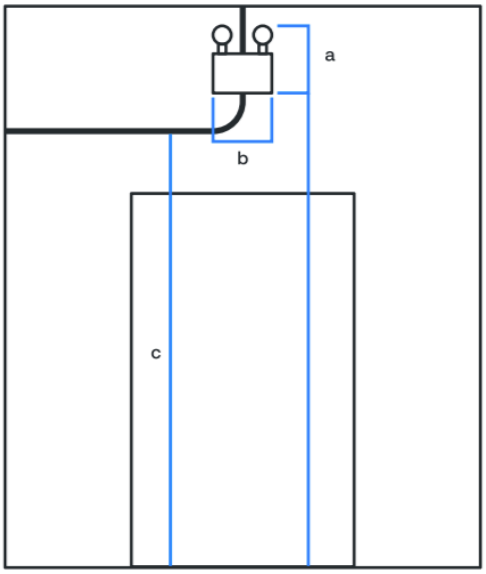
Low Ceiling

For entryways with insufficient space for wall mounting, ceiling mounting will be required. Make sure to mount on the non-door swing side so the sensor and the door do not collide.



Miscellaneous Obstructions

Take photos and measurements of any miscellaneous obstructions above the entryway that may impact the sensor installation.



Mounting Options 04

Standard Wall Mount

For mounting the sensor to a variety of wall types using the provided multi-surface wall anchors and screws.

Ceiling Mount

For mounting the sensor to the ceiling in front of the entryway. Kit includes two options: A Toggle Anchor for hollow ceiling types like drywall or ceiling tiles as well as Threaded Rod and Expansion Anchors for a variety of solid surface materials like wood, metal, tile, stone & plaster.

Door Frame Mount (Top and Bottom)

For mounting the sensor to the top or bottom surface of a wood or metal door frame.

Glass/Metal Wall Mount

For mounting the sensor to a smooth glass or metal surface with semi-permanent adhesive.
Refer to section 12 for more details and mounting instructions.