



**vaddio®**

# PRIMER ON PTZ CAMERAS

Learn everything necessary about the aspects of PTZ cameras in order to choose the right solution for your project.

## INSIDE:

- ▶ What are PTZ Cameras?
- ▶ Benefits of PTZ Cameras
- ▶ Understanding Different Capabilities of PTZ Cameras
- ▶ Understanding Video Quality
- ▶ Signal Types for PTZ Cameras
- ▶ Tips for Choosing the Right PTZ Cameras

# What is a PTZ Camera?



**While PTZ cameras were originally deployed in broadcasting studios, today's PTZ cameras are used in a variety of spaces and offer high-quality, enterprise class video capture with crystal clear image quality.**

PTZ (pan-tilt-zoom) cameras are robotic video cameras that move just as their name implies. With motorized capabilities, PTZ cameras move horizontally (pan) as well as vertically (tilt); and optics within the lens enable the view to move in and out on the target subject. Thus, a PTZ camera can move to show different areas of a space, as well as move to show close up or wide views of a subject.

While some of the first PTZ cameras were originally deployed in broadcasting studios and at sporting events, today's PTZ cameras are used in a variety of spaces and offer high-quality, enterprise class video capture with crystal clear image quality. Since PTZ cameras have motorized movements, they can be mounted in a space – typically on a wall, ceiling or a horizontal surface like a table – and can be operated remotely over long distances.

Modern PTZ cameras are relatively compact and can be placed strategically and unobtrusively throughout a large or small event or meeting space. Unlike a fixed web camera or an SLR (single lens reflex) camera, PTZ cameras aren't "point-and-shoot" devices. The motors in robotic PTZ cameras enable smooth and precise camera movements that do not need direct hands-on human intervention. In fact, one person can operate multiple PTZ cameras at one time.

With automatic and manual settings, PTZ cameras are ideal for both rehearsed events and more spontaneous presentations. Movement of the camera can either be preset or controlled manually, allowing ultimate flexibility. In addition to camera movements, PTZ cameras essentially offer customized aperture and white balance settings. With both automatic and manual capabilities, functionality of PTZ cameras can be adjusted to maximize the variable lighting conditions within a space.



*PTZ cameras are especially appropriate for live conference events where the movements of the speaker or speakers are unpredictable or dynamic.*

When considering video conferencing applications, PTZ cameras are particularly useful. In such situations, it's often important – even necessary – to focus the camera on different sections of the room and do so quickly and seamlessly. With a PTZ camera, the view can change from the speaker on stage to a member of the audience asking a question, quickly and seamlessly. Different lighting conditions – a speaker on a well-lit stage and an attendee in the darkened back of the room – are handled easily by a PTZ camera with wide dynamic range, a feature that enables better light collection when lighting conditions vary.

PTZ cameras are especially appropriate for live conference events where the movements of the speaker or speakers are unpredictable or dynamic. The motor that moves the PTZ camera and the optics that enable the zoom capabilities are ideally suited for subjects that change location throughout a space; the quality and type of motor can be a great differentiator when comparing PTZ camera options.

Non-verbal communication is an important way to convey content. Even with video, audience members engage better with a presentation and respond better to messaging when they clearly see a speaker's face, expressions, body language and hand gestures. A tighter shot of a speaker's face made possible by zooming in makes it easier for the audience to pick up on non-verbal cues. With a PTZ camera, setting the scene via a wide shot is simply a matter of zooming the camera out.

Given the ability of a PTZ camera to show different angles and views, it's important that the motor and optics provide silent and seamless movement. From a viewer's

**While PTZ cameras have been around for several years, the newest models have silent motors, can be operated remotely over long distances, and capture ultra high definition video.**

perspective, there's no lag or jumpy images – even subtle visual discrepancies and delays can leave a viewer feeling disoriented. The robotic movements of professional quality PTZ cameras do as much as possible to mimic the human eye's ability to shift perspective and change focus quickly.

While PTZ cameras have been around for several years, the newest models have silent motors, can be operated remotely over long distances, and capture ultra high definition video. Vaddio has a complete lineup of PTZ cameras – the RoboSHOT, ConferenceSHOT and PrimeSHOT – that provide a range of features and functionality. Vaddio cameras are ideally suited for many applications that commonly use PTZ cameras such as videoconferencing, broadcast, live production, event capture and streaming.

## The Benefits of a PTZ Camera



A single operator in a remote location can operate multiple PTZ cameras, eliminating the need to have multiple camera operators stand at tripods situated throughout the location.

When it comes to cutting-edge technology, point and shoot cameras just can't stack up to modern PTZ cameras.

Take the zoom feature for example. In addition to the pan and tilt motion of the camera, PTZ cameras can zoom in either optically, digitally, or both. With an optical zoom, the lens itself moves in relation to a subject and the aperture opens and closes depending on the zoom direction. In effect, the lens – by moving – captures the image differently as the aperture physically collects more or less light depending on the size of its opening. The light surrounding the subject matter bounces through the camera lens to produce a picture; when zooming all the way out, all the available light is collected; when zooming in, the lens only collects the light from the targeted subject.

In low light situations, optical zoom may not produce the most ideal images, which is why digital zoom is advantageous. With digital zoom, essentially the camera takes a very large image and crops it to make it appear as if the lens is zooming in. Digital zoom can be more or less effective than optical zoom depending on other factors. For example, a 1080p camera can use its 4K module to collect more pixels than are used to allow for a digital zoom that simply crops the image down.

Vaddio, for example, offers the RoboSHOT® 40 UHD PTZ camera that uses an algorithm for image processing – called IntelliZoom™ – that looks at a pixel as well as the pixels that surround it. A yellow pixel next to a red pixel will result in the insertion of an orange pixel between them. These newly



created pixels result in a sharper image. This content awareness that IntelliZoom delivers enables the creation of an image that doesn't optically exist. With IntelliZoom image processing technology, the camera can zoom greater distances without compromising the resolution quality of the image. This mitigates a major shortcoming of digital zooms, as cropping can result in fuzzy images. Vaddio's RoboSHOT 30E cameras provide a 30x zoom – a 20x optical zoom plus IntelliZoom Image Processing on the 20 to 30x zoom range when it's in 1080p mode, combining the best of both optical and digital zoom capabilities.

PTZ cameras are also versatile in terms of installation and easier to operate than fixed image or static cameras. Many Vaddio PTZ cameras use a Category 5 cable to power the camera, control the camera and send the video signals to the equipment rack – all with just one cable, which greatly simplifies installation and integration. Vaddio PTZ cameras offer flexibility by supporting HDMI, HDBaseT, USB or SDI signals out, as well as the ability to create multiple IP-based video streams.

Even with the pan-tilt-zoom capabilities, consider the angle of view options afforded by PTZ cameras, that can be easily mounted on walls, ceilings or horizontal surfaces. Mounting a camera in an appropriate location – one that is both comfortable for the presenter to look at and captures most of the room is the ideal. PTZ cameras have a wide array of mounting options and some models can even be inverted, enabling the camera to be installed upside down on a ceiling while the video is still displayed right side up.

Another significant benefit of PTZ cameras is ease of operation. A single operator in a remote location can operate multiple PTZ cameras, eliminating the need to have multiple camera operators stand at tripods situated throughout the location. PTZ cameras can be mounted on a wall to easily deliver high-angle shots (something that would be difficult for a human camera operator), and PTZ cameras also eliminate trails of cable across the floor, so trip hazards are greatly reduced as well.

Both in terms of production logistics and economics, PTZ cameras offer advantages over fixed cameras

**When it comes to cutting-edge technology, point and shoot cameras just can't stack up to modern PTZ cameras.**

## What Makes a PTZ Camera Different



*The key for professional PTZ cameras is their smooth movement due to electrostatic drive motors, versus lower cost, gear-driven or stepper motors in other models of cameras.*

The robotic movement of a PTZ camera is its most differentiating characteristic compared to static cameras. Today's higher quality PTZ motors move effortlessly and silently – and thanks to several camera control options, an operator located remotely can manipulate angles and focal length, all without disrupting the audience or the presenter.

The key for professional PTZ cameras is their smooth movement, like the kind provided by electrostatic drive motors – they enable movements that are smoother than a lower cost gear-driven or stepper motor. With a PTZ camera, precision recall of specific pan or tilt locations at a maximum zoom is a simple matter of following presets. With gear-driven or stepper motors, such pinpoint precision is difficult. When panning at 30x zoom, a gear-driven or stepper-driven camera may miss a desired location by a foot or more. In addition, an electrostatic motor by design is inherently smaller, allowing those cameras to have smaller, more compact footprints.

Due to their ability to pan and tilt, PTZ cameras enable much more video coverage of a space. Vaddio offers PTZ camera models with a variety of horizontal field of view options ranging from 55 degrees to 74 degrees, providing flexibility to suit a variety of needs. From tight shots to wide angle views, PTZ cameras can cover the shot preferences of conference spaces or rooms of any size. The Vaddio PTZ lineup includes cameras with five zoom capabilities: 10x; 12x; 20x and 30x, and an ultra high-definition camera that zooms 40x.

The abilities to pan, tilt and zoom are only as good as the physical motion of the PTZ camera itself. Coverage of Vaddio's PTZ cameras is enhanced by Tri-Synchronous Motion in which the pan-tilt-zoom movements are essentially coordinated to depart and arrive at a preset location at the same time. Tri-Synchronous Motion is made possible by an algorithm that calculates the position and speed of the PTZ camera's motor, making on-air camera movements seamless and manageable. For the viewer, Tri-Synchronous Motion delivers a smoother visual experience since jitter and bouncing are markedly diminished, even when the camera is at full zoom. In effect, the tri-synchronous feature allows the PTZ camera to function much like natural human eye movement.

**A PTZ camera is a robotic camera that is capable of remote control for its zoom and directional movements.**



**PTZ cameras come in a range of resolutions, from high definition 720p to ultra high definition 4K.**

Vaddio has several professional PTZ cameras with Tri-Synchronous Motion technology for a range of use cases. From the broadcast-quality RoboSHOT 40 UHD camera to the soft-client compatible RoboSHOT 12E USB, there's a smooth-motion Vaddio PTZ camera for any requirement.

The motorized ability to move and change the camera's point of view are not the only characteristics that set PTZ cameras apart from stationary devices. Many PTZ camera models also include features and settings designed to mimic human vision as much as technically possible and provide a wider range of image possibilities.

Wide dynamic range is a feature that provides increased sensitivity to variable lighting conditions including low light. Enabled by sensors, wide dynamic range provides a more highly defined image in settings with highly varied lighting conditions, effectively enabling the camera to display an image much like the human eye does.

For example, if one part of a room is flooded with natural sunlight, a camera without wide dynamic range may "see" people in that area as silhouettes, whereas the human eye can better decipher their images. A well-optimized wide dynamic range algorithm maintains accurate color saturation and balances out discrepancies that occur when there are disproportionate levels of light within the space.

Vaddio's RoboSHOT Elite PTZ cameras provide an enhanced wide dynamic range, evening out lighting that is too dark or too bright in part of the shot to provide detailed images.





## Video Quality: More than Just Pixels



While 4K is more expensive, there are benefits of higher resolution video – even if the video needs to be compressed later, the resulting images are sharper.

Whether it's conferencing, recording or live streaming, today's video applications call for increasingly high-definition, enterprise-class quality cameras. PTZ cameras are available in a range of resolutions – and generally speaking, the higher the pixel count, the sharper the resolution.

PTZ models have a range of resolutions including high-definition 720p with 1280x720 pixel resolution; full HD 1080p with 1920x1080 pixel resolution and UHD 4K (or 3840x2160 pixels) with four times the pixels of 1080p.

Yet keep in mind, video quality is not created equally even among cameras with the same pixel count. The best PTZ cameras in terms of video quality are those which allow some level of manual adjustment. There are cameras that have default settings – not allowing the operator to adjust the iris or white balance levels. With only automatic settings, such cameras don't provide much leeway for operators when lighting situations change or are varied throughout a space.

Higher quality cameras produce higher quality video, and some higher quality PTZ cameras are engineered with both automatic and manual settings, allowing the operator to make adjustments to the aperture and white balance accordingly.

Higher quality cameras also have sophisticated lenses. With PTZ cameras, there are two predominant kinds of high-definition lenses: wide angle zoom and single zoom. The wide-angle zoom is a lens that features a wide- to a very wide-angle position. These lenses are ideal for capturing a large section of a room – say a group of people on a stage – and then zooming in to get a tighter head and shoulders shot of one speaker. The single zoom or telephoto lens moves from a normal focal length to a zoom position and back again.

Manual settings can be key for accurate color reproduction because different sources of light can be processed differently by different cameras, and to a large extent, color



**Genlock is a feature that syncs video coming from multiple sources at the same refresh rate.**



quality is subjective. Some people want bright vivid colors, while others prefer more muted tones. Among viewers, there is not a true color that can be universally agreed upon, which is why manual settings are so important for color quality. Being able to manually adjust image colors to the taste of the viewer makes access to these manual controls an attractive feature.

The way that light interacts with cameras and lenses has a significant impact on video quality. The kind of light in a space – natural sunlight versus overhead LED light, for example – will affect white balance and how the camera reproduces an image. Higher quality PTZ cameras have settings to balance light coming in from the sun – an important function to maintain the warmth of color in a final production.

Color quality is also impacted by image signal processing (ISP). Some PTZ cameras feature advanced ISP technology that enables superior light-gathering capabilities, better contrast and sharp 4K video, even when lighting conditions are not ideal.

For video that requires the highest quality – such as in broadcast installations – Genlock is a feature that syncs video coming from multiple sources at the same refresh rate. This allows a production team to switch between camera feeds without risk of dropping video frames during on-air transitions. Vaddio's RoboSHOT 40 UHD includes Genlock and a 40x zoom, producing superior 4K images for professional broadcast quality video production.

Generally speaking, with video quality, the more pixels the better (however the camera block and lens play a major role in video quality as well). Pixel count often signifies clarity. In effect, the more pixels, the more information the camera has to work with.

While 4K is more expensive, there are benefits of higher resolution video – even if the video needs to be compressed later, the resulting images are sharper. A larger image that gets scaled down can be incredibly crisp and detailed. This is especially useful in capturing and archiving important events and using popular online streaming or video distribution services. Unfortunately, live 4K video over standard video conferencing applications isn't possible with today's networking and bandwidth capacity.

Most applications continue to compress video to 720p in order to give preference to audio performance in conferencing situations. There is a bright future for 4K video solutions in videoconferencing as networking technology and investments in infrastructure continue to rise.

Vaddio's RoboSHOT UHD cameras are ultra HD PTZ cameras with crystal-clear image quality with top resolutions of 2160p that maintain performance in low-light conditions. These 4K PTZ cameras include enterprise-class features such as administrative control and remote operation via web interface and IP streaming. Designed for medium to large spaces for applications such as video production, live events, lecture capture and conferencing, the RoboSHOT 20 UHD with 20x zoom is an ideal choice for corporate broadcasts, higher education and houses of worship.

## Getting the Right Signal



Vaddio's RoboSHOT UHD cameras are ultra HD PTZ cameras with crystal-clear image quality with top resolutions of 2160p that maintain performance in low-light conditions.

PTZ cameras support many signal types to connect to other equipment. When designing video production solutions, it's important to determine the connections required as well as the video output format needed.

### **USB for conferencing**

For situations where video and/or the audio source needs to be sent into a conferencing application, USB is a good choice. In addition, USB works well when looking to connect video from a PTZ camera to a computer for recording or streaming purposes. Vaddio's enterprise-class HD RoboSHOT USB PTZ cameras feature built-in simultaneous uncompressed USB 3.0 and IP (H.264) streaming outputs, and a 74-degree field of view, making it suitable for any size meeting room.

### **HDMI for displays**

For sending video output to a display, HDMI is typically used. HDMI is widely available in video equipment – it's popular in PTZ cameras because nearly all the equipment that the cameras can connect to has HDMI input/output ports. RoboSHOT HDMI cameras from Vaddio are cost-effective, professional cameras. With a 70.5-degree field of view, the HDMI cameras are well-suited for small, midsize and large spaces.

### **SDI for broadcast**

For broadcast quality video, SDI is the signal of choice. SDI also is relevant for situations where it's necessary to run a high-quality signal over a very long distance; in these cases, SDI transmits over standard coaxial cable. Vaddio's RoboSHOT SDI cameras feature simultaneous 3G-SDI, HDMI and IP H.264 streaming. RoboSHOT UHD cameras also have SDI outputs, and the RoboSHOT 40 UHD camera offers the Genlock feature specifically for the broadcast market.



### NDI for IP-based video

NDI® (Network Device Interface) technology offers significant flexibility in terms of the sources and destinations of video. Essentially, NDI enables the routing of any video source to any destination within a network.

NewTek's NDI ecosystem is ideal for IP-based live production and streaming, and other single- and multi-camera applications such as events, video conferencing and lecture capture.

NDI delivers low latency control for live, on-air camera movements, switching and streaming, and it can distribute video over existing IP architecture.

**An NDI setup lets you access any NDI-enabled camera in any facility that is connected to your network and automatically see it as a source.**

Vaddio's RoboSHOT 30E NDI camera is an IP-based NDI video camera that delivers NDI control and streaming to other NDI-enabled applications and devices connected to a standard local area network. The RoboSHOT 30E NDI offers full bandwidth NDI with superior image. It's one of the lowest signal latencies in the industry for superior live, on-air camera control, switching and streaming.

### HDBaseT for extending HDMI

HDBaseT™ is a standard that is used generally to transmit an HDMI signal. Essentially, HDBaseT is used to extend an HDMI source. HDMI – while extremely popular in many devices – doesn't passively transmit video over long distances – it needs a little help once distance exceeds 50 feet (15 meters). HDBaseT is that help, enabling HDMI video to travel longer distances.

While one of the main features of HDBaseT is extending HDMI video, the standard also provides bi-directional serial and network communications, as well as video signal and power for the camera – all transmitted over a single category cable, making HDBaseT cameras easy to install. Vaddio offers the RoboSHOT HDBT camera – its version of HDBaseT. Video outputs of the RoboSHOT HDBT include simultaneous HDBaseT, HDMI and IP streaming.

PTZ cameras offer unrivaled coverage of a meeting space, as well as high-definition video quality. With the variety of signals supported, PTZ cameras are versatile devices that can fit every video production and application need.

# How to Choose the Right PTZ Camera



Choose the right PTZ camera by thinking about the size and lighting of the room, plus a few other considerations.

PTZ cameras are sophisticated. They support a number of video signals and offer a variety of zoom lengths as well as field of view choices. How to pick the PTZ camera with the features that work best for a specific event or room may seem daunting. To help find the right PTZ camera, take into account a few considerations.

## Image resolution

One of the first criteria to consider is the image and resolution. Today's cameras offer image resolution from 720p to 1080p to 2160p (also called UHD or 4K). When considering resolution, it's important to know where video is going – both in terms of the devices for display and the destination where the video may end up.

Suppose there's a need for a solution where a camera will be used for conferencing and lecture capture, and video will also be displayed on a 4K monitor in an overview room. The maximum resolution for one destination is 4K, so building a system with a 4K resolution will provide the most ideal video – even if that video has to be compressed when being sent over conferencing applications.

## Field of view

Then there's the field of view of PTZ cameras. In effect, the field of view determines how much of the room will be captured by the camera at a single point in time. A camera with a wide angle field of view, say 111 degrees, will capture more of the room than a camera with a 73 degree field of view. This field of view is most significant when a subject is near the camera. To capture most if not all of subjects near the camera, a much wider field of view is needed. Of course, with PTZ cameras, the zoom and tilt capabilities also determine how much of the subject is covered by the camera.



### Depth of field

A camera's depth of field refers to the distance that is in focus. Say there's a long conference table with several people seated around it. A camera with a longer depth of field is capable of capturing more people at the table in focus.

A PTZ camera is particularly useful for depth of field due to its ability to zoom in on an object to bring it into focus. However, there are some limitations with optics; while the human eye can focus and rapidly change focal depth as it moves around a room, a camera doesn't quite work like this. Hence if you select a PTZ with manual settings, you will get better video results since you can enable human-eye-like focus capabilities.

**A camera with a longer depth of field is capable of capturing more people at the table in focus.**

### Power requirements

Consider as well a PTZ camera's power requirements – not so much how much power is needed but how the camera is powered.

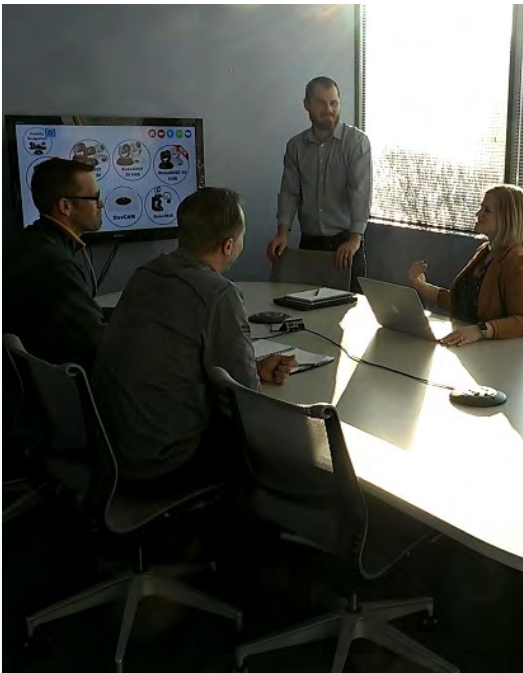
Cameras require different levels of power. For example, those without motors for PTZ functions require much less power. Of greater concern is the method of powering a camera. Depending on the model, there can be a couple different ways to power a camera – over a network port such as PoE or PoE+, over HDBaseT, or via the local power supply by plugging a barrel connector into the back of a camera. The barrel connector option works when the power supply is in a convenient location where the camera is mounted.

This may not be the case when a camera is mounted high on a wall or a ceiling. The ability to power a camera on a network connection just running category cable, simplifies installation and makes it easier to troubleshoot and maintain a video solution in the future. The ability to power a camera over a single category cable also can remove the need for a licensed electrician to run power in inconvenient locations, saving time and money on installations. This is why PoE and HDBaseT-capable cameras are so desired for their ease of installation.

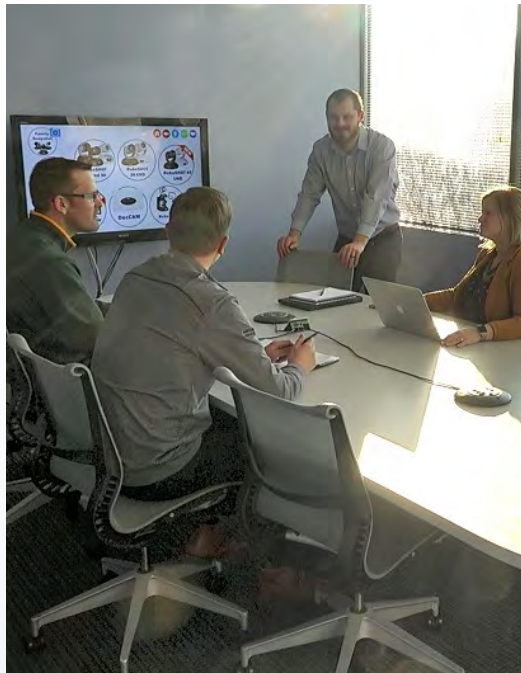
### Remote controls

Many PTZ cameras feature remote control capabilities. This can mean two different things. A handheld physical infrared remote control lets you control the camera while you're in the room. Remote management is different – it allows you to control a camera from a different room, or from across campus. With the latter option, an operator can control one or multiple cameras using a joystick and a web-based user interface, and be located in another room or building. This setup eliminates the need and expense of hiring individual camera tripod operators and streamlines the process of coordinating professional presentations. Also look for a PTZ camera that can be controlled by in-room AV control panels often found in corporate and higher education spaces.

Integrating with existing control surfaces like touch panels and switches makes simple operation convenient for the end user. These panels often use serial or IP control.



WDR off



WDR on

### Wide dynamic range (WDR)

And finally, for situations where lighting conditions are uneven – for example, a table in the foreground with large sunny windows in the background – wide dynamic range is a feature to look for. With wide dynamic range, video images are automatically adjusted to help even out widely varying lighting conditions. People in front of a window won't look like silhouettes – their faces will be visible and detailed thanks to wide dynamic range.

Vaddio has PTZ cameras for every kind of video application and every kind of budget. From PTZs with 10x to 40x zoom, and with resolutions from 1080p to 4K, Vaddio has an option. When looking for enterprise-class, professional high-definition PTZ cameras, look to Vaddio.

For sunny rooms,  
choose a PTZ  
camera with wide  
dynamic range.





THE ART OF EASY | [legrandav.com](http://legrandav.com)

**USA** P 800.572.2011 E [av.vaddio.support@legrand.com](mailto:av.vaddio.support@legrand.com)

**EMEA** P +31.495.580.840 E [av.emea.sales@legrand.com](mailto:av.emea.sales@legrand.com)

**APAC** P +852.2145.4099 E [av.asia.sales@legrand.com](mailto:av.asia.sales@legrand.com)

©2020 Legrand AV Inc. 190283 Rev 3 3/20 Vaddio is a registered trademark of Legrand AV Inc. All other brand names or marks are used for identification purposes and are trademarks of their respective owners. All patents are protected under existing designations. Other patents pending.



**COMMERCIAL AV BRANDS**

C2G | Chief | Da-Lite | Luxul | Middle Atlantic | Vaddio | Wiremold